Teasing Out Technique: Animating Boston's City Hall
by
Ann C. Woods

B.A. Political Science & French
Williams College, 2005

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Submitted to the department of architecture in partial fulfillment of the requirements for the degree of
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Massachusetts Institute of Technology
February 2012

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Signature of Author: _____
Department of Architecture
January 19, 2012

Certified by: _____
Joel D. Lamere
Lecturer in the Department of Architecture
Thesis Supervisor

Accepted by: _____
Takehiko Nagakura,
Associate Professor of Design and Computation
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ABSTRACT

What were once considered advanced visualization techniques have now become commonplace. With the advancement of visualization tools, animation has quickly become a primary means of representation within architecture; however, architects have not yet taken a critical approach to the techniques of this medium as we have with other forms of representation. As it becomes easier and easier for the everyday person to create a fly-through animation of their house, apartment or favorite building, architects are losing the opportunity to utilize this medium to its fullest potential and define it as an important tool of representation deeply rooted in the history of architectural representation.

This thesis aims to critically examine the medium of architectural animation today by presenting a comparative study of one building, Boston's City Hall, through the lens of three contemporary tropes of animation. While this building has a complex and controversial history, the comparative nature of this study places the focus on the medium of representation and its capacity to bring out new readings about its subject, rather than vice versa.

Thesis Supervisor: Joel Lamere
Title: Lecturer in the Department of Architecture

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Joel D. Lamere, Thesis Advisor
Lecturer in the Department of Architecture, MIT

Takehiko Nagakura, Reader
Associate Professor of Design and Computation, MIT

Filip Tejchman, Reader
Lecturer in the Department of Architecture, MIT

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Teasing Out Technique:
Animating Boston's City Hall

Introduction

The way in which we visualize and understand space today has changed. There is simultaneously an abundance of tools and an abundance of media. In 2011, YouTube recorded 2 Billion views per day, the 6 billionth image was uploaded to Flickr and Facebook marked 100 Billion photo uploads. Similarly, the way in which we research and even experience architecture has changed. Rather than seeking project information in trusted journals like *A+U* or *Architectural Record,* we immediately Google a project to retrieve images of it on Flickr, videos on YouTube, or turn to its 3D view in Google Earth or Bing where images of the building facades are mapped onto a 3D mesh in just the same way that an architect today would build a digital model of building and render it. What were once considered advanced visualization techniques are now commonplace from both a production and experiential perspective.

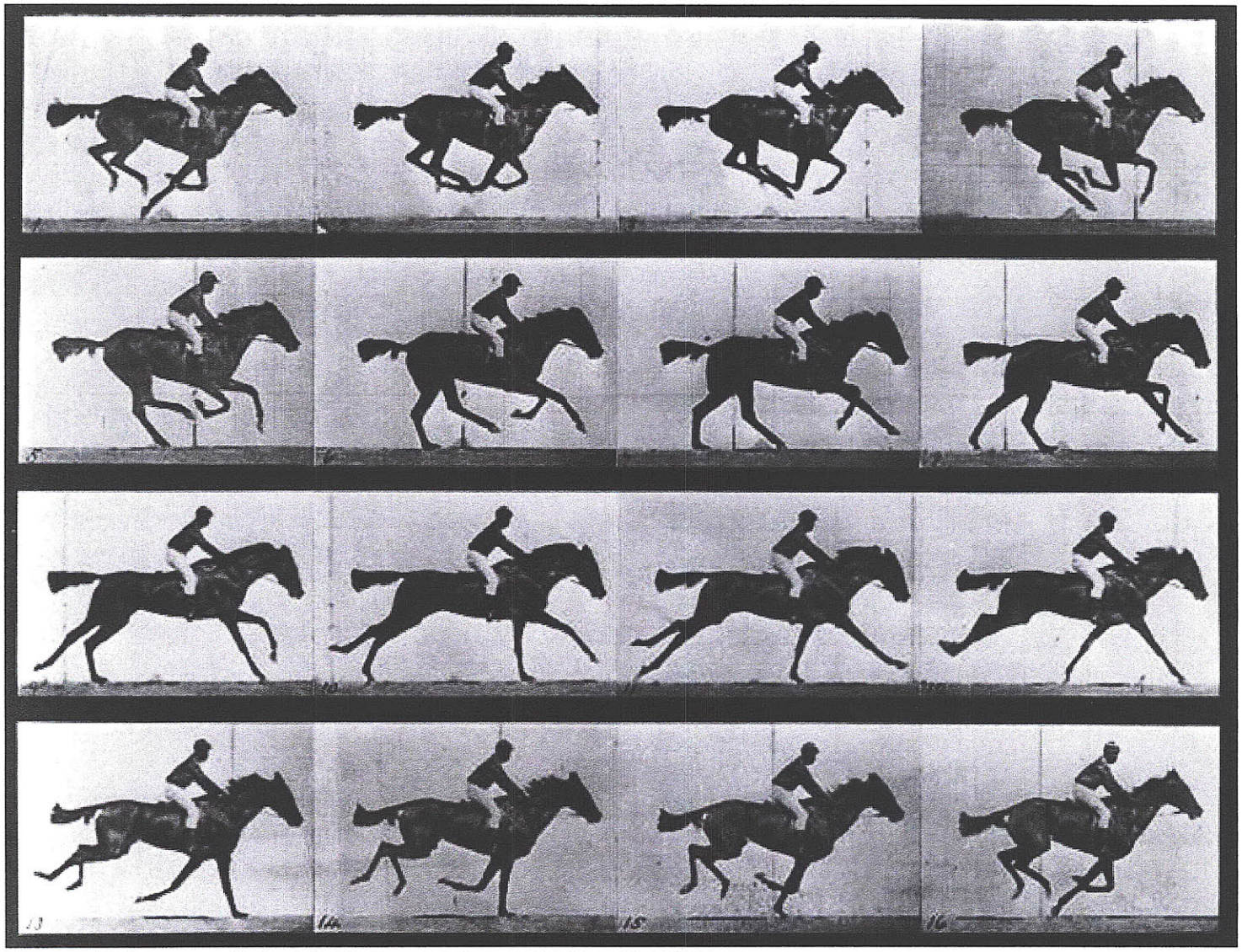
With the advancement of such visualization tools, animation has quickly become a primary means of representation within architecture; however, architects have not yet taken a critical approach to the techniques of this medium as we have with other forms of representation. As it becomes easier and easier for the everyday person to create a flythrough animation of their house, apartment or favorite building, architects are losing the opportunity to utilize this medium to its fullest potential and define it as an important tool of representation deeply rooted in the history of architectural representation.

This thesis aims to critically examine the medium of architectural animation today by presenting a comparative study of one building, Boston's City Hall, through the lens of three contemporary tropes of animation. While this building has a complex and controversial history, the comparative nature of this study places the focus on the medium of representation and its capacity to bring out new readings about its subject, rather than vice versa.

History of Animation in Architecture

Architectural animation has history deeply rooted in the development of film technology and animation techniques pioneered in the mid-nineteenth and early twentieth century. Although the history of the camera can

Figure 1



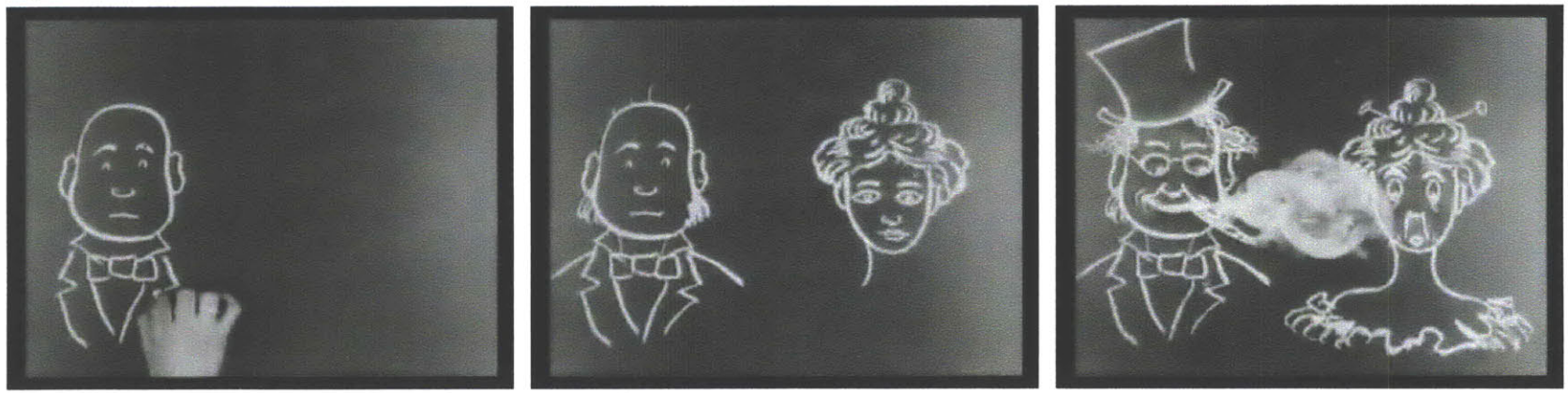
Photographic Sequence of Leland Stanford's horse, Eadweard J. Muybridge, 1872

be traced to early examples of the camera obscura and advancement in the field of optics, photography and motion came together much later with the advent of better quality film and the ability to fix and develop an exposure. Research into motion through the use of photography such as Eadward Muybridge's famous photographs documenting Leland Stanford's galloping horse [Figure 1] were a precursor to early animation techniques.

Advancements in photography such as the development of roll film by George Eastman in 1885 led to the development of diverse techniques of film and animation.[1] From a filmic perspective, as camera became more sophisticated and film became both thinner and more reliably developed and fixed, one was able to shoot sequences of video by exposing numerous frames per second. Similarly, early techniques of animation, such as stop motion animation, profited from advancements in photography and optics research. Photographs taken from one angle when arranged to play in rapid succession (at least 12 frames per second) gave the appearance of motion, despite the fact that the frames may have been taken over a significantly longer amount of time. J. Stuart Blackton was an early pioneer of stop motion animation. His 1907 short, *The Humorous Phases of Mr. Funny Face* [Figure 2], marks one of the first examples of stop motion animation.

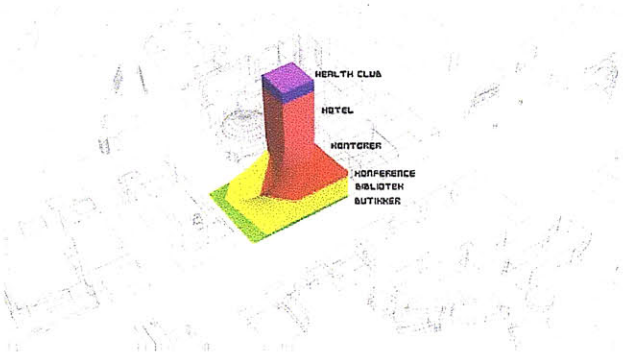
1 "Eastman Kodak" <http://en.wikipedia.org/wiki/Eastman_Kodak#Timeline> accessed 05 May 2011.

Figure 2

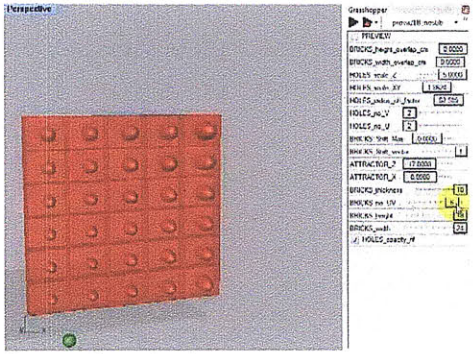


The Humorous Phases of Mr. Funny Face, J. Stuart Blackton, 1907

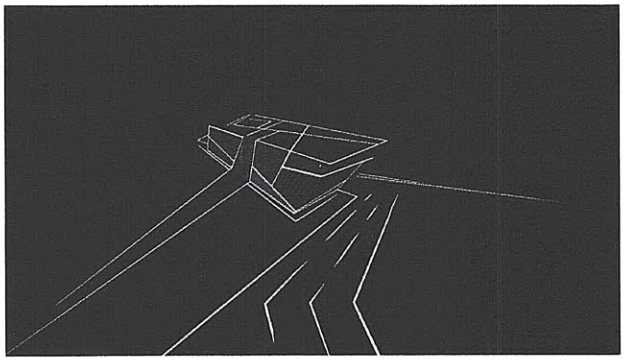
Figure 3



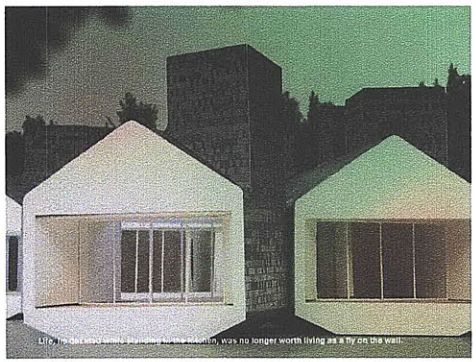
Formal Transformation
e.g. Bjarke Ingels Group



Parametric animation
e.g. Grasshopper



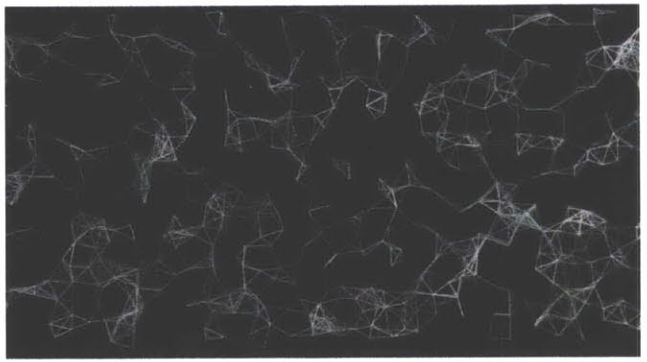
Rendered Flythrough
e.g. Zaha Hadid



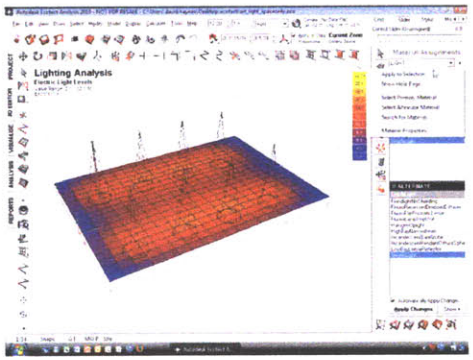
Narrative
e.g. Michael Meredith

As an introduction to the medium of contemporary architectural animation, the images below [Figure 3] represent a catalog of the different types of animation which exist today from the formal transformation to the narrative.

