Porsche 917/20
Porsche Museum,
Stuttgart.

right:

Porsche 917
twelve-cylinder boxer engine, turbocharged
Capacity: 5374 cc
Output: 1200 bhp (882 kW) Top speed:
385 km/h (239 mph)
referred to as the “most powerful racing car of
all times”
Porsche Museum,
Stuttgart.
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“We must work on the society in which we find ourselves, tracking the flows of matter and energy, destratifying hardened institutions, setting into flux human practices that have sedimented - in short, we must find the right viscosity for our fluxes, the exact consistency that would allow humanity to self-organize without the need for coercion and war.”

O.M. Ungers,
*City Metaphors,*
From Morphologie/City Metaphors. (1967)
ABSTRACT MACHINE

"The mind organizes the world by organizing itself."
-Jean Piaget, 1973

"In every human being there is a strong metaphysical desire to create a reality structured through images in which objects become meaningful through vision and which does not (...) exist because it is measured."
-O. M. Unger, 1976

The metaphor between body, city, and machine drawn by O. M. Unger is explicit about its valorization of formal metaphor. Unger felt that the urban planning of his time was based too much on measurable data, and lacked the conceptual sophistication, instinct, and depth that analogical images could alternatively foster. Unger’s images posit that form is function in so far as it becomes the organizational logic of a system that constitutes performance. But as we look at the relationship between figure (white line) and ground (black fill) of the individual images, most apparent is the stark difference between the form of functional system versus the form of overall body. Like the Porsche 917, performance is implied in the black body, but embedded in the systems engineered within that are not readily visible in the real object. As the city grows and the automobile is reiterated, like the organic body, it becomes difficult to locate with certainty that relationship between layers of internal functioning systems and that which is read as form.
The formal gap between the body and the systems that sustain its function has become evident in the trends in architecture today. The architectural problem is addressed as two discreet issues— one of form, and one of building performance. With the increasing amount of engineers and consultants that help realize contemporary architecture, rarely does the formal proposal consider the building’s performance to the extent it could. How is the architect who is interested in crafting both form and function, which today has come to mean high performance building systems, to begin a holistic design process that considers both simultaneously? This thesis will attempt to respond to this question.

Manuel de Landa offers a theoretical insight into how one might begin to uncover those “structure generating processes” that influence the way function is materialized into form. Manuel de Landa’s isomorphic use of metaphor seeks to relate the embedded, immanent structure forming qualities amongst a broad range of entities: from political and social institutions to the most microscopic cellular life. Borrowing the term from Deleuze and Guattari, Manuel de Landa refers to the common diagrams that yield different physical assemblages as “abstract machines.” Performance emerges from the organizational logic of these fundamental diagrams, and it is only here that we might begin to posit new perceptible urban forms. Systems are organizational before they are formal. Their functional, or “performativ” nature relies on the specific organizational logic by which matter moves through their boundaries.

In order to locate performance in an organizational logic that precedes form, it is useful to refer to Jacques Derrida’s notion of the non-visible nature of space. Space in Derrida’s terms refers to a fundamental logic of spacing, by which differential relationships emerge. This spacing, Derrida proposes, “instead of having recourse to the concepts that habitually serve to distinguish man from other living beings...denotes a movement of difference and spacing that goes far beyond the possibilities of the intentional consciousness.” If we to consider performance, as Derrida suggests, in the logic, or coding, of a system, rather than in its material or residual formal appearance, we can understand its abstract structure as a matrix of fluctuations, flows, feedback-loops, and relationships across differentials. It is in this diagrammatic state that the foundation for new modes of experience must begin.

While experience may be rooted in non-visible space, or a diagram, architecture plays a key role in how that non-visible space is perceived. Experience, involving a subjective individual, necessarily relies on sensorial perception. The crucial role for the architect, is to consider performance as it exists between diagram and experience. To conceive of performance objectively, as that which architecture does, limits itself to a purely


2. ibid.

mechanical function. Rather, performance in architecture must deal with how an individual is made aware of, or comes to know, the dynamic flows of the abstract machine. As Sanford Kwinter writes:

"Through the materialization of actualization, architecture has the capacity to free the imagination from three-dimensional experience, to free it from the curse of so-called 'invisible processes' and hidden diagrams and to show us that processes and events, the ones that give form to our world and our lives, have shapes of their own... The real world is always a world of effects (events), not quantities... The difference is that today we have a scaffold of mental technologies with which to investigate the qualitative world in a relatively systematically manner... Forces exist, and can be explained, even if they cannot be rigorously predicted." 4

