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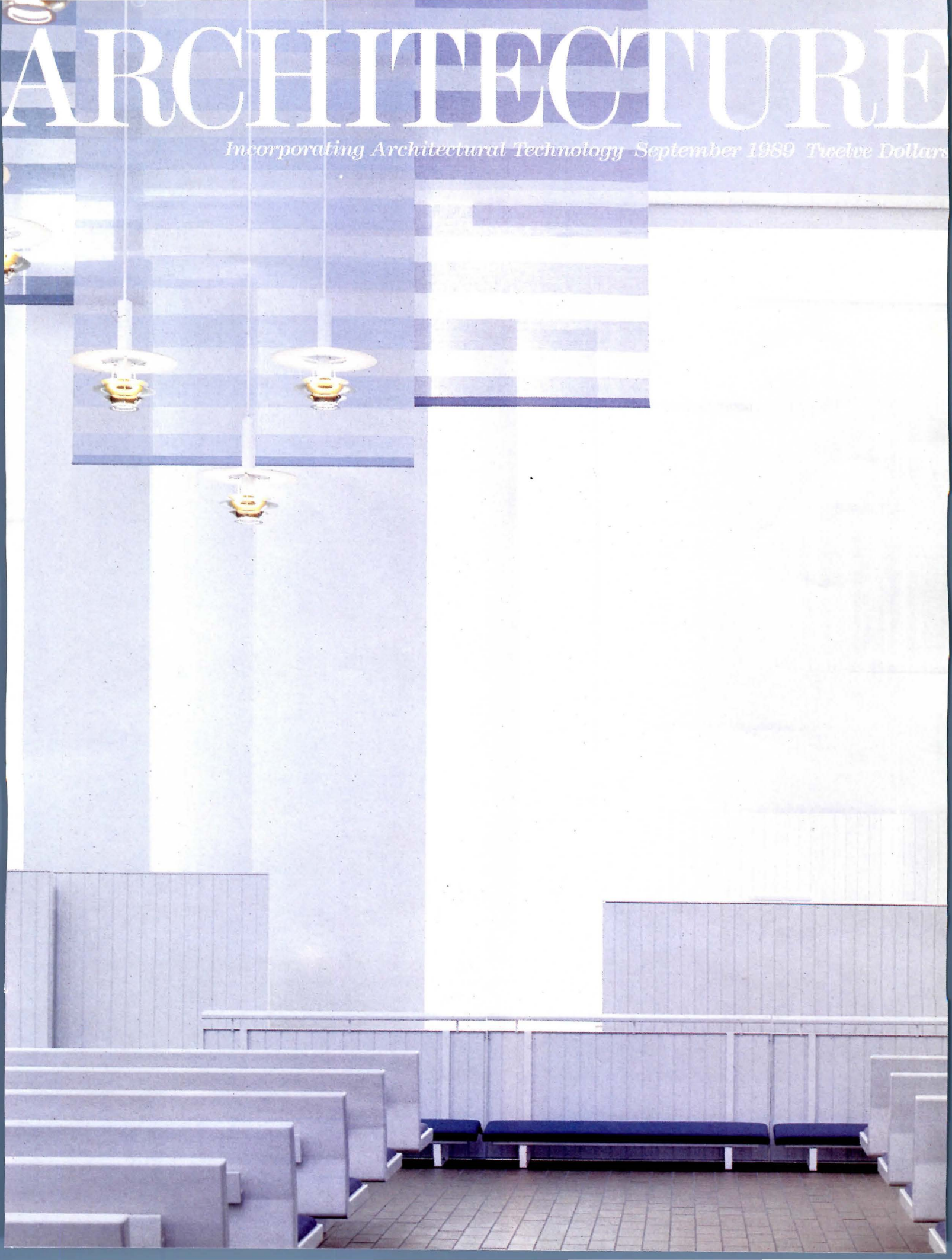

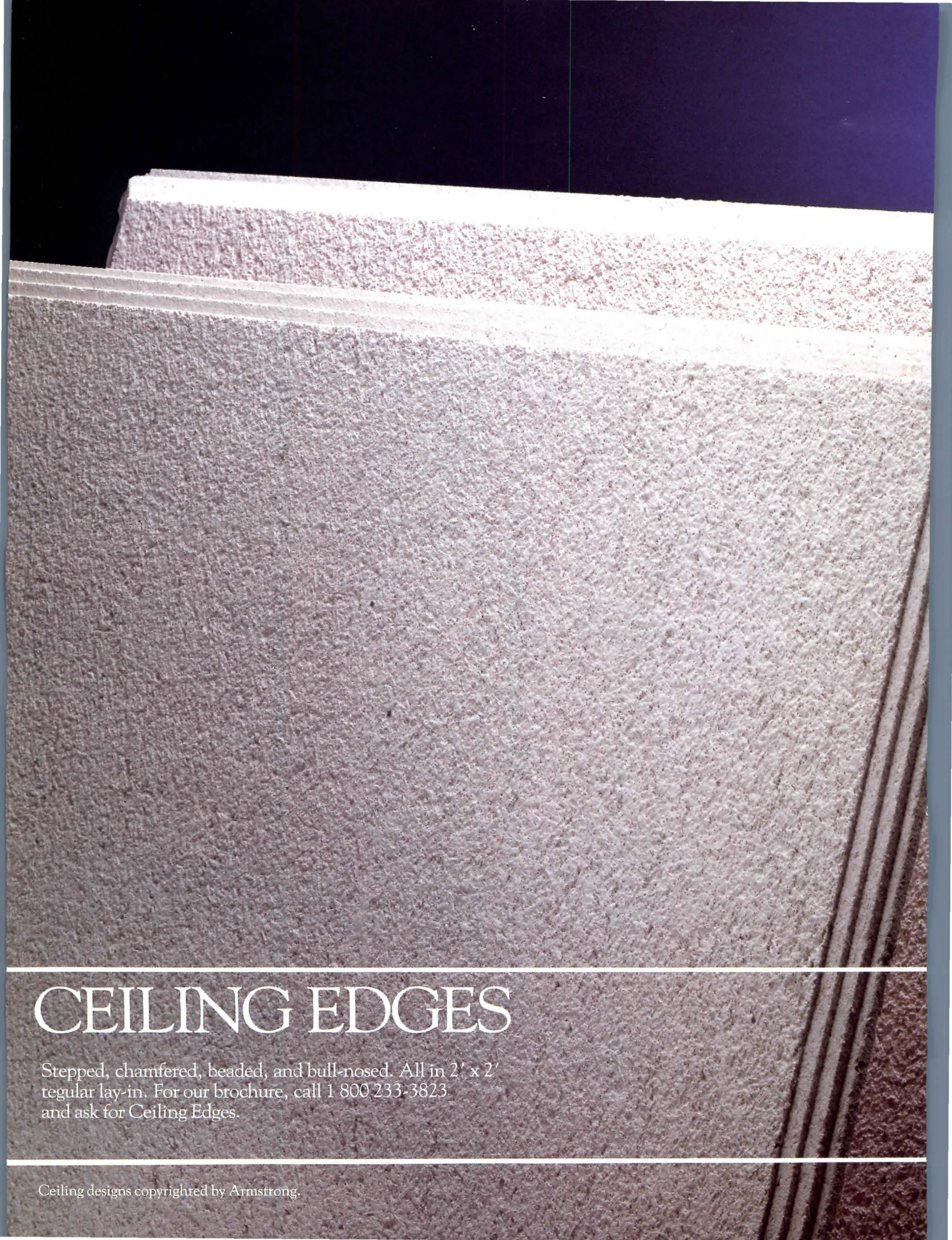

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Far left, a Swedish clubhouse; left, a German educational building.

Right, an Australian corporate headquarters; far right, a Hungarian education center.

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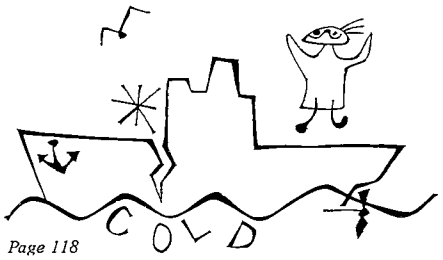

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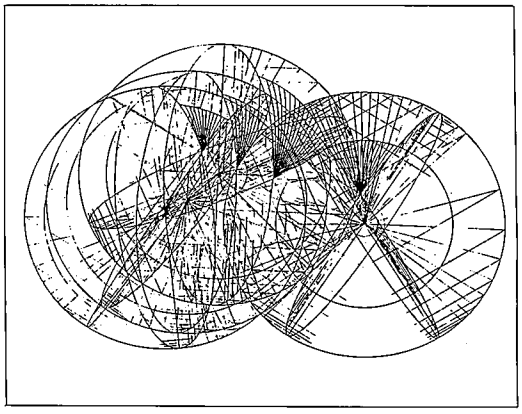
Analyzing failures prevents new mistakes.

Technology and Practice

Cover
Myyrmaki church/parish center (Juha Leiviska, architect) in Finland is built along a train track to create room for an urban park; its theme is light (see page 58). Photograph © Simo Rista.

News



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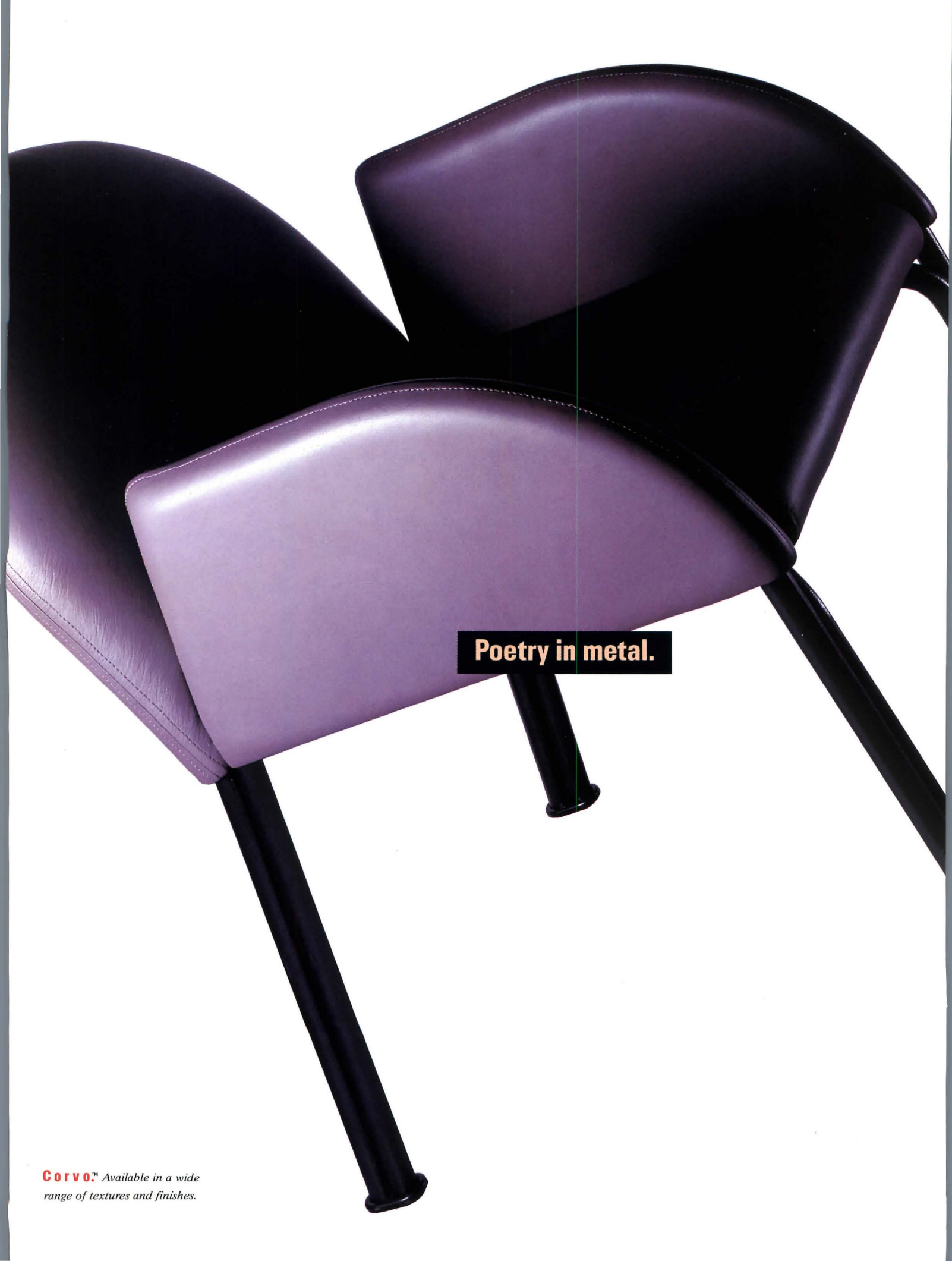
Sections of the same sphere became Utzon's masterpiece.



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EVENTS

Sept. 15-Dec. 22: Exhibit entitled "Blueprints to Buildings: Projects by Vermont Architects," Burlington, Vt. Cosponsored by the Robert Hull Fleming Museum of the University of Vermont and the Vermont Chapter/AIA. Contact: Robert Hull Fleming Museum, Burlington, Vt.

Oct. 1-4: Sheet Metal and Air Conditioning Contractors' National Association Convention and Trade Show, Honolulu. Contact: Rosalind Price Raymond, SMACNA, 8224 Old Courthouse Rd., Vienna, Va. 22180.

Oct. 1-4: Polyurethanes '89: Technical/Marketing Conference, San Francisco. Contact: Society of the Plastics Industry, Polyurethane Division, 355 Lexington Ave., New York, N.Y. 10017.

Oct. 4-7: International Trade Fair for Environmental Design, Frankfurt, West Germany. Contact: Jutta Langen-Benndorf, (069) 7575-6364; (fax) (069) 7575-6950.

Oct. 5-8: American Institute of Graphic Arts Graphic Design Conference, San Antonio, Tex. Contact: Kay Bergl, AIGA, 1059 Third Ave., New York, N.Y. 10021.

Oct. 8-11: Conference and Trade Show of the Associated Landscape Contractors of America, Boston. Contact: Julia Vaught, ALCA, 405 N. Washington St., Falls Church, Va. 22046.

Oct. 10-12: Workshop on Creativity in Design, Madison, Wis. Contact: Donald Schramm, Dept. of Engineering Professional Development, University of Wisconsin-Madison, 432 N. Lake St., Madison, Wis. 53706.

Oct. 10-13: Program on "Making CADD Pay in the '90s," San Diego. Contact: Jennifer Terminesi, Professional Services Management Journal, 10 Midland Ave., Newton, Mass. 02158.

Oct. 16-20: Course on Level-I Infrared Thermography, Burlington, Vt. Contact: Paul Grover, Infraspection Institute, 33 Juniper Ridge, Shelburne, Vt. 05482.

Oct. 16-20: International Conference on Tall Buildings and City Development, Brisbane, Australia. Contact: Conference Secretariat, P.O. Box 731, Toowong QLD 4066, Australia.

Oct. 19-20: South East Design Systems Conference and Exposition, Jacksonville, Fla. Contact: Elaine Elder, 1112 Third St., Suite 10, Neptune Beach, Fla. 32233.

Oct. 22-26: Southern Building Code Congress International Research and Education Conference, Charlotte, N.C. Contact: SBCCI, 900 Montclair Rd., Birmingham, Ala. 35213.

Oct. 22-28: Joint International Waste Management Conference, Kyoto, Japan. Contact: American Society of Mechanical Engineers, 345 E. 47th St., New York, N.Y. 10017.

Oct. 24-28: International "Making Cities Livable" Conference, Charleston, S.C. Contact: Suzanne H. Crowhurst Lennard, P.O. Box 7586, Carmel, Calif. 93921.

Oct. 25-28: 12th World Energy Engineering Congress, Atlanta. Contact: Association of Energy Engineers, 4025 Pleasantdale Rd., Suite 420, Atlanta, Ga. 30340.

Oct. 29-31: Better Building Conference and Exposition, Syracuse, N.Y. Contact: Jim Lafferty, New York State Energy Office, 2 Rockefeller Plaza, Albany, N.Y. 12223.

Oct. 29-Nov. 1: International Facility Management Conference and Exhibition, Seattle. Contact: Don Young, IFMA, Summit Tower, Suite 1410, 11 Greenway Plaza, Houston, Tex. 77046.

LETTERS

St. Louis Landmark: Regarding Francis X. Dudas's letter in the July issue concerning St. Louis's civil courts building, I hope that the city of St. Louis is not considering the demolition of that building. If there is one message that comes through clearly in the April issue of ARCHITECTURE, it is that, in the interest of improving its city, St. Louis needlessly destroyed many of its beautiful and historical buildings.

I hope the people there will consider that factor if they are contemplating the destruction of the beautiful civil courts building, a St. Louis landmark.

Lawrence J. Drummond
Kansas City, Mo.

The Architect and Society: Your article [July, page 50] re-examining socially oriented agendas in architecture is as welcomed as it is timely. One hopes that there is, finally, a renewed concern for the occupants of a building and not simply its form, color, and style.

Most certainly our profession will benefit from a change of attitude that acknowledges that the art of architecture involves accommodating and enhancing the activities of the individuals who use a building. Architecture is not only a visual art.

David Scott Slovic, AIA
Tulane University
New Orleans

Social Concerns: Concern about direction in architecture is building up with more urgency than ever as we approach the final decade of the century. Your perceptive selection of Joe Esherick's thoughts from his AIA 1989 Gold Medal acceptance address in your June issue editorial is right on the mark. Perhaps one of his reflections summarizes the others: "Our goal should be work that is liberating, that makes the quality of life better for us all." As you say in your conclusion, Joe's words "deserve hearing and heeding . . . by all of us concerned with architecture's future direction." I then wondered what influence this recognition might have on ARCHITECTURE's future direction, along with all other key avenues of learning and communication?

The July issue, with Andrea Dean's lead article, "The Architect and Society," gave me a momentary flash of elation and nostalgia for the excitement of the 1960s' great surge of social and environmental consciousness. Remember those wonderful days of new hope and idealism, spearheaded by Urban America, *City* magazine, and even some of us in sedate, sophisticated AIA?

Hoping the whole issue would launch an in-depth look at this long-neglected subject, my excitement died quickly, sad to say, when I found instead a return in the latter part of the issue to the familiar format of lush projects, this time in ironic, if inadvertent, relationship to the lead article.

While applauding the inclusion of FmHA projects in Arkansas and Louisiana, the Amherst, Mass., cohousing, and the Charleston Navy Yard Rowhouses, I thought surely there are other worthy ones across the country that could have expanded the substance of Dean's article and the crisis of affordable housing in America.

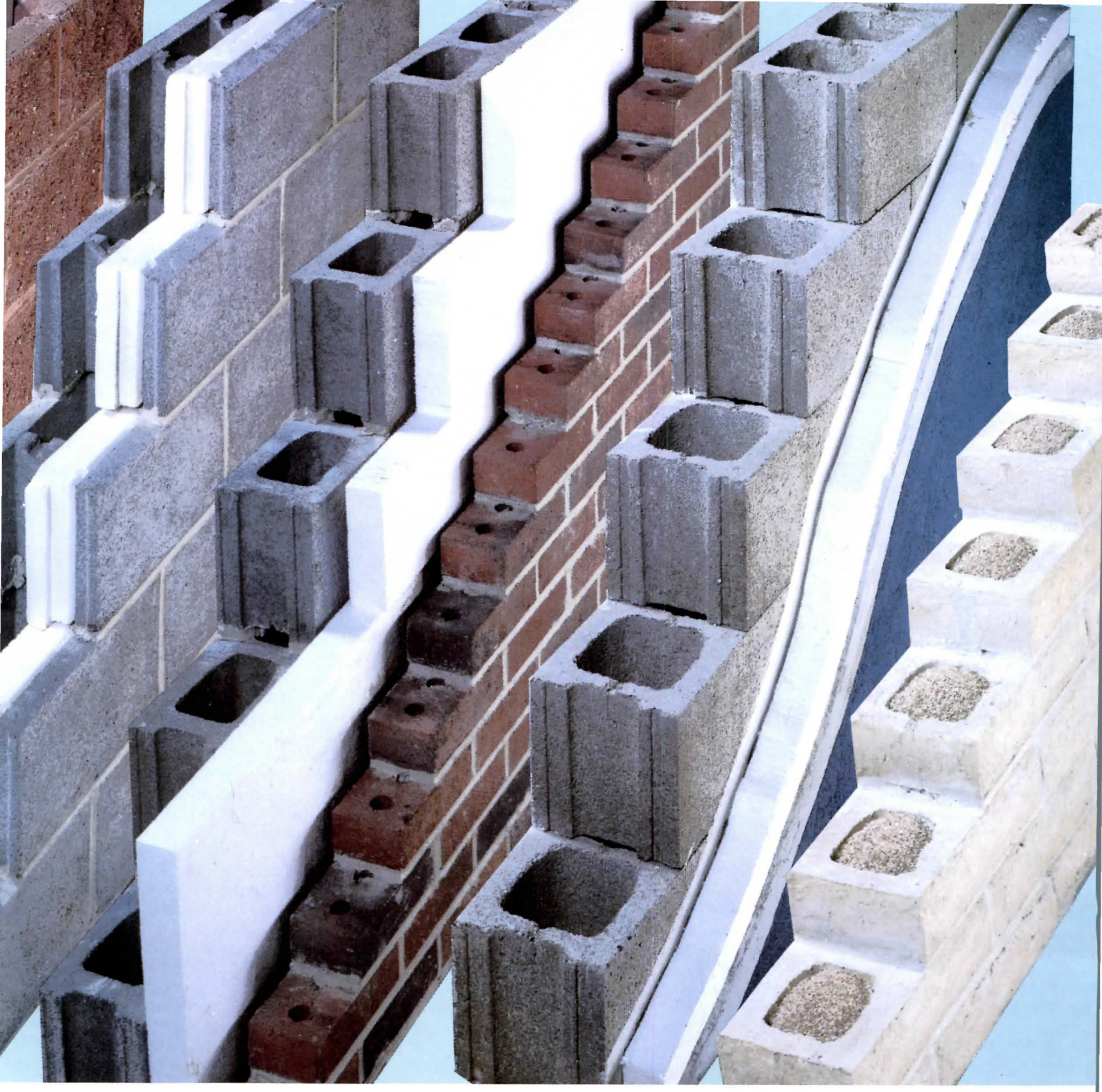
Instead, we are presented with another set of luxurious houses, or rather I should say mansions, their inclusion made even more ironic in that two of them are "vacation" houses. Perhaps this collection would not be so upsetting if the quality of design had been truly excellent, implying the age-old value of the exemplar, at least in part influencing and trickling down somehow to levels of affordability for all. This collection is another example, rather pervasive these days, of how simply marvelous color photography and its accompanying architectural rhetoric can mask mediocrity of design. I hate to see these traits of elitist slick media and comprised criticism (in the manner of *Architectural Digest*) infiltrating ARCHITECTURE.

Where have all the flowers gone? Good design at low cost? Good design in the commonplace as well as in the customplace? Honest, comprehensive criticism as an uncompromising search and reward for excellence?

Andrea Dean concludes her essay with hopeful signs of change from the money worship, greed, and conspicuous consumption of the 1980s. Attitudes, ideas, and projects that foreshadow this change must already exist somewhere across this broad land. ARCHITECTURE is surely the one pacesetting journal to seek, find, and publish them, more than once in a blue moon. Maybe we will then begin to learn, respect, and find joy in the enormously important difference between two verbs: to House or to Dwell? Or two nouns: Housing or Dwelling?

A. Richard Williams, FAIA
St. Ignace, Mich.

Correction: My apologies to Floyd E. Barwig, AIA, for calling him "Louis" in the July issue, page 119, when I mentioned his excellent research on the Lustrom house. Barwig is quoted in Richard Bender's book, *A Crack in the Rear View Mirror.*—FORREST WILSON



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Planning

Barcelona Gets Ready for 1992 Olympics

The most outstanding achievement of the 1992 Olympic Games in Barcelona doubtless will be that of the city itself in its massive, round-the-clock preparations for the event. The Olympic ring, symbolic centerpiece of the Games, is nearing completion on Montjuic, a tree-covered acropolis on the western edge of the city; the Olympic Stadium was finished this past July, in time for this month's meets of the World Athletics Cup; and the rest of the complex will be inaugurated next year.

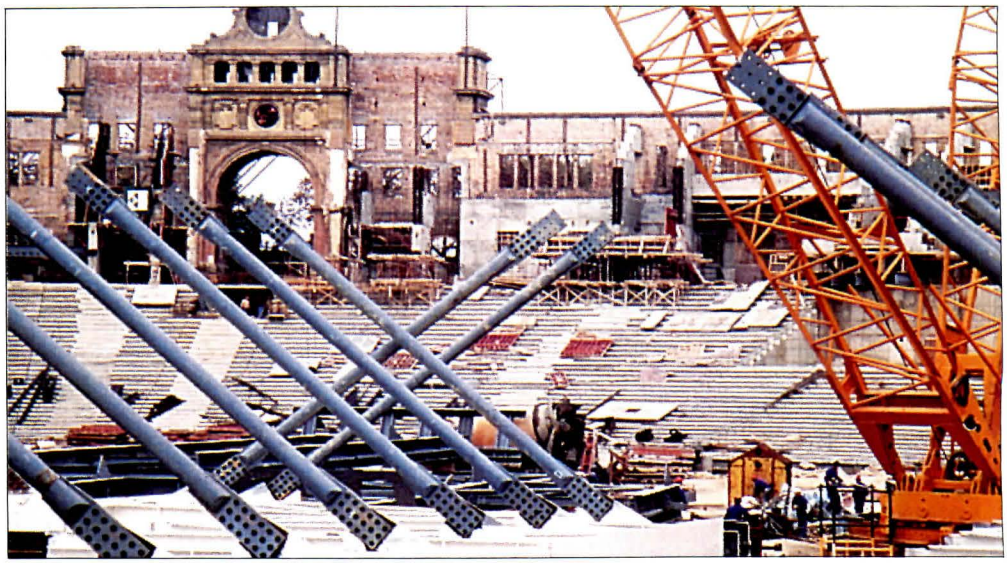
Designed by various architects, the Olympic ring lacks a unified character, but perhaps its central image is that of the Olympic Stadium. Italian architect Vittorio Gregotti was asked to preserve, modernize, and expand the existing stadium, which was built for Barcelona's 1929 International Exposition with sights on the 1936 Olympics. Lowering the level of the playing field, Gregotti inserted a functionalist machine of grandstands, light towers, and a large, cantilevered canopy in the gutted shell of the old stadium, a towered, domed, and colonnaded palace of sport.

Thus we will have the first revisionist Olympics, in the same moment that the modern and futuristic images of past Games again have become attractive.

Arata Isozaki, architect of the adjacent Sant Jordi Sports Palace, registered this shift in his original competition entry for the Olympic ring, where he raised two parabolic arches over the ends of the old stadium, as in Le Corbusier's scheme for the 1931 Palace of the Soviets, from which he suspended a long curving canopy.

The undulating flying-carpet roof of the sports palace in this first scheme has been condensed into a more traditional centralized hall, spanned by a two-stage space-frame dome, beautifully finished in stainless steel. The conventionality of the design is mollified by sensuous idiosyncrasies: the dome is broken at its joints to admit light and is slightly pitched to one side; its top is spotted with bubble skylights like a large reptile or a sesame bun; and a teasing flounced skirt spans from the bottom of the dome to the glazed entry walls.

The rest of the ring consists of a neoclassical sports university by Ricardo Bofill and a pool complex built for Barcelona's 1972 Olympic aspirations; these are grouped around a series of plazas and fountains designed by the Barcelona firm of Correa, Milá, Margarit & Baxadé.



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Above, restoration in progress on Barcelona's 1929 Exposition stadium.

But the best architecture of the 1992 Games probably will be found at the Olympic Village, a seaside complex designed to become a new residential *barrio* of the city. The project betrays the hand of Oriol Bohigas (of the firm Martorell Bohigas Mackay Puigdomènech, urban designers of the project), the key figure behind Barcelona's remarkable urban design program. It is a product of Spain's long tradition of high standards and innovation in housing design, and as such it will also be a showcase for Barcelona's best architects. A total of 23 local firms are designing buildings in the Village, including Lluis Domènech, Martinez Lapeña & Torres, Viaplana & Piñón, Bach & Mora, Bonnell & Rius, Oscarl Tusquets, Lluis Clotet, and the ever-present Bofill.

The overall design attempts to bring together the traditional street as "an essential element of urbanity" with the housing prototypes and standards of the modern movement, to combine Le Corbusier's garden city and the 19th-century boulevard.

The site has been divided into superblocks that continue the blocks of Barcelona's 19th-century Cerdà Extension. Seven-story perimeter housing defines the street lines, freeing block interiors for a variety of housing types from carpet housing to independent towers, all in a setting of parks and gardens. The suppressed streets that cross the interiors of the superblocks are bridged by special "representative" buildings intended to fill the function of traditional monumental sculpture. Individual superblocks were developed by separate teams of architects, and the whole complex is controlled by a set of rigorous norms similar to those for Battery Park City or Seaside, Fla.

The complex is completed by a marina for the Olympic sailing events, a convention complex in the center of a water plaza, still to be commissioned, and two towers: a hotel by Skidmore, Owings & Merrill/Chicago and an office building by the Madrid team of Ortiz-Léon.

