I, Liam M Knecht, hereby submit this original work as part of the requirements for
the degree of Master of Architecture in Architecture (Master of).

It is entitled:
Strange Beauty: Re-Imagining Scraps as Architecture

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Strange Beauty:
Re-imagining Scraps as Architecture

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Abstract

The process of designing with scrap materials presents opportunities for improvisation and play, something that has become lost in contemporary building culture. There are obvious benefits to standardized building products, but there is a lack of material engagement in the process. A marked benefit of recycling scraps is that as a strategy for design it increases the engagement of the designer with these materials, because they must be dealt with on their own terms. The kinds of material scraps that have no steward and that are so problematic because of their awkward state of in-between-ness are the most compelling, because they are rife with potential and there is nothing to lose, and so much to gain, in taking them in and allowing their strange beauty to lead the way. A material palette based upon beautifully problematic scraps must therefore also include the inordinate number of vacant buildings that litter the urban fabric. The re-imagining of these scraps will form the basis of an architectural design process developed from a kinesthetic and dialogical engagement with these materials. A process of designing that exalts idiosyncrasies and simple processes of fabrication will be used to show off the unexpected agility and vitality of materials that were once considered trash. The result is an architecture that has grown out of a dialogical process and is therefore more grounded, and more accessible to the user.
Acknowledgements

Edson Cabalfin for his insight, guidance, logic and patience. Thank you for teaching me that 'question, challenge, and dismantle' is only the beginning. The distance between two points is only relative.
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Introduction

The aim of this thesis is to challenge the connotations of waste and explore the possibilities of using scraps as building materials. The thesis is itself a proposed process; a way of thinking about waste and recycling. Waste comes from a variety of sources. It could be considered as a new kind of locally available material, because it can be found anywhere. That is, it is a universally locally available material. Waste can be anything from food waste, to furniture, appliances, construction debris, clothing, packaging materials, industrial by-products, etc. An architectural design process developed from a kinesthetic engagement with a specific palette of scrap materials is the goal of this thesis. A process of designing that exalts idiosyncrasies and simple processes of fabrication will be used to show off the unexpected agility and vitality of materials that were once considered trash. Most importantly this thesis seeks to ask the question, ‘How can recycling aid the architect as an architectural design tool whose primacy is one of material engagement? How can this engagement enhance the design process by letting a kinesthetic and personal connection with material inform the technological and technical processes?’
Waste

The inquiry began with the general question, ‘What role can the architect play in alleviating waste?’ This led to an investigation of what waste is, and what kinds of waste could be used in architecture.

Within any urban setting there exist forces of industry, economy, culture, and time. These forces produce waste. Once discarded, waste remains a foreign entity to us, existing in large pits, guarded and shielded from view by mounded earth. It is a dirty secret we keep well hidden. Waste can be classified into different types and is known by many names - offal, rubbish, trash, leftovers, scraps – that are discarded and abandoned parts and pieces deemed to be of no value. Anywhere we go we can find scraps and leftover pieces: wood, clothing, plastic, metal, brick, paper, rubble, whole buildings. The smaller scraps are usually tossed into a landfill to rot. The buildings are left to deteriorate, awaiting renovation, or torn down and sent to the landfill. All of these scraps contain the embodied energy that generated them. They also retain the qualities and characteristics (intrinsic and extrinsic properties) that made them desirable to use in the first place. Therefore, they also retain the memory of their initial use. These scraps exist in a state of orphan-hood. Orphan can be defined as something that lacks support, care, or supervision. Sometimes these leftover scraps are burdensome. Sometimes they show some flicker of potential, but seem too small to do anything with. They may be in such great
abundance in some cases that it seems too flippant to toss them aside, but another use for them is elusive because of the residual memory of their previous use, or because their invisible potential is not considered. While the devaluation of these orphaned leftovers is an inescapable outcome of the forces that produce them, their re-conceptualization can invigorate them with new purpose and meaning. These materials offer a productive constraint to the design process, a necessary friction. The goal of the design project is to confront the issue of waste by generating building elements and spatial-physical relationships that force the interaction of the user with material once labeled as waste, turning the negative connotations of these scraps upside down and re-presenting the scraps as sensorial, experiential architectural elements. The process of the design project will include the sourcing and selection of leftover parts and pieces that result from various forces of industry, economy, culture, and then to propose solutions to an existing building shell to be reused, and to serve as the superstructure. The extent to which these scraps can be used in place of or in concert with contemporary construction practices depends upon their condition, the cost effectiveness of fabricating them into viable materials to build with, but most importantly the quality of character that these scraps might lend to the project.
Recycling and Reasoning

After an initial investigation into waste and the specific kinds of scraps that might be used for architectural purposes, it was necessary to move into an inquiry of the process by which these scraps could be incorporated into an architectural design process and project. The process of designing with reclaimed/recycled/reused materials presents opportunities for improvisation and play in building design, and presents interesting opportunities for problem solving. This design aspect is something that has become lost in contemporary building culture where prefabricated and standardized building products are chosen and ‘assembled’ as opposed to being designed, planned and ‘worked’ into a building design. The architect’s role has been relegated to a ‘selector of products’¹ - products that are selected for their stated performance capabilities, texture and color - that correspond to other supporting products whose qualities are also predefined. There are obvious benefits to standardized building products, but there is a lack of material engagement in the process of selection. Manufacturing processes that demand narrow parameters have flattened the creative work out to the thinnest layer: the selection and assembling of the predetermined products. As the need for more holistic approaches

to building increases, one avenue of alleviation to the problem of waste – recycling - is being explored and encouraged here in order to define a new set of resources for design and construction. Materials previously deemed unusable, or valueless, were therefore not considered or explored for their potential uses. When looking into the reuse, recycling and reclamation of materials and components it becomes clear that a marked benefit of reusing materials is that the strategy for design increases the engagement of the designer with these materials. To design and build demands a well-rounded knowledge of various types of fabrication, assembly and construction. In order to adjust to unusual assemblies and methods of joining when working with recycled materials the familiarity with fabrication processes, construction, and an understanding of the limitations and possibilities of the materials becomes even more important. Bill Addis proposes an ‘Environmental Preference Method’, where the hierarchy for material reuse is: reuse, reclaim, recycle, destroy. He also offers the following classifications for reasons to reuse, types of reuse, and strategies for implementation of recycling/reuse in design, and finally the sources of recycled materials (figure at left).

