Ostram’s Building at Rice
Icons, Themes & Images

Keith D. Cooper

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Rice's primary goal for the Computational Engineering Building was to forge a new community by bringing together a diverse group of people, all focused on the application of computation to problems in engineering, and somehow, inducing them to collaborate. In this context, the problem of building design became one of using bricks, mortar, concrete and wallboard to foster a sense of community and to imbue it with a sense of energy and of purpose – in essence, to alter people's behavior.

To accomplish this, Rice turned to John Outram, a British design architect noted for his provocative use of interior and exterior decoration. Outram believes in an architecture of ideas and themes. He uses these themes to create thought-provoking interiors. The building that he designed for Rice surrounds a striking and colorful interior with a deep facade of brick and precast concrete. He believes that buildings and their inhabitants interact in fundamental and subconscious ways. Thus, the design tries to encourage interaction across both the academic geography of departments and the physical geography of distance. It contains private spaces for concentration and public spaces for reaching out to the university's various communities. It has laboratories and classrooms for education and "outworking" spaces to foster collaboration. Its interior vistas catch the eye and its exterior materials harmonize with the campus.

This booklet explores some of the ideas and themes of Outram's architecture and relates them to both his building at Rice and to the surroundings of the campus. It begins by exploring Outram's approach to social organization as it relates to the structure of a river valley civilization. Next comes architectural structure in his concepts of the Robot Order and the Occluded Temple. Then, it delves into the matter of decoration, seen in the building's entablature, exterior and interior. Finally, it discusses some of the functional issues that influenced the design of the Computational Engineering Building. The booklet is also illustrated with some of the pictures and drawings that Outram uses to explain his work. It should answer some of the questions raised by walking through his building, but it is no substitute for experiencing the space directly.
A critical underpinning of Outram's approach to creating communities is the concept of a river valley civilization or the "Republic of the Valley." Many early civilizations formed around a single river valley that ran from a source in the mountains to a delta and harbor in the sea. This pattern occurred in many locales – Ancient Greece, Cypress, Egypt's Nile Valley and Oregon's Willamette Valley. The figure of a river valley occurs as an organizing principle in many architectural settings: in Roman villas and Christian churches, in Chinese cities and Indian temples, in the designs of Le Corbusier and James Stirling. The recurring use of the river valley figure through the ages suggests that it touches something fundamental about the organization of societies and civilizations. This notion is central to Outram's vision of his work and his interpretation of the work of others.

To create a community, Outram designed into his building a river valley with its many diverse elements (mountains, sources, clearings, caves, bridges, delta and ocean). The valley creates a single social space to bring together the diverse community of computational engineering (applied mathematicians, computer scientists, electrical engineers and statisticians). While his building is the first at Rice to create such a space in the interior, the figure of a river valley is not new to Rice. Outram argues that it is a central metaphor of Ralph Adams Cram's original plan for the campus.

In Outram's view, the critical features of the valley are its source from which water flows, the valley or canyon itself and its delta. At the head of the canyon, streams from multiple sources may merge together. At the foot of the canyon, one finds a bridge like the bridge of appearances found in a Gothic cathedral. The delta is a place for cities, for commerce and for contact with other cultures. These features are clearly present in his various drawings of the "republic of the valley."