Other Olympic preparations under way include additional installations for a total of 27 sporting events, a press village for 6,000, a transmission tower by Norman Foster north of the city, a doubling of the Barcelona airport by Bofill (as in his Olympic ring competition entry, he hopes to compensate for the massive and technical aspects of the facility with a classical screen of gardens and trees), the construction of at least 15 hotels (Bofill and Peter Eisenman figure among the architects), and a plethora of new or expanded cultural institutions. Outstanding among the cultural facilities are these:

• Gae Aulenti's new installation of the Museum of Catalan Art in the Palau Nacional, another of the 1929 Exposition palaces. The most spectacular aspect of the design is the collage of miniature exhi-

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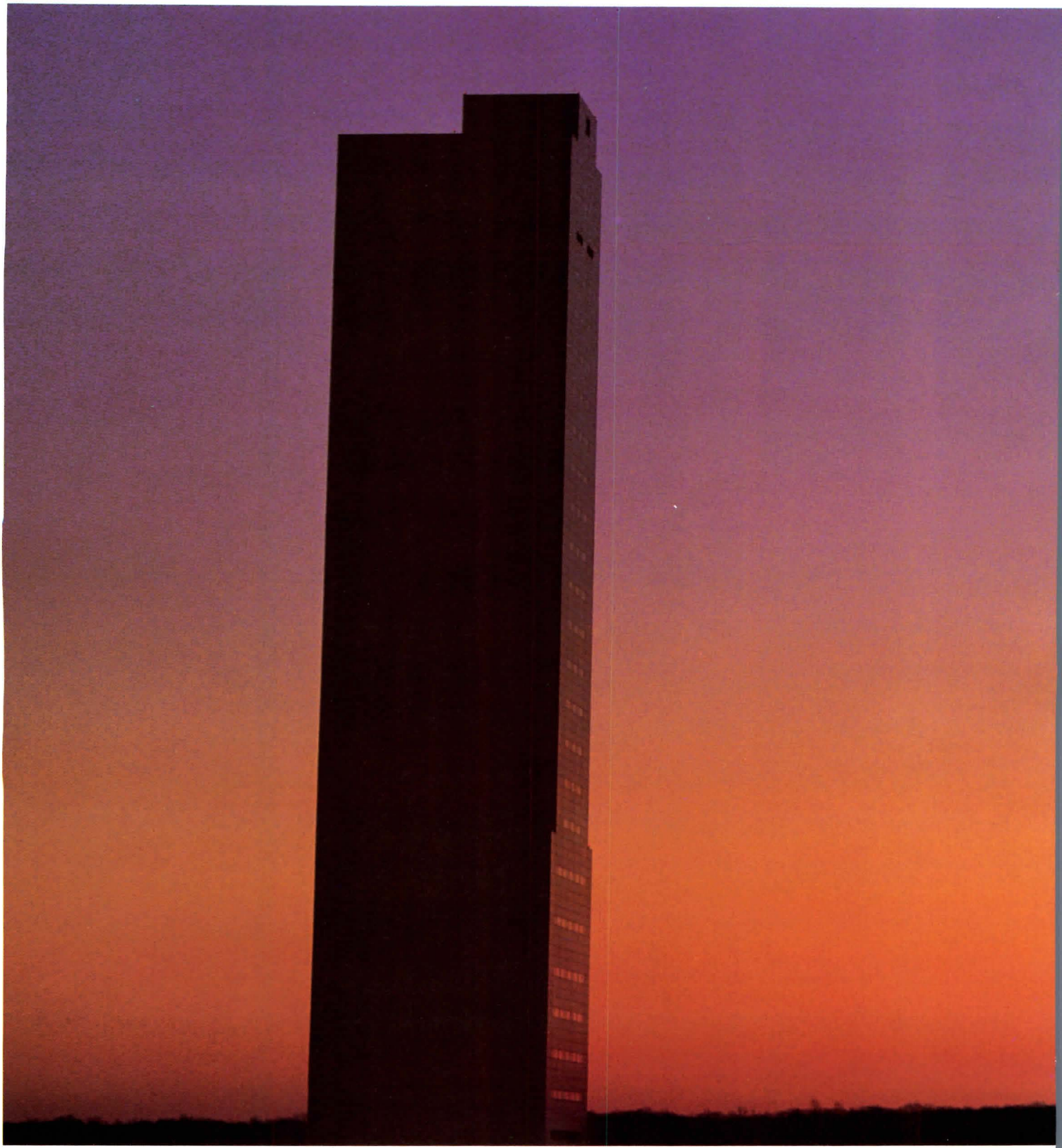

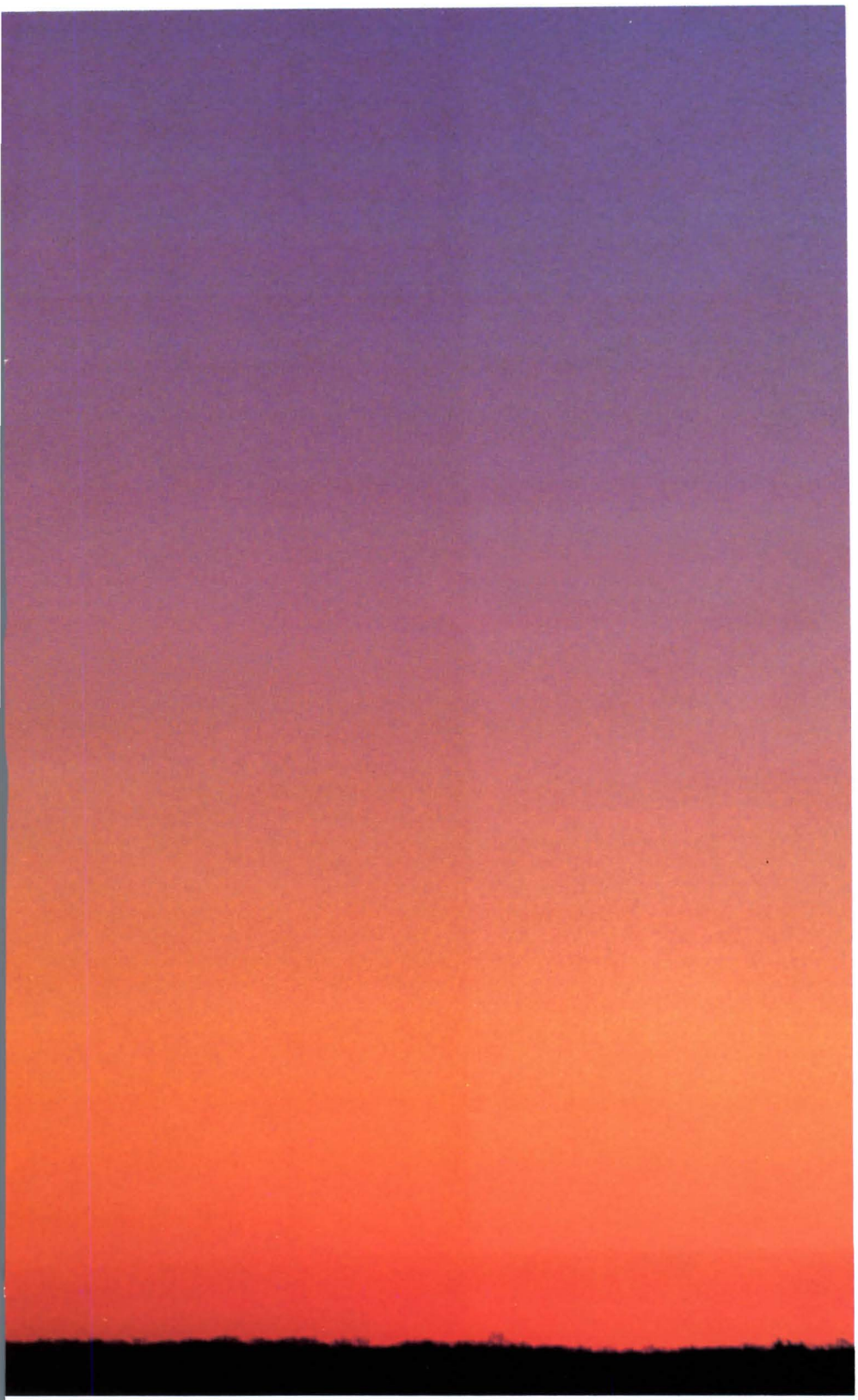

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Planning *from page 23*

bition buildings inside the existing Grand Salon.

- Richard Meier's Museum of Contemporary Art, his most urban building to date, opening to plazas and courtyards on three sides in the dense medieval *barrio* of the Raval.
- Rafael Moneo's Municipal Auditorium, a two-block-long brick rectangle, with two concert halls and a library facing a large covered court.
- Ricardo Bofill's National Theater, next to the Municipal Auditorium, a monumental neo-Greek glazed roof that shelters two theaters and a palm-filled lobby.

Obviously the Olympics mean a great deal to Barcelona, with its second-city self-image and its century-long campaign to host the Games. Bohigas sees the Olympics, like past international events, as a "strategic opportunity" to improve the city. Others see it almost in terms of a secular crusade, an "Olympic calling," Barcelona's last chance to launch itself into the world. It is a curious fact and perhaps a warning that the new seaside Olympic Village will be called "Nova Icària," after a turn-of-the-century utopian community on the site, but also a veiled reference to the legendary Icarus, who flew too near the sun. Now in the anxious middle of its course, this remarkable city must keep a steady eye on its goal.—David Cohn

Mr. Cohn is a writer in Barcelona.

Prince Charles Unveils Krier's Dorset Master Plan

Prince Charles has triggered fresh architectural controversy in Britain, following the unveiling last June of a master plan commissioned from Leon Krier for the urbanization of some 400 acres of farmland owned by the Prince in his capacity as Duke of Cornwall. Some have hailed this instance of princely patronage as nothing short of heroic, while others are determined to see the scheme as a retrogressive affront to contemporary architectural endeavors.

The project, which takes the form of a planned extension to Dorchester in Dorset, was embarked upon in response to local demand for substantial quantities of new houses. After eight months of consultation with local community groups and the statutory planning authority for the area, Krier concluded the land should be laid out to create four wards or quarters of about 100 acres. Each, he suggested, should have its own center, marked by civic buildings surrounded by an urban mix of schools, shops, offices, other workshops, and a range of housing designed for a wide variety of income groups.

During the much-publicized five-day public presentation and discussion of the project in June, Krier's overall master plan was shown in outline, supplemented with more detailed illustrations of a "pilot" ward. Among the fundamental issues remaining to be resolved were the purposes to be served by the civic buildings so essential to Krier's concept. A Duchy of Cornwall spokesman is reported to have said, "If we can't sell them, we can't build them." But Krier was adamant that noble buildings are necessary, for both the form and function of the new development. They should on no account become mere outer wrappings for commercial uses, such as supermarkets, he said.

Provided the principles underlying the master plan can be agreed on, Krier said he expects other architects to take on the detailed design of individual buildings, within the overall code he has established, so as to create "unity without uniformity, in much the same way as the best examples of Dorset towns and villages were created." Krier and Prince Charles clearly believe such an approach will counteract the wholly undesirable tendency in present-day Britain to despoil the countryside with speculative housing, built for short-term profit, with little or no thought for future

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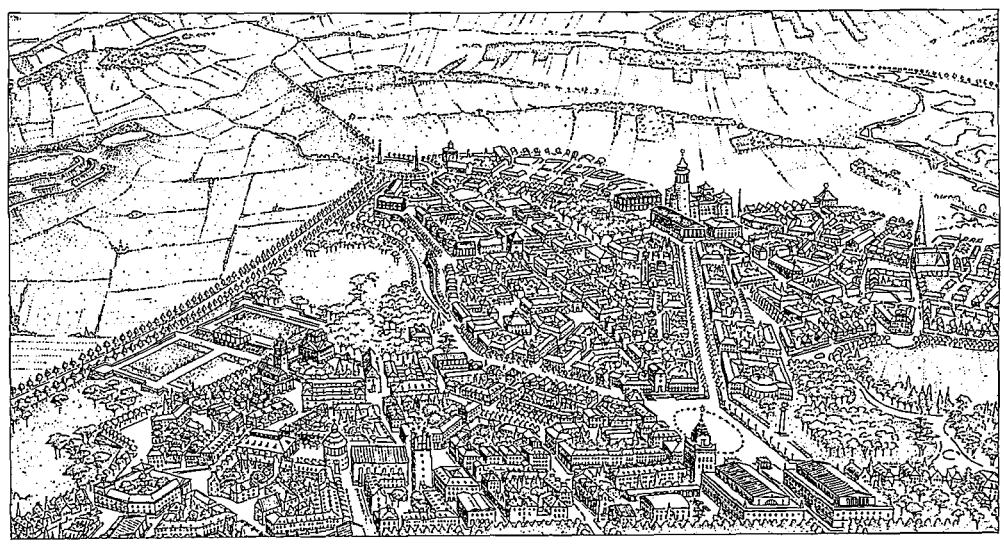
Below, Leon Krier's drawing for the Duchy of Cornwall's planned extension to Dorchester. Each of the four wards is marked with a central civic building.



Planning *from page 26*
community life, let alone the long-term effects on the environment.

By taking this initiative, Prince Charles is following the laudible precedent set by his great-grandfather, George V, who, when still Prince of Wales, sought advice from Britain's first professor of town planning, Stanley Adshead. The result was the exemplary redevelopment of part of the Duchy of Cornwall's Kennington estate, in London, which was largely completed just before the First World War to designs by Adshead and Ramsey. In 1915, the Kennington projct was described in the technical press as "the first example of urban housing carried out on town planning lines." Suggesting it would provide an excellent model for others to follow, a critic then noted that the designs avoided monotony while demonstrating an "architectural restraint [that] is rare in these self-conscious times."

If similar qualities can be achieved, to equally high standards, in realizing the Dorchester project, the present Prince of Wales's architectural convictions will be vindicated indeed.—CHARLOTTE ELLIS

Ms. Ellis is an architect and writer in Paris.

Preservation

International Call for Saving Melnikov House in Moscow

The house of Russian avant-garde architect Konstantin Melnikov is in great need of repair. Built in 1927-29 in Moscow's Arbat area, the residence is a landmark of modern architecture.

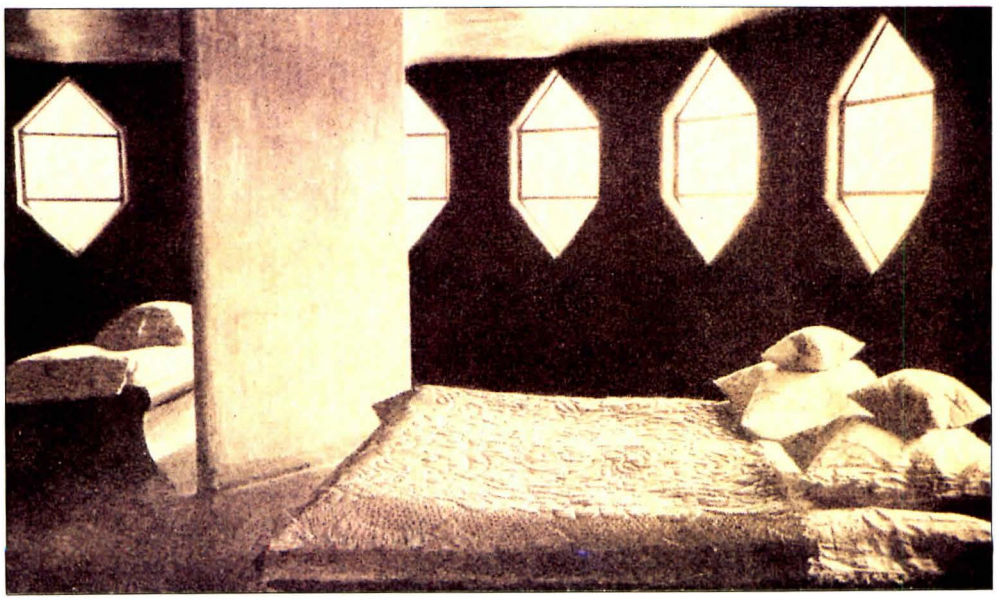
The master builders of 20th-century architecture asserted their design philosophy in their houses, which have become famous. What the Villa Savoy (1928-30) was for Le Corbusier, what the Tugendhat house (1928-30) was for Mies van der Rohe, what Fallingwater (1936-39) was for Frank Lloyd Wright, so was Melnikov's house for him.

The Villa Savoy and Fallingwater have been renovated and opened to the public, and the Tugendhat house was restored in 1986 for the centennial of Mies's birth (though restoration of the original interiors and the garden has not been completed and the house is not open to the public). But the Melnikov house stands neglected. The punishing Moscow winters have taken their toll.

Melnikov was one of the acknowledged leaders of the new Soviet architecture of the 1920s. A prolific designer, he entered numerous architectural competitions during that period, and many of his commissions were realized. His designs for the Sarcophagus in the Lenin Mausoleum and for the Novo-Sukharevsky Market in Moscow were built in 1924. He won the competition for the Soviet Pavilion for the 1925 International Exhibition of Decorative Arts in Paris. The pavilion established Melnikov as an architectural innovator and presented to the world the exuberant designs of the Soviet avant-garde. In appreciation for the success of the show in Paris, the Soviet government gave Melnikov a parcel of land on which to build his house.

Throughout his career Melnikov was preoccupied with curves and especially with the circle. His house is composed of two large cylinders, each 10 meters in diameter, joined to form a figure-eight footprint. The exterior perimeter wall is 50 centimeters thick. The brick of this double cylindrical wall has a diagonal, diamond-shaped pattern that forms a series of some 124 diamond "openings." Half of these make room for hexagonal windows and the other half are covered to create air-cushioned thermal insulation pockets in the wall.

Below, an early photograph of the Melnikov house's central bedroom, which was used by all four family members.



The curvilinear plan and the different way of articulating the various elements of the house generated a set of complex interior effects. The bedroom, which was used by all four members of the family, is located in the back of the second floor. A double bed for the parents in the center is visually separated by two partitions from single beds for the children. All three beds were built into the floor. It is lighted by 12 hexagonal windows. A spiral stair from the living room leads to the studio that occupies the entire third floor and is illuminated by 38 hexagonal windows in three horizontal bands.

Since Melnikov's death in 1974, the house has been owned and occupied by the architect's son, Viktor Melnikov, an accomplished painter. Now 75 years old, Viktor Melnikov has lived in the house since he was a teenager and maintains a collection of his father's drawings scattered throughout the house. He says, "I want the house to be a museum dedicated to the memory of my father. I would like it to be restored to its original state, and then it should have an exhibition of architectural drawings, models, photographs, and works of art by my father. But I would like to continue living and painting in the house and possibly serve as a host, a guide of the house and its collection."

The house is one block from lively Arbat Street, where many turn-of-the-century buildings are getting a face-lift. The Melnikov house is the only privately owned house and lot in the area, so its rehabilitation should be financed privately. With the consent of Viktor Melnikov and in keeping with the Soviet Union's new atmosphere of *glasnost* and *perestroika*, an international collection supported by American and Soviet architects would save a monument of architecture and could contribute to improved relations between the two countries.

The Union of Architects of the Soviet Union is planning an exhibition of Melnikov's work to celebrate the centennial of his birth next year. It is the intention of this writer to initiate an international fund-raising drive to restore the Melnikov house. For more information, contact the Melnikov House Fund, School of Architecture, University of Tennessee, 1715 Volunteer Blvd., Knoxville, Tenn. 37996.—PETER LIZON, AIA

Mr. Lizon is an architect and planner and teaches architecture at the University of Tennessee, Knoxville.

News continued on page 30

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Romania's 'Restructuring' Plan Threatens Cultural Heritage

Nearly one-fourth of the historic neighborhoods of Bucharest, the capital of Romania, and scores of the country's outlying villages have been unilaterally razed and reconstructed without a connection to the nation's collective cultural identity or architectural heritage. This program of demolition and rebuilding over the past 20 years is the work of Romanian President Nicolae Ceausescu, head of the country's Communist Party since 1965. At a time when a majority of the Eastern Bloc countries are experiencing an easing of cultural, political and economic restrictions, Romania remains dedicated to strict Communist orthodoxy with the most limited human rights.

The national "restructuring" program is the subject of *The Razing of Romania's Past* by Dinu C. Giurescu, a Bucharest historian and professor at the Institute of Fine Arts who emigrated to the United States last year. The first documented report of the government-sponsored destruction of cities and villages, the book was published by the U.S. Chapter of the International Council on Monuments and Sites in conjunction with the World Monuments Fund and the Kress Foundation.

Bucharest's historic architecture is unusually diverse with Byzantine and classical Renaissance churches, ornate Beaux-Arts public buildings, and 19th-century Turkish- and Tuscan-inspired apartment blocks. During the past six years large areas of the old city have been destroyed almost in their entirety and rebuilt. A mile-long boulevard, called the Avenue of the Victory of Socialism and lined with new government buildings, has cut a swath through the heart of Bucharest's historic quarter without respect to the existing street network or the urban fabric.

The capital city has large residential neighborhoods comprising single-family houses with intimate private gardens, in styles ranging from Gothic to art deco to Tuscan to Art Nouveau, most of which date to the 19th century and some as far back as the 16th century. Some have been destroyed, but many are still intact although threatened.

Endless rows of monolithic 10-story apartment blocks now line the main boulevards. In the reconstructed areas, the few historic monuments that have been spared are encased in concrete apartment compounds and often screened from the street.

According to Giurescu, under the leadership of President Ceausescu the Romanian government has demolished nearly a quarter of Bucharest since 1984 and government officials have declared that 90 percent of the population of Bucharest will be housed in new apartment blocks by 1991.

The government's restructuring program is not limited to the city. Ceausescu's government also has completely leveled and rebuilt 29 towns in the first stages of the country's rural systematization program. Estimates of the number of residents displaced through the program vary; the government sets the toll at approximately 50,000. The government's campaign is the culmination of a 10-year plan to overhaul the country's entire housing stock.

Giurescu reports that Ceausescu's government has stated openly and for the record that the entire rural population of the country will be resettled to eliminate the differences between the urban and rural standards of living. Families will be relocated from their modest, privately owned, single-family houses to state-owned apartment buildings. Between 7,000 and 8,000 of the country's 13,000 villages are scheduled to be erased from the map, their residents relocated to newly created agro/industrial centers consisting of standarized four- and five-story apartment buildings with communal kitchens and toilets.

"An entire country, obliged to live in collective dwellings, will be submitted to a kind of social engineering never recorded in Europe's history," said Giurescu. Even

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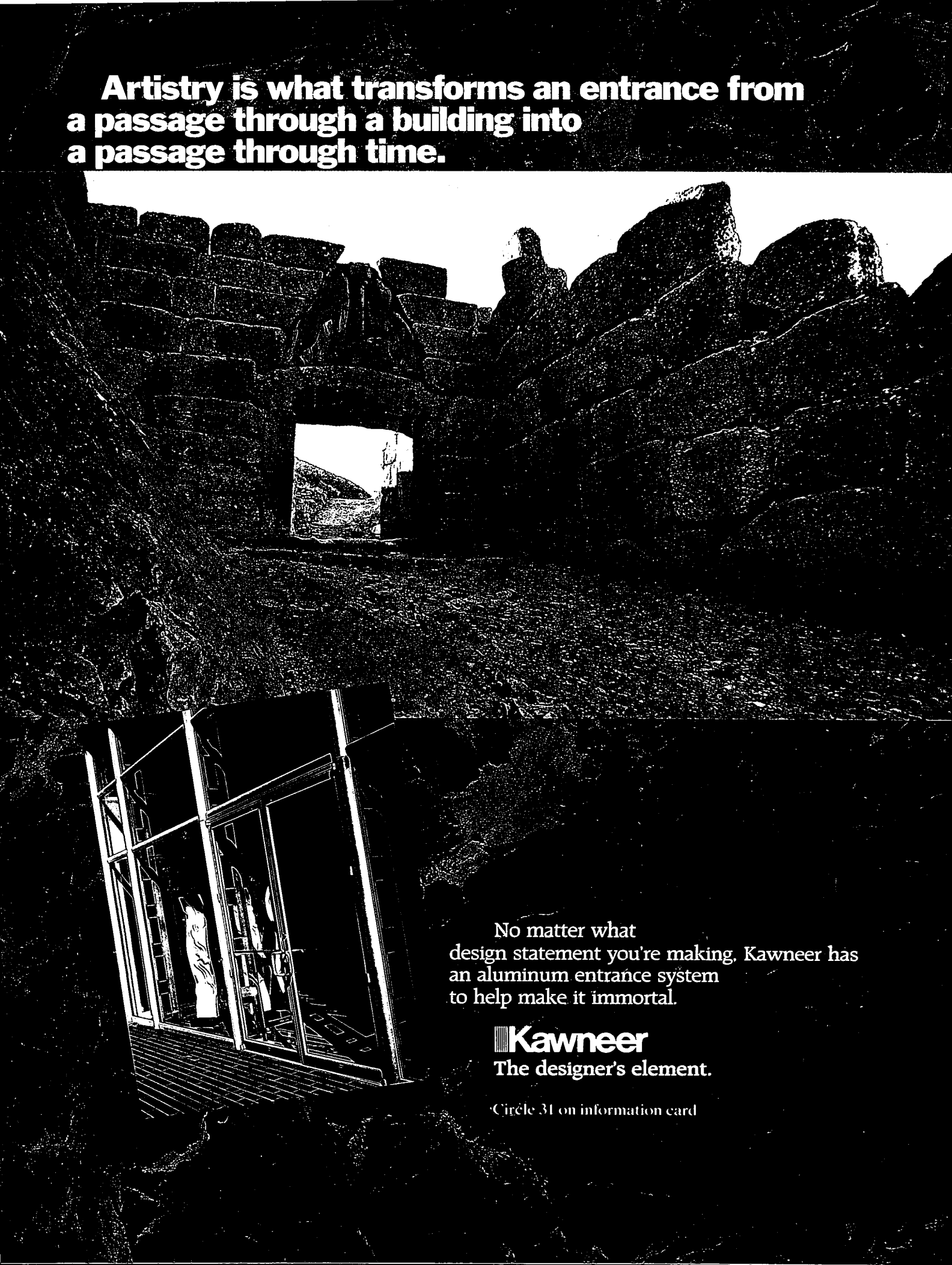
Artistry is what transforms an entrance from a passage through a building into a passage through time.



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Circle 31 on information card

Preservation *from page 30*
those villages not slated for complete razing will be 90 percent demolished and rebuilt.

"This official rural systematization will result only in the homogenization of Romania's population, a land with distinct ethnic differentiation—Romanian, Hungarian, German, and Serbian—and will destroy all remnants of the country's architectural and social heritage," said Giurescu. "Modernity and higher standards of living are not achieved by eliminating the one-family house and an historic past."

Opposition to the government's restructuring plan has been limited, reportedly because of Ceausescu's restraints on freedom of expression by individuals and the press. However, as reports of the destruction of entire villages have spread, foreign pressure is growing, especially in neighboring Hungary. (Many of the villages scheduled for razing are in Transylvania, which was a Hungarian province before World War I.)

In condemning this incomprehensible destruction, the groups that sponsored the book said in a joint statement: "The international community has in the past lamented the loss of great works of art, important monuments and historic urban centers destroyed by wars and human neglect. We have questioned the bombing of Dresden, wept over the explosions that have leveled Beirut, voiced our concern about the fate of Angkor Wat. But never in our century has a human agency put into action a blatant and conscious peacetime program for the willful destruction of the artistic heritage of an entire nation, such as we now witness in Romania."

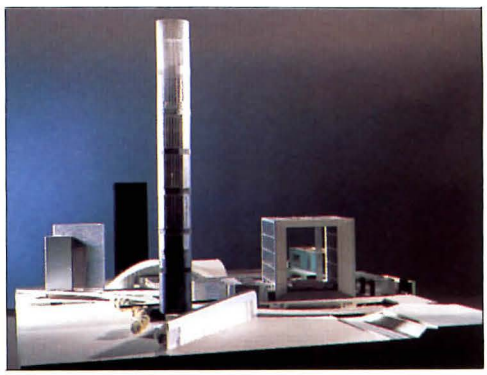
—Lynn Nesmith

Competitions and Exhibitions

Nouvel's and Ibos's Winning Scheme for La Défense Site

A project by Jean Nouvel and Jean-Marc Ibos for a 400-meter-high tower "without ends" has won the architectural competition for a key site in the La Défense business district, just outside Paris. The project was selected by an international jury that included Richard Meier, Oriol Bohigas, Norman Foster, Arata Isozaki, and Rem Koolhaas, among others, and the tower is intended to complement the "Grande Arche" used for the 15th G7 summit in July.

Conceived as three superimposed buildings separated by service floors, the tower will provide some 112,500 square meters of gross floor area, with 67 office stories for a work force of around 4,000 people, as well as a restaurant-belvedere, conference, and other facilities. But, according to Nouvel, this is to be no ordinary tower following the American model—far from it. It is to be constructed with "the simplicity of a chimney," with vertical circulation relegated to the perimeter, to give open-plan office floors. Cladding is to be graded, from near-black granite at the base,



Above, 'Infinite Tower' by Nouvel and Ibos in La Défense, with Spreckelson's 'Grande Arche' (right in photo).

through a gamut of progressively lighter grays (first stone, then various metals), to glass, thereby revealing the structure at the top. Not that the entire tower is intended to be seen at once. The base is to be sunk into a hollow or crater, while the top will "disappear into the clouds."

"What interests me," says Nouvel, "is the superimposition of grids, the perception of depth, the thickness of matter and apparent dematerialization. This tower could almost be seen as a study of the thickness of air." Given the Parisian climate, he says, the tower will be scarcely visible from the city center three-quarters of the time. But it will have a ghostly presence, which he likens to a badly tuned television screen, and its verticality will provide a positive contrast with the historic fabric of Paris. The new tower thus will symbolize the existence of greater Paris, extending beyond the city boundary.

Technical aspects of the Nouvel Ibos second-stage competition scheme have been criticized, notably the poor daylighting levels that will result at the center of such deep office floors. Nor is Nouvel entirely satisfied with the designs as yet, though he is confident they will be improved. "The building will be much better, much more subtle," he says, "just as the Arab World Institute was far more subtle as built than any of the models made during the design process."

—Charlotte Ellis

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Circle 35 on information card

Work of Japanese Firm Nikken Sekkei on View in U.S.

An exhibition of the work of Nikken Sekkei, the oldest and largest architecture firm in Japan, is on view at Columbia University through Oct. 13. Although little known in America, Nikken Sekkei is highly regarded in Japan for its built work as well as its research in construction technology and innovative management of complex design projects. The origins of Nikken Sekkei date back to a predecessor firm established in 1900 to provide Sumitomo Bank with a headquarters building designed in the neoclassical style and constructed using the latest in Western technology. Today, Nikken Sekkei employs a staff of 1,500 architects, planners, and engineers.

Beginning with the Osaka library of 1903 and continuing through recent overseas projects such as the Islamic Development Bank in Saudi Arabia (scheduled for completion in 1990), the exhibition presents a selection of 40 projects arranged chronologically. Photographs and drawings of the buildings, along with introductory text describing the periods in which they were designed, illustrate the historical parallels between the growth of Nikken Sekkei and the modernization of Japan. These parallels are shown in successive phases from 1900 to the present: Meiji importation of Western technology and eclectic styles; political liberalization and Japanese development of European modernism; nationalism and the Imperial Crown style; the Pacific war and heavy industry; postwar reconstruction and urbanization; the "economic miracle" and megastructures; high technology; and the revival of Japanese tradition.

After its showing at Columbia's Avery Hall, the exhibition will travel to other architecture schools around the country.

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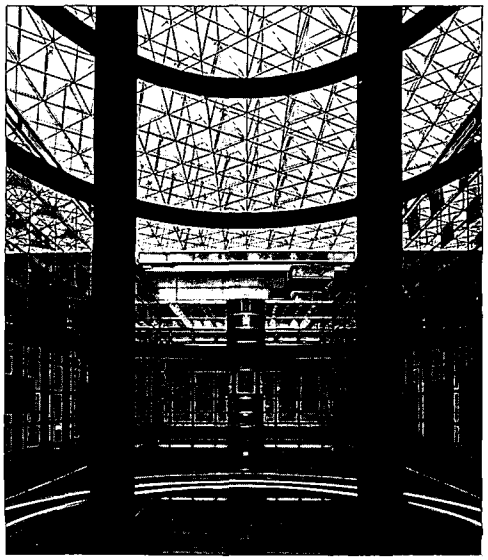
Below, main atrium of Nikken Sekkei's 1980 C. Itoh building in Tokyo.



