Subtraction | Construction in Reverse

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Subtraction
A Construction in Reverse
An Event of Metamorphosis

Sherina Zhang
Advisor: Jonathan Louie
Preface: Introduction

Life Span of a building does not begin at the creation of a new, instead it starts at the Subtraction of an old. Often the architectural discipline is fixed on the product of demolition and the creation process of new designs. Demolition are used to create tabula Rasa that seamlessly erase the “failures” of the precursors. The subtraction process is not acknowledged as a technique used deliberately for design. As it appear on the first page of architectural construction drawings sets, demolition is an inevitable step that every building possesses in the process of space making. Subtraction, as procedures of demolition, are events that create afterlife for build preservation. The metamorphosis of buildings can be achieved through subtractive procedures experimented on multiple building typologies.

This thesis initiates with debates between entropy of a building’s finite ending and metamorphosis of a building’s new beginning. According to Robert Smithson entropy is “an irreversible condition, where everything is gradually wearing down”. The works of Gordon Matta Clark, infused with understanding resulting in the increase of entropy, prevents architecture to pass beyond the point of irreversibility. Clark performs a set of minimalistic acts that provide architecture in obsolescence with an afterlife.

Each species of Subtraction presents different techniques, motives and results. The process of subtraction can be categorized into three main types: destruction, demolition, and creative subtraction. A destructive process, such as implosive demolition, aims to create absolute erasure within a short period of time. The Demolition process proposes a set of pre-planned procedures that can be applied to multiple building types. Creative Subtraction generates events, that can produce a second or third conceptual framework for a building’s performance after that of its intended usage.

Nelson Goodman’s idea of allographic art is introduced in this thesis as a media of design for the subtraction procedure. Through annotated drawing sets this thesis will create pre-planned procedures that specifically instruct a transformation process for a building’s after life.
Subtraction: is a primary activity in the ecology of building and making space -- a capacity that all buildings possess. It is also a procedure that cause the metamorphosis of a building.

Creative destruction: is a phrase first brought up by Joseph Schumpeter as a response to Marx's idea of economics. According to Schumpeter, creative destruction describes the "process of industrial mutation that incessantly revolutionizes the economic structure from within, constantly destroying the old one, constantly creating a new one.

Tabula Rasa: is a Latin phrase often translated as "blank slate" in English and originates from the Roman tabula or wax tablet used for notes, which was blanked by heating the wax and then smoothing it. Keller Easterling has noted: tabula rasa is the mode of subtraction most compatible with architectural desire.

Metamorphosis: a change of the form or nature of a thing or person into a completely different one, by natural or supernatural means. Metamorphosis can also be described as an evolvement of an element from one to another.

Event: a thing that happens, especially one of importance. According to Bernard Tschumi: "there is no space without event, no architecture without program. Architecture’s social relevance and formal invention can not be dissociated from events that happen in it."

Planned obsolescence: in industrial design is a policy of planning or designing a product with an artificially limited useful life, so it will become obsolete, that is, unfashionable or no longer functional after a certain period of time.

Entropy: "a closed system which eventually deteriorates and starts to break apart and there’s no way that you can really piece it back together again."
This book will begin by asking the question of “do buildings have an end”? The current demolition phenomenon in architecture seems to suggest a finite termination for buildings. However works of Gordon Matta Clark may suggest a different alternative to the life cycle of buildings in obsolescence. A dialogue between Robert Smithson’s theory of enotropy and Gordon Matta Clark’s projection of Metamorphosis may provide a resolution for the question.
The Second Law of Thermodynamics states that all things tend towards increased entropy – that is to say, over time everything will get more and more jumbled up, chaotic and random. Something very structured like Humpty Dumpty is said to have low entropy, thus when he falls off the wall and gets all splattered about his entropy increases. Cool

Robert Smithson
Smithson is an entropoligist whose works are based on a sense of irreversibility and the dissolution of things. Smithson’s work questions the limitation and the life span of objects and architecture. To Smithson entropy is “a closed system which eventually deteriorates and starts to break apart and there’s no way that you can really piece it back together again.” Smithson uses properties of entropy as a tool to test out and push for a the death of architecture. To Smithson, anything that are contained by this world has a linear life span. Things have a beginning, the birth, and things have an end, the death.

Partially Buried Woodshed
This work is practiced on a woodshed in Ohio. The work was constituted by him ordering a bulldozer, and burying the woodshed with mounds of earth, until the moment when the central beam of the shed had cracked. This can be regarded as the point at which the structure had disintegrated, which was the defining moment when the work was complete.

