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

It is entitled:
Building as Bricolage: Confronting Hyperconsumption

Student's name: Joel Masters

This work and its defense approved by:

Committee chair: Michael McInturf, MARCH
Committee member: Aarati Kanekar, PhD
Building as Bricolage: Confronting Hyperconsumption

A thesis submitted to the Graduate School of the University of Cincinnati in partial fulfillment of the requirements for the degree Masters of Architecture

in the School of Architecture and Interior Design at the College of Design, Architecture, Art, and Planning

by

Joel Masters
B.S. ARCH University of Cincinnati

August 2010

Committee First Chair: Michael McInturf
Committee Second Chair: Aarati Kanekar
Abstract

We are consuming our world faster than it can be replenished. It is a crisis of consumption – a product of an antiquated linear production paradigm in which resources are depleted and landscapes become wastelands. A more holistic approach is urgently needed: Biomimicry. The imitation (mimicry) of nature (bio) for human means brings about more cyclical, regenerative efficient models of production.

Bricolage is one such alternative method inspired by nature. It is the act of improvisational making, using only so-called waste materials. In nature’s mature ecosystems, organisms us waste as a resource and nothing escapes the system.

Bricolage as a production method for architecture brings the built environment closer to nature, and promotes sustainability through frugality and resourcefulness. It also informs the architectural process, so that it becomes more means-oriented, diversified, and hands-on. In this way both the process and place confront and subvert the consumptive crisis that threatens our world. The stage for this demonstration – as built for this thesis – is the rehabilitation and greening of a building in Cincinnati’s historic Over the Rhine district.
Contents

1. Waste 2
2. Linear Metabolism 12
3. Changes in Perception 16
4. Cyclical Metabolism and Biomimicry 20
5. Waste Materials and Architecture 28
6. Bricolage 44
7. Process, Presence 52
8. Conclusion 96
Image Credits

Unless otherwise noted below, photos, drawings, diagrams, and artwork are original work of the author.

7.2. Ibid.
11.1. Ibid.
26.2. Ibid.
26.3. Ibid.
26.4. Ibid.
26.5. Ibid.
26.6. Ibid.
29.1. Ibid.
29.2. Ibid.
30.1. Ibid.
31.1. Ibid.
31.2. Ibid.
The current scale of waste removal systems in the United States is astounding. What began as simple horse drawn trailers collecting farm wastes a few decades ago, has grown to overwhelming scales of waste removal today. By one account, including industrial and municipal waste “every man, woman, and child in the United States produces twice his or her own weight in waste every day... Together, it’s enough to fill two Louisiana Superdomes daily.”

How has it come to this? What ethics, or lack there of, have allowed such excessive, imprudent use of materials in an ever shrinking world? Furthermore, how does such wastefulness continue under growing awareness of the ecological and cultural destruction involved in so much of today’s industry?

The quality of many of the materials thrown away makes for even more concern. Objects made for one time use, packaging, disposable goods, all these nearly brand new materials get thrown away almost instantly. Other things that get thrown away were never used at all. Or a simple part is dysfunctional and the entire object becomes indiscriminately consolidated at the landfill. These materials embody the energy that created and transported them, and should be valued for this.

It is feasible that, if nothing else, these materials could be put to better use. The mass produced nature of many regularly disposed of materials makes for a advantageous starting point. Even one-off type materials provide many opportunites for reuse. Considering buildings are made of materials, and often of many mass produced, replicated materials, it is logical to consider using waste materials to create new architecture.

Rumpke Municipal Landfill
2600 Wilde Road, Hamilton County, Ohio
3.761,605 tons of waste accepted in one year (2002)
Site in 2013 will have approximately 1.0 million tons of waste expected to be full in 2037 at current rate

- Landfill gas extraction system (methane)
- Faraday cell with vegetation
- Geosynthetic Clay liner
- Low permeability layer

Groundwater monitoring system

Leachate collection and conveyance system in geosynthetic layer
- Geomembrane prevents percolation
- Geosynthetic plastic liner to prevent soil and water contamination
- Compacted clay liner through geosynthetic
Depicts two million plastic beverage bottles, the number used in the United States every five minutes.
Looking at the drink and container industries, as one component of the post World War II consumer market expansion, sheds light on the source of our waste problems. As with other industries, disposable, one-use packaging posed benefits: “it generated higher consumption rates, created new marketing possibilities, and allowed for the consolidation of the beverage industry” quickly changing the market. The durable, reusable glass bottle previously used required local bottling facilities to market beverages. The disposable bottle eliminated that need and allowed large firms like Coca-Cola and Pepsi to monopolize the beverage market, littering the landscape as their profits grew. This can be seen as in 1950, there were over 400 breweries in the US, by 1974 there were only 64.

Meanwhile, expanding suburbia perpetuated the problem, and manufacturers defeated nearly all legislation posing any restrictions on their externalized cost (which were now the public’s problem, rather than the company). Keep America Beautiful was a corporate greenwashing retort to one such law passed against disposables in 1953 in Vermont. KAB was founded by the American Can Company and Owens-Illinois Glass Company, inventors of the disposable can and bottle. Other industry leaders joined in the media campaign to convince the public that the rising amounts of trash, and litter, were a result of individual bad habits, not unregulated industry. Introduced into the mainstream in the 1980s, recycling was a lesser evil to the corporations than source reduction, and allowed for continued consumption rates. The overwhelming scale of the reign of the disposable can be seen in the artwork of Chris Jordan, in his piece Plastic Bottles, depicting the two million plastic beverage bottles used in the United States every five minutes.

Reusables dominate in other countries, due to regulatory laws and economics. Garbage output in Finland has seen a 390,000 ton drop, putting the annual per capita output of packaging wastes at half that of other European union countries, most without refillable mandates. Meanwhile, greenhouse gases, carbon dioxide, water consumption, and energy use is reduced with the use of reusable bottle containers, as well. Jobs are also created, as more workers are needed when companies use refills. If a company is not centralizing production and distribution on a national scale, refillables can bring great savings to a company, which can be passed on in part to the consumer, opening the market to lower income people, too.

