PREFACE

This architectural investigation is an examination of design potentials. It is a search for a timeless vocabulary that asserts itself above any limitation of building type by seeking avenues and thought processes that are not dependent on the values implied in traditional building types and programs. This study uses architecture as a universal expression of design to strengthen my ability to formulate philosophies rather than to design a piece of architecture according to a particular philosophy.

The emphasis of this study looks into how order can be given to form and space within the parameters of sun, wind, and water as generators of the organizing principles. In this exercise, the organizing principles become tools which a designer can use to manipulate order within a particular range of concerns in order to make effective decisions. To be able to use the study as a tool, one must understand the process by which the product was created so that the product does not limit one's creative use of the principles.

Prepared By

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1984-1985 THESIS

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INTRODUCTION

This study attempts to discover creative components of architecture and develop them as a language.

Several objectives of the study according to my personal interpretation of a thesis have been:

* to strike a balance between the creative and rational, yet focus on the creative and imaginative aspects of design
* to use the energy aspects of the case study to provide a logical rationale; for the thesis, they are used to discover and understand the more difficult-to-define aspects of architecture
* to keep natural orders only as a source of inspiration and not as a direct model to copy
* to pursue an architecture which is more enduring than a transient perceptual vision
* to illustrate that functional design is not mechanical at all costs — some aspects are quantitative, but the most important and most difficult-to-define are not
* to understand truths based on facts
This thesis is based on an awareness of the current examples in the field of applied solar energy and the general lack of sensitivity that is characteristic of such solutions. Using paradox as a means to start the thesis year, the thesis statement at the beginning of the year was the following: Energy conscious programing and design emphasizing the dynamic motions and cycles of solar, wind, and water will lead to a catalogue of energy models that will enhance the opportunity to achieve a quality architectural response to energy needs.

Using this dichotomy as the starting point for conducting a thesis investigation, I began to focus on the approaches and processes that would allow for a more complete integration of energy into the language of architecture. As a vehicle for this, the universal framework of enclosure and spatial patterning and the case study using Rushville, Indiana were brought together.
Within the case study, the natural orders of sun, wind, and water became a tool to use for the general planning and layout of the building. At a spatial scale, the specifics of sun, wind, and water within certain ranges of time were used to manipulate the qualities of enclosure and spatial patterns of the building.

Once the case study was completed to the point where it tested the thesis idea, I conducted two exercises to test the product and the process of the case study. The first exercise was to test the use of the spatial patterns and enclosure by changing the context and generator of the idea and deforming the geometries and forms according to the new set of rationale. The second exercise was to test the process to make myself aware of the aspects of the process that underlie my approach.

The understanding that came from these two exercises is used to explain the issues of the case study.
THESIS ISSUES

The issues of the thesis deal with the building's response to aspects of the sun, wind, and water with respect to the energy efficiency of the resulting solution due to orientation and use of natural lighting.

At the space scale, the issue is the clarity between the energy-based principle and the solution with respect to the enclosure and spatial pattern.

The issue related components used to solve the energy aspects of the building are generically defined through elements and methods used to generate the components. The organizing principles are:

AXIS
* connecting two points
* passing between points or elements

HIERARCHY
* shape
* placement
* size

RHYTHM / REPETITION
* size
* shape
* detail

DATUM
* line of reference
* plane of reference
* field of reference

TRANSFORMATION
* prototypical model
Developing a universal framework completes the vocabulary of architecture that is parallel to the language established by the organizing principles set forth as issue related components of the thesis.

The universal framework used is one that identifies enclosure through the building component zones of overhead, ground, surround and identifies spatial patterns of movement, association, and assembly. There exist a parallel to Francis Ching's *Form, Space, & Order* but focuses more on the process of creating architecture.

* overhead, ground, surround . . . form

* movement, association, assembly . . . space

* axis, hierarchy, rhythm/repetition, datum, transformation . . . order
ENCLOSURE

Overhead - zone that forms the space - roof/ceiling zone

Surround - zone that contains the space - wall systems, structure

Ground - zone that implies the space - the building plan is formed

SPATIAL PATTERNINGS

Movement - active in character - participants moving with little verbal interaction
Ex. corridor, galleria, mezzanine

Association - passive in character - informal interaction, casual
Ex. lounge, landing, inglenook

Assembly - structured in character - formal geometry and interaction
Ex. amphitheater, classroom, sanctuary
This section concerns itself with those issues that stand as a quality or need that is unique to Rushville. Background and contextual information of this section provides a framework for decision-making processes in the case study.

