towards a redefinition of 'context'

by

Michael P. Lehner


Submitted to the Department of Architecture in Partial Fulfillment of the Requirements for the Degree of
Master of Architecture at the Massachusetts Institute of Technology February 2004

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Due to a pagination error pages 26 & 27 have been numbered twice, each containing separate material.
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abstract

Context is an ever-present yet elusive issue in architecture and it is difficult for any two people to agree about its definition or role in architecture. Yet context casts a long shadow over architectural design no matter how it is defined. This ambiguity does not stop people from invoking context as an argument to prevent new and innovative architecture from being realized.

Not to negate context, this thesis concerns itself with finding an appropriate balance between the varying factors that exert an influence over the design of architecture with regard to context. This thesis intends to argue that context is in fact an argument for aesthetic and technological change in architecture.

Specifically, it is through the design of a winery in Italy that the thesis engages ideas of context and identity and presents a challenging opportunity for the redefinition of context as the careful convergence of local culture, climate, materials, economics and traditions with the global nature of the production, marketing and sales of wine and with our broadened knowledge base of how to build in closer cooperation with natural forces.

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I would also like to thank everyone that was so helpful to me on my site visit to the Barolo wine growing region in Italy. Every day of my visit there I encountered someone new who would help me find exactly what I was looking for. I am very grateful that they were all very kind and tolerant of my lack of Italian.

I would like to thank the people at the following wineries who were so willing to give up their time to speak with me about wine, wine making, and the culture and history of the region and to learn a little bit about their own family histories, these wineries included: Famiglia Anslema, Aldo Conterno, Bartolo Mascarello, Pio Cesare, Terre da Vino and Gaja as well as at the Alba Scuola Enologica.

I would also like to send my thanks to all of my M Arch classmates this semester and throughout my time at MIT. I have had a great time getting to know you all and am extremely proud to have a been a part of this class.

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1.0 background
“But this - to take the plunge into tradition - is imitation and it paralyzes creative intelligence, which has to operate in freedom... The people we see as classics were great innovators in their time. Looking back to their work should mean rediscovering its values, not its results: otherwise you are just applying a formal code, while betraying the real intention.”

renzo piano, from the renzo piano logbook
"What's overlooked...is that, by rejecting contemporary architecture, society is losing its three-dimensional forms of expression. Not only does this represent a wanton destruction of creativity and energy; it means that sooner or later, the third dimension will lapse into silence. Uncomfortable, precise, self-confident energy will continue to be destroyed until it's replaced altogether by hastening, servile obedience."

coop himmelblau, from the end of architecture?
the issue of context

This project began with an enthusiasm and interest in a range of architecture-related issues I discovered around the typology of the winery. Some of these first ideas included the relationship between technology and tradition, universality and specificity, and identity, issues which converge into a broader consideration of architectural 'context'.

When we build we add something new to a place. A place which may be in a dense urban condition or in a completely natural condition. Each place has a pre-existing order which any intervention of man must consider. With regard to this idea of context in architecture, it has typically been limited to the visual and stylistic aspects of the physical building. But where does this definition of context come from and is it the only one possible or relevant to architecture?

The process of creating architecture occurs on two levels, in active and passive modes: as intention and action, and as perception and observation. There are those directly involved in the process of design and construction that try to achieve or communicate something through their work. Then there are those end users who are consumers and observers of the process.

Discussions regarding context in architecture seem to be dominated by the consumer and observers, expressed through neighborhood committees, design review guidelines, zoning codes and criticism. The convention is one sustained by this meta-profession of critics and bureaucrats operating at a level of activity outside the sphere of active creation. A typical formulation from this group is that context consists of styles and material definitions rooted in historical precedents. Too often this viewpoint has a negative influence on architecture and restricts creativity.
The view of those actively involved in architecture, is the viewpoint of those interested in implementing change. These people recognize that context involves innumerable variables none of which pull in exactly the same direction. Architecture and architects are positively informed by this condition and understand the definition of context as including site, topography, materials, climate and technology. These layers of influence do not negate historical precedent or style but call for their continual reinterpretation.

In recent years, the environmental movement has made steady inroads into the design and building industries spurred by a sense of responsibility, preservation of resources and pollution control. Buildings are designed to be more efficient and materials more available for reuse or recycling. This movement has produced buildings which are more responsive and responsible to their natural surroundings but make no concessions to the specific aesthetic of their neighboring buildings. An environmentally responsible building is, by definition, site specific.

It is my contention that what the environmental movement signifies for architects is a shift in values. Efficiency, responsibility, low-impact in building design and every aspect of our lives are growing to be universal values. For the architect, this represents a shift and an opportunity in how we define context.

What this thesis intends to explore using the winery typology as a vehicle is this link between site and building, resources and uses, responsibilities and opportunities. The project for a winery in the Barolo region seeks to take advantage of its natural surroundings seeing them more as resources and opportunities than as liabilities or costs. This winery project is an opportunity to expand on our definition of context by recognizing and embracing this shift in values.
finding context in the architectural process
The diagram on these two pages is intended to show the split between those directly involved in the process and those peripherally involved but whom wield a great influence over how context in architecture is defined. The stages in a building's life are mapped and then re-prioritized to indicate the issues which this thesis intends to use to redefine and broaden our understanding of context. The grey shapes and the text in bold along the top line indicate where the existing definition of context originates. The red shapes and text indicate where this thesis intends to focus in order to recast our definition of context.
2.0 program
Success in wine making relies on a mix of factors: site, soil, climate, weather, grape choice, fermentation, time and other factors. It is a mix of luck with the natural conditions and knowledge in the winery. The word ‘terroir’ is used in wine making, particularly in Europe, to talk about the unique mix of soil, climate and culture of a place and its wine making potential. It is the wine making soul of a place.