Hotel Palenque
Smithson had been invited to Yucatan perhaps with the expectation that he would make a work about the mine ruins there, since his interest in the ruins was well documented. But he actually made his work about the Hotel Palenque, the hotel where he was staying, which fascinated him because it seemed to him the embodiment of entropy. The hotel was still being built at one end, and yet was already dissolving, being encroached by nature, and crumbling at the other end; a perfect juxtaposition of construction and deconstruction, or of form and decomposition.

Entropy in Science
Entropi in science refers to the measure of disorder or randomness in a system. The Second Law of Thermodynamics states that the total entropy of an isolated system will tend to increase over time, leading to a state of increased disorder or randomness. This law is a fundamental principle in physics and is used to study the behavior of systems at both macroscopic and microscopic levels.

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**Gordon Matta Clark**

**After for Buildings**
Works of Gordon Matta Clark are infused with understanding of process resulting in the increase of entropy. His operation on buildings explores the structure and does not allow the structure to pass beyond the point of irreversibility.

“Matta-Clark was obsessed with producing spatial shortcuts, seeking the simplest way to create complexity...without having to make or build anything”. He aims to recreate events, space and effects for buildings that are slated to be demolished. Clark’s work are sometimes seen as a social revolution, however most importantly his work completes the metamorphosis of a building’s transformation from death to rebirth.

**The Split**
The line that he cut through the abandoned house in Edgewood, New Jersey, produced a continuous ribbon of light through interior rooms and destabilized the image of suburban domesticity on the exterior. The project split utilizes a few minimalistic act of subtraction to achieve the metamorphosis from a building’s obsolescence to a work of art to exhibit.

**Conical Intersect**
His telescopic cone in Conical Intersect sliced multiple interior walls into one shape and pointed the eye towards the Pompidou Center rising beyond, collapsing old and new construction. Clark seeks for the simplest way to create complexity, and transforms values of architecture with a process of subtraction instead of addition.
Taking Benard Tschumi’s theory of events and spaces, these set of diagrams aims to dissect Gordon Matta Clark’s splitting as an event of subtraction for space making. Instead of creating the narrative of event with movements of the inhabitant, this thesis proposes the methods and process of subtraction as the subject of event.
The construction and demolition of a building can be viewed as two sides of one process. This chapter uses ideologies behind "Things come part" by McLellan and "911 St Cyril" by Dan Haffman, to dissect the correlations between assembly, disassembly, and repair.
The concept of “planned obsolescence” is not a new one: Its coinage goes all the way back to 1932, when it was used to identify a simple scheme by which the government would impose a limited shelf life on products in an attempt to help the world emerge from the Great Depression.

The term re-emerged in 1954, when industrial designer Brooks Stevens—who, among many other things, designed the famous Oscar Mayer Wienermobile—used it to refer to the practice of continuously improving and reinventing products in an attempt to influence consumers into replacing their purchases more often. Job’s take on planned obsolescence is a fundamental force in modern economies, and has been adopted by pretty much every manufacturer—including, of course, Apple; it’s the reason why the iPhone is on a two-year release cycle, with major cosmetic differences in the handset’s design between each iteration and the next. In the end, it’s an attempt to thwart market saturation and convince existing customers to replace their hardware on a regular basis.

Planned Obsolescence

iPhone several times in the last couple years, notably by New York Times columnist Catherine Rampell, who calls it “The Apple Trap.”
Things Come Apart

**General Theory**
In *Things Come Apart*, McLellan exposes the inner working of 50 objects and 21,959 individual components as he reflects on the permanence of vintage machines built several decades ago—sturdy gadgets meant to be broken and repaired—versus today’s manufacturing trend of limited use followed by quick obsolescence.

Captured in figure 5.1 are myriad parts laid flat and organized by function, creating recontextualized images of a bike. Figure 5-2 is a high-speed photo of carefully orchestrated drops where pieces are shot in midair as they come crashing down. These two images can be viewed as separate artifacts that presents two methods of deconstruction, or they can be viewed as two frozen moments in a designed disassembly procedure.

**Reuse Value:**
McLellan views things come apart as a critique of construction and manufacturing process of the 1900s. These products are produced to be repaired instead of replaced. The reuse value of these things, not only depends on the quality of manufacture, but also the procedure of assembly. If repaired can be per-planned with a designed construction process, then can obsolescence be predicted the same way?