Rushville is located in east-central Indiana. The courthouse is located at the intersection of state roads 3, 44, and 52 with the central business district lining state road 3 north of the courthouse.
CIRCUMSTANTIAL ISSUES OF CASE STUDY

ASSETS:
- prominent courthouse - visible from outside city limits
- cohesive central business district
- intersection of 3 state highways
- river/island
- CBD to river - less than 5 minute walk

LIABILITIES:
- no downtown open space
- vacant buildings
- fragmented business district extending from downtown
- new commercial developments
- above ground utilities
- flood plain on island
- stagnant water
CIRCUMSTANTIAL ISSUES OF CASE STUDY

Determination of Project

The existing structure of activities, assets, and liabilities suggests from the scattered density of activity such as diners and social clubs that the vehicle of the thesis needs to create a common place where the community can interact. The amenities of the courthouse, river, and island provide an unique opportunity to extend the urban fabric. Open space opposite the courthouse would create an entry for the town and provide direction for extending the fabric. The building allows an opportunity to connect the island with the business district. The building also could increase the range and variety of choice during lunchtime and night-time activities. Within the building, major spaces include a theater, exhibit, market, and entry rotunda. Other spaces include a pub, cafeteria, and support spaces for the theater and exhibit.

In order to keep the thesis idea and the vehicle used to illustrate the statement parallel, the program was only developed to the point to suggest the enclosure of overhead, ground, and surround and the spatial patterns of movement, association, and assembly. With this framework, I can use the notion of theater, market, exhibition, and entry as generators of the enclosure and spatial patterns and focus on the principles of natural order to resolve a solution.
CASE STUDY

SITE SCALE

AXIS - Adjacent Spaces
Extension of the urban fabric to the island suggests an overall movement system through directional qualities of the axis connecting the adjacent spaces

- Wind/Sun
Lines inherent in the movements, rhythms, and cycles of the natural orders can suggest grid networks and provide rationale for greater complexity in the combinations of the grids.

HIERARCHY - Courthouse
One of the amenities of the town is the prominence of the courthouse. Its height, which denotes the town center before one reaches the town limits, historical significance, ornate detail, and location suggest a build up of spaces to the courthouse.
SITE SCALE

RHYTHM/REPETITION - Existing Facade
The existing front facade of the vacant Coca-Cola warehouse building will be maintained to keep the edge of the urban open space a consistent character with the other buildings creating the enclosure.

- Completing Enclosure
Reflecting adjacent buildings at the corner completes the enclosure at a critical point to reinforce focus towards the courthouse.
BUILDING SCALE

AXIS - Sun
As the sun moves across the sky, the sun is constantly changing its azimuth and altitude. The plot of the points would be symmetrical about the north-south axis and would resemble a parabolic curve. If specific times are chosen, such as 9:00, 11:00, 1:00, and 3:00, the resulting orientations would range between southeast and southwest.

- Wind
The quality of wind that can be used in the general layout of spaces is direction. The resulting lines can either be parallel to enhance the wind pattern such as using summer breezes to increase ventilation, or be perpendicular to block or divert the wind pattern such as to avoid infiltration of winter winds.

In this case study, the path of the summer breezes and path of the people coincide to provide an outlet for the breezes to increase the efficiency of the ventilation.
BUILDING SCALE

AXIS - Water
Gravity is the aspect of the hydrologic cycle that suggests the generating component by the way the building sheds the water that falls on it. Directing the water run-off towards collection points provides a structure that is consistent with the overall organization of the complex and allows regeneration of the interior water table causing less impact on the ecology.
BUILDING SCALE

AXIS -
A line of axis generated to pass through the intersection and the major spaces of the building provide an overlay that allows a variety of spaces through its intersection with the regular grid. This line of axis also becomes a tool in laying out the exhibition spaces. The point located as the focus of the theater also becomes the point in which the rotating orientations of the exhibit spaces are generated. This is parallel with the varying orientations of the south wall according to specific ranges of time. The south wall uses the ranges of time to break down the range of azimuth and altitude to more specific angles. Combining the range of azimuth and altitude sets up a three-dimensional grid through which the location of exhibits, according to a specific time of year, can be achieved. This is further explained at the space scale on page 22 of this book.
BUILDING SCALE

HIERARCHY -
Within the building, various geometries of shape that define space contrast with the orthogonal grid and rectilinear spaces to reinforce the importance of that space.

