OAK ALLEY: THE HEAVY MASS PLANTATION HOUSE

M. Susan Ubbelohde
School of Architecture
University of Minnesota
Minneapolis, Minnesota
55455 USA

ABSTRACT

Oak Alley, a southern Louisiana planation house was constructed in the 1830's. The climate responsive strategies employed in the house and site design have been identified and documented through field tests, model analysis and occupant interviews by Brian Andrews and Brian Spencer, working with Dr. Eugene Cizek and Professor Susan Ubbelohde. This paper discusses the background of "bioclimatic design" strategies developed for the Gulf Coast climate of the U.S. Three major factors in the success of Oak Alley's response to climate are examined: the dynamic heavy-mass envelope, the migration of the occupants, and the contributions of ritual, contrast, and synesthesia to thermal comfort. Conclusions address the value of studying historic examples and the complexity of a truly responsive and comfortable design.

1. INTRODUCTION

In comparison to the rest of the continental U.S., the Southeast, and especially the swamps and bayous of Louisiana have epitomized the relative tropics. A world of palm trees and Spanish moss, dripping with humidity and crawling with insects, the South is home to the passions of William Faulkner and Tennessee Williams.

Understanding the South's nearly mythic role as our representative hot humid climate clarifies the ease with which we have assumed that tropical architectural strategies might be appropriate. Thus the "low heat capacity walls and roof, maximum shade, maximum ventilation" described by Fitch and Branch for the tropical rain forest in their seminal article[1] have crept into our general consciousness as somehow applicable design strategies in the Deep South.

2. BIOCLIMATIC DESIGN GUIDELINES

As we became better at both describing the climate and understanding implications for architectural response,[2] we also began to look at 19th century architectural precedents. This search was ostensibly for clues, but functioned primarily as confirmation of the newly developed guidelines.[3] For the northern U.S. and the Southwest, passive designs could provide comfort for most of the year. The basic architectural strategies suggested for orientation, aperture, and envelope and mass characteristics tended, in general, to work through the annual patterns of seasonal change. However, in the Southeast, our sophisticated analysis brought us to a difficult position; a set of conflicting guidelines.

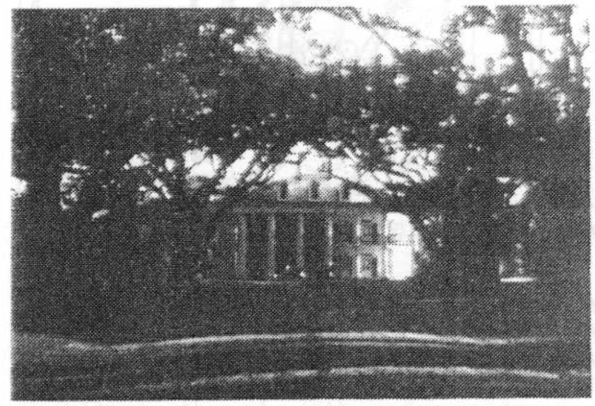

Fig. 1. Oak Alley Plantation, Vacherie, Louisiana.

In Regional Guidelines for Building Passive Energy Conserving Homes (1980), the potential of passive strategies for providing thermal comfort was addressed. Chapter 11 for the Gulf Coast distinguished the "primary design condition" as "too hot for comfort" (52% of the year). The recommendations were: 1. Allow wind to ventilate and cool; 2. Protect from the sun; 3. Flatten day-to-night temperature swings; 4. Avoid creating additional humidity. The "secondary design condition", "too cool for comfort", occurs a substantial 36% of the year. However, the recommendations of 1. Letting the sun in and 2. Avoiding infiltration are, along with #3 and 4 above,"less important and should only be considered if greater detail and operational control is possible".[4] This relieves the designer of resolving the more difficult of the contradictory guidelines. For example, should the architect design with high ceilings or minimize the volume to be heated or refrigerated? Is it better to provide many large operable windows, or do you minimize glazing to reduce infiltration, winter heat loss and summer solar gain? The difficult question of the appropriate use of thermal mass versus a lightweight insulated frame is not clearly answered.