2. Ibid.
### Table 3

MATERIALS DISCARDED IN THE MUNICIPAL WASTE STREAM, 1960 TO 2008

(In thousands of tons and percent of total discards)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper and Paperboard</td>
<td>24,910</td>
<td>37,540</td>
<td>43,420</td>
<td>52,500</td>
<td>50,180</td>
<td>43,550</td>
<td>42,880</td>
<td>38,050</td>
<td>34,480</td>
</tr>
<tr>
<td>Glass</td>
<td>5,620</td>
<td>12,580</td>
<td>14,380</td>
<td>10,470</td>
<td>9,880</td>
<td>9,900</td>
<td>9,950</td>
<td>9,640</td>
<td>9,340</td>
</tr>
<tr>
<td>Metals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferrous</td>
<td>10,250</td>
<td>12,210</td>
<td>12,250</td>
<td>10,410</td>
<td>9,430</td>
<td>9,540</td>
<td>9,960</td>
<td>10,360</td>
<td>10,390</td>
</tr>
<tr>
<td>Aluminum</td>
<td>340</td>
<td>790</td>
<td>1,420</td>
<td>1,800</td>
<td>2,340</td>
<td>2,550</td>
<td>2,640</td>
<td>2,630</td>
<td>2,690</td>
</tr>
<tr>
<td>Other Nonferrous</td>
<td>180</td>
<td>350</td>
<td>620</td>
<td>370</td>
<td>540</td>
<td>570</td>
<td>540</td>
<td>540</td>
<td>550</td>
</tr>
<tr>
<td><strong>Total Metals</strong></td>
<td>10,770</td>
<td>13,350</td>
<td>14,290</td>
<td>12,580</td>
<td>12,310</td>
<td>12,660</td>
<td>13,140</td>
<td>13,500</td>
<td>13,630</td>
</tr>
<tr>
<td>Plastics</td>
<td>390</td>
<td>2,900</td>
<td>6,810</td>
<td>16,760</td>
<td>24,060</td>
<td>26,340</td>
<td>27,480</td>
<td>28,640</td>
<td>27,930</td>
</tr>
<tr>
<td>Rubber and Leather</td>
<td>1,510</td>
<td>2,720</td>
<td>4,070</td>
<td>5,420</td>
<td>5,890</td>
<td>5,970</td>
<td>6,260</td>
<td>6,400</td>
<td>6,350</td>
</tr>
<tr>
<td>Textiles</td>
<td>1,710</td>
<td>1,980</td>
<td>2,370</td>
<td>5,150</td>
<td>8,120</td>
<td>9,110</td>
<td>9,530</td>
<td>10,020</td>
<td>10,480</td>
</tr>
<tr>
<td>Wood</td>
<td>3,030</td>
<td>3,720</td>
<td>7,010</td>
<td>12,080</td>
<td>11,870</td>
<td>12,390</td>
<td>12,770</td>
<td>14,530</td>
<td>14,810</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>70</td>
<td>470</td>
<td>2,020</td>
<td>2,510</td>
<td>3,026</td>
<td>3,050</td>
<td>3,030</td>
<td>3,270</td>
<td>3,350</td>
</tr>
<tr>
<td><strong>Total Materials in Products</strong></td>
<td>49,010</td>
<td>75,260</td>
<td>94,370</td>
<td>117,470</td>
<td>125,330</td>
<td>122,970</td>
<td>125,040</td>
<td>124,080</td>
<td>120,370</td>
</tr>
<tr>
<td><strong>Other Wastes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Scraps</td>
<td>12,200</td>
<td>12,800</td>
<td>13,000</td>
<td>20,800</td>
<td>26,130</td>
<td>27,760</td>
<td>29,530</td>
<td>30,840</td>
<td>30,990</td>
</tr>
<tr>
<td>Yard Trimmings</td>
<td>20,000</td>
<td>23,200</td>
<td>27,500</td>
<td>30,800</td>
<td>14,760</td>
<td>13,140</td>
<td>12,210</td>
<td>11,730</td>
<td>11,600</td>
</tr>
<tr>
<td>Miscellaneous Inorganic Wastes</td>
<td>1,300</td>
<td>1,780</td>
<td>2,250</td>
<td>2,900</td>
<td>3,500</td>
<td>3,620</td>
<td>3,690</td>
<td>3,750</td>
<td>3,780</td>
</tr>
<tr>
<td><strong>Total Other Wastes</strong></td>
<td>33,500</td>
<td>37,780</td>
<td>42,750</td>
<td>54,500</td>
<td>44,990</td>
<td>44,520</td>
<td>45,430</td>
<td>46,320</td>
<td>46,370</td>
</tr>
<tr>
<td><strong>Total MSW Discarded - Weight</strong></td>
<td>82,510</td>
<td>113,040</td>
<td>137,120</td>
<td>171,970</td>
<td>189,720</td>
<td>169,470</td>
<td>170,470</td>
<td>170,400</td>
<td>166,740</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper and Paperboard</td>
<td>30.2%</td>
<td>33.2%</td>
<td>31.7%</td>
<td>30.5%</td>
<td>29.6%</td>
<td>26.0%</td>
<td>25.2%</td>
<td>22.3%</td>
<td>20.7%</td>
</tr>
<tr>
<td>Glass</td>
<td>8.0%</td>
<td>11.1%</td>
<td>10.5%</td>
<td>6.1%</td>
<td>5.8%</td>
<td>5.9%</td>
<td>5.8%</td>
<td>5.7%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Metals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferrous</td>
<td>12.4%</td>
<td>10.8%</td>
<td>8.9%</td>
<td>6.1%</td>
<td>5.6%</td>
<td>5.7%</td>
<td>5.8%</td>
<td>6.1%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.4%</td>
<td>0.7%</td>
<td>1.0%</td>
<td>1.0%</td>
<td>1.4%</td>
<td>1.5%</td>
<td>1.5%</td>
<td>1.5%</td>
<td>1.6%</td>
</tr>
<tr>
<td>Other Nonferrous</td>
<td>0.2%</td>
<td>0.3%</td>
<td>0.5%</td>
<td>0.2%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
</tr>
<tr>
<td><strong>Total Metals</strong></td>
<td>13.1%</td>
<td>11.8%</td>
<td>10.4%</td>
<td>7.3%</td>
<td>7.3%</td>
<td>7.6%</td>
<td>7.7%</td>
<td>7.9%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Plastics</td>
<td>0.5%</td>
<td>2.6%</td>
<td>5.0%</td>
<td>9.7%</td>
<td>14.2%</td>
<td>15.7%</td>
<td>16.1%</td>
<td>16.8%</td>
<td>16.8%</td>
</tr>
<tr>
<td>Rubber and Leather</td>
<td>1.8%</td>
<td>2.4%</td>
<td>3.0%</td>
<td>3.2%</td>
<td>3.5%</td>
<td>3.6%</td>
<td>3.7%</td>
<td>3.8%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Textiles</td>
<td>2.1%</td>
<td>1.8%</td>
<td>1.7%</td>
<td>3.0%</td>
<td>4.8%</td>
<td>5.4%</td>
<td>5.6%</td>
<td>5.9%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Wood</td>
<td>3.7%</td>
<td>3.3%</td>
<td>5.1%</td>
<td>7.0%</td>
<td>7.0%</td>
<td>7.4%</td>
<td>7.5%</td>
<td>8.5%</td>
<td>8.9%</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>0.1%</td>
<td>0.4%</td>
<td>1.5%</td>
<td>1.5%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>1.9%</td>
<td>2.0%</td>
</tr>
<tr>
<td><strong>Total Materials in Products</strong></td>
<td>59.4%</td>
<td>66.6%</td>
<td>68.8%</td>
<td>68.3%</td>
<td>73.8%</td>
<td>73.4%</td>
<td>73.4%</td>
<td>72.8%</td>
<td>72.2%</td>
</tr>
<tr>
<td><strong>Other Wastes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Scraps</td>
<td>14.8%</td>
<td>11.3%</td>
<td>9.5%</td>
<td>12.1%</td>
<td>15.4%</td>
<td>16.6%</td>
<td>17.3%</td>
<td>18.1%</td>
<td>18.6%</td>
</tr>
<tr>
<td>Yard Trimmings</td>
<td>24.2%</td>
<td>20.5%</td>
<td>20.1%</td>
<td>17.9%</td>
<td>8.7%</td>
<td>7.8%</td>
<td>7.2%</td>
<td>6.9%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Miscellaneous Inorganic Wastes</td>
<td>1.6%</td>
<td>1.6%</td>
<td>1.6%</td>
<td>1.7%</td>
<td>2.1%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.3%</td>
</tr>
<tr>
<td><strong>Total Other Wastes</strong></td>
<td>40.6%</td>
<td>33.4%</td>
<td>31.2%</td>
<td>31.7%</td>
<td>26.2%</td>
<td>26.6%</td>
<td>26.6%</td>
<td>27.2%</td>
<td>27.8%</td>
</tr>
<tr>
<td><strong>Total MSW Discarded - %</strong></td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery.
Does not include construction & demolition debris, industrial process wastes, or certain other wastes.
** Includes electrolytes in batteries and fluff pulp, feces, and urine in disposable diapers.
Details may not add to totals due to rounding.
Source: Franklin Associates, A Division of ERG
The construction industry, “through building materials manufacturing, construction, and operations, consumes 16 percent of the available fresh water annually, 40 percent of the world’s total energy use, about one-third of the emissions of heat-trapping carbon dioxide from fossil fuel burning, two-fifths of acid-rain-causing sulfur-dioxide and nitrogen-oxides, and 40 percent of the total material flow in the global economy. At the same time construction waste constitutes between one-quarter and one-third of all US landfills. … We might decide such impacts are worth it, given the importance of what we get in return: the places in which we live and work, the settings in which we learn and play, and the linkages over which we travel and communicate. But we can no longer ignore the question of where the materials we use come from and where they end up once we no longer have a need for them. In a world entirely affected by us and thus entirely our responsibility, there is no other place that we are not also accountable for. The ‘preferred condition’ that design seeks now includes, whether we acknowledge it or not, all of the material and energy flows related to what we make, as well as all of the effects our actions have on others – not just the direct users and inhabitants of what we do, but everyone and everything affected by what we create, operate, and dispose of.”

The contents of one construction site dumpster processed on August 11, 2004, at the 334 Recycling and Transfer Facility, owned and operated by Ray's Trash Service in Zionsville, Indiana, included hundreds of 2x4 lengths, dozens of oriented-strand board sheets, tons of wood trusses, tons of cardboard boxes, tons of aluminum cans and plastic bottles, tons of rigid insulation pieces, and tons of lengths of metal striping.

Approximately 75 to 100 dumpsters are processed every day at 334, along with 75 to 100 garbage trucks, and 5 to 10 smaller trucks. Most of the dumpsters come from construction sites; selected loads are sorted for cardboard, steel, or concrete chunks. A few objects are pulled out; bicycles, tires, among them. Everything else is transferred into 40-cubic-yard trailers that are driven southwest to the Twin Bridges landfill site nearby in Zionsville. There, the trucks are backed onto a platform and unhitched; filled into the air, their contents are poured out. Thirty two 18-wheelers arrive daily.

In the past three years, I have photographed 250 construction site dumpsters and one year ago my students photographed 250 more. We found walls and sections of walls, doors, windows, carpeting, carpet pads, trusses, shingles, building paper, lumber and steel framing stock, sheets of plywood, sheetrock, and oriented-strand board. We saw metal and PVC pipes of all sizes and lengths, ductwork, rigid and batt insulation, airborne ceiling systems, corner bead, tape, smooth stones, rope, burlap, plastic pots, branches,

---

material world

A Midwestern architect and his students catalog waste.

Text and photos by Wes Jurek
The flow of waste from construction sites is relentless, the transfer, a mad ballet, the destruction, twin.

I am done photographing dumpsters.
“New studies indicate that the oceans, the air, the mountains, and the plants and animals that inhabit them are more vulnerable than early innovators ever imagined. But modern industries still operate according to paradigms that developed when humans had a very different sense of the world… According to some accounts more than 90 percent of materials extracted to make durable goods in the United States becomes waste almost immediately.”

Currently, cities’ means of production rely almost entirely on a linear metabolism. These linear systems of production typically extract and transport resources, manipulate and use the materials, and then dump them somewhere else. There is often little concern for the origin or destination of resources within the materials economy of cities. This results in what we call “waste,” which is not a natural phenomenon, but a man made idea.

The term “paleotechnic” appropriately describes most of these systems of production. Though they may be very high-tech processes, overall these systems of production are quite antiquated. We are currently operating civilization’s materials economy on paradigms from an old age of plentiful resources and piecemeal scientific data in an age of growing ecological awareness and environmental destruction.

Take the way we produce electricity for example. The tops of the Appalachian Mountains are strip-mined for coal. Strip mining is now the cheapest way to extract coal, but leaves toxic sludge ponds and flattened mountain tops. The coal is shipped hundreds to thousands of miles away to steam powered energy plants. Here, the coal is burned to heat water eventually producing electricity at about forty percent efficiency. The unsightly power plants are located far from the demand, and so twice the needed electricity must be produced to counter the line resistance. And once all the coal is gone, it’s gone.

The standard food system provides another linear example. It relies on rural production, where nutrients are extracted from the land in the form of food, which is then shipped to the cities to be consumed. From there, the unused nutrient rich waste is flushed to a waste water treatment plant where chemicals “treat” the waster before it is released into water systems to carry it away. The nutrients are not returned to the land in a cyclical fashion. Instead, chemical fertilizers are added to the agricultural land to “make” more food grow. The fertilizers along with chemical pesticides are partially rinsed off the land and into waterways via rain to further contaminate the otherwise natural systems.