DATUM -
The shaded area of the diagram is a constant height and establishes a plane of reference which serves to organize the penetrating form of the major spaces.
BUILDING SCALE

Process of Transformation
SPACE SCALE

For the space scale explorations, reference to the implications will be within the universal framework of overhead, ground, surround and movement, association, and assembly.

The drawings below call out the various spatial patterns of the building and suggests the sense of enclosure with respect to height and form of the most important building component zone defining that spatial pattern.
EXHIBIT

The exhibit space is based on the concept that the dynamic light pattern that would occur during the daily and yearly cycle could provide an added dimension to the exhibition. The exhibit would constantly be varying during the year as the light from one particular aperture moves from one exhibit to another.

Using direct beams of sunlight requires that one understands that the ecliptic (apparent path of the sun) has a second order of movement. While the sun appears to be moving across the sky, it is constantly changing its altitude and azimuth which determines the sun's position in space. By dividing the exhibition spaces into three orientations according to a specific range of time, it reduces to 90° or less the angle between the two different extremes of the summer and winter azimuths of that time period. The range of azimuth generates a grid that can identify the range of directions that a beam of light will take along a horizontal plane after it passes through a vertical plane at a specified point. The qualities of altitude on the next page combines with the qualities of azimuth to complete the grid.
The study of angles of altitude shows some interesting relationships between angles and distance. Since the variables of the sun's position are angles, I began with a circle to establish unit distance on an x-y axis. At one unit from the y-axis, I struck a line at 74° (June 21st - altitude) until it crossed the y-axis. At that point on the y-axis, I struck a line at 27° (December 21st - altitude) until it crossed the x-axis. The difference between the two lines crossing the x-axis was six units. By dividing the units in half, this conveniently represents the months of the year.

The point on the y-axis where the two lines converge is three and one half units above the x-axis or six tenths of the total horizontal change. An aperture one unit high on the y-axis produces a pool of light two units long on December 21st and just over one quarter (.28) of a unit long on June 21st.

The information from the azimuth and the altitude suggests that a parallelogram grid exists that is six units long along each of its sides. Understanding this as a tool would allow for one to position exhibits according to the aperture that illuminates it.
Spatial Patterning

Association - The dominating spatial pattern of the exhibition space is association. The geometry of the space does not suggest formal gathering or linear movement, but suggests a casual gathering reinforced with the art and natural illumination. The exhibit is the individual focus that people randomly gather to observe or discuss and move to the next exhibit.

Enclosure

Overhead - The overhead plane establishes a rhythm according to the scale of space by passing into separate progressively increasing heights yet always being referenced to the plane established as the datum.

Surround - The surround is characterized by a wall with apparently random punctures. However, as the light from the aperture illuminates an exhibit, it begins to reinforce the spatial pattern.

Ground - The ground plane mainly reinforces the spatial pattern through the manipulation of the surface of the floor with light.
SPACE SCALE

MARKET

Since the market area coincides with the movement system that connects the CBD to the island at the site scale, the concept was to design a series of stalls so that through rhythm and repetition, the sense of movement is enhanced. This also collects the summer breezes (explained in SITE SCALE) and ventilates the additional internal load generated by a higher level of activity.

At the space scale, the market stalls are laid out on a minor axis perpendicular to the major axis of movement. The minor axis serves a directional purpose and provides points of reference to reinforce movement.

Light plays a role in the market through its interaction with the overhead zone. A pattern of apertures puncture the ceiling plane and produces a more dynamic light pattern on the surface of the floor.
SPATIAL PATTERNING

Movement - The vocabulary of columns and planes produces direction of movement. Its linear direction and varying layers of enclosure produce a complex use of vocabulary within a simple solution.