Atmospheric illustration
e.g. Obra Architects



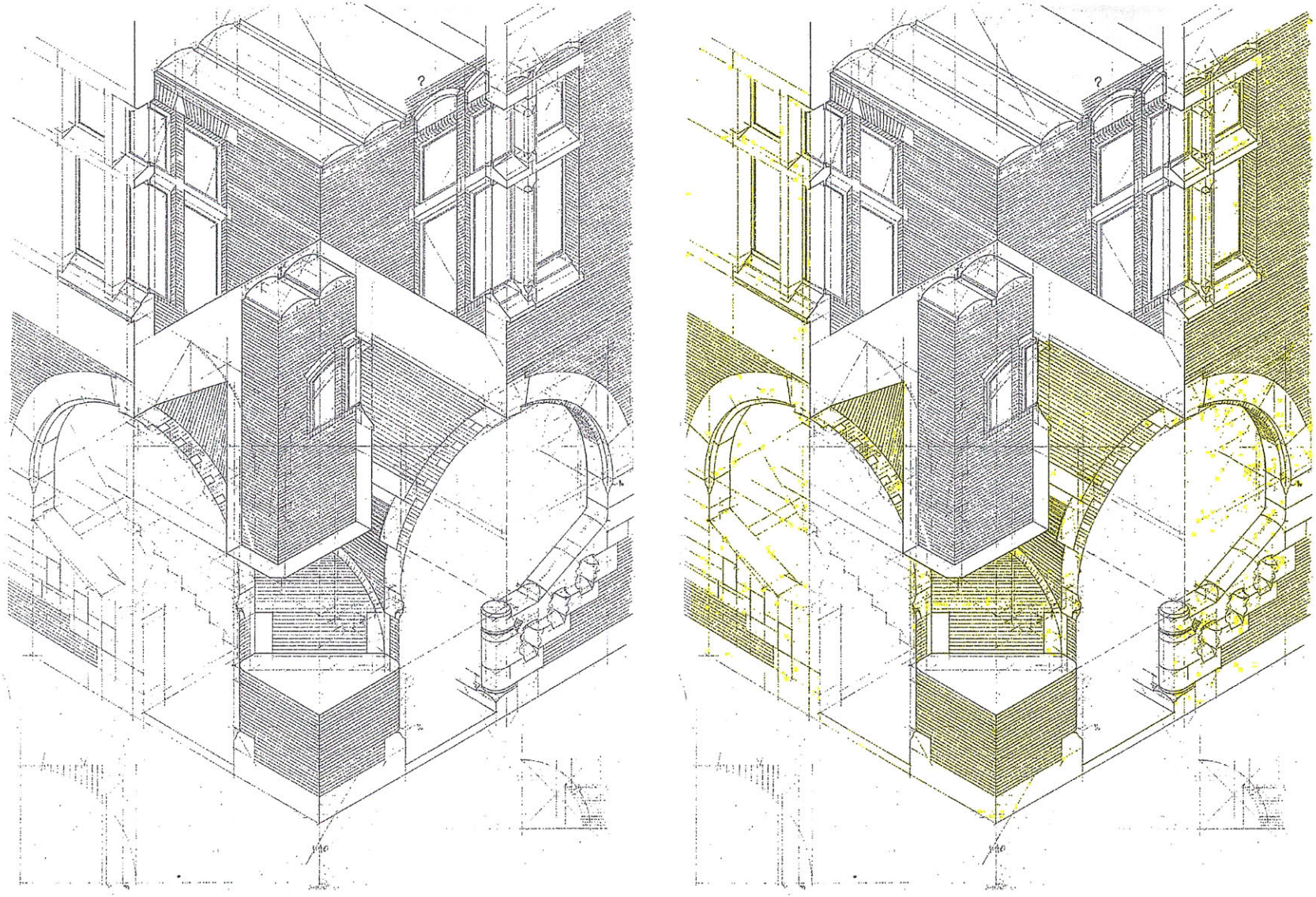
Interactive Script
e.g. Processing sketch



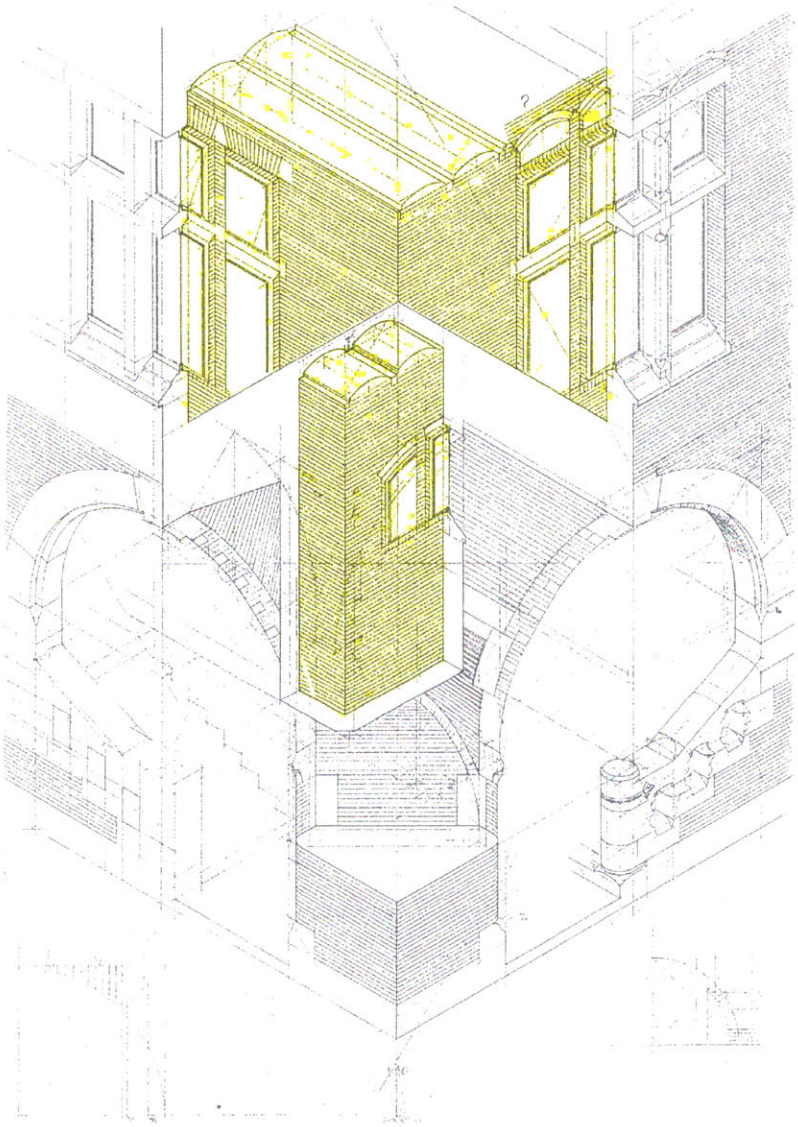
Environmental Simulation
e.g. Ecotect

Process Document
e.g. Ensamble Architects time lapse

Figure 4



Daniel Castor, Flip Flop Drawing



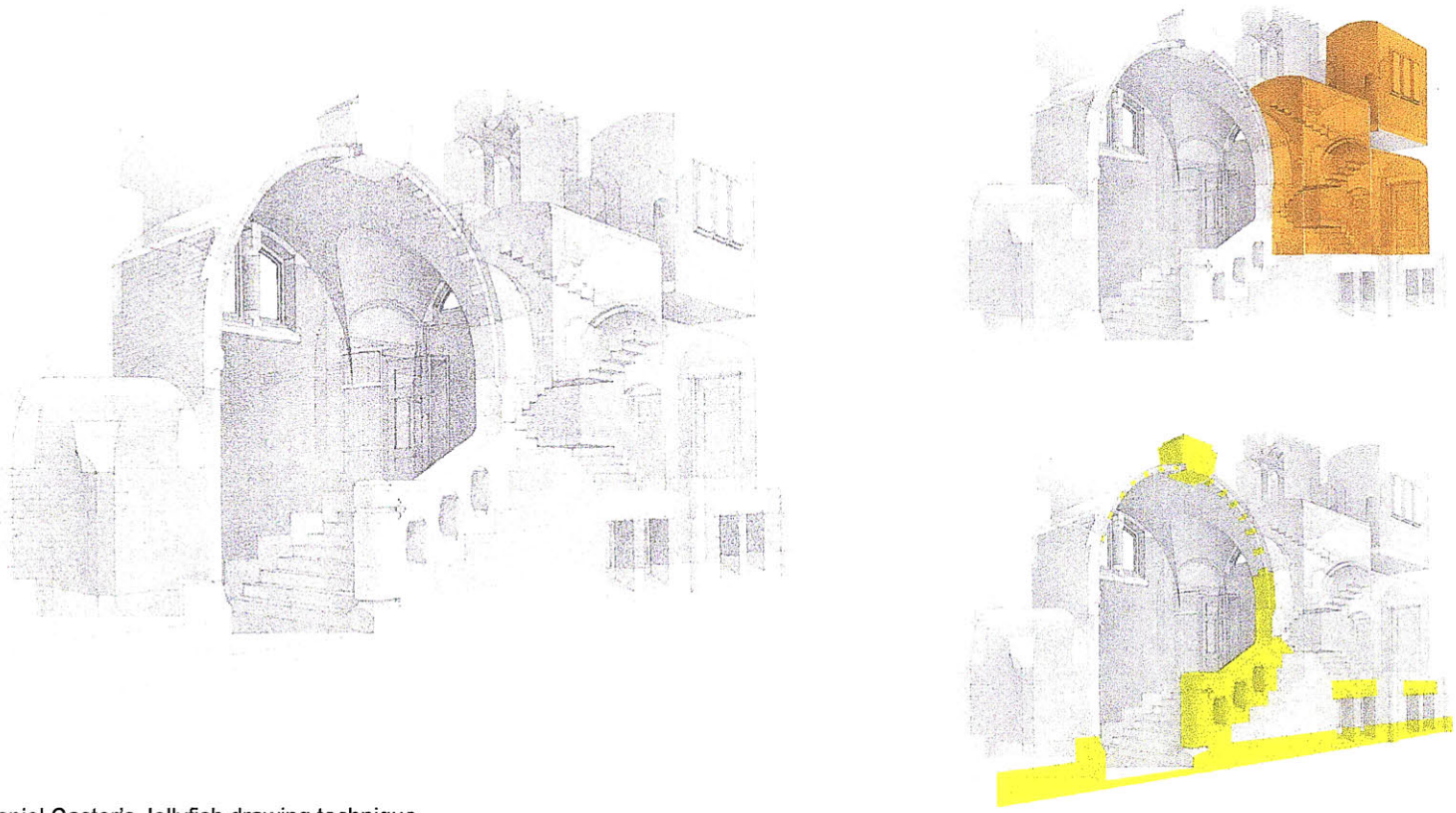
Studies in Representation

Because this thesis examines a particular medium of representation, it is useful to re-visit other studies of representation, even if such studies deal with alternate forms of representation. Daniel Castor's *Drawing Berlage's Exchange*, his Master's Thesis from the Graduate School of Design at Harvard University, is an important precedent for this project. Castor's thesis presents a series of drawings of the Exchange Building in Amsterdam [Figure 5] designed by Hendrik Petrus Berlage, completed in 1909. His thesis radicalizes the traditional drawing techniques of Auguste Choisy's axonometric drawings and the Beaux Arts style perspective [Figure 7]

Figure 5

Berlage's Exchange Building

Figure 6



Daniel Castor's Jellyfish drawing technique

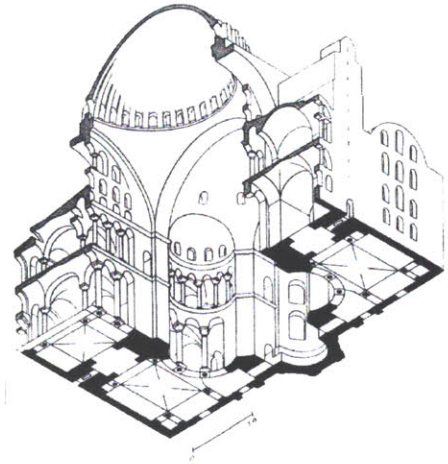
Although the drawings benefit from the research and understanding of the building not only in its contemporary context but also as a product of a certain building material, conclusions about these techniques of drawing become the primary output of his thesis, rather than a survey of evidence to describe the building as a whole or to support a larger argument about the building. Notably, these drawings only become significant in relation to their counterparts drawn by Auguste Choisy and students at L'Ecole des Beaux Arts. Castor is forthcoming with his agenda; he writes, "Choisy privileges representation in the service of analysis, I reverse that order of priority." [2]

Castor structures his study into two parts: Initially, he does a series of tests to develop a method of representation for the project. In this testing period, he takes on Choisy's technique of the cutaway axon, extending the notion of simultaneity to a different level by incorporating multiple points of view within a single axonometric drawing [Figure 4].