PTW and Arup
Water Cube, 2004
Liquid epoxy resin model.
The imperative to design sustainably has reached critical mass in recent years, as design at all scales has sought to waste less, minimize environmental impact, and reduce material and energy consumption. Demand for better building performance has put pressure on architects and engineers to develop smarter building systems that respond to environmental conditions, both improving user comfort and reducing energy waste. However, as the standards for sustainability increase, the nature of the architectural spaces served by such system engineering has seen relatively little change. Rather than transforming of the user’s experience of architecture, systems engineered for sustainability most often have minimal sensible impact on inhabitable space and therefore do not affect the way people understand what will here be referred to as architecture’s performative nature. Performative systems that regulate heat, light, energy, waste and water are typically located beyond the inhabitable and perceptible building space, missing the opportunity to become dynamic architectural interfaces that transform the user’s experience of space. This thesis project attempts to spatialize such systems, such that the building’s performative matrix serves not only to create a more efficient architecture, but becomes a tool in the design of desired experiential phenomena. By considering a building’s systems as integrated architectural surfaces, rather than separate, pre-engineered appliances, fixed and concealed behind static walls, floors, and ceilings, this design proposal realizes the potential for such systems to shape the form and quality of the interior environment in a more perceptible way.

PERFORMANCE

“...technological and aesthetic styles of thought reduce architecture to our concepts of it. Other and essential aspects of buildings come into view of one supposes that the actuality of the building consists largely in its acts, its performances.”

Diagrams of recent work published for its noteworthy sustainability.

Location of sustainable systems in relation to user inhabited space.
In my analysis of several buildings known for their sustainable designs, the performative features, while emphasized in the dynamic diagrams used to represent the projects, are essentially lost from the actual experience of their built spaces. While these buildings feature state-of-the-art systems for solar power, water collection and filtration, natural ventilation, passive cooling and heating, and planted roofs, these systems are typically located in the same place as conventional mechanical systems. Hidden between floors, underground, or on roofs, the remarkable processes that make these projects sustainable do not radically transform the experience of space as they are made to fit into a conventional architectural framework. These designs could potentially be rethought as unified, integrated sustainable systems that create a unique aesthetic environment.

All buildings are ecosystems in which air, water, light, energy, and biomass are in constant flux. Less often is this flux utilized in the creative design process and expressed in the experience of architectural space. As a result of the usually opaque partition of dynamic systems from the space of experience, users, whose actions play a major role in the overall environmental impact of a building, do not perceive their place within a building’s overall ecology. So it is often the case that sustainable building strategies fail to meet projected performance levels because occupants are essentially unaware of the processes that take place out of their sight. Users in some cases feel that the actions required by sustainable buildings burden their routine, or sacrifice their comfort, rather than enhance their daily experience. But in the best cases, sustainability is not merely a technical and marketable quality of the designed work, but a positive consciousness that influences the way users conceive of and respond to their surroundings.

There are various examples where sustainable building concepts have pushed design limits in unusual ways. In these projects, sustainable systems become a means of fulfilling a design concept are integrated into the sensible experience of the building. The Dutch Pavilion at the Hannover World Expo in 2000 ambitiously tested the feasibility of the concept of architecture as ecosystem. MVRDV’s design is a literal translation of the essentially man-made Dutch ecosystem, into an architectural ecosystem of stacked landscapes.
MVRDV,
Dutch Pavilion,
2000 World Expo,
Hannover.
whose relationship to one another defines the visitor pathway through the pavilion. Water, which is crucially engineered and controlled throughout the Dutch landscape, is experienced in the pavilion as a continuously transforming element that sets the pace for spatial and programmatic transitions. As visitors arrive by elevator to the roof of the building, they are met by a pond, from which water flows down to the walls of the level below, indicating the direction of visitor movement. On the way down to the next level, visitors are able to touch the curtains of water that soon envelop the space around them. Beyond this underwater environment, mist creates a dream-like effect down through the forest canopy of the next level. These three floors demonstrate water’s “natural” states, corresponding to the natural landscapes featured at each stage of the passage. Through the bottom three levels, water is featured in its engineered forms, as these environments showcase human intervention in the natural landscape. First it is featured as temperature control by thermal mass, expressed in giant flower pots that hold the “roots” of the forest trees above. The next floor features irrigation, making possible the staple Dutch industry of flower farming. At the ground level, the Dutch system for extracting drinking water from its long coastline of sand dunes is repeated in an architectural system that circulates water cooled deep in the earth up through the bottom three levels, maintaining the cool temperature of their concrete surfaces.

While the pavilion demonstrates water in its various forms across the Dutch landscape quite literally, water is used architecturally as an interactive cooling system that varies according to the material characteristics and programmatic agenda of the spaces it cools. While cooling for the upper levels is achieved through direct visual and tactile contact with water or mist, the lower system uses water to maintain the cool temperature of thermal mass, which is then conducted by air throughout the first three levels. The distinct organization of different cooling strategies and their respective effects on the interior space helps to establish the architect’s desire to create the experience of distinct environments. Water becomes a sustainable cooling system that is used to describe the nature of the Dutch landscape and human intervention within it by creating a highly varied and interactive architectural environment. MVRDV’s pavilion not only proposes a sustainable architectural ecosystem, but also utilizes the diversity within this system to establish an architectural concept by shaping the visitor’s experience and interaction with the surrounding environment.

