Contingent Patterns looks to challenge the classical assumptions of variation and contingency in today's urban model. Starting with a lineage of conceptual planning and occupation strategies - the highway is antagonized as a new point of departure as an occupiable domain. Environmental, Economic, and Social constraints are reconsidered through the use of complex material systems.

Traditionally change and variation is confined to the realm within the envelope; and where there is variability outside of the envelope it is confined, typically, within the footprint of the surrounding street grid. Environmental edges are typically framed by grid periphery and separated from pieces of the larger ecosystem. The use of complex material systems creates the foundation for a continuity of biological and environmental conditions. The use of water and phase change as a vessel to create a frozen surface in winter to an floral scaffolding.

Contingency and variation are the tools to develop a new occupational space in the horizontal sphere, as well as, a continuity of systems between interior and exterior domains.
ACKNOWLEDGEMENTS

To my amazing wife Jennette and my wonderful son Maceo. For enduring my efforts and inspiring me to achieve beyond my own dreams.

To my Mother and Father who have given me the tools and desire to reach for that which I love.

To my studio mates who accepted my intensity and passion and shared their own. To my friends who have stuck with me throughout my circuitous route.

To Troy Schaum, Fares el-DahDah, Chad Loucks, John Casbarian, Eva, Kathleen Roberts and the rest of the Rice family that has supported me throughout my stay at Anderson Hall.
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CH 4  FLUCTUANT ENVELOPE

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Beginning with the Plan Obus, there has been an attempt to project a new urbanism where infrastructure, specifically major transportation flows, become enmeshed with an adaptive program - an intertwining of contingent needs in hopes of fostering new opportunities of architectural engagement. These four projects: Le Corbusier’s Plan Obus, Takis Zenetos’ Cable City, Constant’s New Babylon, and Archigram’s Instant City - serve as a lineage of efforts to resolve the automotive layer and to define a new typology of occupation in which contingency and variability are defining factors.

Le Corbusier’s Plan Obus utilizes, as a principal, the occupation of the core element of isolation - the highway itself. Corbusier envisioned a project that would be filled in over time, like drawers in a large horizontally expanded cabinet, with a highway positioned on top like an aqueduct of automotive flow. This confluence of infrastructure, the highway, with housing and retail below, is a precursor to later projects that develop from the idea of contingent space. Meaning, a constructed system that adapts itself over time as opposed to the notion of the essentially designed object. Although Plan Obus still stands as an Essentialist solution - where the issues of the highway in the form of separation
are exacerbated and given a back seat to the strict regularity of height to support flatness on the top surface for the ease of driving. This results in the Plan Obus becoming not only housing and a highway, but a massive 144 foot wall as well.

The Plan Obus also works as a project of linear growth. As time passes the cells fill in resulting in a wall of housing in the end. There is no application of change other than that of the linear variety. This point is important to note in the aspect of creating a more intense separation of land and social relations. Separating populations further and giving one a largely elevated view over all others.

In contrast Takis Zenetos developed a series of conceptual projects that looked to indigenous means in a contemporary light. Using large scale tensegrity as
a structural method of spanning, hanging, and occupying space. While the impetus was indigenous the materiality was completely contemporary if not novel. From wind farms in canyons to cantilevered cells held taught by a cross work of cables and lightweight compressive autonomous cells.

These projects differ from Corbusier’s Plan Obus largely in the way the Plan Obus is celebrating the automobile by placing it at the apex of height - giving
Constant's New Babylon was a continuation and elaboration of both the Plan Obus and Cable City. New Babylon would use the street grit as an avenue of growth extending elevated above the ground - leaving the ground plane free of segmentation; a lush landscape with a scaffolding of unfolding variation cantilevered above in a mash up of structural densities. The arterial growth paired with an elevated system of variable program projects a new faculty for urbanization that begins to rationalize a new space of occupation that is directly related to the mode of transportation, or movement rather, as opposed to a static isolated autonomous relationship where vast fields of parking lots

become the mediating environmental condition. New Babylon instead envisions a urbanization that grows in its elevation away from the ground plane. This alone would create the issues of cities such as Chicago and New York before the enforcement of setbacks. New Babylon reassesses the enforcement on form and instead looks to the actual occupation of the footprint as the issue. Once the liberation of ground is given and the occupation of arterial space is defined, the vertical density can more freely aggregate without the geometric issues of a classical static grid extrusion. Evolution over time ensures connectivity as opposed to isolation as well as ground plane continuity.

source: New Babylon <http://3.bp.blogspot.com/_ZicPpqiF4/Onb6xqg0iCI/AAAAAAAACk3/y7M3ck0YYs400/constant-01.jpg>
Lastly, looking at Archigram’s Instant City project the issue of immediate response, media, and accretion of program become more developed.