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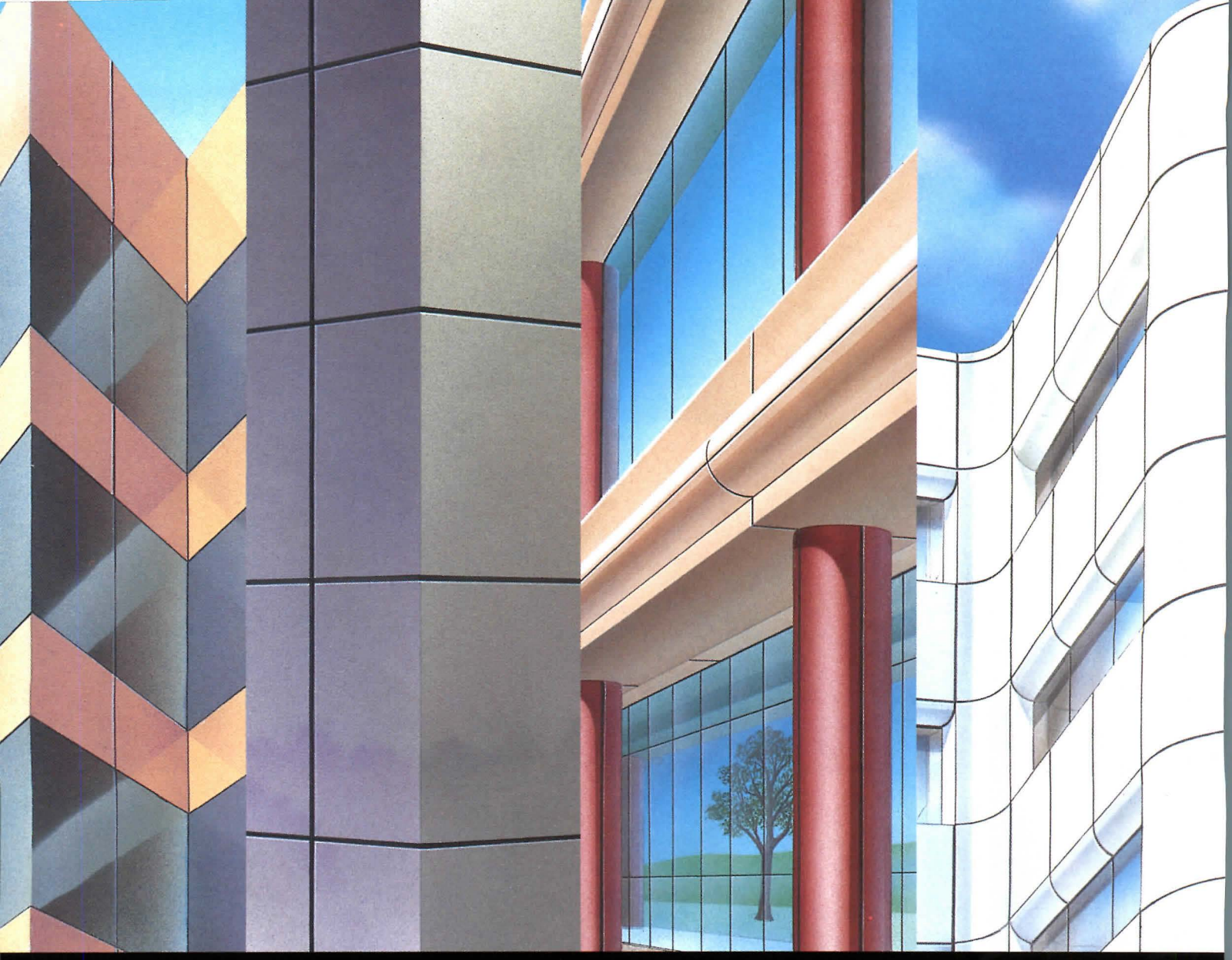

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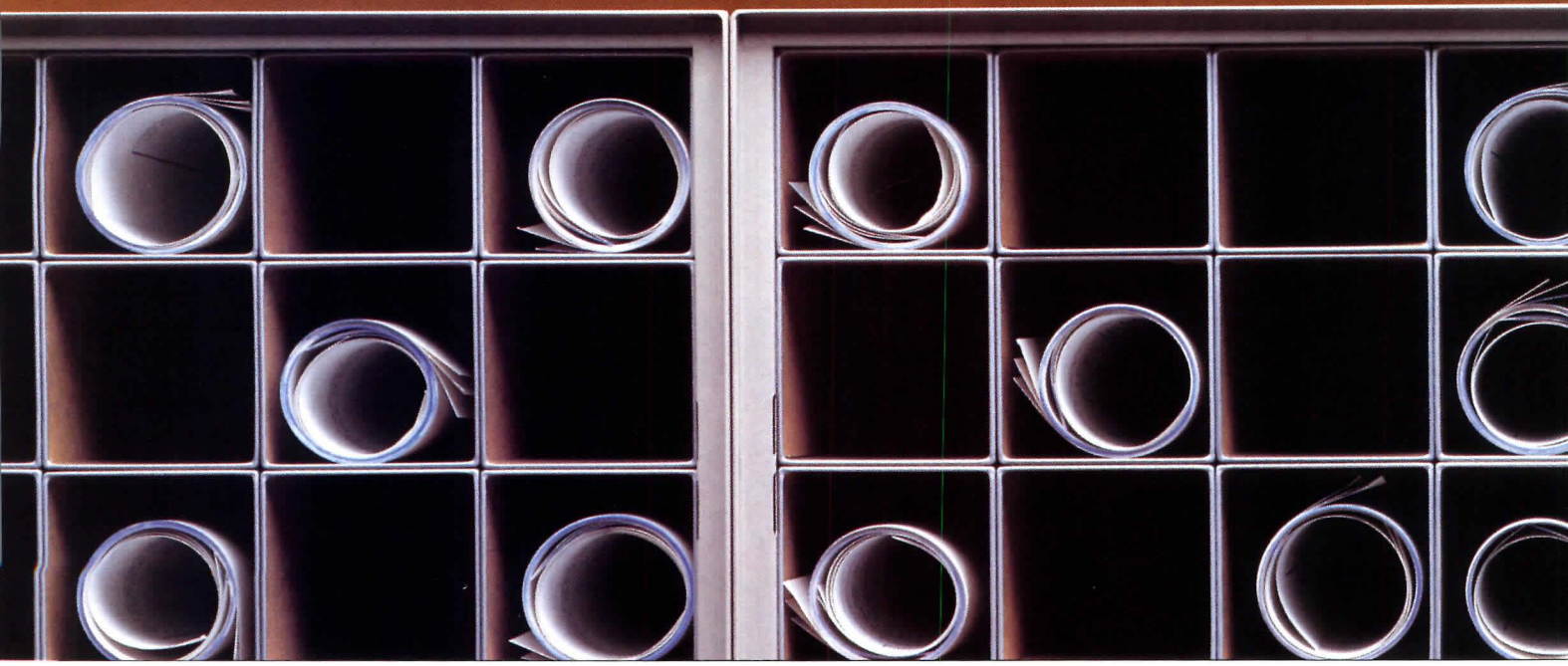


The Institute

Lake Tahoe R/UDAT Explores Controlling Resort Growth

A Regional/Urban Design Assistance Team (R/UDAT), sponsored by the American Institute of Architects, recently visited the North Shore of Lake Tahoe to devise ways to prevent a natural treasure of unsurpassed beauty from becoming degraded beyond rescue by man's addiction to the automobile.

Although the entire North Shore has only 15,000 year-round residents, the seasonal population can increase tenfold. Since seven million people live within a four-hour drive of Lake Tahoe and no alternative transportation options exist within the basin, the road network is severely overloaded. The result is gridlock, loss of business, declining property values, and the degradation of water and air quality. Ozone levels at Tahoe Basin occasionally are as high as those in Los Angeles.

A group of experts volunteered their services to help North Shore cut through the Gordian knot of traffic that stalls summer vacationers and winter skiers. R/UDAT members were chairman Dennis M.Ryan, AICP, associate professor of the department of urban design and planning, University of Washington; Jean Ackerman, president of the financial consulting firm of Coley/Forrest Inc., Denver; Robert Cope, associate professor of policy, governance, and administration at the University of Washington; King Cushman, director of development and community affairs, Pierce Transit in Tacoma, Wash.; Ralph Evans, AIA, of Ralph Rolland Evans/ Architecture Planning Interiors, Salt Lake City; Alan R. Pendleton, executive director of the San Francisco Bay Conservation and Development Commission; Myles C. Rademan, director of public affairs for Park City, Utah; William T. Roach, market development supervisor for the transit department of the the municipality of metropolitan Seattle; and architect J. Dennis Wilson, AICP, of J. Dennis Wilson & Associates, Dallas.

The R/UDAT study area falls under the jurisdiction of two states, three counties, and several special districts. The Resort Triangle enfolds the California towns of Truckee, Tahoe City, and Kings Beach, and connects to Incline Village in Nevada and to the nearby ski resorts of Squaw Valley, Alpine Meadows, and Northstar.

In 1980, Congress adopted the Tahoe Regional Planning Compact to conserve Lake Tahoe and the Tahoe Basin. The compact authorizes the Tahoe Regional Planning Agency (TRPA) to adopt a regional plan for the Basin, establish environmental threshold carrying capacities, and provide opportunities for orderly growth and development.

TRPA is committed to cutting vehicle miles traveled in the Basin by 10 percent of the 1981 VMT (which was 1,700,000) by increasing public and private mass transportation. But TRPA has no jurisdiction over the ski resorts (which are major traffic generators) nor over Interstate 80, the freeway that feeds North Shore. The R/UDAT advised TRPA to extend its jurisdiction over these traffic corridors.

Traffic congestion was identified as the symptom of a more fundamental problem: the need to empower local residents to take control of their collective destiny. Development to date has largely cloaked the lakefront, resulting in *de facto* privatization of public vistas. The R/UDAT encouraged urban and historic design controls to "resolve the schizophrenia between beauty of the natural environment and the drabness of much of the built environment."

An integrated, low-tech approach to strategic regional traffic management was proposed. The popular dream to revive the historic narrow-gauge railroad linking

Truckee to Tahoe City was pronounced "foolhardy" in light of an estimated $150 million price tag. Another popular notion, to extend the existing tourist ferry into a waterborne transit system, was torpedoed by the R/UDAT's assessment that ferries cannot compete economically with surface transportation.

Since transportation reality at Tahoe points to continued used of the private automobile, the R/UDAT focused on ways to reduce the number of low-occupancy cars. The R/UDAT urged that a single transportation management association be established within the Resort Triangle. The successful, yet under-funded Tahoe regional transit bus line and the spotty shuttle services provided by the ski resorts were seen as the seed for a region-wide network of buses that would run frequent routes among the resorts and cities.

Immediate traffic fixes relied on the well-placed application of a bucket of paint rather than the laying of asphalt. The greatest VMT reductions were projected from restripping Highway 89 from Truckee to Squaw Valley to create a third, high-occupancy vehicle lane.

A successful effort by the Squaw Valley Ski Corp. to have its staff direct traffic at strategic points in Tahoe City inspired the R/UDAT to recommend that a battery of "gridlock busters" operate with the Resort Triangle next ski season.

To improve traffic flow in the resort towns, the R/UDAT proposed a uniform charge for parking to fund off-street parking facilities; short-term on-street parking; converting from angle to parallel parking; and petitioning the U.S. Post Office to institute delivery service to major subdivisions. Each town was advised to widen the highway and create cross-traffic turn lanes to improve traffic flow.

Specific urban design suggestions were made for each town within the Resort Triangle. As the gateway to the Resort Triangle, Truckee is inundated with pass-through traffic. The transcontinental railroad that bisects the town exacerbates the problem by using downtown Truckee as a switchgear. Relocating the switching functions outside of town was strongly advocated.

Conversion of the recently renovated historic train station into retail use would spark redevelopment of vacant areas north of the railroad tracks. New historical theme buildings for retail were proposed to complete Truckee's main street and expand its commercial core.

To divert traffic headed toward South Shore away from Tahoe City, the R/UDAT supported local proposals to build a bypass north of Tahoe City, and that some Forest Service land be converted into visitor parking. The bulk of the 64 acres would remain as natural open space.

—Janice Fillip

Ms. Fillip is a freelance architecture writer based in Sacramento, Calif.

AIA Calls for Nominations For Honorary Membership

Every year a panel of architects assembles in Washington, D.C., to consider candidates for honorary membership in AIA, the highest honor the Institute can bestow on a nonarchitect. Oct. 6 is the postmark deadline for submission of those to be honored in 1990.

Recent honorees include historians James Marston Fitch and David Gebhardt, engineer William LeMesurier, fianancier and art collector Paul Mellon, developer Gerald Hines, Jay Pritzker, Mayor George Latimer of St. Paul, Minn., landscape architect Laurie Olin, and graphics designer Deborah Sussman.

Established to acknowledge the interdependence of architecture and other professions, the annual awards program honors individuals distinguished in their fields who "add dimension, meaning, and even magic to architecture," said Pittsburgh architect David Lewis, who chaired last year's jury. Because the honor is a reflection of the esteem in which a nominee is held by practicing architects, candidates must be proposed by individual AIA members. No more than 10 persons can receive the award each year.

For more information, contact Lisa Klevatt, program manager, AIA, 1735 New York Ave. N.W., Washington, D.C. 20006.

News continued on page 38

Deaths

Edgar Kaufmann, jr.: Author And Architectural Historian

Edgar Kaufmann, jr., architectural historian, author, museum curator, apprentice to Frank Lloyd Wright, and the preserver of Fallingwater, died in late July in New York City. He was 79 years old.

As a student at Taliesin, Kaufmann recommended to his father, Pittsburgh department store owner Edgar Kaufmann, that Wright design the family vacation house for a site along a waterfall in Bear Run, Pa. The suggestion resulted in Fallingwater.

In 1963, Kaufmann, who had inherited the house when his father died eight years earlier, donated Fallingwater and 1,600 acres of neighboring lands with a large endowment to the Western Pennsylvania Conservancy. At the time of the donation Kaufmann said, "Such a place cannot be possessed. It is a work by man for man, not by a man for a man. . . . By its very intensity it is a public resource, not a private indulgence."

Kaufmann was born in Pittsburgh on April 9, 1910. After high school, rather than attending college he studied painting in New York City, Vienna, London, and Florence before returning to this country in 1932 and joining Wright's fellowship. After six years with the family retail business, Kaufmann joined the staff of the Museum of Modern Art, where he later served as the director of the department of industrial design. He was responsible for MoMA's series of exhibitions on furnishings and household objects of high design quality.

Kaufmann also organized numerous exhibitions at other museums, including the 1956 centennial exhibition honoring Louis Sullivan and the Metropolitan Museum of Art's 1970 exhibition "The Rise of an American Architecture 1815-1915."

An adjunct professor emeritus at Columbia University, Kaufmann had taught architectural history beginning in the early '60s. He also had taught at M.I.T. and the Institute of Fine Arts of New York University.

Kaufmann was named an honorary member of AIA in 1967, and in 1978 he was a founding director of the Architectural History Foundation.

Kaufmann wrote numerous articles and books on design and architecture, including *Fallingwater,* published by Abbeville Press. In reviewing the book in these pages in January 1988, Edgar Tafel, FAIA, also a former Taliesin apprentice, wrote, "There have been many books on Fallingwater and there need not be any more. . . . How fitting that the book is written by the man who of anyone living today had the most intimate and longest relationship—50 years—with this uniquely historic building, and an equally unique relationship with the building's architect, Frank Lloyd Wright."

When he died Kaufmann was working on a collection of essays, entitled *9 Commentaries on Frank Lloyd Wright,* to be published this fall.—LYNN NESMITH

Charles M. Nes Jr., FAIA, Baltimore architect and former president of the American Institute of Architects, died last spring at the age of 82.

Born in York, Pa., Nes graduated from Princeton University in 1928 and attended Princeton's graduate school of architecture before joining the Baltimore firm of Palmer & Lamdin in 1930. He was a partner in the succeeding firms of Fisher, Nes, Campbell & Partners; Nes Campbell & Partners; and NCP Inc. He remained active in his practice until his retirement last year.

Elected president of AIA in 1966, Nes led the Institute's opposition to a proposed extension of the west front of the Capitol in Washington, D.C.. He was a Ben Franklin fellow of the British Royal Academy of Arts and an honorary member of the Royal Architectural Institute of Canada. Nes also served on the advisory committee to Princeton's school of architecture. □

Lifelong Search for an Authentic Architecture

Balkrishna Doshi: An Architecture for India. William J.R. Curtis. (Rizzoli, $40.)

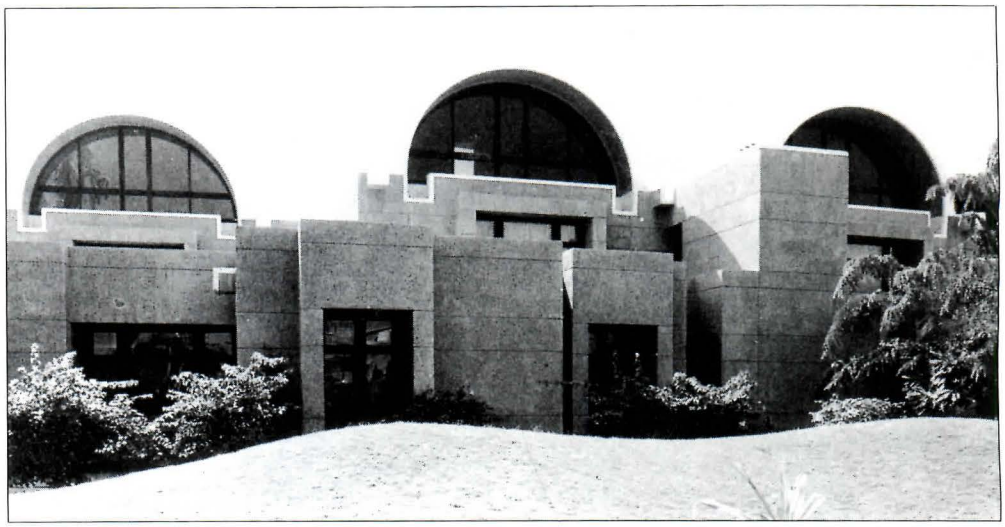
During the last decade, so much of our energy has been consumed by the debate between modernism and postmodernism. It is a phony debate, in which modernism is deliberately misrepresented as monolithic, rootless, and devoid of symbolism, and it has contributed little to an understanding of the contemporary situation. New "isms" have been pronounced with alarming regularity. One can hardly wait for Philip Johnson to announce the next wave of the future.

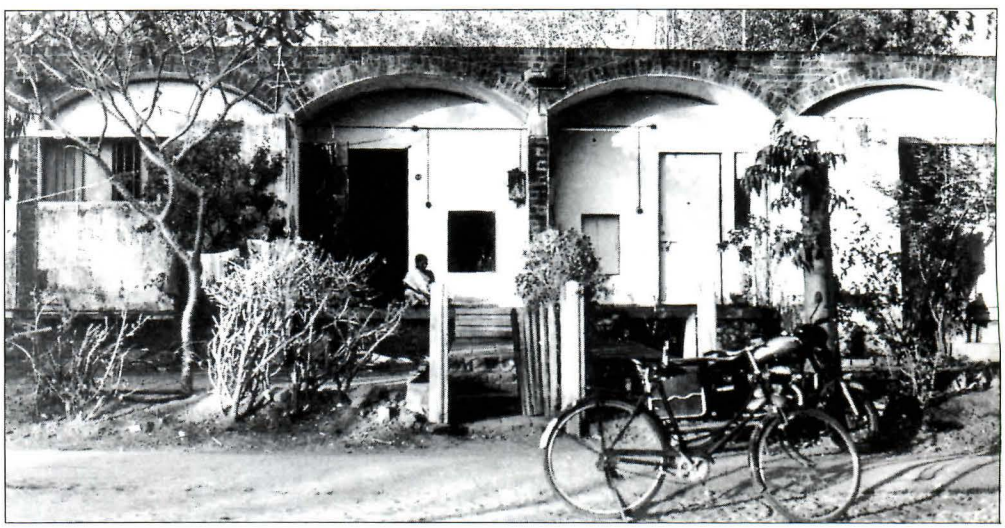
In many parts of the world, primary lessons learned earlier in the century are being extended and transformed to better deal with the issues of context, change, and tradition. Remote from current discourse in the Western press, some of the best architectural work is being produced in Third World countries—work that deals with change and yet derives its roots from the cultural conditions of the past, work that is resolutely modern and timeless.

One such country is India, where, according to author William Curtis, "What began 30 years ago as a tributary of the modern movement has since become a stream with its own momentum." Balkrishna Doshi's career has spanned the entire period of modern architecture in India, which started in the 1950s with stimulus from Le Corbusier.

Doshi is not exactly unknown in the United States. He has taught at MIT, Penn, the University of Washington, Rice, and the University of Illinois and has lectured at major schools in this country and in Europe. While his work has been published in architecture journals, this is the first monograph to be devoted to it.

India became independent in 1947. Doshi, born in 1922, represents the first generation of Indian architects to come of age in the postindependence era. In 1947 he joined the school of architecture in Bombay, found it stagnant, and left for England in 1951. While there he attended the CIAM conference in Hoddesdon, where he met Le Corbusier, asked him for a job, and was hired. During the next four years he worked on the High Court and Governor's Palace in Chandigarh and





Top, a recent Doshi project, the Gandhi Labor Institute in Ahmedabad, completed in 1984. Above, an early project, the ATIRA low-cost housing in Ahmedabad of 1960.

the Millowners building and Shodhan house in Ahmedabad. Doshi had the opportunity to learn firsthand how to adjust the modern architectural language to suit the climate of India. The lesson left a deep influence on him.

In 1955 he returned to India to supervise the construction of four of Corbu's projects in Ahmedabad—a wonderful way to start his own practice. Among his earlier commissions were two low-cost housing projects and laboratories for the University of Gujrat. The housing projects utilized brick vaults on parallel brick walls. The units were oriented north-south to minimize the effect of afternoon sun and to provide natural ventilation and subdued natural light in the interior. While these projects were influenced by some of Corbu's earlier work, "Doshi succeeded in rethinking these prototypes in a way which incorporated the scale and spatial gradations of an Indian village," writes Curtis, extolling a step toward an archi-

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Books *from page 47*

tecture appropriate to an Indian way of life.

The laboratories employed structure as the generator of form and expression of "servant" and "served" spaces similar to Louis Kahn's laboratories at Penn, but Doshi did not know of these at the time. Doshi's design for the Institute of Indology (1957-62), lighted by natural means, placed the collection of rare manuscripts partly below ground for insulation from heat, thus avoiding the need for artificial ventilation.

In 1962 Doshi arranged for Kahn to design the Indian Institute of Management in Ahmedabad. His collaboration with Kahn influenced Doshi's philosophy and subsequent work. According to Curtis, "Louis Kahn and Le Corbusier were the two main mentors whose lessons Doshi struggled to synthesize in a way that would deal with Indian conditions." His design for the Indian Institute of Management, while clearly indebted to Kahn's work at Ahmedabad, uses a less rigid geometry and draws influence from Fatehpur Sikri and Hindu temple cities—precincts of shaded walls and courts, with strong axes that shift to give unexpected experiences and ambiguous, dual impressions.

Doshi's design for Sangath, his own studio, synthesizes all his ideas into a fully developed, coherent architectural vocabulary and therefore represents his most important work. Doshi has said that it is

Above, Doshi, at center, in Le Corbusier's Paris studio in 1952.

the building in which he truly became himself. The building's design is derived from climatic considerations. The main studio is sunk partly below ground to protect it from heat, and crushed china is embedded in the outer surfaces of the vaults to deflect heat and glare. Grassy mounds absorb the afternoon sun, and natural light is baffled to obtain a gentle glow in the interior.

The elements of Doshi's vocabulary include these: a dual system of structuring—a main system for activity areas with a secondary system for the enclosure; ambiguity of space; the use of plinths to relate to the ground and the use of courtyards and transitional spaces to create a sense of cohesive community; shaded, well ventilated, softly lighted interior spaces. The associative ideas are inspired by Hindu temple architecture, havelis, the Indian village, Fatehpur Sikri, and Indian classical music (which has a primary theme, allows for improvisation, and then returns to the theme). Sangath is a building in harmony with climate, culture, and the Indian tradition.

The principles Doshi developed in earlier housing schemes come to full maturity in the design of several townships, which successfully confront the issue of rapid modernization. These principles include using natural devices to deal with the sun and rain, natural ventilation, courtyards and alleyways, standardization of construction, and design of dwelling units that are "always conceived in relation to the community as a whole and respond to the overlapping uses of Indian life."

The book is organized in four parts. The first is an introductory essay that traces Doshi's development, his "emancipation from mentors" and growth of his own architectural vocabulary, and the synthesis of his ideas and their relationship to the Indian tradition. The essay is incisive, thorough, and objective. The second part analyzes 20 key projects; the third part includes excerpts from Doshi's articles, lectures, and diaries; and the fourth is a postscript by Curtis on the future of Indian architecture. The book is meticu-

lously researched and thoughtfully written. It includes not only the necessary drawings but many of Doshi's original sketches, which hint at his sources of inspiration. The photographs are excellent. A detailed bibliography and a catalogue of Doshi's works complete the study.

Balkrishna Doshi: An Architecture for India is a superb book on the work of a talented architect. Curtis has been so meticulous and thorough that I hesitate to make a suggestion for improvement, lest it sound like a quibble. I will stick my neck out anyway. I wish that the next edition of the book would include a chronology of all Doshi's projects with a photograph or drawing and a brief description of each.

According to Curtis, "Doshi's quest for an authentic architecture blending old and new, regional and universal, has relevance beyond India. Doshi's work suggests that the architect must avoid both international and national stereotypes. The aim should be to transform, not to imitate or to reproduce. As always, architecture of depth relies upon ethical as well as esthetic convictions."

Eloquently stated. In these confused times of the profession's regression into superficial stylistics, it is advice well worth remembering.—Raj Saksena, AIA

Mr. Saksena directs the architecture program at Roger Williams College, Bristol, R.I.

The Living City. Roberta Brandes Gratz. (Simon & Schuster, $21.95.)

Given the catastrophic results of late-20th-century mass migrations to urban centers, due in great part to overpopulation with the resulting disease, crime, and starvation, a book such as this one is an insult to common sense. In the introduction, the author explains why: "The evidence is everywhere that there is a fundamental national problem underlying the crisis of our cities. As long as a permanent underclass and permanent unemployment exist on the present scale, fundamental urban problems will remain. Our economy no longer develops the jobs suitable for a critical portion of the urban population. The distinction must be made between pools of labor—for example, those engaged in short term construction and those engaged in long term production and service jobs. Whatever we do about rebuilding our cities won't matter without more long term productive jobs for the minimally educated and the minimally skilled."

Given these facts, which are not national but international, this reviewer is astounded that Roberta Brandes Gratz comes up with such solutions for saving cities as were proposed by Jane Jacobs in 1961: big schemes lead to big mistakes; preserve, don't tear down; preserve the neighborhoods; etc. Gratz has little to add to this list.

Bashing and blowing up the big projects is hardly a new critique in the last 30 years. The author does nothing to help us understand how and why many of these monsters were built and why it is that some have been grim failures and some highly successful.

She is better when she describes gentrification in Soho, where once the sewing machines hummed and the presses pounded, where now the cast iron fronts are painted, the glass is polished, and art galleries and boutiques line the streets. Above, the floors are polished and interior decorators have arranged *pieds-à-terre* and studios for those who can afford them.

And the jobs? I am reminded of a story the author tells of the saving of the Davenport house in Savannah, Ga. It is an early-19th-century Georgian house, in terrible condition, inhabited by 11 families. The local historical society decides it must be saved. The society buys it, paints it up, and makes it a "part-time museum" and looks for a tenant to use the basement. One wonders, what became of the 11 families? Have they joined the ranks of the homeless or disappeared into thin air with the jobs and workers of Soho?

I am not asking Gratz and others writing similar books to cure the urban cancer, but I am begging that they stop drumming up the merits of their nostrums.
—Percival Goodman, FAIA

Mr. Goodman is a historian and critic of city planning and urban design; he lives in New York City.

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ARCHITECTURE

In a departure from our usual September format, we begin this eighth annual review of international architecture with five survey articles. Then comes the more familiar staccato presentation of new buildings from around the world.

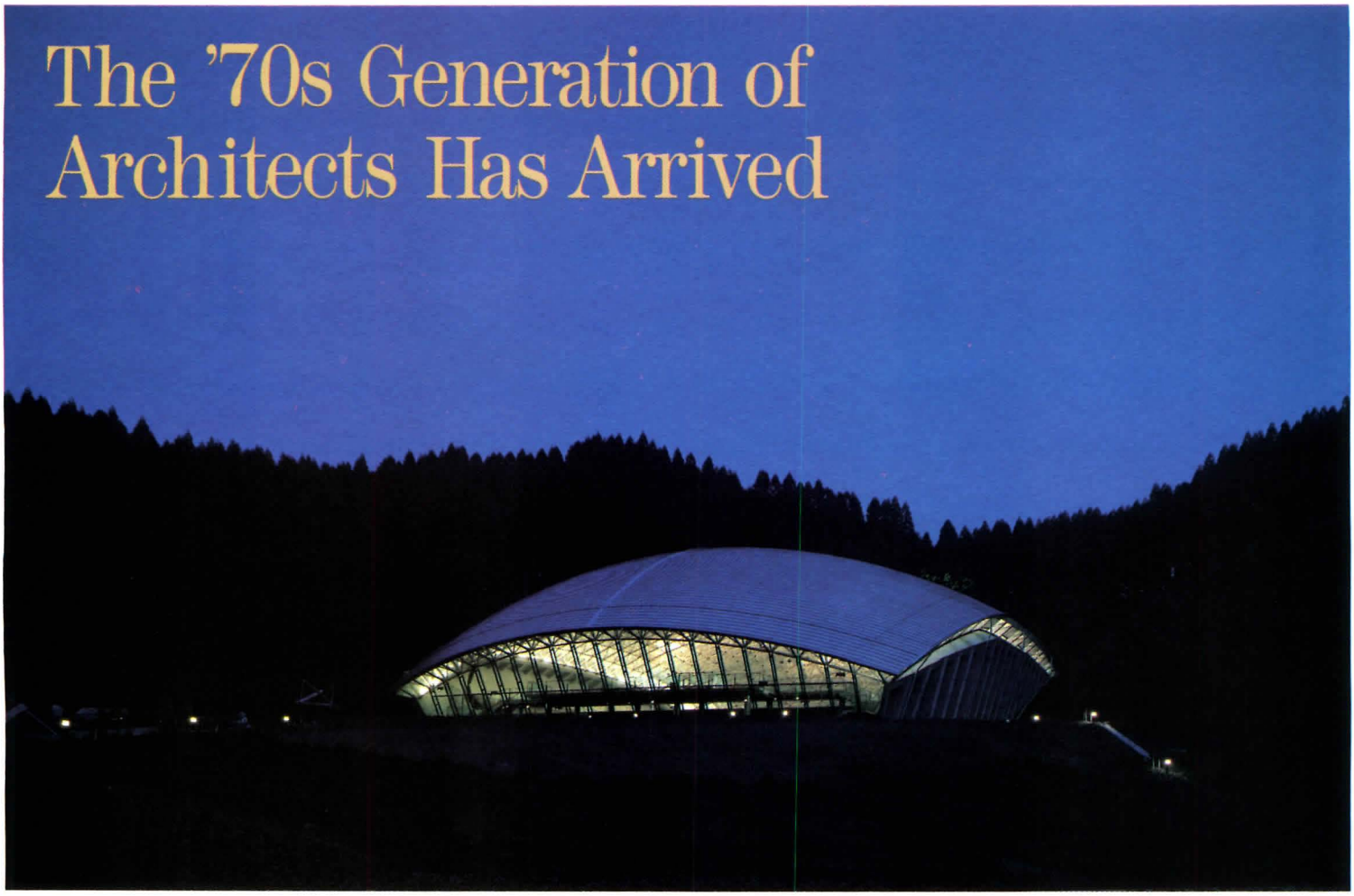
In Japan, the subject of the opening survey, the generation of architects that emerged in the '70s has come into its own, aided by a run-away building boom, growing public interest in architecture, and an increasingly international approach that welcomes foreign architects as well as overseas commissions for Japanese designers. Our survey of France updates, among other things, President Mitterand's ambitious program of *grands projets,* now nearly complete; he has proclaimed architecture "a political act intended to restore to France the means of being great." Finnish architectural ambitions are far more modest, as discussed on pages 58-61. The now-mature post-Aalto generation has built on the master's organic interpretation of modernism.

Organic, tactile images are also the dominant theme of work shown in our two remaining surveys. The one is on new and humane educational buildings by the German architect Gunther Behnisch. The other is on Hungary's Miskolc group, about which John Macsai writes, "Its members are suspicious of ideology and theory as being too trendy and ephemeral."

This attitude emerges this year as an abiding theme, shared by architects in most countries. Their buildings tend to reflect a modernism enriched by the absence of dogma and by greater inclusiveness. As the Swedish critic Claes Dreijer writes, "It emphasizes a sense of discovery, of understanding for the client and the locale. It clearly affirms the possibilities of modern society, of the 'new age.'"

—Andrea Oppenheimer Dean

The '70s Generation of Architects Has Arrived



Japanese architecture shows signs of becoming less parochial, as foreign designers find increasing opportunities here for commissions large and small and their Japanese counterparts go forth to tackle projects in all corners of the globe, from Sofia and Singapore to St. Paul, Minn. Meanwhile, the generation of architects that emerged in Japan in the 1970s has finally arrived and is engaged in large-scale, often high-profile work. These developments have been made possible in part by a building boom that rivals the frenzy of construction that characterized the period of intensive economic growth in the heyday of Metabolism before the onset of the energy crisis.

The announcement last December that Renzo Piano had won the design competition for the new Kansai International Airport terminal building was dramatic evidence of changes afoot. Political pressures are being exerted to open markets in Japan and correct an egregious trade imbalance with other countries; and what was only the second international competition for a public building in Japan and the first to be won by a non-Japanense was a symbolic gesture of accommodation. Demonstrating that it was not an isolated incident, this November a jury will meet in what is billed as the first international competition in Japan officially approved by the UIA (Union Internationale des Architectes) to choose a designer for Tokyo Forum, a 96 billion-yen cultural complex that will stand on the site vacated when City Hall moves in 1991 to its new quarters in Shinjuku, designed by Kenzo Tange.