Association - The transition zone between the columns and market stalls bring people together while people are shopping and selecting items. A puncture above this zone reinforces the definition.

ENCLOSURE

Overhead - The overhead is designed for the effect that it will have on the surface of the floor. The pattern of the punctures is to reinforce the minor axis perpendicular to the axis of movement. During periods of higher temperatures, a fabric material can be draped across the ceiling plane.

Surround - The surround is composed of a series of columns and planes that are located by a density that produces the enclosure to enhance movement rather than by basing the distance according to typical structural spans.

Ground - The ground plane is manipulated at the surface of the floor by the shadow pattern produced by the overhead plane.
In switching from the building scale to the space scale, the dome transformed in order to become a more integral part of the movement system and to speak to the difference between the morning and afternoon sun. As one enters the building from the central business district, the spiral leads into the space which allows a generous space for decision making and getting oriented to the building without interrupting the movement pattern to the island.

The lighting is an aspect that reinforces the sense of association. The spiral is a deep light well so that the light rays are reflected at least once in order to reduce the heat content before the light reaches the floor. The soft, reflected light reaches the floor as a general pool and reinforces the informal gathering.

Air flow became an important factor that transformed the dome to the spiral since it interrupts the axis created by the market to collect the summer breezes. Warm air that rises into this taller space will need to be discharged to prevent stratification of air in that space. A small compression ring that supports the joist supporting the glass is hollow on the inside to allow heat to escape like an oculus on a dome.
SPATIAL PATTERNING
Association - The spiral geometry reduces some of the formal implications which is more in character with the spatial pattern of association as opposed to the dome. The off-center entrance to the space is for this purpose and also preserves the movement pattern along the path to the island.

ENCLOSURE
Overhead - The overhead would be translucent in order to scatter the light rays and soften the light.

Surround - The surround is mainly columns at the base and walls at the top to bounce the light. To preserve the movement system, an inner circle defined by the curl of the spiral and the stairs/balcony that provides access to the second level above the market.
Theater is based on a formal geometry with a focus to the center of the stage to reinforce the formal spatial pattern of assembly. This focus is also used to organize the exhibition spaces, the access to the seating, the overhead which is a collapsible fabric and has the capability to open when weather is permitting as demonstrated to the right.

The theater uses themes carried through in other areas of the building. For example, the removable fabric overhead is used to dissipate heat in the market area, the column rhythm is used again in the entry rotunda, and the punctures in the overhead used to designate entrance to the seating is seen again in the market space.
SPACE SCALE
THEATER

SPATIAL PATTERNING
Assembly - The formal geometry of the space and the focus to the center of the stage reinforces the formal interaction of the audience with the performers.

ENCLOSURE
Overhead - The overhead is a fabric material that is translucent in order to emit a soft light with the geometry of the space defining the edges of the light.

Surround - The enclosure consists of a vocabulary of columns, seating, and extra rows of seating rising above the main floor plane to help control the acoustics of that space.

Ground - The whole ground zone is manipulated to reinforce the focus towards the stage. The edge of the theater implies a division of space yet provides a continuity of view between the two types of exhibitions.
EPILOGUE

The natural orders of sun, wind, and water have different aspects that can be utilized in a building. For example, the sun contains heat and light, the wind has velocity and direction, and the water can absorb heat which can be used to enhance comfort levels of the interior. Also, optimum orientations that best take advantage of those qualities can increase the range of climate extremes that the building can naturally attenuate. One must develop an understanding of how to use those qualities to solve architectural issues rather than to use it solely for its ability to reduce the cost of maintaining a level within the comfort zone. Unique forms, spaces, and technologies should not be the goal if it is not given an architectural context. Conditions of conflict can provide the architectural context where meaningful uses of energy can be explored.
APPENDIX
BIBLIOGRAPHY


Consultants:

Stan Mendelsohn
Studio Critic

Bob Koester
Outside Critic

Les Smith
Landscape Critic

Additional Support:

Jeff Cuip
Fluid Mapping table

Art Schaller
"Variations" exercise

Les Fenimore
Photographic reproductions

Mary Powers
Typist

Diana Wickersham
Typist

Student Participants in "Variations on a theme" exercise:

Diana Wickersham
Elementary Ed. student

Mary Powers
Deaf Education student

Paul Reed
Architectural student

Alan Kirkpatrick
Architectural student

Special recognition to Paul Reed whose thesis generated a dialogue of different issues within a similar range of concerns. The dialogue enhanced an internal understanding of my thesis.
DEFORMATION OF FORMS

In case study II, the generator of the issues changes but the organizing principles remain the same. For this case study, I will use Paul Reed's site in Valparaiso, Indiana and use the language he has set on the site using the urban fabric to generate the organization at the site scale. I will be using this as a starting point to relate to at the building scale and to generate rationale for organizing principles. The generator of rationale in this case will be:

1. Urban fabric (given)
2. Views to site and site features
3. Cycles of sun, wind, and water

After speaking with Paul, the following program of major spaces was developed:

1. Restaurant
2. Market area
3. Small children's theater and exhibit
DEFORMATION OF FORMS

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2. Views to site and site features
3. Cycles of sun, wind, and water

After speaking with Paul, the following program of major spaces was developed:

1. Restaurant
2. Market area
3. Small children's theater and exhibit
The purpose of this exercise is to demonstrate the transformation of the physical forms according to the direction of view and to test the vocabulary of spatial patterns and enclosure developed in the first case study.
VARIATIONS ON A THEME

The purpose of this exercise was to make me aware of those components of the process that were the most universal of the study in order to approach a different problem without having the solution limited by the energy rationale. To carry this through, I devised a game where the test would be another's ability to build constructs. To give them something to base the constructs, I used abstract diagrams that were representations of spatial patterns through the use of either formal, casual, or linear geometries and of enclosure by using various types of lines, line weights, and masses. Through this abstract diagraming, I discovered the components of the process that were inherently used in the case study to organize the spaces. These components are: axis, hierarchy, rhythm/repetition, datum, and transformation.

From this, I developed the program on the following page and then brought the participants into the studio where I had laid out for them the palate of materials they could choose. They were given the program and then had one hour to complete the exercise.
VARIATIONS ON A THEME

This problem concentrates on the act of translating architectural concepts to architectural constructs. The conceptual idea can exist unburdened by the means of implementation. It is open-ended, presenting a variety of possibilities . . . avenues of choice.

For the purpose of this exercise, accept that the elements of architecture lie within two frameworks: 1. the building component zones, and 2. spatial patternings.

Definitions

BUILDING COMPONENT ZONES
1. The Overhead - zone that forms the space - roof/ceiling zone
2. The Surround - zone that contains the space - wall systems, structure
3. The Ground - zone that implies the space - the building plan is formed

SPATIAL PATTERNINGS
1. Movement - active in character-participants moving with little verbal interaction
   Ex. corridor, galleria, mezzanine
2. Association - passive in character-informal interaction, casual
   Ex. lounge, landing, inglenook
3. Assembly - structured in character-formal geometry and interaction
   Ex. amphi theater, classroom, sanctuary
Choose one of the diagrams as a starting point and as a suggestion of overhead, ground, surround, and spatial patternings. Develop a three-dimensional construct exploring one or more of the following organizing principles:

* Axis
* Hierarchy
* Rhythm / Repetition
* Datum
* Transformation

(Feel free to violate or add to the diagram accordingly)
The solutions explore the three-dimensional aspects of the diagrams by manipulating and suggesting the overhead, ground, and surround planes according to one or more of the organizing principles. The significance of the solutions lie in the process of choice that created them.
DESIGN PROCESS

The following is the chronological process and development of the thesis. The case study explains the reasons for the evolution of the design whereas this part graphically shows the tools used to make decisions.
ENERGY RHYTHMS/CYCLES

GRAPHIC OF DYNAMICS

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LATITUDES

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### Table

- **用途**: 特定用途
- **社会**: 社会用途
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- **湿度**: 湿度
- **运动**: 运动
- **温度**: 温度
- **类型**: 类型

### 图表

- **图示**: 图示
- **说明**: 说明
SITE CONCEPT