Wine makers understand deeply that the process is dependent upon climate and weather to a large extent and thus try to interfere as little as possible in this aspect of wine making and allow nature be allowed to do its work.

Not only are the choices in the vineyard important but the environmental conditions required in wine making once the grape enters the winery are also stringent and extremely important to making great wines. Temperature, humidity and proper ventilation all play a role.

Wine making is also seasonal; various activities occur at various times in both vineyard and winery and the wine is susceptible to even minute changes at any point along the process. Given the requirements of the process in the winery the need for the building to facilitate this process is imperative. Moreover, there is the opportunity for the building to integrate itself with the site and environment by utilizing what is available in the immediate surroundings.
In my visit to the Langhe region of Italy, in the north of the country, there was one long-time wine maker I spoke with who helped me to understand how important the weather and the environment are to the wine making process. The wine maker was Bartolo Mascarello who is wheelchair bound and has handed daily operation of the family winery over to his daughter. Upon my entrance to their house I was shown to Bartolo's office to wait for his daughter. As I was waiting there were voices in the hall behind me. They inched ever closer to the front door of the house. I was unsure whether it was Bartolo coming to meet me or something else. As the voices moved closer still I could see it was Bartolo and his wife but they were moving toward the front door not into the office to meet me. A moment later Bartolo's daughter, Teresa, appeared. We met and then she explained that the previous year their entire crop of nebbiolo grapes which make up their renowned Barolo wine was wiped out due to a sudden and fierce hail storm. As a consequence there will be no Mascarello Barolo for that year. Being a small winery with only 5 hectares of vineyard this was a big blow. Now fully in view at the open front door of the house Bartolo and his wife waited to see if the coming storm clouds would bring another destructive hail storm.

The message to me was clear, the direction of my thinking was confirmed and I began to believe that these people would see the merit of linking climate and architecture.
program introduction

The intent of the thesis is to expand on the ways in which a building can utilize the environmental conditions of its immediate surroundings such that it is more closely linked to its site. This background is used as the impetus to rethink and broaden the local building culture and traditions and thereby begin to redefine what it means for a building to be ‘contextual’.

Given this, the program for the thesis is not rethought, or questioned to any great extent but is conceived more as the problem which the building must engage in an efficient and architecturally interesting fashion. It is a vehicle with many rich possibilities used to explore these larger architectural issues.

After researching the winery typology with respect to the internal environmental conditions required in different parts of the winery and at different stages of the wine making process, program elements were grouped to facilitate the use of specific natural resources to satisfy specific requirements. The zones or program groups are explained in more detail below.
The first decision with extensive implications for the organization and spatiality of the winery was to determine what wines would be produced.

- 8 wines produced
- 31 total hectares vineyard
- 300,000 bottles / year capacity

- Barolo: 50,000 bottles, 7.7 hectares
- Barbaresco: 30,000 bottles, 4.6 hectares
- Nebbiolo d'Alba: 20,000 bottles, 3.1 hectares
- Barbera d'Alba: 20,000 bottles, 3.1 hectares
- Dolcetto delle Langhe Monregalesi: 20,000 bottles, 3.1 hectares
- Dolcetto di Dogliani: 20,000 bottles, 3.1 hectares
- Langhe Chardonnay: 20,000 bottles, 3.1 hectares
- Langhe Bianco: 20,000 bottles, 3.1 hectares
Wine making is an equipment intensive endeavor. Much of this equipment takes up significant space and requires even more space to move and maintain. On this page is the breakdown of some of this equipment, its general scale and how much of each is required to produce the desired amounts of wine.

- **Palette:**
  - 64 cases or 768 bottles
  - need: 390 palettes

- **Case:**
  - 12 bottles
  - need: 25,000 cases

- **Bottle cage:**
  - 500 bottles
  - need: 600 bottle cages

- **Bottle:**
  - 750 ml
  - need: 300,000 bottles

- **Botti:**
  - 3000 l or 4000 bottles
  - need: 40 botti

- **Barrique:**
  - 225 l or 300 bottles
  - need: 850 barrique

- **Fermentation tank:**
  - 7500 l or 10,000 bottles
  - need: 30 tanks
program groupings

From precedents studies, my own visits to wineries and interviews with wine makers, it became evident that the program could be grouped according to similar spatial environmental needs. The list below shows the final groupings of program elements accommodated in the proposal. Beyond environmental needs, the program must efficiently meet the sequencing needs of the process.