The River and Cram's Plan for Rice

Looking at Cram's plan for Rice, it is easy to see the valley that Outram envisions. It has a source placed in what is now the stadium parking lot and a valley that flows from there to its delta in Founder's Court. The implementation of the plan still follows this model. Alice Pratt Brown Hall lies at the western end, in the mountain glade or "round dance" under the dome of the sky – an appropriate figure for the performance halls of the music school. In Cram's plan, a single, small, central building sits like a boulder in the middle of the river, as realized in Fondren Library. It is a dam that truncates the whole arrangement. The buildings aligned along the axis – Physics, Sewall, Anderson, Rayzor, the Student Center, Herring and now, the Baker Institute – become the canyon walls. The walls break to admit flow from tributary valleys to the north and south. The Sallyport of Lovett Hall forms a gateway underneath its bridge of appearances, leading to the delta that faces eastward, toward the City of Houston. In this iconographic view of the campus plan, even the oft-recounted limerick about Lovett's office takes on new significance. Watkins placed Edgar Odell Lovett's office above the Sallyport, where it dominates the bridge. This placement implicitly underscored both his central importance to the institution and his role as guardian and protector in the interactions between the university and the adjacent city. Appropriately, the current academic rituals of the institution both recognize and reflect this river-valley myth. Matriculation, the formal entry of a student into the University, is held on the lawn of Founder's Court. Thus, students begin their academic journey in the river's delta, pass under the Sallyport's bridge and enter the valley wherein they work and study. At the completion of their studies, they graduate. Graduation is staged just inside the quadrangle, to the west of Lovett Hall. The students receive their degrees and pass back through the Sallyport to the delta and its harbor. They have spent their time in the valley and are sent forth to use their new-found knowledge in the commerce of the outside world.
This early aerial shot of Lovett Hall and the Physics Building shows the two buildings as viewed from above the academic quadrangle. Notice how the vegetation and walkways of the quadrangle flow together into the constriction of the Sallyport. Notice the three paths leaving Founder's Court and running to the outside world, which form the figure of a delta.

The River in the Computational Engineering Building

The Computational Engineering Building is a physical manifestation of the river valley plan. It has clearly defined sources in the balconies of the western and southwestern wings. Water gathered in these highland "roof gardens" flows down the open stairs to the floor of the West Hall. The water mixes and meanders a bit on the sandy floor of the West Hall before coalescing into the river that ripples down the central hallway. (Outram refers to this as the "dancing floor" or the "round dance.") The central hallway or "street" forms a canyon with its precipitous walls rising on either side. On one side, the caves of habitation cling to the canyon wall along the exposed hallway. The canyon ends at the "bridge of appearances," giving way to the delta and harbor in the Main Hall. Other tributaries form around the balconies of the northern and eastern wings, running down the central stair to the Delta. The river organizes the building. The two critical locations are the canyon's head in the West Hall and the delta in the Main Hall. These spaces are given over entirely to public functions for activities that deal with the community and its interactions with the world beyond the valley.

The Main Hall contains the principal community outreach spaces in the building. Surrounding the hall are the auditorium, two lecture halls, three classrooms and two conference rooms. Each hour of the day, hundreds of students will file through this space en route to classes. The street, connecting the Main Hall to the West Hall, is lined with the administrative offices of Rice's Center for Research on Parallel Computation, the Computer and Information Technology Institute and the academic departments housed in the building. As the administrative center of the building, the West Hall contains the public offices of the various organizations housed in the building, along with a conference room. The glazed brick patterns on the columns of the main entrance depict this river-valley figure. The rivulets of water, formed in the highlands, begin at the top of the columns. They run downhill to the head of the canyon where they hit the "round dance," shown as the swirl that divides the rivulets from the canyon. The water runs down the canyon to the gateway bridge, represented by the arches of the arcade, with the windows of the central conference room forming a balcony of appearances. Finally, the river flows into the delta depicted on the lower column, across the creasing tiles and into the unending waves of the sea. (Notice the small icon set to the left of the swirl. It represents the "occluded temple," an idea we will encounter later.)
Along with the figure of the river valley, Outram uses a regular grid of columns called a “hypostyle” to organize his architecture. While the valley structure focuses the architecture inward, the hypostyle relates the detail of its structure to the surrounding world and integrates them together. The hypostyle is a regular grid of columns, potentially infinite in its extension. Where the valley recalls the structure of the Greek city-state, the hypostyle reminds us of the unifying force of the Roman Empire. It reaches out to shelter everyone under its spreading canopy. In the campus plan, the hypostyle might be recognized in the regular and ordered planting of trees. Within the building, the massive columns of the hypostyle both organize the space and provide it with a sense of scale. In the Computational Engineering Building, for example, the columns are six feet in diameter – a human dimension. To create rooms, walls are set between the columns. To create larger rooms like the Main Hall, some columns are removed. To reinforce the column’s absence, Outram leaves a scar in the floor where the column is missing. It appears that the columns of classic architecture are somehow fundamentally related to human form – the classic, cliched image of Samson chained between two columns that hold up the roof. And, to trees – the columns of an idyllic forest holding up a canopy of leaves. The human scale of the columns is important. In some mystic way, it helps people relate to the scale of the building. Using modern construction techniques, however, Outram’s columns are far more massive than structural requirements would dictate. To justify their size and to bring the various building services into a rational relationship with his architecture, Outram moves all of the major services into the columns, creating columns that, quite literally, serve the building. In Outram’s buildings, the oversize columns constitute a distributed, localized service core. Each column creates a vertical shaft to contain the support structure, power, water, environmental control and network systems required to operate the building. This leads to a discipline of vertical distribution. To accommodate horizontal distribution, Outram sometimes adds a “robot beam” along the grid lines of the hypostyle. In the Computational Engineering Building the robot beams are rarely realized. In some of Outram’s other buildings, the robot beams occur regularly and quite visibly. In the Computational Engineering Building, the columns are large enough that they can be hollowed out and a hallway run through them. This occurs throughout the building, although it is most noticeable along the south side of the street at the second floor. Where the hall passes through a column, a round light marks its hollow core as if it were simply transmitting the light of the overhead skylight. Walking the hallways, the “robotic” function of the columns is reinforced by the fact that access panels, fire alarm enunciators and electrical distribution panels are all located in the “column zone.”
The Occluded Temple