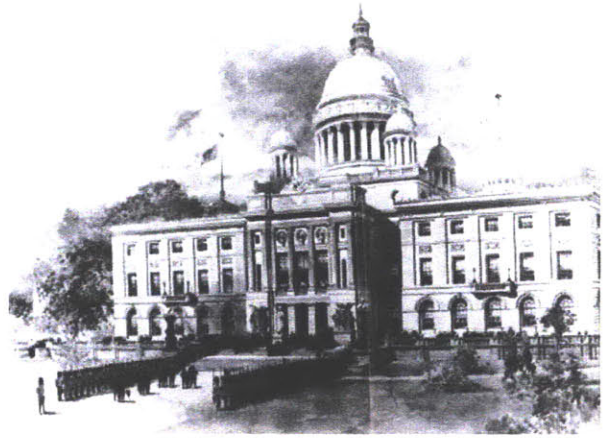
In the second half of his study, Castor challenges the traditional Beaux Arts perspective which use shading to describe surface and solidity [Figures 6, 8, 9]. He develops a technique that he calls the jellyfish drawing in which shading is used to show interior volumes at the same time that it describes an exterior envelope, thus radicalizing the traditional Beaux Arts rendering. Castor then uses this drawing technique to describe each entry to the building. The collection of these drawings enable one to see the complexity of what at first glance seems a very rigid and simple building.

2 Daniel Castor, Drawing Berlage's Exchange, Amsterdam: NAi, 1996.

Figure 7



Choisy's Worm's **Eye Axonometric of Hagia Sophia**

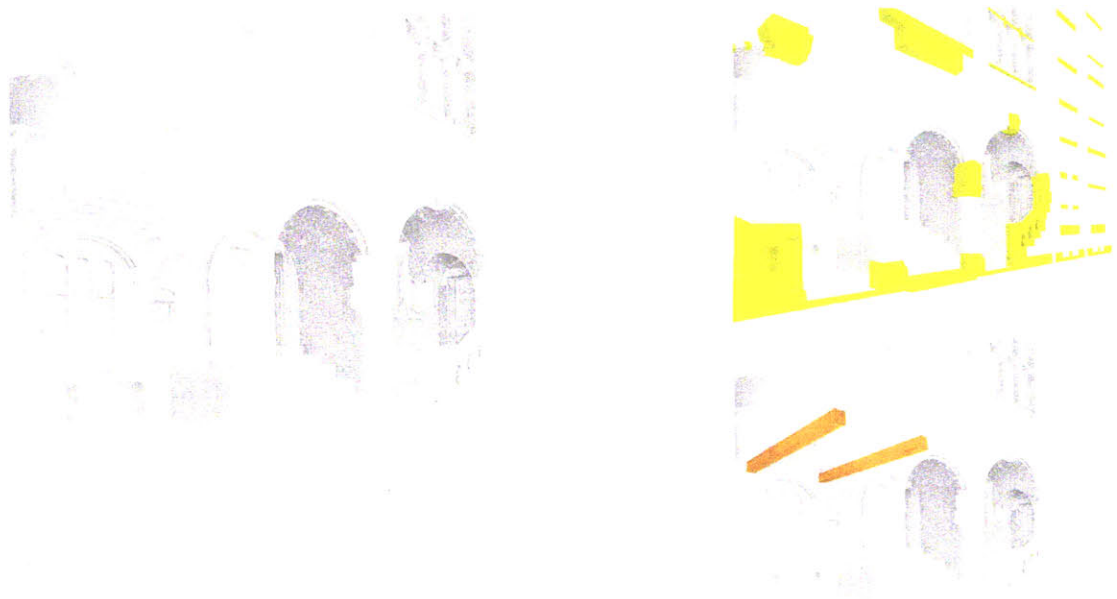


Beaux Arts Rendering

Figure 8

Daniel Castor's Jellyfish drawings

Figure 9



Daniel Castor's Jellyfish drawings

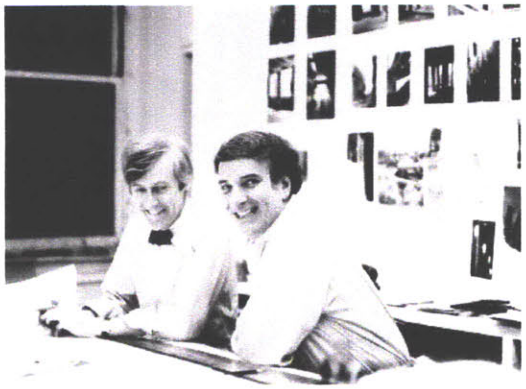
Part I Teasing Out Technique

Figure 10

Boston City Hall, 2011

Figure 11

Boston City Hall



Gerhard Kallman and Michael McKinnell

Teasing Out Technique

As a point of departure, this thesis adopts Castor's methodology. In adopting Castor's method, this thesis takes as its subject the existing building of City Hall in Boston to study animation as a form of representation. The first half of this thesis presents a series of animations, which, in the spirit of the Exchange drawings attempt to use analysis in the service of representation. The second half of the thesis presents a comparative study of representation, adopting the styles of three contemporary tropes of animation.

Boston's City Hall

Completed in 1969, Boston's City Hall [Figure 10] is one of the most significant buildings of the 20th century. Located in downtown Boston, sited on a large brick plaza [Figure 11], the building was the result of a 1961 competition won by Gerhard Kallmann and Michael McKinnell. Since its completion it has been the site of controversy—inspiring a seemingly endless number of proposals for its redesign [Figure 12] and gaining the mixed accolades of sixth best building in American history as well as World's Ugliest Building. [3]

The building also ushered in new architectural language to the United States heavily invested in concrete construction. Preceding this competition, Kallmann had begun to outline his vision for this "new Brutalism" which reacted against the impermanence and inauthenticity of modernism. He wrote,

"We have moved towards an architecture that is specific and concrete, involving itself with the social and geographic context, the program, and methods of construction, in order to produce a building that exists strongly and irrevocably, rather than an uncommitted abstract structure that could be any place and, therefore, like modern man— without identity or presence." [4]

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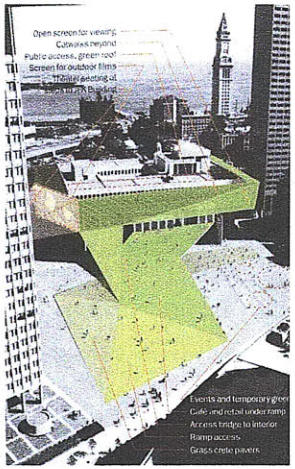
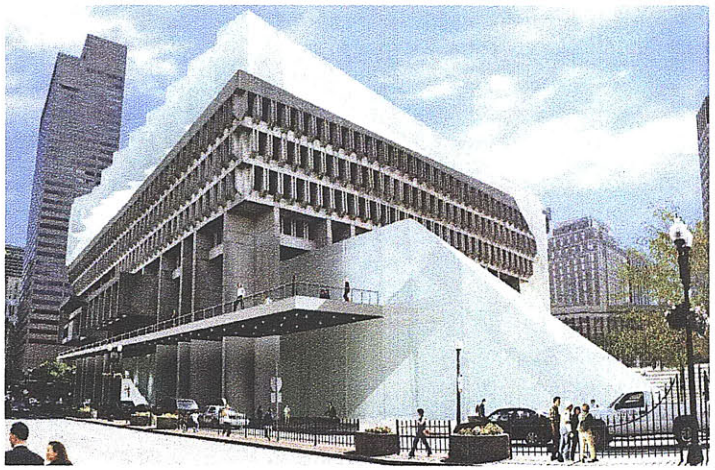
3 "Boston City Hall," Wikipedia. accessed 14 August 2011< http://en.wikipedia.org/wiki/Boston_City_Hall>

4 Gerhard Kallmann, Boston City Hall, <http://www.archdaily.com/117442/ad-classics-boston-city-hall-Kallmann-mckinnell-knowles/> 6 March 2011, accessed 9 September 2011.

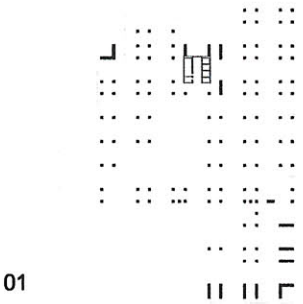
Figure 12





Recent proposals for City Hall's Redesign

Figure 13



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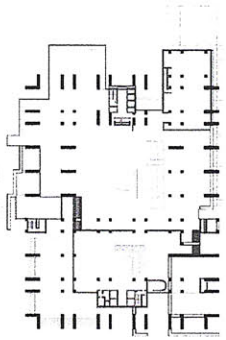

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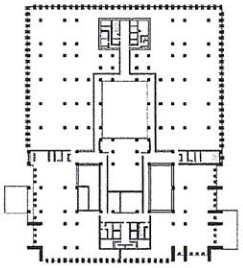

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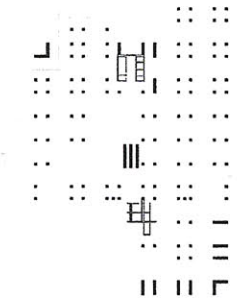

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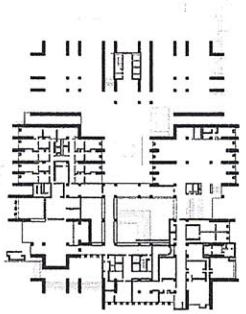

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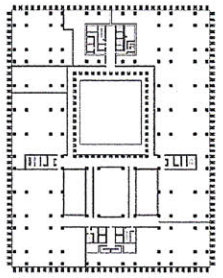

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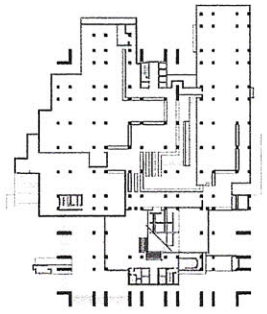

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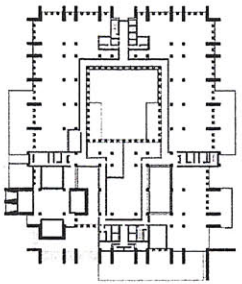

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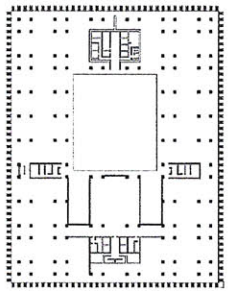


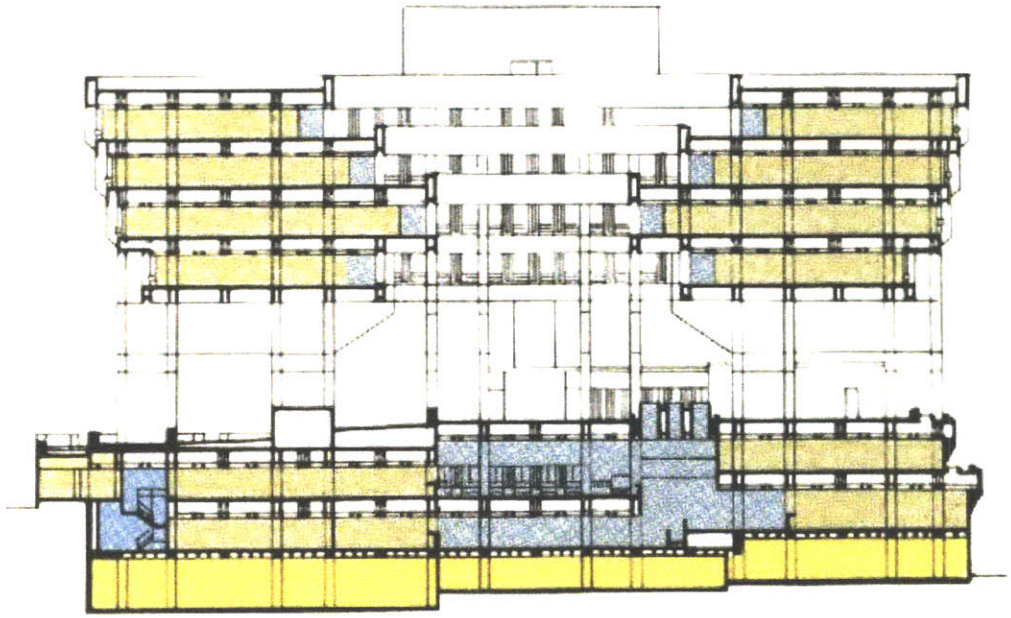
09

City Hall Plans

As a subject for a study on representation Boston City Hall is a powerful example as it is easily recalled by architectural scholars and laypersons alike. Also, like Berlage's building, it is heavily invested in a specific structural logic. While Berlage obsessed over the brick, Kallmann and McKinnell obsessed over concrete details. Concrete was meant in both a literal and figurative way in this case rallying against modernist tendencies of lightness and transparency in favor of longevity and authenticity.

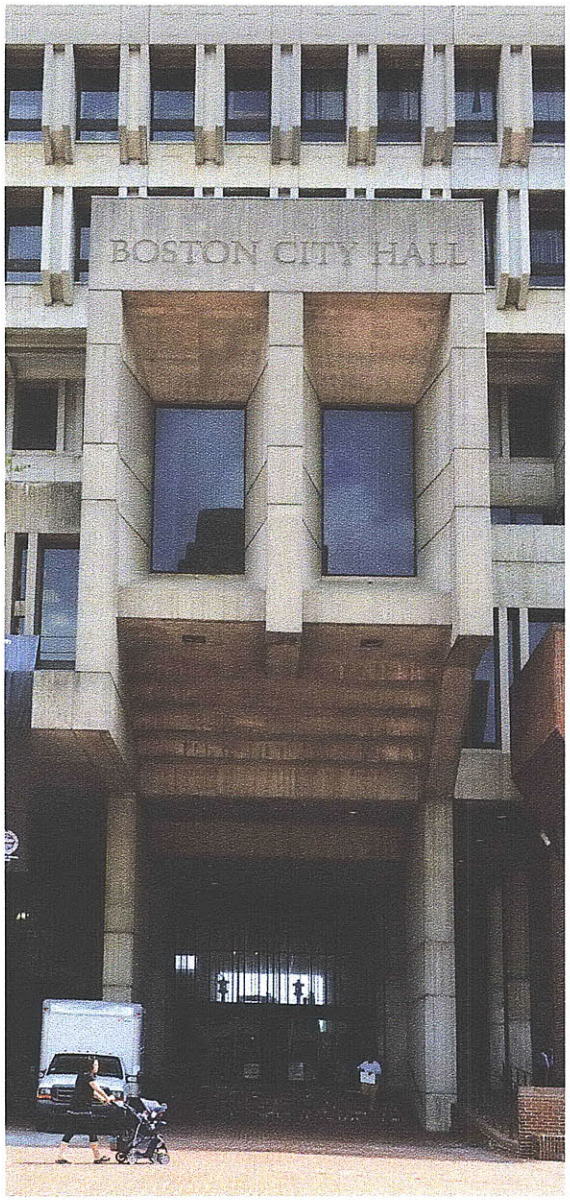
In even a cursory look at the plans [Figure 13], as we move from upper floor to ground floor, one can immediately notice both the prevalence of the structural grid as well as the way that spatially the building transitions from a quite regular floor plate to one that is increasingly excavated and segmented. In section [Figure 14], we can see how the major public spaces divide the building and are connected to the exterior courtyard space.