<table>
<thead>
<tr>
<th>spaces</th>
<th>criteria for grouping</th>
</tr>
</thead>
<tbody>
<tr>
<td>reception</td>
<td>stable temperature and humidity for occupation of these space on a regular daily basis by tourists and administrative staff.</td>
</tr>
<tr>
<td>offices, meeting rooms</td>
<td>needs can be met through a combination of mechanical systems and natural means when reasonable to do so.</td>
</tr>
<tr>
<td>public functions</td>
<td></td>
</tr>
<tr>
<td>wine tasting</td>
<td></td>
</tr>
<tr>
<td>wine makers residence</td>
<td></td>
</tr>
<tr>
<td>loading area</td>
<td>exposure to exterior conditions is acceptable, shading from sun in summer, access to water, electricity, drainage</td>
</tr>
<tr>
<td>intake and crush area</td>
<td></td>
</tr>
<tr>
<td>equipment storage</td>
<td>vehicle access</td>
</tr>
<tr>
<td>fermentation area</td>
<td>indirect exposure to external conditions is acceptable, stable temperature and humidity, shading from direct sunlight, sufficient ventilation during fermentation and for night cooling, access to water and electricity, space for equipment and people</td>
</tr>
<tr>
<td>wine makers lab</td>
<td></td>
</tr>
<tr>
<td>bottling</td>
<td></td>
</tr>
<tr>
<td>warehouse</td>
<td></td>
</tr>
<tr>
<td>barrel storage</td>
<td>partially or fully buried in the earth, environmental needs met through mass and stabilizing effect of earth, supplemented by mechanical systems if necessary, operable windows aid with ventilation</td>
</tr>
<tr>
<td>botti storage</td>
<td></td>
</tr>
<tr>
<td>bottle storage</td>
<td></td>
</tr>
</tbody>
</table>
linking program and climate

2.b

vineyard

2.c

harvest

2 - 6 weeks
wine: external conditions, grape intact
environmental: external conditions, covered or indoor

3 - 6 weeks
wine: external conditions, grape intact
environmental: external conditions, covered or indoor

7 - 30 days
wine:
31 - 32°C: 8-9 days
lower temp longer
environmental: wine temp conditions controlled in tank, cool, indirect light, ventilated

crush

fermentation

barrel ageing
One key to this thesis is to examine the wine making process to see where the needs of the process can be met through natural means. As an example, given the temperature and humidity requirements for barrel storage and ageing, what times of year will heating or cooling be needed, humidification and dehumidification? With this analysis, one can start to match up wine making requirements with ways in which to satisfy these needs using the naturally occurring resources around the site, such as rain water collection for equipment washing and temperature stabilization in the fermentation process.

In this design there were five areas in which program needs were met with resources available on site. The idea being to match up the opportunities available through on site resources with the needs of the wine making process. From here one can also begin to make decisions about systems, materials, orientation and other decisions that facilitate the integration of the building with its surroundings making it efficient and responsible yet without compromising the needs of the process. The five resources are utilized in the final proposal are: air, water, sun, earth and materials.

- **barrel ageing**
  - 3 - 36 months
  - wine: 15 - 18C, 6 months to 4 years
  - environmental: 55 - 60F, 80 - 85% RH, cool, artificial lighting, mech. ventilation

- **tasting**
  - days
  - wine: cool temperature
  - environment:
    - 55 - 60F, 80 - 85% RH, cool, natural or artificial indirect lighting, mech. ventilation

- **bottling**
  - weeks - 1 year
  - wine: cool temperature
  - environment:
    - 55 - 65F, 80 - 85% RH, cool, natural indirect lighting, mech. ventilation

- **bottle ageing**
  - days - weeks
  - wine: cool temperature
  - environment:
    - cool, natural or artificial lighting, natural ventilation, operable openings

- **warehouse**
  - 2.d
In seeking to find ways for architecture to be more intimately linked to its site, be environmentally responsible, and at the same time speak to ideas about context and identity, it is important to develop analytical tools and ways of seeing and understanding the problem in order to best see and take advantage of opportunities. The chart below illustrates the links between the needs of the winery program and some of the available resources on the site. Each color block below corresponds to a different space in the winery. The vertical gaps between the outside conditions at a particular time of year and the interior environmental requirements for that space suggest a space be heated or cooled, humidified or dehumidified as required. This diagram was used to begin to get an understanding of the magnitude of the needs and begin to suggest ways in which these needs might be met.

The weather information for this diagram was based on locations closest to the site of Barolo.
3.0 precedents
The site for this winery included several quite old structures which were rehabilitated and integrated into the winery program as small hotel and caretaker’s house. These consist of the three small buildings seen in the center of the plan below. The main winery industrial buildings wrap around these older structures, creating a centrally oriented outdoor area, and are intended to create a relatively neutral backdrop to these older buildings. The new buildings utilize sandblasted concrete with coloring and aggregates to closely match the stone of the older structures. The program also incorporates an explicit tourist path through the winery ending in a grand tasting room which affords views back across the outdoor area to the rest of the winery. The barrel ageing cellar is partly buried into the hillside behind and the bottle ageing area is submerged completely under the barrel ageing cellar.
This winery is located close to the thesis site and is one I visited in June 2003. This winery is collectively owned by approximately 12 corporate and private owners none of whom live in the Barolo region. It is a medium scale industrial producer with a capacity of about 4 million bottles a year. The plan consists of a series of large rectangular spaces mapping the wine making process going in a counter-clockwise direction in the plan below starting on the upper left. The structure to the lower right is the main public face of the winery (see bottom images) and houses a shop, wine tasting area and administrative offices. It takes on the scale, coloring and form of the traditional farm houses in the region as is evident in the image at lower right this page. The visitor path is completely elevated above the operations of the winery as it moves from entrance building to bottling room to barrel cellar. The exterior of the main industrial buildings is finished with alternating horizontal color bands that mimic another older winery in the region.
This Sir Norman Foster designed London municipal building on the banks of the Thames has much less to do with fitting in aesthetically or stylistically with its historic surroundings than with responding to site very specifically to maximize energy efficiency and without compromising comfort.