One of the fundamental ideas underlying Outram's building is the notion of an idealized but obscured temple. To see the hidden plan of the Computational Engineering Building, you must climb to the third floor and look down the clear story. The clear story is the key. It reveals the long march of columns through a grand space that resembles a gothic cathedral. Looking below the clear story reveals that this grand structure has been infested with a horde of small rooms. The clear story reveals the plan of the building. Its form is that of two Greek crosses. The Main Hall forms the center of the larger cross, while the West Hall lies at the center of the smaller cross. These abstract truths about its shape are hidden by the details of daily life. Outram calls this hidden building the “occluded temple.” This ideal but hidden structure cannot be seen, it can only be visualized and held in the mind. This requires the willful suppression of detail, a deliberate abstracting away of the myriad small rooms that partition the larger space into mundane offices, labs and classrooms. Outram was commissioned to build an office building. By leaving the clear story open, Outram has created a space that suggests the larger, grander structure to the observant mind. Just as the nature of the interior is hidden from direct view, so too is the exterior. The building is embedded into a site that is rich with trees. Most views of the building show it peering through the trees. It is difficult to discern either its size or shape until one is quite close. Again, the temple is obscured. It can best be perceived by mentally elaborating the hints seen through the trees. The same effect can be seen in Rome, where ancient buildings are hidden in and under more recent structures.

The concept is not new. This kind of abstraction is commonplace. Consider the maps of cities like Paris that are produced for tourists. These maps show the major monumental buildings – the Eiffel Tower, the Arc du Triomphe, the Opera, Place de la Concorde, Place de la Bastille, the Louvre, Montmartre – but omit everything that lies between them. In essence, they call on the user to ignore the fact that this mythic and monumental landscape has been taken over by neighborhoods and office buildings. This notion appears to have been invented in the fifteenth century by Leon Battista Alberti. His map of Rome demands that the user ignore the details of reality; even in his day the space between the monuments had been filled. Even so, his maps call on the user to picture an idealized reality, a mythic landscape. Outram argues that although we cannot take the old fables seriously and enshrine them in a mythic landscape, we can and should embed the extraordinary facts of our history and our imaginings of the future to create a new, modern mythic landscape. In this view, the occluded nature of monuments is just a natural part of the machinery that can liberate us from a mundane and literal world.