The private sector in Japan, by comparison, has moved much more swiftly, and in the last five years a number of foreign architects including Norman Foster, Frank Gehry, Zaha Hadid, and Richard Rogers have found clients here. Language and the legal system still present barriers, and the possibilities for cross-cultural misunderstandings and conflicts are legion. (An architect who was aiming for a slapdash effect by using industrial materials found his Japanese associates neatening details and thereby weakening the overall impact of the design.) Yet intermediaries such as general contractors, developers, and so-called producers (like Yasuhiro Hamano, who acts as an agent for Michael Graves) make the task of working in unfamiliar territory considerably easier. Needless to say, the strength of the yen also makes a lot of the bother tolerable.

Internationalization and a growing public interest in architecture has led to two IBA-inspired architectural exhibitions on the southern island of Kyushu. In Fukuoka City, a development on reclaimed land facing Ilakata Bay has drawn architects such as Graves and Stanley Tigerman from the United States and Kisho Kurokawa, Yasufumi Kijima, and Shoei Yoh from Japan. In Kumamoto Prefecture, Arata Isozaki is serving as the commissioner for Artpolis, an exhibition that will take place in 1992 and include a wide variety of buildings for both the public and private sectors—for example, a social welfare center (Hans Hollein), a museum (Toyo Ito), a ferry terminal (Yoh), and a 276-unit housing project (Kunihiko Hayakawa). Kazuo Shinohara,

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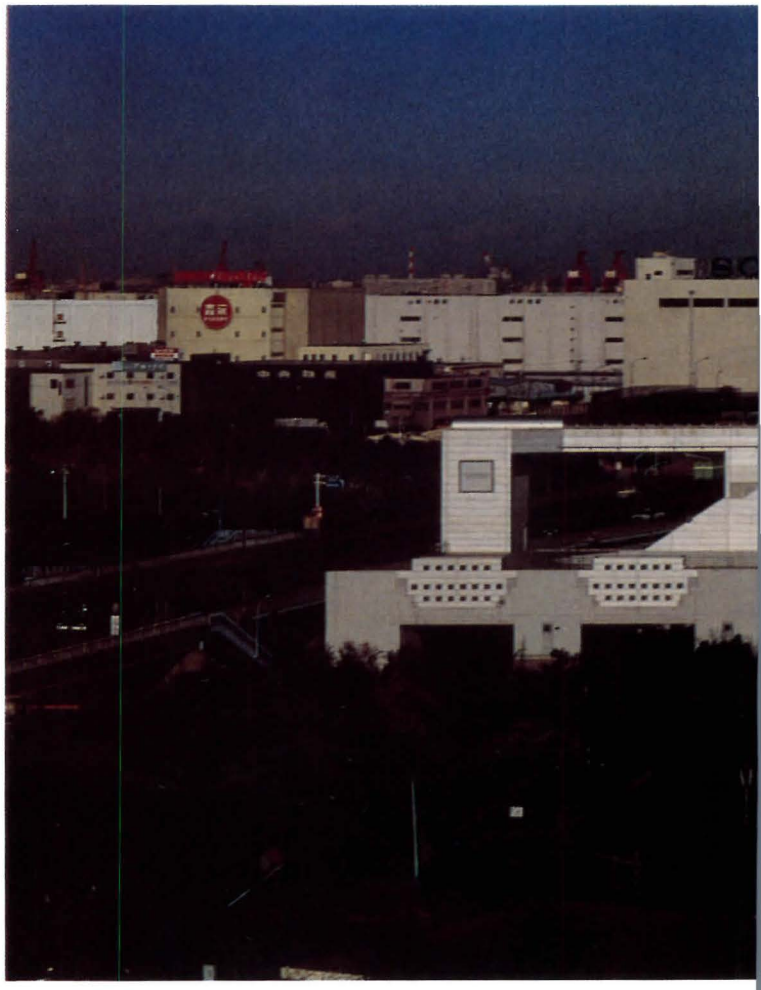
Three examples of increasingly catholic work by the generation of Japanese architects that emerged in the 1970s: Facing page, Oguni Dome by Shoei Yoh, the largest wood-construction gym built in Japan since World War II; above, Kidosaki house by Tadao Ando, as indisputably Japanese as it is modern; and right, Centennial Hall by Kazuo Shinohara, an architect who 'finds inspiration in the concept of chaos.'

© Hiroshi Watanabe



Top and above, the Shonandai Cultural Center by Itsuko Hasegawa. Hasegawa sees in the spontaneous quality of Asian cities an alternative to modernism. Above right, Yamamoto International by Hiroshi Hara, better known for his introspective houses favored by atelier architects in the 1970s. Facing page, Platform, a house by Kazuyo Sejima, an architect in her 30s who worked for Ito before opening her office in 1987.

the man who finds inspiration in the concept of chaos, is, ironically enough, designing the very symbol of law and order, a police station.

Internationalization has meant more lines of communication with the outside world. Not so long ago practically every visiting architect, critic, or editor of consequence was taken in hand by one of four or five well-connected architects in Japan, who would arrange itineraries and meetings with presentations by lesser-known practitioners and, intentionally or not, color the visitor's impressions of contemporary Japanese architecture. When it was time to arrange overseas exhibitions, these same architects would control who was represented. While this hegemony —benevolent in most respects, but a hegemony all the same—has not been entirely overthrown, younger architects are establishing contacts of their own, and visitors nowadays are generally more knowledgeable and have less need to be told what and whom to see.

In reaction to the trend toward internationalization, a number of architects are asking again what exactly constitutes Japaneseness. Admittedly, to a cynic the issue at times appears somewhat contrived and urgent only to journalists in need of good copy, yet for all that it cannot be entirely dismissed. Despite their abstract modernity, the spaces in Tadao Ando's Kidosaki house (1986), which are defined by their relationship to exterior courtyards and the nature-in-the-abstract that the courtyards represent, impress visitors as being indisputably Japanese. And, as

if to identify what remains constant in that quintessentially Japanese space, the tea-ceremony room, when the material is made a variable, Ando has designed a series of such rooms in concrete, plywood, and tent and is contemplating building an earthen one underground. A quite different architect, Itsuko Hasegawa, sees an affinity between the architectural approaches of Japan and the rest of Asia. She believes that the spontaneous, unplanned quality of Asian cities that have not yet been completely made over by redevelopment suggest a more "supple" alternative to modernism.

Hasegawa once studied under Shinohara (b. 1925), who together with Isozaki (b. 1931) and Fumihiko Maki (b. 1928) was something of a role model for the so-called new wave architects. Today, the three men are busier than ever. Isozaki is engaged in many projects overseas, including a sports hall for Barcelona and a university in Australia. Maki, in contrast, has concentrated on buildings in Japan, though he is doing an arts center for San Francisco. He has just completed a science museum in Tokyo, and construction is proceeding on Makuhari Messe, a convention center in nearby Chiba City (to be completed in October) and the Tokyo Metropolitan Gymnasium (which will be finished next April). Shinohara, whose reputation used to rest on his houses, has taken to designing not only the police station but a museum, a hospital, and an office building. His Centennial Hall for the Tokyo Institute of Technology (1987), which serves a mixed bag of uses, has been widely acclaimed.

It is premature, therefore, to cast any of those three in the role of elder statesman, yet there is no question that they are entering new stages in their careers. In the last three years Shinohara and Maki have retired from their respective teaching positions, and it may be noteworthy that Isozaki has been preparing the publication of a two-volume *oeuvre complète.*

A number of developments herald the arrival of a younger generation. Osamu Ishiyama (b. 1944), who has built houses out of corrugated steel sheets and who has been an articulate and often caustic critic of the establishment, recently was appointed full professor at Waseda University, which has the leading architecture department among private insititutions. However, the watershed event was perhaps the competition for the Shonandai Cultural Center in Fujisawa City, won by Hasegawa (b. 1941). This project, now under construction in a suburb of Tokyo, ushered in an era of competitions with juries that were suddenly willing—thanks to leadership by people like Isozaki and Maki—to take chances on younger architects. Kijo Rokkaku (b. 1941), who had a six-person office and plenty of time on his hands, suddenly was faced with the need to greatly expand his staff when he won a limited competition for a 7-billion-yen martial arts center for Tokyo (expected to open next February) on the strength essentially of a one-page statement of his architectural philosophy.

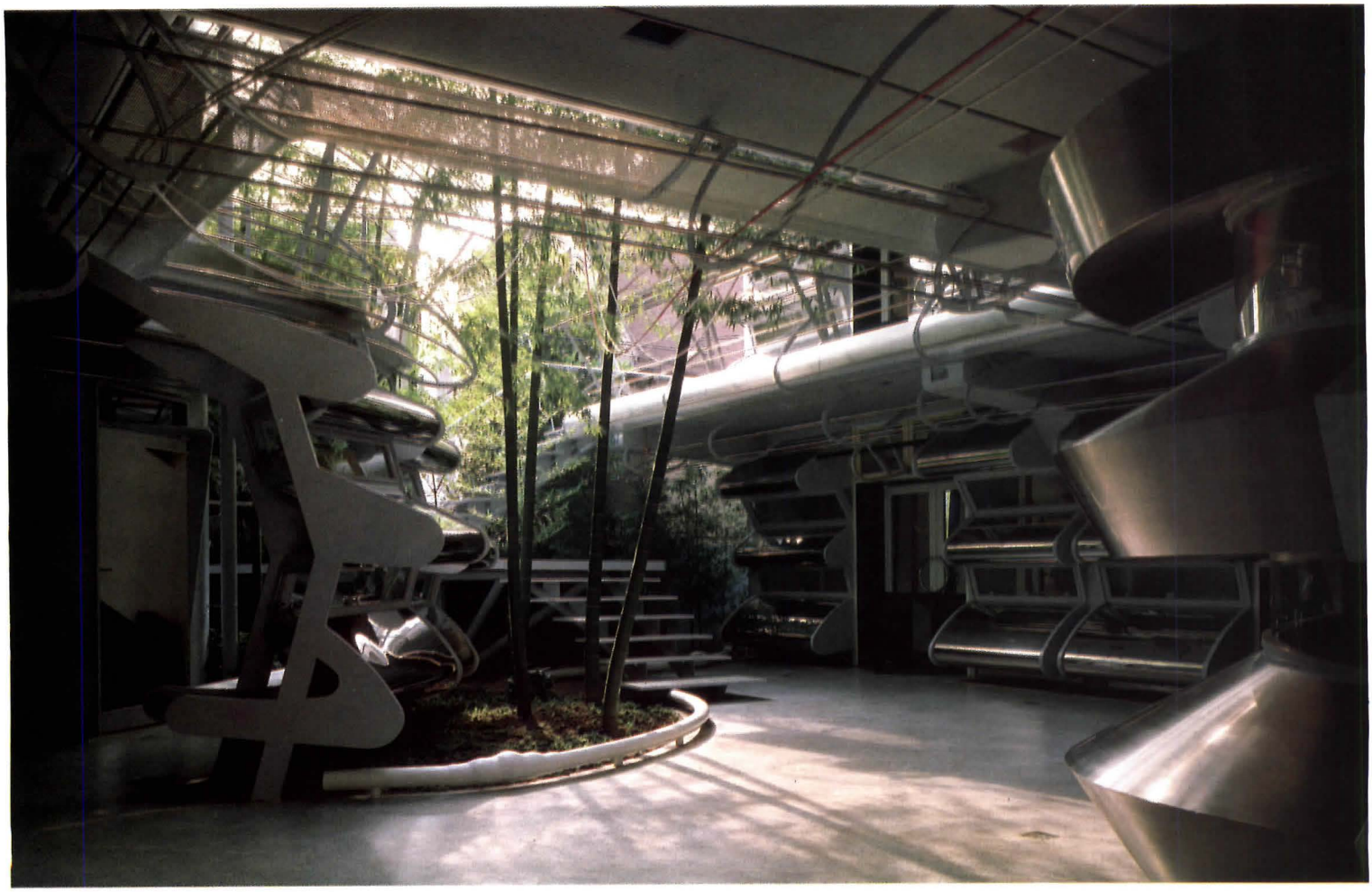
The miniaturists of yesterday are painting now on large canvases. Hiroshi Hara, whose dreamlike Reflection Houses exemplified the introspective environments favored by atelier architects in the 1970s, has turned to designing big urban structures like Yamato International, the headquarters of a Tokyo manufacturer, and skyscrapers for Osaka. Kiko Mozuna, who made his architectural debut with a small house in Kushiro called the Anti-Dwelling Box, is working on a huge waterfront project called Fisherman's Wharf in the same city.

In the last few years some architects in their 30s have begun to make their presence known. They include Kazuyo Sejima (b. 1956), who worked for Ito before opening her own office in 1987. Platform, a house in Katsuura, Chiba Prefecture, completed in 1988, features an undulating roof that seems to float above the datum of the floor. Masaharu Takasaki (b. 1953) spent a number of years in West Germany and Austria before returning to Japan. His visionary projects sometimes defy existing technology, but unlike many of his confreres he is in no hurry to get things built. It took five years for him to realize his first building, Crystal Light, a combination office and residence in Tokyo.

Today, with the enormous volume of work available, fewer architects are willing or able to spend that much time on one small building. In fact, so much work is going on that Japan is faced with a shortage of construction workers. Here, too, the answer has been internationalization, but of a clandestine sort—the importation of illegal laborers from South Asia.

—Hiroshi Watanabe

Mr. Watanabe is a critic and translator working in Tokyo.



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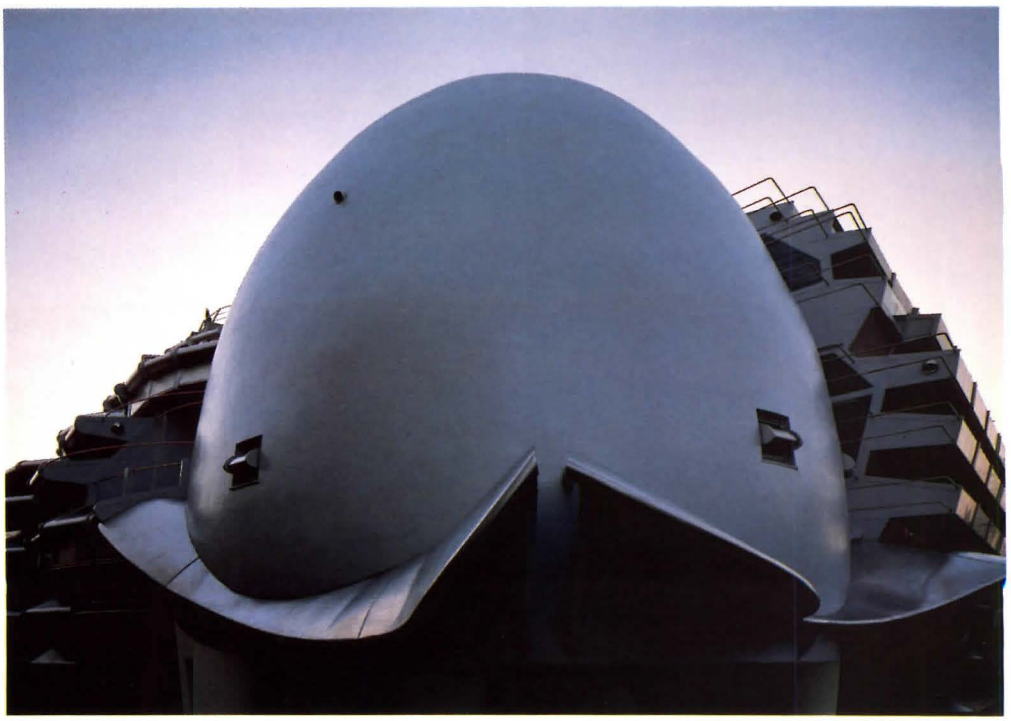
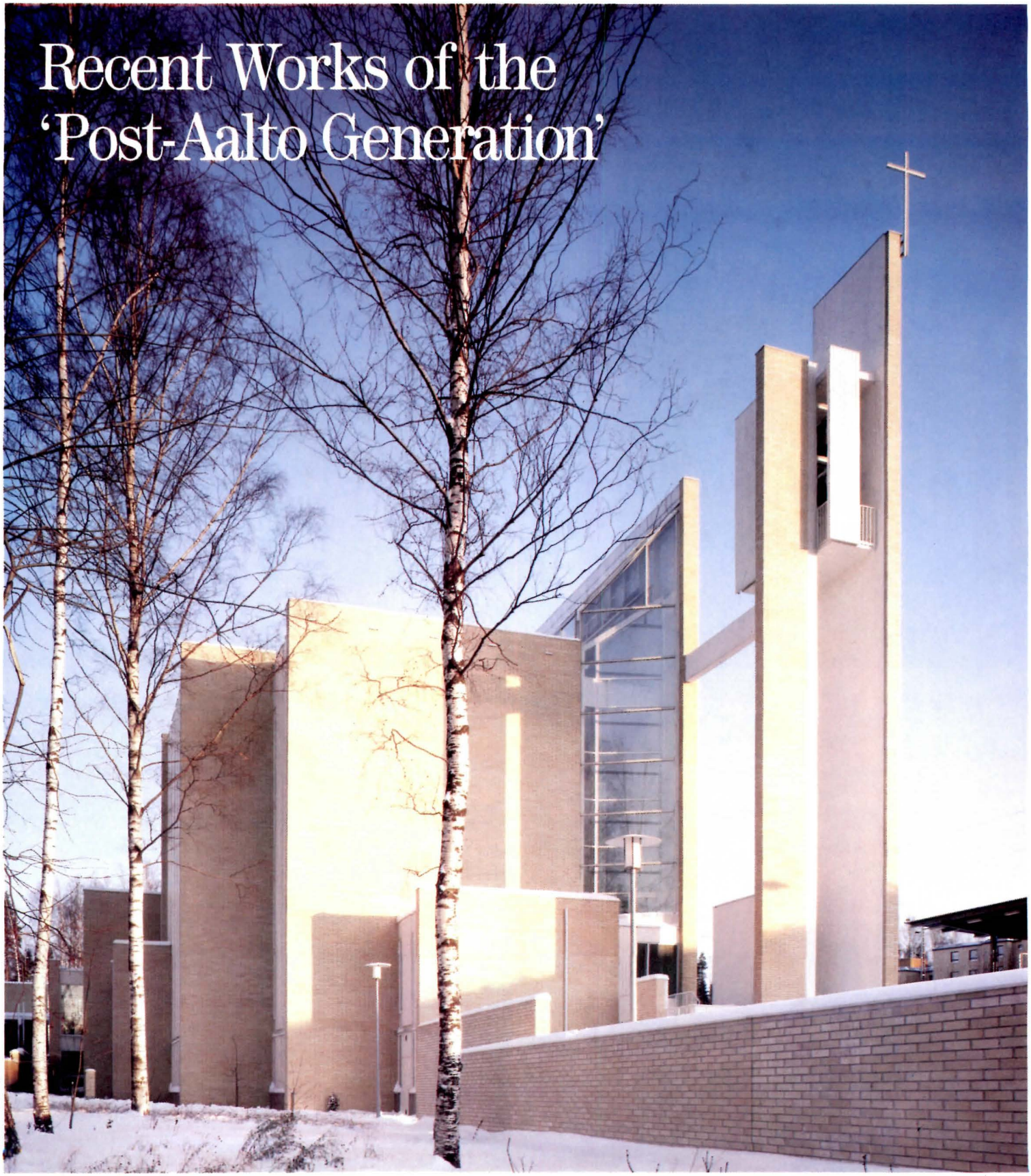
Facing page, Riken Yamamoto's 'Hamlet,' using Teflon tents to provide shade and privacy in a Tokyo apartment building, shows a continuing tendency among architects like Ito and Hasegawa to use lightweight, translucent and transparent membranes in the form of metal panels and fabric. This page, 'Crystal Light,' a combination office and residence in Tokyo by Masaharu Takasaki, a young architect of visionary projects who has lived in West Germany and Austria.



Recent Works of the 'Post-Aalto Generation'



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Facing page, Leiviskä's church/parish center at Myyrmaki. The long elevation bordering tracks is a solid spine; its mate, of stepped parallel planes, is more open. Above left, a view of the altar; above, toward the organ. The whole is 'about light.'

The post-Aalto generation of Finnish architects has been building on an unbroken 60-year tradition of modernism. Some of their new work, now mature and confident, deserves closer attention.

Juha Leiviskä's church complex at Myyrmaki, a Helsinki suburb, follows a long tradition of Finnish church/parish centers—community gathering places for both religious and secular activities. Located next to the train station, the complex at Myyrmaki turns its back on the trains, with one long wall bordering the tracks. This wall is interrupted only by a series of strip buttresses and one small, projecting panel that allows light to slip into what, surprisingly, turns out to be the church altar. In the design competition for this project, only Leiviskä's entry placed the building next to the noise and problems of the tracks and thereby gained a protected parkland on the urban side of the site.

This solid-wall spine bordering the tracks dictated the unusual form of the church: its longitudinal axis is compressed, making for superior acoustics for speaking clergy; while its great width is acoustically advantageous for the organ, located on the south wall.

On its more open, east side, the complex is broken down into a series of parallel faces that step forward and back to accommodate and precisely mirror the complex program of chapels and meeting rooms within. Nothing is done simply for effect. This open facade also interacts sensitively with a small grove of birch trees on the property and then with the community below.

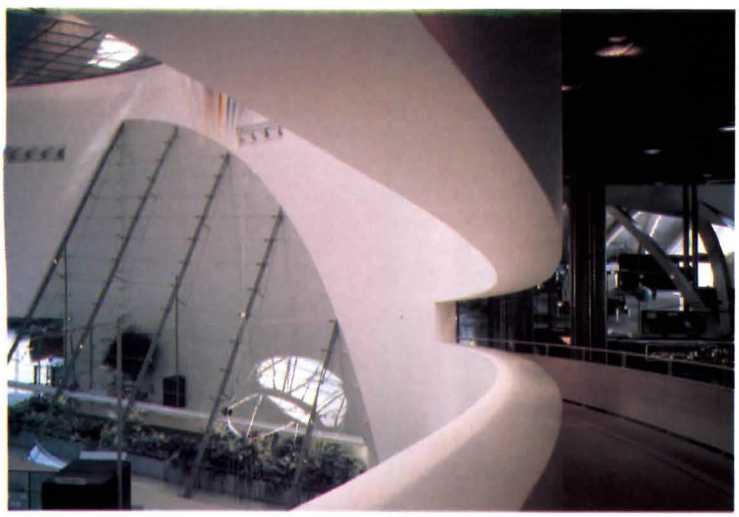
The church is phenomenal: a building about light. Never invited directly in, light folds around a series of baffles and washes across the surfaces of panels. Rhythmic vertical shadows are created by light passing over grooves in the wood paneling, by the exposed organ pipes, and by the long, thin cords from which the architect-designed light fixtures are suspended. These linear shadows find an echo in the birch trees outside. Two layers of windows on the rear wall shift past one another so that light must overcome obstacles. Again light triumphs.

In writing about this church, Colin St. John Wilson summoned up Abbot Sugér's cathedral at Saint-Denis. Both buildings use light to achieve a transcendent spiritual experience.

The Heureka Science Center in Vantaa, by architects Mikko Heikkinen and Markku Komonen, opened last April, ahead of schedule and under budget. Its purpose is to promote science to Finnish youth and to promote Finland as an international leader in technology and architecture.

Nodding to both constructivism and deconstructivism, the architects organized the project as follows. The main space is an industrial shed, a flat-roofed rectangle with exposed columns. Extending above the roof is the wall of a cylindrical hall, whose center is exactly marked by Foucault's pendulum. Standing in the center of this circular space, one feels echoes of Stonehenge and the Pantheon.

Touching a corner of the main space is a small theater in the form of a quarter-circle, while a hall for temporary exhibitions, formed of tilted parabolic arches resting on each other, breaks into the main space and is, in turn, invaded by the spherical planetarium. This element, clad in a reflective steel skin, houses



Above and left, the Heureka Science Center in Vantaa by Mikko Heikkinen and Markku Komonen.

the latest hemispherical projectors for multimedia presentations, a 500-square-meter hemispherical screen, and a state-of-the-art planetarium projector made for Heureka by Carl Zeiss Jena.

The long service wing lies alongside the main space, shielding it from the noise of passing trains with a sloping glass wall. The public restaurant and roof terrace are reached by a cantilevered ramp spiraling up the outside of the cylinder, marked by a spiraling strip window. The cantilevered glass and steel entry canopy is an act of engineering bravado, and, above all these disparate parts, laser beams, yet to be installed, will define the cardinal points of the compass and glow elusively overhead.

Some current Finnish attitudes toward restoring and enlarging older buildings are reflected in three recent projects. The first is Helsinki City Hall.

When Carl Ludwig Engel was invited to design virtually all the public buildings for the new city of Helsinki in the mid-19th century, he created Senate Square, a large, open plaza at the heart of the city, and surrounded it with the cathedral, the university and its library, the Senate building, and the block comprising Helsinki City Hall.

The restoration and extension of the City Hall, the work of Aarno Ruusuvuori, Hon. FAIA, was done in two phases, separated by a gap of nearly two decades. The first phase, completed in 1970, converted the interior of a historic shell into a strong modern space for government, eliminating many of the old interiors. Nineteen years later, phase two consists of a new ceremonial city council chamber in the form of a granite cube set jewel-like in the center of Engel's block. The facets of the perimeter skylights reinforce the jewel image.

The cube meets Engel's block with a respectful change of materials: bronze railings meet iron ones and do not touch. A large hall by Engel has been restored to its original colors, as have a group of offices along the Senate Square side. Office furnishings, corridors, restrooms, and the like are designed for efficiency in colors sensitive to Engel's original.

Interestingly, public transportation in Helsinki has improved so much in the two decades since the restoration began that parking, originally planned for phase two, was eliminated.

Above left, left, and below, Aarno Ruusuvuori's addition to Helsinki's City Hall sets a cube-shaped city council chamber into the center of the original block. Above, Kristian Gullichsen's extension to the Stockmann department store respects its neighbors while recalling Charreau's Maison de Verre.

The Stockmann department store stands in a neighborhood of architecture by giants. The main part of the building was completed in 1930 by Sigurd Frosterus and is surrounded by works of Eliel Saarinen and Aalto. So when Kristian Gullichsen of Gullischsen, Kairamo & Vormala began the new extension to Stockmann's building, he thought in terms of conversing with the "old gentlemen" on the street.

The new building continues the rhythm of the granite-clad pilasters of Frosterus's facade, while infill derives from Chareau's Maison de Verre. The highly polished steel in the facade also speaks to Aalto's copper Rautatalo and Academic Bookstore across the street, while the granite nods to Saarinen's building.

Inside, Frosterus's atrium-and-gallery organization is repeated in a streamlined, loosely triangular shape, and the ceiling above is a glass dome surrounded by blue plaster inset with stars, astronomically correct in their placement.

These lighthearted quotations and allusions make the addition respectful but irreverent. What is significant is that, in spite of all this architectural conversation, there is an integrity to the design. It is quite elegant.—Janey Bennett

Ms. Bennett is an architectural historian in Carmel, Calif. Her recent trip to Finland was made possible by the Finnish Foreign Ministry and the Museum of Finnish Architecture.

Expressing a Proud Nation's Ambition

Contemporary architecture has attained the status of a national cultural investment in France over the past 10 years, in the wake of what President Mitterrand has called "a political act intended to restore to France the means of being great, [for] the more she becomes universal, the more she must remain herself. Architecture best expresses this ambition."

As is well known, a vast program of buildings, mainly for cultural purposes, was launched in Paris and the provinces at Mitterrand's behest soon after he was elected president in 1981. Most of these *grands projets* were the subjects of architectural competitions, some of them national, some international. Of the seven ambitious architectural undertakings so initiated in Paris, two are scheduled for completion next year and five are already in use, as are the two mammoth museum projects inherited at the construction stage from former president Valéry Giscard d'Estaing and completed in slightly amended form—"Science City" at La Villette (see Sept. 1987, page 85) and the Orsay Museum.

"Every one of these projects has a cultural and an economic function," said Mitterrand, and, since "a living culture underpins the national heritage, disseminates inventions and knowledge, and creates centers of production," the French taxpayer was expected to foot the lion's share of the bill. The policy paid off, and Mitterrand's national aspirations for contemporary architecture now are shared by many politicians in France, irrespective of party allegiance. Indeed, there is scarcely a city in France where the mayor has not made his mark in recent years with an eye-catching new building—not infrequently commissioned from a world-famous foreign architect.

This revival of political confidence in contemporary architecture has benefited French architects too, not least those who in the 1960s protested the perceived political complacency that continued to promote *grands ensembles* of towers and slab-blocks, held by their detractors to be no better than hutches for human rabbits. The speed and scale of building in France at the time was undoubtedly a cause for concern. In 1960, Georges Candilis remarked, "I believe in what may be called a brutal style. As architects, we are so rushed we have to say really brutally a few things in which we believe, in order to make the point."

It was precisely this haste and brutality of expression that younger architects and students wanted to see reversed. As one student protagonist of the time has since put it, "A general strike was organized at the Beaux-Arts school of architecture in 1960 to insist work should be done on mass housing. Although 500,000 dwellings a year were being built at the time, mass housing had never been set as a project at the Beaux-Arts school." Following the *événements* of May 1968, the Beaux-Arts system was dismantled, educational reforms were introduced, and architectural forms deemed less destructive to the urban and social fabric were researched eagerly by architecture students and their teachers. However, opportunities to put these theories into practice remained very thin on the ground.

The turning point is still widely held to be the rue des Hautes-Formes housing project, completed in 1979 to competition-winning designs by Christian de Portzamparc and Georgia Benamo. It provided 209 subsidized apartments in Paris's 13th *arrondissement.* Portzamparc had been a student at the Beaux-Arts from 1962 to 1969 (when he received his diploma) and was a key figure in the still raging architectural debate.

Yet, until the Hautes-Formes commission, his entire built *oeuvre* amounted to a small extension to a private house (1969) and some street furniture and a water tower at Marne-la-Vallée new town (1970-76).

Somewhat more experienced architects, from Ricardo Bofill to Henri Ciriani, began to receive substantial commissions in the French new towns in the early 1970s, and opportunities for younger architects started to increase after a law was passed in 1977 making architectural competitions compulsory in France for most projects receiving public subsidy. Jourda & Perraudin, for example, won the competition for the new Lyons school of architecture in 1982, though the project was not built until six years later (see Sept. 1988, page 90). In the meantime, they saw built two other of their competition successes—a small, experimental housing project using *pisé,* in L'Isle d'Abeau new town (1984), and a primary school in the St. Christophe sector of Cergy-Pontoise new town (1985), right next door to one of Bofill's "Versailles for the people." (Officially entitled "Le Belvedere," this Bofill project was featured in Eric Rohmer's film *My Girlfriend's Boyfriend,* a fiction based on life in Cergy-Pontoise).

A major opportunity of an entirely different nature came in 1983 when Mitterrand's government identified an urgent need for a large, inexpensive, and rapidly available structure for rock concerts at La Villette with a capacity of around 6,500 places. Philippe Chaix and Jean-Paul Morel—both then in their mid-30s—came up with a solution so successful for the "Zenith" that similar structures have been commissioned to their designs in several other French cities. Pictured here (top right) is their Montpellier "Zenith," erected in 1985.

The upturn in architectural fortunes brought about by government policies in the early 1980s extended to interior design as well. In 1983, Mitterrand's ebullient culture minister, Jack Lang, commissioned five virtually unknown designers to revamp the private apartments in the Elysée Palace. The most conspicuous beneficiary of the ensuing publicity was Philippe Starck, who soon landed a private commission to design the Cafe Costes (1984), where his evocation of "the melancholy of an eastern European railway station" proved so popular with a young, fashion-conscious clientele that Starck was rocketed to designer stardom.