Sometimes, waste is even planned. Planned Obsolescence is a policy of designing and making products so that they will quickly become outdated, wear out or break easily, so that people will have to buy a replacement. The idea was openly discussed in Industrial Design magazines in the 1950s and 1960s as a tactic to safeguard against negative economic downturns. The practice is still used to this day, yet not openly discussed as it is now viewed as unethical, and sometimes unlawful.

Recycling may initially be seen as a way of closing the loop, however it does not solve the problem. Where the recycling loop diverges from an environmentally sound practice is the resultant rate of consumption. It is a fix for treating waste after it is created, it requires its own manufacturing process, and it does not infringe upon consumption rates. It is therefore saluted by the manufacturing companies who produce the excessive waste that overloads the landfill sites. Recycling often is a process of downcycling materials. As they are reconstituted into raw materials, they most often loose quality as they combine with other materials.

The matter of linear systems of production should be considered with regard to the Laws of Thermodynamics. Any given system, being an organized transfer of energy through work, is governed by the laws of thermodynamics. The first and second laws are most relevant to the functioning systems of our cities. The First Law of Thermodynamics concerns the conservation of energy, and states that energy cannot be created or destroyed, that it can only change form. The Second Law of Thermodynamics concerns entropy, and states that in any isolated system, the entropy never decreases, or put another way, the entropy increases unless new energy is put in the system. Entropy is defined as the measure of disorder that exists in a system, or a measure of the energy in a system or process that is unavailable to do work.

Materials embody the energy that created and transported them. Often this energy is created by wasting landscapes and burning a very finite supply of precious natural resources. There is only a limited supply of materials and energy on earth, and every thing embodies a portion of that limited supply. Dramatically disposing of, or wasting, this finite supply only depletes the chances of having things in the future, or even having a future.

Mankind’s relationship to the natural world has not always been so influential or devastating. For most of history, population remained minute compared to the scale of the untamed natural world. This external world was revered for its abundance, mystery, and splendor. Cultures varied, but relationships to plants, animals, and the earth were of the deepest respect. Earth was viewed as a nurturing mother, a living entity providing for mankind. Sure she was wrathful at times, with droughts, floods, and other extremes, but other times her kindness was abundant.

Though no single moment or movement is solitarily responsible for the devastating effects we have on mother earth today, the Scientific Revolution plays an enormous part in altering man’s ongoing perception of nature. This period in the 16th and 17th centuries marks great achievements in science, including profound discoveries and innovations still affecting us centuries later. Yet it also marks drastic alterations to the attitudes and perceptions of the people of the western world. This new scientific method approached nature in drastically different ways than previous generations, with the intent of controlling nature for human benefit.

Historian of Science, Carolyn Merchant, uses histories of social and political thought, as well as art, history, philosophy, and science of the time to understand the changes in perception during the scientific revolution. The overriding metaphor attributed to nature in the previous centuries was that of an organism. In this light, nature was regenerative, alive, a functioning system of interdependent parts, a living body enlivened by vitalism. Nature was more than an assembly of functioning physical parts, a vital life force or spirit was essential to all living things. This organic model included female, fragile, demure, respectful, and virgin attributes. The conception of nature was that of a benevolent mother of all things. Mother earth was a nurturer and provider of everything. In this model, cultural taboos existed that, for instance, equated such things as mining with the qualities of avarice, lust, and greed.

The idea of nature as an organic system was then transformed during the Scientific Revolution into nature as a mechanical system. During this time, the idea of controlling nature for the good of the human race prevailed. Mother earth would have to give up her secrets for the benefit of man. Control over nature would come through the use of the scientific methods of dissection and experiment. Through dissection, animals really began to be regarded as machines. Experiment, in the controlled environment of the lab, was controversial at first. Seeing that the natural world could not be directly mimicked, naturalists preferred studying nature in its environment. These methods forced the female nature to reveal her mine of natural knowledge, therefore giving man dominion over nature.
The new mechanistic means of scientific investigation involved new thought structures. “The mechanical method that evolved during the seventeenth century operated by breaking down a problem into its component parts, isolating it from its environment, and solving each portion independently.”

Though this method brought about new and useful knowledge, it reduced nature to passive and inert atomic particles. This reductionism overlooked the many complex, interconnected relationships within nature, which we are still only in the elementary stages of understanding today.

These altered perceptions of nature validated the actions taken towards earth. Things were done for the sake of mankind, and the world was so vast that it was unperceivable there would be adverse affects. Extractions and exploitation were no longer met with a sense of guilt. Nature’s conversion to a resource pool also fared quite well with growing desire for economic production. The commodification of nature had begun.

During this time, the scale of mankind’s effect on nature was still minimal. Man-power was the only means to extract or manipulate, until the Industrial Revolution. As machines replaced hands, vast new scales of extraction and production were realized. Along with this came new scales of waste. With virgin materials practically free for the taking in the vastness of the natural world, there was no need to conserve or reuse, no economic incentive to “extract sustainably, process cleanly, or optimize use.”

The economy never put a price tag on environmental costs such as pollution or resource draw downs. In fact, increased material throughput was, and generally still is, the means of measuring a successful economy. As for the waste, it was sent out into nature without a second thought. It was believed the waste would be diluted, absorbed, and decomposed back into a natural state. We now know this is far from the truth.

Industrialization also brought about the influx of people to cities. As people moved from rural locations to cities, they left behind a direct physical connection to nature. Aside from the psychological and spiritual changes this produced in mankind, it created a disconnect between man and the sources of his mastery. Growing populations only knew of their local urban conditions, and not the increasing exploitation and devastation of distant lands. Population expansion, suburbanization, and mass production in the wake of an endlessly growing consumer economy have further led to the overwhelming pollution and waste problems of today.

2. Ibid.
The relationship to the world that modern science fostered and shaped now appears to have exhausted its potential. It is increasingly clear that, strangely, the relationship is missing something. It fails to connect with the most intrinsic nature of reality and with natural human experience. It is now more of a source of disintegration and doubt than a source of integration and meaning. It produces what amounts to a state of schizophrenia: Man as an observer is becoming completely alienated from himself as a being. Classical modern science described only the surface of things, a single dimension of reality. And the more dogmatically science treated it as the only dimension, as the very essence of reality, the more misleading it became. Today, for instance, we may know immeasurably more about the universe than our ancestors did, and yet, it increasingly seems they knew something more essential about it than we do, something that escapes us. -Václav Havel
1. **Nature as model.** Biomimicry is a new science that studies nature’s models and then imitates or takes inspiration from these designs and processes to solve human problems, e.g., a solar cell inspired by a leaf.

2. **Nature as measure.** Biomimicry uses an ecological standard to judge the “rightness” of our innovations. After 3.8 billion years of evolution, nature has learned: What works. What is appropriate. What lasts.

3. **Nature as mentor.** Biomimicry is a new way of viewing and valuing nature. It introduces an era based not on what we can extract from the natural world, but on what we can learn from it.

---

“If we can see these things not simply as objects, but as embodied energy, then we can see ourselves and others not as material objects, but as living systems interacting continuously with other systems, both animate and inanimate.”

The modern city is a complex composition of numerous interlaced and interacting systems, a system of systems. These systems, or organizations of energy, range in scale and complexity. They include social, cultural, economic and technological systems, as well as food, trade, power, communication, construction, and transportation systems, to name a few. They have diverse and complex relationships through which they interact to support one another. This assembly of relationships resemble something in the natural, biological world: an ecosystem. A city can be considered an ecosystem.

Like any ecosystem, organisms are a crucial element. People of course could be those organisms, and indeed are. But buildings can also be considered organisms of the city-ecosystem. They consume material through their construction and operation. They create waste as a result of their construction and upkeep. They relate to other buildings and people through information networks. They even die.

“Cities, like other assemblies of organisms, have a definable metabolism, consisting of the flow of resources and products through the urban system for the benefit of urban populations. Given the vast scale of urbanization cities would be well advised to model themselves on the functioning of natural ecosystems, such as forests, to ensure their long term viability.”

Mature ecosystems in the natural environment relate to materials with a different ethic than cities currently do. They adhere to the laws of thermodynamics, acknowledging the finite supply of materials and energy available. The processes that compose these natural systems are of a cyclical metabolism. Large “chains of use” form an interwoven web of mutual benefit. In this model, outputs of one system or organism are inputs of another, maintaining balance and harmony within nature’s ecosystems. A leaf falling from a tree provides an example. It is not just waste. It provides shelter and preserves moisture in the ground. Bacteria and fungi make use of it as it decomposes into the soil. It is now a deposit of vitamins and minerals for another plant to grow from, creating a cycle.

Such cyclical systems have alternate names in the design realm. Regenerative design is a term for products and buildings that are designed with these principles in mind. Materials are often of sustainable sources, and help to restore and revitalize their material sources. Cradle-to-cradle is another design term describing the cyclical systems of material use for human benefit. Industrial Ecology is quite similar, referring to the material flows of industrial systems. Biomimicry is one more important term on the list.

Biomimicry is the developing science of studying and mimicking the wisdom developed in nature, and applying that information in the design of the built environment. After millions of years, nature knows the best use of materials and functioning of systems. As nature has always been the source of our knowledge, it is merely the application of natural laws that work with, rather than against, nature. For instance, if we understand how a spider spins a web, we could have a material of equivalent weight to strength ratio, which we don’t, and it wouldn’t require any pollution to fabricate.

