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Vocational technical high school, Houston, Texas

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Rice University, 1992
RICE UNIVERSITY

VOCATIONAL TECHNICAL HIGH SCHOOL, HOUSTON TEXAS

by

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A THESIS SUBMITTED IN PARTIAL
FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE
MASTER OF ARCHITECTURE

APPROVED, THESIS COMMITTEE

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ABSTRACT

Vocational Technical High School, Houston, Texas.

by

Jonathan C. C. Campbell

This investigation attempts to create an environment that will foster the notion that the creation of an object is not merely a physical act but a mental journey. As architects, we are aware of the lack of separation between learning and making. Yet mainstream American education has long adhered to a practice of division of study and separation of disciplines. The result has been less than satisfactory. The building strives to mimic the journey from the unknown to the known and thus parallel the educational process. The method of exploration has been the construction of large scale models of technology. The design process has not taken the traditional form of architectural exploration of plan, elevation and section. Rather, the construction process has served as design process, and by questioning and examining the way objects are made and joined the building as a whole has been generated.
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Preface

Throughout the entire process of investigation, the intent of this investigation has been to create a building that will foster the notion that the creation of an object is not merely a physical act but a mental journey. As architects, we are aware of the lack of separation between learning and making. Yet aside from certain non-mainstream schools such as those ascribing to the philosophies of Montessori and Stiener, American education has long adhered to a practice of division of study and separation of disciplines. The results of such a practice are exemplified in the presented statistics. While these statistics serve as a call to arms, this thesis undertakes this charge with the understanding that architecture alone can not solve the problem of American education. The roots of such a problem are deep and varied. While this building can not address the social conditions that foster America's unfortunate state, it can attempt to provide a new visible symbol for educational facilities. The act of placing a school in a building that resembles a warehouse and not a Greek temple or red barn is a very weighty act. While this thesis sought to emphasize the tectonic aspects of architecture over the social issues involved, such issues are nonetheless acknowledged and understood. The building strives to mimic the journey from the unknown to the known and thus parallel the educational process. Similarly, the
design process itself was a journey from the unknown to the known. The traditional design process of planometric investigation, sectional manipulation, and theoretic consideration, was eschewed in favor of investigation of construction. Details of the building were investigated before the final outcome was achieved. The method of such an investigation has been to create large scale models of technology. Wood, concrete, and the Computer were utilized to create models of connections and structural systems. Thus the design process was the construction process of these models.
Original statement of Purpose

December 16, 1991

The purpose of this thesis is to design a high school. More specifically, a vocational high school. One wishes to use the given architectural program of the Houston Metropolitan School district to avoid centering the thesis on various theories of education. Although it is impossible to create a work of architecture that is not able to be interpreted in light of various intellectual movements, the author does not wish the focus of the investigation to center on issues of theory. While theory can inform the making of an object, it has been the observation of this author that more often than not it is the making of the object that shapes the theory. It is the literal marks on the page that insight the architectural mind to thought. Theories and reasons are then used to validate these marks. Theories by themselves do not draw buildings. They must go through first the mind and then the actual hand of the architect. Theory is by its own nature a non-visual entity. Architecture by its own nature is a visual entity that spurs intellectual thought. Architectural theory is defined by words that are backed up by carefully compiled images. Moreover, successful buildings are not necessarily bound to successful theories. Certain modern buildings are deemed masterpieces even though the movement that spawned them has failed. The Acropolis of Athens
continues to inform architecture today even though the social and theoretical institutions that formed it are no longer appropriate. Such a belief in the misplaced importance of theory was the initial reasoning behind the choice of a vocational high school. Rather than a conventional high school where what is taught is the reason for the school's existence, a vocational school relies on what is made. A more compelling reason I have for wishing to do a Vocational School is demonstrated by the accompanying sheet of statistics. More clearly than I could surmise in words, these statistics show that America's traditional vision of itself is no longer valid. No longer are we a nation of emigrants who are imbued with the same cultural work-ethic of our white, protestant forefathers. America is much more rapidly and increasingly changing in cultural composition. The current system of education is bankrupt. The outdated mode still in operation is rooted in a Greek notion of the dialectic in which the one room, red barn school house is still the predominant imagery that society embraces. Moreover, the last one hundred years of higher education have all but removed the idea of a core curriculum form their philosophies. The notion of independently chosen majors is now standard in almost all American Universities. Indeed, the dilemma that faces a pluralistic society (particularly in today's climate of the "politically correct" society) is that in order to avoid dividing the cultural pie ad infinitum (or even ad absurdum), the solution has been to simply give away more pies. The result is a collection of groups each very well versed in their
own subculture, but completely ignorant of the larger cultural whole. The educational imperative to go to university is not to acquire a grounding in what was once referred to as Common Culture, but rather to attend in order to promote individual achievement. One current manifestation of this is the lack of credibility given to the *mere* liberal arts degree. Currently, the liberal arts degree is mostly used as a pedigree to gain entry to a prestigious law, business, medical, or architecture school. Yet these later institutions are nothing more than expensive trade schools. Education is no longer an act of cultural fidelity, but specifically an act of personal advancement. While education has traditionally always embraced this notion of personal advancement through higher learning, society has always frowned upon the notion of a trade school. It is time we as a society properly dealt with this issue. As architects we are fully aware of the educational value inherent in the making of an object. The discipline of architecture is in keeping with certain educational theories (specifically the Montessori Method and the philosophy of Rudolph Stiener) which place great value to the lack of separation between learning and doing. The traditional approach to knowledge is that it is based on Theory. The traditional educational approach draws a very distinct line dividing life into distinct areas such as work and play. Such an approach goes on to further distinguish between theoretical principles and application of that knowledge.
For the architect, and indeed for the system of vocational education, the knowledge and the making are informed by each other. Architects above all other professionals are aware of the great educational potential inherent in the act of making an object. The making of an object is not merely a physical act but also a mental journey. The author wishes to use such a metaphor as the guiding principle of this thesis. Not only is this metaphor to be used as the genesis of an architectural program, but also as the actual method of discovery. One hopes to be able to explore spatial and material attributes through the making of large scale models. Such models are meant to be simultaneously the 'marks on the page' as well as representatives of the actual joints and details. The models and completion of the thesis is meant to be an incarnation of the metaphor of the school; a journey from the unknown to a state of knowing.
A manifesto