Counterclockwise from below: Portzamparc & Benamo's influential housing at the rue des Hautes-Formes; Henri Ciriani's housing at Marne-la-Vallée new town; Edith Girard's housing, quai de la Loire, Paris, a 'sensitive yet modern contribution'; around the corner from the last is Henri Gaudin's school on the rue Tandou; Jourda & Perraudin, experimental housing at L'Isle d'Abeau new town; Philippe Chaix & J-P Morel, 'Le Zenith,' Montpellier.

Photographs © Couturier/Archipress

More typical of France's architectural quest for forms and imagery deemed to make a sensitive yet modern contribution to the urban fabric is Edith Girard's acclaimed housing project on the quai de la Loire, in the 19th *arrondissement* (1985), and the school just around the corner, in the rue Tandou, built to designs by Henri Gaudin (1987). Girard, who is a former pupil of Henri Ciriani, bested Gaudin in the competition for the design of the quai de la Loire housing. Undeterred by this defeat, Gaudin has continued to develop his highly sculptural architectural approach, notably in housing projects in the rue de Menilmontant (1987) and at Arcueil (1988). He was elected joint winner of the French national Grand Prix de l'Architecture this year (but refused the title).

Equally single-minded in his highly personal interpretation of French post-1968 architectural and urban ideology is Christian de Portzamparc, who moved on from the rue des Hautes-Formes housing in 1979 to complete a music conservatory and housing for the elderly in 1984, between the rue Jean Nicot and the rue de l'Université in the seventh *arrondissement* (see Sept. 1985, page 88), and the dance school at Nanterre in 1988; he now is engaged in the Music City *grand projet* at La Villette, the first phase of which is scheduled to be completed to his designs in 1990.

Girard, Gaudin, and Portzamparc are among the more distinguished essayists in the peculiarly Gallic genre generated by preoccupation with urban fabric, fragmentation, and facade. But, inevitably, the very reaction against debased modernism that engendered such endeavors has now produced an entire lexicon of facile assumptions and overworked clichés, as can be confirmed by a trip around almost any part of French cities, towns, or suburbs earmarked for urban regeneration in recent years. As always, bad habits are more easily assimilated than reforming zeal.

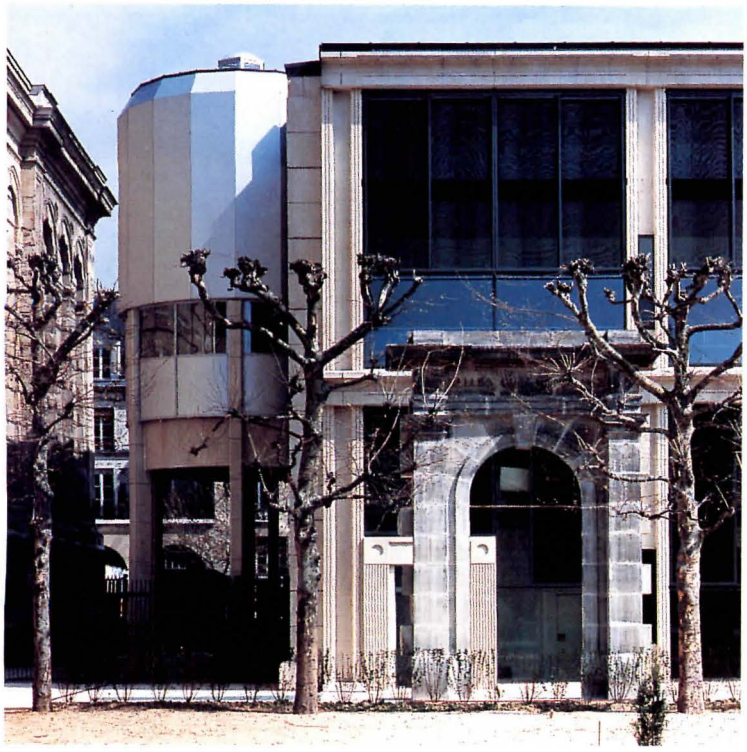
Happily, investigations are being conducted in other directions as well. Jean Nouvel, for instance, who has never won a housing competition in his life, began to ponder why it is that "architecture" nearly always stops at the facade in French public housing, with apartments having the requisite number of rooms crammed inside any old how. His opportunity came when Mayor Bousquet offered him an experimental housing commission in Nîmes, as an unscheduled consolation prize for being pipped at the post by Norman Foster in the Nîmes Médiathèque competition. With Jean-Marc Ibos, Nouvel was able to demonstrate that generously dimensioned apartments could be provided at costs comparable to conventional public housing. Nemausus I was completed in 1987 and represents a rare and radical depar-

Top, Arcueil housing shows sculptural approach favored by Henri Gaudin, especially in housing. Center and bottom, Portzamparc's dance school at Nanterre illustrates his typically French preoccupation with urban fabric, fragmentation, and facade.

Above, Jean Nouvel & Jean-Marc Ibos's housing at Nîmes went beyond the facade, is unconventional but popular, and is more spacious, though no more costly, than conventional French public housing. Below and right, Charles Ott's Paris Opera House, 'wrapping for technical wizardry.'

Photographs © Couturier/Archipress

Below and bottom, the Archives National in Paris by Stanislas Fiszer.



ture from long-established assumptions concerning the accommodations and building techniques tenants will find acceptable. And, although so unusual in many respects, Nemausus I has proved highly popular with the majority of tenants.

Completed in the same year as Nemausus I was the Lycée du Futur training college in Poitiers, by Architecture Studio, which then was working with Nouvel and others on the Arab World Institute *grand projet* in Paris (see Sept. 1988, page 92) and evidently shares Nouvel's fascination with using building technologies to create architectural effects. But, whereas such effects are deployed throughout the Arab World Institute, in keeping with the building's functions, the same cannot be said of two more recently completed Parisian *grands projets*.

The architectural content of the new Opera House at Place de la Bastille (opened briefly in July but not due to be put to full-time use until 1990) never amounted to more than an architectural wrapping for a predetermined box of technical wizardry intended to whisk entire sets on and off stage at lightning speed. Carlos Ott's finished building is remarkably faithful to the designs that won him the international competition for the project in 1983, and it unquestionably fulfills the brief. Yet one has the distinct impression his architecture might be peeled off, like so much stage scenery, to be replaced with something else as soon as a suitable political motive crops up.

Conversely, the Grande Arche at Tête-Défense has been stripped of its original function, and the completed building inaugurated in July amounts to no more than the barest outline of the concept that won for the late Johan von Spreckelsen the international competition of 1982. In accordance with the brief, his designs envisaged an international communications center, as was reflected in the imagery he devised for the project. The communications center was scrapped later and the designs amended by others to provide more office space on either side of Spreckelsen's "window on the world."

If the French government has failed to make the most of international architectural talent in either of these *grands projets*, far more creative and complete roles have been afforded to architects in the wide variety of other commissions awarded or stimulated in France by the policies of President Mitterand and his advisers. No doubt, on the strength of this past experience the briefing and backup services surrounding the "Très grande bibliothèque" planned in Paris will be still more enlightened. Two library projects completed last year, albeit on a far smaller scale—the Archives Nationales in Paris by Stanislas Fiszer and the Maison du Livre, de l'Image, et du Son, at Villeurbanne, by Mario Botta—certainly suggest there is every reason for optimism.

—Charlotte Ellis

Ms. Ellis is an architect and writer in Paris.

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Top, Architecture Studio's, Lycee du Futur College; above, left, and right, Mario Botta's library, Villeurbanne.

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A 'Design Community' Of Young Practitioners

Facing page, lookout at Bükk National Park by Benö Taba. Below, left and right, Csaba Bodonyi's Education Center in the village of Békés shows how a large building can be fit into a small-scale village to look like infill.

Photographs by István Panyik

Architecture students frequently dream of forming their own design community. In Hungary, in the late 1970s, the dream came true.

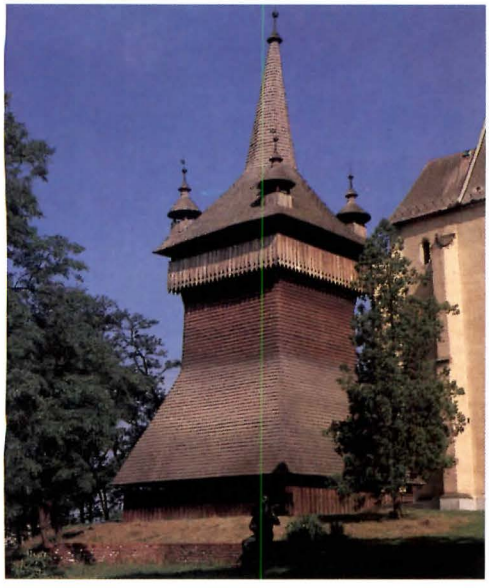
After graduation from the Budapest Polytechnical University school of architecture, about a dozen young architects looked for a strong design firm that would employ them all. They found the Regional Design Bureau of Northern Hungary in the city of Miskolc (population 200,000). The 400-person office (of architects, engineers, and clerical and field personnel) was run with great energy and efficiency by Csaba Bodonyi, one of the country's most talented young designers, together with his associate István Ferenc. Bodonyi not only hired the graduates and gave them considerable independence but also arranged to have the government build a 12-unit apartment co-op for them.

Some of the original group members have left, new ones have been added, and all are now in their mid-30s, but they are still known as "the young ones from Miskolc."

Though they live in a commune and share many opinions, the group is not ideological. In fact, its members are suspicious of ideology and theory as being too trendy and ephemeral, especially compared with serious experimentation in design, which Hungarians are undertaking as part of their newly gained freedom. For the Miskolc group the strongest design determinants are particular local conditions—terrain and climate, local materials and technologies—plus imaginative programmatic responses.

Bodonyi's Education Center in the village of Békés is a classic solution to the problem of fitting a large project into a small village where most of the buildings are one-story. The Education Center includes a school, library, restaurant, public meeting rooms, clubs, theater, cinema, sports hall, and cafe. "Once I understood the scale of the surrounding village," says Bodonyi, "the first thing I did was break up the functional spaces into two groups—those that are low and can act as infill between existing abandoned houses and those spaces that needed more height." For the latter he created courtyard buildings toward the block's interior, which also link the project's other buildings, sometimes via a bridge, sometimes via a courtyard arcade. At the center of the grouping is a tower that serves as a visual anchor and a sign from afar that something important is happening.

The stucco exterior uses local colors, the bricks and roof tiles were produced locally, and there are frequently repeated details from the local vernacular to provide a continuous streetscape.



As one experiences this undogmatic, contextually respectful yet individual project, it is easy to see why Bodonyi's favorite architect is Alvar Aalto.

The Roman Catholic church in the small village of Vaja, by János Golda and his wife, Ágnes Thoma, is a considerably smaller project that shows how much can be achieved by very simple means. When the existing chapel was in danger of collapse, Golda, who had attended the Piarist brothers' high school, was asked to help; and, with the Miskolc group concurring, he and his wife agreed to work pro bono. With little money and locally donated labor, the church, truly a labor of love, took seven years to complete.

The exterior design takes its clues from the local church vernacular: a single tower, high roof, whitewashed walls, small windows. It is a simple nave arrangement with classroom, priest's office, toilets, and storage occupying the side aisles. The church's main feature, a heavily glazed bell tower, is shifted 45 degrees off axis and also forms the first-floor entry vestibule. Light floods the tower to wash the simple, white stucco interior, providing drama as well as illumination.

The local stone and stained timber gate house to the National Park in the Bükk mountains is by another member of the Miskolc group, Benö Taba. It houses a caretaker's quarters, public toilets, a shop, and exhibition space for local flora, fauna, and folklore arranged in symmetrical volumes on each side of the gate. The gate house is also symbolic. Its exposed vertical timbers, silhouetted against the sky like so many drawn swords, greet the visitor and form a reception line.

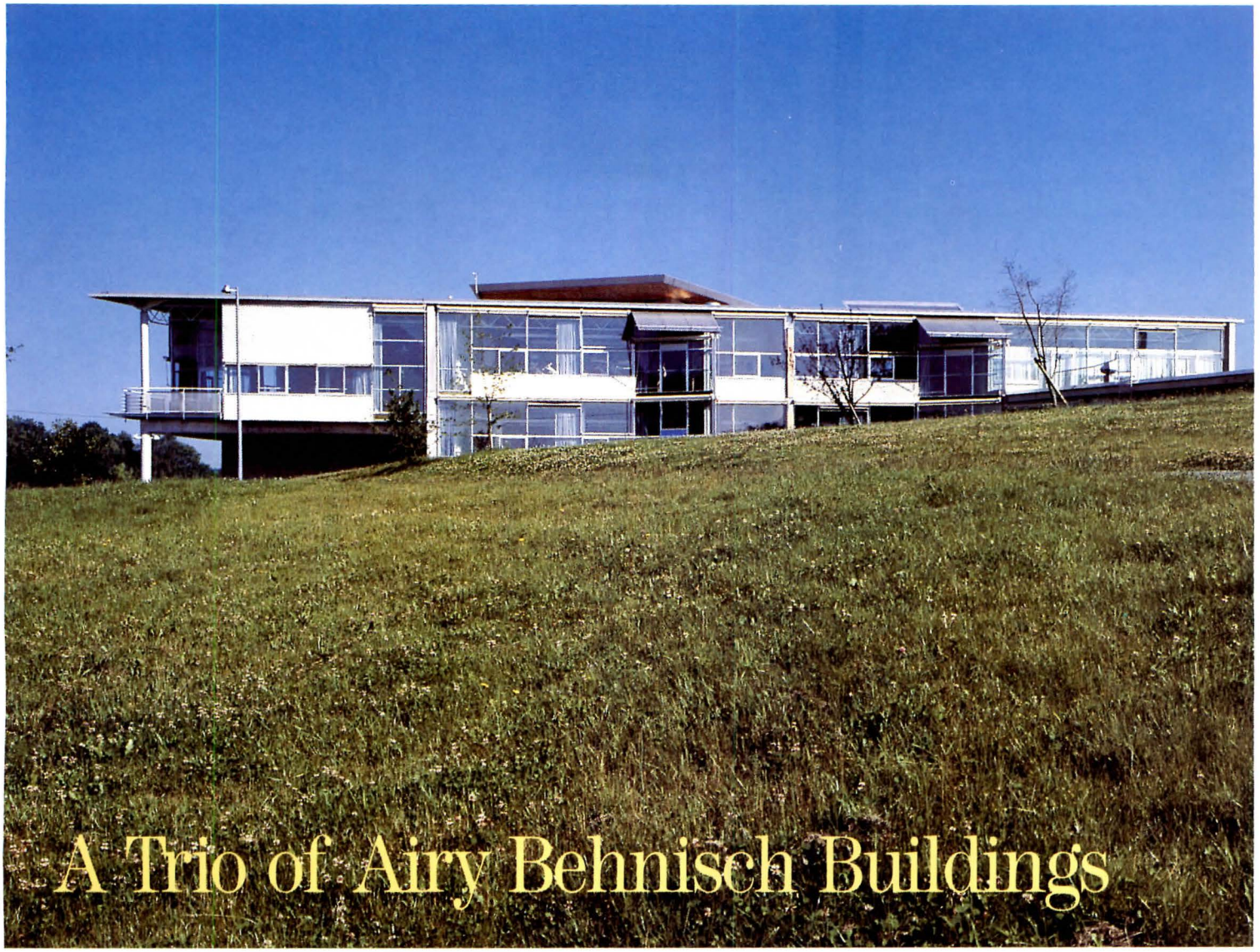
The town of Sátoraljaújhely is famous for the Tokaj wine that grows in the surrounding hills. At the town's entrance stands a richly detailed old residence. Architect Tomás Noll made a translation of it to the left of the original to create projecting wings that welcome the visitor. Between the two wings, a two-story, glazed atrium runs the entire length of the building, its length accentuated by forced perspective.

The Miskolc group is known not only for its respect toward local architecture but also for its belief that serving people is architecture's noblest goal. As Bodonyi says, "Architecture is foremost the building of human relations."—John Macsai

Mr. Macsai, a native of Hungary, has an architecture firm in Chicago.

Photographs by István Panyik

Facing page, Catholic church in the village of Vaja by János Golda and Ágnes Thoma, along with a local vernacular antecedent from which it took clues. Above and right, the entrance building to the Bükk National Park.



A Trio of Airy Behnisch Buildings

Gunther Behnisch is a foremost contributor to the modern German organic tradition in architecture, as originated by Hugo Häring in the 1920s. Perhaps best known for their park for the 1972 Munich Olympics, Behnisch and his colleagues, now of the 13-year-old firm of Behnisch & Partners, recently have designed several important educational buildings in south Germany, which reflect an abiding commitment to socially responsible design.

The Hauptschule at Lorch is a three-story, transparent block cut into the hillside above a picturesque small town. It is sited alongside an earlier, polygonal gymnasium and perches comfortably in its hillside setting. It is a glassy building with two wings of classrooms enclosing a double-height, skylighted hall to create a form that is roughly triangular in plan. The galleried hall serves as the entrance as well as the social focus of the school. It is overlooked by classrooms, while the music room, on the first floor at the apex of the triangle, opens onto a south-facing balcony lookout high over Lorch. The use of extensive glazing suggests an openness perhaps appropriate for an educational institution.

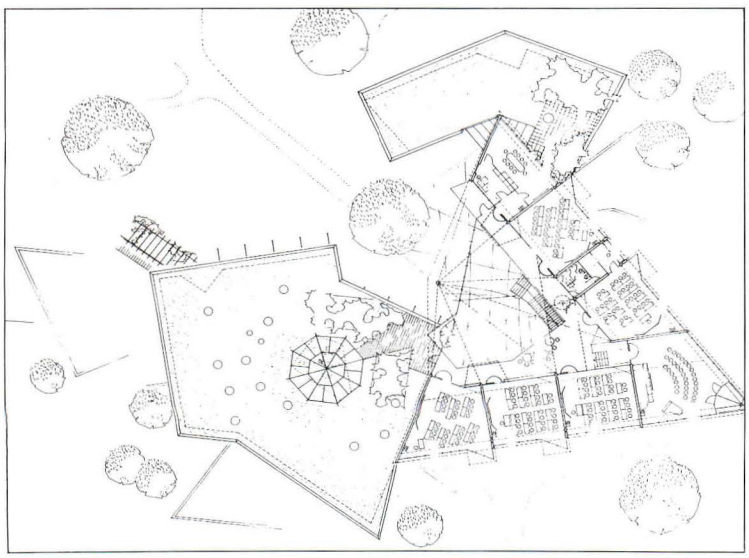
In their design for a new library at Eichstatt, Behnisch and his colleagues had the opportunity to develop further some of the ideas they used at Lorch. The competition-winning scheme, selected in 1980, was subsequently developed, and the completed building was opened late in 1987. The library was designed for Eichstatt's Catholic University and situated just outside the historic town center overlooking the river Altmuhl. In addition to reading rooms and stacks, it was to provide facilities for storage, faculty offices, classrooms, an exhibition area, and a lecture room.

While the large storage spaces have been buried back into the site and the offices and classrooms have been grassed over, the overall scheme, as with the Hauptschule, has been organized in radiating wings. Here three wings, each three stories high, are linked on the southern side by a large radial space. This houses the main reading room with a mezzanine. A series of glassy study carrels lines part of the serrated perimeter of the reading room and has fine views out to the river beyond.

The main circulation within the library has been planned in a generous stair hall wedged between the reading room and the

Above, the Hauptschule at Lorch, emerging from its hillside.

Photographs © Behnisch & Partner/Christian Kandzia

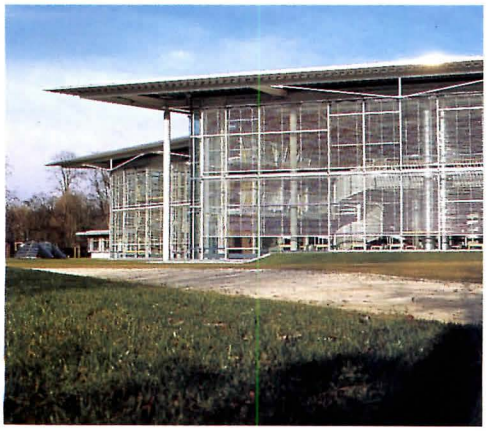


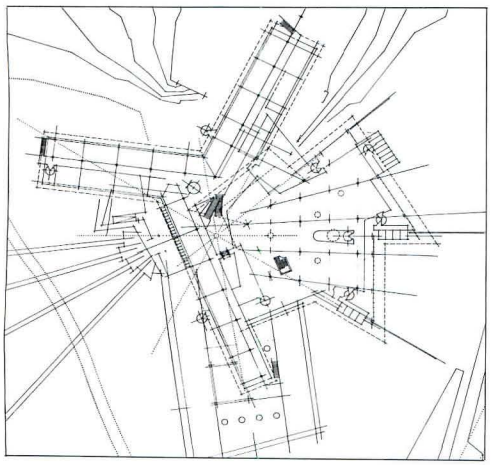
Top left, the school at Lorch is a glassy, three-story, double-winged block enclosing a skylighted hall (above left) that serves as entrance and social center. Above, the music room opens onto a balcony.

pinwheeling wings of classrooms. Externally, this stair hall is marked by a tilted northlight that brings daylight into the heart of the building. Almost all of the spaces in the library are daylighted, and the predominantly glazed facades are screened by automatically operated white, yellow, and black sun blinds.

Strikingly obvious, both at Lorch and Eichstatt, is the use of varied and impure planning geometries. Behnisch's enthusiasm for irregularly shaped spaces collaged together builds on the organic tradition of Häring and Scharoun. But while they prefer natural materials, Behnisch has an enthusiasm for modern man-made materials—the steel frame and deck, glass, and industrial cladding systems—and for their conspicuous expression in buildings.

Absent from his designs, however, are the rationalizing grids and orthogonal layouts that many other designers derive from





using such materials, components, and systems of construction. Instead, Behnisch overlays one system with another to create an agglomerative order in both the Hauptschule and the library.

The Hysolar Institute is Behnisch's most recently completed project. It was designed to house experiments in the large-scale production and utilization of solar hydrogen. Assembled with the apparent haste and ad hoc increments of a laboratory test rig, this shining metallic two-story heap sits on the suburban campus of the University of Stuttgart at Stuttgart Vaihingen.

Because the institute houses facilities for the university and an independent research arm, its laboratories are separated into two blocks linked by a central hall. To build quickly and within a tight budget, the laboratories were made of simple, rectangular, factory-made containers. They are clad in metal on a regular grid that incorporates windows. The result is a more opaque building than either the school or the library.

The central hall accommodates two staircases that are linked to first-floor galleries and bridges. On its southern face this hall is enclosed by a glazed screen to form a light, spacious entrance for the institute.

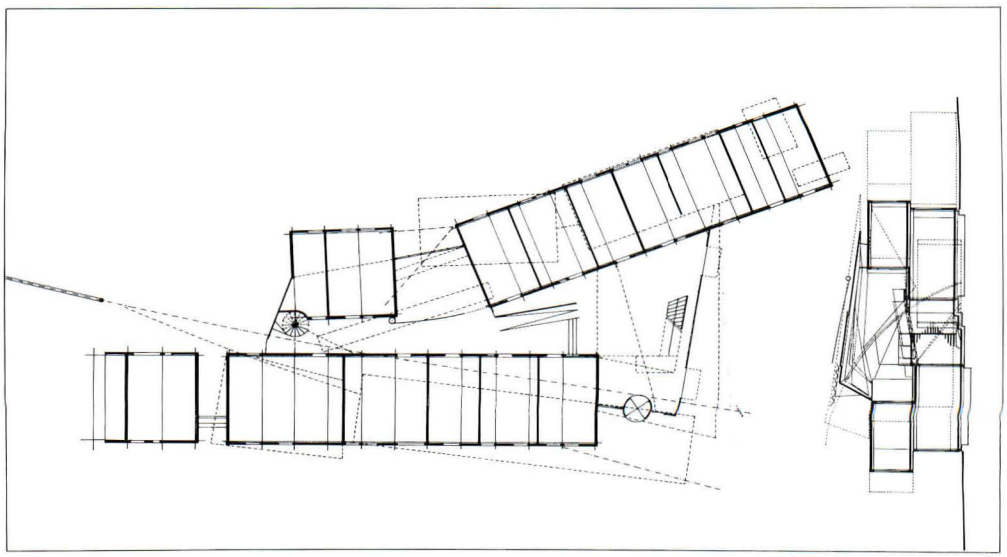
The two laboratory blocks are linked by a great sweeping roof that is supported off an arched, tubular steel spine. This bright red spine springs directly out of the ground at the northern end of the site, arches over the building, where it supports an apparently random framework of solid and glazed panels, to end up high over the main entrance in an emphatic sign and marker. This great skeletal winged roof shows the influence of Frank Stepper, formerly of Vienna's Co-Op Himmelblau, who cooperated in the design of the institute.

All three of Behnisch's recent projects are emphatically light, airy, and optimistic. They are carefully made and technically sophisticated, without being overwhelmed by technology. As Behnisch recently said, "Architecture should tend generally toward greater openness, not basing itself just on current realities, but also leaning a little toward the future—a future that is not technocratic in nature but geared toward the human world."

—Brian Carter

Mr. Carter is a critic and architect with ARUP Associates in London.

Facing page, Library for Eichstatt's Catholic University is, again, a play of irregular spaces, this time organized in three-story radiating wings that are linked by the main reading room with windowside study carrels. This page, Hysolar Institute, a 'shining two-story heap,' with two blocks of laboratories linked by a central hall.



Combining Marine Imagery and the 'Excitement of Movement'

Sydney Cove is the heart of Sydney. Hardly more than an indentation in the perimeter of the city's vast harbor, it is nevertheless the spot where the first settlement was established. Today it is walled off on the landward side by office buildings. On the east is Benelong Point, site of the Sydney Opera House. Where the rocks meet the cove is the Overseas Passenger Terminal. Formerly the gateway to Sydney, it is now used mainly by cruise ships. Until recently, the best thing that could be said about this huge 1950s shed was that it was bland and unassuming.

The decision to reconstruct the terminal was one of several undertaken for the Bicentennial of Australia. A linked series of pedestrian open spaces, walks, and parks was to be built all the way round the cove, from the tip of Benelong Point to Dawes Point in the shadow of the Harbour Bridge. The reconstructed terminal had to function as an incident in this pedestrian way, without obstructing the sense of contact with the water.

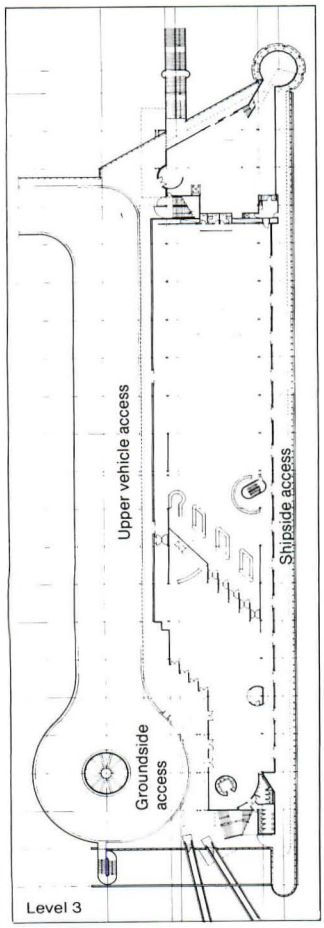
Lawrence Nield & Partners and the New South Wales government architect achieved what was necessary by a process for which surgery seems too mild a term. Nearly a third of the existing building was demolished. The rest was stripped not only of its skin but also of a substantial amount of its flesh. What remains is the original, finely detailed steel frame and the slabs. At a stroke, this created transparency, lightness, and greatly increased visual interest. Replanning was less drastic than might have been expected. The upper level remains, as before, the customs and passenger hall. Functions relating to cargo and customs, including duty-free stores, occupy the lower level. Change rooms and facilities for the workers have been concentrated in a mezzanine.

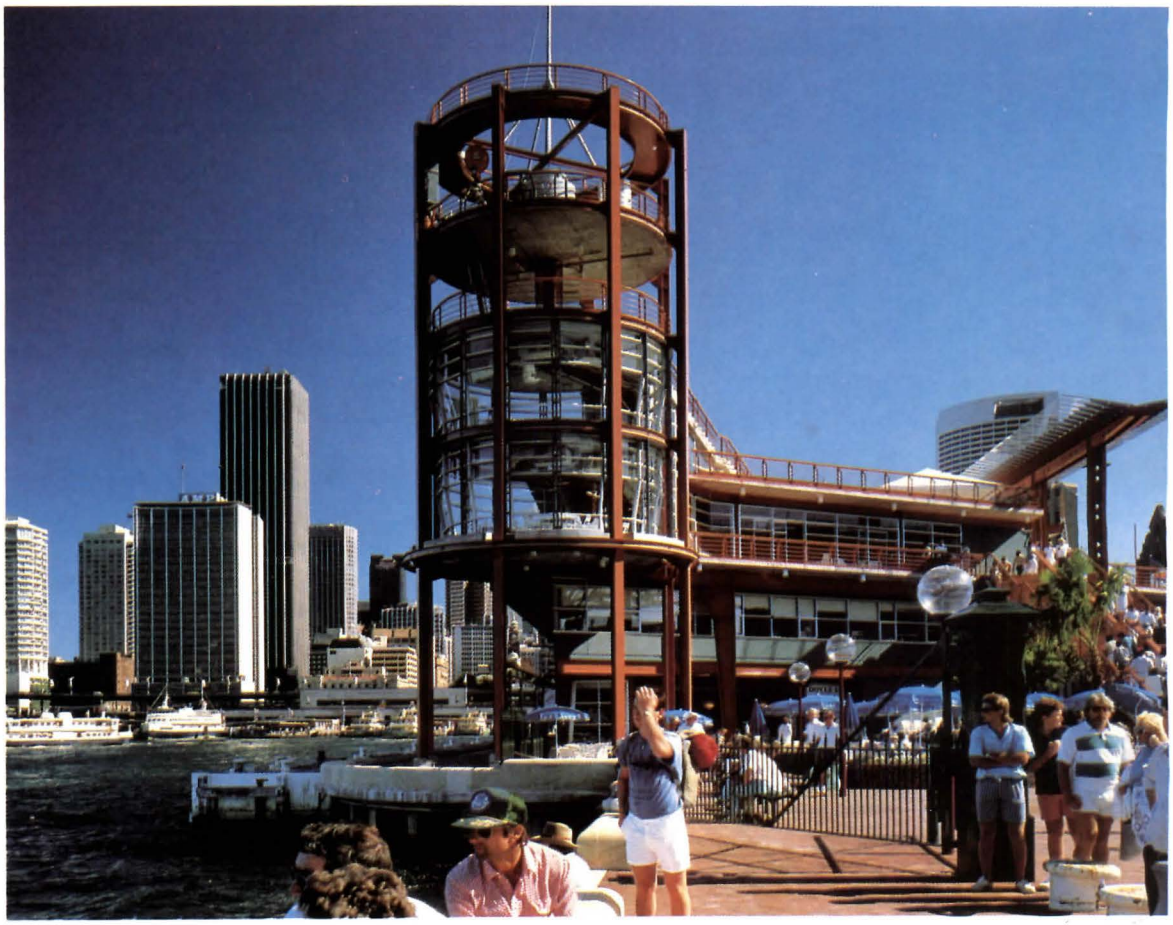
In addition, three restaurants were added. At the north end of the upper level is a luxury restaurant commanding a view of the Opera House that bears comparison with a view of Notre Dame from the Tour d'Argent. At each end of the lower level is a more informal restaurant. The additions contribute life and movement even when no ships are in, and the terminal is now a festive, lighthearted place.