Figure 14



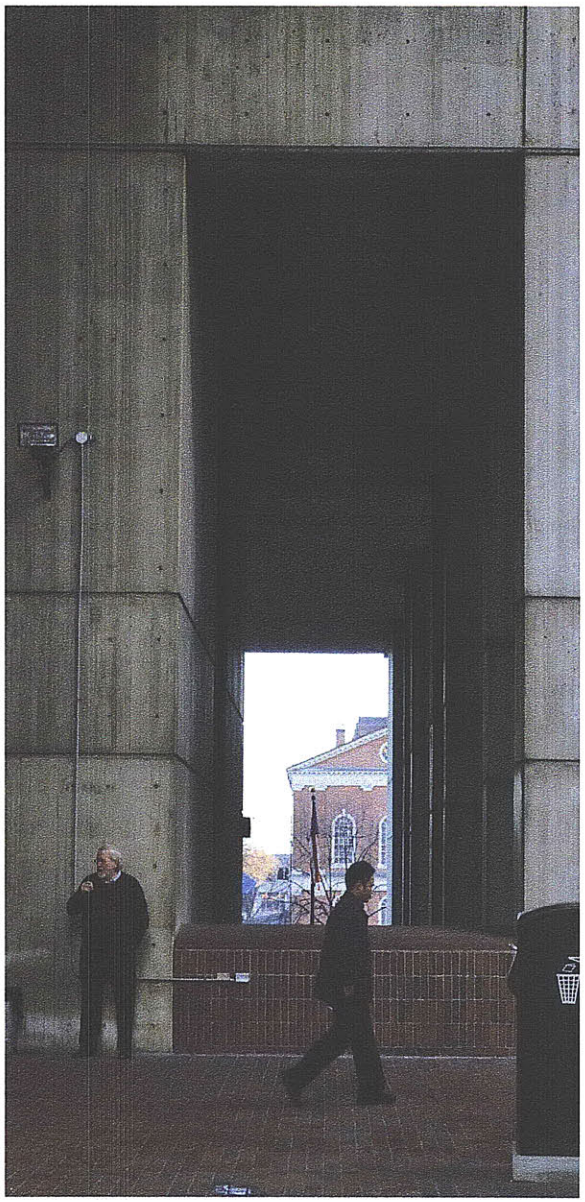
Section through Courtyard Space

Figure 15



Transparency at the Plaza level

Figure 16



Framing views across the city

Figure 17

Interior view to Faneuil Hall

Moving around and through the building, the concrete structure frames different views across the city and site [Figures 15-21], from the interior to the exterior, within the building itself, from exterior to interior, and then finally, from the site through the building, giving the building a certain openness at the most public level of the plaza despite the heaviness of the concrete.

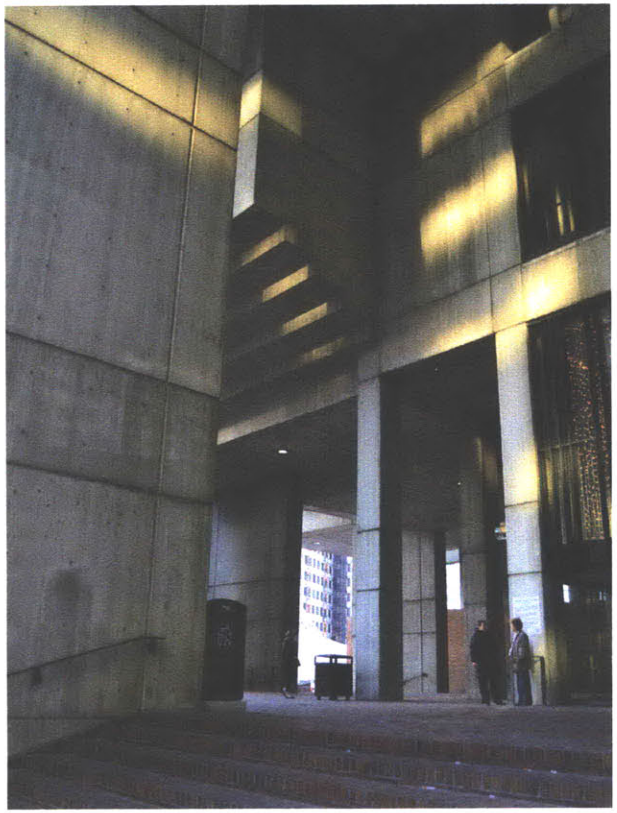
Figure 18

Views frames from exterior inward

Figure 19

Framing Views on the interior of the building

Figure 20

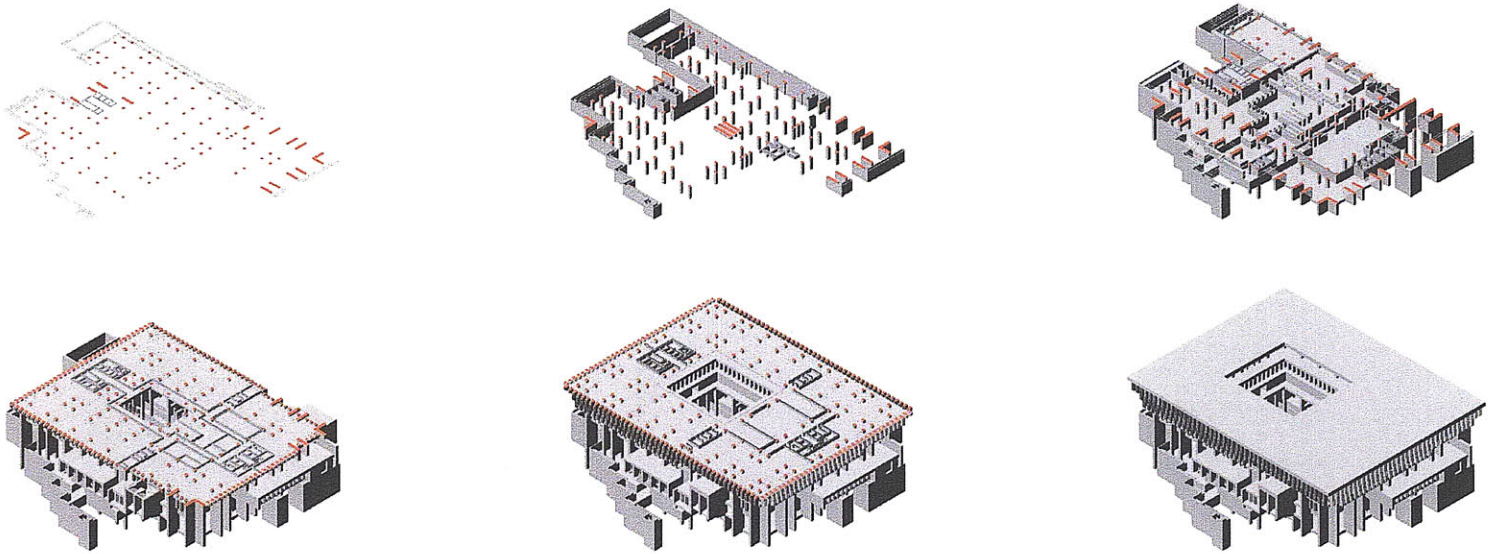


Framing views across the city

Figure 21

Framing views from interior to exterior

Figure 22



Axonometric slideshow

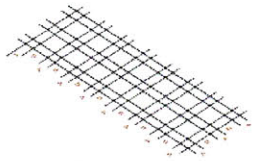
This initial axon [Figure 22] presents the most basic form of animation—toeing the line between slide show and animation. One can understand how major public programs are located on the lower floors, with symbolic spaces projecting out from the building above, and finally a regularized office floorplate at the uppermost level, and we get a hint of the significance of the structural grid in the project. Also significant is the relationship of interior to exterior space.

The column is the primary structural component of the building. This element wears many hats in this building as it transforms from single column to wall to projection to corner to interior wall [Figure 23].

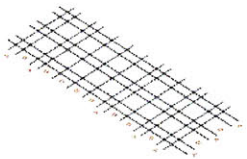
Figure 23

Column transformation

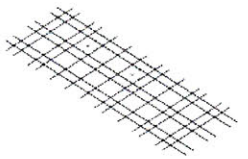
Figure 24



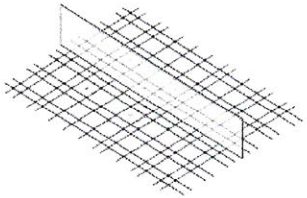
establishing the grid



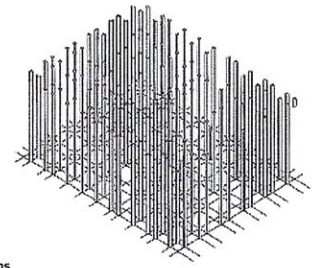
rearranging the grid



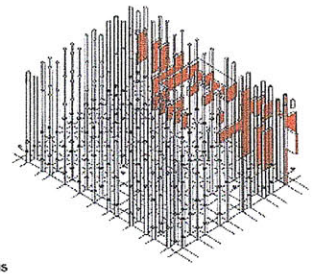
add and subtract columns



mirror along axis



extrusions



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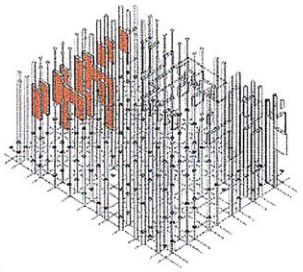

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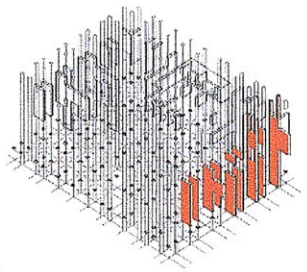

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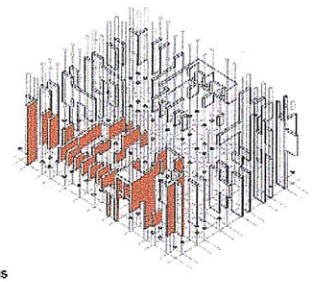


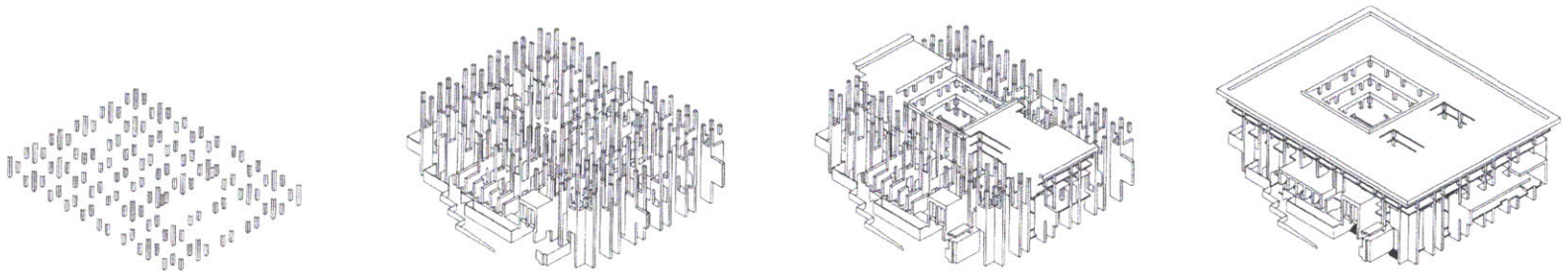
extrusions

Logic of the Grid

The column as a single unit plays a role in the larger system of the structural grid [Figure 24] which begins quite regular but then quickly transforms to an irregular grid based on an alternating 14'-4" and 28'-8" grid which is added to and subtracted from, mirrored along the north-south axis and then as the columns are extruded vertically we see the extreme anomalies which develop as the columns transform at the levels of symbolic importance within the building to create large urban scale projections out to the city at the library and mayor's office along congress street, the, interior courtyard space, the mayor's office again and finally the city council chamber and offices, facing the plaza as the main public face of the project.