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Beautiful Orphans

To begin, it was necessary to locate where materials could be found and in what quantity, in order to develop a palette that could in sum provide the basic components to make a building project. The discovery was that there are a number of woodworking operations that generate offal that is too small for the shops to re-incorporate, and that get tossed. Wooden palettes and wooden shipping containers are also available frequently, comprised of hardwood and softwood, and the best supply of them I have found are used only once for the transport of goods and then disposed of. Used clothing is generated in bulk amounts: it is sometimes compressed and baled into large volumes and sold, or it is sold in smaller quantities by the pound. Corrugated cardboard and tubes can be found en masse as well, and processed paper pulp is available in bulk.

Mostly, no one knows what to do with these kinds of scraps. In some cases it’s hard to give them away, and may even cost to have them hauled off. These scraps that have no steward, and that are so problematic because of their awkward state of in-between-ness are the most compelling to me. They are rife with potential and there is nothing to lose, and much to gain, in taking them in and allowing their beauty and their strangeness to lead the way. This palette, based upon beautifully problematic scraps, must
### MACHINE

- **FORCES**
  - Excrement

- **USE**

### REGION

- **SPRAWL, ECONOMIC SHIFTS**
  - Abandoned retail centers,
    - New hub: Reclaim concrete, Carl, trusses

### CITY

- **TIME, GENTRIFICATION**
  - Vacant and condemned buildings,
    - Reclaim masonry and wood, fixtures and accessories; infill with garden space

### INDUSTRY

- **DEMAND, MARKET**
  - Offal from manufacturing processes
    - Fabricate these bits and pieces into structural systems and member, casework

### INDIVIDUAL

- **HUNGER**
  - Bottles, cans, containers, food scraps
    - These products can be utilized in cob building

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**SOUTHWEST OHIO REGION: MATERIAL RECLAMATION STRATEGIES**

**REGION**

- Sprawl, economic shifts
  - Abandoned retail centers,
    - New hub: Reclaim concrete, Carl, trusses

**CITY**

- Time, gentrification
  - Vacant and condemned buildings,
    - Reclaim masonry and wood, fixtures and accessories; infill with garden space

**INDUSTRY**

- Demand, market
  - Offal from manufacturing processes
    - Fabricate these bits and pieces into structural systems and members, casework

**INDIVIDUAL**

- Hunger
  - Bottles, cans, containers, food scraps
    - These products can be utilized in cob building
SOUTHWEST OHIO REGION : VACANT AND CONDEMNED : TEMPLATE HOUSES

CITY

TIME, GENTRIFICATION

VACANT AND CONDEMNED BUILDINGS,

RECLAIM MASONRY AND WOOD, FIXTURES
AND ACCESSORIES, CUT OUT THE ROTTEN
SPOTS AND HYBRIDIZE WITH SALVAGED
MATERIALS FROM INDUSTRY, INFILL WITH
GARDEN SPACE

1 NORTHSIDE : 153
2 OVER THE RHINE : 325
3 SOUTH CUMMINSVILLE : 46
4 WEST END : 135
5 CAMP WASHINGTON : 18
6 LOWER PRICE HILL : 51
7 MOUNT AUBURN : 112
8 SOUTH FAIRMOUNT : 200

MACHINE

FORCES
EXCREMENT
USE
therefore also include the inordinate number of vacant buildings that litter the urban fabric. If we are to consider recycling as a way of re-imagining then there is no better candidate than the hollowed masonry buildings that yearn to once again be revered. If the models for recycling given by Bill Addis were to be seen as a holistic approach to recycling, truly a continuum, then each of his categories of types of recycling and types of materials to recycle could be seen as a smorgasbord from which to mix and match. Certainly each category could be taken as a separate piece to focus on, but this thesis is suggesting that we do take a holistic approach and consider how all of the parts and pieces can be used together at different scales and in different capacities.

Figure 5. (opposite page) There are over 1,000 vacant, condemned buildings within merely 9 Cincinnati neighborhoods.
‘Hollowed (or Hallowed) Masonry Buildings’: A Case Study

Introduction

(In order to understand the building shell as a large scrap, it was necessary to investigate it in ‘in situ’. Since the building shell is at such a larger physical scale than the smaller scraps it comes with a much larger set of issues – namely cultural. These were investigated in an attempt to gain a better vantage point from which to integrate the scraps, and to understand what elements were needed to do so.)

Goethe St. is a dead end street near downtown Cincinnati, in a neighborhood called Sycamore Hill. There is a multifamily building on Goethe St. that has been vacant for over five years. On its own it does not provide the basic amenities expected of a home, let alone a house. The circumstances of its demise are not clear, but like many vacant and condemned buildings, it stands hollow, a shell. It occupies an awkward state of erasure. Though it still exists, physically, its not really there. It is as though it has suffered a slow existential death from lack of companionship - at least an insufficient level of companionship. Now it begs questions that may not be easily answered, but that will be explored in this case study.

Figure 6. The hollow shell of 226 Goethe Street.
Research

The Absolute, Relative, and Relational Spaces of 226 Goethe St.

The research and documentation of Goethe St. will be analyzed based upon the premise set forth by David Harvey in ‘Space as a Key Word’. According to Harvey, space can be generally categorized as absolute, relative or relational. ‘Absolute space is fixed and we record or plan events within its frame’ and ‘applies to all discrete and bounded phenomena’ where socially it is the ‘space of private property and other bounded territorial designations’.3 This is the measurable, tangible data such as property line, square footages, materiality, geographical characteristics. Relative space revolves around the aspect of ‘space-time’. Essentially, relative space ‘depends crucially upon what it is that is being relativized and by whom’.4 Relational space is that which is ‘contained in objects in the sense that an object can be said to exist only insofar as it contains and represents within itself relationships to other objects’.5

Several resources were used to gather information about 226 Goethe.