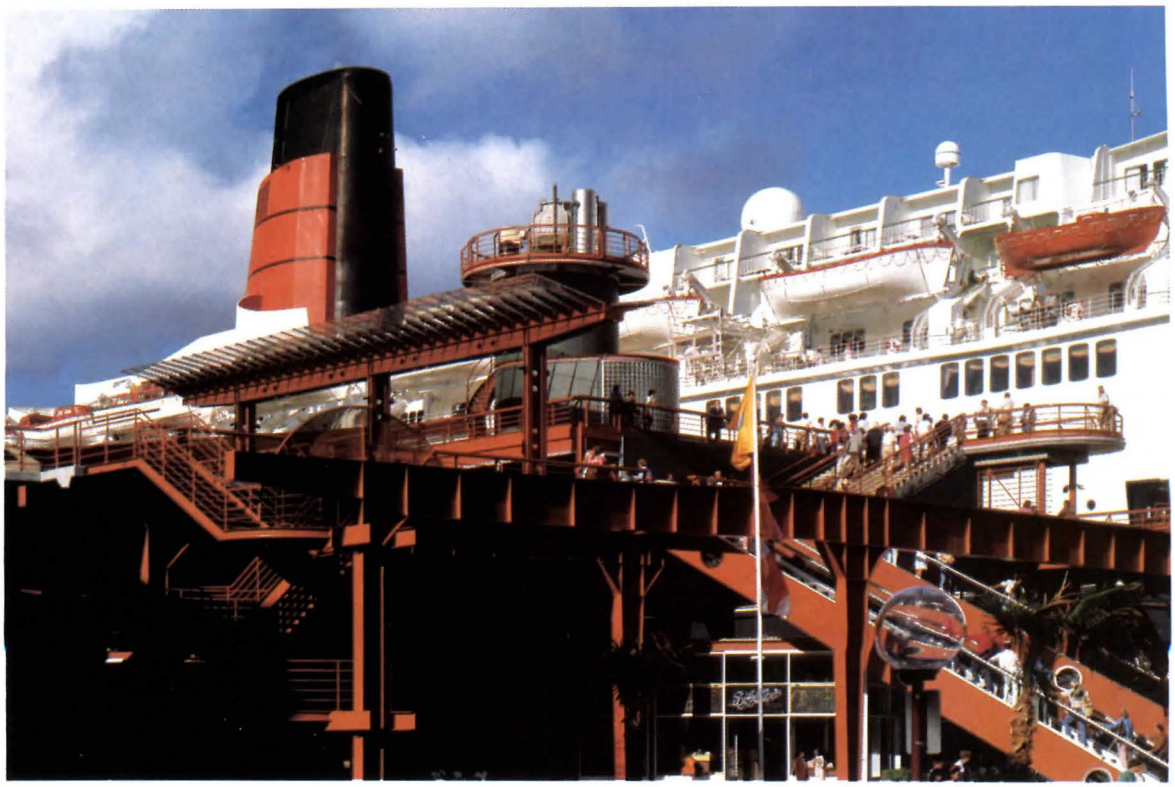
The imagery of ships and the sea and the excitement of movement are the themes. Much is made of stairs, ramps, escalators, and gangways. The horizontal sweep of railings recalls the decks of liners. A vent stack at one end becomes a funnel and is answered at the other end by an observation tower. A porte cochere takes the form of a seabird poised for flight. There is, too, a game of contrasts with the Opera House across the water: open against solid, colored against white, the forms of steam against those of sail, a more fanciful cetacean skeleton against crustacean shell. No wise architect would seek to challenge Jørn Utzon's masterpiece on its own waters; but here a course is delicately steered between deference and impertinence.—Tom Heath

Mr. Heath is editor of Architecture Australia.

Facing page, night view with Opera House to the east. Below, existing, bland, 1950s terminal was stripped of its skin and flesh, leaving a finely detailed skeleton conveying transparency, lightness. Bottom, once the gateway to Sydney, the terminal is now used mainly for cruise ships.







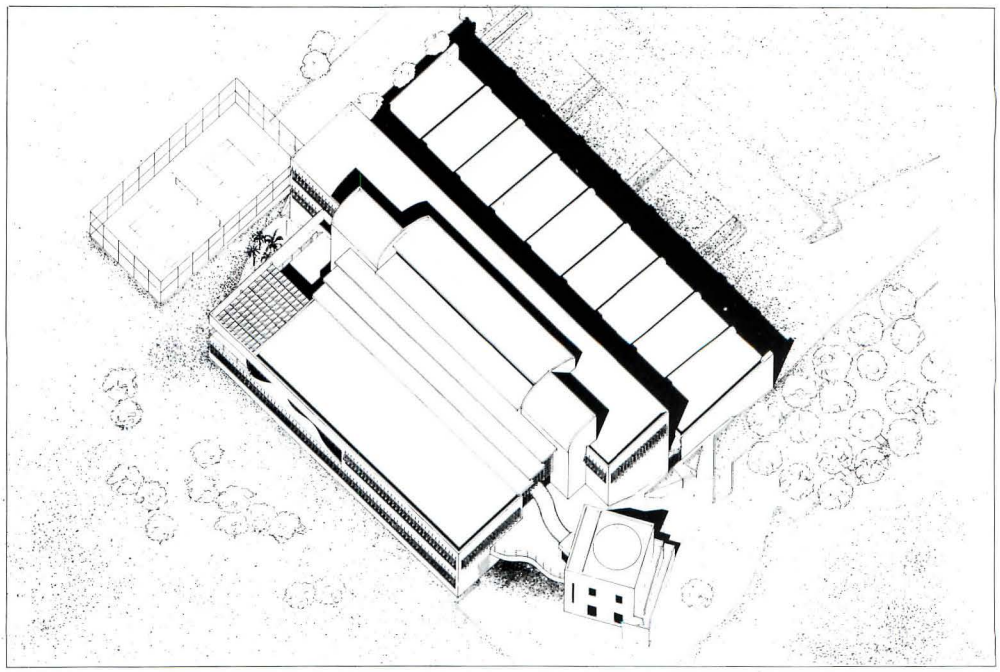
'Polished and Sophisticated Yet Approachable'

The new Apple Computer headquarters is poised on the rim of the booming Pacific Ocean, within earshot of the pounding surf, barely a stone's throw from Sydney's northern beaches. Apple Australia, which grew a stunning 38 percent annually over the past two years, insisted on a democratic, nonhierarchical environment for its employees and a style of architecture that was fresh, bright, and cheerful yet efficient and innovative.

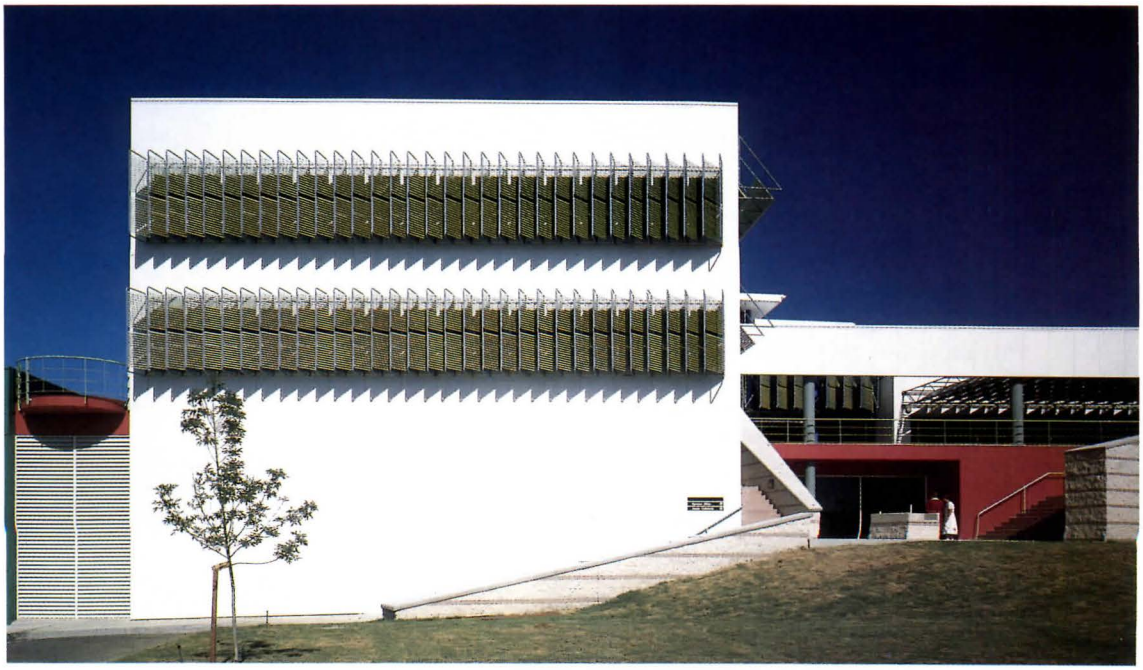
Sydney architects Allen Jack & Cottier struck a balance in representing Apple as polished and sophisticated yet relaxed and approachable. Their design is a blend of American and Australian eclectic approaches. It mixes U.S. postmodernism (Apple America oversaw the design) and British high-tech, but, unlike British tendencies, it employs high-tech not as mere symbol but for economic and functional reasons—for instance, to control sun penetration and shield outdoor areas from unpredictable southerly busters in summer.

Stranded beside a busy highway, the building has a deliberately low profile, but its ziggurat form and color catch the eye of passing motorists. The building looks

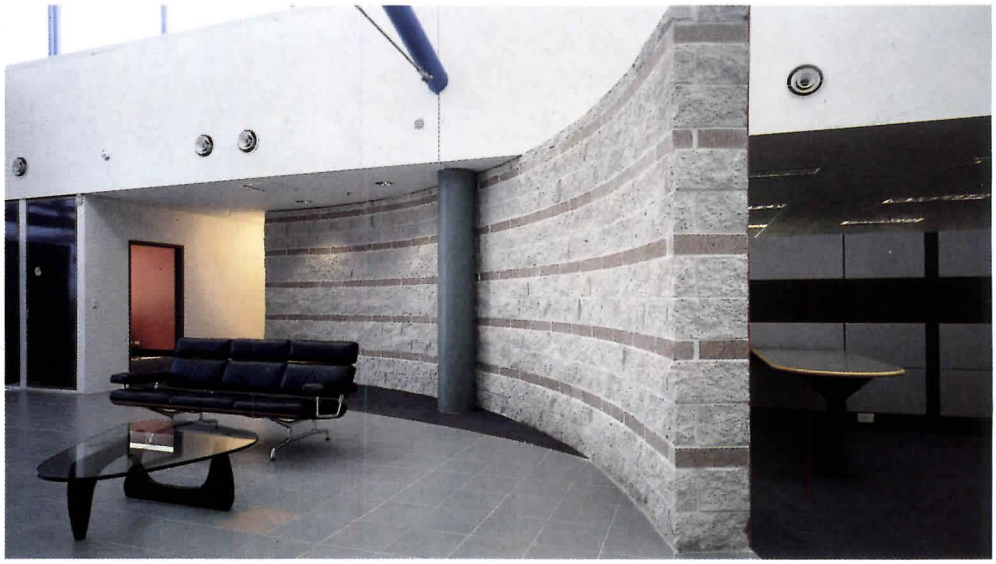
Photographs by John Gollings

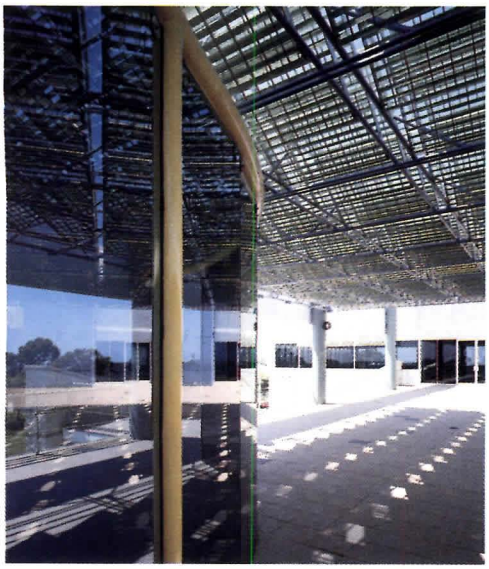


Facing page, left, marking the entry, a pylon with the familiar Apple logo. Above, to create a low profile, the roadside building steps down from four to two stories, while color and a ziggurat shape make it visually lively. The freestanding training center is meant to attract attention to the adjacent entry. At right is a view of the rear entrance.



Below left, entry forecourt. Below, reception area with curving stone wall recalling training center. Bottom left, entrance at east shaded by adjustable grid of louvers. Bottom right, cafeteria with curving window wall. Facing page, atrium, organized around broad 'street,' uses colorful airconditioning ducts as accents.





Photographs by John Gollings

smaller than it is. Operations are housed on four levels and include a high warehouse that has an extension to the south and slides under the main buildings to hide its true bulk. On the second level is the computer operations and repair center. On the third foor, technology and customer support are sensibly placed alongside the entrance and reception area, which are beneath a flamboyant, double-height, stepped hall supported on blue steel trusses with large apple-green ducts descending into stair cores. This area is overlooked by marketing on the fourth level.

The training area, a freestanding building next to the entrance, is used to attract attention to it. This, concrete-block ziggurat, capped by a blue cone, is at an angle to the main office building to permit access at all hours of the day without affecting the security of the main building.

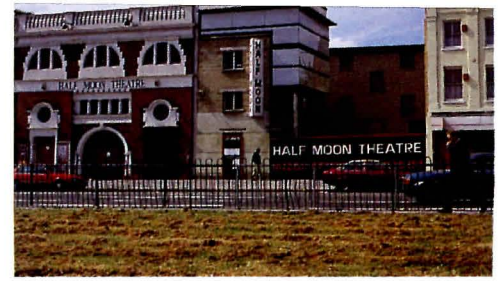
At the cafeteria, a floor-to-ceiling glazed screen snakes in and out of the structure along the southern facade with panache of a skateboard rider. In the reception area also and outside the theater are other curvilinear departures, momentary lapses when the building breaks away into some angled or sensuous fantasy from the overriding discipline of its practical, rectangular grid. Among other uses, this grid will accommodate future changes.

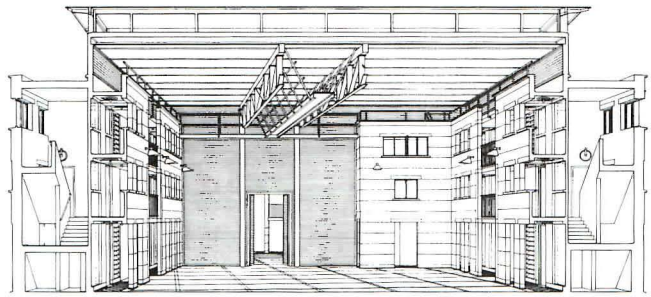
Much of the exterior character results from fixed-louver, aluminum sun breakers on the east, west, and north sides and horizontal blades over the staff terrace, which are set at 30 degrees to admit winter sunlight. These give the building a delicacy and patterns of light and shadow that soften the large, blocky forms.

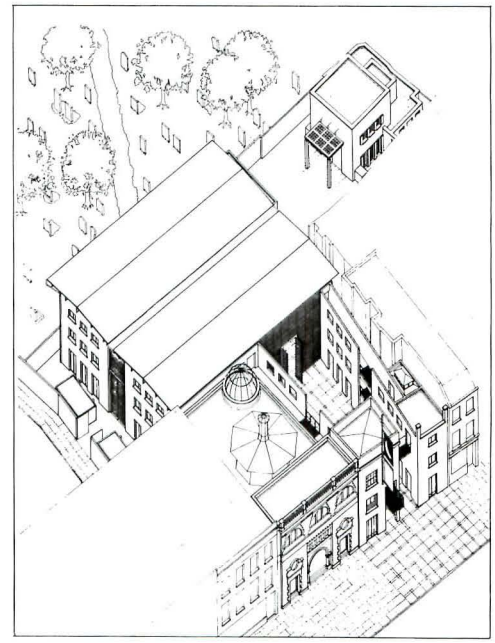
The building's friendly feeling is achieved in part through use of bright colors, especially in the common areas, such as the entry hall with its assertive steel-framed, stepped roof. The communal areas—the outside spaces, cafeteria, lobby, and circulation spaces—are especially important in a building where people tend to spend their day hunched over a computer terminal.

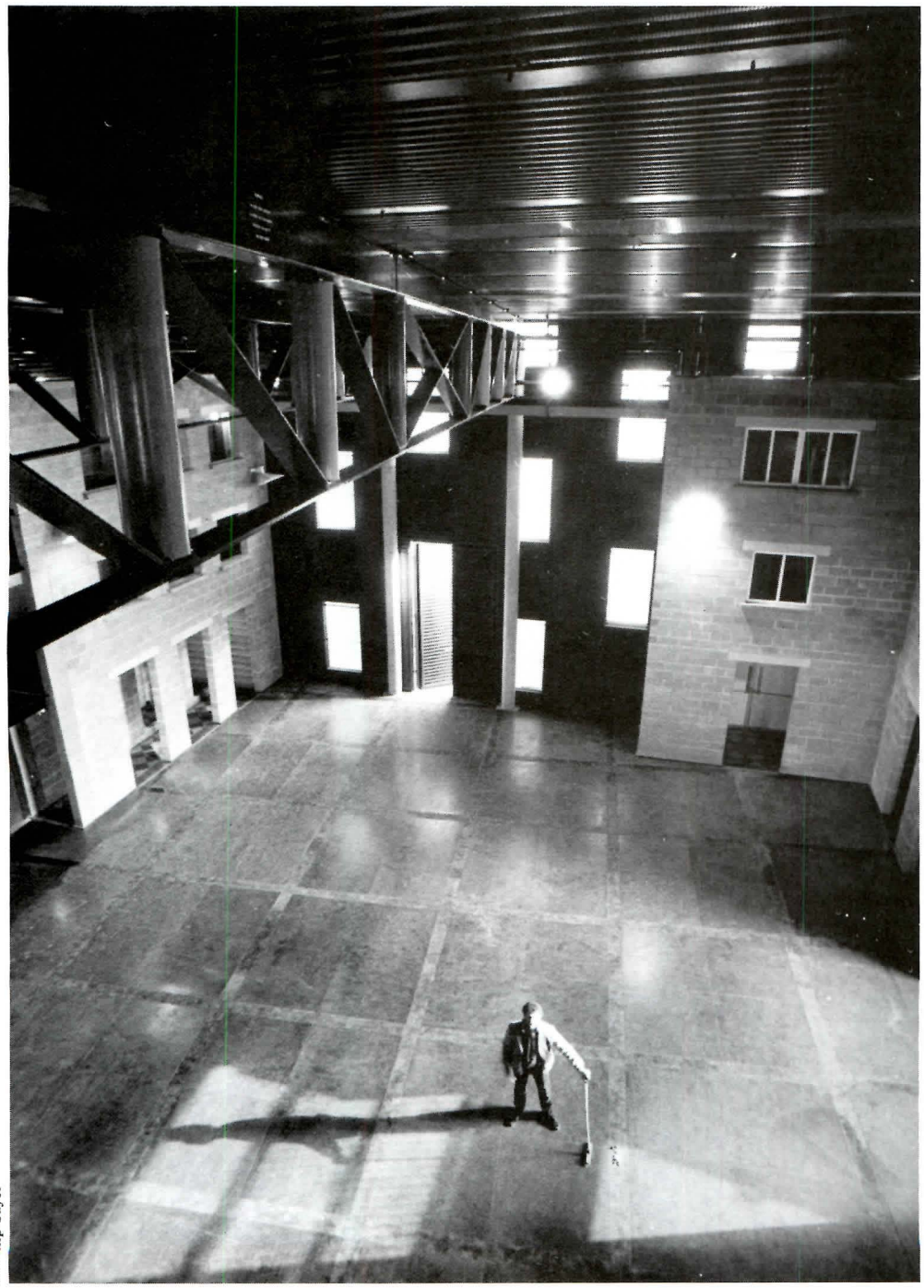
Apple's main fault is its overreliance on architectural cliché, intensified because the clichés are mixed. Yet it retains precision and care in its details, together with a relaxed urbanity that allows it to sit easily if not entirely comfortably beside the surf.—Philip Drew

Mr. Drew is an Australian architectural historian and author.









© Philip Sayer

An Attempt to Renew a Theater Company—And a Neighborhood

The Half Moon theater company began life in a disused synagogue before moving to Mile End Road in Stepney Green, where a redundant chapel could seat audiences of about 200 and an adjacent vacant lot offered space for future expansion. Like other parts of London's traditionally working-class East End, the neighborhood was intensively bombed during World War II. Public housing of the 1950s and '60s now dominates a hybrid townscape, traffic pounds relentlessly along Mile End Road, and such brick-fronted 19th-century row houses as survive are battered rather than quaint. The Half Moon company's choice of this location represented a conscious attempt to widen the horizons of the actors and the local population alike.

In 1979, ideas on how the chapel and the neighboring land might be developed to serve the Half Moon company's future needs were sought from 15 architectural practices, most of them long established. The scarcely known Architecture Bureau—a teaching office run by Florian Beigel from the North London Polytechnic school of architecture—was chosen no doubt because its members shared the social commitment of the actor-clients.

After researching ways the new build-

Facing page: above, the entrance gate-tower, with space for future entrance courtyard; below, interior of the main hall from a gallery window. Below, an event for the East End Festival at the theater, which shows one among many ways the stage and seating can be adapted for different dramatic forms.

© M. Goldwater

ings might be designed to entice local people into the theater, Architecture Bureau proposed a solution that included a "street," defined by facades, analogous to permanent stage sets, extending from the existing sidewalk to the heart of the site. The entrance was to be marked by gate towers, beyond which an open-air "piazza" would lead into a screened off and roofed over "square" as auditorium.

The intent was to make the new theater visually, psychologically, and physically accessible from the street, and also adaptable to numerous dramatic forms. Seating and staging possibilities, for instance, extended to the "windows" of the facades, which could be used by spectators or, alternatively, might be appropriated by actors as extra performance spaces. But Architecture Bureau did not want to insult audiences' intelligence by too literal an interpretation of such imagery. The notion borrowed from Palladio of an implied "open sky" over the auditorium, for instance, was to be achieved simply by making the entire ceiling dark blue, without painting in clouds or stars. And the solidity of the "facades" was to be evoked in fair-faced blockwork with plain openings for the "windows," in contrast to the implied impermanence of metallic "curtain" walls (the intentional pun is Beigel's).

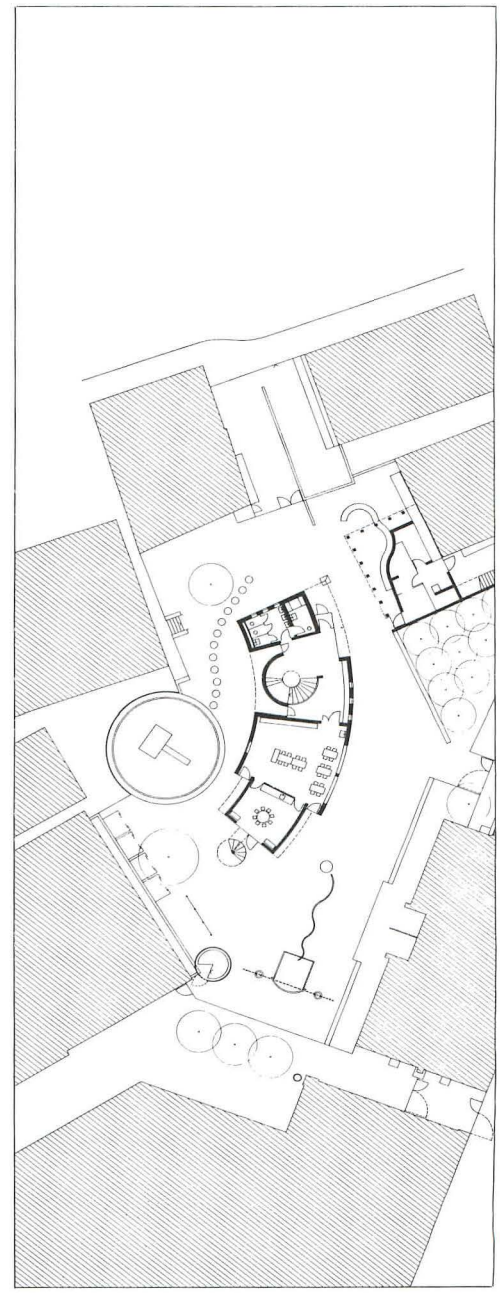
Other elements of the design included a separate children's theater and workshop, set in its own garden; administrative offices and other ancillary accommodation in the gate towers and behind the facades defining the "piazza"; and the conversion of the former chapel for use as combination theater foyer and community space, with bar and restaurant facilities spilling out into the "piazza" in fine weather.

The chapel conversion was postponed so that Half Moon could continue its programs until the new auditorium was complete. Another reason for phasing construction was a cutback in public-sector funds for the arts under Prime Minister Margaret Thatcher. The various elements of the new Half Moon theater therefore were divided into affordable packages, to be built as the money was raised.

The children's theater-workshop was completed in 1984, and the new auditorium was opened to the public a year later—revealing remarkably thoughtful and high-quality detailing, especially for a low-budget building. Since then, one of the gate-towers has been built in the form of a "lantern" clad in translucent, insulated glass. But its twin, the facades to the "piazza," and related accommodations have yet to materialize; likewise the full conversion of the former chapel and permanent dressing rooms and restrooms.

On the evidence of what has been achieved, Architecture Bureau's designs manifestly fulfill all the requirements of the brief compiled by Half Moon's first artistic director: "Our aim is to draw new audiences into the theater, to give it a new popular base. It should be a place where meetings can take place and newspapers [can be] bought and read, where to sit and have a beer or have a discussion is as legitimate as . . . to watch a play. . . . It should be a freeflowing space from the pavement [sidewalk] to the auditorium. . . . It should *not* be tatty fringe, art-house board, sturdy oak provincial, polished steel Swedish, wine-bar smoked pine, nor faded plush and gilt."

It would be a great pity if these aims now were scuppered by abandoning Architecture Bureau's carefully conceived master plan. The completion of the "piazza," gate house, and chapel conversion would endow Half Moon with the unique identity so vital to its success as a *theater* in London's East End.—Charlotte Ellis

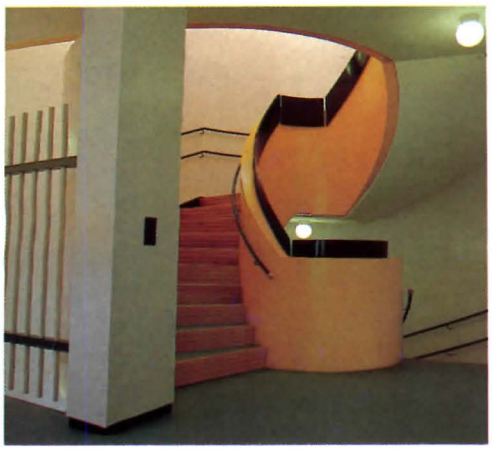


Multi-Use Complex Designed Within a Web a Regulations

This ensemble by Arno Lederer and Jorúnn Ragnarsdóttir is a model for sensitive infill in a densely built, historic city core. It comprises a kindergarten, an apartment house for the disabled, a two-unit annex to an existing apartment, and an underground garage for 27 cars. The complex met the city of Tübingen's strict zoning requirements for historic districts, which prescribed specific design elements down to the size and shape of window mullions. Although such regulations are generally restrictive, the architects managed to produce a contemporary building conceived for specific functions rather than simply re-creating a historic house and adapting it as a kindergarten. Their detailing also shows concern for traditional local forms without imitating them.

Ensemble of kindergarten, apartment expansion, and underground garage is integrated into dense, historic area.

In 1983 the city held a competition for one of the last available sites in the historic core. The neighborhood was characterized by half-timbered houses and a municipal utilities building dating from the turn of the century. Subsequent changes in the competition requirements



resulted in the curved form of the kindergarten. Its shorter side responds to the proportions of neighboring buildings to the south, while its longer side creates a dialogue with the larger buildings on the northern edge of the neighborhood.

The division of interior space was determined by the competition. The rooms for the kindergarten were to be in a "masonry house," topped by a "wooden house" containing an activities room and a small handicrafts area. The design elements are simple cubes, joined together as though by children playing with blocks. The stairs, located in a cylinder in the middle of the building, were to be more than just a vertical access route—they were to be fun.

The playful grouping of the functional blocks is accented with materials and colors. As a contrast to the strong colors dominating the exterior and stairs, the remaining interior walls are finished in pale tones. The facade's blue masonry section and white and yellow paneling are seen from neighboring streets with glimpses of surrounding buildings, which are subdued in color.—PAULHANS PETERS

Mr. Peters is editor of the Munich-based Bauwelt.

Left: top, kindergarten handicrafts area; middle, activities room; bottom, cylindrical, 'fun' yellow stair in the center of the building. Above, the kindergarten was curved to fit into its awkward site amid different-sized buildings. Its light, wood-covered upper floor was meant to be reminiscent of old Schwabian half-timbered houses.

An 'Imaginary Landscape' Serving as Monumental Entry to a Powerhouse

The proliferation of memorials and monuments erected in Czechoslovakia since World War II is unprecedented. In fact, the design of "monumental"—funerary, memorial, celebratory, etc.—architecture, sculpture, and painting is a part of the curriculum of the premier schools of fine arts in Prague, Brno, and Bratislava. The government sees monumental architecture as a good investment in elevating public consciousness and educating the young.

Most monumental architecture in Czechoslovakia is memorials to the dead, so it is refreshing to see a monument honoring living people. The "Imaginary Landscape" was designed to celebrate the construction of the hydroelectric power plant in Dalesice. Located some 40 kilometers west of the city of Brno, it harnessed the river Jihlava to supply energy for the Brno region in southern Moravia. The "Imaginary Landscape," situated under the wall of the dam, marks the entrance to the hydroelectric powerhouse.

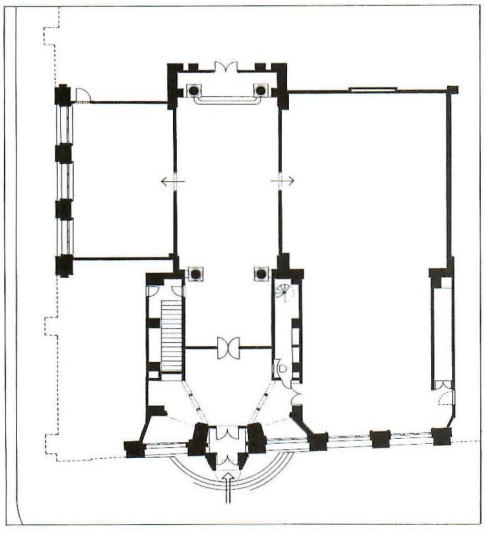
The construction company that built the dam initiated the project and commissioned a team composed of architect Ivan Ruller, his son, sculptor Tomas Ruller, and painter Karel Rechlik to create a memento to the builders of the power plant that would use leftover materials from the dam construction. The concept of built earthworks, mimicking the journey of the river from its source through its transformation into energy, was born in 1979. The monument was dedicated in the fall of 1988.

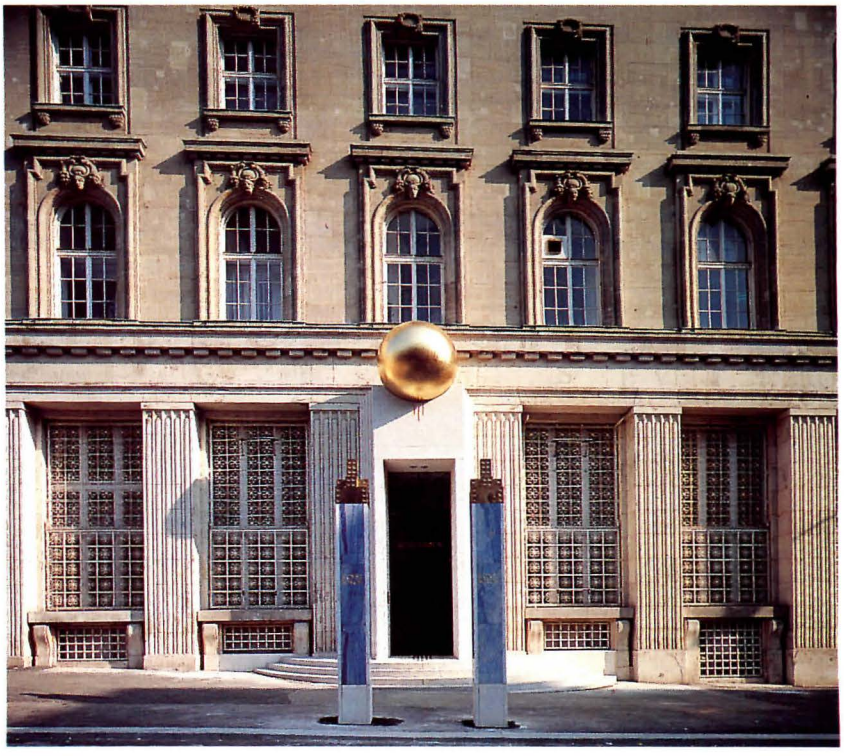
One hundred meters long, it consists of several conceptual parts. The first, on the wall above the road approaching the powerhouse, is an abstraction of a waterfall, symbolizing the river's origin. A concrete square, incised and broken by branches of the river, is the centerpiece of the composition and symbolizes the capturing of hydroelectric energy. On the square lie three fragments of pipe, six meters wide, which originally were used to bring water to the turbines. You can enter these to experience the enormous bowels of the dam. The symbolic waterways then lead through a circle with a spring of water to a rock garden. Finally, the symbolic journey of the river ends in the convergence and then in release of its energy via a spout over a retaining wall.