**Disassembly vs Assembly**
Disassembly and assembly can be viewed as two side of the same process. The tearing down informs the engineer of assembly. For instance, polymers and alloys are being developed so that, when cooled, they harden and fasten together an assembly. When reheated the material liquefies and became easily removed from component.
De-constructed Parts of A Film Camera From *Things Come Apart* by Todd Mclellan.
Haffman’s theory
The architects dismantled the house by carefully undoing the work each trade in reverse order. As Dan Hoffman Describes: “The piles of material were weighted against the body of memories that once made the house a home. The erasure of the evidence of this memory was the subject of this work.”

911 St Cyril
After Purchasing the house on St. Cyril for a dollar, he meticulously disassembled, sorted, and inventoried its component parts, writing that it was the “reversal, or unmaking of the assumptions of architectural practice” that were important to the project.

Schedules
In addition schedules and specs are created for the deconstruction of 911 St Cyril, just as schedules created for construction drawing sets. This experiment not only proved that demolition is a construction in reverse, but also presents the reuse values of waste building materials.
Event of Subtraction:

“There is no space without event, no architecture without program.”

architecture’s social relevance and formal invention can not be disassociated from events that happen in it.

Tschumi critiques: 1970’s exacerbation of stylistic concerns at the expense of programmatic one and a reduction of architecture as a form of knowledge to architecture as knowledge of form.

history had became a recordance of style the focus on form had lead to developer in planning large buildings, encouraging many architects to become mere decorators. and on the other, the tendency of many architectural critics to concentrate on surface readings, signs, metaphors, and other modes of presentation, often the exclusion of spatial or programmatic concerns.

Exploration of formal elaboration of spaces and the invention of programs, between the abstraction of architecture though and the representation of events. architecture is a place that confronts space and action

The notion of photography and representation: "Any new attitude to architecture had to question its mode of representation."

Transforming words and theory into space, form and event “words and spaces, these events underlined the importance of a certain kind of relationship between abstraction and narrative-- a complex juxtaposition of abstract concepts and immediate experiences, contradictions, superimpositions of mutually exclusive sensibilities. “ the unfolding events in a literary context inevitably suggested parallels to the unfolding of events in architecture

Tschumi’s research is an exploration of the disjunction between expected form and expected use.
Devices of Demolition

This book will begin with the devices that are used in the process of demolition. Demolition had been interpreted as a preface of architectural design. These devices are not considered as a tool for design. The devices of demolition have changed significantly as the technologies of machines advances and the scale of construction expand. Various devices of demolition sets out different procedures for the process of demolition. Each device has several specific building types to act upon. Each device has hazards and advantages that creates an unique narrative for the demolition process. The four main type of demolition device introduced here are: hand/tools, Upper Armer, Wrecking balls, Implosives and cables.
Excavation Drill

Hand demolition is not a quick method, because only hand tools are used. However, cranes and shear legs may be used to hold or lower beams during cutting. Chutes, or crane-and-skip are usually used to get debris safely from the upper stories to the ground.

Demolish only one story at a time. It is usually safest to demolish the building in the reverse order to building it, so the roof should go first. Next, part of each floor is taken out so that the debris can fall through.

Debris must be removed regularly and not allowed to pile up on floors. An overloaded floor could collapse onto the floor below, which in turn, could collapse on the floor below it. Without propping from the floors, the walls of the building could collapse. Walls could also collapse if debris is piled against them.

**Time Frame:**
slow
usually the time frame of construction process

**Hazards:**
low damage level to surroundings and workers

**Advantages:**
low damage
high material reuse value

**Suitable Building type:**
Housing
two to three story buildings
Wrecking Ball Demolition

Most structures can be demolished by balling. The Wrecking ball is a tool that are very commonly used for buildings which suffers structural decay and deficiency. This technique was invented by Henry Bath and Co in 1888 during the demolition process of SS Great Eastern building.

Balling is a viable and effective method of demolition when demolishing multi-story structures that have suffered structural damage, where all other methods have been considered, and a hazard assessment has determined that this method is the most appropriate.

Balling is hard on the machine: not all cranes can swing and control a demolition ball safely. Converted drag lines are the best machines for this work as they are robust and stable. Cranes with hydraulic rams must not be used for balling.

**Time Frame:**
Fairly quick, A month for a three story building

**Hazards:**
Noise, Dust, Vibration to adjoining structures/building, Flying debris, Uncontrolled unintentional collapse, Limited waste minimization.

**Advantages:**
Strong force

**Suitable Building type:**
Multi-story buildings with initial decay or deficiency
Upper Arm Excavator Demolition

Hydraulically-operated excavators and loaders can be fitted with various attachments for demolition work. Excavator buckets, boom-mounted hydraulic percussion breakers and pusher arm equipment have been successfully used with these machines.