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4 Ibid.
5 Ibid.
USGS

USGS\(^6\) offers the most ‘absolute’ data: topographic maps, satellite images, latitude and longitude coordinates. Of course as Harvey points out it is impossible to consider space as separate from time, which led to the ‘tripartite division’\(^7\) described above. So to take this a step further, the USGS offers absolute data relative to several points of reference such as satellite images taken at certain times, or regimented intervals of time, and topographic data that is understood as three dimensional but viewed as flat relative to the angle of perspective. Google Earth offers three dimensional models of terrain and buildings, and while these can enhance the experience of a map, they are still relative interpretations of absolute space.

Department of Buildings and Planning

The Department of Buildings and Planning\(^8\) offers information that mostly falls under the category of ‘absolute space’, but borders on ‘relative space’ because of the extensive use of database software, forms and information compiling that defines the parameters of the department functions. For instance, in order to create and maintain databases, certain information had to be

\(^6\) USGS.gov
\(^8\) Department of Buildings and Planning, Cincinnati, Ohio.
included and excluded, then organized into categories and codified language. In doing this an information bias is established. The agenda of the department becomes the filter through which properties are catalogued. Property boundaries, maps, notices for condemnation, code violations, can be found here.

Data:

There are no files on record for 226 Goethe St. The parcel can be viewed on the mapping software, but the exact address does not correspond to any parcels in the database records. The only other information on file for this address is a list of citations for hazardous conditions and ‘keep vacant’ notices.

Hamilton County Auditor

The Hamilton County Auditor\(^9\) is another instance of space organized into relative absolutes. A relational nuance is present, however, because the information found here begins to paint a picture of a parcel as it relates to other parcels and to people. Ownership, value history, sale and transfer history, improvements to land and buildings, amenities and parcel maps, including zoning and use designation, square footage of building and parcel, are found here.

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\(^9\) Hamilton County Auditor of Ohio. www.hamiltoncountyauditor.org
Property Summary:

A three family dwelling, built in 1875.
2876 finished square feet, on an irregular lot 43’ x 78’.
The property information lists the parcel as ‘Dorsey St.’, the street
to the north, parallel to Goethe St.
The transfer history shows that the property has been in the same
family, passed from one member to another since at least 1976.
Adjacent lots are empty. The building is apparently holding up a
steep hillside, its northern wall acting as a retaining wall.
The photo from 1999-2003 shows the building with windows, a
vehicle parked out front, signs that it is inhabited. The photo from
2005 shows windows, but there is a noticeable disintegration of
the building. The photo from 2008 shows the building windows
gone, deterioration of the interior, and overgrowth of the land.
Photos taken on site in 2011 show the building in a desperate
state of neglect. Conveyance forms documenting transfer of
ownership tell their own story of this parcel:
2004 – property is transferred from G. Anderson to G. Anderson,
K. Anderson, and J. Anderson. Building is not primary residence
nor will it be used as such.
2004 – property is transferred from C. Anderson, to E. Anderson
and E. Anderson. The date of filing is the same as the above.
2009 – property is transferred from J. Anderson, to E. Anderson,
The form indicates that the building will be the primary residence, and is not a multifamily dwelling.

Site Visit

(My first visit to this property was in the summer of 2009. By then it had no windows. There were signs of squatting, and the lots next to it were overgrown with summer. The conveyance form from 2009 indicates that it would be used by the grantee(s) as a primary residence, and that it is not a multifamily dwelling. No where in the property report does it indicate a change of use or zoning. It is registered as a ‘530 Multifamily Dwelling’ by the Hamilton County Auditor.)

The site experienced, walked upon, smelled, heard, touched and seen. This method of inquiry may be the most compelling and precise balance of absolute, relative and relational space. It is absolute in that it is tangible, measurable in present time, as it exists. It is relative in that it is I, the visitor, whose experience informs an interpretation of the site. Finally, it is relational because the experience of the site is a direct interaction between object and subject, object and object, subject and subject. An impression of the place is conjured through a direct interaction as well as through the culmination of past experiences and associations, all
of which combine to create a multidimensional – tripartite\textsuperscript{10} - experience in the present.

Notes:

There is a noticeable stillness at this place, but it is not a peaceful stillness. It is a harrowed stillness, but not recent, not freshly plundered. There is a tangible sense of time having set itself upon it. Other forces as well have preyed on the place. It has become a dumping ground of sorts, where an occasional squatter comes and stays for some time, leaving behind the evidence of makeshift living; tires and bags of garbage piled and strewn across the empty adjacent lots; graffiti; branches and brush clippings piled in the driveway. At street level the doors and windows are boarded, most likely to prevent what appeared, on a previous visit several years ago, to be a two or three person camp inside the building.

A great feeling of sadness is elicited by this place. It is not the place itself that is sad, and crying out. The sadness elicited is a response to the situation of neglect, of virtual erasure. The erasure of relationships between this particular place and the person, the place and the neighborhood, the neighborhood and the city through a series of relative omissions.

Reflection

Home and Homelessness

Within thirteen of Cincinnati’s centrally located neighborhoods there are nearly 900 vacant or condemned buildings, only counting residential.

What has happened to the previous inhabitants of these buildings? What were the circumstances that brought the use of these buildings to an end? Dovey suggests that ‘home is a demarcated territory with both physical and symbolic boundaries’ and is ‘a place of certainty and stability’.\(^{11}\) Home is also considered an environment ‘imbued with the familiarity of past experience’.\(^{12}\) If a home is the place where we project our past experiences, and attempt to recreate the spatial patterns familiar to us, then what will these vacant, condemned buildings become and to whom will they be a home?

If it is true that a person makes the home and the home makes the person,\(^ {13}\) then this building offers a situation of home that is cold, unstable, exposed, and battered. On its own it does not provide the basic amenities expected of a home, let alone of a house.

What does it mean to know home as a place of instability and


\(^{12}\) Ibid.