Entablature, or the Raft

How did this river valley come to be? Outram explains it by relating it to our common mythic heritage. When early civilizations set out to colonize, they sent forth a raft or an ark. The raft carried people, fire and civilization. It would float until it struck new land. At that point, the colonists would use the transported fire of their old home to start the fire of their new home. They had, in effect, moved their civilization, their ideas, their fire to a new land. The raft would decay or break up, but the essential elements – people, ideas and fire or energy – would persist. The roof structure of a classical building recalls this raft structure. In fact, its supporting members are often called “rafters.” A deck of rafters supports a pyramidal roof or “pyre.” In Outram’s architecture of ideas, this superstructure, or entablature, represents that mythical raft. Thus, above the column capitals, we find the blue logs of the raft. They are still dripping wet. The swells remind us of the chaotic waters of the flood. Above the logs, we find a green “saddle” that is the deck or table (entablature) upon which the ark rides. It is colored green because, in the raft, it is the lifespace, the level where people can actually live. On the table rests the pyramid of the raft, containing civilization, ideas and fire. The raft of computational engineering rests on a field of columns, impaled on Texas’ alluvial plain. In Outram’s myth, it came to rest on a mountain. The act of impalement opened a hole deep in the mountain’s core into which the flood receded. As the water rushed out, it eroded the interior into the river valley, revealing in the process the orderly hypostyle of columns. On the exterior, we see the geological striations of the eroded stone – a faint reminder of Outram’s myth. The classic vocabulary of architecture uses the word “entablature” to describe that part of the building above the columns. The word appears to derive from in-tablum, meaning a table or planked surface. The tablinium was a room where one kept pictures, painted on wooden planks. Thus, we can envision the entablature as a table on which one places ideas, mediated by text or pictures. The ideas are visible on the outside, where openings appear at the high windows and terraces, or where a ceiling coffers protrudes upward into the ark. In the Main Hall, the ceiling reveals some of these ideas, with its iconic representation of the birth of consciousness.
EXTERIOR DECORATION

Outram believes that the exterior decoration on a building should relate the building to the various communities and cultures that form its context. For example, the columns of Lovett Hall’s arcade relate that building to the historical community of scholars, with the series of capitals depicting scholars; to Texas, with the capitals featuring chaparrals and lone stars; and to the emerging culture of Rice, with the capitals depicting a lonely student battling the twin distractions of companionship and athletics. In the same way, the exterior decoration of the Computational Engineering Building places it into context.

Main Entrance
- The main entrance, facing Lovett Hall, carries several themes. First, the centerline of both the entrance and the Main Hall are aligned on Lovett Hall’s arcade. The columns carry an iconographic representation of Outram’s river valley — representing both the building itself and the culture of computational engineering carried out inside the valley. Above the large arches of the arcade are mountings for medallions commemorating four historical figures from the history of computational engineering. These four heads both echo the scholars’ capitals of Lovett Hall and terminate their march. Finally, the entire wing is fronted by a spacious, two-story arcade that carries on the architectural traditions of earlier Rice buildings while deferring to Cram’s Beaux Arts plan for the campus.
- The arcade snakes its way from east to west across the building. Occupied interior space encroaches on its height in each wing, taking it down to a single story in height. It cuts through the southwest wing, creating the physically separate space for undergraduate computer labs. Similarly, it cuts north through the west wing to isolate the Dean’s offices from the central body of the building. The north-south portion of the arcade lines up on the front of Abercrombie Laboratory to accommodate a planned arcade extension that would connect the buildings at both the first and second floor. At its western extremity, the front of the arcade aligns with the front of the Chemistry Building.

The Other Wings and Their Columns
- The four other wings all fit a common plan. Each wing is five bays across and two bays deep. Because the wing end is broad, the roof line is broken down to emphasize the five smaller bays. The outer bays have a pitched tile roof. The middle three bays have patios — the two outer bays have inaccessible patios at the fourth floor, while the central bay has an accessible patio at the third floor. The result is to break down the bulk of the wing into a series of distinct and smaller spaces.
- On each wing, the columns flanking the central balcony are decorated with icons in glazed brick. The decoration in glazed brick is intended to reflect and reveal the interior, particularly the Main Hall. On each wing, the icons read, from bottom to top, as water, earth, air and fire. Each wing has icons drawn from a different culture.
  - On the southwestern wing, the icons are drawn from Mayan culture. The water symbol is a turtle, the turtle that carries the earth on its back. The earth symbol is a diamond for the maize field. The sky symbol is a series of diagonal stripes, the sky bands found at the top of many Mayan temples. The fire symbol is a set of vertical lines that represent the bundle of sticks used to start a fire.
  - On the western wing, the icons are drawn from Greek mythology. The water symbol is Poseidon’s trident. The earth symbol is a set of six spots, the pomegranate seeds that bound Persephone to spend six months on earth and six months in the underworld. The air symbol is Hermes’ staff, with its ribbons trailing across the third floor spandrel. After all, spoken messages require air. The fire symbol is the thunderbolt of Zeus.
  - The northern wing is drawn from the Neoplatonic iconography of the Renaissance. The water figure is a simple wave. The earth figure is a square turned on its diagonal, the cubic room-figure of Renaissance architectural theory. The air figure is a spiral, reminiscent of gas boiling off from liquid. The fire figure, on top, is a simple triangle, reminiscent of the flame.
  - The eastern wing draws on images from Vedic mythology — symbols found in Indian, Iranian and Islamic architectural iconography. The water figure is the Khumba, or water bowl. In Islamic architecture, the Khumba often occurs at the base of a column. The earth figure is the Pipul leaf from Mohenjo Daro. It is an iconographic predecessor of the Lotus leaf. Above the Pipul leaf is an icon for the “subtle body,” an abstract idea conceived in the eye, spoken by the mouth and made concrete by the hand. The fire figure is the Cakra, the wheel of fire.
The building's interior decoration takes three forms: the shapes and colors of the structure itself, the patterning of the terrazzo floor and the ceiling of the Main Hall. Each merits brief explanation.