Another example of architecture that has integrated a sustainable climate control strategy with an architectural concept is PTW and Arup’s “Water Cube” at the 2008 Olympics in Beijing, which uses an integrated structural and climate control system to support the large interior swimming stadium. The hollow tube steel pentagonal-hexagonal structural matrix is thirty percent more efficient than a conventional steel beam structure would be to cover the large span of the space, thus decreasing material consumption and minimizing
the overall consumption of energy in construction. The packed structural “water bubbles” distribute forces more evenly across the building’s surfaces, thus eliminating the moment stresses present in conventional steel structures, and allowing the structure to better absorb earthquake stresses, important for seismically active Beijing. In this double layer system, the interior and exterior faces of the structure acts as the flange, while the connective matrix of interior tube steel acts as the web. The steel structure is clad with pillows of ETFE, a durable lightweight plastic that has an extremely smooth surface which repels water and prevents dirt collection. Each pillow is permanently inflated by a low power pump. This internal air pressure transforms a 0.2-millimetre-thick plastic into a cladding panel capable of spanning relatively large distances, up to nine meters. In this pillow form, ETFE is a better insulator than glass. A double layer of these air-filled pillows cladding both interior and exterior surfaces of the structural matrix creates an insulated cavity where exterior air is pulled in, heated by direct sunlight, and distributed throughout the interior to passively heat the building and pool water. By patterning the various layers of the facade with translucent painted frit and by ventilating the heat out of the cavity in summer, and containing it in winter, the building is able to respond effectively to environmental changes. In the “Water Cube,” energy performance and the experienced architectural concept are conceived of as an integrated system. The filtered quality of light and shadow-like appearance of the hexagonal structural system screened by the fabric in front of it create an underwater like quality, allowing visitors to experientially relate to the swimming event through the feeling of being immersed in water.

The concept of architecture as ecosystem is the basis of a growing body of intriguing installations and studies by Philip Beesley. These material and structural experiments investigate responsive architectural systems that behave like networks of living organisms that feed off of their surroundings. The result are immersive, interactive architectures that utilize artificial intelligence, synthetic biology, and interactive technology move and breathe around their human inhabitants, precluding any sense of architecture’s stability. In each of these projects, an invented productive process, like that of an organic battery or air filtration mechanism, informs a material system that makes its activity dynamically perceptible to the viewer. The installation acts on its viewers as a sensorial foray of the environmental process embedded within it. The viewers’ registration of movement and life within the material system heightens one’s awareness of and subjects the body to the instability of the surrounding environment. As Beesley states, “it’s about being inside something, not being on top of it and owning it, but being swallowed by it with a sense of vertigo.” An unique relationship between visitor and surrounding ecosystem is established; through the senses, visitors embody the functioning movement of the living system.

PTW and Arup.
Water Cube,
2004, Beijing.
Filtered light through EFTE pillow.

Passive heating by solar gain in air cavity.

Section through entrance space and pool seating.
Beesley’s *Endothelium*, is a network of organic batteries made within geo-textile bladders and suspended from a lightweight structural matrix. The creation of local feedback loops within the system ingeniously allow for an elegant expression of the projects perpetual state of flux. These organic compound filled bladders are wired in series that feed into electronic circuits to collect weak electric current until enough strength accumulates to emit a pulse of power. The design realizes the potential for the irregular rate at which power is produced in the organic battery to create an expressive dynamism within the experiential space of the system. Rather than collecting and masking the temporal differential between the power generation of each battery within a central power storage, the organic irregularity of each battery series is expressed through an individually controlled miniature light, which it powers when it has reached its energy potential. The visitor’s experience of space is illuminated as one embodies the life-like activity of the dynamic pulsing and shifting chorus of fluctuating energy. As Cary Wolf describes of *Hylaozoic Ground*, “visuality is embedded within the multi-dimensional space of embodiment, sight is no longer equal to the viewer’s position of mastery, but is simply part of the larger animal sensorium- “Is it going to pet me? eat me? What and how does it know?”.”1 *Aurora* similarly activates the exhibition space where it hangs delicately over the heads of visitors. Barely within arms reach, golden liquid filled sacs producing organic crystals hang like gems waiting to be snatched within a weightless matrix of mylar feathers. Beesley states of the project, “its delicacy sets up a very interesting reaction: people care about it; they touch carefully. Its vulnerability brings out a quality of intimacy that is absolutely natural in a crowd.” As visitors pass through the space, their movement sends a ripple effect through the hanging system. These installations ask visitors to question those boundaries that exist between one’s self and one’s surroundings. They demonstrate that a systematic approach to design need not sacrifice its focus on human experience.

above:

Philip Beesley,

Aurora, 2010,

Toronto.

above:

Philip Beesley,

Endothelium,

2008, UCLA
ABJECT BODIES
PSYCHO-ARCHITECTURAL BOUNDARIES

Over the course of history, architecture has served to elevate society from nature’s unclean ground. The architectural monuments left from ancient cultures stand as remnants of an incessant human desire to separate the pure from the filthy, the living from the dead, and the sacred from the profane. Ancient burial chambers encapsulated rotting flesh to prevent it from entering and contaminating the space of the living. Dietary laws that deemed meat from certain animals as “unclean,” implicated architecture that had been tainted by its blood. The temple was sacred, and required all who enter be pure.