By understanding the way a mature forest functions, a city could function in a more efficient, cyclical manner. If we understand the intricacies of the web of cyclical systems of a mature ecosystem, such as a forest, cities could contribute to the environment, rather than simply taking from it. If we take the rules of organisms in a mature ecosystem, and apply those same rules to buildings in a city, we would have guidelines for cyclical, regenerative buildings.

“These mature ecosystems do everything we want to do. They self-organize into a diverse and integrated community of organisms with a common purpose - to maintain their presence in one place, make the most of what is available, and endure over the long haul.”
Organisms in a mature ecosystem

1. Use Waste as a Resource

“One of the key lessons of systems ecology is that as a system puts on more biomass (total living weight), it needs more recycling loops to keep it from collapsing.” There exists a diverse assembly of producers, consumers, and decomposers, filling all holes in the organizational chart. “All waste is food, and everybody winds up reincarnated inside somebody else.” The only import to the system is energy in the form of sunlight, and the only export is heat as a byproduct of energy use.

2. Diversify and Cooperate to Fully Use Habitat

Dynamic stability is formed when organisms spread out into a diversity of noncompeting niches. Even if an organism drops out, there are typically backups to keep the web whole. Cooperation, not competition, maintains peaceful coexistence, even as some organisms reside at the top of the food web. Positive symbiotic relationships occur when two organisms mutually benefit from one another: gobies pick parasites from the teeth and gills of Nassau grouper fish, which in turn protect the goby fish from other predators; noisy oxbirds alert hippos to interlopers while eating ticks in the hippo's skin; clownfish eat harmful small invertebrates off sea anemone, which protect the clownfish. These advantageous relationships which are greater than the sum of its parts are known as synergy. An even greater example is known as the endosymbiotic hypothesis. This theory states that our body is an aggregate of single-cell creatures, such as chloroplasts and mitochondria, that have formed a much greater multicellular assembly. “In short, we are a colony - a single organism composed of many - and living proof of the power of cooperation.”

3. Gather and Use Energy Efficiently

The only open source of energy in the ecosystems of the natural world comes in the form of sunlight. Photosynthesizers are the importers of this energy in almost every community on earth, acting at 95 percent efficiency in the act of converting sunlight to making bonds. Of that energy, only 10 percent is available to the next level of the food chain, and 10 to the next, and so on, which is why plants are normally most of the biomass in ecosystems. For this reason, organisms certainly acknowledge the second law of thermodynamics: in the process of doing work, energy is converted to heat and is therefore unable to do more work. Therefore, minimal energy is used for maximum rewards. Quite simply, work smarter, not harder.

4. Optimize Rather than Maximize

In natural systems, as they mature, the emphasis from maximizing throughput and offspring changes to an emphasis on optimization. This generally means closing nutrient and mineral cycles and making sure a few offspring survive. This means quality rather than quantity. Also, overall system stability tends to increase as flow rates slow down. Our industrial systems still operate in a state of arrested adolescence. Cheap, disposable, assembly line manufactured, ticky-tacky stuff continues to be mass produced endlessly since the Industrial Revolution.

5. Use Materials Sparingly

“Organisms build for durability, they don’t overbuild. They fit form to function, building exactly what is needed, with the bare minimum of materials and fuss.” Honeycombs and bone are great examples of mantra. In essence, organisms make the most of every design decision, often fitting multiple functions into one well designed structure.

6. Don’t Foul their Nests

Life creating conditions necessary for life, that is rule here. Organisms build using catalysts and self assembly techniques. In these natural conditions, chemistry takes place in water at room temperature, with no high heats, chemicals, or high pressures the way man most often operates. Organisms certainly don’t pollute the air and water or cut down the forests they depend on. Amory Lovins suggests that the decentralization of production facilities, especially energy production would greatly reduce the nest fouling we have come to accept as normal. Line resistance, high fluxes, and massive breakdowns would not be possible with redundant localized sources of the right kind of power.

7. Don’t Draw Down Resources

1. Don’t use non renewable resources faster than you can develop substitutes. 2. Don’t use renewable resources faster than they regenerate themselves. In the natural world, nothing is made that cannot be easily broken down to the original base elements again. In our industrial systems, synthetic materials are created with no means for a return to basic components. In our recycling systems, materials are often combined with similar, but not the same, materials creating a lower quality material, which eliminates the higher quality materials after one use. Another example of indiscriminate material use and disposal is that metals and minerals can often be found in higher concentrations in landfills than they are in ore deposits.

8. Remain in Balance with the Biosphere

The Biosphere is, in essence, the grandparent of all cycles. All other cycles are subcycles, or subcycles of subcycles, within the biosphere cycle. Its main elements include carbon, nitrogen, sulfur, phosphorus, etc. It is a closed system, compared to our “open” systems operating within it. Our one way import of nutrients and export of “waste” does not currently balance well with the biosphere, our CO2, for instance, is not balanced by any natural processes.

9. Run on Information

“It is possible to have societies whose members have rich communication channels that carry feedback to all members… Excess and waste are held in check by mechanisms that reward efficient behavior and punish foolish genes. Any organism that is surrounded by and dependent on so many other links must develop unambiguous ways to signal its intentions and interact with its neighbors.” The most successful body designs and behaviors are high in information content. Numerous, rich feedback systems spread grassroots messages throughout the community. Waste exchanges in cities and regions are beginning to temporarily fill this void in our current industrial systems, though that alone is not the sole solution. Many cities, even states and regions have such information sharing: Northeast Industrial Waste Exchange, B.A.R.T.E.R., and the Interchange in Cincinnati, for example.

10. Shop Locally

Biological communities are most always closely connected in time and space. Shopping locally conserves precious energy and also makes for the best use of organism’s abilities. In contrast, our production and consumption systems are very disconnected from us. An average piece of food for an American has been transported approximately 1400 miles.
A city is comprised of many systems - economic, technological, social, cultural - which overlay and interact with one another in complex ways. Each system is different, but from one point of view all share a common purpose - the organization of energy - and a common goal - giving the cumulative energy of the city a coherent form.

According to Maxwell’s second law of thermodynamics, the entropy in a system will increase (it will lose energy) unless new energy is put in.

According to Newton’s law of inertia, a system will stay at rest unless it is disturbed by an external force.

Energy exists in two states: kinetic and potential. A brick sits on top of a wall - potential (it could fall). A brick is pushed from the top of the wall - kinetic (its potential is released).

Energy takes many forms, each created by a system that contains it for a particular purpose. Architecture is one such system that contains energy by establishing stable boundaries, limits, edges. New energy - in the form of maintenance - must continually be added to the system of materials, or they will decay. Metaphysically speaking, new energy - in the form of human thought, emotion, activity - must continually be added to the system of boundaries, or they will lose their purpose and meaning.

<table>
<thead>
<tr>
<th>Ecosystem Attributes</th>
<th>Developing Stages (Type I)</th>
<th>Mature Stages (Type III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food chain</td>
<td>Linear</td>
<td>Webslike</td>
</tr>
<tr>
<td>Species diversity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Body size</td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td>Life cycles</td>
<td>Short, simple</td>
<td>Long, complex</td>
</tr>
<tr>
<td>Growth strategy (how to multiply)</td>
<td>Emphasis on rapid growth (r-selection)</td>
<td>Emphasis on feedback control (K-selection)</td>
</tr>
<tr>
<td>Production (body mass and offspring)</td>
<td>Quantity</td>
<td>Quality</td>
</tr>
<tr>
<td>Internal symbiosis</td>
<td>Undeveloped</td>
<td>Developed</td>
</tr>
<tr>
<td>Nutrient conservation</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Pattern diversity</td>
<td>Simple</td>
<td>Complex</td>
</tr>
<tr>
<td>Biochemical diversity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Niche specializations</td>
<td>Broad</td>
<td>Narrow</td>
</tr>
<tr>
<td>Mineral cycles</td>
<td>Open</td>
<td>Closed</td>
</tr>
<tr>
<td>Nutrient exchange rate</td>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Role of detritus</td>
<td>Unimportant</td>
<td>Important</td>
</tr>
<tr>
<td>in nutrient regeneration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inorganic nutrients</td>
<td>Extrabiotic</td>
<td>Intrabiotic</td>
</tr>
<tr>
<td>(minerals such as iron)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total organic matter</td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td>(nutrients tied up in biomass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stability (resistance to</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>external perturbation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entropy (energy lost)</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Information (feedback loops)</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>


Permaculture is an interdisciplinary earth science that also provides design guidelines that mimic the efficiency of natural ecosystems.

- Redundancy – multiple elements meet essential functions. More than one source of water, heat, income. Large systems are more stable, energy pathways are more flexible.
- Stack functions – for example, a roof is shelter, collects rain, and solar collector.
- Energy cycling – capture, use, and recycle energy many times before it leaves the system. Sun – plants – animals – manure, meat, compost, heat, other animals. Catch water high and move it slowly through the landscape.
- Zones, sectors, elevations
- Use biological resources
- Succession and stacking
- Observe and replicate natural patterns
- Incorporate diversity and edge

Not to make use of the roof of a building is very inefficient. Adding a green roof is beneficial for various reasons. It adds usable building space to the otherwise unused rooftop. This adds to the value of the building. The addition of growing medium and plants is a huge increase in insulation, in a place it is often needed. This reduces the heating and cooling loads of a building significantly. Just think, during the summer, the rays of the sun are absorbed by the plants rather than hitting the roof and radiating into the building.

Green roofs are sometimes prohibited due to the additional weight it adds to the structure. A typical, commercially available intensive green roof system weighs anywhere from 80 to 300 pounds per square foot when fully saturated. A new building can be designed for this, but a rehab project is limited in possibilities. The Gaia Institute has designed a unique growing medium for such circumstances. Their growing medium is a combination of shredded post-consumer expanded polystyrene (styrofoam) combined with pectin and compost. This medium, engineering by biologist based in biomimicry, does everything regular soil does at a fraction of the weight, and using waste materials. A fully saturated cubic foot of this growing medium weighs only 30 pounds.