\(^{13}\) Ibid.
squalor? Does this kind of building breed instability and squalor? Is this an inevitable outcome? Is this place a product of a natural cycle of entropy, or is it the product of a cultural pathology? While these questions are largely rhetorical due to the complexity of the factors and variables that play into the circumstances like that of 226 Goethe, they are a point of departure for discussing the issues of ‘home and homelessness’. Dovey frames the importance of home as an interaction between person and place and place and person, implying an interdependence of building and person; inanimate and animate. It also implies that at some level, the building is not entirely inanimate, as it has an inherent influence over the person inhabiting it. Not to imply too strongly that the building exerts a supernatural influence, but instead that there are factors, relational factors, that can greatly effect the dynamic between person and building. While there are too numerous tales to mention of ghosts and haunting from all over the world, many of these stories are born of an essential need to understand and explain the world around us, they persist in part because there is no way to fully disprove them. Environment as a reflection of self is perhaps a more relevant analysis. The interdependence of people and architecture couldn’t be more explicit as in the example of the Batammaliba people where ‘personal difficulties often necessitate some form of architectural

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change as part of their resolution’. In this case, spirits and the anthropomorphism of place and built structures are very real, in a way that Western culture cannot relate to. For the Batammaliba ‘the house is both a metaphor of psychological unity and an ontological expression of the reality of psychological disjuncture.’

When Harvey defines relational space, he could easily be referring to a dynamic much like this. The interdependence of the individual, of the culture, on its architecture, is a relational one, where the place plays a central role in identity and inner balance.

Dovey asserts that home is a ‘schema of relationships that brings order, integrity, and meaning to experience in a place – a series of connections between person and world’, further echoing Harvey’s ‘relational space’.

The situation at 226 Goethe St. is disturbing because it points out a deficiency in our cultural attitudes towards environment. Anything that cannot be easily measured is ignored and degraded. It’s not that we have no sense of relationship to environment, but that our relationship to environment (also read as ‘space’) is dysfunctional: ‘the rationalistic attitude is that it implicitly gives priority to the abstract conceptual modes of “space” as opposed to

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16 Ibid.

17 Ibid.

the meaning centered mode of “lived space”’.19 As soon as the house became an object of technology, homelessness pervaded cultures the world over.20 We have become less connected to a deep sense of home, and more connected to superficial substitutes offered to us by representations of ‘home’. Dovey explains, ‘the designer’s reputation is determined more by the visual images of buildings in professional journals than by the experience of the users’.21 This certainly poses no incentive for designers to encourage a sense of home through their designs by diverging into expressions of place based on use and experience of use, as opposed to form and image.

One problem of the squalor and deterioration seen at 226 Goethe St. is that it can be contagious. These characteristics can invite more of the same, can breed more of it, and can impose an impression upon the neighborhood and upon passersby. It leads to stigma. In a culture that favors a rationalistic attitude and conceptual modes of space, the fate of this building, and others like it are already decided. Harvey’s tripartite divisions of space amount to what is a definition of a critical balance of forces at play in any situation. To ignore one or more of these can lead to consequences we may not have intended. ‘If people cannot adapt their living space to suit their needs, they will adapt their needs to suit their living space, even if it is detrimental to their own well-

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20 Ibid.
21 Ibid.
being and to those with whom they live’.\(^\text{22}\) Just as Dovey points out that ‘lived space’ is a ‘meaning centered mode’\(^\text{23}\), Harvey refers to this similarly as ‘spaces of representation’\(^\text{24}\). These spaces can also be understood as overlapping with the absolute, relative and relational. As a category the bias is still towards what can be measured – absolute, sometimes relative, rarely relational. So perhaps a more accurate description of what is going on at Goethe is as a space of representation it has influence and it is this influence that is contagious.

‘Rationalism’ is bent on order and reason, while ‘relational’ implies softness, emotion. This cultural bias - the cultural pathology of ‘rationalism’ - can be defined simply as a dichotomy bias – we don’t acknowledge the in-between spaces, the grey areas. Harvey attempted to provide a graduated definition of space; not quite a spectrum, but a decidedly gradient matrix. Surely this was done in order to combat this dichotomy bias. Regardless of whether relational space is considered or acknowledged, it is working in the background. Spaces are ‘always invested with meaning by its users as well as its creators, and even when its creators have the power to define its official and dominant meaning, its users are

usually able to develop tactics that allow them to use the space in alternative, even oppositional ways that confound the designs of its creators’.  

People, places, relationships, can all be erased by omission. 226 Goethe St exists as a physical structure, as a point on a map, as a parcel number. Some of its identity and relationships can be traced, but the breadcrumbs end abruptly at the edge of the departments and public record institutions that determine the quality and quantity of information to be made available. The effects of this kind of erasure are not well considered because rationalism is valued over relationship; theoretical over existential.

_Epilogue to Case Study_

My thesis attempts to reclaim buildings like 226 Goethe St and recognize them – in situ - as large scraps. The goal is not necessarily to deconstruct these buildings into their parts but to view them as large pieces of scrap. The intrinsic properties of these scraps can serve to satisfy a portion of the requirements for the design of a livable building. The idea is that the embodied energy in these building shells has a value that should not be tossed aside simply because it cannot be easily measured, or because it cannot be measured by the standards currently used.

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This case study is an attempt to deconstruct conventional definitions of space and to offer a variety of perspectives and alternative definitions. My inclination in the design portion of the thesis is to follow the trend of erasure; to go with the flow of entropy. Can these building shells become like palimpsests that the user can write upon with their own furnishings? Can a home be embodied within these furnishings? On one hand Dovey offers us a definition of home that emphasizes the effect of the place on the individual and the individual on the place, implying an interdependence of these, and that we ‘draw our identity from that of the place’. Simultaneously, according to Dovey home is a ‘patterning in environmental experience and behavior’. It is this patterning of space - the order: spatial, temporal and sociocultural – that seems to be fertile ground for re-imagining these building shells into viable structures for living in. The strategy is to take these deteriorating structures, and push the issue of their entropy – the decay, the squalor, squatting and dumping - and put a positive spin on it; bring them out of the relational darkness into the light. Marry these larger scraps with little ones, medium ones in an ordered way. The dichotomies discussed previously create a situation where the positive attributes of one characteristic can be overshadowed by the

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28 Ibid.
negative. In the context of 226 Goethe St. the squalor and deterioration – the chaos – is problematic. The value of the building and its site – embodied energy, scenic view, proximity to services, privacy and open adjacent lots – are omitted from the public record. The thesis project attempts to take the conditions of trash and deterioration and present them in the same context as productive as opposed to destructive, and to invoke the beauty of the place by shifting the perspective from which the situation is viewed and to relate to it in all of its complexity and difficult

Figure 17. Stacked carpet tiles form the walls of this house designed and built by Rural Studio.