New Babylon developed variation; although, a variation with a hardening of contingency. As New Babylon would propagate it would become more and more concrete with little ability to augment itself beyond its boolean relationship with the landscape. A kind of total isolation and separation as opposed to a continuity - an integration.

Instant City looks at the notion of materiality as a precursor to defining space. The event becomes as precious as the temporal projection of space in a static domain. This liberation of the idea of space as static materially and temporally becomes integral in beginning to consider an integrated architecture. Where each previous project looks to create a variable spacial occupation either through time, geometry, material, or all of them combined - they fail to integrate as a continuous element of the adjacent environment; becoming one contingent procedure in a greater context. The human event becomes a point of variation not merely to accommodate but to utilize as a architectural moment whose residue is as important as its origin.
The lack of available land, variations in seasonal housing demands, and environmental oscillations, make Vail Colorado an extreme case study in questioning the contemporary development model of static autonomous enclaves sitting alone from isolated infrastructural systems - or the vehicular model. Vail reflects the confluence of urbanization issues - accessibility, connectivity, and affordability.

From its inception as a small ski resort stop west of Denver on 1-70 in the mid 1960's, to its current place as the largest ski resort in the United States, Vail has been intimately defined by its relationship to the highway that passes...
through it. In turn Vail has many of the same issues more typically associated with a larger urban centers. Lack of housing with an ever larger segment of the population forced to commute further and further as property values near the resort climb exponentially. This has an economic effect on Vail's resorts due to the lack of employee access during extreme winter weather conditions - when the employees are most needed.

**SNOW COVER**

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**TEMPERATURE**

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- **Average Daily Temp above 65 (F)**
- **Average Daily Temp below 65 (F)**
- **Average Daily Temp below 32 (F)**

**YEARLY NEED FOR HEATING**

**NO NEED FOR SUMMER COOLING**

**SEASONAL HOUSING NEED**

**PEAK HOUSING NEED**

**LOSS OF EMPLOYEES**

**LOSS OF SPACE**

**5 MONTHS OF SUB FREEZING**
This has been exacerbated through the years as towns that once were filled with housing options have now become their own resort towns; pushing affordable housing even further away - with regular commutes of more than 1 hour each way for those who either can not afford housing closer or those who can afford it, but housing does not exist.

Growth Diagrams

Loss of Views

Loss of Sunlight

Fully Obscured

Partially Obscured

Full View
Other issues that are shared in larger urban centers, the lack of parking, segmentation and isolation, trouble Vail as well. The city pays the Colorado Department of Transportation $10,000 a day during ski season to utilize the shoulder of the feeder roads for parking; The difference in property values have continued to create development problems where the north side becomes separated from the resort side in consideration for long term solutions that would serve the greater Vail community. As it stands, North Vail has slowly become the site for public housing, parking, and another hardening of the edge between Vail and the surrounding ecosystem.
Novelty as a solution to contemporary issues has been a trend for avant-garde architectural investigations. This has led to novelty being considered within the context of the traditional architectural definitions. Looking to incorporate new opportunities that are expressed outside of tradition I chose to look to emerging science for possible solutions.

Analyzing slope data for available footprint trajectories developed into a consideration of materials that could be used in a structural system that would utilize forces in variant form. Data mappings projecting material possibilities and opportunities persisted in various analysis against traditional building methods for the currently used solutions - trailers, apartments, and tents.

Considering environmental mapping data, geometric and material variability a series of processes were developed to investigate new possibilities outside of traditional building methods.

Redefining typical building components with new proportions creates new conceptual opportunities that allow for variation and contingent optimization
A process of variation is conceptualized that would allow for continuous augmentation in the planning and execution of development.
of geometry and materiality. Two solutions focused on were nanofabrics that respond to environmental variation - such as temperature; and carbon fiber fabric sock forms that allow for lightweight and efficient deployment without the need for excessive scaffolding or form work.