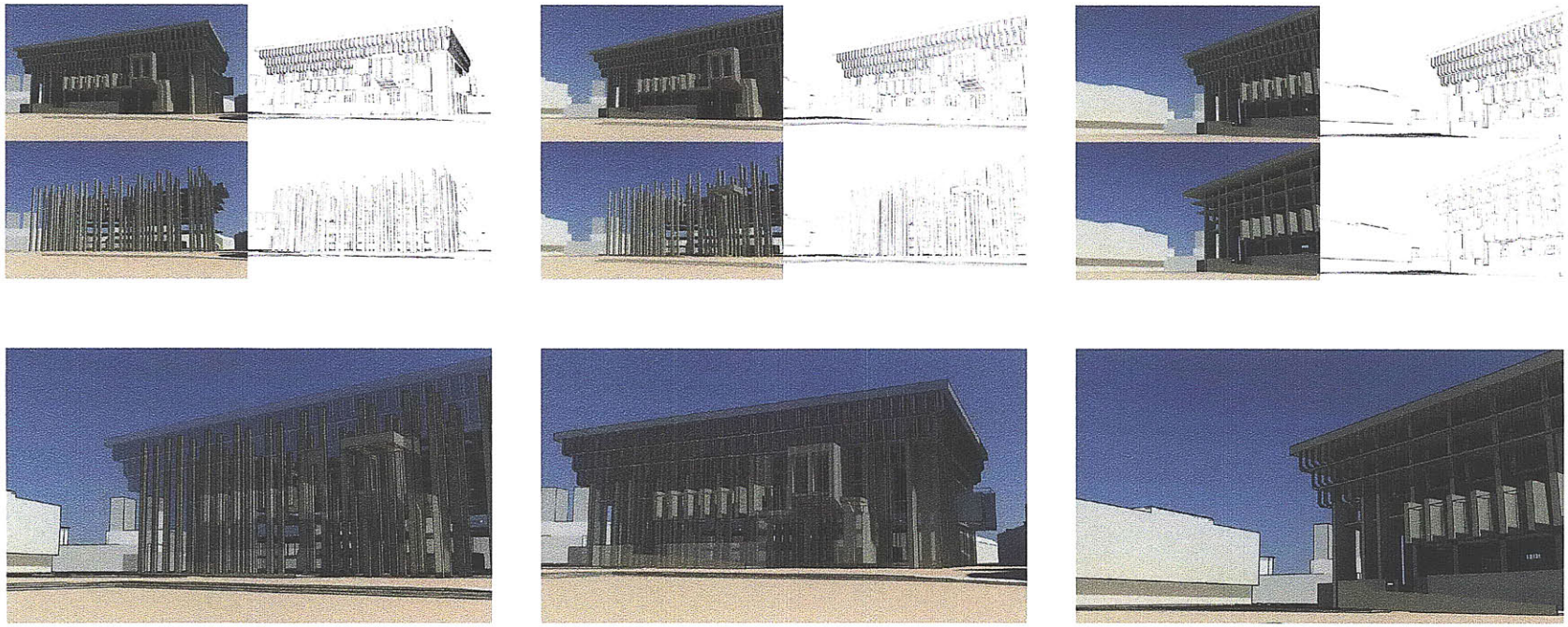
As the vertical and horizontal elements unfold to form the building in this line animation [Figure 25] one can see the geometry of the anomalous moments in the building The line animation differs from a rendered version as it emphasizes the geometric relationships over others.

Figure 25



Vertical and Horizontal Unfolding

Figure 26



Line Drawing and Rendered Animation overlay

In contrast, in a rendered version [Figure 26], we can understand the building in terms of volume and mass, and in terms of material.

In the compositing of these four views, we merge the rendered view of the whole which emphasizes the massing of the whole, the cutaway rendered view which emphasized spatial qualities as they unfold in the building, including the surprising verticality of the building. In the drawn whole we understand the geometry of the whole, especially the facade while the drawn version of the cutaway emphasizes the geometry of the anomalies and floorplates cutting through the column field.

Finally, a collaged video [Figure 27] and rendered cutaway demonstrates the relation of the plaza entry to the rest of the building. Much of the building existing below ground from this view, but also to suggest a dramatic change to the site while still revealing the interior of the building. In fact, the building is very tall—9 stories, each 13.5' feet and taller, most of this mass is buried and gives the building the appearance of being only a few stories tall from the main entry off the plaza.

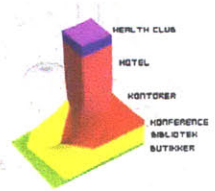
Figure 27

Collage Cutaway, Boston City Hall

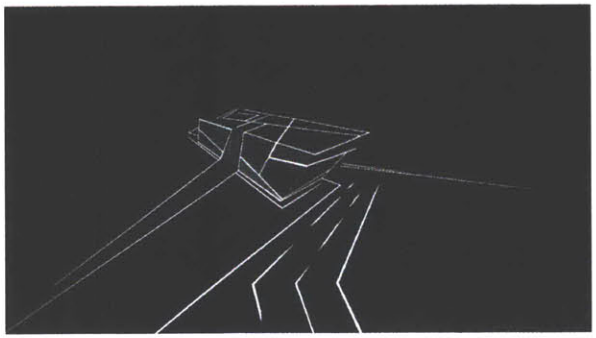
Part II A Comparative Study

The second half of this thesis takes a comparative approach and focuses on three contemporary modes of animation: the Bjarke Ingles Formal Transformation, the Zaha Hadid Continuous Flythrough and the Michael Meredith Layered Narrative [Figure 28]. Each of these contemporary tropes is deeply rooted in both a filmic and architectural lineage. Through the act of comparative application the techniques and prejudices of each particular animation style are revealed:

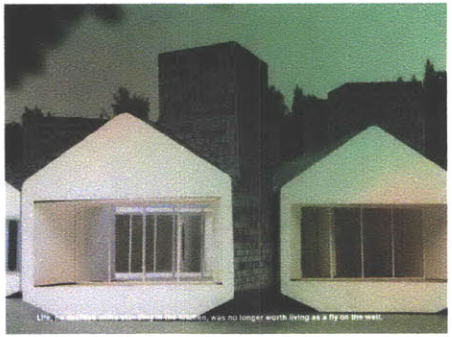
Figure 28



Formal Transformation
e.g. Bjarke Ingels Group

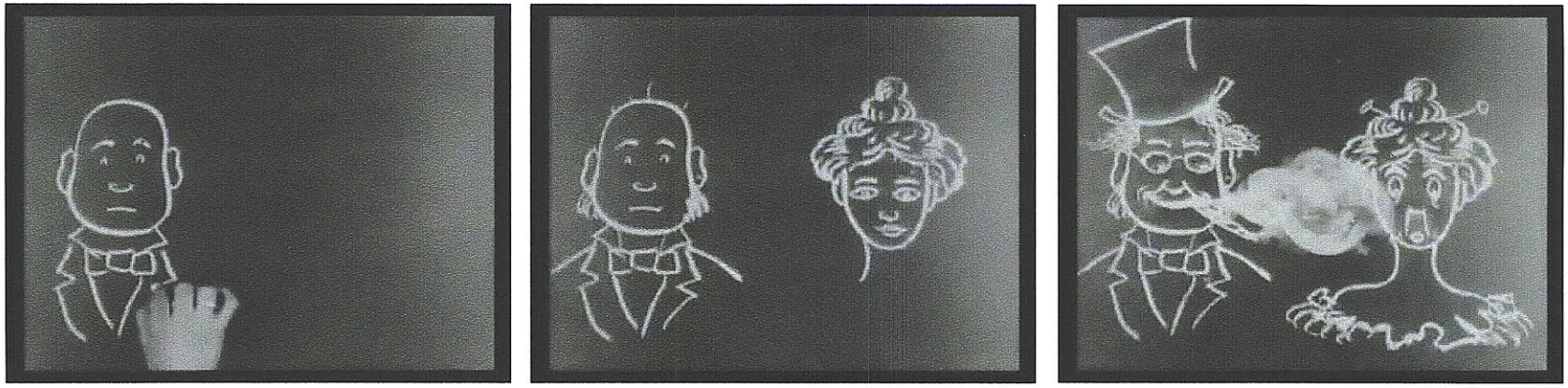


Rendered Flythrough
e.g. Zaha Hadid



Narrative
e.g. Michael Meredith

Figure 29



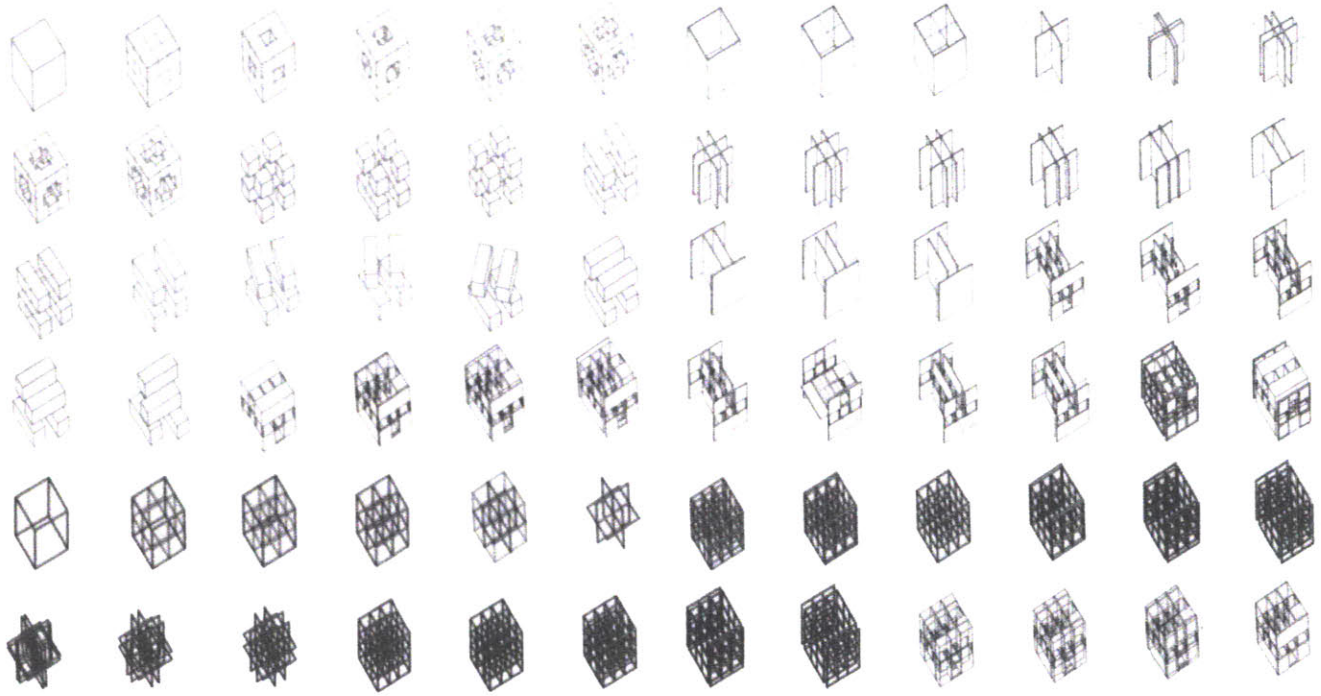
The Humorous Phases of Mr. Funny Face, early stop motion animation

The Formal Transformation

The formal transformation, has its roots in the earliest history of animation with the production of stop motion shorts, such as the 1906 short by James Stuart Blackton [Figure 29]. The technique of stop motion animation focuses on the transformation of a single object, relying on the continuity of a few points in the scene, to emphasis the incremental changes being made from frame to frame.

In architecture, the technique of architectural sketching on layers of traces lent itself quite readily to the output of a series of frames documenting iterative changes to an original drawing/object. Peter Eisenman's drawing of the formal transformation of House IV [Figure 30] is a well known example of how a cube is cutaway or augmented to its final form in a house.

Figure 30



Peter Eisenman, House IV transformation

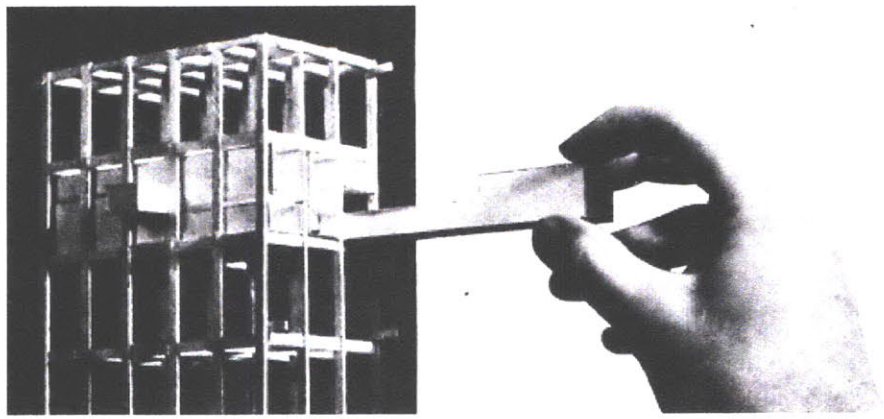
Figure 31

Bjarke Ingels Group, House 8 animation

In many of Bjarke Ingels animations [Figure 31], an object is transformed from its platonic solid state to its final form through a series of operations, often performed on the object by Bjarke, himself. It is worth noting that in enacting these operations on the object himself, Bjarke is also adopting a lineage of the architect's omnipotent hand which shapes the model/city/region—often associated with Le Corbusier [Figure 32].