The building features a cooling strategy utilizing ground water pumped from below the building for air conditioning and grey water uses, a solar strategy using form and orientation to minimize solar gain and heat loss through the skin as well as progressively stepped floor plates intended to shade the floor below, a centralized heat recovery system which redirects heat to the periphery, and operable windows to permit natural ventilation.
This building responds to its surroundings in multiple ways. It utilizes the local material vocabulary of the place, heavy masonry, and composes a building which intelligently responds to the environmental conditions of the site for the purposes of the program. The brewery program requires stable temperature and humidity. The building solves this through its heavy double skin condition to insulate the inner program from solar gain. The high towers on the building bounce indirect light into the space below and encourage stack effect ventilation of the brewery hall coupled with the openings placed lower in the exterior envelope.
Though Peabody Terrace is characterized most boldly by its tall housing buildings, the complex includes several lower structures located to the rear of the site adjacent to the lower typical housing structures of the neighborhood. These lower elements were placed specifically to relate to the existing scale of the surrounding buildings although without mimicking their style or aesthetic. Also the complex is intended to accommodate local pedestrian access to the river via a broad brick walk cutting through the site.

Peabody Terrace, though, has been considered by some to be a disaster in terms of relating to its context. Its materiality, construction and lack traditional or familiar ornamentation has been characterized as alienating.
A process engaged with the neighborhood is the means by which the architects have achieved a contemporary building which could still be considered contextual. Issues of materiality and scale were dealt with and solved through a survey of the surrounding neighborhood buildings. This was based in the architect's belief that their work must be very locally based making connections and influences from the neighborhood prominent in the process and result.

While the clues may have been taken from local precedents, the result is not a repetition of those, but a highly thoughtful and original response to both these influences as well as the contemporary needs of the program.

Boston Public Library
Allston, Massachusetts
Machado and Silvetti
Quintessa Winery
Rutherford, Calif.
Walker Warner Architects
The Quintessa Winery in California is a thoughtful and thorough example of the integration of a program with its specific site and environmental conditions. The chief driving force for the design was to minimize the impact of the building on the surrounding landscape and vineyards and to use its siting and sustainable design principles to facilitate the wine making process.

The wine making building itself is set into the base of the hill and allows the trucks to pull onto a sod roof surface for the unloading of the grapes into the fermentation room below. These roof hatches also function to bring in light and aid in ventilation. The mass of the curving front facade, sod roof and cellars set into the earth allow for natural cooling and humidification so that the winery has no mechanical cooling system. The administrative building and tourist entrance is above ground and is characterized by large roof overhangs and wood screens to block excessive direct solar gain.

In talking with the designer of the mechanical systems of this winery their strategy was to break up the elements of the program into zones each with their own unique environmental needs. These zones were as follows:

- fermentation room: thermal mass in the facade and sod roof, night air cooling, natural ventilation
- cellars: earth cooling and humidity control, night ventilation
- above ground program elements: mechanical cooling and humidity control, evaporative cooling, shading
- case goods storage: mechanical cooling and dehumidification, night air cooling
Famiglia Anselma
Barolo, Italy
This winery is just outside the town of Barolo and is near the thesis project site. It was under construction during my visit and I spoke with one of the owners who showed me around the site.

Their plan is to focus exclusively on Barolo wine and this new building is intended to be a signature winery for their shift in focus. We spoke specifically about how the architecture was generated and what it is meant to convey. The form and materials of the building are exactly as they are in the surrounding existing structures: rough masonry walls, timber roof framing with ceramic tile roofing. The structure, though, of this winery is poured in place concrete with masonry infill all of which is sheathed in the natural found stone of the region intended to look like a load bearing masonry building. The masonry exterior was characterized as the appropriate 'clothing' for the structure beneath which is to present this prestigious and historic wine in the tradition of the architectural and aesthetic tradition of the region.

Another interesting approach taken in this building concerns all of the detailed stone and brick work. They were very interested in the richness of the local colors of earth and stone and so limited themselves to only what they could find locally. All of the detailed work was designed only when a material was decided upon and enough of it could be collected. There were no drawings done of it. First, stones and bricks were collected from fields and old crumbling farm houses around the region. Once these were collected they would go through several iterations of building a detail full scale with what they had collected until they had come upon a detail they liked and then based on that and how much of the material they had only then would they be able to build the final detail in place.
Stargazer's Winery
Pennsylvania
Stargazer's is a small winery in the hill country outside Philadelphia, Pennsylvania. It's production is only 10,000 bottles a year and it is run by a retired couple who have a passion for wine making and sustainable design. I visited them early in the semester after hearing about some of the sustainable measures they have incorporated into their small operation.

Their winery is partly buried into the ground and the roof extends over an external intake/crush area. The roof is oriented and sloped such that a series of photovoltaic panels could be mounted on its southern face. The 30 panels provide all of the electricity needs for their house and winery for most of the year. It is only during the equipment intensive period of the grape harvest in the fall that the electricity generated by the photovoltaic panels must be supplemented with electricity from the grid.

The roof is a standing seam metal surface. The surface and gutters collect and direct the water to the back of the winery where there are four 1000 gallon cisterns buried in the earth. Other than for equipment cleaning, this water, cooled by the earth's mass, is used in the fermentation process. The temperature in the tanks can rise quite high during fermentation and to control this, cooled fluid is run around the exterior of the tank, called a jacket, and this prevents the temperature of the juice inside from getting too high.

