
by

Kurt Frederick Eichenberger

Bachelor of Environmental Design in Architecture (B.E.D.)
North Carolina State University (1977)

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Signature of Author Kurt Frederick Eichenberger
Kurt F. Eichenberger, Department of Architecture
June 8, 1982

Certified By Stanford Anderson, Prof. of History & Architecture, Thesis Supervisor

Accepted By Shun Kanda, Assoc. Prof. Architecture Design Committee Chairman

SEP 21 1982
This thesis is dedicated to world peace.
DESIGN & CONSTRUCTION TECHNIQUES
OF AN AMERICAN VERNACULAR ARCHITECT:
THE WORK OF DR. HENRY CHAPMAN MERCER

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ABSTRACT

The design and building process of Dr. Henry Chapman Mercer is explored for its relationship to vernacular design. The vehicle for this exploration is 'Fonthill,' the home of Dr. Mercer constructed by him in 1908. Complete measured drawings of Fonthill and cylindrical perspective photography were used to document the existing building. Analysis includes excerpts from Mercer's design and construction drawings, design model and design notebook.

Discussion and analysis center around the design and building strategies that contributed to the character or 'sense of place' of Fonthill. The appendices include discussion of measuring and drawing methods employed in producing the measured drawings, and discussion of cylindrical perspective photography techniques utilizing a pinhole camera.

Thesis Supervisor: Stanford Anderson
Title: Professor of History and Architecture
ACKNOWLEDGEMENTS

Many people have helped me with this work. I thank the Bucks County Historical Society and the staff of the Spruance Library and the staff of the Fonthill Museum for their generosity and assistance in opening Fonthill and the Mercer Archives to me: Lynn Poirier, Terry McNeily, Judy Hohmann, Angel Conran, Ken Hinde, Linda Dyke, Helene Walls and Judy Hayman, thank you. I would also like to thank Jim Blackaby and Angel for their hospitality.

The measuring and drawing of Fonthill would have been impossible without the large and careful contribution of Eric Haugness. I would also like to thank Judy Hayman, Andy Hayman, Avi Wanger, Craig Unanoff and Joyce Frazier for their assistance with the measuring. Mark Herdter deserves great credit for his technical advice and help with photography. My hat is off to Jenifer Simpson, my typist, who knows much more than I about spelling and punctuation.

Lastly I would like to thank my thesis committee, Stan Anderson, Jan Wampler and Mike Reynolds for their encouragement, advice and willingness to allow me more rope than necessary.
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>8</td>
</tr>
<tr>
<td>1. Experience of Fonthill</td>
<td>8</td>
</tr>
<tr>
<td>2. Timeline of Henry Mercer</td>
<td>59</td>
</tr>
<tr>
<td>3. Program of Fonthill</td>
<td>67</td>
</tr>
<tr>
<td>4. Henry Mercer and Vernacular Design</td>
<td>72</td>
</tr>
<tr>
<td>5. The Building Process</td>
<td>91</td>
</tr>
<tr>
<td>Conclusions</td>
<td>103</td>
</tr>
<tr>
<td>Appendices</td>
<td></td>
</tr>
<tr>
<td>A. The Measured Drawings</td>
<td>104</td>
</tr>
<tr>
<td>B. Panoramic Photography</td>
<td>105</td>
</tr>
<tr>
<td>Bibliography</td>
<td>113</td>
</tr>
</tbody>
</table>
INTRODUCTORY STATEMENT

I came upon Fonthill one summer day while travelling alone by bicycle from Boston to Raleigh, North Carolina. The spirit of independence and adventure of my trip, how to read maps, how to ignore maps, what I was learning about charting a course in unknown territory: here it all was in architecture, the record of one journey like my own -- alone in a different time and place. Fonthill is Europe, Fonthill is Moravian and Spanish tile, stoveplates, obscure books, memories and a poignant exposition about American self-reliance.

The work of this thesis is my attempt to understand the making of Fonthill; behind the idiosyncrasy and uniqueness of Fonthill is something quite common. Vernacular design is about patterns, experience, imagination and being smart.

I have enjoyed this experience. The organization of this thesis reflects my growing understanding of the importance of direct experience as well as abstraction in design. I can't give you Fonthill, but I can show you what I saw there.

CHAPTER ONE
EXPERIENCE OF FONTHILL

Henry Mercer travelled widely before the age of fifty and not at all after this time. He began construction of his home 'Fonthill' at the age of fifty-two. Fonthill has a strong character or 'sense of place,' which to me is its value. Many buildings lack this 'sense of place'; they, instead, have the feeling of being mere abstractions from the drawing board.

The following was penned by Mr. Charles C. Abbott. After visiting Henry Mercer and Fonthill I found this handwritten manuscript
in an album of Mercer's Fonthill photos:

Reincarnation of the storied past
Skyward in majesty thy walls arise;
In strength assuring us they shall last,
Not crumble as the common structure dies,
Thy tower mantled with the morning light
Proudly acclaims the past still alive,
Where prose, grim [unsaid?]—o the sorry sight,
Would have the world in soulless fashion thrive,
All honor then to him who raised the pile,
Where daydreams wander through each classic room,
Where honest speech is never brought to trial,
Nor trustful candor hears its certain doom,
Defying critics, faithful though wrought,
Thou master building of artful thought.

Charles C. Abbott
for HCM, in recollection of a pleasant day,
Three Beeches
Trenton, New Jersey
August 14, 1910.

Fig. 1 Front gates of Fonthill.
Fonthill also demanded a response from me. I offer these drawings and photographs as the residue of my experience at Fonthill.