In the name of public health, modern architecture has tended to reinforced both physical and psychological boundaries between people and the vital processes that make life as we know it possible. With the 19th century urban population boom, it became apparent that the amassing quantities of animal, human, and industrial waste in urban centers posed a serious threat to human health. Modern theories on sanitization resolved to centrally deal with waste if the city were to continue to grow and prosper. No sooner did modern engineering, plentiful skilled manual labor, and enormous amounts of public funding, help transform the city into a mechanized urban infrastructure that separated and removed waste and unclean industries from every human inhabited quarter of its domain. In this process of sanitizing the city, water, once the carrier of garbage, sewage, and floating corpses, was essentially removed from sight and smell wherever possible. Urban streams, harbingers of waste and stench were canalized, covered, piped, or hidden to be lost from urban consciousness. Water lost its presence as a natural feature of the urban landscape, instead becoming a medium for sanitizing and carrying away filth from the city center to be dumped elsewhere.

... [spatialization] brings into play a system of options that reveals the way in which a group, in order to protect itself, practises exclusions...it is the locus of various dialectics: heterogeneous figures, time lags, political struggles, demands and utopias, economic constraints, social confrontations...

- Michel Foucault The Birth of the Clinic, 1963. (16)
Rendering house. Brighton Abattoir, 1872-1957. All animal parts are processed and used.
Similarly, by the mid 19th century, cities in Europe and the United States pushed to remove stockyards and slaughtering practices from the city center. Inhabitants of Paris grew fed up with the perpetual stench, unpleasant noises and flow of blood in the streets and sought to remove slaughter from the city center to protect the health and morality of the public. By 1867, the total centralization of animal slaughter within Paris was completed with the construction of the modern market and slaughterhouses, La Villette, on the outskirts of the city. Like the Crystal Palace, La Villete was a feat of modern industrial design in steel and glass, the fifty-six hectare complex housing the trade of livestock, stables for cattle, sheep, and pigs, a police station, post office, and stock market. Standing as an “icon to the rationalization of space” hundreds of humans and millions of animals arrived by water or train to La Villette each year.\(^1\)

Animal slaughter became far more industrialized in the United States, where large herds could be raised on vast tracts of land and no professional butcher’s guild guarded the long standing traditions of their practiced craft. As captured in Upton Sinclair’s The Jungle, Chicago’s Union Stockyards were the epitome of industrial mechanization. The disassembly line, which gave Henry Ford his ideas for car production, was introduced as an overhead rail system by which animals were hoisted and moved through compartmentalized workstations, where one man would slit the animal’s throat, another would tear off its hide, a third split the carcass, and so on until the dressed carcass was hoisted into a rail car and sent on its way to consumers, taking less than twenty-four hours from the moment an animal arrived until it was shipped off as meat.\(^2\) Sinclair’s revealing novel prompted a heightened consumer consciousness regarding the brutal and unsanitary working conditions in the Chicago slaughterhouses. If animal slaughter had not already been stigmatized as an unclean profession, the mass mechanization of the meat industry and removal of livestock from the consumer’s personal experience served to strengthen the boundary between consumption of meat and the means to that end.

The chilling, corporeal reaction we have to the image of the slaughterhouse is discussed by the French philosopher George Bataille, who argues that it is not the physical sight of death that horrifies, but its detached, mechanized treatment that we find so disturbing. The extreme order and banality of slaughter depicted in Eli Lotar’s photographs of La Villette, which were printed with Bataille’s writing, are devoid of the bloody, chaotic presence of death. The images of the carefully aligned row of cows feet propped up along the sidewalk, neatly wrapped and aligned animal hides laying on the street, and the rolled up animal hide that has been dragged across the floor are sinister in their evacuation of violence.\(^3\) For Bataille, the slaughterhouse, “cursed and quarantined like a plague-ridden ship” is a metaphor for exclusionary

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2. ibid
structures within society in its perpetuation of the removal of the violent act of slaughter from daily life. But this comes at a cost, as Bataille admonishes “the unhealthy need of cleanliness, with irascible meanness and boredom” that leads people “to exile themselves out of proprietary, to a flabby world in which nothing fearful remains and in which, subject to the ineradicable session of shame, they are reduced to eating cheese.”¹