Watson's analysis and guidelines (1981)[5] assume people will use air conditioning when conditions are unrelieved by passive means. However, he also looks at percentages of occurance to determine design strategies for this climate:

minimize infiltration	71%
minimize conductive heat flow	56%
passive solar gain	42%
minimize external air flow	42%
minimize solar gain	43%
promote ventilation	19%
promote radiant cooling	5%
promote evaporate cooling	4%

Examining Watson's recommendations in relation to the AIA guidelines is even more perplexing: the statistics tell you clearly that if you want to have the option of air conditioning, you must build a thermos bottle which can admit and block solar gain on an equal basis.

What becomes clear is that choosing bioclimate design strategies via percentage of occurance is akin to designing for an average daily temperature of 50 degrees F. It is possible that the climate described consists of 90 degree days and 10 degree nights. Being comfortable <u>part</u> of the time, even if it is more than 50%, is not a satisfactory solution. It is important to find new ways to define the problem.

In the Gulf Coast, one needs to design a building that can be both an open parasol and a protective enclave, recognizing the differences between winter and summer, spring and fall and the accompanying sun position and wind shifts. In effect, a truly climate-responsive house would need to be a complex <u>integrated</u> set of passive systems;a chameleon of many talents. Herein lies the value of examining historical precedents. Many of these houses, including Oak Alley, respond in a sophisticated fashion to the complex demands of the Gulf Coast climate.

3. OAK ALLEY PLANTATION HOUSE

Oak Alley was built in the 1830's facing the Mississsippi River to the north at the end of an existing <u>allée</u> of twenty-eight oak trees. The house was placed on the site of a previous cottage and constructed with

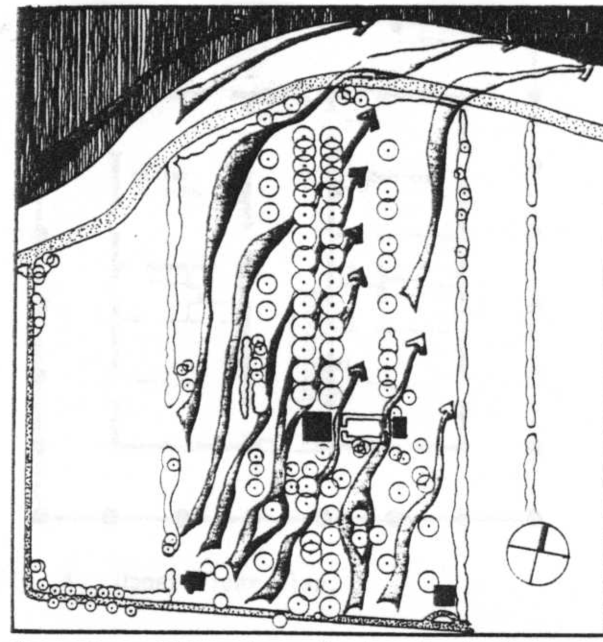

Fig. 2. Site plan showing typical summer winds.

bricks of Mississippi River mud, molded and fired on site. Completed in 1839, the house has two floors of living areas, each with an eleven foot central hall running north and south. Square in plan, the house is surrounded with an eleven foot deep gallery and a total of twenty-eight brick columns, corresponding to the twenty-eight oak trees which form the <u>allée</u>. The 16" walls are of masonry, finished with painted stucco on the exterior and painted plaster on the interior. Originally there were four dormers, one on each side of the hipped roof. The full complement of out-buildings typically associated with a working plantation (kitchen, garconnieres, shed, stables, slave quarters, etc.) are also on the grounds to the east and south of the house.

The house was altered by the architects Koch and Armstrong during restoration in the 1920's after fifty years of abandonment. The original kitchen building still stands opposite the formal garden to the east; however, the kitchen was brought into the house in the southeast corner of the ground floor. The dormers were increased to three on each side of the house for a total of nine. The stairway has also been moved from the southwest corner to the center hall, explaining the absence of fireplaces in the southwest rooms. Finally, the original black and white marble floors were replaced with wooden floors.

4. THE DYNAMIC ENVELOPE

Oak Alley recognizes the demands of the exterior climate by providing an envelope which can function as either an open parasol

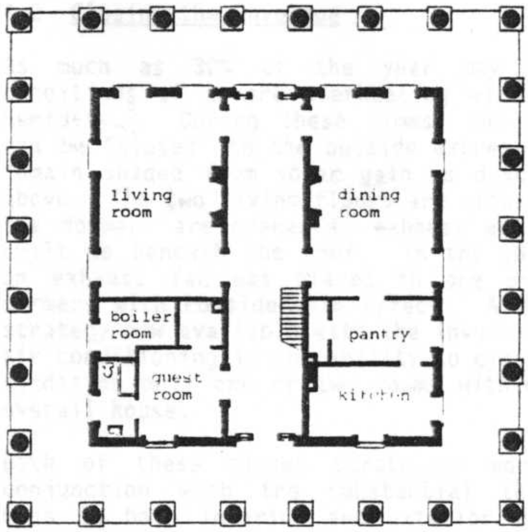

Fig. 3. Ground floor plan.