**Normal Excavators**
The main advantages of such machines are that they are extremely mobile, have a high output, and are able to work on vertical faces and floors above standing level. Their disadvantages are that the machines need adequate access, a firm and relatively flat base to work from, and can only work within the reach of their booms. To operate these machines efficiently, the length of boom when fully extended should be at least 1.5 metres above the height of the building being demolished.

**The High-reach Excavators**
A high-reach excavator is defined as one that has a particularly long boom, allowing controlled deconstruction of multi-story or high structures to a safe height where conventional excavators can continue. Boom lengths can vary in size from 19 to over 50 meters and come with a variety of specialist attachments to allow the operator precision and accuracy during the demolition process.

**Time Frame:** Fairly quick, Similar speed as wrecking ball demolition

**Hazards:** Dust, Flying debris, machine height limitation, Limited waste minimization, debris accumulation, transferring debris off site

**Advantages:** easy to operate, fairly quick, less labor needed

**Suitable Building type:** large buildings on confined sites,
Forced Collapse

**Implusive Demolition**
Implosion or explosion deconstruction is an effective and efficient method of deconstruction, and can reduce both cost and time to bring dangerous multi-storey structures to ground in comparison to conventional demolition methods. This method was first used on demolition of Pruit Ilgeo residential complex. The CDI is an institution that specializes on implosive demolition and claims it is the “art of demolition.”

**Wire Rope Pulling**
This method is a form of deliberate collapse. Cables and wire ropes are fixed to key structural members, then pulled down by tractors or winches. It is suitable for detached buildings where there is plenty of surrounding room. The method can be used for timber-framed buildings, bridges, brick, masonry or steel chimneys, and for spires and masts.

**Time Frame**: Very Quick, collapse happen over the course of a few minutes to one hour.

**Hazards**: Noise, Flying debris, explosive chemicals, potential damage to neighboring buildings, debris accumulation, transferring debris off site.

**Advantages**: Very quick, very little labor force, less costly.

**Suitable Building type**: Large buildings and infrastructures on confined sites.
A-5:
Event of Subtraction
Art of Assembly and Disassembly

The construction and demolition of a building can viewed as two sides of one process. This chapter uses ideologies behind "Things come part" by McEllan and "911 St Cyril" by Dan Haffman, to dissect the correlations between assembly, disassembly, and repair.


Destruction: Erasure of Information

**Destruction**: the action or process of causing so much damage to something that it no longer exists or cannot be repaired.

Destruction has an inherent connotation of damage and erasure. The destruction of a building aims to erase every trace mark of the building and provide blankness for latter buildings to occupy. Some of these destructive methods of erasure are carried out in the form of implosion.

The CDI or Controlled Demolition Inc was established in the 1950s for its great invention of demolition method of Pruitt Ilgeo. The Loizeaux family, founders of CDI, claims this explosive demolition methods has "saved property owners and contractors hundreds of millions of dollars worldwide."

That leadership and unparalleled experience gives CDI clients access to a full range of services and capabilities through a global network of offices and agents, all dedicated to the precision application of our technology.

And behind each successful project stands the CDI team - a talented group of professionals with decades of experience dedicated to absolute perfection on each new project.

Images from Google Search
Images from Google Search
A high-rise construction boom in Japan during the 1960s and 1970s has resulted in a large amount of aging towers. Building owners have an interest in demolishing the old structures to replace them with more modern, safe, and work-friendly buildings, but there are several issues to address in this process.

The work is being carried out by a joint venture between Taisei Corporation and Seibu Construction using the ‘Taisei Ecological Reproduction System’ (Teco-Rep System). By installing scaffolding that conceals the roof and mimics the windows of the existing building, the demolition site is less conspicuous, thus preserving the image of the hotel as it gradually shrinks.

Suspended scaffolding around the exterior was first set up to install the soundproofing panels, and a cover was placed over the top of the building to prevent dust from escaping. The 1,500 ton scaffolding and temporary rooftop is supported by 15 20m-long temporary pillars.

By keeping a cover over the top of the building, noise is reduced by 15 decibels, and dust dispersal is reduced by 90%.