Even more value can come of a green roof. Growing food on a green roof provides a local source of fresh food, reducing energy use and pollution by decreasing the distance of food transport. Urban rooftop agriculture is the best way to make the most of a roof space. The nutrients required, in the form of compost, can be sourced from within that very building, or from a few neighboring buildings. Permaculture provides guidelines for even more efficient design of garden systems and planting patterns. The photos below show a few vining fruits that could be a part of an urban rooftop permaculture environment.

---

Grapes
vitis vinifera
yield: 10-30 pounds per vine

Maypop
passiflora incarnata
yield: 12+ fruits per plant

Blackberry
rubus spp.
yield: 3 pounds per plant

Hardy kiwifruit
Actinidia arguta
yield: 10-200 pounds per plant

Currant
diene cuspidata
yield: 2-10 pounds per plant

---
Ultra-Lightweight and Eco-Friendly

The main ingredient in GaiaSoli™ for Green Roofs is nontoxic recycled expanded polystyrene foam, coated with organic pectin, mixed with high-quality finished compost. The Gaia Institute’s proprietary, patented process makes GaiaSoli™ for Green Roofs almost 50% lighter than any other green roof growing medium.

This ultra-lightweight nature gives GaiaSoli™ for Green Roofs significant advantages:

- Structural support of roof often needs no additional reinforcement
- More diverse plant selection possibilities for greater biodiversity
- More stormwater capture made possible by greater soil depth allowances
- Easier to transport to site and move in case of maintenance

H₂O Retention

GaiaSoli™ for Green Roofs retains an incredible 200% of its weight in water, easily capturing the majority of stormwater.
- Dry Weight 10 lbs. per cubic foot
- Saturated Weight 30 lbs. per cubic foot

What About Wind?

With vegetation and any appreciable water content, the surface tension of water holds GaiaSoli™ for Green Roofs in place, even under substantial wind loads. GaiaSoli™ for Green Roofs maintains the same strong footing as wet sand on a beach.

LEED® Certification

GaiaSoli™ for Green Roofs can significantly contribute many credits on green building projects seeking LEED® Certification, including stormwater control and island heat reduction.

Plant Suggestions

GaiaSoli™ for Green Roofs is an ideal growing medium for all types of vegetation. From shrubs to sedums to wildflowers. We especially recommend a diverse selection of native plants, which not only possess distinct aesthetic and environmental benefits, but also attract more birds and butterflies.

Biomimicry

The Gaia Institute possesses a deep understanding of how soils work and what makes them productive. GaiaSoli™ for Green Roofs simulates and enhances essential properties of high-quality, natural soil, including water retention, nutrient delivery, capillary action, and drainage.

For use with all plant types

Great LEED® potential

Strong footing and durable

Superior H₂O retention: 30 lbs. saturated per cubic ft.
Waste Materials and Architecture
2012 Architecten is a firm in Rotterdam, Netherlands actively engaging in reusing waste materials to form new architecture. Rather than describing their work as reuse, they call it Superuse, indicating the increased value of materials through their architectural use. In their words “Superuse… is a way of creating architecture by shortcutting the flow of products and elements from their state of maximum added value to the stage at which value has either been dissipated, by storing them in a warehouse or dumping them on some landfill, or been broken down in order to recreate it all over again.”

“Superuse as a design method is concerned with all aspects of building quality and environmental impact throughout the building’s life cycle, but it focuses on energy efficiency of transport and processing materials.”

Taeke De Jong, professor of Ecology and teacher of design methodology at the University of Technology in Delft, speaks about superuse: “I really like what I see and the reason is the lack of visual perfection. You see, architects often have a perfectionist attitude, whereas I feel small blemishes are essential to create a convincing image. It’s the way things work in nature. When molten metal solidifies it needs some kind of fault to act as a seed for crystals to start growing. Strength in materials evolves from dislocations in crystals, for they prevent cracks from growing when the material is put under stress. That can be seen as a metaphor for the kind of aesthetic I’m talking about.… In your projects you get results from means-oriented design as opposed to goal-oriented design. In architecture the latter is by far the most prevalent method: a goal is defined and every decision serves to reach that goal. It’s the classic empirical approach. The architect designs a building according to a set programme for a certain site based on his perfectionist standards. City planning is more focused on the potential of a certain area, means-oriented. The difference is that in that kind of process you start from the means that are available and see what you can do to approach a less strictly defined goal. A process is of course never entirely one or the other. It’s a matter of emphasis, but I would say that a means-oriented method would be refreshing in architecture.”

2. Ibid. p.46
3. Ibid. p.77
Worm:2012 Architecten
The Worm project was the addition of various architectural elements to an old existing structure. The program of the space was an audio/visual performance space, theater, and store. The project was achieved using locally sourced materials from other buildings and waste streams. Separate acoustical separations were achieved in part through new interior walls made primarily of exterior double glazing. A nearby building was replacing the windows, making the old windows available for reuse. Further acoustical improvements were realized by the installation of a reclaimed computer room floor. The standard elevated floor space once used for wiring made room for multiple layers of reused ceiling tiles, making great sound absorption. Private bathrooms were constructed from two IBCs. Intermediate Bulk Containers are standard containers for transporting up to 330 gallons of liquid.
Categorizing Waste Materials

In categorizing waste streams, it is important to note that any given material may overlap into more than one categorization. Often, it is a matter of the phase within the production and consumption system that the material is analyzed, as well as the laws and regulations governing the material’s continued use, or regulated disuse. Characterizing the nature of materials is useful in describing their inherent attributes through various phases of use, as well as opportune moments to intervene in the system for the most desirable embodied energy of said material.
End-of-Use Lifecycle

Comprising the most apparent form of waste is material in the "end of use" state of the lifecycle of a product. At this point, when the material or product has served its function and is no longer needed (often as simple as temporarily containing the desired product), there are typically two routes it may follow, to be recycled or "thrown away." Whether or not the product is recycled depends on a number of factors. Laws and regulations mandate certain materials are dealt with in particular ways, while other materials are recycled due to a certain raw material value, others are recycled at the discretion of the consumer based partially on available facilities, while some material types are not or can not be recycled.

The most prevalent form of waste that occupies a large portion of our landfills is the constant stream of consumer products and packaging intended for one time use. Although recycling of such material waste is available, breadth of accepted materials varies greatly in the United States, and is much dependant on the actions of the consumer and availability of convenient recycling receptacles.

This category includes standard commodites such as plastic, glass, aluminum, and styrofoam beverage containers, cardboard and paperboard packaging, paper in all forms, and plastics in all their widely varying forms. Some of these materials offer different values for potential reuse as durability, replication, and necessary alterations are considered. Products like single use drink containers pose higher potential as they are mass produced and essentially still of new quality once used.

These omnipresent, everyday materials may even be more useful intercepted from within the flow of the recycling stream. Various types of paper and cardboard are separated and baled within the recycling process. Like materials, such as wax impregnated cardboard or sticker backing, are baled independently, offering a number of options of processed bulk products. Baled paper is quite similar to straw bales (a waste byproduct of agriculture) which are now commonly used as a highly insulative building material. Plastic bottles, aluminum cans, even cars are also compacted and pressed into blocks within the existing recycling facilities, offering opportunity for alternative architectural reuse.

Car tires are another mass produced and highly disposed of material commodity ripe for architectural reuse. Regulations in many states have banned used car tires from landfills, forcing the creation of monofills of used car tires. Some current reuse applications include the shredding of tires to be used as fill, mulch, or a component of new pavement, however shredding greatly wastes the embodied energy existent in the strength and shape of a car tire.

Other, less common end-of-use material vary from household items to large scale replacements. Old refrigerators, stoves, hot water heaters, etcetera become inefficient or obsolete in regards to new models, or may break and not be worth fixing, but still maintain desirable material qualities worth exploiting. Larger scale replacements of specific building components are sometimes replace due to new, leaving large quantities of ceiling tiles, windows, carpet tiles, and other assorted building parts available.

Construction and demolition debris is one large component of end-of-use waste. Construction debris is generated as a structure is built and packaging and shipping materials, defected or broken materials, and cut off or miscut materials are haplessly tossed in the dumpster. Often materials are of new quality and potentially useful, just not in the situation they are a byproduct of, and the easiest treatment is disposal. Demolition debris constitutes everything of a building that is demolished. Brick, stone, steel, wood, even appliances fall victim to the wrecking ball or dynamite. A building is sometimes allowed to be scrapped, or even deconstructed, preserving much of the embodied energy of materials, but building most often are simply indiscriminately destroyed. Metal is usually separated for its value as a raw material, and brick, concrete, and stone are sometimes crushed into fill material, a small concession for the energy supplied to create the previous structure. These building components could easily become portions of new buildings, as that is their original intention.
Production Waste

Within the production facilities that create the multitudes of products that compose our material culture, a typically unseen strain of waste exists. Production waste encompasses all the materials that are temporarily used in the production and transportation of material goods. (interchange...) One great advantage of the use of production waste is the consistent output of this often redundant excess material. As long as the production of certain goods continues, the unused byproducts will continue to be produced and available.

Cut off materials created in the fabrication of products are one form of production waste potentially applicable. Sometimes, when possible, the material is simply reintroduced to the production process. Though that may not be possible, or it may be more advantageous to use the redundant extras in a new application, as most of the time there are vast quantities of the same component as a result of the mechanized manufacturing process. Some examples of this type of material potential include trimmings, punches, turnings, shavings, or even grinding sludge from the production of metal products. Other possibilities range from paper mill sludge and sawdust, to misprinted laminates for food packaging, scraps of mylar cut off copper coils.