**Shape and Color**

- The interior is constructed largely of inexpensive, manufactured materials. The walls are sheetrock and fiberglass-reinforced, cast gypsum. The structural concrete is exposed in many places. The ceiling is a simple, lay-in, acoustical tile, set at a forty-five-degree angle to the building's grid. The balustrade rails are made from steel pipe. The only "natural" material found in any quantity is the wood of the doors. To dress up the interior and imbue these inexpensive materials with a deeper meaning, Outram uses both shape and color. The column yokes, where a round column metamorphosizes into a cage of four square columns, stand out because of their curved surfaces. The eye refuses to believe that the smooth and changing curve of its corners is simply gypsum. It looks more expensive. The color changes on the yoke ensure that the eye "reads" the curves. Similarly, the smooth, round columns of the West Hall deceive the eye. They are built from sheetrock. The mind is prejudiced to think of sheetrock as rectangular and flat. When confronted with this curved application, the immediate assumption is that some more sturdy and expensive material was used. All the surfaces of the interior are colored from the floor to the ceiling. Outram uses color to make your eye "read" the curves and twists of the interior. However, it is important to understand that color is simply another arrow in the quiver of his architecture of ideas. He selects colors to convey larger ideas; each choice is fraught with symbolism.
  - Each floor has a characteristic color, matching the scheme of the exterior. Thus, first floor is blue, for water. Second floor is green, for earth. Third floor is red first breath.
    The clearstory is yellow for fire.
  - The long expanse of ceiling is broken by the two halls into eight large rooms. The ceiling in each room has a different color.
  - The natural wood doors are stained aubergine, the color of shadow.
  - Slab edges, bridges and the stairs have a blue wave beneath them. This shows that each floor rests on the river's shore and is thus, prime river-front property.
  - The balustrade rail has four colors. The structural members are anthracite and yellow, recalling day and night or time. The green grid is set in a blue cage, suggesting land surrounded by water or space. Together, they juxtapose space against time.

- Color is intended to convey meaning and to provoke thought. These are a few examples, to tease your mind. As you walk the building, you can search for others. This is precisely as Outram intends. The interior should stimulate thought, both conscious and subconscious.

**Floor**

- The public areas of the first floor are emblazoned with a terrazzo floor that depicts the river valley. It starts in the West Hall, the dancing floor at the head of the canyon. Here, the rivulets of water that flow down the stairs from the high balconies mix together on the sandy floor to form the river. The waves flow eastward down the canyon toward the delta. As the river passes under the bridge of appearances, it takes an almost cubist turn through ninety degrees. It enters the delta from the north between the lecture halls, forms the classical three-fingered "goose's foot" and flows into the broken infinity of the ocean. Superimposed on the valley's image is the hypostyle. This is most apparent in the Main Hall, but it occurs along the entire floor. A particularly noticeable "column scar" occurs just inside the west entry.
Ceiling

The ceiling of the Main Hall is a vault, roughly fifty-five by seventy-five feet. The mural found there encodes a myth titled "The Birth of Consciousness." At first glance, it seems that the flower in its center must hold the key to its meaning. Look, however, directly east of the flower to find the small black spot. The spot is nothing.

However, nothing has a dual – that which is not nothing. You will find it opposite nothing, to the west. Once nothing notices its dual, they begin a random conversation, which you can see running between them. This conversation leads to self-awareness, begetting consciousness – the flower in the middle.