Fig. 2 Possible names for house (from Design Notebook, Series 8, Vol. 10, Fonthill Papers).
HENRY MERCER'S WORKING DRAWING FOR THE CELLAR.
MEASURED DRAWINGS OF FONTHILL

1. WEST TERRACE.
2. MORNING ROOM.
3. MORNING ROOM BATH.
4. SALOON.
5. LIBRARY.
6. SECOND LEVEL OF THE LIFT.
7. ENTRY HALL.
8. ENTRY.
9. CONSERVATORY.
10. FRONT KITCHEN.
11. BACK KITCHEN.
12. OVEN ROOM.
FIGURE 4  PLAN OF FIRST LEVEL ABOVE CELLAR.
1. Morning room.
2. Morning room gallery.
3. Saloon.
4. Library.
5. Library gallery.
6. Third level of the lift.
7. Saloon gallery.
8. Hall of Four Seasons.
10. '1742' room.
11. Open to kitchen below.
13. Pine Room.
14. Block Room.
15. Stair Room.
Figure 5  Plan of Second Level.
1. Study
2. Dormer Room Bath
3. Dormer Room
4. Map Room
5. West Bath
6. Second Floor Hallway
7. Yellow Bath
8. West Room
9. Yellow Room
10. Light Shaft Open to Saloon
11. Fourth Level of the Lift
12. Hall of Four Seasons
13. Breakfast Room
14. Smoking Room
15. Upper Kitchen Bath
16. Marine Room
17. Pompeii Room
18. Store Room
Figure 6  Plan of Third Level.
1. Columbus Room
2. Columbus Bath
3. Bow Room
4. Terrace
5. Dressing Area
6. Terrace Room Bath
7. Terrace Room
8. Spring Terrace
9. Spring Kitchen
10. Fifth Level of Lift
11. East Bath
12. East Room
13. Terrace
14. Crane Room
15. Tent Loft
16. Open to Space Below
FIGURE 7  PLAN OF FOURTH LEVEL.
1. Wind Room
2. Cisterns
FIGURE 8  FIFTH LEVEL.

FIGURE 9  SIXTH LEVEL.
FIGURE 10  ROOF PLAN.
FIG. LONGITUDINAL SECTION
Figure 13  Second level; saloon and saloon gallery.
FIGURE 14 Panorama from Saloon Gallery, overlooking Saloon.
FIGURE 15  LONGITUDINAL SECTION; SALOON AND SALOON GALLERY.
FIGURE 16 VERTICAL PANORAMA OF SALOON.
FIGURE 17  THIRD LEVEL; MAP ROOM.
**Figure 18** Panorama of Map Room.
Figure 19  THIRD LEVEL; SECOND FLOOR HALLWAY.
FIGURE 20  PANORAMA OF SECOND FLOOR HALLWAY.
Figure 21  Third level; Hall of Four Seasons.
Figure 22  Panorama of Hall of Four Seasons
Figure 23  Third Level, Yellow Room
Figure 24: Panorama of Yellow Room.
NOTES ABOUT TILES

Henry Mercer was a tilemaker. Tiles embellish the walls and ceilings of Fonthill. They are wonderful and successful as decoration because of the meaning and beauty they convey at many different scales. I spent three weeks in Fonthill measuring. After the first week I began to see beyond the shapes and space and notice groups of tile and the color of the walls. After two weeks I began to see the individual tiles; their form and glazes. As I ended my stay I glimpsed the meaning of the stories. There is more; Henry Mercer equipped and financed expeditions to far parts of the world to collect comparative examples of tools. Collectors also sent him tiles, some quite old. These tiles were set in the walls of Fonthill and tell the story of tilemaking. The placement of tiles is as wonderful as the events they mark of Mercer's life.

The ceiling and capitol tiles are of Mercer's design. The tiles were placed face down in the sand of the formwork and then cast into place with the concrete. The method enriches long planning with spontaneity. The rooms have different themes visually and in story line. Henry Mercer wrote The Bible in Iron, a definitive book on the history of early iron stove plate. Concrete casts of the stove plates adorn the saloon along with the Mercer tiles they inspired. Dr. Henry Mercer was an archeologist. The Columbus Room tells the story of the coming of people to America. This room is dedicated to Aunt Elizabeth Lawrence, his intellectual guide.

Excerpt from HCM's typewritten draft, "Guide to the tiles of the Columbus Room":

52
Fonthill

Columbus Room:
The Vaulted Ceiling: This rests on two columns, two pilasters, and nine corbels, and is divided into nine panels, some of which are subdivided by the groins of the vaults into four triangular subdivisions. The whole is decorated with tiles adapted from wood cuts of the sixteenth century, illustrating events in the voyages of Columbus, and the discovery and exploration of America.

Triangle 2 and 3. To the right and left. Departure of Columbus in replica. The caravels Santa Maria, Nina, and Pinta, standing under sail in the harbor of Palos with Columbus saying farewell to Ferdinand and Isabella before the city walls, from a German print of the sixteenth century.

Fifth Panel: East. Two large triangles repeat an ancient picture of Carib Indians cooking and eating human flesh. Inscription in English. First known picture of Native Americans published.
at Augsburg Circa Anno MD (about year 1500). Inscription in Latin -- 'Gentes nuper reperti.' Translation—people newly discovered. Also 'Eorum longevitas CL annos durat.' Translation—Their age lasts one hundred and fifty years. Also 'Homines inculti anthropophagi sunt.' Translation—The savage men are cannibals.

4. Fu Shan—According to a possible inference from an ancient Chinese story, two Chinese missionaries, who have crossed Behring Straits in the fifth century, and descended the Pacific coast of America; here approach the King of Mexico, about a thousand years before Columbus.

...  

8. Leif Ericsson—A Norwegian sea rover, who, according to an ancient Norse manuscript, known as the Codex Flatoyensis, compiled from oral tradition about 1390, discovered America about the year 1000, or 494 years before Columbus.

3. Crossing Behring Straits—Boats crowded with men, the fabled sea ser-

\[\text{Fig.26 Beamed ceiling in the study (Mercer construction photography, courtesy Spruance Library).}\]
pelt, a polar bear upon an ice floe, and blowing heads of storm demons, rudely typify the strange adventure, when unknown savages first cross Behring Straits to discover America.

6. Saint Brandan—One of the mythical islands of the once unknown Atlantic Ocean marked upon maps before Columbus, supposed to have been discovered and Christianized in the sixth century by the Irish Saint Brandan, who here appears under a rainbow seated upon a sea crag, blowing a horn, as he looks down upon the island.

The Capitals of Columns and Corbels: These are decorated with floral baskets and scrolls in the style of the sixteenth century, surrounding the initials E.L. for Elizabeth Lawrence, to whose memory the room is dedicated, and enclosing inscriptions in rhyme in her honor as follows:

East Column:
As Tiles in Bright fire burn, bright thoughts to E.L. turn:
Fig. 28 Gallery of library.
Chapter Two
Time Line of Henry Mercer
The purpose of this history is to present briefly the flow of Dr. Henry Chapman Mercer's life. The range of which is important to the understanding of Fonthill. Design references from experience or books are a powerful tool for architectural imagery. Good design requires an understanding of how to make things and how made things fit in their historical context.