Lastly, at the back of the winery there are several vents which emerge out of the ground and run to the floor level in the bottle cellar underneath. These ducts aid in ventilation and cooling. Electric fans inside help with this.
Diagram showing some of the environmental systems:
- wind driven ventilation and heat recovery
- rainwater collection
- biofuel CHP plant
- pv for electric car charge
- living machine waste-water treatment

BedZed Housing
Beddington, England
Among the many useful sustainable lessons to learn from this project, the following ones were of particular interest for researching the thesis. The solar energy strategy uses direct solar gain to heat the main living spaces of the housing units all of which are oriented on site to get sun. Photovoltaic panels are integrated into the facade and roof planes and provide enough electricity to power up to 40 electric vehicles as residents are encouraged to use. Rainwater is also collected from the roof plane and used for grey water uses in the units.

The most interesting element of the BedZed project is the combined heat and power plant, also known as a cogeneration plant. Run by Exus Energy, tree clippings and tree waste from around the region are used in a system where they are burned to generate electricity as well as the heat for all the hot water in the complex. The diagram above shows the process.
4.0 site analysis
One inspiration for the site came from an article in the New York Times in February of 2003. The article spoke about the growth in the wine industry in the Langhe region of Italy - where Barolo wine is made - but focused upon the recent transition wine makers have been forced to go through changing from traditional methods to more contemporary methods of wine making. These changes were prompted by market pressure from other wine growing regions which were improving their wines and production using new technology.

The other aspect of the article which made this transition difficult, was that the nebbiolo grape only grows in this small area of hills and valleys with any success in order to produce great wine. Over many centuries the nebbiolo has been cultivated in many other places but without any success. This defines the Langhe region as an incredibly unique region within the wine making world. Its unique place and great tradition of wine making have combined to shape the identity of this place. So deeply rooted is this identity that as changes in the wine industry began the wine makers here took the changes as a threat to their culture and identity.
culture and history

As stated above the inspiration to utilize this region for my thesis research and design project came from an article in the New York Times and the interests in provoked in me.

This agricultural area lies in the foothills of the Maritime Appenines in the south half of the Po river valley. The Tanaro river runs roughly north from these mountains and feeds into the Po. Historically it is been a much more diversified agricultural area growing many different crops and raising various animals. The region has always cultivated grapes and produced wine but this has generally been of a more local or regional distribution.

Among red wines and Italian wines in particular Barolo is known as the King. Harsh and difficult to drink when young. If aged 8 years or so it is a wine of great balance and taste. Its ageing potential depending on the vintage is tremendous. It may still be close to its peak even after forty even fifty years of cellaring. While the prestige of Barolo has been built up over many
centuries of cultivating the unique nebbiolo grape on the slopes in the Langhe hills it has only been in the last few decades that viticulture has taken over the region as the most lucrative of crops. And so many families have shifted to the exclusive cultivation of wine grapes.

Being a largely agricultural region the landscape is thoroughly dotted with houses and farm buildings at regular intervals in every direction. Since these houses and wineries are almost exclusively family based - going back many generations - these structures are often a mix of many phases of construction. They have evolved as families have grown or shrunk and as their agricultural focus has shifted from other crops to wine or existing wine making operations are expanded to accommodate growing production. After travelling through the area and speaking with several wine makers the ad-hoc nature of house/winery construction is evident. Several of the wine makers I spoke with proudly pointed out the differences in the building and usually referenced when a father, grandfather or great grandfather ran the operation and made an addition to the winery. Three of the wineries I visited made such references. These included the Aldo Conterno, Bartolo Mascarello and Pio Cesare wineries. The Pio Cesare Winery boasted a stone cellar wall originally built in the middle ages and one dating back to the renaissance.

Since many families have recognized the potential worldwide market for Barolo and other local wines many have adopted the newer technologies and expanded their wine making operations.
The following are some of the features of the land in the Langhe region where Barolo and many other wines are cultivated.

- stretches from the Ligurian Maritime Alps in the south to the Tanaro river valley
- 'langhe' comes from the Latin word of tongue, relating to the land morphology
- it is a narrow strip of steep hills
- soils comprise sedimentary clay and calcareous marl alternating with grey-blue sandstone, layers of sand and yellow-brown or yellow sandstone, and layers of sand or reddish-grey sandstone alternating with grey marl
- a high limestone content yields an alkaline soil
- the marl soil at La Morra and Barolo give elegant rich wines that evolve sooner
- in other parts of the Barolo zone the soil yields a more robust, alcoholic wine with greater ageing potential

The boundaries in the maps on these pages correspond with the Barolo DOCG zone. This is the exclusive growing zone for the Nebbiolo grape that can be called Barolo. Bar at base of maps is 1 KM.
Map: topography, roads, buildings

- contour lines at 10M intervals
- Barolo town
- paved roads
- unpaved roads
- elev: 380 M
- site
- Aldo Conterno Winery

Legend:
- 100 M
- 500 M
- 1000 M
Map: buildings, land use, streams
Map: topography, roads, streams, select vineyards, wooded areas