DEFINING TOOLS

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MEGA

UNIT

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AGENCY

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CONTINGENCY

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MEDIUM / MICRO

CONNECTION

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SYSTEM

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FLEXIBILITY

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The solution proposed for Vail concentrates on challenging two architectural conditions that define the static constraints of contemporary buildings. First, the structure as an orthogonal static extension from the ground plane that is defined by autonomous constraints; and secondly, the idea of the envelope as a fixed medium strictly defining interior and exterior and negotiating the porosity of light in the most extreme of situations. The first leads to a variability of forces and geometry while the second leads to a variability the envelope and space itself.

The carbon fiber form work is easily erected by using cranes and cables. These can be elevated and injected with a resin that secures the temporary form while the concrete is pumped through. The fabric mesh is then deployed with a mediary skin layed on top; Lastly a nano fabric is attached that responds to the surrounding environment by expelling water and freezing, depending on ambient temperature and the temperature of the underlying mesh, in the winter. In the summer it then absorbs moisture out of the air allowing for plantlife to grow on the membrane.
The geometric deployment of the carbon fiber socks is a pattern of oscillating sine waves that shift forces through each member both horizontally and vertically. This allows for connectivity between a variation of geometries both manmade and natural.
EXPLODED AXON

ENCLOSURE

CONTINGENT BLANKET

PERMANENT

STRUCTURE

PATHS / DECKS
Through the procession of winter this blanket of ice densifies, a structural sheathing of ice and snow that is regulated by a membrane of climate controlled fluid. The ice serves as a mediator between inside and outside, as an insulator, as a battery for water storage in the form of a contingent hydronic membrane, and as a continuous surface of the surrounding ecosystem.

In the Summer the membrane serves as a park surface without any strict interiority.

The structure is a series of undulating carbon fiber socks that are filled with a resin that causes the sock to take form. Then, the sock is filled with concrete - creating a carbon fiber tensioned exoskeleton around a compressive concrete
core. The interweaving structural mass creates a framework that the envelope membrane wraps around; an inner membrane consists of a system of tubing that circulates a fluid that regulates membrane temperature. The difference between membrane temperature and the exterior temperature create the relation to the nano material skin that then begins to expell or absorb moisture.
The first intervention connects 6 primary nodes where there were previously 2.

There is then a growth from 1 route to more than 10.

Main Parking Terminal access with connection to Middle Creek employee housing

### PARKING DATA
- Lower Deck: 220 vehicles
- Top Deck: 400 vehicles
- Total: 620 Vehicles

### HOUSING DATA
- 442 Minimal Seasonal Housing Units

### RESORT DATA
- 2 Restaurants
- 6 Points of Connectivity
- 1 Trail Convergence
The second intervention connects 10 primary nodes where there were previously 2. There is then a growth from 1 route to more than 14.

Total there were 3 nodes and 2 routes. After the development there are 14 nodes and more than 20 routes.

---

**Ever Vail Resort with fill to Timberline employee housing and access to new high speed gondola**

<table>
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<th>HOUSING DATA</th>
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<tr>
<td>Lower Deck</td>
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<tr>
<td>Top Deck</td>
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<td>680 Vehicles</td>
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<td>1040 Vehicles</td>
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The third intervention connects 6 primary nodes where there were previously 2.

There is then a growth from 1 route to more than 8.

Total there were 3 nodes and 2 routes. After the development there are 20 nodes and more than 26 routes.

Timber Ridge Redevelopment with multiple arteries connecting with direct access to resort amenities.

### Parking Data
- Lower Deck: 186 vehicles
- Top Deck: 400 vehicles
- Total: 586 vehicles

### Housing Data
- 390 250 sq ft Minimal Seasonal Housing Unit

### Resort Data
- 8 Added Points of Connectivity
- 10 Building Condo Redevelopment
- 1 Upgraded High Speed Quad
The last intervention connects 6 primary nodes where there were previously 3.

There is then a growth from 1 route to more than 6.

Total there were 3 nodes and 2 routes. After the development there are 26 nodes and more than 32 routes.
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