The removal of the interiors, along with asbestos, began in June 2012, and scaffolding went up in August. It takes approximately 10 days to demolish 2 floors.
TRUSS SYSTEM FOR EXTERIOR SCAFFOLDING

CAT WALK SYSTEM FOR ADJUSTMENT OF SCAFFOLDING

ROOF COVER TO PREVENT DUST FROM ESCAPING

REINFORCING STRUCTURE OF ROOF

TEMPORARY EXPANDABLE TRUSS COLUMNS

BUILDING COLUMNS

Diagram by Fujimoto Cooperation

Images From Google Search
Subtraction

EXTERIOR WALL
STEEL BEAM
STRUCTURAL COLUMN
HYDRAULIC JACKS

PROCEDURE/EVENT

AFTER ALL COLUMNS ON THIS FLOOR HAVE BEEN REMOVED, HYDRAULIC JACKS ARE EXTENDED TO REPLACE COLUMN THAT HAVE BEEN REMOVED.

AFTER ALL COLUMNS ON THIS FLOOR HAVE BEEN REMOVED, ALL JACKS ARE LOWERED TO PERFORM DEMOLITION OF FLOOR ABOVE.

EFFECT

SPACE
conical intersect Photography from Gordon Matta Clark
Over Production of Architecture

Skyscrapers in Obsolescence

The construction and demolition of a building can viewed as two sides of one process. This chapter uses ideologies behind "Things come part" by McLellan and "911 St Cyril" by Dan Haffman, to dissect the correlations between assembly, disassembly, and repair.
The exhibition by OMA at 2010 Venice biennale is titled Cronocaos. Cronocaos shows “the wrenching simultaneity of preservation and destruction that is destroying any sense of a linear evolution of time. Through 60 historical sites around the world the exhibition shows “the current moment has no idea how to negotiate the coexistence of radical change and radical stasis that is our future. The current definition and regulations of demolition and preservation are critically challenged by Rem Koolhaas. The regime on the correlation between preservation and demolition is a key factor in the selection of skyscrapers as the typology for the actualization of subtractive acts.

Demolition is not merely an act of erasure of a building, however it is also an erasure of a building typology. Pruitt Igoe was slated for demolition in 1972. The event broadcasted on television was the demolition of a dysfunctional residential building as well as the destruction of a modernist ideology and typology.
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Ghosts Cities in China

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The construction and demolition of a building can viewed as two sides of one process. This chapter uses ideologies behind "Things come part" by McLellan and "911 St Cyril" by Dan Haffman, to dissect the correlations between assembly, disassembly, and repair.
For the past eight years, the Tower of David – a half-built skyscraper in downtown Caracas – has been home to thousands of squatters who transformed the abandoned block into a vertical slum complete with grocery shops, tattoo parlours, internet cafes and a hair salon.

This week, however, looks like the beginning of the end for the ramshackle community, as city authorities started to move the first of the tower’s inhabitants to a new social housing complex in Ciudad Zamora, more than an hour’s drive from the Venezuelan capital.

The relocation comes after three months of negotiations between government officials and representatives from the tower, and will entail moving the inhabitants out three floors at a time until the 27 inhabited storeys of the 52-storey skyscraper are emptied out.
A high-rise construction boom in Japan during the 1960s and 1970s has resulted in a large amount of aging towers. Building owners have an interest in demolishing the old structures to replace them with more modern, safe, and work-friendly buildings, but there are several issues to address in this process.

The Kajima "Cut and Take Down Method" was developed to satisfy both safety and environmental concerns. In April 2007, Kajima started to develop this new demolition method to demolish its aging office headquarters buildings, which were 76 meters tall and 65 meters tall.

Buildings are usually demolished by placing heavy equipment and workers on the top floor and then lowering the waste material down to ground level. The "Cut and Take Down Method" alternatively allows the workers to start at the base and work their way up. By starting at the bottom, gutting one floor, and then lowering the entire building on jacks one floor at a time, all work can be performed safely at ground level.

On the 85 by 60 meter site, the two towers were situated quite close to another office building and a residential building, emphasizing the need for a clean, quiet demolition process. To accomplish this, temporary columns are used around the structural column grid, the existing columns are replaced, and then hydraulic jacks are placed where the existing columns were and the building can be lowered to the next floor plate where the process is repeated.

The hydraulic jacks each had a capacity of 1,200 tons, and supported the structure through each cycle of lowering. A cycle would lower the whole building by 675 mm, which meant that five cycles were required for each floor (total of 3.375 meters). The total time to demolish a whole floor was six days: 2.5 days for lowering and the remaining time to demolish the rest of the structure.

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Electricity Distribution

1. Building Breakers
2. Floor Breakers
3. Apartment Breakers
4. Consumption Board
5. City Electrical Grid
Water Distribution

1. Main Water Tank
2. Water Pumps
3. Apartment Tanks
4. City Water Main
Subtraction

Images From Urban Think Tank
A-8:
Subtraction To Absorb
Formal Strategy of Experiment

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Bibliography

Books


Web Sources