The flower is the primal energy event, akin to the "Big Bang." Around it, the universe forms, creating both space and time. As matter coalesces into the twin planets, seemingly made of cinder block to show their solidity, it forms both day and night. You can see that the energy event, or sun, is carried from day to night in a boat made of papyrus reeds. It is falling apart, probably due to its ancient construction.

This entire depiction of these ideas is carried in the center of the raft of migration (see "Entablature"). You can see the raft's outline, with its structure of logs that surrounds creation. The raft rides on the blue ocean, beyond which lies chaos. The corners of the raft carry crystalline mountains, which condense the sea-vapors evaporated by the sun to form the rivers flowing out to the corners.

Like many artists, Outram has produced multiple explanations for this work. In particular, the curious reader might consult his "Outline of an Iconography" and "The Log of the Navigator." To produce the ceiling, Outram drew it on a single A1 sheet of paper. The drawing was photographed to produce an eight inch by ten inch color positive, which was scanned at 1200 dpi. This produced a file of roughly 750 megabytes of data. The image was enlarged, using Live Pictures software, into 225 panels, each two by eight feet in size. These were printed onto vinyl using a 12 dpi Scanachrome printer. The vinyl was then wrapped around curved acoustical tile and bolted to a standard ceiling frame. Installation took just two days.
Building for the Computational Community

- So far, we have focused on the ideas and themes of Outram's architecture. It is easy to forget that the building was commissioned to fulfill a purpose: providing a home for the new interdisciplinary effort in Computational Engineering. The role of functionality in the design may be less obvious than the role of architecture, but it was no less important.

Outreach
- The Main Hall was created to accommodate a variety of outreach functions. In stark contrast to many Rice buildings, the Computational Engineering Building's public facilities are located just inside the entrance, where they can easily be found. To accommodate after-hours use for functions such as Continuing Studies courses, the entire Main Hall can be easily secured from the rest of the building.
- The auditorium can hold a meeting of 230 people. The hall outside, with its small catering kitchen, can accommodate various breaks and, if needed, meals. The auditorium is not a scheduled classroom. Instead, it is reserved for professional and outreach functions. The classrooms and lecture halls are clustered around the hall providing students with a space where they can wait before class and loiter and talk after class. The terrazzo floor is a concession to the hundreds of students who will pass through the hall each hour. They would destroy a carpeted floor. Two conference rooms are located on the wall. This makes them easy to find for meetings and to use as staging areas for events in the hall.
- The third floor of the Main Hall has two more conference rooms and a large meeting room, along with both interior and exterior balconies. These rooms are clustered together to allow coordinated use. For example, a meeting in the large conference room can use the small conference room to serve lunch; the attendees can sit in the 16 chairs on the interior balconies surrounding the Hall.

Collaboration
- To create collaborations, people must interact. In the early discussions about this project, Professor Don Johnson suggested that most collaborations begin with casual conversation when researchers collide at a common resource, like the coffee pot or laser printer.

Taking this notion to heart, the design team tried to lay out the building in a fashion that encourages circulation, both horizontal and vertical, by the inhabitants.
- The interior layout tries to provide good reasons for the residents to walk around the building. From each office, most day-to-day activities should be convenient. However, for each office, something is quite distant. The building features broad staircases that rise through the public space and a short floor-to-floor height to make the stairs an attractive option. (The distance from second to third floor is a mere eleven feet.) Coffee rooms, printer/copier rooms and bathrooms are placed quite deliberately; for example, from the second floor offices around the Main Hall, it is much closer to get coffee on the third floor than on second. Similarly, from the west wing third floor, the nearest coffee pot is down the western stair on the second floor. Paths leading to these common resources usually include at least one vista of the public areas to slow people down and increase chances for conversation.
- Serious collaboration entails many meetings. Thus, the building has a large number of conference rooms, five smaller and two larger rooms. It is littered with public gathering points and interaction spaces, which Outram calls "outworking" areas. These occur at places where people are likely to meet: at the confluence of paths, at stair landings, on the various bridges. Each is a space set apart from the corridor, furnished with comfortable chairs and, usually, a table. Our hope is that these spaces will help develop casual encounters and conversations into real technical exchanges and ultimately, collaborations. Finally, the policies for managing space within the building are meant to encourage interactions that cross departmental boundaries. Thus, offices are assigned by research affinity rather than departmental affiliation.