Other forms of production waste consist of temporary materials used during the making process. Often, materials are used simply as a means to alter another material in the creation of the final product. Spent foundry sand is one example of this temporary material. No longer appropriate for the foundry process, it heads to the landfill, though it could easily become an architectural component. Other times, a final product of one manufacturing cycle contains components that simply maintain the consistency of the material to be used in another manufacturing cycle. These materials are also typically destined for the landfill, unless intercepted with an alternative intent.

Another, third type of temporarily used production waste is a byproduct of the transportation of products. This may be as simple as something used in the transportation of large quantities of product over longer distances. Wood pallets, shipping crates, shipping containers, and wire spools are examples of temporary transportation materials that are still useful and of good quality once they have done their intended work, but are too costly to transport back to the original destination, simply for reuse. Economics determine the usefulness of these products rather than the condition of the materials, meaning they can often be of a rather high quality.
Dead Stock

A third, less common form of material waste exists as dead stock. Often new materials, they have remained stagnant for longer periods of time, and potentially are disposed of. These are supplies of part or products that are no longer called for. They may have been over produced and have become somewhat obsolete, or at least of little value due to the age of products they are intended to service. Regardless, they are no longer needed for their original intent, and have trouble being sold.

Automobiles provide a number of opportunities for repurposing dead stock. Unused, stocked car windshields, or any other car parts, eventually lose value after 15 years or so as people will usually go to a scrap yard for a replacement, leaving the typically higher priced stock on the shelf. Decommissioned airplanes are another source of this material waste. There are literally thousands of airplanes and jets stocked in the desert, where dry air preserves them. To expensive to repair or scrap, they sit, waiting.
Construction and Demolition Debris

Buildings generate a lot of waste through their construction and potentially, eventual demolition. During construction, cut offs, mistakes, packaging, and overordering, just to name a few sources, often fill dumpsters at construction sites. Materials are typically paid for by the time they reach the construction site, and workers get nothing out of saving elements here or there, especially when a surplus is available to keep a lack of materials from slowing the construction timeline.

During demolition or renovation of structures, there is little incentive to save anything. Sometimes more valuable elements are saved, as the resale value makes it worthwhile. But typically, a group of people is paid to do the dirty work, and care little if at all about what happens with the old, discarded materials.
Durables & Electronics
COMPUTERS - New
A14-0015
Computer servers, desktops, laptops, monitors deemed "obsolete" in lieu of new models. 10 pallets currently. Recurring. Potential end use: recycling or reuse.

Construction Materials
RECYCLED ASPHALT - New
A12-0012
We have recycled asphalt available for purchase. F.O.B. Potential end use: sub-base, dust control, embankment. Reoccuring amount. Call for more information.

CRUSHED CONCRETE - New
A12-0011
Crushed concrete; concrete from construction sites is picked-up, crushed and resold as a fill or gravel alternative. ODOT class 304 material. We pick-up used construction concrete and deliver crushed concrete. Potential end use: fill or gravel alternative. Dump truck load available weekly.

ASPHALT
A12-0009
GTR - 78-22 is a chemically bound modified asphalt with Ground Tire Rubber suitable for hot mix paving. This asphalt is terminal blended and modified using recycled tire rubber that is incorporated into the liquid asphalt. This process aids in extending pavement life and makes a quieter pavement. Our GTR asphalt qualifies for grant money from Ohio Dept. of Natural Resources - Division of Recycling & Litter.

CONCRETE
A12-0010
Waste concrete and concrete washout located in Campbell County, KY. Potential end use as fill material. 60 yds. available now with 10 yds. available every month.

Metals & Metal Sludges
STAINLESS STEEL
A10-0027

Raw Materials
Paints & Coatings
Currently, there are no listings for Raw Materials.
Plastics
PLASTICS A97-0053
Baled shrink wrap. 2 bales available now; Recurring. Potential end use: recycling or fuel recovery.

PLASTICS A97-0061
HDPE Nalgene 20 liter and larger white carboys used for manufacturing purposes, rinsed. Potential end use: recycle. 100 available one time.

PLASTICS A97-0050
We have densified white EPS condensed to 20 lbs per cubic foot in boxes; 750 lbs/box. Recurring. Potential end use: recycle for reuse.

PLASTICS A97-0039
We are a full service plastic broker, who has been in business for over 15 years. We specialize in unwanted and unusable materials that may find their way to the landfill due to contamination.

PLASTIC BAGS A97-0048
Used baled bulk bags 40,000 lbs. Available year round.

Rubber
RUBBER WALL BASE A19-0004
FREE for the taking. Small boxes containing rubber samples of wall base that were donated by Johnsontile. They are left over from our program and are available to anyone.

RUBBER CUBES A19-0003
Approximately (96) 5" x 5" x 6" dense black rubber solid cubes. Available one time. Potential end use: shock absorbers/bumpers.

Shipping Materials
PALLET - CORRUGATED New A14-0090
Up to 700 pieces of 48" X 48" X 4" 4-way corrugated pallets w/ TW decking on reinforced corrugated runners available one time. Packed in pallets/bales. Potential end use: shipping point to point or in-house storage.

PALLET - CORRUGATED New A14-0091
Up to 400 pieces of 48" X 48" X 5" 2-way corrugated pallets w/ TW decking on reinforced corrugated runners available one time. Packed in pallets. Potential end use: shipping point to point or in-house storage.

SHIPPING MATERIALS New A14-0099
Scrap wood pallets leftover from receiving goods. 2 tons currently. Recurring. Potential end use: recycling or reuse.

GAYLORD BOXES A14-0068
Good reusable Gaylord Boxes in truckload quantities. Potential end use: Material handling. 800 available now, recurring amount of 800 per week. Available year round.

SHIPPING MATERIALS A14-0075

PALLETS A14-0099
48" X 48" to 4" X 8" wood pallets available. Recurring supply of approximately 30 per month.

Textiles & Leather
WOOL RIBER A08-0019
20% synthetic and 80% wool fiber. 5,000 lbs for use in roofing materials, padding in 500 lb bales.

CLOTHING RAGS A08-0029
Used clothing suitable for rags. Steady supply.

Wood
WOOD - Pallets - New A18-0035
Pallets 43" X 45" approximately - 4 way. 100 available now; reoccurring 100/week. Potential end use: recycling materials.

WOOD A18-0034
Old & end pallets available. Recurring about 100 per week. Potential end use: recycling materials.

WOOD A18-0033
Plywood, OSB, various in sizes ranging from 14" X 30" and larger dimensional lumber - 1" X 4", 2" X 4", 4" X 4" from block size to 5 foot length odd size pallets, broken pallets, shipping containers and machinery crates.

WOOD - Sawdust A18-0031

WOOD WASTE A18-0030
Drops and waste from pallet and crate operation. All new wood - not recycled lumber. Potential end use: firewood, mulch, paper raw material. 45 cubic yards every week.

Glass
Currently, there are no listings for Glass.
an identification which may, up to a point, prove useful and, so much so, that if one may be inclined to recognize Le Corbusier as a fox in hedgehog disguise, one may also be willing to envisage a parallel attempt at camouflage: the “bricoleur” disguised as engineer. “Engineers fabricate the tools of their time... Our engineers are healthy and virile, active and useful, balanced and happy in their work... Our engineers produce architecture for they employ a mathematical calculation which derives from natural law.”

Such is an almost entirely representative statement of early modern architecture’s most conspicuous prejudice. But then compare Lévi-Strauss:

The “bricoleur” is adept at performing a large number of diverse tasks; but, unlike the engineer, he does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project. His universe of instruments is closed and the rules of his game are always to make do with “whatever is at hand,” that is to say with a set of tools and materials which is always finite and is also heterogeneous because what it contains bears no relation to the current project, or indeed to any particular project, but is the contingent result of all the occasions there have been to renew or enrich the stock or to maintain it with the remains of previous constructions or destructions. The set of the “bricoleur’s” means cannot therefore be defined in terms of a project (which would presuppose, besides, that, as in the case of the engineer, there were, at least in theory, as many sets of tools and materials, or “instrumental sets,” as there are different kinds of projects. It is to be defined only by its potential use... because the elements are collected or retained on the principle that “they may always come in handy.” Such elements are specialized up to a point, sufficiently for the “bricoleur” not to need the equipment and knowledge of all trades and professions, but not enough for each of them to have only one definite and determinate use. They represent a set of actual and possible relations; they are “operators,” but they can be used for any operations of the same type.

For our purposes it is unfortunate that Lévi-Strauss does not lend himself to reasonably laconic quotation. For the “bricoleur,” who certainly finds a representative in “the odd job man,” is also very much more than this. It is common knowledge that the artist is both something of a scientist and of a “bricoleur”... but, if artistic creation lies mid-way between science and “bricoleur,” this is not to imply that the “bricoleur” is “backward.” “It might be said that the engineer questions the universe while the ‘bricoleur’ addresses himself to a collection of oddments left over from human endeavors,” but it must also be insisted that there is no question of primacy here. Simply, the scientist and the “bricoleur” are to be distinguished “by the inverse functions which they assign to event and structures as means and ends, the scientist creating events... by means of structures and the ‘bricoleur’ creating structures by means of events.”

But we are here, now, very far from the singular notion of an exponential increasingly precise “science” (a speedboat which architecture and
urbanism are to follow like highly inexpert water-skiers); and, instead, we have not only a confrontation of the "bricoleur’s" "savage mind" with the "domesticated" mind of the engineer, but also a useful indication that these two modes of thought are not representatives of a progressive serial (the engineer illustrating a perfection of the "bricoleur," etc.) but that, in fact, they are necessarily coexistent and complementary conditions of the mind. In other words, we might be about to arrive at some approximation of Lévi-Strauss’s "pensée logique au niveau du sensible."