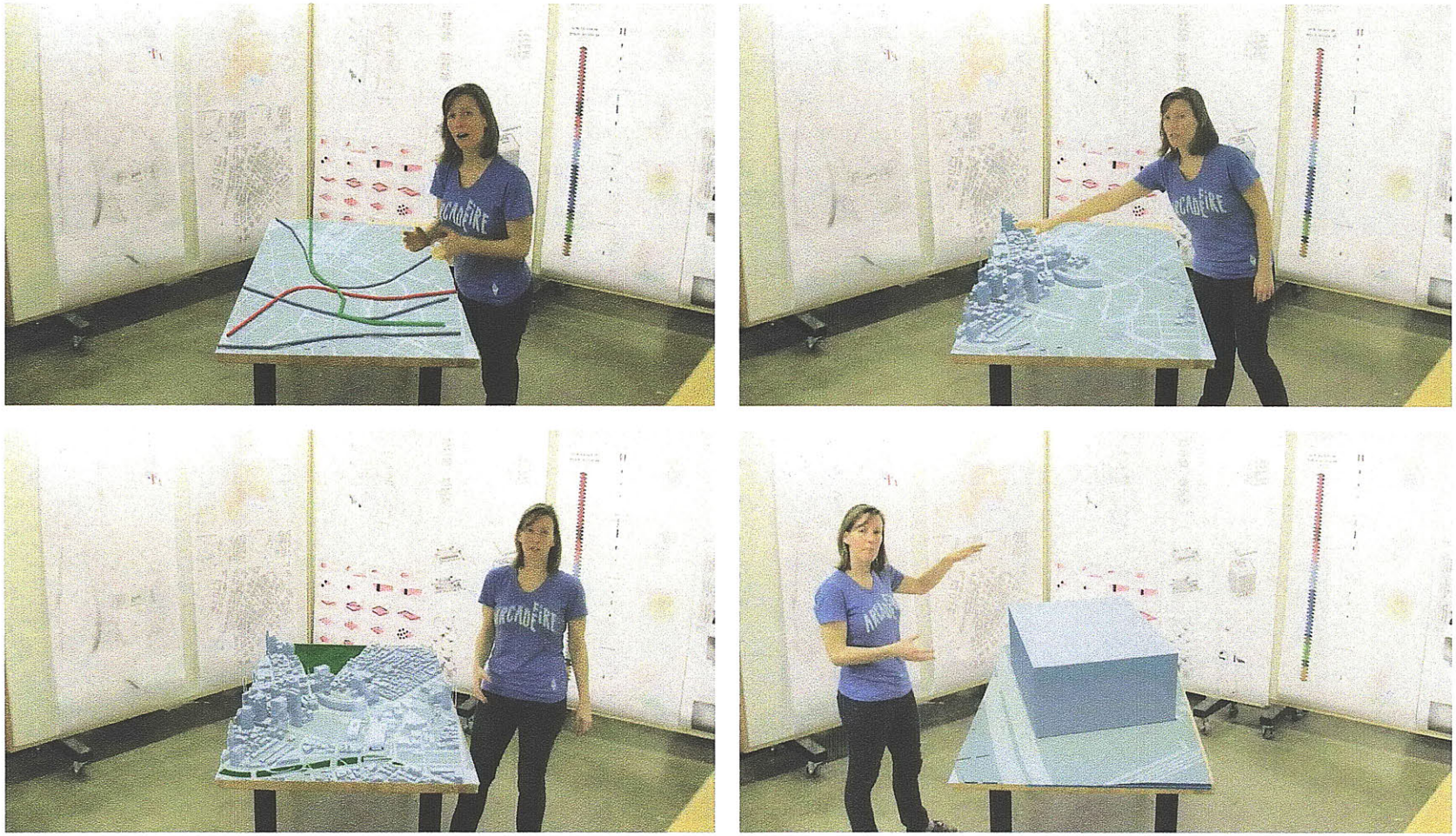
Remaking City Hall in the style of Bjarke Ingels [Figure 33] requires that we first understand the project as a series of formal transformations, and secondarily as a series of programmatic volumes arranged into a single form. The way that the form of the project is manipulated as a function of different programmatic concerns is manifest through a series of physical operations such as pushing, pulling, lifting, splitting and twisting. Ultimately the form of the project is dictated by these operations.

Figure 32

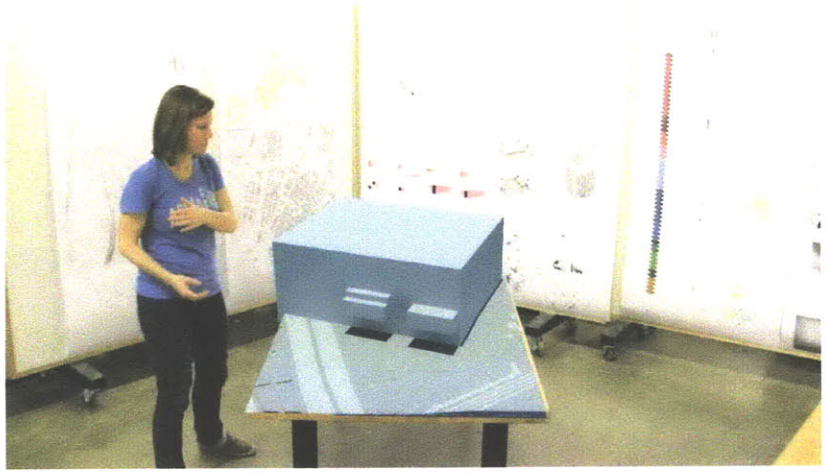


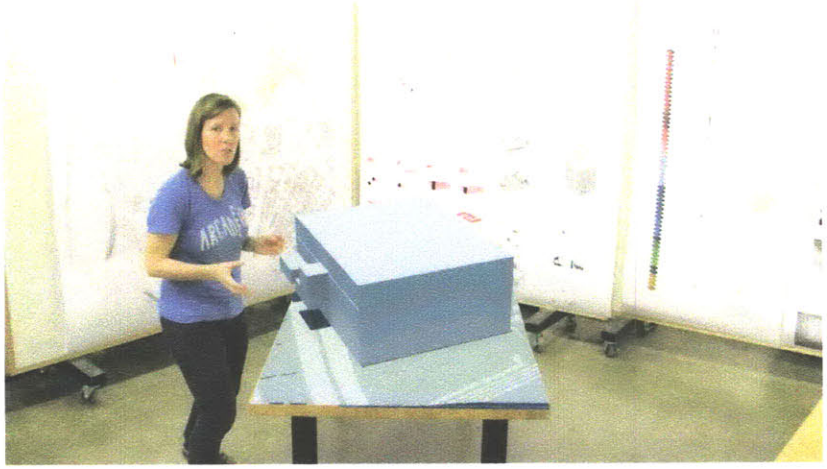
Le Corbusier's omnipotent hand

Figure 33



City Hall remade in the style of a Bjarke Ingels formal transformation





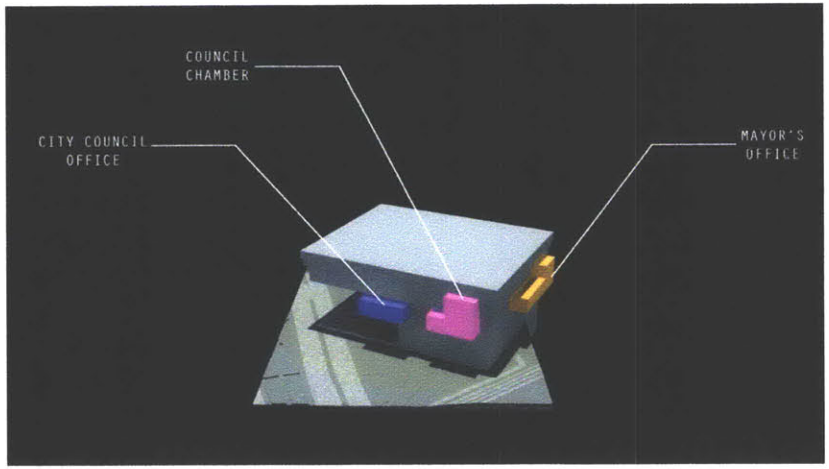
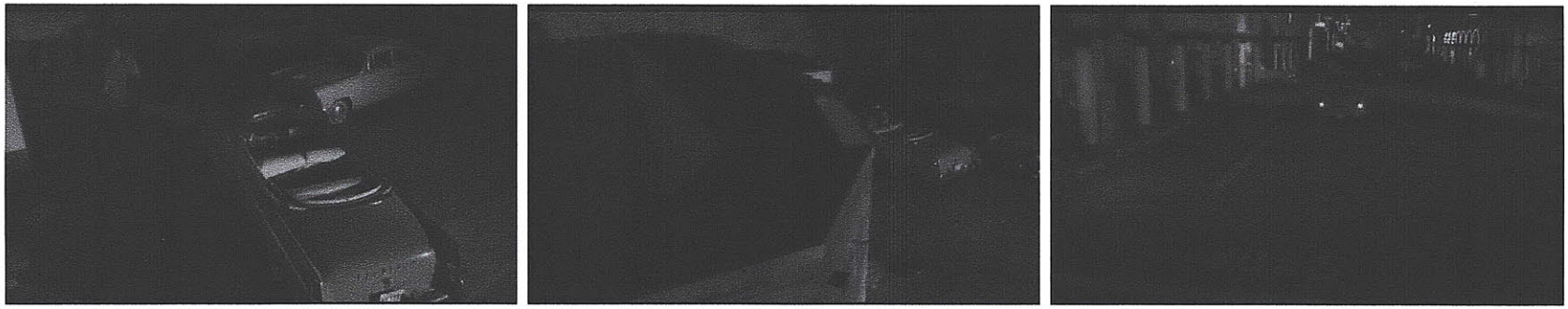

COUNCIL
CHAMBER
CITY COUNCIL
OFFICE
MAYOR'S
OFFICE

Figure 34



Touch of Evil by Orson Welles exemplifies the technique of the continuous tracking shot

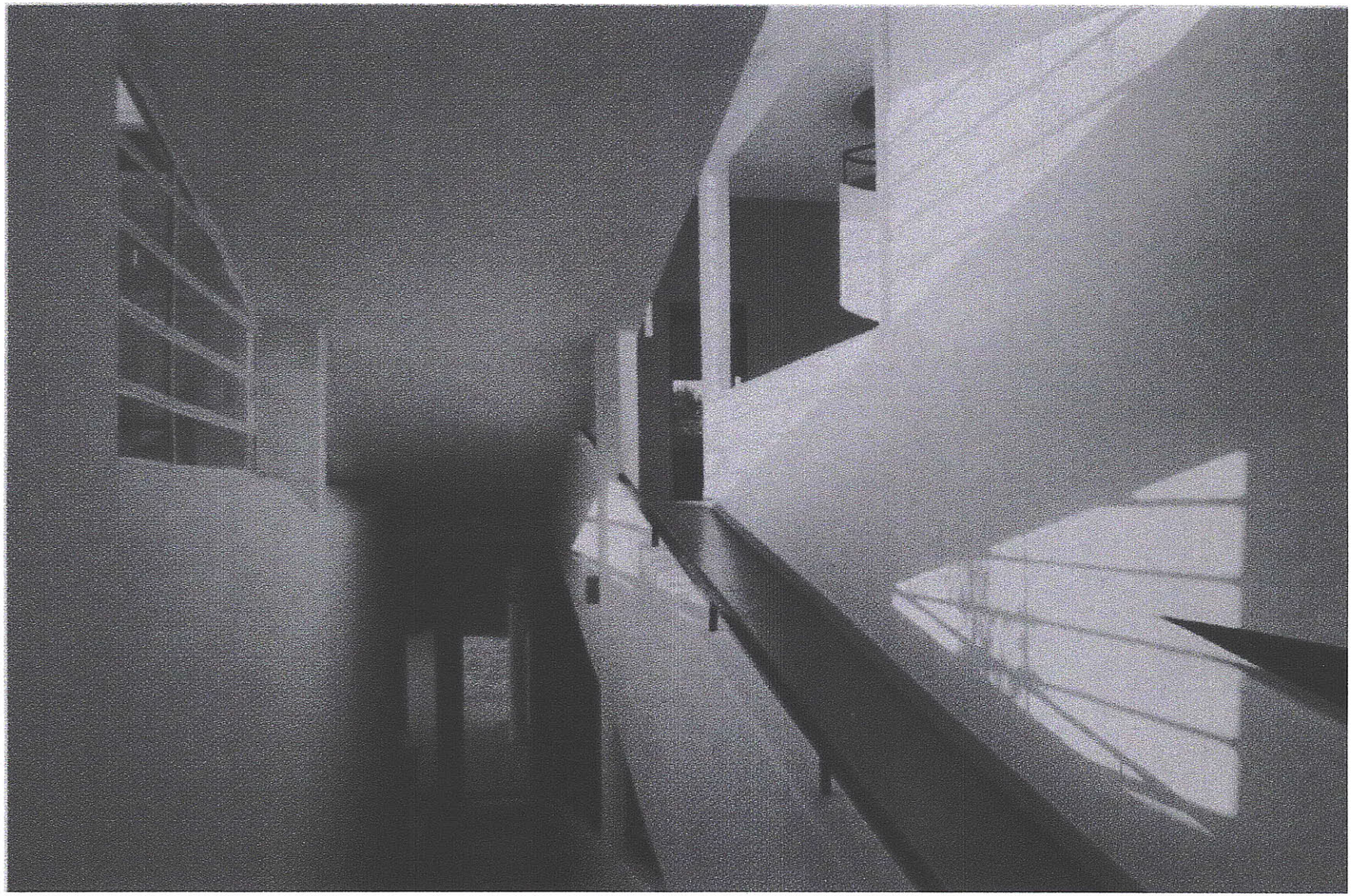
The Continuous Flythrough

The flythrough has a lineage in traditional filmmaking techniques pioneered by filmmakers like Orson Welles in his Touch of Evil, [Figure 34] or more recently in the film Russian Ark, a single 96 minute take, filmed in the Hermitage Museum. These long, continuous tracking shots present a continuity of space within the film, allowing the viewer to understand the larger area of the shot. In Touch of Evil we can understand where the main street is in relation to the original shot. Likewise in Russian Ark [Figure 35] we are led through 33 rooms of the museum in a single 96 minute take, unveiling both the narrative of the film as well as the major rooms of the museum.