Adjacency, in either the horizontal or vertical direction, is based on an expressed interest in collaboration; in most buildings it is an artifact of the departmental affiliation listed on some personnel form.
Offices

- The building is large, housing approximately 10% of the faculty and a similar portion of the graduate student population in a collection of roughly 250 offices. The offices influenced the architecture in significant ways. For example, 75% of the offices have exterior windows. So, a large part of the building's skin consists of windows. Of the remaining 25%, all but 11 offices have windows. The need to cluster offices for research purposes led to the wide and deep profile of the wings. This, in turn, led Outram to break down the roof on the wings in an attempt to hide their bulk. Similarly, the architecture influenced the design of offices. The clearest examples are the "roofless" offices on the third floor and the "porthole" offices along the north side of the street. More subtly, the underlying hypostyle limits the number of places where a partition wall can be placed. This results in a couple of "standard" office shapes. Variations are introduced by the two placements of the interior hallway relative to the office and by the presence of the "bay windows" at the ends of wings. These occurrences create a large set of office sizes and shapes, rather than the two sizes (large and small) that might be expected.

Research clusters

- To provide appropriate space for research groups, the wings are organized into clusters. The typical cluster is a hallway cut through a collection of larger and smaller offices. Each cluster will house a group of faculty, research staff and graduate students. The clusters are somewhat isolated from the central spaces of the street and the two halls. Their narrow corridors and short ceiling height create a sense of privacy. Most wings house two clusters, surrounding a central resource like a laboratory, a library or an outside balcony.

Technically Speaking

- Each office has plenty of power – typically four outlets that can supply 10A each. Next to each power outlet is a data outlet that connects back to one of the network wiring closets. The initial plant for network wiring includes over 100 miles of category 5+ twisted-pair cable and over 13 miles of fiber optic cable. The lights in offices, labs, and conference rooms are double switched to provide both low and high levels of illumination. They rely on transistorized ballasts rather than electromagnetic ballasts to significantly reduce their power consumption. The lights have parabolic reflectors with a 55° cutoff to ensure that they cannot reflect glare onto a computer display.

- Even the air conditioning system is unconventional; each office has an independent fan-coil unit, with a thermostat and fan-speed control. The fan-coil units, in turn, can be ganged together for scheduling from the University's Central Plant. This combination should accommodate the diverse heat loads caused by changes in equipment and occupancy without requiring the "rebalancing" that plagues conventional double-duct systems. It affords each occupant with a large degree of control of their environment. It eliminates most of the ductwork in the building. In fact, the fan-coil system reduced the building's height by six feet, with a corresponding reduction in the building's skin and cost. Since it avoids the traditional air return plenum above the ceiling, it eliminates the need for Teflon-jacketed network cable, a substantial saving in cost.
This booklet is my interpretation of John Outram's approach to designing Rice University's Computational Engineering Building. It contains many ideas and themes expounded by John during our three year collaboration. John's own words can be found in his writing, particularly his "Outline of an Iconography" and "The Log of the Navigator."

It is short, at least by comparison to the two texts cited above, and its level of detail suffers from that brevity. Nonetheless, I believe that it provides an accurate introduction to the themes and ideas that collide to form the Computational Engineering Building."

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September 1996

ABOUT THE AUTHOR

Keith D. Cooper is an associate professor in Rice's Department of Computer Science. His involvement with the Computational Engineering Building dates back to the late 1980's, when the initial discussions about the size, site and purpose of the building began. Since 1993, he has been the School of Engineering's liaison to the design team. In this role, he has been deeply involved in all aspects of the project. When he is not interpreting Outram's architecture of ideas, he is busy working on compilation problems for microprocessors.

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"This booklet is my interpretation of John Outram's approach to designing Rice University's Computational Engineering Building. It contains many ideas and themes expounded by John during our three year collaboration. John's own words can be found in his writing, particularly his "Outline of an Iconography" and "The Log of the Navigator."

It is short, at least by comparison to the two texts cited above, and its level of detail suffers from that brevity. Nonetheless, I believe that it provides an accurate introduction to the themes and ideas that collide to form the Computational Engineering Building."

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