Mechanisms like the abattoir that remove the human psyche from its relationship to the reality of human existence are at work throughout contemporary society. Our cultural consciousness is based on a constructed partition between the material life we know and those concealed practices that make possible our heightened standards of comfort. Technological innovation in the industries of food production, public health, sanitation, material production and construction has increased society’s capacity to provide a better quality of life for a greater number of people. Simultaneously, this has transferred each individual’s awareness of one’s environment to those few in charge of large industries. Thus, this upward trend in living standards for a greater general public has had a taxing effect on our environment over the last century. The pervasive oblivious consumer attitude has worked against any potential for those industries to become more sustainable. Corporations have used this to their advantage for years, intentionally concealing alarming production processes from consumers so as not to have to invest more than the minimum in environmentally sound practices.

The danger in this highly partitioned spatialization lies in the obvious lack of social awareness of what lies beyond the wall that protects us from horror. Those hidden modes of sanitation, production and death are momentarily revealed when the boundaries between consumption and

¹. Bataille, Georges. Documents. (1929)
production are breached by news reports or events within the urban context. In these instances, consumers are often horrified to learn of the damaging or revolting nature of the processes that support their habits, yet interfere with their desire to assume a sort of civilized purity. As the chain from consumer to the means of production is so attenuated, individuals fail to understand the direct impact of their habits of consumption on the environment, resulting in our contemporary situation in which the public wants to be “green,” but has an ironically skewed perception of their own filthy “footprint.” In *The Modern Spirit and the Play of Transpositions*, it is Bataille’s call for a return to consciousness of our human reality that is relevant in reconsidering the design of those mechanisms which currently bar us from that which is deemed undesirable. Here, a “return to reality does not imply any new acceptances, but means that one is seduced in a base manner, without transposition and to the point of screaming, eyes open wide.”1 This radical proposal asks us to replace repulsion with lust by changing the nature of our gaze. While Bataille is motivated by an explicitly political agenda to breakdown hardened social structures that prohibit revolutionary change, his words carry radical design implications.

As the awareness of the means of production is becoming an increasingly critical issue due to the endangered state of our global ecosystem, it would seem necessary to make more transparent the boundaries that once removed individuals from the processes that make their lives possible. This is not to say that the protected spaces of civilization must be sacrificed to make room for the dark and grotesque processes that make life as we know it possible. Rather, if we were to consider life and the means to it as a more integrated whole, perhaps the act of animal slaughter would not be so repulsive a presence. If designed into our sensorial experience instead of quarantined and out of sight, the visibility of sustainable processes could have a positive impact on our relationship to our environment.

The work of R&Sie(n) questions our relationship to the environment and the safety zone that typically protects us from it, using architecture as a means to confront the uninhabitable world. The Mosquito Bottleneck, 2003, brings the inhabitants of a private house in Trinidad into extremely close proximity with their biggest threat, the West Nile Virus carrying mosquito, by essentially trapping the insect within the thickness of a translucent doubled skin of its Klein bottle form. The Mosquito Bottleneck simultaneously protects the occupants from the mosquitoes and heightens their awareness of the proximity of threat by forcing them to live side by side with potential danger. The design constantly reminds users of the artificial reality of their presence in this hostile environment, and the delicately thin balance between their life of comfort and the nature beyond.

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R&Sle(n),
Mosquito Bottleneck,
2003.
MI(pi) Bar, Francois Roche’s concept for a tea room on MIT’s campus that would recycle rainwater and wastewater from sinks and toilets to make tea would make visitors question the quality of water and their trust of the technology used to clean it. Roche hoped the conversation around water would reveal the “gaps and links between the idea and reality of purity” and the great environmental expense of our having an endless supply of clean water. “we can comfortably discuss the future of the planet, and the ethical and moral transformation that it requires of us, but only on the condition that we are not personally implicated in the process” MI(pi) would change this by forcing visitors to recognize “the central place we each occupy at the heart of the global machine of industrial production, at the center of the global rubbish heap that we must now renegotiate and resolve.”

Our built environment does all things possible to eliminate the fact of waste and decay from our experience. Architecture facilitates the covert process by which the waste products of our lifestyle are neatly collected and carried away by invisible forces, allowing us to produce waste without the anxiety of dealing with it afterward. Unless there in an outbreak of E.coli bacteria in our produce, or our waterfront has been polluted by a sewage overflow, we rarely think of the potential danger of our own waste on our health because its elimination has been so totally engineered by our municipal government. As much as the natural environment poses threats to our survival, our own toxic waste would have as great a potential to harm our health were it not for our highly engineered mechanism for its removal. However, the failure to take responsibility for our own toxicity has led to the present day scenario in which we are helpless against our own negative environmental impact. The forces of waste production are beyond our control. We usually have little direct say in where our waste gets pumped and how it is treated.