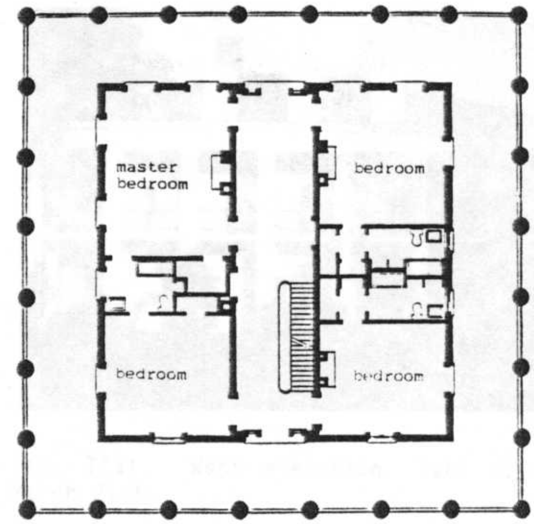

Fig. 4. Upper floor plan.

or a thermal enclave. Each living area, including the central hall which functioned as a second parlor, has French doors giving onto two orientations. These can open the rooms dramatically to the outside breeze and temperature. The interior doors to the hall and through the service rooms support additional cross ventilation, while the fifteen foot ceilings allow hot air to rise above head height.

Coupling the hatch door on the roof's belvedere and the operable dormers with the vertical opening created by the move of the stair, the house has an effective stack ventilating system. This supplements the potential for cross ventilation during those periods of minimal and uncertain wind speed and direction, generally the months of July and August.[6] (Fig.6)

4.1 Shade

In conjunction with ventilation, shade is still required for comfort during those overheated periods not yet severe enough to require an enclave (March, April, May, and October).[7] This is provided on the north or front galleries nearly all year. The east walls and glazing are shaded after 10 a.m. in March and September and from 9:00 a.m. on June 21st. The southern walls are shaded throughout the day from early March to early October. The west wall is the mirror of the east, lacking shade in the afternoons from March to September (Fig.7) A second layer of operable sun controls, the wooden shutters on each French door, can be used during those periods when the overhangs do not provide the necessary shade.

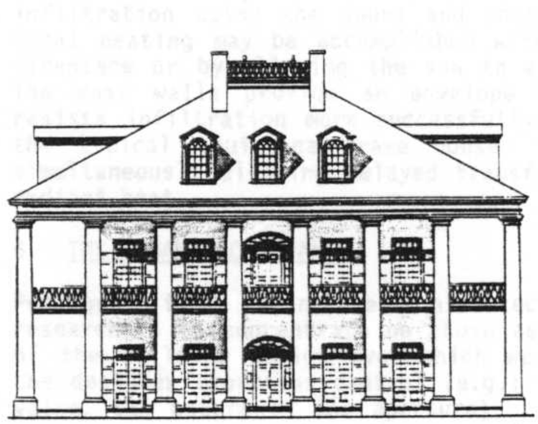

Fig. 5. North elevation.

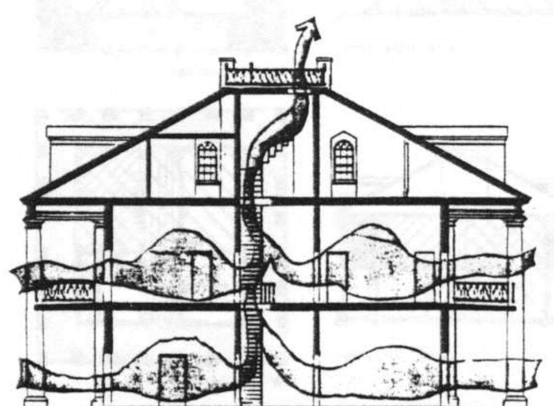

Fig. 6. Section showing stack ventilation.