The following statistics provided the initial impetus to reconsider the traditional notion of American education. As these numbers may be used to point out, American education is not as effective as it desires to be. All statistics were taken from What Counts: The Complete Harpers Index, edited by Charis Conn and Ilena Silverman.¹

Every 8 seconds of a school day a child drops out

Average number of words in the written vocabulary of a 6 to 14 year old American child in 1945: 25,000

Number today: 10,000

Number of the 6 best selling extracurricular books in college book stores that are collections of cartoons: 4

Percentage of Americans under the age of 30 who say they read a daily newspaper: 40

Percentage of Americans under the age 50 who say they do: 65

Number of words in the English language that exist because of typographical mistakes or misreadings: 381

Number of black men currently enrolled in New York State colleges and Universities: 24,000

Number of black men currently in the New York State Correctional Facilities: 24,000

Change since 1979, in the average annual earnings of a black woman with only a high school diploma: +$279
With a college degree: -$744
Percent increase, since 1977, in the number of American children diagnosed as having learning disabilities: +142
Percent change, since 1980, in the number of American families composed of a housewife, and employed husband, and 2 children: -21
Ratio of work force entrants that are white males born in the USA: 2 in 10
Number of the 10 largest American cities in which white residents are in the majority: 3
Number in 1989: 8
Chances that a black American child will be born to a single mother: 2 in 3
Chances that an American child born this year (1991) will spend at least one year on welfare before reaching adulthood: 1 in 3
Chances that the cause of death of a 10-14 year old American in 1968 was suicide: 1 in 67
Today: 1 in 17
Percentage of business students at American Universities who admit to having cheated on an exam: 57
Percent increase, since 1988, in the number of American college students who have their own credit card: +37
Rank of Washington, D.C., High school students among students with the lowest mathematics scores nationwide: 1
Rank of Washington, DC, high school students who say that they are "good in math": 1
Percentage of American junior high school students who say they have sex at least once a week: 7
Average number of months an American girl is sexually active before using birth control: 12
Number of Americans who say that oatmeal is made of wheat: 48%
Rank of Television viewing, Eating, and Shopping among activities on which Americans spend the most leisure time: 1, 2, 3
Percentage of new American public-school teachers who say that they plan to quit the profession in five years: 34
Portion of American High School students who can not locate Latin America on a map: 1/3
Number of hours that an American teenager spends each week in class or studying: 38
Number of hours a Soviet teenager spends: 52
Number that a Japanese teenager spends: 59
Number of Japanese children who have died since 1985 as a result of disciplinary beatings by school personnel: 5
Percentage of American parents who say they spank their children: 83
Number of New York City public school teachers who were assaulted on the job in 1989: 710
Average ratio of students to teachers in a U.S. public school classroom in 1955: 27:1
Average ratio today: 17:1
Number of U.S. states that claim test scores in their elementary schools are above the national average: 50
Percentage of private school students in New York City who are not white: 16
Percentage of public school students in New York City who are white: 20
Rank of national and local Miss America pageants among all sources of college scholarship money for women: 1
Percentage of doctoral degrees conferred by U.S. engineering schools that are earned by foreigners: 55
Chances that a college educated American who did not vote will claim to have done so; 1 in 2
Median age of an American voter: 45
Average weekly increase, in 1989, in the population of state and federal prisons; 1,800
Chances that an American male has spent a night in jail: 1 in 5
Percentage of the $10.6 billion 1990 federal anti-drug budget that went to educational programs: 13
Chances that a black American who graduates from college will graduate from a black college; 1 in 3
Average number of U.S. presidents an eight to twelve year old American child can name: 4.8
Average number of alcoholic beverages an eight to twelve year old American child can name: 5.2
Average number of minutes per weekday that the child of a working mother watches television: 111
Average number of minutes per weekday that the child of a nonworking mother watches television: 139
Percentage of parents who say they want the option of having their child's school photograph retouched: 30
Chances that an American between the ages of six and seventeen cannot pass a basic fitness test: 2 in 3
Number of different familial relationships for which Hallmark makes cards: 105
Building Program