There could, of course, have been other routes followed. Karl Popper might have put us down in, very approximately, the same place; Jürgen Habermas might have helped to somewhat equivalent conclusions; but we have preferred Lévi-Strauss because, in his discussion, with its emphasis upon making, it is far more possible for the architect to recognize something of himself. For, if we can divest ourselves of the deceptions of professional amour propre and accepted academic theory, the description of the "bricoleur" is far more of a "real-life" specification of what the architect-urbanist is and does than any fantasy deriving from "methodology" and "systemics."

Indeed, one could fear that the architect as "bricoleur" is, today, almost too enticing a program—a program which might guarantee formalism, ad hocery, townscape pastiche, populism and almost whatever else one chooses to name. But... The savage mind of the bricoleur! The domesticated mind of the engineer/scientist! The interaction of these two conditions! The artist (architect) as both something of a bricoleur and something of a scientist! These evident corollaries should alleviate such fears. However, if the mind of the bricoleur should not be expected to sponsor universal ad hocery, it must still be insisted that the mind of the engineer need not be imagined as supporting the idea of architecture as part of a unified comprehensive science (ideally like physics). And, if Lévi-Strauss’s conception of "bricoleage," which patenty includes science, may now be placed in some relationship with Popper’s conception of science, which evidently excludes "methodology," there is here the illustration of some more restrictive intention in the present argument. For the predication of architecture—which, because it is always, in some way or other, concerned with amelioration, by some standard, however dimly perceived, of making things better, with how things ought to be, is always hopelessly involved with value judgments—can never be scientifically resolved, least of all in terms of any simple empirical theory of "facts." And, if this is the case with reference to architecture, then, in relation to urbanism (which is not even concerned in making things stand up) the question of any scientific resolution of its problems can only become more acute. For, if the notion of a "final" solution through a definitive accumulation of all data is, evidently, an epistemological chimera, if certain aspects of information will invariably remain undiscriminated or undisclosed, and if the inventory of "facts" can never be complete simply because of the rates of change and obsolescence, then, here and now, it surely must be possible to assert that the prospects of scientific city planning should, in reality, be regarded as equivalent to the prospects of scientific politics.

For, if planning can barely be more scientific than the political society of which it forms an agency, in the case of neither politics nor planning can there be sufficient information acquired before action becomes necessary. In neither case can performance await an ideal future formulation of the problems as it may, at last, be resolved; and, if this is because the very possibility of that future where such formulation might be made depends upon imperfect action now, then this is only one more to intimate the role of "bricoleage" which politics as much resemble and city planning surely should.

Indeed, if we are willing to recognize the methods of science and "bricoleage" as concomitant propensities, if we are willing to recognize that they are—both of them—modes of address to problems, if we are willing (and it may be hard) to concede equality between the "civilized" mind (with its presumptions of logical seriality) and the "savage" mind (with its analogical leaps), then, in reestablishing "bricoleage" alongside science, it might even be possible to suppose that the way for a truly useful future dialectic could be prepared.

A truly useful dialectic? The idea is simply the conflict of contending powers, the almost fundamental conflict of interest sharply stipulated, the legitimate suspicion about others’ interests, from which the democratic process—such as it is—proceeds; and then the corollary to this idea is no more than banal: if such is the case, if democracy is compounded of libertarian enthusiasm and legalistic doubts, and if it is, in theory, a collision of points of view and acceptable as such, then why not allow a theory of contending powers (all of them visible) as likely to establish a more ideally comprehensive city of the mind than any which has, as yet, been invented.

And there is no more to it than this. In place of an ideal of universal management based upon what are presented as scientific certainties there is also a private, and a public, emancipatory interest (which, incidentally, includes emancipation from management); and, if this is the situation and, if the only outcome is to be sought in collision of interest, in a permanently maintained debate of opposites, then why should this dialectical predicament be not just as much accepted in theory as it is in practice? The reference is again to Popper and to the ideal of keeping the game straight; and it is because, from such a criticist point of view, collision of interest is to be welcomed, not in terms of cheap ecumenicism which is only too abundantly available, but in terms of clarification (because, in the battlefield engendered by mutual suspicion, it is just possible that—as has been usual—the flowers of freedom may be forced from the blood of conflict) that, if such a condition of collusive motives is recognizable and should be endorseable, we are disposed to say: why not try?

The proposition leads us (like Pavlov’s dogs) automatically to the condition of seventeenth century Rome, to that collision of palaces, piazzas and villas, to that inextricable fusion of imposition and accommodation, that highly successful and resilient traffic jam of intentions, an anthology of closed compositions and of the stuff in between, which is simultaneously a dialectic of ideal types plus a dialectic of ideal types with empirical context; and the consideration of seventeenth century Rome (the complete city with the assertive identity of its subdivisions: Trastevere, Sant’Eustachio, Borgo, Campo Marzio, Campitelli... ) leads to the equivalent interpretation of its predecessor where forum and termeic pieces lie around in a condition of inter-dependence, independence and multiple interpretability. And imperial Rome is, of course, far the more dramatic statement. For, certainly with its more abrupt collisions, more acute disjunctions, its more expansive set pieces, its more radically discriminated matrix and general lack of "sensitive" inhibition, imperial Rome, far more than the city of the High Baroque, illustrates something of the "bricoleage" mentality at its most lavish—an ohlahk from here, a column from there, a range of statues from somewhere else, even at the level of detail the mentality is fully exposed; and, in this context, it is amusing to recall how the influence of a whole school of historians (Positivists, no doubt!) was, at one time, strenuously dedicated to presenting the ancient Romans as inherently nineteenth century engineers, precursors of Gustave Eiffel, who had somehow, and unfortunately, lost their way.

So, Rome, whether imperial or papal, hard or soft, is here offered as some sort of model which might be envisaged as alternative to the disastrous urbanism of social engineering and total design. For, while it is recognized that what we have here are the products of a specific topography and two particular, though not wholly separable, cultures, it is also supposed that we are in the presence of a style of argument which is not lacking in universality. That is: while the physique and the politics of Rome provide perhaps the most graphic example of collusive
In architecture school, we typically work with abstractions. Students make drawings and build models that by definition refer to something else, usually a thing never directly met or realized. As useful as they are as tools, these abstractions have two major limitations that are essential to architecture: scale and materiality. We cannot encounter the spatial and behavioral properties of the materials they represent or fully experience the physical consequences of our decisions through these modes of representation alone. This fact creates a significant vacuum in the education of an architect. It’s no wonder that architects have a notorious reputation among builders for knowing little about how things are really put together. Any tradition of architect as builder is long gone.

Architectural Analog
As fundamental as it seems to architecture, confronting material reality is typically not a priority. It is either not recognized as essential to architecture, or just plain difficult to approach. With the apparent triumph of the image, the idea of studying material relationships almost seems anachronistic and esoteric, even irrelevant. Easily subsumed and obscured by other legitimate issues that are more readily accessible through conventional analytical and representational tools like drawings, the tangible consequences of architectural decisions often become an afterthought. There are whole regions of architectural philosophy based on denying or avoiding material reality altogether... odd, to say the least, for a discipline anchored in materiality.