<table>
<thead>
<tr>
<th>Source</th>
<th>Date</th>
<th>Age</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1684</td>
<td></td>
<td>John Chapman arrives in Bucks County from England. This is Henry Mercer's great-great-great-great grandfather, mother's side.</td>
</tr>
<tr>
<td>B</td>
<td>1720</td>
<td></td>
<td>John Mercer, of Marlborough, arrives in Virginia. This is Henry Mercer's great-great grandfather on his father's side.</td>
</tr>
<tr>
<td>F</td>
<td>June 24, 1856</td>
<td>7yrs.</td>
<td>Henry Chapman Mercer is born at Duch Lane, Doylestown, Pennsylvania.</td>
</tr>
<tr>
<td>F</td>
<td>1863</td>
<td>7yrs.</td>
<td>Living on farm in Doylestown.</td>
</tr>
<tr>
<td>A</td>
<td>1870</td>
<td>14yrs.</td>
<td>First trip to Europe. Travels to England, France, Germany, Austria and Italy. Travels with his mother,</td>
</tr>
</tbody>
</table>
Mary Chapman Mercer, and his aunt, Fanny Chapman. His aunt Lela is visited while they are in Florence. Aunt Lela will travel with Mercer a number of times in the future; she is instrumental in his education and the financing of later projects.

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<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td>1880</td>
<td>J</td>
</tr>
<tr>
<td>1881</td>
<td>C,J</td>
</tr>
<tr>
<td>1881-82</td>
<td>F,A</td>
</tr>
<tr>
<td>1883</td>
<td>A</td>
</tr>
<tr>
<td>1883</td>
<td>F</td>
</tr>
<tr>
<td>1885</td>
<td>C,J</td>
</tr>
<tr>
<td>1886</td>
<td>A,F</td>
</tr>
</tbody>
</table>
A 1887  31yrs. Goes to Yugoslavia and Austria, resumes journey on
Danube on houseboat. Bulgaria in late July and Sep-
tember in Czechoslovakia, returns to United States
in November.

F 1888  Places monument on grave of Moses Dean.

A,F 1889  33yrs. Trip to France; travels by houseboat on Rhone, Allier

A,F 1890  34yrs. Trip to Paris, France.

A,F 1891  35yrs. Trip to England and France in February.
Archeological expeditions: York Harbor, shellheaps
(Maine) and Indian House Cave, Haycock.

H,A,F 1892  36yrs. Archeological expeditions:
Susquehanna expedition.
Madrid, Spain, as honorary member of the United
States Archeological Commission.
Visits archeological sites in San Isidora, Spain and
sites in Belgium and France for purposes of comparing
neolithic tools with his own findings along Eastern
seaboard of United States.

H 1893  37yrs. Archeological expeditions:
Lookout Cave
Gaddis Run
Hartman's Cave
Durham Cave

J 1893-97  Editor of American Naturalist

H 1893-94  Expeditions to Texas and Louisiana (Fossil Sloth)
Lookout Cave
Mickajack Cave
1894 38yrs. Archeological expeditions:
   Hinton's Mound, West Virginia
   Kanawha
   New River
   Other sites in Virginia, Illinois and Kentucky

F,A  Travels to Germany, Italy; Bavaria and England in July and in September with Aunt Lela.

J  Appointed Curator of American and Prehistoric Archeology at the Museum of the University of Pennsylvania.


F  1896 40yrs. Builds Indian House. (First building?) This will become his pottery in 1898.

J,C  Publishes The Hill Caves of Yucatan. Not well received.

H  Archeological expeditions:
   Zirkles Cave
   Frank Cave
   Lookout Cave
   Port Kennedy
   Indian House Cave

H 1896-97  Archeological work in Yucatan.

H 1897 41yrs. Archeological expeditions:
   Lookout Cave
   MacElhattan
   Carlisle
   Bainbridge and Springtown
   Cavetown, Maryland
   Lower Black Eddy (Bucks County)

J  Quits curatorial position.
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<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tr>
<td>1897</td>
<td>July 20, Begins to collect and study tools and &quot;old relics of former days in Bucks County.&quot;</td>
</tr>
<tr>
<td>1898</td>
<td>First showing of &quot;Tools Of The Nation Maker.&quot;</td>
</tr>
<tr>
<td>1898</td>
<td>Mercer begins serious study, design and manufacture of pottery and tiles. This activity consumes his interest in the next years.</td>
</tr>
<tr>
<td>1900</td>
<td>42 yrs. Travels to Austria, England and France, collecting tile designs.</td>
</tr>
<tr>
<td>1902</td>
<td>44 yrs. Visits pottery in Madiera and travels to Italy.</td>
</tr>
<tr>
<td>1904</td>
<td>46 yrs. Travels to Gibraltar, Spain, Germany, Austria, England. Gathers tile designs. Becomes ill during this trip. (His last trip abroad?)</td>
</tr>
<tr>
<td>1905</td>
<td>Mercer designs and manufactures tile pavement for the new state capitol in Harrisburg, Pennsylvania, his largest commission.</td>
</tr>
<tr>
<td>1905</td>
<td>Aunt Elizabeth Lawrence dies. The Columbus Room in Fonthill will be dedicated to her.</td>
</tr>
<tr>
<td>1907</td>
<td>51 yrs. Expresses desire to fireproof Elkins Building, the home of the Bucks County Historical Society.</td>
</tr>
<tr>
<td>1908</td>
<td>Buys land for Fonthill.</td>
</tr>
<tr>
<td>1910</td>
<td>Begins construction of Fonthill.</td>
</tr>
<tr>
<td>1910</td>
<td>Begins thinking of building new fireproof museum.</td>
</tr>
<tr>
<td>1910</td>
<td>Begins construction of new pottery building.</td>
</tr>
<tr>
<td>Year</td>
<td>Event Description</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td>1911</td>
<td>55yrs. Elected president of Bucks County Historical Society.</td>
</tr>
<tr>
<td>1912</td>
<td>56yrs. Begins tile production at new pottery.</td>
</tr>
<tr>
<td>1916</td>
<td>60yrs. Construction begins on new museum.</td>
</tr>
<tr>
<td>1922-23</td>
<td>66yrs. Finances Rudolph Hummel's expedition to China to gather comparative examples of tools. American Institute of Architects awards him gold medal for ceramics.</td>
</tr>
<tr>
<td>1926</td>
<td>70yrs. Finances Dr. Amandus Johnson's expedition to Africa to collect tools.</td>
</tr>
<tr>
<td>1929</td>
<td>73yrs. Publishes the renowned <em>Ancient Carpenters Tools.</em> Lehigh University confers honorary degree, Doctor of Laws.</td>
</tr>
<tr>
<td>March 9, 1930</td>
<td>73yrs. Dies at Fonthill.</td>
</tr>
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OBSERVATIONS FROM TIMELINE

Henry Chapman Mercer's classical education and travel exposed him to a wide range of formal architectural references.