Local waste water treatment is one sustainable feature that has potential to become integrated into an architectural fabric. Waste water treatment units have typically been used in buildings that house processes that produce larger than normal amounts of organic or harmful chemical waste. In such cases, the state mandates that the buildings treat their waste water before releasing it back into the sewage system to help minimize the load on centralized waste water treatment plants. When necessary, these systems are located underground or in separate enclosures, removed from inhabitable space due to their unpleasant odor and bothersome mechanical noise. Furthermore, the water they process is not usually treated to the extent that it can be recycled back into the building for human use, although it is possible to do so. Water treatment engineering has recently been researching the feasibility of domestic scale waste water treatment and has thus been interested in reducing some of the effects of the treatment process that would bother human inhabitants in close proximity. In the following study, a biological waste water treatment

In the initial experiment, a two-stage settling and biological treatment process was set up, in which unpleasant odors coming from untreated settled sludge became a problem. In this setup, a primary tank with no activated biological matter was used to allow large sludge particles to settle to the bottom, from which they would be periodically removed. From here water would pass into the second tank which contained the activated biological matter, and a small pore filter through which treated water would pass into the clean water storage tank. In the primary operation period, the settled sludge that built up over time in both tanks caused an odor that was unsuitable for the occupants of the household. To resolve this, a sludge recycling operation was introduced. Mixing, aeration, sieving of the inlet to the MBR (membrane bio-reactor) and sludge recycling in the first tank resulted in fewer odor problems, a higher denitrification rate and partially enhanced biological phosphorus removal of about 70–90%. Another advantage was that a single, stabilized sludge was produced, which could be pumped out, de-watered and air-dried on site. It was found that the essential parameter for stable operation is the return sludge ratio, which was largely irregular in the experiment, but could potentially be controlled through a sensor feedback loop. If the waste water treatment operation was to be distributed across a series of modules, as in Endothelium, the feedback of sludge into the initial aeration compartment could instead be transferred to a new module, that repeats the process of the previous module, therefore creating local modular stability within a globally fluctuating environment. In this way, the system could be distributed across an array of smaller volume treatment modules, in effect propagating the operation across a surface, and space, instead of concentrating it within a single volume tank. The series distribution would prevent large quantities of odor-causing sludge from building up within the system as well as aid in aerating the activated sludge by increasing its overall surface area by which air is introduced. The diagrams to the right demonstrate the tested working system (top), and a concept for how this system could be contained in a single, smaller module, and distributed in series (right). The proposed alternative asks to re-introduce waste into our perceptible environment and forces us to confront the fact of our own toxic nature. Here the realization and appreciation of the chaotic instability of our own decay and simultaneous need to control our waste is evoked through the organization of the system.
Domestic waste water treatment system, MBR (membrane bio-reactor).

Combined water treatment module.

right:
Proliferated module.
Water flow diagram.
Hollow fiber membranes, submerged wastewater treatment module
PERFORMANCE

GROUNDWORK
Storm Water Outfall: Slowly drains to Aerobic Water Treatment
Burms and Drainage Basin protect site from storm surge
Protected Water Areas promote urban wildlife habitat
to naturally revive water quality and add oxygen
An archipelago landscape is created as a foundation for program

WATER TREATMENT
Existing combined sewer outflow network is retained in an underground sewage river that drains into a biogas digester, and resurfaces during secondary treatment phase as a visible wall system. Final UV light sanitation takes place within grain silo's vertical shafts. A gravity driven system distributes clean water back to program.
Programs drain into shared water treatment system.

WIND
Directed around burms into concentrated flows that carry away smell from slaughterhouse