1. Film used in the commercial process of silkscreening come in durable plastic tubes with red, translucent caps. Typically they are thrown away. Collecting and consolidating them creates a beautiful light filter. 2. Aluminum cans are designed to last a long time, in constant contact with soda, beer, and other beverages. A can opener easily removes the top, and with a little more effort the bottom, creating a screen that reflects indirect light. 3. Hole punches from industrial sheet metal production can easily be reused as tiles. 4. Plastic grocery bags can be ironed together to form a more rugged, durable plastic. 5. Paper mache is a very simple way to reuse paper, which in its various forms constitutes about 18 percent of landfill. Papercrete is another variation, using paper pulp and a bit of cement.
1, 2, 3. aluminum cans can be manipulated in various ways. Here, the sides are extracted to develop aluminum siding, or roofing. 4. These aluminum cans are reused as small planters, which when assembled together, form the basis for a green wall, with a unique, colorful circle pattern.
1. The historic neighborhood of Over the Rhine in downtown Cincinnati is densely packed with buildings. A few stands of trees remain in an otherwise hardscaped acreage. The neighborhood is ripe with potential rehabbing, especially the type that includes some plants.  
2. The character of typical storefront can be seen along the right side of the photo. Here an old building has been condemned and demolished, leaving a colorful collage of building components exposed to the street. This variety is prevalent between buildings, and within them, too.  
3. Another photo showing the variety of styles one might experience on any one building. These images demonstrate that an architecture of bricolage is suitable for the neighborhood.
1. existing condition of the space, looking northeast.
2. existing condition of the space, looking south.
1. looking east, the existing condition of the space. 2. it began with removing portions of the overhead partition. electric was mounted to that, determining the extent to which subtraction of material could easily occur. water damaged peg board was removed from the furred out wall studs. a small panel was left remaining in the middle of the developing composition. ceiling studs were sawed off, leaving only a few inches remaining. the sculptural quality of the remaining composition is interesting by itself, yet it also alludes to the history of the space prior to the new manipulation. in contrast, a standard, orthodox redevelopment of such a space would involve complete removal of said elements. however, realizing the energy embedded in the existing situation and the additional effort of rewiring, these elements remain for historical, aesthetic, and functional reasons.
1. drilling required. holes represent entropy, yet the act of bolting will allow the wood to be reused. When possible, existing holes in reused boards were used. 2. construction photo shows the linear collage of existing and new, electric, light, and wood. 3. construction photo highlighting loft structure made of reused ceiling studs, found boards, and reclaimed beam. 4. view up through grate in loft, under existing skylight, to incorporate plant life. 5. detail of variety of materials at a joint.
1. dimensions of the loft were determined by certain existing conditions. the depth from the back wall was determined by the edge of the existing skylight. coincidentally, that dimension was just enough for a piece of plywood, a reused 2x10 and a two inch reveal. the reveal is a nice affect in itself, but it also alludes to the two inches of remaining ceiling studs previously mentioned. 2. loft plan. the found grate matched the dimension of a plywood sheet. the 2x10, layed adjacent and abutting against both, was unplanned for, and happened during construction. 3. access to roof via old library latter, just tall enough for the loft.
1. section of loft and partition remains over photo.
removed ceiling studs (dotted lines) were reused in
the loft. the reveal in the loft, exposing two inches
of the beams from above, mirrors the remaining
two inches of the original stud location. the circular
window [drawn in] is an existing window, behind the
lath and plaster. what used to be an exterior window
for the adjacent building, was covered when this
building was built. removal of plaster and lath would
expose the brick and window, requiring an addition-
al translucent layer. 2. floor plan including loft
1. removed rusted metal lath and plaster from verticle steel member and ceramic downspout. stud ceiling remains are removed. reciprocating saw one end of each beam and it swings down to hang by nails, pull further to dislodge. 2. to reuse ceiling studs, many small nails were removed. 3. stud wall, steel column, ceramic downspout, and plaster, over brick wall.
several layers of blinds were removed to increase natural light and view of trees in park. the resulting linework is more dynamic and interesting than the original composition, by simply manipulating the existing material.
1. existing wall adjacent to windows. 2. the first layer of peg board is removed. 3. notice the shadowed linework projected onto the wall. 4. a piece of wallboard is removed, exposing insulation. this interior wall was actually treated as an exterior wall. this space was probably the only conditioned space in the building for many years. at this point, the remaining wall board is interesting enough to stop with removal. 5. the insulation was removed, revealing the back of the wood siding. the other side had been painted white, but this side reveals the true wood. a stamp on one board reads “heart redwood.” a small panel in the remaining wall board reveals a curious, framed out section.
the finished wall. Notice the new top line of the blinds matches the horizontal studs previously behind the wall board. Also, the double studs align with the edge of the box. The curious framed out section in the remaining panel works well as a mantel over the fireplace.
experimenting further with additional window treatments. 1. misprinted t-shirts were cut up and sewn together to form this curtain. it would also function as a projector screen, to be discernible from the exterior as well. 2. taping together another screen. 3. this screen was made from the waste of part of the silk screening process. the film which holds an image, comes mounted on a velum like material, which is thrown away. 4. the result of taping together a variety of random sizes creates a unique, translucent linework, thereby allowing light but not sight through the windows
a complete view of the corner composition with window screen. also notice the wood flooring which was leftover from another project. it works well to conceal the particle board floor below, which covers a drop in the concrete floor. the various lineweights meld together into one conceivable language.
1, 2, 3. construction.  4. floor textures.  5. bookshelf in process.  6. construction diagram photo of bookshelf.  
7. bookself taking shape from existing studwall with surface mounted electric.
1. the existing southern wall 2. water damaged peg board was removed, leaving the remaining furred out stud wall with attached electrical conduit and outlet. 3. rather than remove the wall and rewire the electric, it remains as another homage to the history of the space. the structure was used as the basis for a bookshelf wall.
section facing south, includes bookshelf wall and relation to other components of space, such as the loft. the greenhouse over the skylight and loft acts as a mediator between inside and outside. one can stand on the loft and be partially within the rooftop greenhouse. the greenhouse is constructed of old, reused windows and reclaimed wood beams. it functions as any greenhouse would, to extend the growing season and protect sprouting plants, before they are planted in the green roof. the vent stack for the heater has a copper, water filled coil to collect the waste heat. this heat is collected in an old hot water tank within the greenhouse, aiding in temperature control during colder months.
1. books on shelves, with additional lighting.  2. old silkscreen with layers of history embedded in the mesh were used as filters for light.  3. the shelves were made of reused ceiling studs from within the space, and a dead stock of boards intended to be silkscreened decades ago.  4. the 2x10 used as the top shelf was just the width of four bays of the wall. its height was determined to match the existing double 2x4s of the adjacent wall. the lowest shelf height also came from the existing stud wall. more shelves may be added to the wall as needed.
1. existing space, prior to loft construction. 2. old stock of used silk screen frames (without screen) are combined via simple fasteners to form an expandable structure. 3. silk screen scraps are used as visual screen, which warps point light sources. 4. a sink from an old pizza kitchen is reused. Additionally, a hose from a broken pressure washer is attached to the faucet to extend the reach of the water, as well as adding pressure and reducing water flow. 5. silk screen structure used to make a table and stairs, which also function as storage space. the loft adds space and conceals a kitchen underneath. old file cabinets work well as kitchen cabinets.
1. variations on how the green roof might function. structure, paths, greenhouses, and other utilities are diagramed here. 2. on the roof: a greenhouse, a small paper mache structure, plants, workspace...
1. experimenting with using styrofoam as part of the growing medium for plants. 2. strawberries and other plants in temporary rooftop containers. 3. designing on the roof using skids as a path. more found wood beams and leaves help visualize the space.
1. an important view on the roof, also illustrating the existing variety of elements. 2. sketch of potential organization.

3. reorganizing existing elements in the actual space allows for a greater understanding of the reality of the design. Moving elements such as these skids gives greater depth to the design process, as relationships are actually comprehended, rather than abstract paper ideas. The space and design evolves in real time and real space.
Conclusion

Contemporary building practice consumes huge amounts of resources, and generates vast amounts of waste. A seemingly endless supply and variety of building materials are available. Any material, from any part of the world, can be transported and manipulated to represent the abstract lines of the architect. Any building can be ordered from a catalog and plugged into the city grid.

There is little concern for the source of any of the energy or materials that come together to form the built environment. Environmental and social costs are not factored into price, and subsidies often distort true costs even further. Waste has no voice in the design studio- it is not part of the clean white drawing set produced in the clean white studio, miles from the building site. Waste, both material and energy, is not seen in this overly-abstract process of making. As a result, energy and materials are constantly wasted as an unseen but “necessary” part of the process.

This modern manner of designing, constructing, and fueling the built environment is rooted in an antiquated paradigm. These linear, one way throughput systems of production and consumption focus on profit, and ignore the finite nature of material sources. Though contemporary styles vary aesthetically, the predominant contemporary forms of production, construction, and energy supply are rooted in these outmoded, unsustainable, linear industrial processes.

This project subverts this wasteful, outdated mode by operating differently. There is an alternative pattern, method, and material. The pattern is biomimetic, the method bricolage, and the materials are reclaimed from waste streams. This project is a decomposer in an ecosystem overrun by consumers.

The new pattern is biomimetic. Biomimicry is the new science of solving human problems through imitating the wisdom of nature. This project does this by conceiving the city as an ecosystem, and buildings as organisms within that ecosystem. Within mature healthy ecosystems, organisms follow a set of rules for success. They form diverse, cooperative environments. They use waste as a resource. They collect and use energy and materials efficiently. They don’t foul their nest. They remain in balance with the biosphere. This project reflects these guidelines in a number of ways.

The project environment is diverse- the building site is in the dense, diverse, historic neighborhood of Over the Rhine. This community finds strength in this functional and cultural diversity. The project certainly uses waste as a resource- a derelict building is rehabilitated through the reuse of various, locally sourced waste materials. Energy is conserved with the installation of a green roof, which also increases healthy, habitable space. Rainwater catchment combined with gravity fed irrigation supplies food to occupants. Altogether, the building is a waste free, regenerative organism.

The method, bricolage, also mimics nature. Bricolage is the creative process of constructing something from materials at hand, regardless of their original purpose. Bricolage is a postmodern production method for architecture. It is critical of contemporary methods, which are plagued with bad habits left over from modernism. We are in the habit of designing from the office computer, and constructing buildings from new uniform materials, shipped in from around the world. How inappropriate, when we live in a world of finite resources and infinite variation?
Materials for bricolage are highly varied. Their sources are local. Materials are already used, often old. They come with predetermined rules and qualities, which tell of their history. Portions of the traditional design process become reversed: available materials determine the architectural lines and functions they can inhabit. The focus of the project becomes more means oriented than goal oriented. The architect must directly interact with the materials to creatively manipulate them to another use. There is complexity to the resulting eclectic composition.

Various forms of waste were implemented in this project. The building itself, potentially waste in the eyes of many, was the basis. Some elements of the existing structure were partially removed, while others were reorganized within the space. What would be considered waste by standard practices – dirty used ceiling studs, random charred beams, a found grate – was reclaimed to construct a loft.

More ceiling studs were combined with a dead stock of boards (used for political signage in the ‘70s) to make a wall of book shelves. An existing furred out stud wall with external electrical conduit was the original governing structure for the shelving system. Removal of multiple layers of sheathing on another internal wall revealed rich, redwood slats.

Old silk-screening frames were organized to create structure. Pieces of velum, a waste product from the film used in silk screen, were recombined to make a window screen. File cabinets found new use as food and clothing storage. A hose from a broken pressure washer was affixed to an industrial sink from a pizza restaurant to become more versatile and to conserve water.

Additions to the roof will further expand the project. A growing medium of Styrofoam, pectin, and compost will provide necessary insulation while acting as a lightweight medium for plant root structure. Reclaimed wood will create paths. A variety of reused windows will come together as a greenhouse over the skylight. Water will run through copper coils in the exhaust stack of the heater below. This hot water will go to an old water tank within the greenhouse. Rainwater from the adjacent building will collect in reused intermediate bulk containers at the high point of the flat roof. Food will be produced, and food scraps will be composted.

Both the process and place of this project confront and subvert the outmoded unsustainable way we make our built environment. It uses the forgotten spoils of our antiquated linear production model to demonstrate a healthier cyclical alternative, rooted in the wisdom of nature. Bricolage is employed as a method for reusing these waste materials. This project becomes a symbiotic organism (building) which increases the efficiency of its ecosystem (city). The building uses (decomposes) the waste material of the city so the positive net effect extends well beyond its walls.