Mercer's archeological expeditions were often to caves, many of which he measured and detailed. He spent years investigating these informal homes. This exposure to irregular vaults later found expression in Fonthill.

An element of interest throughout Mercer's life was the study of the artifacts of the common people, be it the Lenape Stone, indigenous tile designs or eighteenth century axes. By implication, Mercer was studying the design process of vernacular design -- the ability of individuals to create anew from inherited patterns. It is this process that is exemplified in the design and construction of Fonthill.
**List Of Sources For Timeline**

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<tr>
<th>Code</th>
<th>Source</th>
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The Program of Fonthill
Chapter Three

In writing I discovered that 'program' could not be separated from 'design' or in Mercer's case, from 'construction.' I am presenting this subject separately for reasons of clarity.

'Program' can be thought of as the intentions of the designer or client for what the building is 'to do' or 'to be.' There is no reason that these intentions cannot change at any stage of the game. Ideally, the design, construction and programming process should work together. Program can have much to do with how a building is organized, what it looks like and what kind of 'feel' it has. Ideals and intangibles such as 'beauty' can be part of the program. The program of Fonthill and the plan organization evolved as the design and construction proceeded.

The diagram from Henry Mercer's design notebook (Fig.29) shows an original plan-program organization for the second floor hall area. Certain intentions for this floor are spelled out in this plan:

1. Servants' bedrooms;
2. Servants' bathrooms;
3. Storage area.

As construction and design proceeded the program developed and the plan organization changed. Perhaps the idea occurred during construction. For whatever reasons, Henry Mercer realized he wanted a bigger and programmatically more complex house. The house was restructured.

The second floor hall area of the present plan now consists of guest bedrooms (Yellow and West rooms), Mercer's original bedroom (Dormer room), various bathrooms, the study and the map room. The servants' quarters, baths and
storage areas were moved to a newly-created "servants' wing." It is interesting to note that in the original plans and plaster model, the present servants' wing was a very minor one-story addition called the 'woodhouse.'

Mercer's will indicates that he intended for Fonthill to become a place of study and a museum after his death.

EXCERPT FROM WILL OF HENRY CHAPMAN MERCER

... 

(d) That the tiles now in the buildings, and all other tiles which may be placed therein from time to time, shall be preserved and cared for with the object and design of illustrating the meaning and history of ornamental tiles as ap-

1 Pages 141-142 of the Design Notebook, Series 8, Vol. 10, of the Fonthill Papers, have initial diagrams for layout of first and second floor of the servants' wing.
plied to architecture.

e) That all tapestries, paintings, drawings, engravings, etchings and works of art: all the books, catalogues, manuscripts and other papers, as well as all other exhibits and decorations, together with the furniture, fixtures and appliances, now in the said buildings, shall likewise be cared for, maintained and preserved therein, forever, by the said Trustees and their successors in the said Trust.

(f) That the said buildings and grounds shall at times be open to visitors for study and instruction under such reasonable rules and regulations as the Trustees and their successors in the said trust from time to time shall make and ordain, to the end that an opportunity will be afforded to the public of viewing and studying the history and meaning of tiles as applied to architecture.

... It is my hope that my house called Fonthill, thus left to the Public for their benefit, may be of lasting good

![Fig. 30 Plan of second floor hall area as built.](image-url)
to them as a Museum for the exhibition and study of Decorative Tiles and Decorative Art, of Engravings and Woodcuts, and of the technical and artistic processes of concrete house construction.

This restructuring of plan and program happened a number of times. I calculate the house is now about double the size originally planned.

AREAS ADDED AFTER ORIGINAL CONCEPTION
- wind room
- roof terrace (tower)
- Columbus terrace
- dressing area
- Jersey Terrace
- breakfast room
- smoking room
- five levels of the servants' wing
- Romeo and Juliet terraces (over the conservatory and off the East room)

The possibilities of construction and continual rethinking of what Fonthill could be influenced design and program.

Fonthill was to be a home for Henry Mercer’s interests, life experiences, memories, fantasies, his collection of tiles, his own tile creations, for impressions and casts of his stove plates, all lighted by his collection of ancient lamps. The library would house over 6,000 books on every subject. Fonthill evolved into a museum of vernacular design.

What interests me about the program of Fonthill, beyond the provisions for creature comforts, are:

1. The intention to create a certain kind of experience, memory or place;
2. The intention to create a place of interest and benefit to society at large.

The complexity and broadness of the Fonthill program resulted
in an engaging building. The evolution and growth of the program is characteristic of vernacular design. In contrast, the program for a modern day office building can be summed up as 'offices,' perhaps modified by 'efficient' or 'cheap' but almost certainly not 'beautiful.' Is it any wonder they are so boring?

**Organization of Fonthill by Plan and Section**

- **AA** Mechanical/Service
- **BB** Private quarters for Mercer and Guests (Bedrooms, Study, Map Room, Baths)
- **CC** Private quarters for servants
- **DD** Public living area of house (Library, Saloon, Entryhall, etc.)
- **EE** Kitchen and service
- **FF** Mercer and guests
- **GG** Servants and service

**Fig. 31** Organization by section.

**Fig. 32** Organization by plan.
HENRY MERCER AND VERNACULAR DESIGN

CHAPTER FOUR

In *Ancient Carpenters' Tools*, by Henry Chapman Mercer, many American axes are described with notes about their European and Roman models. These axes were made by the men who used them and were thus fitted to the maker and the task at hand. This creative act of production, using a model or type as a pattern is what I characterize as vernacular design; it is the individual's creative mediation of pattern with experience.

Henry Mercer devoted much time and energy to preserving and studying the products of American vernacular design. The 30,000 tools and other objects within the Mercer museum are products of vernacular design. Henry Mercer's initial interest in pottery grew from his attempt to prevent the disappearance of the craft as practised by the Pennsylvanian Germans, who were vernacular potters.

When Henry turned his hand to tilemaking, his first themes and visual material were drawn from his collection of iron stove-plates, which were works of vernacular art. His long study and collecting of the common products of the ordinary person resulted in a wonderful sympathy with the process of vernacular design. Fonthill is a home that suits Henry, as the axe fits the maker and the task.