Figure 18. Nestled picture frames applied to the ceiling create a rhythmic, though hodge podge, pattern. Dan Phillips designed and built.
Building Culture: Regulation and Legitimacy

‘It is generally easier to introduce a new material into the human body by way of biomedical engineering, than it is to introduce a new material into buildings. The reasons for this include the decentralized nature of the US construction industry, the relative paucity of research funding and the conservative nature of the building trades, the extreme pressure on least cost solutions and a general set of cultural ideals that have consistently undervalued the more subtle aspects of architectural invention.’

-John Fernandez

The earliest explorations of the smaller scraps – wood offal, used clothing, cardboard - consisted of a simple substitution of this-for-that. I was attempting to model with them at a small scale in a logical fashion how these scraps could become a part of a typical construction assembly. I wanted to explore ways that these assemblages could fit together with the masonry shell on Goethe St. Clothes replaced fiberglass insulation; scraps of wood replaced exterior siding and the tape-and-mud joint of drywall. This method seemed to be exhausted quickly, and soon I found myself, without much resistance, modeling assemblies where the scraps were made more visible, more articulated and much thinner than a typical wall. I began to think of these morphing assemblies as stiffened tapestries and tents that lived within the masonry shell,

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and warmed and softened the space. There was a simple poetry to this that drew me in. When I applied logic however, the figurative wall I continually ran into with all of these was regulatory: fire and building codes. The material properties of the scraps I had chosen to use did not easily translate into structural elements, except for the building shell, and even that was in need of structural repair in places. So first there were the restraints of building code that caused me to reconsider this initial approach. This foray had been based upon preconceived ideas of construction where walls are frames in-filled with fluff and clad with a smooth, hard, fire-proof, and shear resisting sheathing, and then all of the seams and gaps filled and sealed over. The properties of the construction type and assemblies – of the parts and pieces – therefore can be tracked and accounted for and then given a stamp of approval. The scraps however were more problematic because they did not provide this kind of assurance and certainty, and so simply trading one for another did not translate well. Besides, I had started to suspect that this wasn’t the point.

I began to wonder how an ordinary person could incorporate these scraps into construction. It occurred to me that one reason more scraps are not being utilized into construction is because the current building culture is geared towards specific materials and products and is not flexible enough to accommodate the introduction of new processes and materials very easily. Scraps, and waste in general, are stacking up and there is little that the
average person can do when there is so much relational distance between the production of goods and the individual. Our trash is hauled away for us to places we don’t see. The products we buy are made in places we don’t see through processes we are not familiar with, and frankly, do not understand.

**Stating the limits of using recycled materials**

Recycling, reclamation, and reuse exist as a continuum. If a building can be reused, in situ, then it’s total embodied energy is capitalized upon and its life is extended through renovation processes. If a building cannot be reused as a whole, then some of its parts can be reclaimed, repurposed - the embodied energy of those parts can be captured and put to further use. Recycling scraps usually occurs when waste generated by various industries is collected en masse and then reprocessed into new materials. On a smaller scale, where the techniques of constructing rely mostly on the human and traditional technologies of fabrication instead of industrialized machines and processes, the result can be one of intimacy and can offer various levels of experiential interaction. Overall, the consequences of recycling scraps into construction assemblies, and of recycling a building in-situ, are that certain standards of performance must still be met, while simultaneously the process of recycling opens up possibilities for the playful, delightful transformation of construction, space and experience. In order to understand the limits as well as the benefits of designing
with recycled materials, the standards of conventional construction methods must be considered.

**Units of Measure**

Technologies of industrialization have provided convenience and ease of assembly, and have done so through the standardization of parts. The primary driver of this standardization has been achieved through units of measurement. The standardization of units of measure has allowed for construction assemblies and systems to evolve; to become interchangeable; for tools and techniques of installation to approach a universalized model. This interchangeability of parts and tools has led to a diverse and widespread market-industry of building products, making it easier and more cost effective to build. Scraps, many of which are produced as the by-products of these very processes, do not fit within the standard units of measure. They demand a consideration of their own dimensions. This leaves the designer a choice of when to exploit the odd dimensionality of the materials and create a new unit of measure relative to the given material, and when to impose the industry standards upon the given material.

**Assemblies of Construction**

Standardized units of measure have allowed for standardized compositions of construction assemblies to emerge.

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**Figure 23. Typical wall properties**

**Figure 24. An example of a non-standard construction type by Japanese architect and historian Terunobu Fujimori.**
Dimensionally compatible sheeting (drywall and composite), dimensional lumber, and insulation, for instance, comprise the primary structural and thermal functions of wood light frame structures. Sheetin—drywall, OSB, plywood, etc.—is most typically four feet by eight feet; studs are typically nominal dimensions of two- by four, six, eight and so on in increments of nominal two inches; their lengths accord with the dimensions of sheet goods so that the finished height of a wall for example will accommodate a full sheet of drywall, and so on. Batted insulation is dimensioned to fit in between the spaces of a sixteen-on-center framed stud wall. In assemblies constructed of recycled scrap materials there is a constant shifting of standard and non-standard compositions. These materials offer an opportunity to diverge from the norm.

Performance Standards

The rated strength and appropriate recommended use for construction assemblies have allowed for further convenience in construction by standardizing the manufacturing processes that produce these goods. These particular standards include type of wood, glue and direction of grain, amount and length of compression of plys and chips as in the production of OSB and plywood; safety issues like fire rating; structural performance requirements (as in the maximum compression of a stud of a given thickness, depth and length; the shear strength of a given
thickness of sheeting like drywall, or plywood and OSB). Recycled materials present challenges in regard to meeting standards of performance. The appropriate use and placement of these materials is critical to ensuring the safety of the construction assembly in which they are used. This tends to relegate the use of recycled materials to certain kinds of assemblies where their non-standard qualities can be controlled as much as exploited.