- vineyard of known quality
- steep wooded terrain
- site
climate:
- wettest months are May at ~100mm, April at 80mm, September at ~70mm
- rain is crucial during flowering in the spring and can cause substantial reduction in yield, and during harvest when rain can lead to mould, rot and other problems
- nebbiolo is a very hardy variety and the rains in September and October generally don’t affect the berries
- spring is generally rainy
- summer is hot and often drought-afflicted
- there is excellent sunlight in the area
- hail can have a severe impact on the quality and quantity of the grape harvest and can cause losses from 20 percent up to a total loss of harvest, hail never affects the entire area at the same time though

sun: relatively steep south facing slope

soils: sedimentary clay, calcereous marls, sandstone
- marl is a combination of sand (30%), clay (55%) and limestone (15%)
- the limestone content gives a very alkaline soil with a pH of 8 depending of which side of the valley a vineyard lies the barolo’s it produces may be soft and age more quickly, or may be more robust with greater ageing potential
- Wine is often grown on what is considered very marginal soil for other crops. Is it often very sandy, which is good for root growth. This soils will also have implications as far structural needs for underground spaces.

water: the site is located on a hilltop, as are many residences and wineries in the region and so there is no immediate body of water, still or running. The region gets monthly average rainfall from 41 mm in January to 120 mm in May.
- With rainfall amounts and slope of the site there is good opportunity for a rainwater collection system and under ground storage to maintain constant temperature

other site features: The site has a stand of trees to the NW. The building should try to avoid taking out trees as much as possible, but what does come down for construction or other means over time can be used in the CHP plant in the winery. The site is a small hilltop toward the center of the valley. The towns of Barolo and Castiglione Falletto are both close and Barolo can be seen from the site. The site has great views of almost the entire valley.
With the exception of the town of Barolo, the other towns in the region are almost without exception at the top of some high point. Also many private houses and other wineries occupy higher points in the valley. Thus it seemed somewhat natural to want to propose a winery on a high point. Views of the entire region from this site also made it attractive.

I was generally looking for hillsides that were unoccupied by either another building or a vineyard and that seemed to offer a southern exposure. In the endeavor to design a winery which harnesses the climate and the land for its proposed site.
raison d'être, a site with abundant access to sunlight and a sloped site are dispensable. This high point in the valley is a distinguished promontory: there not many other taller features in the immediate vicinity and so seems to hold a central location. It is also geographically centrally located among several of the towns in the region - notably Barolo and Castiglione Falletto. The point has great visibility of the rest of the valley, and there is great visibility of this point from all over the valley as well.

The sloped site will help the project to develop a thoughtful and useful relationship of program elements to the land and to the climatic conditions of the locality.
existing local materials and construction methods
It is evident from the images here that the typical materials are stone, brick and concrete with timber and ceramic tile roofing. The old towns in the Langhe region are dominated by this type of construction. Though much of what you see there that looks old that is not necessarily the case. The typical scenario is for a family to add on to a structure as needed so several phases of construction are often evident adjacent to one another. Newer construction consists of a lot of concrete masonry and brick as infill for a concrete structure either cast in place or pre-cast. Contemporary architecture is not widespread but does occur. There are movements underway in the area to preserve and promote the existing and indigenous architecture and to promote its likeness in new buildings primarily for the promotion of tourism.

All around the region during my visit there were cranes on nearly every hillside from expanding wineries or family fortunes from the wine business. But this is still an obviously an agricultural area. In the tiny regional capital town of Alba there were probably six or more ongoing construction projects for buildings in the city center. As a result there were many opportunities to see on-going construction at several scales. Several of the wineries I visited were undergoing construction as well.
5.0 design development
design concept

right: early design sketches linking program, site and environment

far right: sectional diagram exhibiting environmental forces at work on the site
Early thoughts about the program and site were guided by the strict environmental needs of the process. Choosing a steeply sloped site presented the opportunity to utilize the earth to help achieve some of these needs. Initial arrangements were very linear with slight shifts in plan and section. Sequential spaces move further into the earth and back into the hillside. There was also an early recognition to take advantage of sunlight and some organizational correspondence between the needs of various environmental zones and the seasonal nature of winery activity.

The thinking that guided the final proposal comes from the belief that there is tremendous opportunity available in the things that occur on site, on any site, naturally. Thus, the area of focus became to isolate these potential resources on the site and then to design ways in which the building could engage these resources to meet the needs of the wine making process. It is also important to find opportunities to rethink building components and systems in order to find ways in which the building could more actively facilitate the program within. The building is to perform a transformative role between the environment and process of wine making.
orientation and massing

The appropriate massing and orientation was developed over this series of sketches and small models. There were many logistical concerns over the siting particularly with regard to the path of the grapes to and through the winery and back out. Would the program be broken up between above ground elements and below ground elements? Would it be designated by environmental zone? What were the spatial needs for the equipment and trucks? How large? How often?