THE MYTH OF HCM'S DESIGN PROCESS

A guided tour of Fonthill passes through the Yellow room. One wall of this bedroom has a pictorial story set in tile of Bluebeard's chamber of horrors.

Bluebeard was notorious for his treatment of captives and some guides will tell you that it was here that female guests slept. I know of no evidence supporting this story; it is part of the Mercer myth.

What I call the design myth is the story told about how HCM designed Fonthill. The story is based on HCM's own presentation of the process. As is characteristic when using words to tell a story, the myth proceeds in a linear fashion.

THREE ACCOUNTS OF HENRY MERCER'S DESIGN PROCESS
1. In 1913, after visiting Dr. Mercer, W.T. Taylor gave this account of the process: 2


Fig. 33 Axes from a Museum of Early American Tools, by Eric Sloane.
ACCOUNT ONE

With a memory stored with pictures of buildings studied during protracted travel in Austria, Holland, Egypt, Turkey, Italy, Germany, Spain and France, Mr. Mercer commenced the designing of his house. A keen appreciation of drawings by Adrian Ostad, Dürer, Gerard Dow, and Rembrandt prompted an effort to secure a play of light and shade in the ceilings of the house similar to that of the drawings by the old masters. One drawing was made for each wall of the sixty-five rooms, and from these drawings the rooms were modelled separately in clay. When a sufficient number of rooms for a suite was finished in clay they were set together with regard for the relation of the floor-levels. When all of the rooms were made and arranged in suites, the suites were composed to the best advantage. Large stairways were avoided for economy of space and irregular stairways and passages made to conform with the arrangement of the suites.

The roof was modelled when the suites and stairways were complete, its shape being determined by the disposition of the rooms and the chimneys. Garret space was avoided by flattening the roof for terraces wherever possible.

The lines of the exterior were developed when the model had reached this stage of growth, the outside appearance being a minor consideration to the arrangement of the interior. The clay model when complete was reproduced to scale and a plaster cast made to be placed on the ground and serve as a working model.

2. Jacob Frank, who assisted Mercer with the tile ceilings, gave this account: 3

ACCOUNT TWO

... Before starting construction Dr. Mercer drew the floor plans as to area of each room and hallways, etc.; he

3. From papers given to Spruance Library, by Jacob Frank's relatives.
knew the height of ceilings and levels so decided to make a model of plaster of Paris and proceeded to make clay blocks the size and shape of each room and hallways and placed them in their place to form the house as it was completed in concrete.

3. The final account is Henry Mercer's, written around 1916:

ACCOUNT THREE

The house was planned at "Aldie", Doylestown, Pa., by me in the winter of 1907, room by room, entirely from the interior, the exterior not being considered until all the rooms had been imagined and sketched after which blocks of clay representing the rooms were piled on a table, set together and modelled into a general outline. After a good many changes in the profile of tower, roof, etc., a plaster of Paris model was made to scale and used till the building was completed.

The plan of the whole house was an interweaving of my own fancies blending with memories of my travels and suggestions from several engravings, in particular the Dutch Housekeeper by Gerard Dow, the Great Barn by Wouvermans, in the Dresden Gallery and a Lithograph, now in my Morning Room, called Le Main Chaud by De Boucourt, also a woodcut illustrating a story called "Haunted" in a book published about 1865 by Tinsleys Magazine named, "A Stable For Nightmares". This picture gave me the night lighting of the Morning Room. The first interior imagined and clearly seen was that of the west side of the Saloon seen when standing near the large window about eight feet from the door to the Library. The arrangement of rooms at different levels seen over the gallery in the Saloon is a memory of a Turkish house seen by me from a rear garden in Salonica in 1886. The saloon still clearly retains the appearance of these preliminary dreams but the original fancies for nearly all of the other rooms were changed as we proceeded, sometimes perhaps for the better and sometimes for the worse.
These descriptions can be thought of as abstractions of the design process. To abstract in this sense means to use a conceptual 'grid' to translate an infinite number of relationships from one medium or time frame to another. It is difficult to abstract the relationships of the design process with words because words are linear and the implication is then that the design process is one-dimensional and one-directional (like time). While certain design strategies and approaches may work better than others, it is possible to start anywhere and with any number of process elements. This, of course, was true of Henry Mercer's process.

The elements from the description of the design process that interest me are:
1. Use of references (patterns and models);
2. Emphasis on the interior design over the exterior (the process of 'fitting' the building to his needs);
3. Use of clay and freehand drawing as the design medium;
4. Willingness to redesign Font-hill during the process of construction.

The last point played a large role in the design process. It has been overlooked in most accounts. This element of redesign is key to the non-linearity of the process. I have found two more organizational tools that HCM used in the design of Font-hill:
1. The design notebook;
2. Scaled, freehand working drawings.

REFERENCES
In vernacular and intuitive design, patterns or references (the implicit knowledge of the designer) are the framework for design. The patterns can be knowledge about detailing or spatial
or organizational concepts. When using patterns, the vernacular architect changes, adjusts, invents or moves on to something else as the problem dictates.

The vernacular architect learns patterns from personal experience and from the collective experience of his culture.

Henry Mercer collected references in memory and notebook during years of travel. His thousands of books were source for many, many more. Some details or memories were used directly (see Figs. 34-36). More often the references were starting points for design; intentions for character or spatial experience. The uniqueness and character of Fonthill come from Mercer's ability to use his references creatively and to reflect the situation, not force it.

The Design Notebook

The design notebook is Mercer's journal of design decisions concerning Fonthill and accounts of construction events. The journal contains structural and reinforcing information, names of engineering consultants and various sketches and plans for Fonthill. The drawings "made for each wall of the sixty-five rooms" as recounted by Mr. Taylor, have never been found. The design notebook does have interior elevations and sections of Fonthill. It is possible that these are all there ever were (see Fig. 37-39).

Throughout this notebook are references to Mercer's vast collection of books. The journal also offers conclusive evidence for the changes in plan and section of the second and upper stories during construction.

Design Changes During Construction

Entries (plan and section diagrams) made after construction
Fig. 34 Drawing from Mercer's archeological notebook (Series 5, Vol. 4, Fonthill Papers) Gates from courtyard, Yakat.

Fig. 35 Drawing of Fonthill gates from Design Notebook (Series 8, Vol. 10, Fonthill Papers).
had begun\(^4\) show reworking of west wing bedrooms and major changes in the second floor and garret organization. The roof over the dormer room was raised approximately ten feet, when the plan for this area changed from a narrow servant's bath to Mercer's bedroom.\(^5\) See Fig. 30. The original floor for this area was three feet lower to allow headroom at the eave. Evidence for this lower floor can be seen in the change of ceiling level.