Details

From performance standards come details standardized to meet these performative requirements. In various construction types, standard details are readily available for import or export to designer, builder, consumer, etc. Though the details of particular products may differ in their specific composition or arrangement they all are aiming to achieve specific standards of performance. Several examples: condensation channels in curtain wall construction and weep holes in brick façade construction; the span to thickness/depth ration for beams; the on-center spacing requirements of two-by-four stud walls. These detail examples all address issues in construction that protect the construction assembly and the inhabitants. Recycled materials must be used in a way that these criteria can be met, especially in load-bearing applications, and in applications where water and weather will be an issue. In applications where these scenarios are either not at issue, or where the recycled scraps do not play a direct role in
satisfying certain technical criteria, is where the possibility of diverging from the norm of construction and performance standards, and aesthetics, is greatest.

**Consequences**

The purpose of building codes, organizations and laboratories for testing materials and building products, is to provide a framework within which building can occur as a safe, cost-effective, and convenient practice for all involved. Yet, art remains relegated as a ‘purposeless’ activity and contemporary construction continues to exemplify itself as an activity of ‘purpose’. Architecture, when involved in building projects, largely follows the trends of a building culture that operates on many levels without a need for an architect. As the mother of all arts, architecture has taken a back seat to building activities. Architects are selectors of building products; conceptual assemblers of products with predetermined results. Art and construction have been seemingly divided into separate categories in a world of standardization. Standards have allowed for easier access to materials, construction techniques and tools, and their predetermined guarantee of performance when applied appropriately. The alienation of art from the process of most}

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construction practices has paralleled this development, resulting in bland, box-like building forms and interior spaces. While the predictability of standardized construction and materials is desirable for practical reasons, it has also led to redundancy. Architects are practitioners of both technical and aesthetic design. The trend has been for technology to inform design processes, while the matter of the experience of space is subservient to form. It seems that there can be a way for architects to allow a kinesthetic and dialogical process to inform the technical process of architectural design. That is, the technological object\(^{32}\) can become subservient to - can grow out of - the experiential, without compromising or disregarding continual advancements in technology that undoubtedly aid architectural design and fabrication processes immensely.

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Recycling, or something else?

Simply mention the word ‘recycle’ and a slew of other words will come to mind: sustainability, ‘green’, eco-friendly, to name the more commonly associated terms. But what if recycling weren’t really about sustainability at all? What if the act of recycling was understood as re-imagining? What if it was considered an opportunity to engage in a process of ideation and creation - where the possibilities were almost endless? Across several industries, recycling is happening, and always has to some extent because it makes good economic sense with certain materials – plastics, metal, glass - but it occurs in a somewhat linear fashion. An obvious example is the plastic bottle. The bottle is used to contain a liquid and is disposed of when that liquid is consumed. Once disposed the plastic is ground down for use as another bottle. There are other processes that are evolving around the recycling of the plastic bottle into decking, and fabric, but the point here is to say that the bottle is recycled through a relatively narrow lens- it is not re-imagined. It is not transcending its inherent properties. To re-imagine something requires a shift in thinking, a wiping away of preconceptions and a willingness to improvise. Stated another way, re-imagining favors intuition over rationality; it relies upon the relationship and dialogue of the maker with the process of making and the thing being made. Just

33 Dovey, Kimberly. “Home and Homelessness” in Home Environments: Human Behavior and Environment, edited by Irwin Altman and Carol Werner, New York, Plenum, 1985, pp. 33-64
as preconceptions can hinder any creative process, I also believe
that total freedom in design is not a good thing. There must be
productive constraints, some amount of friction to push back
against. So, when using scraps as the driver for a design process,
there is an immediate set of constraints presented. The
strangeness of the scraps is in itself a challenge as well as an
exciting motivator. The idea here is to choose the scraps that one
has the best chemistry with; to find the ‘thing… which prompts us
to act, to invent, to practice, to extend ourselves beyond
ourselves’. For instance, when engaged in conversation with
someone, the dialogue will fail or flourish depending on the level
of interest in the subject being discussed, or with the person with
whom the conversation is happening. In any act of making
something there is an inherent dialogue occurring. It is the level of
interest of the subject (designer) in the object (material) that will
enrich that dialogue. The best conversations I’ve ever had were
ones that did not conclude in answers, but that opened up more
questions and therefore more possibilities- where at the
conclusion of the conversation there was a liberating sense of not
knowing, as if the world had gotten bigger. The process is based
upon using scraps as a design tool – taking advantage of their
idiosyncrasies - whether to produce a building made from the
recycled scraps, or to use the resulting iterations as metaphors
that evolve into building elements constructed of different
materials. In a ‘non-logical’ – i.e hermeneutical as opposed to

34 Grosz, Elizabeth. ‘Notes on the thing’ in 'The pragmatist imagination: thinking
epistemological – design process a ‘single factor in the design situation can trigger the whole design process’. The scraps and the modes of production utilized in the transformation of the scraps become the generators of artful, playful, and delightfully unconventional assemblies that cut through the rampant blandness of the current building culture.

**Thirty-Two Iterations**

Possibly the most important step taken during this exploration was to take a handful of the smaller scrap materials and make some stuff. I needed to get to know them better, work them a couple of different ways, talk to them a bit. It was time to turn the mind off, to enter into a state of uncertainty where the process of re-imagining could take flight.36

And so it went. It seemed that with each one I made there sprouted several more, and I found myself not physically able to keep up with the increasing permutations of these iterations. There was a quote that kept recurring in my mind’s eye about how gothic architecture made ‘stones into architectural facts’ and I

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couldn’t stop wondering how these scraps were like those stones - if they were. Except that the beauty of these scraps is not only in their difficulty, but also in their impermanence, a quality not shared with stones at all. It is this impermanence that makes them less fragile, less precious, but nonetheless beloved.