A vocational educational facility to house:
24 classrooms
Wood shop
Metal shop
Faculty and Administrative offices
Library
Cafeteria/Kitchen
Custodial space
Mechanical space
Loading dock
Parking for staff

2 stories at 19,750 sq. ft.
3 stories at 18,850 sq. ft.

5 stories total at 96,050 sq. ft.
The Site

The site chosen for this building is on Commerce street, Houston, Texas, between the Main street and San Jacinto bridges. The site is at the edge of the Central Business District of the city. Directly across the bayou stands the new county jail, while to the northwest stands the downtown campus of the University of Houston. The buildings to the east are warehouses, and directly to the west is a decrepit park known as Allen's Landing. The park celebrates the site chosen by the Allen Brothers to found the city of Houston in 1836. Repeated flooding has caused the retaining wall of the park to slide into the bayou, and the park is mostly fenced off with temporary chain link fencing. Currently, the park and the area underneath the Main street bridge is inhabited by the homeless.

The site itself lies eighteen feet below street level, on a man made plinth. The plinth is twelve feet above the banks of the bayou, and six feet again above the level of the water. The retaining wall towards the southern end of the site is collapsing, and twenty four feet of Commerce Street has been fenced off to prevent further collapse. Currently, a decrepit warehouse stands on the northern edge of the site. The entire site is for sale.

There also exists the presence of the foundation piles of two previous warehouses. One of these warehouses was know to be a coffee warehouse, while the other is believed to have served as a grocery store. The foundation piles are revealed as two distinct
grids. One grid is parallel to Commerce street, while the other is parallel to the retaining wall on the western edge of the property. The former grid is 12' by 12', while the later is 10'-6 by 11'-0". The column caps are flush with the level of the site. The materials of the two grids systems are either steel or brick. Both grids employ both materials.

As is was impossible to test the integrity of these two existing foundation systems, is was decided that any new structure could not utilize these existing piers and would have to drill new ones. Thus this structural necessity, combined with a themematic desire to relate to the ghost-like imprint of the previous buildings, created the opportunity and necessity to depart from a purely orthogonal geometry.
Structural System

The building is supported by an internal heavy timber frame and an exterior masonry shell. The wood columns are on a 10' by 10' grid. When unobstructed space is required, as in the classrooms for example, glue-lam beams support wood truss joists that clear a 30' span. Steel decking is screwed to 1.25" plywood decking to form a rigid decking. The wood is treated with fire-retardant paints and is left exposed. A system of poured concrete piers and CMU block comprises the exterior shell of the building. The internal wood structure leans against this outer shell for structural stability. The concrete piers are oversized and hollow. Their interior volumes serve to house the requisite mechanical chases and duct work. The Southwest and Northeast corners of the building house the vertical circulation of the building, as well as fire stairs. The shop spaces that occupy the center of the building are surrounded by a glass curtain wall, supported by custom made wood columns. The spaces extend from the second to the fifth floors, and serve as light wells. The glass protects against sound, dust, and fire transmission. The windows of the building are operable steel casement windows. The wooden screens on the outside of the building serve to lessen the solar gain of the building. They are comprised of rough sawn oak 3x6's, 3x8's, 3x10's, and 3x12's. The wood is meant to warp and check and give the general appearance of a hand woven basket. The oak is affixed to the concrete via steel angles bolted to the surface. The boards are densest on the South and North faces of the building,
and least so on the east and west facades. It is hoped that these boards will serve as a passive cooling device and cause the South wall of the building to function as a trombé wall.
Design Intentions