Figure 35

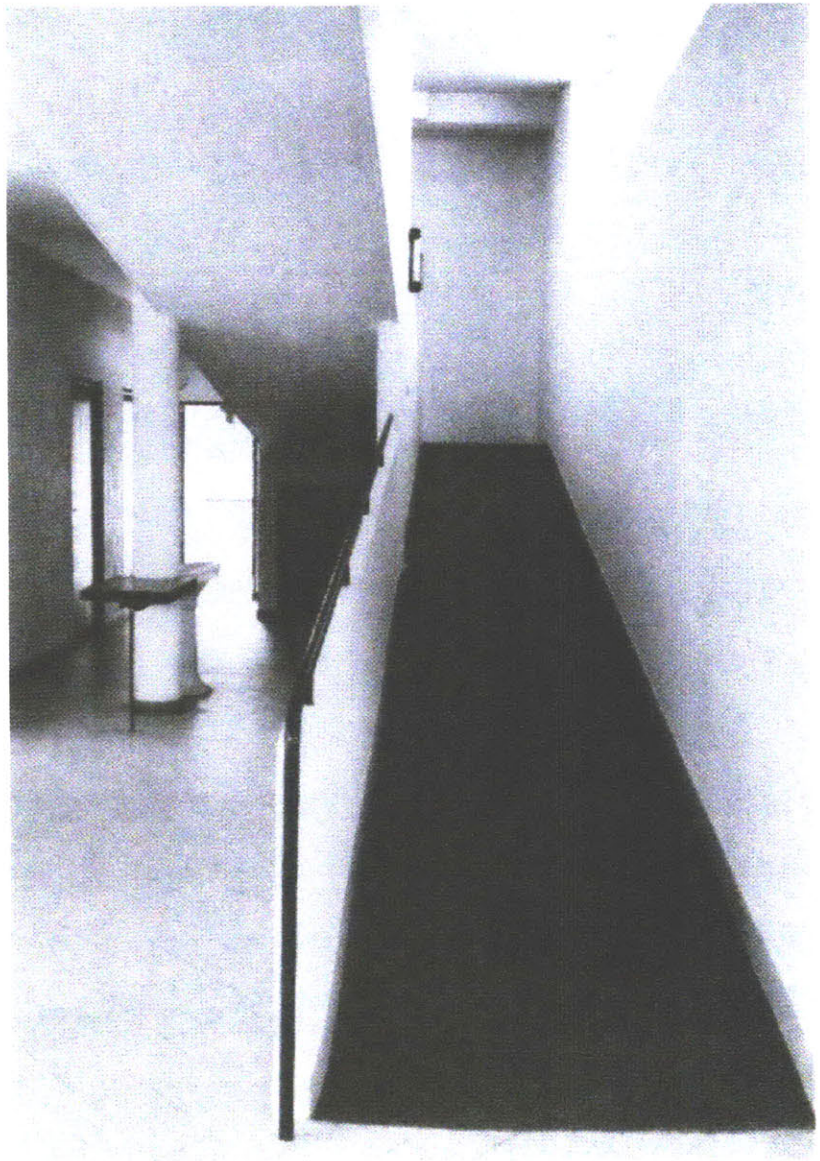
Russian Ark, a 96 minute single shot through the Hermitage, 2002

Figure 36



Ramp at Villa Savoye

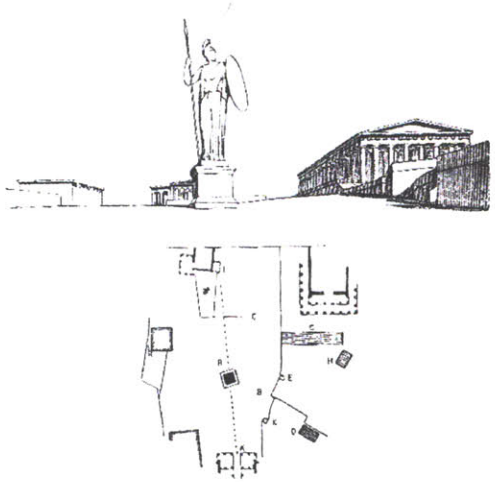
Figure 37



Ramp at Villa Savoye

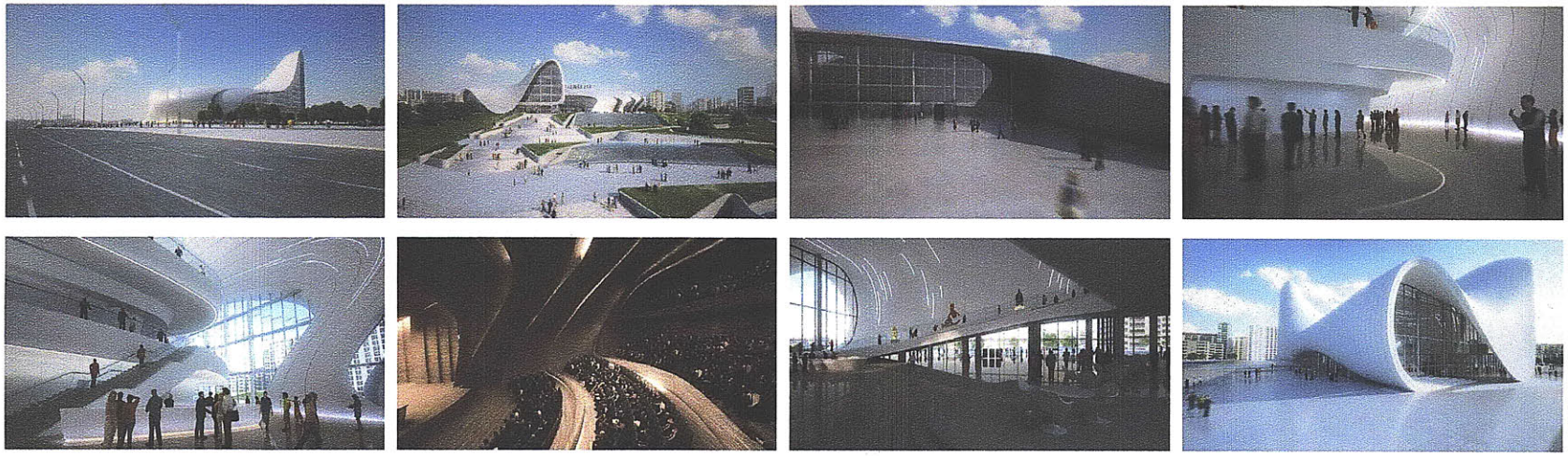
In architecture, this is manifest spatially through the promenade, theorized by Le Corbusier and exemplified by projects such as Villa Savoye [Figures 36 and 37] which features a ramp that leads one through the building. Of course, Corbusier was highly influenced by classical ideas of order and alignment brought to light most famously by Auguste Choisy in his analysis of the Acropolis sequence of spaces [Figure 38].

Figure 38



Choisy's analysis of the Acropolis

Figure 38

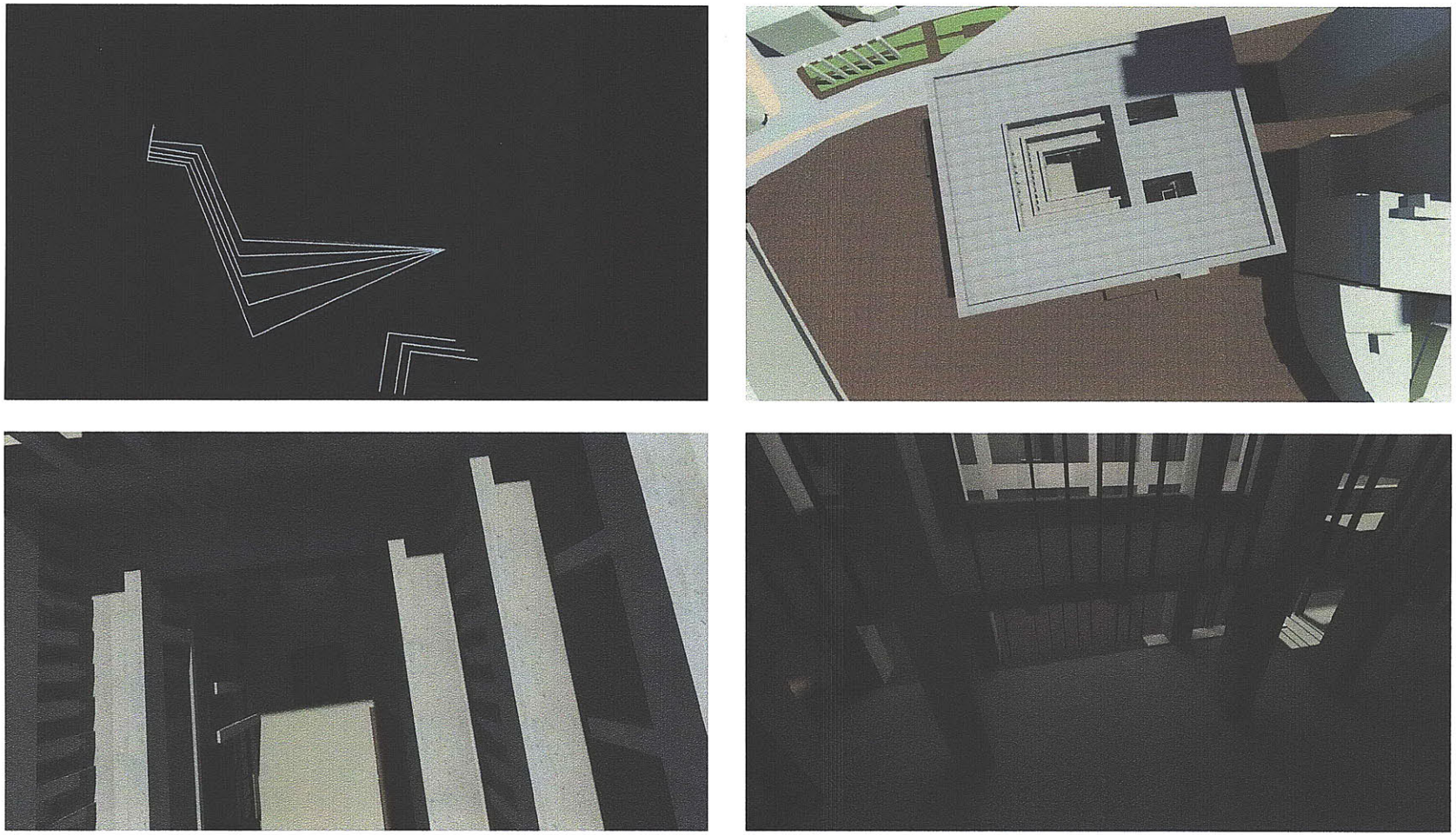


Zaha Hadid, Heydar Aliyev Cultural Centre Flythrough Animation

In the contemporary flythrough by Zaha Hadid Architects, [Figure 38] the structure of the animation coupled with the spatial continuity of the architecture itself reinforces the idea of the promenade. Generally speaking, her animations are made up of only a few shots each of considerable length and are rendered to the same degree of resolution in terms of material (texture) and atmosphere. They reveal a grand sequence of circulation moments which connect to show the major programmatic spaces of the project.

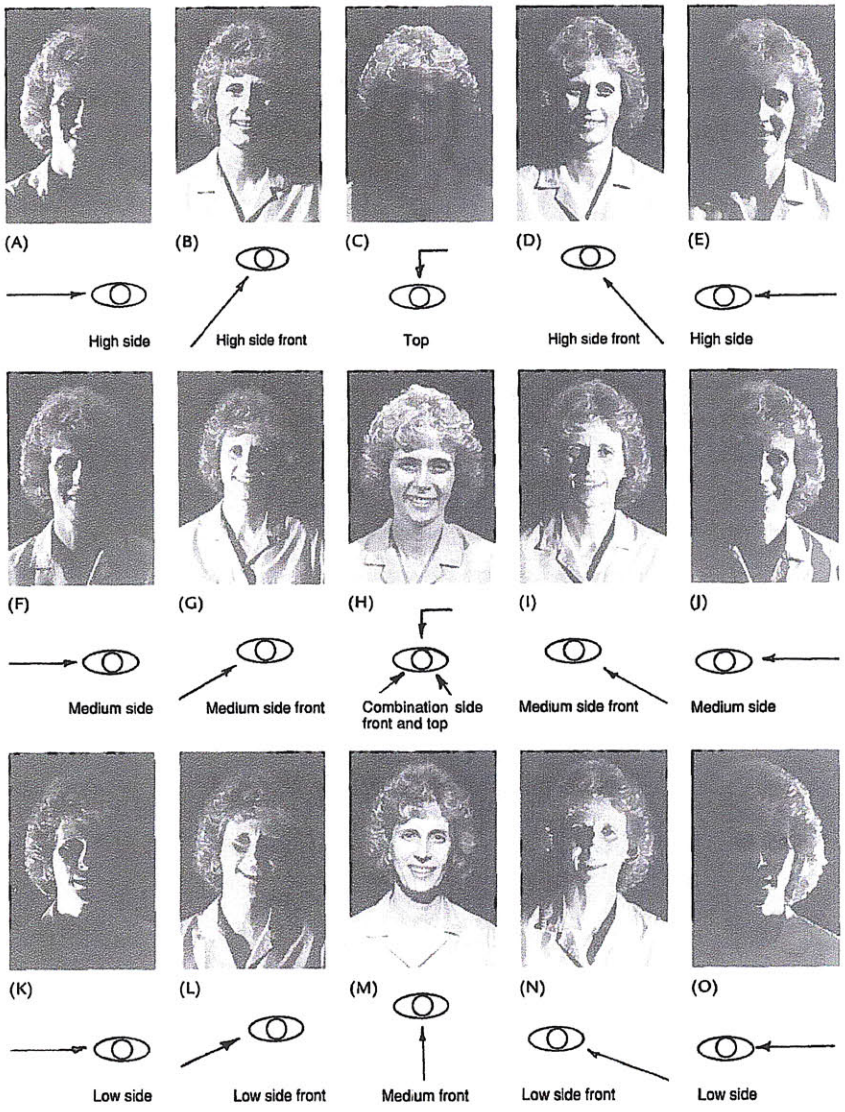
In remaking Boston City Hall through the lens of Zaha Hadid [Figure 39], it is necessary to understand the project as a series of continuous sequences. As a public building there is ample program devoted to public services and circulation and in fact there are three main sequences through the building. In addition, the building's major public thoroughfares could be seen as almost classically inspired in the sense that they follow many of the same principles highlighted by Choisy in his analysis of the acropolis, terminating with views of important buildings or sites across the city. The view corridors through the building from the plaza also frame images of important buildings such as Faneuil hall and the custom house tower—promenade continues outside of the building and across the plaza.