4. On page 99 of the Design Notebook, Mercer writes "Earth forms used with great success early in June ... the whole ground floor cast July 13th" indicating construction was well under way by this page. Series 8, Vol. 10, of the Fonthill Papers.

5. Page 70 of the Design Notebook, Series 8, Vol. 10, the Fonthill Papers, has original cross section of this area.
in the saloon; this change follows the line of the originally planned servant's bath. There is also a trap door in the false floor of the dormer room leading to the space between these floors. The raising of the roof allowed the floor of this area to be level with the study and second floor hall area. It also provided enough height for rooms above the second floor hall area (the dressing area and Terrace room). Originally the terrace room was to be only a few steps up from the second floor hallway and four or five feet below the level of the Spring terrace. The west wing bedrooms (West and Yellow rooms) were originally planned to be one large room but gradually evolved.

Fig. 38 Original conceptions of stair to library gallery, from Design Notebook.

Fig. 39 Tower variations from Design Notebook.
Fig. 40  Plaster cast of clay model. Mercer construction photograph, courtesy Spruance Library.
Fig. 41  Fonthill, from perspective close to that of clay model.
Fig. 42  Plaster cast of clay model. Mercer construction photograph, courtesy Spruance Library.
into the present arrangement. There are six different plans of this area in the design notebook. The working drawings also show these revisions (see Fig. 43 and 44). The raising of the roof over the main body of the house no doubt made the tower appear short. The Wind room was thus added as recounted by Jacob Frank. Other significant changes from the clay model and original plans are the covering with concrete of the 1742 stone farmhouse and the five level servants' wing addition. Fonthill evolved as it was built.

Clay and Plaster Models and the Scaled Working Drawings

The clay model and the free-hand drawings in the design notebook are the working tools of Henry Mercer's design process. It is interesting to note that the tolerances of these design tools accord well with that of the building material. Mercer took advantage of the plastic qualities of concrete, by using design and conceptualizing tools which reflected the nature of the material (and the building system).

In a similar way, the building abstractions (plaster cast of clay model and scaled working drawings) that were used as construction documents, also had a feel and tolerance similar to that of the building material -- concrete -- under the conditions of Mercer's system of formwork. It would be a waste of time to have working drawings drawn to a tolerance much tighter than the material. It is counterproductive due to the extra effort required to push a material and process to the limit of its accuracy or
Figure 43

Fonthill working drawing by Henry Chapman Mercer. Scaled and drawn freehand with grease pencil. Paper glued and sewn to cloth, then glazed.
Figure 44
Fonthill working drawing, revised second floor.
'definition' in order to match the tolerance of the plans.

Henry Mercer had a better strategy. The design process, the conceptualizing tools, the working documents, the building process and the building material all had a similar degree of 'slack.' This tolerance fit made the job easier and encouraged concrete to be thought of and used as a plastic material.

REAL TIME DESIGN

Many design decisions were made at the time of construction. I call this 'real time' or experiential design. The shaping of vaults was done this way as was the laying of tiles. I believe many of the stairs of Fonthill were also done this way. This process has the advantage of making it possible to design at the scale and with the material being used. This sculptural process is often much easier. The effort required to model and plan a complex stair is of about the same order as building it. The direct creative process of making 'things' that we humans are so good at can thus be utilized. This is also a process of vernacular design that contributes to the 'placeness' of buildings. The capacity to plan in advance and also to make decisions directly with the material is characteristic of good vernacular design. The 'placeness' of Fonthill is due in part to Mercer's great ability with both these design strategies.
Fig. 45 'Slack.'
Fig. 46  Fonthill under construction (Mercer construction photograph, courtesy Spruance Library.)
Construction of Fonthill began early in 1908. The work crew consisted of a foreman, eight to twelve day laborers and Lucy the Horse. All were paid approximately $1.75 per day. Henry Mercer, in his writings, states that the house was built during the summers of 1908, 1909 and 1910. However, the account book of construction costs indicates that major work proceeded continuously through 1912. The workforce diminished in the winter months due to the difficulty of pouring concrete in cold weather. Tilesetting, carpentry and finishing work no doubt proceeded during this time. A construction photograph showing a temporary wood stove in the library confirms the idea of winter work.

Casting of the main house (southwest of the 1742 stone farmhouse) was possibly finished by 1910 and other work such as the reconstruction of the farmhouse and the addition of the servants' wing continued into 1912. There is a separate accounting for the garage (started in 1913) and the two concrete bridges. In his journal, Henry Mercer notes Wednesday May 29, 1912, as the day he moved into Fonthill.

Finishing work and tile setting continued until at least 1916, and other work, such as expansion of the electrical system continued into the 1920s. The last entry in the account book is October 20, 1923. Final accounting of the cost of Fonthill (excluding land) was $35,529.43. This works out to approximately $21/sq. ft. in 1982 dollars, a remarkably low figure. I found no
accounting for the cost of the tiles, although the cost of labor to set them was recorded.

**Construction and Design**

The construction process of Henry Mercer can also be considered part of the design process. The concrete forming system used for the reinforced vaults encouraged Mercer, his tilesetter and builders to make design decisions in 'real time' and at the scale of construction. The walls and columns of Fonthill were laid out in an organic fashion. The forms for the walls and columns were constructed from rough and used lumber. There is a consistency to the resulting irregularity of surface and plan. The vault forms are ingenious for their ability to gracefully span this irregularity.

These forms were made by first erecting a platform level with the top of the walls and columns. A thin slat of wood was bent from column to column, thus describing the profile of the vault. The shape of the vault was built up using boxes, grass clippings and dirt. The final shape and surface of the vault form was completed with a layer of fine sand. Tiles were set face down into this layer of sand to embellish the finished vault. A layer of small aggregate concrete was poured over these tiles, then the balance of the concrete over this. After the props were kicked out, the sand, earth, boxes and lumber collapsed, leaving a brilliantly tiled vault, spanning, at times, a very irregular space.

The plastic ability of concrete to take on any shape (analogous to clay, similar to water) was thus used to advantage.