The design attempt of this building was to create a structure that didactically describes the tectonics of making. The building first appears as large and forbidding, built by large machines and an industry beyond the scale of a single individual. Upon entering the building, the structure reveals itself to be a wood timber system, with a visible presence of the carpenters who built it. The symbolic heart of the building, the wood shop spaces (which also serve as light wells for the whole building), are further articulated by a curtain wall system built of entirely hand crafted wood columns. It is in this journey from the exterior of the building, which is built at a monumental scale, to an inner core built at the scale of a single craftsman, that the building hopes to allude to the educational journey of freshman to senior, from the state of naivete to that of confidence.

The thesis investigation started with an initial review of the work of Santiago Calatrava. It was thought that the large scale expression of structure might serve as an appropriate urban gesture for this very industrial part of town. While the final solution did not opt for the complete expression of a singular, domineering structural solution, the influence of such study can be seen in the appropriation of the design for the loading dock door. The urbanistic gesture of the building has been to mimic the neighboring warehouses typologies. A site inspection of these
buildings lead one to believe that the buildings were orthogonal and simplistic. A more intensive scrutiny of the published plans of the structures revealed that they were in fact not orthogonal. Walls were cropped, skewed and extended in various directions, presumably to achieve the maximum square footage while still complying with property set backs and easements. This building encountered a similar condition in that the property lines were not perpendicular, but in fact deviated by two degrees. This would explain the existence of the two column grids visible on the site. In order to achieve the requisite square footage and necessary parking, this building follows the examples of the warehouse in the area and mimics their skewed geometry. Thus the two L-shapes that comprise the classrooms of the building are set at a 2 degree angle to each other, one parallel to Commerce street, the other parallel to the property line. The resulting tension in plan that arises out of the offsetting of these grids is absorbed in the two circulation towers at the Northeast and southwest corners of the building. The expression of the shop spaces as conforming to the location and meter of the existing column grids is an attempt to pay homage to the historical nature of this district of the city. While the building is new construction, it attempts to recognize that previous buildings have stood on its site, and that the site is adjacent an area of significant local history.
Summary of Final Review
Final Jury, April 17, 1992
Natalye Appel
Joseph Colaco
Steven Harris
Gordon Wittenberg
Ellen Whittemore
Natalye Appel commented that the building is reminiscent of the movie "Brazil," in which older buildings become re-inhabited with students 'gone wild over technology.' She mentioned that I have become a high school student of this school of my own making. Ms. Appel likened the wooden screens to a midwestern corn crib structure, and thought that that was an interesting analogy to draw. She further elaborated that the piers of the exterior served to cause the building to read more like a castle than a warehouse, and that it was perhaps more related to the University of Houston building than to the other warehouses. She expressed concern over the siting and seemed to feel that it was under developed. Ms. Appel also stated that the problems of American education that inspired the investigation of a vocational school in the first place would not be solved by architecture.
Joe Colaco questioned as to the sites susceptibility to flooding, and later commented that the concrete piers alone were enough to support the loads of the building. He expressed admiration for the concrete models.
Steven Harris described the thesis as comprising of three parts; the technological aspect, the formal manipulation of the plan, and the overall siting of the building. He stated that the main interest and energy of the project lies in the expressive aspect of the technology and the fascination of joinery and components. Mr. Harris stated that this aspect of the project was handled with great expertise, but that he felt that the plan was overly simplistic and rendered with out passion. Mr. Harris felt that the site was the least considered aspect of the building.

Ellen Whittemore expressed concern that the social agenda inherent in the placement of a school in a warehouse-like building was not adequately described in the verbal presentation. Ms. Whittemore expressed a desire to see detail drawings of how a person would interact with the walls and windows of the structure, and at what scale is this interaction most effective.

Gordon Wittenberg expressed a desire to make it known that the construction of the models served as the design process of the building. Mr. Wittenberg stated that these models of technology were very expressive and that it was important to properly document them. He felt that it was very interesting the way the building evolved as a result of trying to model technology. He felt it was possible to derive a building through an investigation of construction as opposed to formal solutions to imposed architectural problems.
BIBLIOGRAPHY


Appendix A- Illustrations

Study Models
Alternative Structure Model
Model of Structural System
Detail Model of Interior Column Connection
Final Model
Appendix B-Final Drawings
SCALE: 1" = 33' - 4"

Concrete Shell
SCALE: 1" = 33'-4"

Third Floor Plan