—Peter Lizon, AIA

Mr. Lizon, a native of Czechoslovakia, is a professor of architecture at the University of Tennessee, Knoxville.

Jewel of a Gallery Within an Elegant Viennese Building

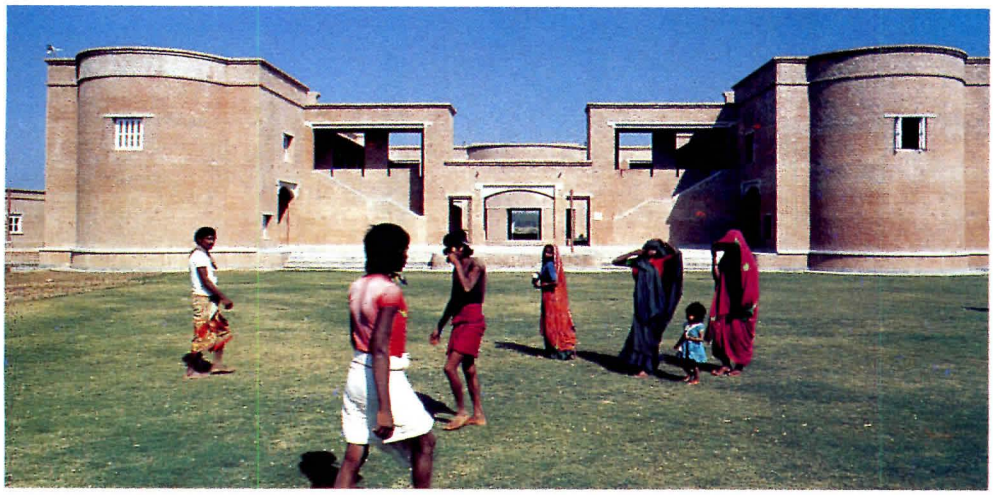




In building an art gallery in the ground floor of the Austrian Länderbank, architect Gustav Peichl created a small jewel that melds the new with the existing *Jugendstil* building, designed between 1916 and 1921 by Ernst von Hotthilf and Alexander Neumann. And, by adding a new entrance that plays on the fluting of existing pilasters and is topped by a gilt sphere and flanked by two pillars of blue Brazilian stone, the architect altered the Freyung square on which the building stands. It is one of Vienna's oldest and most beautiful squares. Peichl calls the sphere crowning the portal "the golden pearl on the Freyung." It is meant as homage to Secessionist architect Josef Maria Olbrich.

The interiors consist of three exhibition rooms, which are independently lighted. The entry foyer is a colorful, lively space using pink and gold. From there a corridor whose white marble flooring is broken by narrow strips of black inlay leads the visitor into the main exhibition spaces. Restrained and intended as background, they contrast with the playful entry foyer. The display spaces, with stone floors and painted walls, are white on white, with "stuccolustro" pillars the only form of ornament. "And here again," wrote Austrian critic Maria Rennhofer, "Peichl uses noble materials and proportions very elegantly." She lauds his "restraint and coolness."

—Andrea Oppenheimer Dean



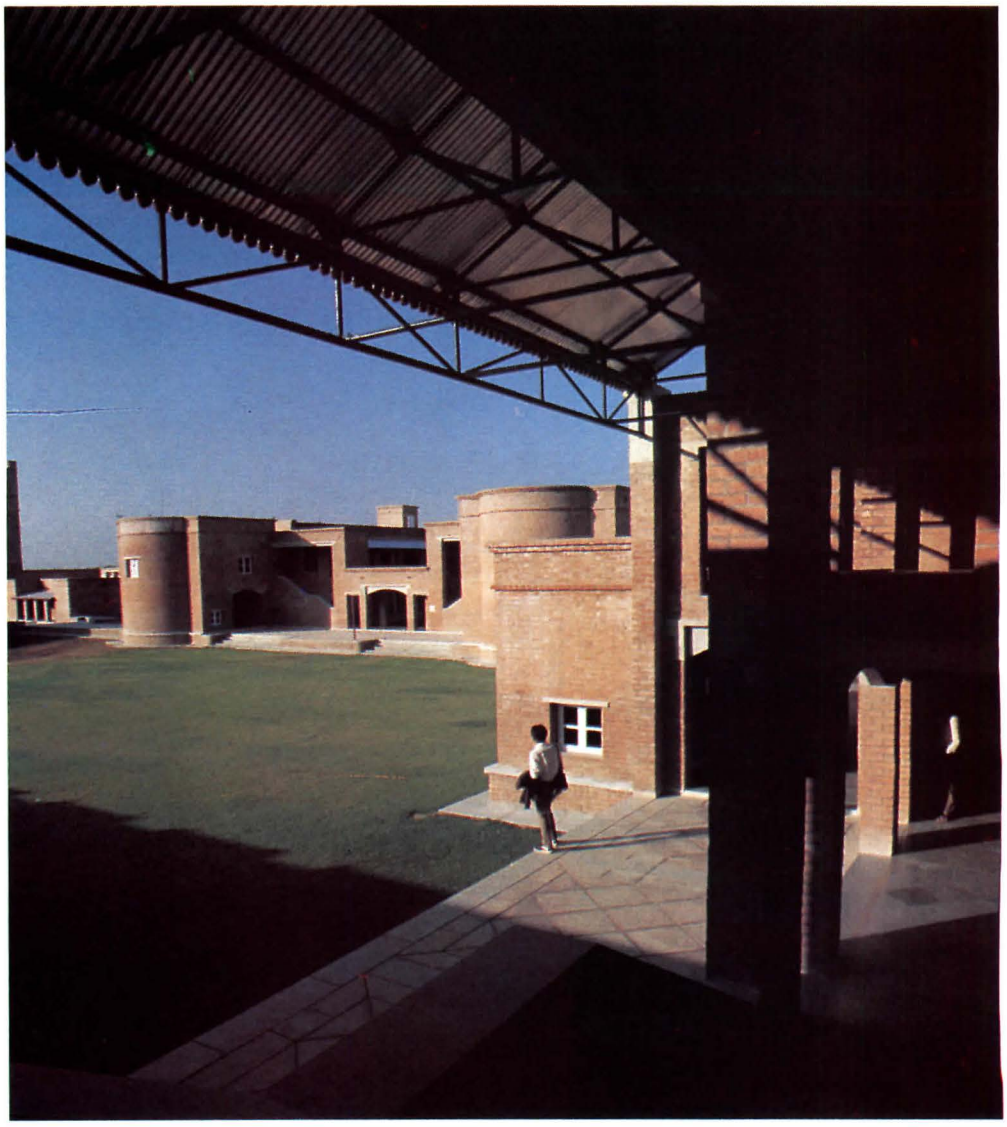
'Significant for Its Vernacular Sensitivity And Its Simplicity'

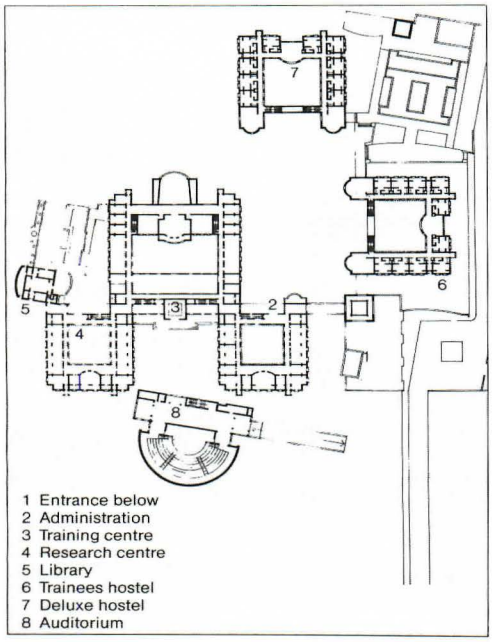
Bimal Patel's Entrepreneurship Development Institute at Ahmedabad is a campus significant for its vernacular sensitivity and its simplicity. The buildings use unadorned brick walls, flat concrete roofs, and corrugated galvanized steel roofs, materials associated with low-cost squatter settlements or simple vernacular houses. But the architect handled his materials with panache. Flush pointed, exposed brickwork has corbeled bands; corrugated, galvanized iron sheet roofs of varied heights have decorative wooden eave trimmings; simple doors and windows are painted white; interior floors are polished kotah stone; exterior open areas are a combination of kotah stone, plain cement flooring, and grass.

Starting with a featureless site, Patel created a sequence of spaces linked by courtyards and corridors. The complex consists of five veranda-type buildings—three for academic facilities, two for dormitories—whose rooms edge an open courtyard. In addition there are separate buildings housing the library, dining hall, and a still-unbuilt cafeteria. All the buildings are tied together by two axial spines that are at right angles to each other and converge on the entry pavilion, which is across an open forecourt from the car park.

In its symmetry and its use of brick, concrete, and bright green, pyramidal, corrugated iron roofing, the entry pavilion summarizes the design elements shaping the complex as a whole. From this entry

Facing page: top, the entry pavilion, upon which converge two axial spines connecting all the buildings; center, covered axial corridor leading from entry pavilion to academic complex; and bottom, the veranda-type buildings open onto arcaded courtyards. At right, roofs of covered passages are trimmed with decorative wooden fringes on eaves.





a covered, axial corridor leads to the academic complex, whose cellular spaces are divided into a large area and a small one—the larger for meeting or teaching space, the smaller for study or contemplation. The spaces also are articulated by careful modulation of natural light to exclude harsh sunlight and to make a graduated transition from exterior to interior.

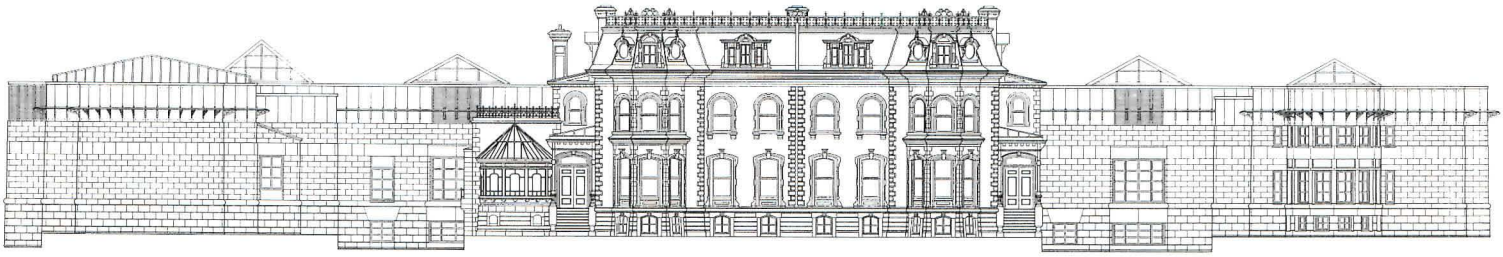
The connecting corridor itself is an exciting space, expanding both sideways and upward. There are at intervals wide staircases leading to an upper level where more academic facilities will be built. Endowing the corridor with visual interest and variety are natural light from above and below, alternating flat and arched lintels spanning openings to adjoining courtyards, and a combination of flat and steel-framed sloping roofs of varied heights.

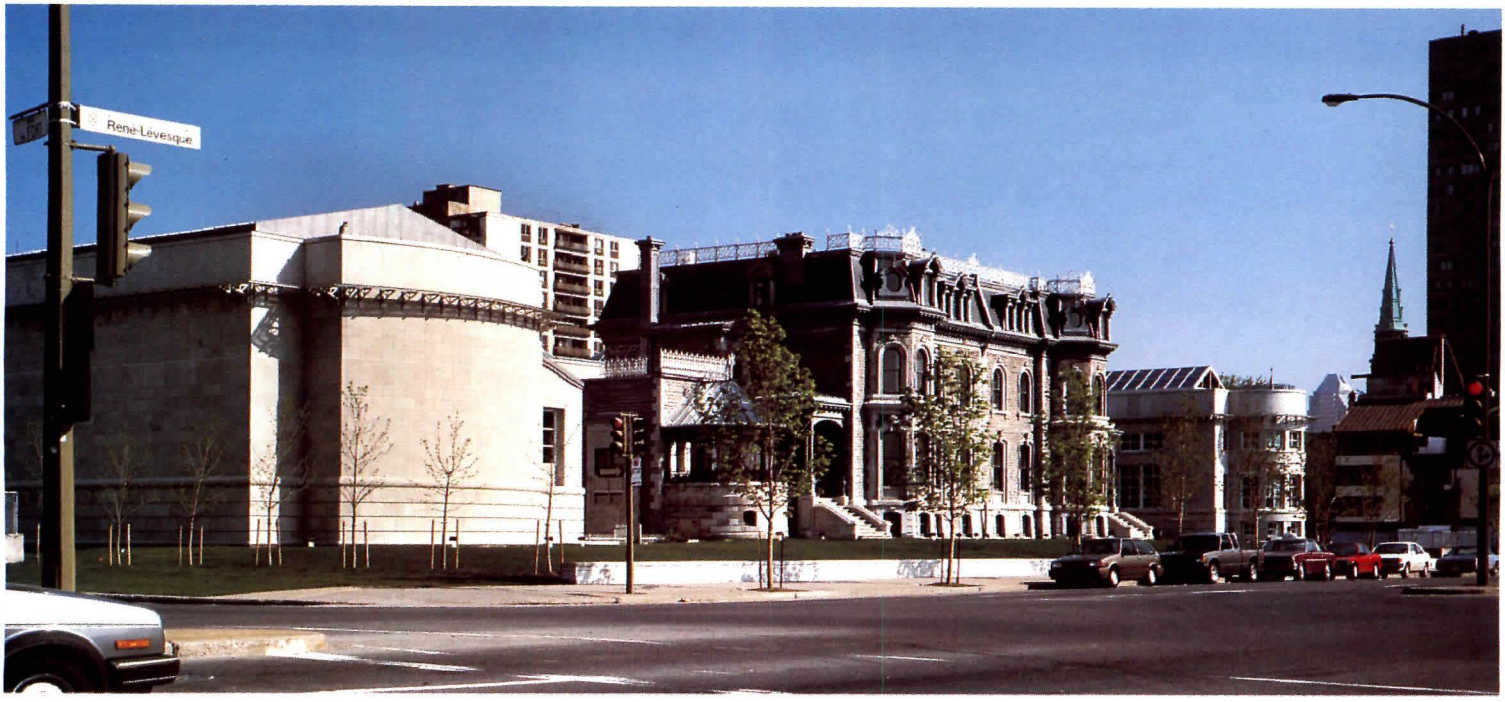
Although the complex is unfinished—the auditorium is not yet built and many of the administration, research, and training spaces remain to be added at second-floor level—it has a look of completion about it, mostly because the main corridor, with its staircases and double-story spaces, is finished.

From the entry pavilion, a partly covered corridor leads, at right angles to the central academic spine, to the dormitories and dining hall. The two-story dormitories are on axis with the pathway while the dining hall leans away, its asymmetry emphasized by the brick water tower at the end of the pathway. Curved corner elements define the entrance to the dormitory courtyard while a similar curved wall delineates a lounge projecting into the courtyard space. Lean-to roofs, sheltering the upper-level corridors on two sides of the court, are trimmed with decorative wooden fringes along the eaves—an element found in many local buildings in Ahmedabad.

The one flaw in the scheme is that the somewhat disjointed and random disposition of the various blocks excluded the library, dining hall, dormitories, and unbuilt auditorium from being aligned along the covered corridor. Access, therefore, necessitates crossing unsheltered, open space, often in inclement weather. The passage between the dining hall and dormitories also is uncovered. In the main, however, there is a strong sense of harmony and unity in this complex of buildings, a significant achievement considering this was the architect's first major building commission.—Ranjit Sabikhi

Mr. Sabikhi is a New Delhi architect and critic.





Photographs © Richard Bryant

Courageous Attempt To Synthesize Aspects Of Opposing Styles

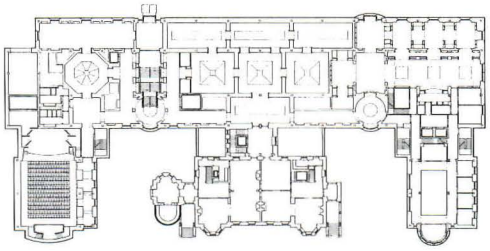
Seen from outside, Peter Rose and Phyllis Lambert's Canadian Centre for Architecture is either a terribly dry building or a very subtle one. Inside, it is quite the opposite. The interior is livelier and more expressively detailed, and occasionally even flirts with fussiness. The institution itself, an impressive repository of architectural books, photographs, drawings, and other design artifacts, seems directed toward a narrow scholarly constituency, much of it in residence (see July, page 19).

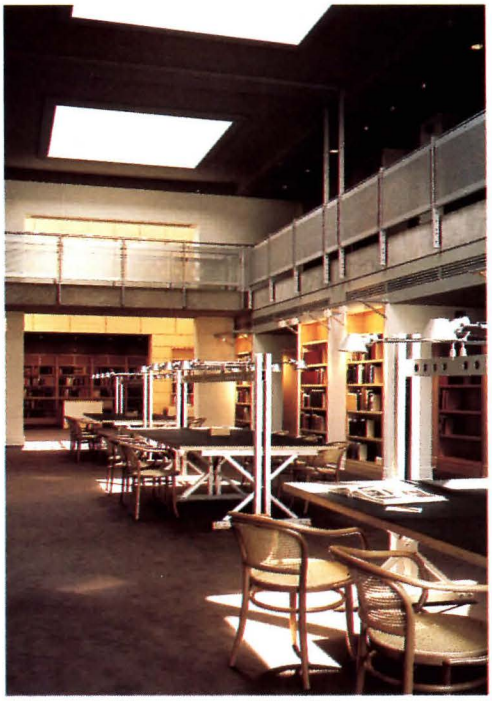
On the face of it, this seems an easy building to dismiss, yet it demands attention for two reasons. The CCA's quarters are a polemical statement and the tangible symbol of a major treasure house of architectural documentation. Its design incorporates and simultaneously runs counter to the spirit of the time in such a convoluted way that it may be impossible to deal with it clearly before gaining temporal distance. History may prove it to be a refined new design direction for the postmodern movement, an ambitious flop, or, most likely, something between those two extremes, but it does suggest a new avenue of architectural discourse. Unlike Moshe Safdie's National Gallery (see Sept. 1988, page 98), it is not meant to reach a broad public through either its use or its imagery. Unlike that building, its ambitions are intellectual rather than theatrical.

Indeed, this is an artifact that was studied within an inch of its life. Preceded by schemes from two other architects dating back to 1980, it was in design and under construction for six years. Those processes overlapped greatly since interior and exterior elements were tested as full-sized mock-ups within and upon the unfinished structure. That period also witnessed daily discussions and weekly meetings between the client and the architect.

Phyllis Lambert, the CCA's strong-minded patron and associate architect, was for long a strict Miesian but later distinguished herself in historic preservation. Design architect Peter Rose is a postmodernist strongly influenced by Charles Moore. The building takes many of its cues from a Victorian double mansion at the center of its site, and also from certain century-old Montreal building and planning traditions. Lambert bought the 1874 Shaughnessy house to avert its destruction well before conceiving the CCA, and its architectural quality is not outstanding for a local building of its class. As the centerpiece for the larger ensemble it leaves something to be desired, and the relationship between old and new buildings is not especially convincing.

Unmistakably postmodern on first impression, the new building also is guided by some strict modernist notions of "honesty" and consistency. These give it unusual rigor for a postmodern exercise, but they also produce inhibitions and a certain dourness that one would not expect in a his-





Left, the street elevation wraps around and takes cues from its centerpiece, a Victorian double mansion. Above, the aluminum entry gate, which is urbanistically, at the building's rear. Right, the skylighted main library. Far right, materials in loft entry court and stair—Montreal graystone, maple paneling, black granite, aluminum—repeat throughout the building.

torically derived building of the '80s. It seems constrained by an almost scholastic definition of its permissible nature, and this rigidity shows up externally.

Rose and Lambert gave great thought to the physical and philosophical nature of a stone wall appropriate to the late 20th century. It is not exactly a veneer, since it supports its own weight and is not hung from the building structure. Yet it also is not exactly a structural element, since it supports nothing but itself. The central half of the main facade (which in urbanistic terms is at the rear of the site) is blank to express the unfenestrated reality of the galleries behind it. A traditional masonry building would recognize a higher obligation to the eye and the heart by devising some sort of relief such as blind windows or a blind arcade. There is a flimsy and tentative openwork aluminum cornice that seems fashioned of drafter's triangles. While decorative in the postmodern manner, it also seems constrained by an obligation to be simple and off-the-shelf in the modern tradition. Its low placement and insubstantiality prevent it from terminating the facade effectively. There are other awkward exterior passages.

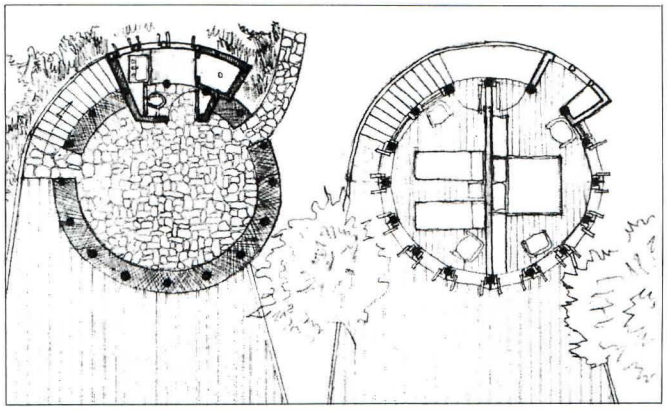
Inside, matters improve considerably. Rose presents the best part of the building almost immediately in the form of a lofty entry court that bristles with detail. Reminiscent of Otto Wagner's Vienna post office, it has lower walls of Trenton limestone, stairs of black granite, upper walls of maple panels, and balustrades of aluminum. These materials, all Canadian products, repeat throughout the building. "This building is about native species," quips Rose, "including Phyllis and myself."

It is also about jointing, especially inside, where the careful and nicely scaled patterning often recalls Louis Kahn at his best. The other public spaces are not as successful; the galleries are rather dull, as perhaps they should be, and the scholars' wing, although using a similar vocabulary and materials palette as the entry courts, is cramped and busy in comparison. Most of the interior is not for the public. The basement curatorial offices are architecturally self-effacing but nevertheless pleasant, and the underground archives and conservation spaces are as white and antiseptic as a 1950s hospital.

Melvin Charney's not yet finished sculpture garden, facing the Shaughnessy house across a wide street, seems certain to be the CCA's greatest design achievement. Composed of linear groves of trees, allegorical architectural fragments, and a ghostly replica of the mansion's lower floors, it has the discipline of the parent building but also a poetry and fullness of spirit and imagination that have eluded the Rose-Lambert building.

Successful or not, this is a courageous building that attempts to synthesize the quite likely irreconcilable aspects of the modern and postmodern canons. If more of it had been as rich and lively as the stair hall and garden, one could embrace it wholeheartedly. If more of it had been as awkward as most of the exterior, one could dismiss it entirely. But, because it is as it is, we must await the verdict of time. —JOHN PASTIER

Above, tumbling down the hillside, this visitors' settlement of wooden huts with oversized palm roofs (below) and circular stone terraces is modeled on village architecture of the local Kogui Indians.



Making Architecture 'Transparent' in a Tropical Forest

Contemporary Colombian architecture has many faces. Some buildings adhere to the rules of international modernism; others follow postmodern trends. And there are explorations of languages and techniques based on native and historical sources. The resulting heterogeneity mirrors the cultural diversity of this Latin American country.

This visitors' settlement was built by the National Institute for Natural Resources (a member of the World Commission on the Environment) in Tayrona, one of Colombia's 26 national parks. The settlement was intended to fit into the environment without damaging it, to serve as an educational tool and as a product of cultural identity. The park, located on the Caribbean coast, is a huge enclosure for important natural and archaeological sites. The idea of bringing visitors in was risky but was justified because it would further the educational programs of the Institute.

Fernando Samper, the young architect appointed to the project, had carefully studied the architecture of the Kogui Indians, descendants of the Tayrona culture that dominated the area from the 11th to the 15th centuries and one of the main pre-Hispanic cultures in this part of the continent. Samper chose as his model a Kogui settlement that retains some of the original Tayrona features: circular stone terraces and circular huts with huge palm roofs. Samper took advantage of the steep, rocky hillside site to create a random-looking pattern of huts of varying sizes.

The wooden huts are on circular stone terraces that serve as "living rooms." Above them are sleeping spaces. The wooden windows can be opened completely or partially to give a view of the sea or mountains while protecting interiors from the sun and providing ventilation. The roofing is built according to traditional Kogui patterns. Bathrooms are designed to avoid contamination of the land. The largest hut serves as a restaurant and meeting place.

The type of design was named "transparent architecture" to represent the idea of an ecological architecture in a natural tropical forest.

The Caldas Institute is a private, secular

Completed first stage consists of lower portion of reversed L-shape, including administration and library building (below) and secondary school—two parallel wings separated by pedestrian street (bottom left).

elementary and secondary school in Bucaramanga, a city where religious communities traditionally have been in charge of education. With a population of half a million people, Bucaramanga is Colombia's sixth-largest city and growing.

When the institute decided to build a new campus on the outskirts of Bucaramanga, it commissioned Rafael Maldonado, an architect trained in England. To accommodate the local topography, hot dry weather, and strong sunlight, the architect created a scheme of rectangular blocks with their longer sides facing north-south. They are linked by terraces, bridges, and canopies.

The completed first stage, comprising the lower corner of a reversed L-shaped plan, includes the secondary school, administrative offices, library, and athletic facilities. The school is formed by two parallel blocks. A pedestrian street between them links the octagonal athletic facility with the main entrance in front of the administration/ library building. The volumes are built with thick brick walls and tiled roofing, features common in urban Colombian architecture.

The use of green outlines for rooflines, floor slabs, and openings gives the buildings their particular identity. The breaking of the roofline, which also contributes to the buildings' character, provides ventilation to the upper classrooms.

The result of Maldonado's work is a functional, logical scheme that has a nice, youthful air.—ALBERTO SALDARRIAGA ROA

Mr. Saldarriaga is a critic and architect with his own firm in Bogotá, Colombia.

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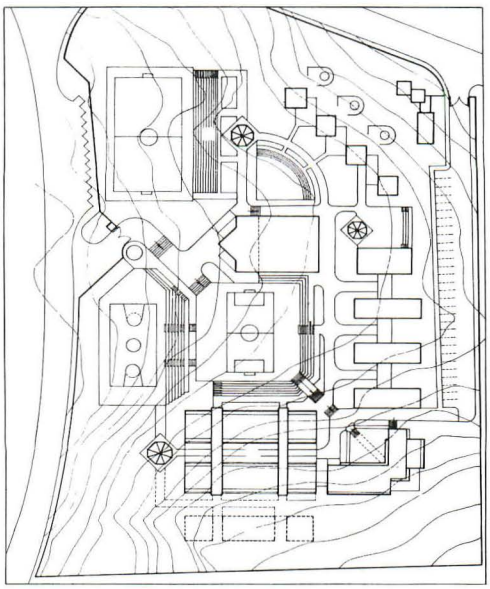

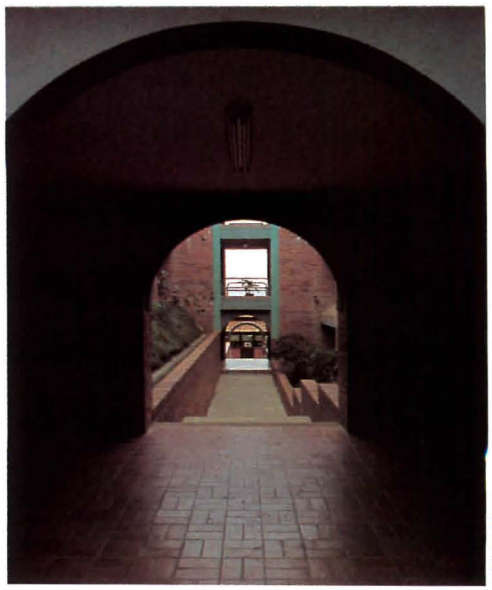

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Fresh Interpretation Of Modernism in A Wooded Setting

Swedish architecture has to a great extent entered a vacuum, in which the ties to the modernism of Asplund, Lewerenz, Celsing, and others have been broken concurrently with a standoffish attitude toward movements in other countries. Öijard Club House is an exception in which architect Gert Wingardh, whose first large work this is, has drawn on the modernist heritage with freshness and imagination.

The club house stands in sylvan surroundings about 50 kilometers east of Göteborg, off a minor road that meanders through an ancient broadleaf forest run wild, a piece of western Swedish "wilderness."

Here you find a latter-day grotto gouged out of a crinkly rock with its roof stretched and elongated like skin, reminiscent of Eero Saarinen's supple concrete shell for his famous TWA building. The exterior, making use of soil and grass, stone, Falun-red-painted wood, and reddish-brown limestone, conveys originality. Brittle and poised, the glazed sections separate inside from out, like thin gossamer at the doorway of one of those outdoor larders, burrowed into the soil, that you see nearly everywhere in the Swedish countryside. Through a rent in the gossamer you enter the cave and are amazed by its spaciousness, openness, and warmth, the embracing ambience of the limestone-faced, Wrightian walls and floors.

The interior is one big common room, ascending by stages that form irregular landings for seating. On the way up you pass an open fireplace and a cafeteria and finally come to a restaurant and a number of small conference rooms. During this ascent the rough-hewn limestone gradually gives way to a more finely worked and polished surface, ending at the top in a soft carpet matching the stone in color.

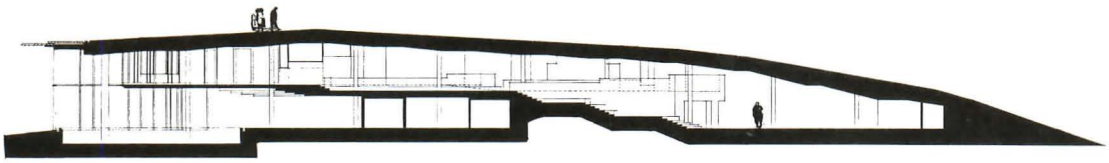
Up there, you look down into a terra-cotta-colored swimming pool. A gymnasium, changing rooms, showers, and a sauna are tucked beneath the lovely stone floor.

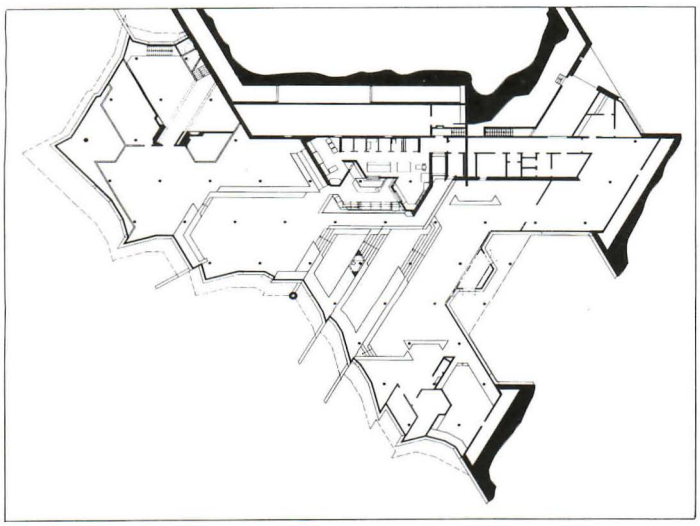
Detailing and finishes become ever more refined as you move further into the cave. The changing room lockers are beautifully crafted in oak and teak, the saunas are resplendent with woodwork, and an ingeniously designed swimming pool is lined with blue and terra-cotta tiles. The mood evoked is one of pagan worldliness.