Many contemporary forming
systems using materials that are linear or planar (plywood, steel beams) can mold concrete with curvature in only one direction. These systems are well-suited to exploiting the tensile properties of reinforced concrete (beams and slabs). These forming system qualities are also easier to abstract in working drawings. However this element of abstraction can work against the desire for a personal touch. Mercer's system encouraged a direct creative interaction with the form and decoration of his house by having a forming system that could be shaped or 'sculpted' by hand. That Henry Mercer thought of concrete as something plastic (like clay) is also evident in the remolding of concrete details, openings and column shapes (see Fig. 50 and 51).

It is characteristic of vernacular design and of people who

Fig. 47 Formwork made from used lumber, plant material and sand (Mercer construction photograph, courtesy Spruance Library).
**Fig. 48** System to produce concrete vaults (from Design Notebook, Series 8, Vol. 10, of Fonthill Papers).
build their own homes to continue to work, adjust 'fit' and 'mold' their living environments. Mercer's process encouraged plasticity of thought and action. The most modern and adjustable modular system will do homeowner or designer no good without the ability to think plastically.

Vernacular design is about being responsible for and responsive to your environment. Mercer's construction and design process enable him to exploit the plastic qualities of concrete. His ability to design directly with the desired quality of the construction material, adds to the 'fit' and character of Fonthill.

The following is excerpted from Mercer's typed draft about the building of Fonthill:

Fig. 49 New house foundation adjoining 1742 farmhouse (Mercer construction photograph, courtesy Spruance Library).
During construction the building was roughly roofed with felt paper. The reenforcing irons used everywhere according to approved formulas were hollow 1/4 inch and less iron pipes bought in junkyards in Philadelphia and Doylestown, except for the beams, where solid iron rods, not twisted, were used in the usual way after bending around posts, etc., to the proper angles, six per beam. Besides this, heavy galvanized farm fencing in large rectangular mesh, was laid over all the reenforcements.

Several demolished buildings, followed by car loads of unplaned boards, furnished the wooden material for the forms. These consisted of partitions made by laying the boards horizontally, edge to edge on upon another with battens nailed wherever convenient against their outer sides. Double lengths of wire were looped around and twisted upon the projecting ends of these battens as we proceeded to keep the forms from bulging. These forms were set.

Fig. 50 Rough casting of saloon. Comparison with picture of finished saloon reveals how concrete was used plastically during design and construction. Note change in column shape to include water pipe, reduction in size of doorway and how transverse beam was re-detailed in tile. Also note addition of concrete bookcases and finish coat of cement plaster (Mercer construction photograph, courtesy Spruance Library).
Vertically with a spirit level, and not by eye as has been asserted. Where high winds deflected (sic) them or where they sagged or where mistakes were made the results were corrected after construction by chiseling away projecting corners or building up crusts as against the north corner of the east gable. Nevertheless the north library wall still shows a bad overhang. Pieces of tin were tacked over knot holes, large cracks and open joints. Owing to warping the board joints never fitted close and there was continual leakage of liquid cement. This produced many porous spots on the outer wall which were plastered over afterwards. The Concrete (sic) was purposely not spaded inside the walls in the hope of making them more porous. Continued suggestions as to dampness, rheumatism, etc. caused us to cast large vertical holes by means of collapseable wooden boxes invented by me, stove pipes were fitted with dry sand, pulled upward as we proceeded, and even cornstalks wrapped in
Fig. 52 Servants' wing under construction. Note '1742' house in foreground. Originally this house was incorporated in the new house as was. Note how a section of roof has been carefully shifted to one side for later replacement. Plan was changed and this house is now roofed in concrete. Photograph, courtesy Spruance Library.
paper at intervals of a few feet throughout all the walls. The cornstalk plan was, however, a failure as the leaves flew in all direction into the forms and the wet stalks would not burn out of the holes. Angles in the very irregular chimneys and the chimneys themselves were cast upon wooden boxes or boards pounded, pried or burnt out afterwards.

The result of our precautions as to wall ventilation, namely loose tamping, collapseable boxes, and cement batches mixed by hand and greatly varying in density, was very successful. Blackened shoes in dark closets never mildew. There has never been condensation of moisture except on the tile pavement in the hall. Cigars dry up in their boxes. Windsor chairs rattle loose.

Ceilings and Roofs

For the flat ceilings in the cellar, platforms of boards sawed to fit were placed between the beam troughs and these levels covered with earth. Later, for upper rooms, the platforms were made very roughly of rails covered with grass under the earth layer and then about two inches of yellow Bucks County sand was spread over the earth. The roof terraces and flatter roofs were also so treated but on the very steep roofs of the tower and east gable carpets only were spread over the boards except on the East room ceiling where, in spite of the steep slope, the earth and sand layer was used as described.

The vault forms were made of heaps of earth spread over piles of boxes and overlaid as before with sand producing a series of carefully graded mounds resting (sic) on the platforms as before. This process began in the crypt of the tower where no sand layer was used. In the Library the earth mounds were raked into semicircles or ellipses and the sand overlay carefully smoothed. All worked well notwithstanding the difficulty of scalloping the wall forms to meet the slope of these mounds and cleaning or washing out the column forms from down fallen earth and sand.
Decorations

In the hall and Salloon (sic) clay troughs for groins and borders and clay impressions of stove plates were used in casting the ceilings. Otherwise tiles were pushed face downwards into the sand crust so as to project about a quarter of an inch on the backs. The tile and cement pavements were set after construction. A method of casting designs or pictures upon ceilings in colored cements was tried twice un-successfully in the cellar of the Salloon but not attempted elsewhere. The ceiling tile work pictures, inscriptions, designs, etc. cast as described directly during construction tried first in the crypt and next in the Library was very successful. The elaborate and probably overworked pictures in the Columbus and Bow Rooms which may be called adaptations of our mosaics with patterns modelled in relief and no background were designed in August and burnt and set before frost. The tiles were laid first with much difficulty from the wind on large drawings and then turned upside down and pushed into the sand. We feared sagging of vault forms and the falling of heavy tiles set in this manner but no such bad results followed. When we pulled out the platform props and the platforms collapsed tons of earth and sand fell exposing the tiles, after which the loose sand was washed off with a hose and when dry brushed and shellaced between the tiles.

Columns

Tiled capitals and bases and cement capitals were put on after construction. Some of the latter in the windroom were taken from very old Byzantine churches in Greece and one, the owlish face in the cellar, from St. Michel in France. An octagonal wooden column used by one of my friends, an architect, in a house near Philadelphia and adapted by him from a column in the Castle of Tratzberg in the Austrian Tyrol, suggested the polyginal (sic) columns, two or three
of which are octagons while the others have nine faces or are made circular by the use of narrow wooden strips in the form. The columns referred to by visitors, etc., made on with stove-pipes and the other with nail kegs are in the cellar of the east wing. One column was cut off during construction in the yellow room to make way for the bed. Some of the columns were plastered after construction with lime and sand mortar, other with cement. Some were left untouched and some slightly retouched.