I attempted to decipher the logic of these swatches by categorizing them into groupings of modes of production. Some were woven, some were stitched, some were stacked, some glued. It seemed, however, that somehow I could fit many of them into the weaving category if I defined weaving a certain way; as well as with carving, and laminating. But regardless of how I defined each process, there was still the aspect of permutation that became a focal point for deriving a methodology that can be used to further explore not only scraps but the combination of any material via a specific process. The discovery of this matrix that generates so many possibilities to explore serves as proof that a design process based upon a ‘personal, tactile connection to material’\(^\text{37}\) can result in a parametric approach. To be sure the uniqueness, and the difficulty inherent in working with the scrap materials served as a pivotal component in the development of this matrix.

Supplements to the Scraps

Furthermore, the masonry building shell began to come into more focus when the operations in conjunction with the materials were the driver. In essence, any material combination can be viewed as an inseparable relationship between material and the operation used to transform it. The augmentation to the masonry building shell could then be understood in a similar way as the iterations. Weaving of two materials, for instance, had produced a number of variations on this operation – weaving - dependent on the qualities of the materials. Therefore, though at a larger scale, the masonry shell can also be woven into with a reinforcing frame, or some other iteration on the theme of weaving that would depend upon the secondary or tertiary material chosen.

While the ideal implies the need for a critical mass to engage in order to delay and shelter, the reality is that some intermediate framework is required. Because the iterations primarily took the form of skins, the next step was to begin to explore what supplemental materials could provide a framework upon which to attach them. The resulting design project therefore focuses on the connections and transitions between materials, and the operation used to integrate them – in this project it is specifically weaving.
**Deeper Questions: Why Individual Kinesthetic Engagement?**

The development of a matrix that could spawn more combinations to iterate upon was and is an exciting tool, but there was still a question lingering in my mind about what it was that these iterations represented. What they indicated about how architecture might respond to their state as I had produced them. The swatches were primarily planar, and I kept thinking of them as skins. All the while, I had imagined that a person could acquire materials and fabricate them through the most basic modes of production, and that through this activity some connection would be made between the individual and a collective consciousness, as though through a ritual of weaving with the hands the artifacts that comprise the furnishings of home, a person might be able to reach back through time and ignite some deep seated DNA linking past with present and future.

By working with the hands there is some essential reconnection made to self and to others; to the material being worked with the hands. These scraps and all of their strangeness offer us an opportunity to re-engage with materials, fabrication processes, and essentially a connection to the eventuality of the design project. Making things – (i.e. manipulation, with Latin roots meaning ‘to fill the hands’ and also manufacture, with Latin roots meaning ‘to make with the hands’) - is a human need that is currently predominantly unfulfilled. Humanity is crying out for the
lost knowledge of making of all kinds that was once an integral part of daily life, and passed down generation to generation. The achievement of fame and recognition is often a measure of an architect's success – and genius - implying that a sole intellect is responsible for the creation of a ‘masterpiece’. As opposed to this top down hierarchy, that celebrates only one individual out of an expansive network of disciplines, a more down to earth and pragmatic approach that encourages cross-disciplinary communication and collaboration is needed.

Here are several accounts to support these statements:

Item 1) ‘Self and social relations develop through making physical things, enabling the all-around development of the individual’.  

Item 2) ‘Relying on the hand and simple tools [Fujimori’s] open-ended attitude raises incomplete documents and late changes to a virtue’, while offering ‘an alternative to the dominant system, one open to shared control over aesthetic outcome, encouraging all to add their own playful flourishes’.

Item 3) ‘Ritual and artifacts are the originators of architecture’.

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Item 4) ‘Technical skill has been removed from imagination’ and this situation is a kind of ‘pandora’ where there are so many conveniences afforded to us by technology that seemingly everything is possible and within our reach. In order to cope with this situation of Pandora ‘requires a more vigorous cultural materialism’. 41

Item 5) ‘It is inconceivable that a designer would be able to conceptualize [a particular] structure without a tactile, personal connection to the material’ and ‘The hint of the full range of creative possibilities in any design situation cannot be reasonably perceived through a mere listing of the mechanical and physical properties alone’. 42

Item 6) ‘Simply, all the ideas have to be tested through the designer’s/artist's own imagination, the wisdom of the body, and one’s empathetic capacity; there is no other testing ground.’ 43

This is not, however, advocating that everyone learn how to make things. I have witnessed first hand that some people, no matter how intelligent, are not put on this earth to build things. Some people don’t care to build or make things. There is evidence,

however, in contemporary culture that more and more individuals have the desire to take things into their own hands and make something. It is evident in the DIY movement, and the number of big box retail stores that specialize in selling home improvement wares to everyday folks, and the plethora of TV shows whose focus is on how to fix up your own house, or how to build something. These examples are meant to illustrate the connection between making things and making culture. If an architectural design process can begin with this same kinesthetic engagement, then a more accessible and grounded architecture will result.

In terms of waste, the most desirable and idealistic scenario would be that in the development of any product the entirety of the life cycle of the product and all of its secondary and tertiary accoutrements would be accounted for and planned. But this is not cost effective in the short term. This is part of the problem of how waste is produced- we are very focused on the right now. So, designing out waste cannot reasonably be an expected part of every product development process. This is not a bad thing, if there are those who are willing to take on the task of intercepting scraps and re-imagining them. Take, for instance, the dung beetle that takes the excrement of mammals and rolls it into balls that are then used to create nests, and that become a place to lay eggs, as well as a food source. In this example, the most foul and undesirable by-product of one species becomes the most essential and desirable resource to another.
Essentially the mantra for the process goes like this: Engage, Delay, Shelter. No matter what stage the scraps are in when intercepted, the first step is one of *engagement*, from acquisition through production. Through this engagement the impermanence of these scraps is *delayed*. They begin their life anew, in some other iteration, with a different purpose. Through the re-imagining of these scraps into viable building elements they are given *shelter*—these beautiful orphans are given a home.