Figure 39



City Hall remade in the style of a Zaha Hadid Flythrough

Figure 40



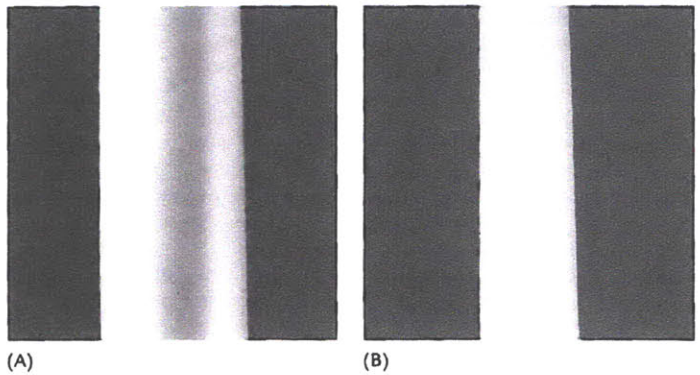
Typical Stage Lighting Diagram

Finally, the third type of contemporary animation layers different narratives in a series of still images. Visually, this style of animation draws inspiration from the theater and stage lighting techniques [Figure 40, 41] which are carefully calibrated on stage to show a range of depth or flatness of objects, characters and, of course, space.[5] In film, this has been used by cinematographer Gordon Willis in Woody Allen's *Manhattan* (1979) [Figure 42] where a still camera records the space of the room revealed through changes in lighting.

In architecture, the layered narrative finds its origins in the birth of architectural theory—stemming from philosophers like Plato and his Socratic dialogues [Figure 43]. This dialogue was of course appropriated by early theorists of architecture, including Le Corbusier in L'Esprit Nouveau and avant garde artists like Piet Mondrian in De Stijl.

5 J. Michael Gillette, Designing with Light: An Introduction to Stage Lighting, 4th ed. (New York: McGraw Hill, 2003) 9-10.

Figure 41



Lighting used to show 3D vs. flat lighting

Figure 42

Lighting used to reveal different spatial conditions, *Manhattan*, Woody Allen

Figure 43

SOCRATES: Yet it is your view that anyone who's a good rhapsode is also a good general?

ION: Oh, indeed.

SOCRATES: Now then, are you, as a rhapsode, the best among the Greeks?

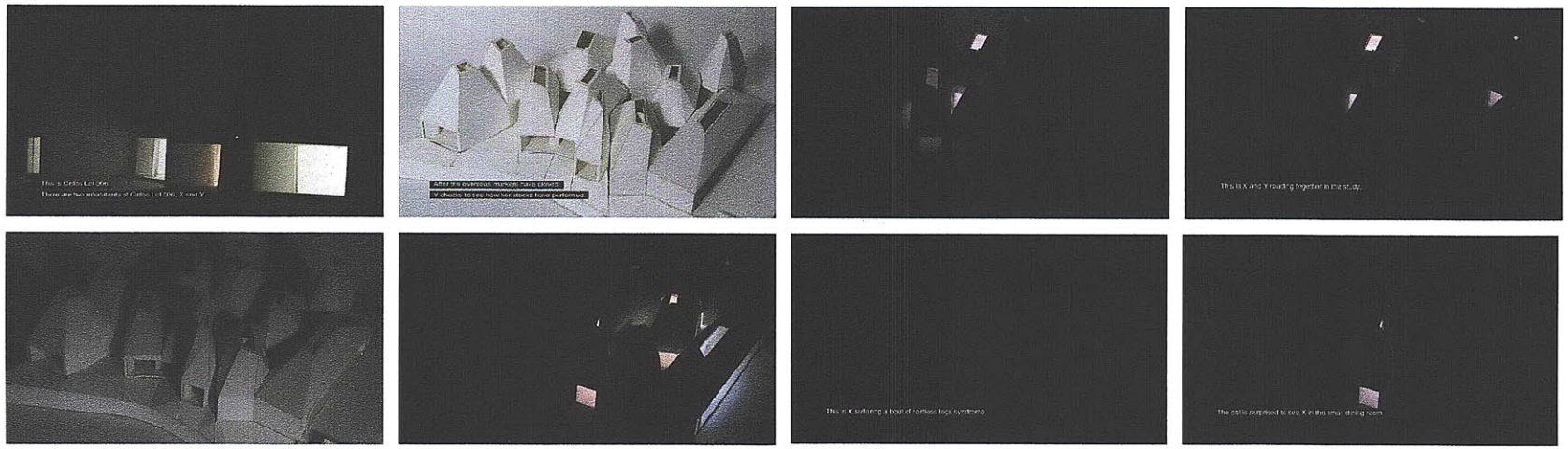
ION: By a long chalk, Socrates.

SOCRATES: So, as a general too, are you the best among the Greeks?

ION: Have no doubt of it, Socrates; that too I learnt from the works of Homer.

Platonic Dialogue

Figure 44

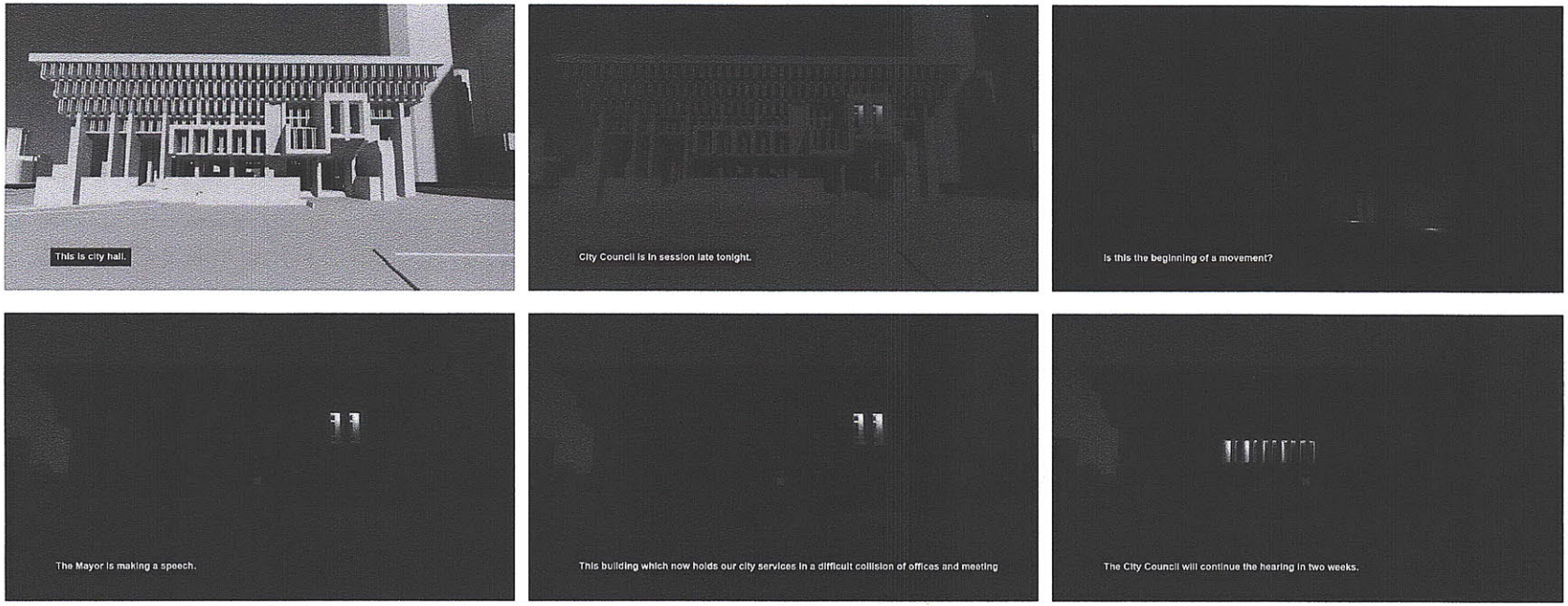


Michael Meredith, Ordos House Animation

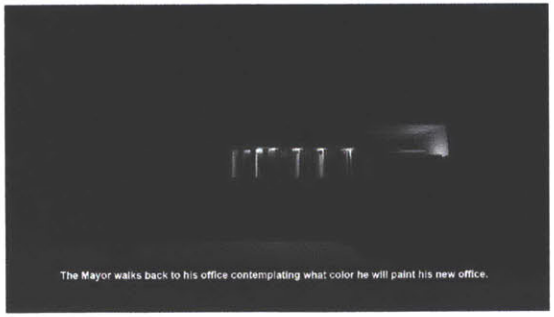
The animations of Michael Meredith [Figure 44] take on the format of a Socratic dialogue between two characters while chronicling one day in their house. At the same time, the dialogue is deeply invested in current architectural discourse and actively contributes to this discourse. Meredith's animations are less about the architectural forms or techniques and much more a comment on the larger discourse, even if they remain ambiguous about where they would self situate.

In remaking City Hall through the lens of Michael Meredith [Figure 45], this animation blends discourse from the time in which City Hall was designed with more contemporary discourse in order to update the project and bring it back into the realm of the contemporary. The ideals of Gerhard Kallmann's Action Architecture take on new meaning as they are used to wage new arguments about the state of architecture and the city today—from both sides of the argument. This ambiguity is a hallmark of Meredith's work and demonstrates a kind of self awareness of his process whereby he understands the use and limits of the discourse by both sides of a discussion.

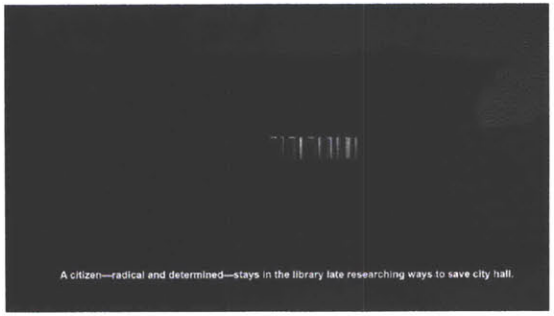
Figure 45



Boston City Hall remade through the lens of Michael Meredith

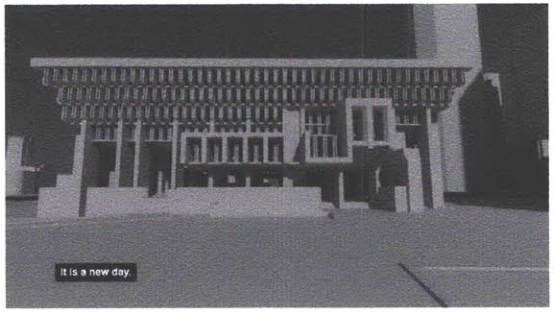

The Mayor walks back to his office contemplating what color he will paint his new office.

He decides to go home for the day.


A citizen—radical and determined—stays in the library late researching ways to save city hall.

The police arrive and investigate.

Is this the beginning of a movement?


It is a new day.

Works Cited

Works Cited

Anderson, Lawrence B. *A Competition to Select an Architect for the New City Hall in the Government Center of the City of Boston.* Boston, 1961

Blackton, James Stuart, "The Humorous Phases of Funny Face," *YouTube*. 1906. 01 Sept 2011. <http://www.youtube.com/watch?v=8dRe85cNXwg>

"Boston City Hall." Wikipedia. 14 August 2011< http://en.wikipedia.org/wiki/Boston_City_Hall>

Castor, Daniel. *Drawing Berlage's Exchange.* Rotterdam: NAi, 1996.

Gillette, J. Michael. *Designing with Light: An Introduction to Stage Lighting,* 4th ed. New York: McGraw Hill, 2003.

Hadid, Zaha. "Heydar Aliyev Cultural Centre on Vimeo." *Vimeo,* 01 Mar. 2011. Web. 05 May 2011. <http://vimeo.com/21481782>.

Ingels, Bjarke. "The 8-House on Vimeo." Vimeo, 01 Jan. 2009. Web. 09 Sept. 2011. <http://vimeo.com/3499612>.

Kallmann, Gerhard. "The Action Architecture of a New Generation." Arch Forum 4 (1959): 132-137. 1183

Manhattan. Dir. Woody Allen. By Woody Allen, Marshall Brickman, and Gordon Willis. Prod. Charles H. Joffe. Perf. Woody Allen, Diane Keaton, Michael Murphy, Mariel Hemingway, Meryl Streep, and Anne Byrne Kronenfeld. United Artists Corp., 1979.

Meredith, Michael. "Ordos House." *MOS Studio.* Web. 05 Sept 2011. < http://www.mos-office.net/uploaded_files/project_file/path/84272/Venice_Ordos_640_x_360.mov>

Sokurov, Alexander. *Russian Ark.* Hermitage Bridge Studio, 2002.

Additional Bibliographic References

Blade Runner. Dir. Ridley Scott. Prod. Ridley Scott and Hampton Francher. By Hampton Francher and David Webb Peoples. Perf. Harrison Ford, Rutger Hauer, and Sean Young. Warner Bros., 1982. DVD.

16 Hours. Prod. Dbox. Dir. Elizabeth Diller and Ricardo Scofidio. Dbox. Animation.

Carter, Marcus, Alonso Hernan Diaz, Forth Bagley, and Ceren Bingol. *Perspecta 38: Architecture after All* : The Yale Architectural Journal. Cambridge, MA: MIT, 2006.

Europa. Dir. Lars Von Trier. Perf. Barbara Sukowa, Jean-Marc Barr, Udo Kier. Canal+, 1991.

Evans, Robin. *The Projective Cast: Architecture and Its Three Geometries.* Cambridge, MA: MIT, 1995.

Evans, Robin. *Translations from Drawing to Building.* Cambridge, MA: MIT, 1997.

Fear, Bob. *Architecture and Animation.* New York: Wiley, 2001.

Run Lola Run. Dir. Tom Tykwer. Perf. Franka Potente, Moritz Bleibtreu, Herbert Knaup. X-filme Creative, 1998.

Tschumi, Bernard. *Architecture and Disjunction.* Cambridge, MA: MIT, 1994.

Tschumi, Bernard. *The Manhattan Transcripts.* London: Academy Editions, 1981.

Vidler, Anthony. *Warped Space: Art, Architecture, and Anxiety in Modern Culture.* Cambridge, MA: MIT, 2001.