The final proposal calls for a linear process with the building stepping further into the earth for the cellars and back out for the bottles. The warehouse is moved across the road to separate out the incoming from the outgoing. The massing is broken up along these lines such that it doesn't present itself as a overly massive industrial building. All elements of the building have some relationship to both earth and sky but based on environmental concerns some spaces are buried while others are not.
iteration one

This iteration consisted of two intersecting rectangular volumes which nestled the building into the site between the two hilltops behind. The approach passes by the winemaker's house and around a hilltop and then meets the building at the joint between the two volumes. The grapes/wine follow a looping path in this iteration through the winery. First entering the wing with the fermentation room then moving into the cellars. The program is split between these volumes by which elements can be above ground and which elements would benefit environmentally from being below ground. Thus all of the cellar areas are either partially or fully buried and the fermentation room, warehouse, administration and tourist areas are above ground.
iteration two

This iteration makes a stronger more explicit connection to the house. The control or responsibility of the wine maker is manifested in a descending set of stairs and landings which cut through the vineyards and join the main building at the intake location. The path of the wine is more of a linear path entering and exiting from the same point close to the unpaved access road to the right of the house. In this iteration the building engages the earth more dramatically pushed back into the hillside more and burying more of the program. The intersecting volumes of the previous iteration has given way to a more loose linking of the spaces which respond more to the contours.
detail study model

Study model of area where volumes of space merge and the wine makes its way underground to the cellars. Working out how environmental zones are separated and articulated based on program adjacencies, circulation and materiality. Sketches at right are working out details in the fermentation room where wood, stone and concrete come together.
roof and facade development
Studies for the roof and facade of the main building. Working out the function of each of the planes with the purpose of integrating their typically understood architectural functions with the internal program environmental control requirements. One early idea was to integrate both planes into a single arching element. The use of a double skin for both the facade and roof was an early idea which continued throughout and into the final proposal.

On this page are early models for a roof top pv system set above a lower waterproof roof layer. The pv system would be comprised to 2M square panels faceted to develop a south facing slope and would be lapped with a small gap between panels to allow air flow between roof layers and water penetration to the opaque roof layer below. The diagonal configuration, at bottom, was chosen to align the panels to the south for the best possible solar exposure.
facade design
Explained in more detail on the following pages, these two pages illustrate the use of wood planks as louvers as a completely external sun shading device. The removable planks are white oak and are merely held in place on the framework. The planks stay in place for approximately three years as the wood dries to an appropriately level. They are then taken off site and built into wine barrels which come back to the winery to perform that function for three to five years. As the wood dries the building takes the opportunity to utilize them in this additional capacity until they are ready for wine barrel construction.
material reuse

In my visit to Italy I discovered the construction of wine barrels is extremely important to the wine making process infusing the wine with flavors and ageing potential. At one winery I observed that the wood used to make the barrels was stored outside to dry for approximately three years. And then once the barrel is put to use in the winery it only has a life span of about three years before losing its influence over the taste of the wine. I felt that this arrangement presented an opportunity for the functioning of the building and to simultaneously create a relevant representation of the local industry and culture. If the raw wood planks must sit for such a long period of time why could they not be used by the building in some way that would allow them to dry and would function in some other capacity for the building as well?

This opportunity led to a series of components and details for the complete utilization of the material on site through its life span. The above is a continuum of these functions and time, accounting for the wood through its multiple incarnations in the building. The high quality of the material coupled with its limited use in any one function ensure its potential to be continually reworked into new details until the material itself becomes too deteriorated.
The next few pages illustrate several post-barrel stave uses for this wood. The detail proposed above is for an interior screening element composed of the barrel stave wood cut into thin strips and stacked. The staves could be built into panels hinged between them or could be built into a more rigid arrangement. Uses in the proposal include vertical screens, handrails, and ceiling treatments. It became a labor intensive process to cut down the thicker staves into these thin strips but the process could be streamlined for efficient production.

The details proposed below are for the utilization of the stave wood as flooring. The option to the left is comprised of the thin strips also represented in the detail above. The two details at right call for the staves to be cut down into rectangular sections to produced a more typical flooring pattern. The blackened pieces are from the use of barrel staves that have been fire toasted rather than air dried to influence wine taste.
The detail shown on this page is for the barrel staves to be used in their shape once the barrel is disassembled. Held in channels at all edges the staves are threaded and stacked on to vertical steel rods. The finish is left rough to emphasize their previous existence in barrel form. The width of the assembly is one meter and is ideal for interior doors, partition systems, or facade screens. The final building proposal utilizes all of these functions.
Taking the BedZed precedent as an example, the integration of a CHP plant into the winery is proposed to take the now well used stave wood - and perhaps other local timber or vine material - burn it and turn it into a source of electricity and hot water for the winery. The need for hot water in the equipment cleaning process could be met with such an arrangement.
6.0 final proposal
Semi-opaque pv panels generate electricity for the winery during lower demand times and supplement grid power at peak times. This is also used to power electric vehicles during harvest time and for other local travel purposes.

Panels are faceted with gaps between them. They sit above the proper roof creating a void between them allowing the intermediate air to heat up encouraging air flow and aiding exhaust ventilation at the higher points of the fermentation room below.

Removable white oak planks sit on a framework outside the building’s envelope shading an exterior visitor’s path and the building during the summer and facilitates indirect lighting of the spaces behind. The planks are air-dried over time in this facade system for later use in wine barrels.
rain water collection and uses

Water is collected on the lower of the two roof layers and directed to water holding tanks embedded in the hill behind the winery.

The earth cooled water is piped through the floor slabs of the fermentation and bottle cellar rooms for cooling and temperature moderation of those spaces. In summer the cool slab combined with the heated roof will encourage air flow to the top of the space and aid in ventilation of off-gases from the fermentation process.

The earth cooled water is also piped into the jackets on the fermentation tanks to control temperatures during the fermentation process.

Water is also collected for cleaning purposes throughout the winery. Floor drains collect this grey water, treat it and store it back in the tanks for similar uses later.

Based on rough estimates, there is more than enough yearly rainfall and roof surface area to meet the needs of all of these functions.
The fermentation process produces a lot of CO2 and so it is important that this space is properly and regularly ventilated.