I'll openly acknowledge that this may very well be an idealistic simplification, where individuals must take on the responsibility of engagement, in order to take advantage of what I personally see as the increased benefit of delaying the impermanence of these particular scraps—or of any, in the larger picture—and that through these first two steps a home is made, and this home making is a recapitulation of lost modes of cultural making. Note the complex web of referencing in this excerpt from ‘The thinking hand’ by Juhani Pallasmaa, as he argues the important role that idealism plays in architectural thought. He writes:

‘Great poetry is only possible when there are great readers’, argues Walt Whitman significantly. It is equally evident that there are good buildings only as long as there are good dwellers and occupants; but aren’t we, citizens of this obsessively materialist consumer world, losing our capacity to dwell, and as a consequence becoming unable to promote architecture as great readers/users of architectural spaces and narratives? Ludwig Wittgenstein suggests in one of his notes that this could, indeed, be the case: ‘Architecture immortalizes and glorifies something. Hence, there can be no architecture, where there is nothing to
glorify.' Haven't we lost the dimensions in our culture and personal lives that could be worthy of glorification? Haven't we lost the dimension of ideals in our obsessively materialist world? Architectural thought arises from given conditions, but it always aspires to an ideal. Hence the loss of the ideal dimension of life implies the disappearance of architecture.\textsuperscript{44}

Moreover, this kinesthetic and iterative process of material engagement sets up a scenario where a kind of cultural making becomes the driver for complex technological processes. With the development of a matrix that provides a framework for combining materials with modes of production, derived from an engagement with the materials firsthand, a comprehensive and parametric design tool has emerged.

Conclusions

As a process of exploration and also of development as a designer, this thesis project has been instrumental in helping me form a critical theoretical foundation from which to work. This exploration has resulted in several lessons learned. First, the importance of specificity when naming the categories that fall under intrinsic and extrinsic properties. Second, that from this understanding of intrinsic and extrinsic properties comes a process of cross-fertilization. Third, operations are just as important as materials. Fourth, an intermediary element is needed to make the jump in scale from the smaller scraps and the larger scraps.

Intrinsic and extrinsic properties are critical to any architectural design. These properties determine the proper use and arrangement of a specific material within a construction assembly. They also provide a framework from which to understand what operations are best suited to a given material. Though these properties are often taken for granted as being empirical – fixed – there are some areas of flexibility within which to redefine. Intrinsic properties are usually equated with measurable data. These are in the realm of rationality, of scientific process. Extrinsic properties are usually considered as subjective factors, more difficult to measure – cultural relevance, is one instance of these intangibles. One cannot easily measure cultural relevance and it is surely to
change according to other factors. Some experts would categorize ‘cost’ of a material under extrinsic properties, due to the fact that cost does change according to a number of subjective factors. Scrap materials have been the subject of this thesis because of their inherent value. Embodied energy in any material must be considered as intrinsic to the material. Through a critical evaluation of the terminology commonly used, a different vocabulary was developed in the process of this thesis. For example, instead of cost, embodied energy has been a term regarded as an intrinsic property even though it cannot be measured. To better understand the nature of the categories of intrinsic and extrinsic, they too were redefined and referred to as the ‘rational’, and the ‘sensible’, respectively. In this vein, embodied energy could be said to be a sensible property of a material - since intrinsic implicitly means measurable, and embodied energy cannot easily be measured. Sensibility, therefore, includes not only the intangible, or invisible qualities of materials, but also the ‘common sense’ reasons for using certain materials. Sensible means what is sensed – what the senses perceive or experience. Sensible is the experiential, also the technique. Sensible includes the immeasurable, yet reasonable qualities and aspects of a material, which are just as important to consider as the measurable. Rationality, as has been discussed has a beneficial effect of allowing for assurance through measure and empiricism. Rationalism can also lead to what has been referred to in this thesis as a cultural pathology grown from the
bias of what can be proven, versus what is experienced. When these things are not taken into consideration, then the true value of a material is underestimated, and remains invisible.

The process of this exploration has been one of cross-fertilization of the rational and the sensible. A continual call and response between these two. This has also been true of the kind of operation of fabrication that a given material can accommodate. Operations were not a part of either intrinsic or extrinsic properties considered by the experts referenced in this thesis. The operation that a given material can accommodate can be thought of as a number of measurable and immeasurable factors. The measurable qualities of a material might inform a literal application of an operation. However, the figurative application of an operation with a given set of materials could not be deciphered through measurable properties alone. This kind of understanding must come from the cultivation of measurable with immeasurable – through the senses, and good sense, and the assurances that empirical data afford.

The operations are as important as the material, inseparable in fact. A shift in focus from the material to the assemblage took place during the thesis exploration. The assemblage is the composite of the material and operation; an interactivity. Assemblage can therefore be used as way to understand design and construction at all scales.

Figure 34. Operational modes of production when crossed with site of production result in varying degrees of figurative/literal application of the particular operation dependent upon the materials involved. Here the gradient diagram represents a kind of permutation that will occur when multiplying operational modes with material.
The scraps explored in this thesis were missing a binding element. In the iterations of the smaller scraps that element was more of a connector – screws, glue, jute, thread, etc. The masonry building shell was modeled with representations of stiffer, stronger connecting elements. The emergence of an understanding of material and operation as assemblage shed light on the need for an intermediary – the missing binding element. This intermediary acts as a translator between the different scales of the scraps. It is a translator between the vocabulary of rational and sensible and it assists in maintaining the integrity of the extrinsic properties – that is, of the experiential, sensible properties.

Though the process of this thesis has been one of proliferation, it is estimated that over time it will become quicker, shortened, as the extraneous questions of a rookie are answered and built upon. The process has consisted of an expansion and contraction; of a continual interactivity of synthesis and analysis. It was an initial determination of the thesis that a rigorous approach to recycling scraps would result in a more thorough conclusion of their efficacy. I wanted to squeeze as much out of the scraps as possible, knowing that through stewardship and will, these scraps could be re-imagined and understood on their own terms. It was this vigilant approach that led to a new understanding of recycling as re-imagining. To understand the inherent value of these scraps required that I put myself in service to them – that I act as a
mediator between their current state - perception of them as useless – and their potential – their invisible beauty. In doing so I discovered that not only was an intermediary element needed to bring the scraps at their various scales together into an assemblage, but that I was also the intermediary. The curator and choreographer, ever treading the fine balance between grace and strength.
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