ENERGY
Wind

PROGRAM_CIRCULATION

GROUNDWORK

COLD STORAGE
AIR TUBES
SMELL PROJECTION
AIR WELLS
FLOOR TUBES
BIOGAS
WATER HEATER
HEAT EXCHANGE

FOODLAB
BBQ PITS
PIZZA OVENS

KITCHEN
BBQ PITS
FOODLAB
KITCHEN

PARKING
PUBLIC DOCK
SLAUGHTER
DINING
BUTCHER
MARKET
BBQ PITS

MEAT LOADING DOCK
LIVE PIG LOADING DOCK
MEAT DIST.
MARKET
LOADING

PUBLIC DOCK

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SYSTEMS OF SLAUGHTER

My thesis design proposal explores architecture’s potential to re-integrate into the experience of everyday life, systems now hidden within the city. Modern city planning’s thick concrete walls segregated the city into distinct zones of material production or public activity. The 20th century streamlined the urban environment, obstructing from public view and thereby facilitating a psychological disconnect from the gritty processes that sustain them. Today, architecture must address this psychological dissociation if we are to achieve a future of urban sustainability in which the public is fully aware of the environmental implications of the lifestyle it leads. With modern technology, architecture has the potential to reveal, rather than hide, the productive processes that make modern life possible without threatening the public’s health and safety. In this proposal, the barrier between life and production becomes transparent and penetrable. The central program, a sustainable urban pig slaughterhouse, creates public space for related activities, while once again making animal slaughter a socially acceptable activity. The project responds to the recent rise in the number New York City slaughterhouses due to the heightened demands of an increasing immigrant population, and the subsequent increasing conflict between the live animal industry and nearby residents, which prompted a new zoning law stating that no new slaughterhouse be built within 1500 feet of a residential property. But by pushing slaughterhouses farther away from urban life, we fail to recognize their crucial role in creating a sustainable food system, and miss the opportunity to encourage better practices for handling meat and making sure that the waste they produce is properly treated.

The victim dies and the spectators share in what his death reveals... the revelation of continuity through the death of a discontinuous being. A violent death disrupts the creature’s discontinuity; what remains, what the tense onlookers experience in the succeeding silence, is the continuity of all existence with which the victim is now one. Only a spectacular killing, has the power to reveal what normally escapes notice...

Georges Bataille Death and Sensuality, 1957.
At a post-industrial site near the notoriously polluted Gowanus Canal in Red Hook, Brooklyn, both this fringe area of the city and the abject practice of slaughter are elevated to a new position of public interest, while serving the practical demands of pork production. The site remains close enough to the market demand for pork, the greatest in New York City being the Chinatown market, but is ideally located along strong wind paths which aid in carrying out across the water unpleasant smells that might otherwise cause unwanted rifts with neighbors. The project simultaneously addresses New York City’s problematic combined sewer overflow mechanism which dumps raw sewage directly into coastal waters during storms and has been the primary cause of the unacceptable water quality in and around the Gowanus Canal. One of eight sewage overflow points along the Gowanus is located on site and will be directed into a meandering underground series of biological treatment tanks.

As it was during the ancient sacrificial ritual, at the rapidly gentrifying, post-industrial waterfront, slaughter is once again made a celebration of humanity’s dominion over nature, yet here emphasizes the importance of dealing responsibly with that power. Slaughter transcends its contemporary negative environmental associations as it engages with a community that comes to understand the pork process as a part of a holistic lifestyle, one that includes death. Rather than deny meat eating its right to exist, the public becomes aware of the reality of what it means to consume meat, and helps put positive pressure on the system of slaughter by its ability to see into the process, thus providing a natural quality control mechanism.
The site is ideally situated to attract people from the adjacent Red Hook playing fields, busy with athletes and spectators on the weekends, and shoppers from the nearby Ikea and Fairway market area, easily accessible by New York Water Taxi. The nearby Red Hook Community Farm will gain immediate access to a new market pavilion integrated into the park and slaughterhouse program, helping to expand clientele and support for local agriculture. As the farm already uses land on Governors Island to raise goats and sheep, the potential to collaborate and raise pigs there to be brought to the slaughterhouse by boat is a feasible strategy. With an unusually open air view of New York Harbor, and a perpetual wind that cools even in the thickest summer humidity, the site is a refuge from the city’s dense residential neighborhoods. Currently, along the narrow canal that makes up the site’s eastern edge, an abandoned concrete structure looms as a mysterious relic of Red Hook’s industrial past. The Port Authority Grain Silo, still in impeccable structural condition, which now remains barred from the public who are unaware of its history, is integrated with the social life of the city and opened to the public as an urban historic park. The ground, currently paved over as a sparsely used parking lot, is graded to create a terrain for the drainage, collection, and storage of storm water, and clean effluent from the on-site water treatment facility. This new topography of hills and ponds creates a
dynamic, continuous terrain for public movement from the land to the water’s edge. The functions of slaughter are raised one storey above the ground in an jagged line that slopes down towards the land at each end to receive live pigs from both boat and truck loading, and send out freshly butchered pork through the Columbia Street loading entrance. The public passage beneath the slaughter line is metered by structural cones that provide an echo of the processes taking place above. These funnels vertically connect the slaughter volume to its ground as they expose the movement of slaughter wastewater from its source above to the biological treatment holding tanks that meander underground across the site before it is released as clean effluent at ground level. Both effluent and storm drainage fill the depressions made into the ground plane and create a waterscape that becomes the source of a secondary treatment phase. From the landscape, water is pumped into a secondary membrane bio-reactor, designed as a modular system located within the walkways that lift off of the ground to become volumes of public program. As water moves through this secondary treatment phase, it is directed towards its final destination for re-use within the various programs. Recycled water is used up in large quantities by the slaughter process, as well as by the public kitchens, meat curing and preparation facilities, and bathrooms across the site.
These sketches test out ideas of wind direction and smell carry on another site on the East River. Site sections begin to develop ideas of program relationships.
The design process began by diagramming systems of slaughter and wastewater treatment to discover opportunities for human interaction and formal cohesion. Through the outlining and layering of flows of storm drainage, waste, water treatment, clean water, energy, and pedestrian movement onto the topography of the site, an organizational logic emerged that was based on all of the project’s various parameters. The following series of sketches provides a pictorial narrative of that process. These sketches are not meant to be read linearly, but as superimposed layers that were simultaneously revised through analog feedback loops.
Waste and storm water.