The double roof system is designed such that the air space between is heated encouraging air flow and pulling air out of the fermentation room aiding in ventilation. The upper layer of PV panels is faceted and permeable to air flow.

The form of the roof layers with the tall fermentation space below is intended to encourage air stratification and ventilation through the upper operable windows. The water cooled slab also encourages this air flow condition.

At the facade, the white oak planks serve to interrupt the flow of wind to the glass facade behind. In the process the removable planks are being air dried for later use in wine barrels.
The history and value of burying wine cellars is long and well proven. Here too, the barrel cellars are covered with earth to aid in the temperature and humidity requirements of the spaces below. The bottle cellar is semi-embedded as well.

In the Barrique cellar, there are gaps in the slab exposing the cellar air to the earth below which improves the temperature and humidity control performance of the cellar.

Similarly, the water storage tanks are embedded in the ground to benefit from the earth's cool stable temperature. Cooling of the slab and control of the fermentation process both utilize this earth chilled water.
Secondary roof, comprised of 2M square pv panels, powers electric vehicles and supplements winery power needs.

diversion, absorption by earth

rain water collection roof

secondary collection

Water collected meets need of winery for cleaning, fermentation temperature control, ambient cooling of fermentation room and bottle cellar.

fill earth

excavated earth

All excavated earth for construction is kept on site and reused to regrade the landscape around the winery.
second floor plan

administration, offices
daily use

public spaces, occasional use

outdoor spaces, daily use

program / use diagram

mechanical and natural controls
predominantly natural controls,
some exterior exposure

environmental zone diagram
first floor plan

outdoor spaces, short term daily and seasonal use
early stages, short term seasonal use
cellars, daily long-term use

program / use diagram

mechanical and natural controls
exterior condition
predominantly natural controls, some exterior exposure
natural controls - buried spaces, no exterior exposure

environmental zone diagram
intake and house
fermentation room

bottle cellar: partially buried spaces, no exterior exposure
offices: mechanical and natural controls
double roof system: pv panels above, rainwater collection below, space for ventilation
fermentation: predominantly natural controls, some exterior exposure, operable openings
visitor path: exterior condition, sun shading, barrel plank drying system

excavation and fill diagram

environmental zones diagram
bottling and public areas

fill earth
excavated earth

bottle cellar: partially buried spaces, no exterior exposure
offices: mechanical and natural controls
public space: some exterior exposure, operable openings
bottle area: mechanical and natural controls

excavation and fill diagram
environmental zones diagram
botti cellar

excavation and fill diagram

environmental zones diagram

fill earth
excavated earth

bottle cellar: partially buried spaces, no exterior exposure
tourist path: exterior condition
barrique cellar

excavated earth
fill earth

barrique cellar: buried space, no exterior exposure

visitor path: exterior condition, sun shading, barrel plank drying system

excavation and fill diagram
environmental zones diagram
7.0 conclusion

The winery program proved an excellent platform to research and design a building to address environmental concerns and to intimately tie the building to the site as well as explore issues of identity and contextuality. There was a plethora of information and possible directions to take with such a project.

The possibility of creating buildings that are more energy and resource self-sufficient and to seek opportunities in on-site resource use is something which became evident during this project. Contrasted with a time when the elements were seen only as problems, industrialization permitted building assembly from globally produced components, and utilities harnessed from large natural resource deposits were delivered from afar via small anonymous wires or pipes, the opportunity today is for an environmentally responsible building to be completely self-sufficient without compromising comfort, performance or life span - in fact component life span may be extended and redefined several times as is proposed in this project.

Tieing these issues to the idea of context in architecture goes back to the argument that our values are constantly shifting, even on a daily basis in small ways, and to constrain architecture to a limited set of aesthetic constraints based on traditional building styles or any past aesthetic sense is to ignore our ever-shifting surroundings and to keep us mired in an aesthetically homogenous world. As coop himmelblau aptly point out, by "rejecting contemporary architecture, society is losing its three-dimensional forms of expression" which ultimately deadens the energy and creativity of our society.
As architects we are responsible for how people use buildings and what they think of them, but architects are also responsible for a range of other factors which represent both constraints and opportunities in creating a building. The move toward more environmentally responsible buildings pointedly calls into question the pursuit of a narrow definition of context in architecture. It also illuminates a course which seeks to broaden our understanding of context and recognizes our shifting values and increasing importance placed on environmental concerns.

Initially, the leap from the general idea of context in architecture to the specificity of an environmentally responsible winery in Italy specifically seemed quite large. As the project developed the link became more clear though it is still not fully realized. This project allowed a convergence of disparate and long-running architectural interests into a single project. It confirmed the value of the investigation and potential of the direction. There is clearly much more work to be done in order to convey the idea that the definition of architectural context is neither simple nor constant in architecture and that the environmental concerns engaged by this thesis present a viable alternative to the definitions of context bound narrowly to style.
8.0 image credits

Unless otherwise noted all other illustrations, photographs and images are by author.

1.0 background
1.b  Ibid

2.0 program
2.d  Ibid

3.0 precedents
3.a  Cohn, David. Architectural Record, May 2003.
3.b  Ibid
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4.0 Site analysis
4.a Slow Food Editore: A Wine Atlas of the Langhe
4.b Courtesy of Poderi Aldo Conterno
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5.0 Design development
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6.0 Final proposal
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