Partitions

The cement windows were cast in channels cut with wire loops in slabs of clay and were reenforced with thin iron rods and set in their wall holes after construction. Those on the hall stairs are the first of their kind ever made to the writer's knowledge but in these the stone ingredients were too large. One of them with another on the West terrace have cracked around the irons.

Fig. 53 Section through Spring Terrace detailing waterproofing (from Design Notebook, Series 8, Vol. 10, Fonthill Papers).

The mold for the window (mullions) was made by cutting into a horizontal slab of clay. The tool for this was a wire bent to the profile of the mullion.
CONCLUSIONS

From this study I have come to some conclusions for a design strategy directed toward creating buildings with character, style and 'sense of place.'

1. The program of the building should include intents beyond mere function (beauty, spiritual symbolism, public service, etc.);

2. The design tools should fit the nature of the problem and the tolerance or 'desired feel' of the building material (clay for concrete, 6H pencil for steel, water colors for a garden);

3. Endeavor to recognize what decisions can be made in 'real time' (shaping of forms, mosaic work, lighting);

4. Utilize the intrinsic creative ability of the individual to work out problems of 'real time' design.

5. Use references, patterns and places directly and indirectly for the sense of 'place' they convey;

6. Do what your heart tells you to do and not your ego.
APPENDIX A
MEASURED DRAWINGS OF FONTHILL
For three weeks in January and February of 1982 Eric Hauness and I recorded the measurements of Fonthill for our use in producing the measured drawings. The difficulty of the task was rooted in the complexity of the building and the lack of any right angle or straight line references. The problem was further complicated by the necessity of obtaining all the measurements at once. We planned to complete the drawings in Cambridge.

The measurement taking became a problem of how to create or 'build' a reference system. We started with the outside. We first measured all perimeter dimensions, every bump, ground floor window and change in direction. We also measured the distance across all inside corners. The
second stage of the outside measuring required us to survey the
locations of all corners in relation to five arbitrary points,
using transit stick and tape. With this angular and dimensional information, we were able to construct a very accurate plan of the ground level "footprint" of Fonthill. This became our first reference or framework.

Two problems with this survey soon became apparent as we began the inside drawing:

a) walls between corners that were assumed to be straight were not, and

b) walls were not plumb (up to one foot difference from bottom to top story).

Once our preconceptions about "straight" or "plumb" were put to rest, our measurements made sense.

After the outside survey was complete, we began the inside measuring. My original idea was to proceed with the inside, measuring the angular differences with transit and stick. This proved to be too slow and cumbersome.

The inside measurements were taken and recorded in the following way:
A freehand drawing was made on vellum of the space to be documented, and traced three times. The first copy was used to record positional information, materials, built-in furniture, tiles, mechanical systems, etc. No dimensions were recorded on this sheet. All perimeter dimensions were recorded on the second sheet, including overall dimensions. The third sheet was used to record the dimensions of the diagonals of rooms and spaces. This information gave the shape of the space. The last
sheet was for ceiling information and miscellaneous information, such as:

1. direction and location of beams and vaults;
2. height of ceilings at columns;
3. high and low points of vaults measured from the floor;
4. thickness of walls at doors and windows and top and bottoms of all sills.

Level changes were recorded in a separate notebook. We used a string and line level to take these measurements.

The drawings took a long time to do. The process of assembling and analyzing all the angular and dimensional information took patience. The drawings depended on spatial memory and common sense (perceiving patterns) plus a liberal fudge factor to get started.

The most common problem was wrong or missed dimensions. The dimensions were usually wrong
by exactly a foot (6'5" for 7'5") or reversed (6'5" for 5'6"). The missed dimensions were picked up on a subsequent trip.

The finished drawings are highly accurate to within an inch or two in most places (including diagonals). This is within the accuracy of the building method.

The exceptions to this are the roof plan, which is mostly guesswork. It was done from photographs and a projection of relationships from the floor below. The terraces were measured accurately. We did not have time to measure the basement except for the floor-to-floor height in the crypt.

The cut of the sections varies from a straight line and changes slightly from floor to floor. This was done to make clear the curve of the vaults.
The floors and walls are shown as level and plumb although this was not necessarily the case. The basements in the sections were done from memory and by projecting columns from the floor above. I feel it is reasonably accurate. I enjoyed the measuring immensely.

Fig. 57 'Diagonal dimensions' sheet.
Fig. 58 'Ceiling information' sheet.
APPENDIX B
CYLINDRICAL PERSPECTIVE PHOTOGRAPHY

The 360° panoramic photographs of Chapter One are based on cylindrical perspective theory. The filmplane, or picture plane, is a cylinder. Horizontals are circular projections and verticals are flat projections.

The pictures were taken with a pinhole camera I designed and built for this purpose. The camera shoots 100° of image at a time and is rotated on a jig 90° for each shot. 10° overlap is necessary for recombination printing. Vertical field of view is 90°.

Exposures
Pinhole diameter is 0.020"
Filmplane to pinhole distance is 2.5"

Hence f stop is \( f = \frac{\text{focal length}}{\text{lens diameter}} \)

\[
\begin{align*}
fl25 &= 2.5'' \\
0.020'' \\
\end{align*}
\]

Knowing f number and ASA of film, exposure is calculated in the normal way.

For testing exposure and color balance I constructed a pinhole camera that would accept a 4x5" Polaroid back. I was then able to immediately ascertain filter and reciprocity corrections.

Film
I used 4x5" Tri-X and Vericolor II film.

Developing
I developed the black and white film to a higher contrast than normal to improve apparent resolution.
Fig. 59 Cylindrical Perspective grid, analogous to, and used like, the flat plane perspective grid.
Some Thoughts about Panoramic (Cylindrical Perspective) Photography

This perspective system comes closest to duplicating how we see (except perhaps spherical perspective which has the problem of unrolling a sphere onto a plane for viewing). Careful attention to what you see will reveal that visually the world is made up of curving lines. Try following the vanishing lines of a room from one corner to another. As a means for mapping wide angle information it cannot be surpassed for simplicity.

Fig. 60 Note that the world equidistant from the observer (pinhole, lens, eye) is mapped in an unequal way on the flat plane. (Equal intervals are not the same). The curved plane maps the information exactly.
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