People and pig circulation.

Energy.
Concept drawings
Sketches for air cooling system.

Sketch of operable shading and roof drainage system.
Break down of pig slaughtering process.

Study of slaughterhouse waste treatment systems as architectural surfaces.
Live pig section. Public space occupies ground below slaughter floor.

Dead pig section. Public space passes below loading ramp. Demonstration auditorium looks back into cleaning and quartering processes.
System layers.
In the architectural proposal, the linear slaughterhouse process is perforated by interwoven volumes of public space that facilitate awareness, learning, and participation in slaughter and waste treatment, those civic functions ordinarily shunned and placed as far from social life as possible. The organization of space and systems can be most visibly in the plan. Here the intersection and overlapping of system lines is translated into the building volume and delineated with discreet surface patterning. The slaughterhouse volume is treated with a rib frame structure, sheathed in a double membrane skin that uses the force from natural wind to lift and carry smells along and out of the internal program volume. The slaughter volume is for this purpose strategically situated on the prevailing wind axis which tends to move from West to East. The public programs of farmer’s market and public kitchens are located in the larger branching volume that intersects the slaughterhouse. This volume is distinguished by a perforated deck that allows the public to see through the section of the floor slab to view the process of water filtration that takes place within this layer. The perforations also establish a vertical connection between programmed space below, and open outdoor public space.
on the deck above. Within this volume, individual pockets of programs are spaced within a larger linear zone, maintaining distinction while establishing a space of related activity. The kitchens become positive glass volumes that are both contained between, and perforate the two layers of open public space that define their upper and lower limit. The top surface of the kitchens is broken up by depressed wells and raised platforms that follow the outline of the kitchens below. The perforations through the farmer’s market remain as voids that act to break up the larger pavilion like space below, allowing air and light to pass through to the ground level, or in one instance becomes a translucent solid, enclosing a public bathroom.

The third program volume weaves in and out of the slaughterhouse and contains the butcher, meat curing, sausage making, demonstration theatre and education spaces. This folded ribbon moves back and forth through the slaughter volume, at times ascending to puncture the slaughterhouse membrane and allow inside views into different stages of the pork production process. One moves upward through a staircase the penetrates the slaughterhouse floor, leading to the demonstration theatre that offers simultaneous views of the open ocean and the process of pork production. Here one can watch a butchering demonstration, with the horizon of water and sky beyond and the quartering and packing of pig carcasses at the periphery. Another ascending passage from the ground level water pumping plaza, ramps upwards to the roof of the meat curing volume and enters the slaughterhouse. Once inside the intestines of the slaughterhouse, the procession continues up a stairway and crosses over the scraping and cleaning stage of production below. The visceral sight of the cleansing of intestines signifies the inaugural passage to the butchering school, where students learn to shed their phobias and deal in the real meat and bones of preparing a pig to be eaten.
The intent of the public urban slaughterhouse is not meant to shock, but to familiarize the mechanism of animal slaughter within our society. Industries that threaten the environment are too often so far removed from the public’s consciousness that the danger of their activity goes uncontested. The meat industry in the United States is a prime example of the danger of so totally removing once localized practices from public view. By setting a pork processing plant in direct public view, the project confronts the meat industry, demanding a more sustainable and more humane production process for workers, pigs, and the environment. Simultaneously, the public is confronted with the reality of that which is necessary to be a meat eating society. We can claim to be working for a sustainable future if we are in denial of the means to our lifestyle.

Architecture can recognize social momentum where it already exists, and support current cultural movements by providing the much needed space for a public voice. In the contemporary trend toward sustainability, the architectural profession must insist on creating and participating in a social discourse. State-of-the-art sustainable building systems alone cannot do the work of transforming our society into one that is conscientious of the delicate ecosystem with which we must maintain a balance. Architecture has the ability to ground critical issues, such as society’s relationship to meat, within instances of the physical environment, where they can be wrestled with through architectural solutions. This type of public architecture, imbued with conflict, acts as a means for confronting and resolving contemporary issues within the local context of the city. The sustainable food movement has demonstrated the power of local activities and events to encourage interest and awareness in the cause of maintaining a stronger local agricultural network. Here, architecture has found an opportunity to both test its own material limits and its capability to affect and facilitate the confrontation of critical issues within our contemporary society.

opposite:
Model 1/16” = 1’
acrylic, paper, and wire.
Views from land (North side).
opposite: “dreaming of the pure vegetable kingdom”
Watercolor on paper.
Bibliography