Gert Wingardh's modernist roots are clear, especially in conversation. But it is a modernism dissociated from Swedish functionalism or other Swedish models. It emphasizes, instead, a sense of discovery, of understanding for the client and the locale. It clearly affirms the possibilities of modern society, of the "new age."

—Cles Dreijer

Mr. Dreijer is an architect with ABAKO Arkitekt AB, Goteberg, and winner of the Salin architecture prize, Sweden's Pritzker.





On the facing page and top of this page, the Wrightian club house, set in an ancient forest, is gouged out of rock, covered with soil, and finished in red-painted wood and reddish limestone. Above, the interior is one large, ascending room, with stepped landings for seating. Left, the pool room.

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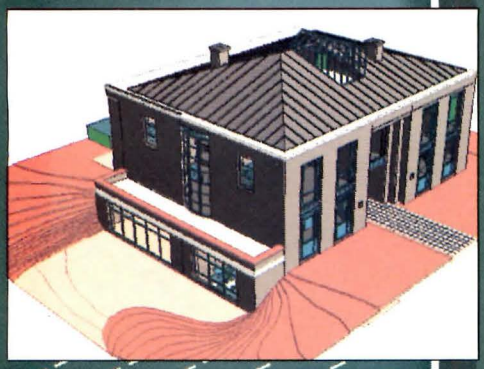

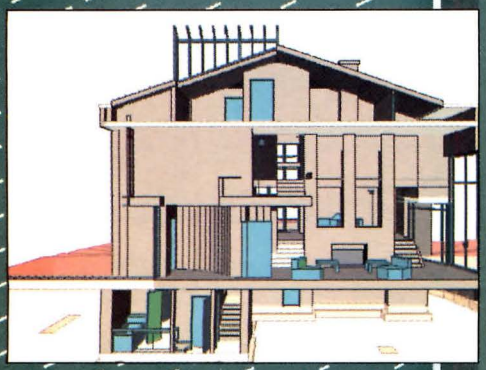

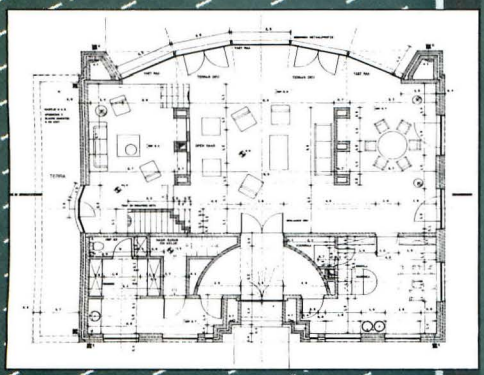

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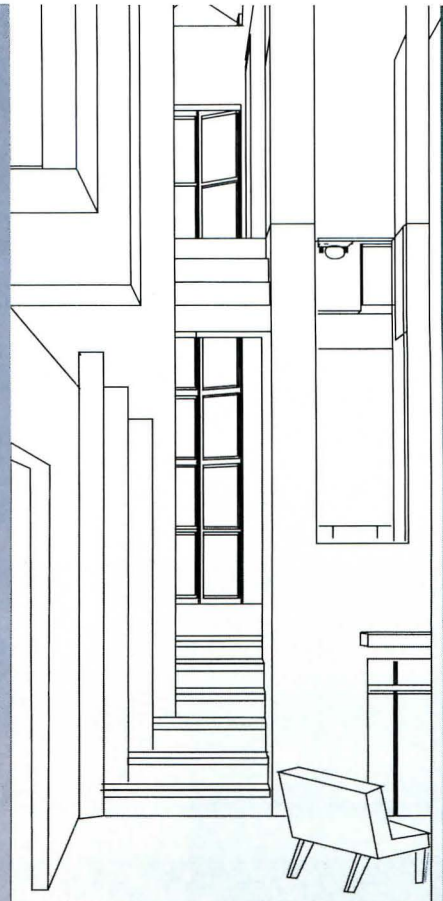

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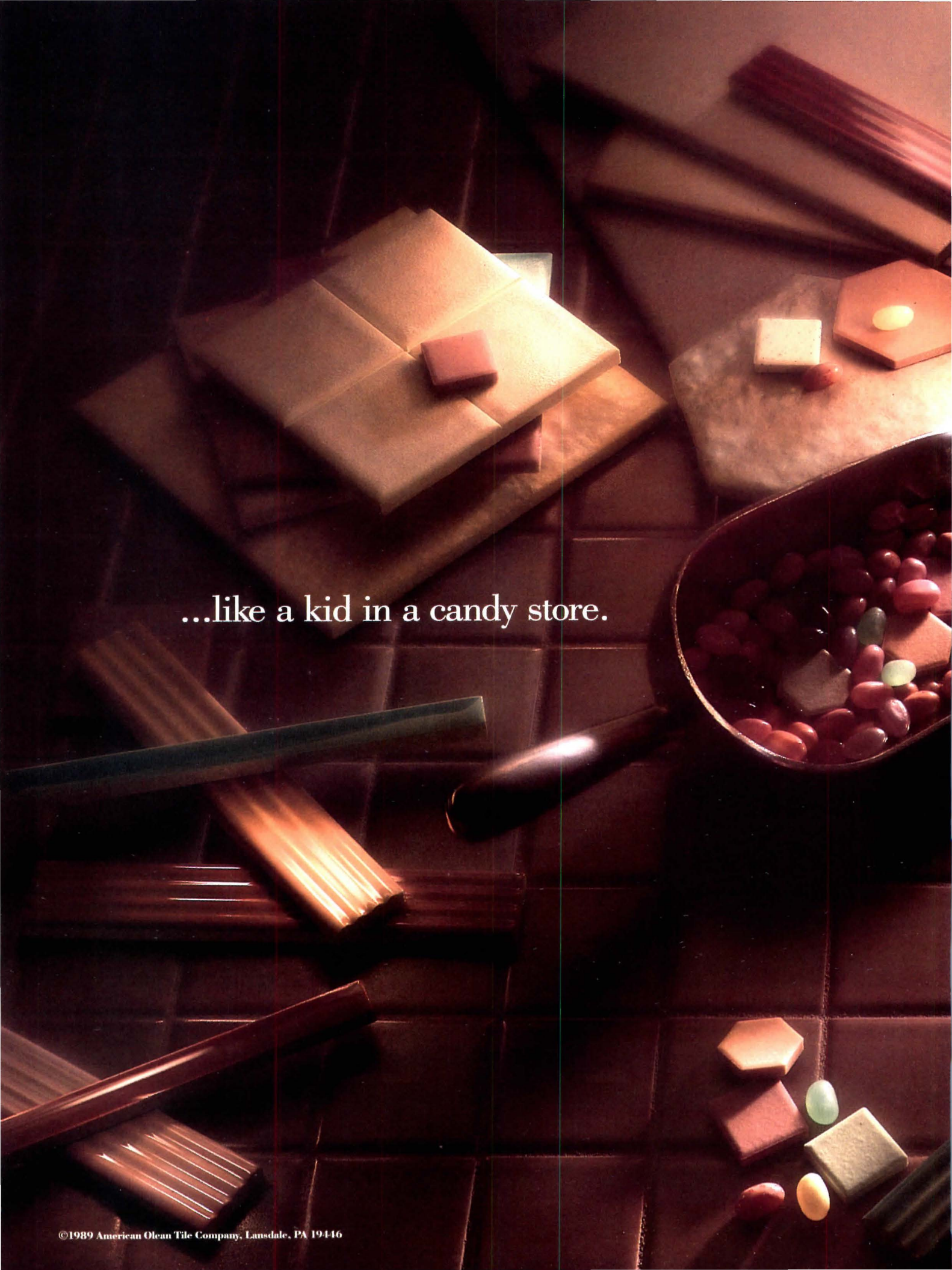

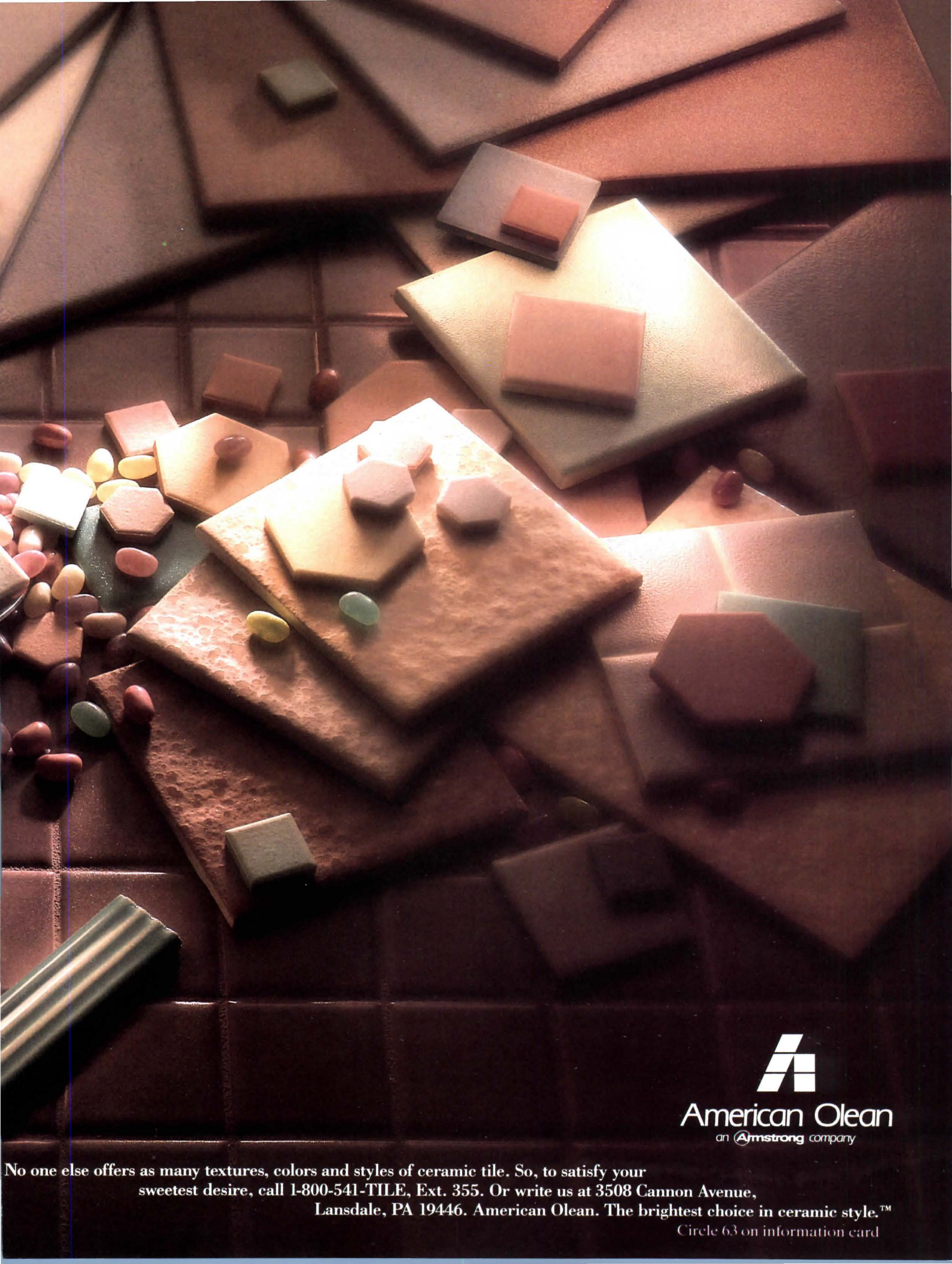

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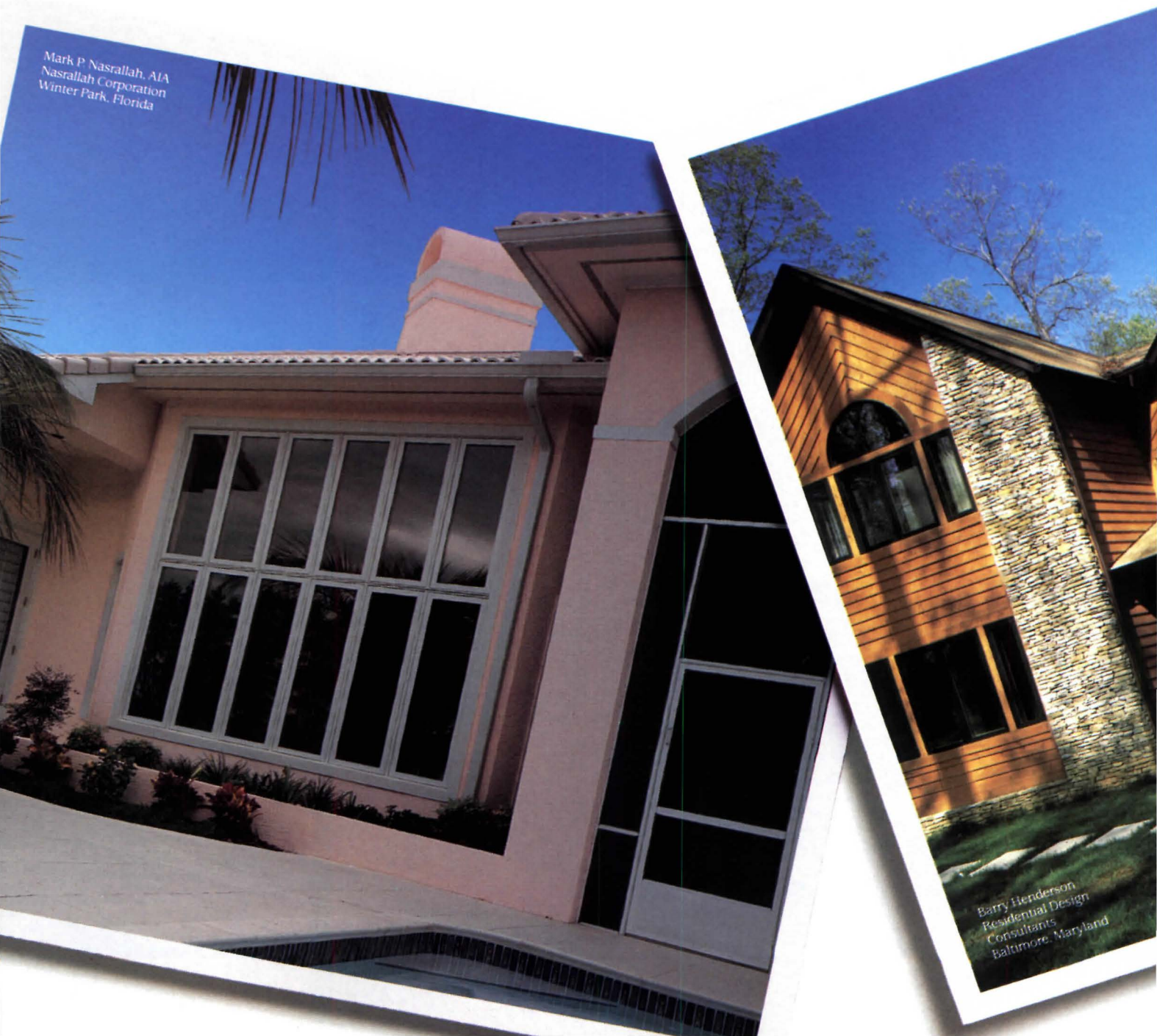

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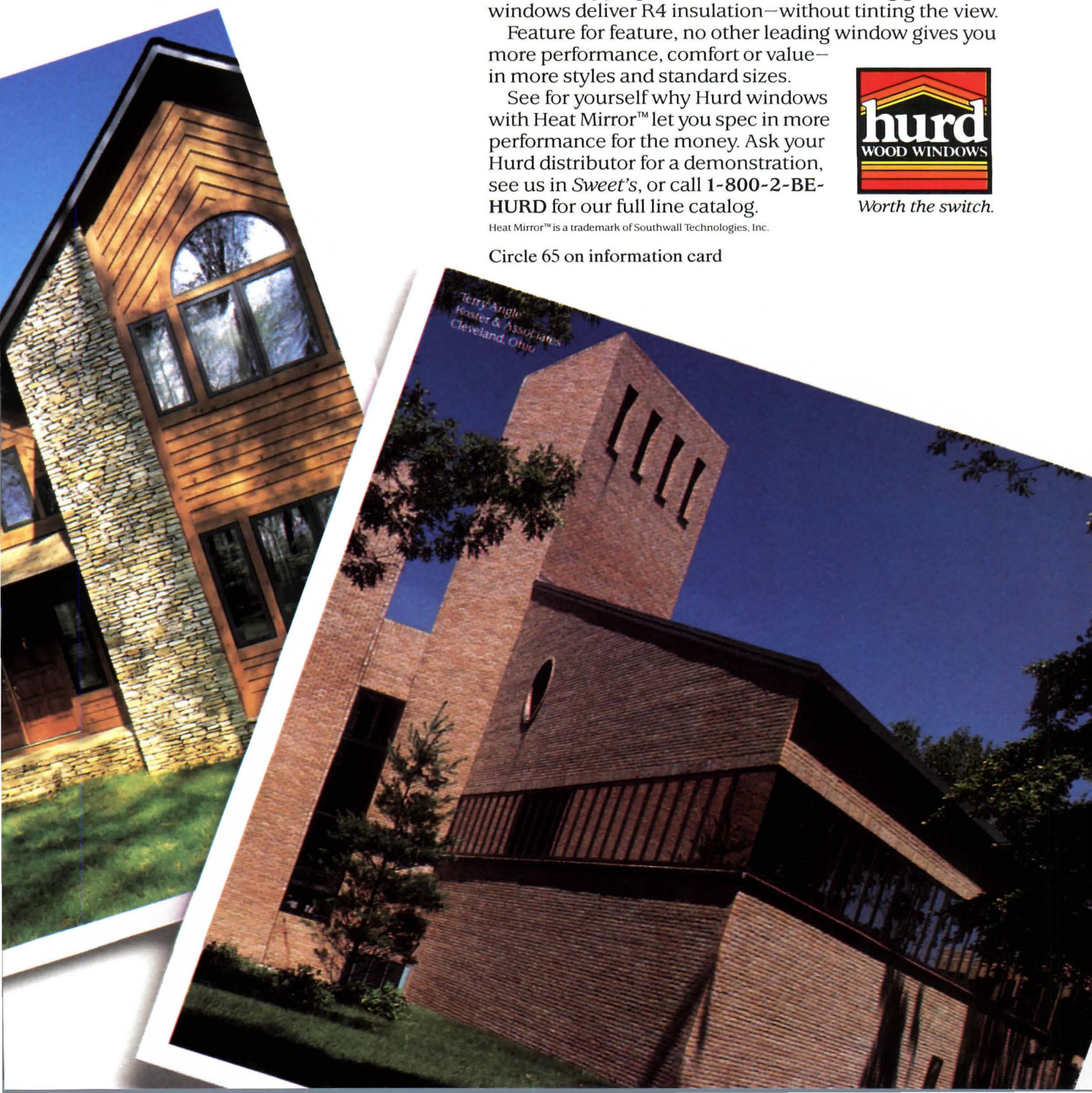

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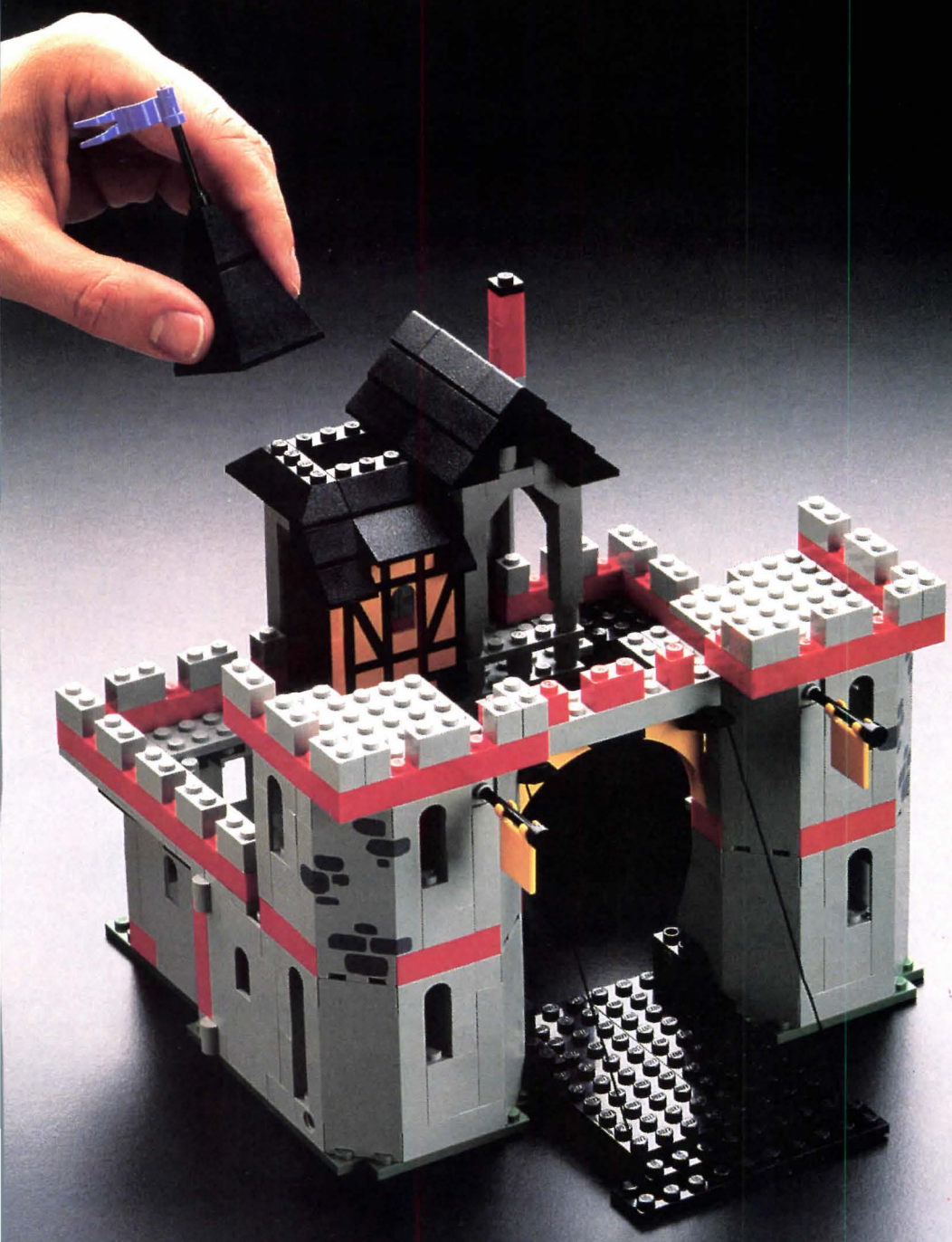

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The Sydney Opera House: A Survivor

By Forrest Wilson

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An opera house was built because a London symphony conductor of Belgian descent needed a concert hall in Australia. Australians excel in outdoor sports and are largely indifferent to opera. But the conductor interested a politician who became obsessed with the idea. The building was started before anyone knew how much it would cost, when it would be completed, or even whether it could be built.

The architect resigned halfway through the project. Three local architects took over the job and completely reversed the building's functions. The opera house was completed after 16 years of planning and 14 years of construction. The politician died during the first stage of construction and the conductor during the second. The job was design/build—designed by committee and 1,800 percent over budget.

The Sydney Opera House celebrated its 15th anniversary last year. It is universally acclaimed as a historic monument and one of the world's great buildings, comparable to the Parthenon, Chartres Cathedral, and the Taj Mahal.

Dramatic tales of triumph over adversity such as this are the stuff of "penny dreadfuls" rather than architectural history. Why, after a series of disasters—any one of which would have scuttled a speculative office building, a corporate headquarters, or a municipal recreation center—did the Sydney Opera House survive to become a world famous monument?

To understand the evolution of the Opera House, it is useful to examine architectural criticism written at the time of its completion. Robin Boyd, an Australian critic, made notes on the eve of the completion of the Opera House. They were published, posthumously, in the August 1973 issue of *Architecture Plus,* by then-editor Peter Blake.

The Opera House, wrote Boyd, is the only building in Australia known in other parts of the world. He said its external design alone would have made it famous, but the building also became notorious for the reasons listed above.

But by the time of its opening, Boyd reported, argument and angst were forgotten. "The man in the Sydney street likes it . . . Sydney enjoys its being there and is totally unconcerned about what happens inside, it might as well be as empty as the Taj Mahal," and, Boyd adds, "perhaps [it would be] even better if it were."

Boyd noted that the myth of architectural competitions is that the public believes they are held to find the best possible design for the problem at hand. Architects know the reason is political and has nothing to do with design. There are other valid reasons, but good design is not one of them. Boyd also noted that Australia was a young and terribly isolated country and was trying to drag herself into the world with international competitions large enough to interest it. There was the plan for Canberra in 1911, the Sydney Opera House in 1956, and the Parliament building in 1972.

The success of any competition rests on the individuals selected for the jury, Boyd contended. Saarinen, one of the jury mem-

Above, the Opera House in its magnificent harbor setting.

bers, consistently advocated the Utzon design. Saarinen at the time was building the Milwaukee War Memorial and designing the TWA terminal at Kennedy International Airport and the Ingalls Hockey Rink at Yale. Utzon's design was precisely in line with this phase of Saarinen's work. Although the Opera House was more subtle formally, it was no more rationally related to the plan than Saarinen's monuments, said Boyd.

Jørn Utzon submitted two designs: the shells and the plan. "The plan was pure architecture even more beautiful than the 'sails,' " wrote Boyd. "It was a simple, single-minded resolution of the conflicts and complications of the program. Serious architecture does change radically every 15 or 20 years and Utzon steered his vision from one age to the next [1950s to 1970s]."

Boyd described the vaults as "umbrellas over a delightfully direct and simple plan, a perfect model of clarity in architectural thinking. Utzon proposed a concrete hillside, under which all the minor requirements were swept and on top of which he laid the two main auditoria-opera, side-by-side, their steps and seating calmly climbing the hill. The concept, to most architects, was as satisfying in an esthetic and emotional sense as the vaults above. Eventually Utzon's plan could not be realized in the space enclosed by the vaults. It is fair to say that it did, at the time he won the competition."

Boyd noted that the '50s and '60s were marked by a firm belief in concrete, particularly for shells, and in the ability of engineers to analyze any form. Utzon, he said, did not demand that Ove Arup's structural engineers deliver precisely the shapes he had drawn in the advanced sketches; he gave them a set of guidelines that they could modify to suit the stresses. The imaginary freedom of shell concrete was disciplined in the end by Utzon's decision to make all parts fragments of the same sphere. This allowed prefabrication that imparted a precision to the forms more in keeping with the time. Utzon, unbelievably, pulled his design alive from the mid-1950s to the mid-1960s.

Sydney received what appeared to be a final design at a firm price, and there were very few people who could have known that it couldn't be done. Arup, after tedious months of computer analysis proved conclusively that it could not be done.

About the same time as Boyd's critique appeared, Sigfried Giedion wrote a new chapter for *Space, Time, and Architecture* called "Jørn Utzon and the Third Generation." "In him," Giedion wrote of Utzon, "several sensitive characteristics of the third generation are sharply delineated. . . . Utzon's brilliance—genius, if you like—is in his multiple ability. He analyzes the complex, conflicting series of problems which constitute practically any architectural brief and he comes up with a single answer which solves all of them simultaneously. Arup said Utzon was probably the best designer he had come across in his long experience of working with architects."

Engineers on the Opera House structure

With the perspective of more than 15 years since the opening of the Opera House, Henry Cowan, professor emeritus of building science at the University of Sydney, remembers, "Architects were very interested in new structural forms when the Sydney Opera House competition was held. The problem was that many of the things they wanted to do could not be built at that time, and the Opera House was typical. The jury thought the design a thin shell; Saarinen said it was economical because it was a shell. The government architect member of the jury insisted on a cost estimate. Saarinen said to assume it is a four-inch shell and that the formwork will be expensive because of its shape."

Cowan says the roof structure proved difficult to calculate, although today it would not be a problem. "There is nothing we cannot calculate today," he says. "There are things we cannot build, but these are usually not buildings. Buildings are not that complicated."

Shell structures never caught on in Australia, and Cowan speculates that the structural design of the Opera House might have had a lot to do with this lack of interest. There is no record of what passed between Arup and Utzon concerning the structure. "I had the opportunity once to ask Arup whether the story that he had advocated a space frame was true. He said that he did not want to discuss his conversations with Utzon," Cowan recalls.

"The use of a space frame between the inner and the outer shells is an obvious solution, and it would be surprising if it had not been considered," he continues. "One cannot see much of the concrete shell structure, either from the inside or the outside. What is seen are the nonstructural concrete slabs with the tiles. They could easily have been supported on a separate steel

The Complex Creation of Utzon's Masterpiece

1947: Eugene Goossens is appointed resident conductor of the Sydney Symphony Orchestra.

1952: John Joseph Cahill becomes premier of Australia.

1954: Cahill organizes a committee to advise the government on the ways and means of building an opera house.

1955: The government of New South Wales announces a competition for the design of an "opera house" suitable for the performing arts. It will have two halls, a restaurant, and two public meeting rooms. The site on Bennelong Point is spectacular. The building will be seen from every direction, including above from the great Harbor Bridge close by.

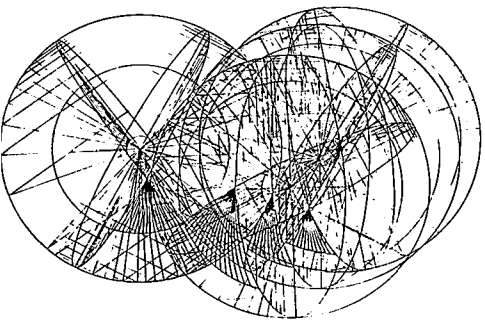
First prize is to be $10,000; second, $4000; third, $2,000. The winner will be retained to make drawings and supervise construction. Judges are Eero Saarinen from the United States, J.L. Leslie Martin from England, and Henry Ingham Ashworth and Cobden Parks from Australia. The 721 architects who respond pay a $20 registration fee.

Goossens is knighted for his services to music in Australia. Opera, however, is not popular entertainment in Sydney. The two greatest Australian opera singers, Nellie Melba and Joan Sutherland, have gone abroad to become know.

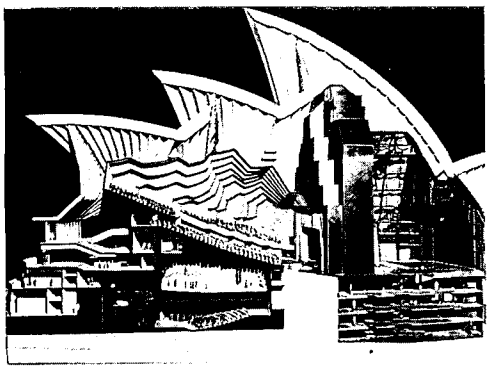
1956: March 22: Goossens, returning from a trip to Europe, is met by detectives at Sydney Airport and later is fined $200 for a customs offense.

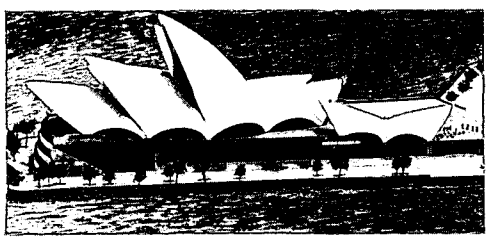
April 11: Goossens resigns as director and conductor of the Sydney Opera and leaves Australia shortly thereafter.

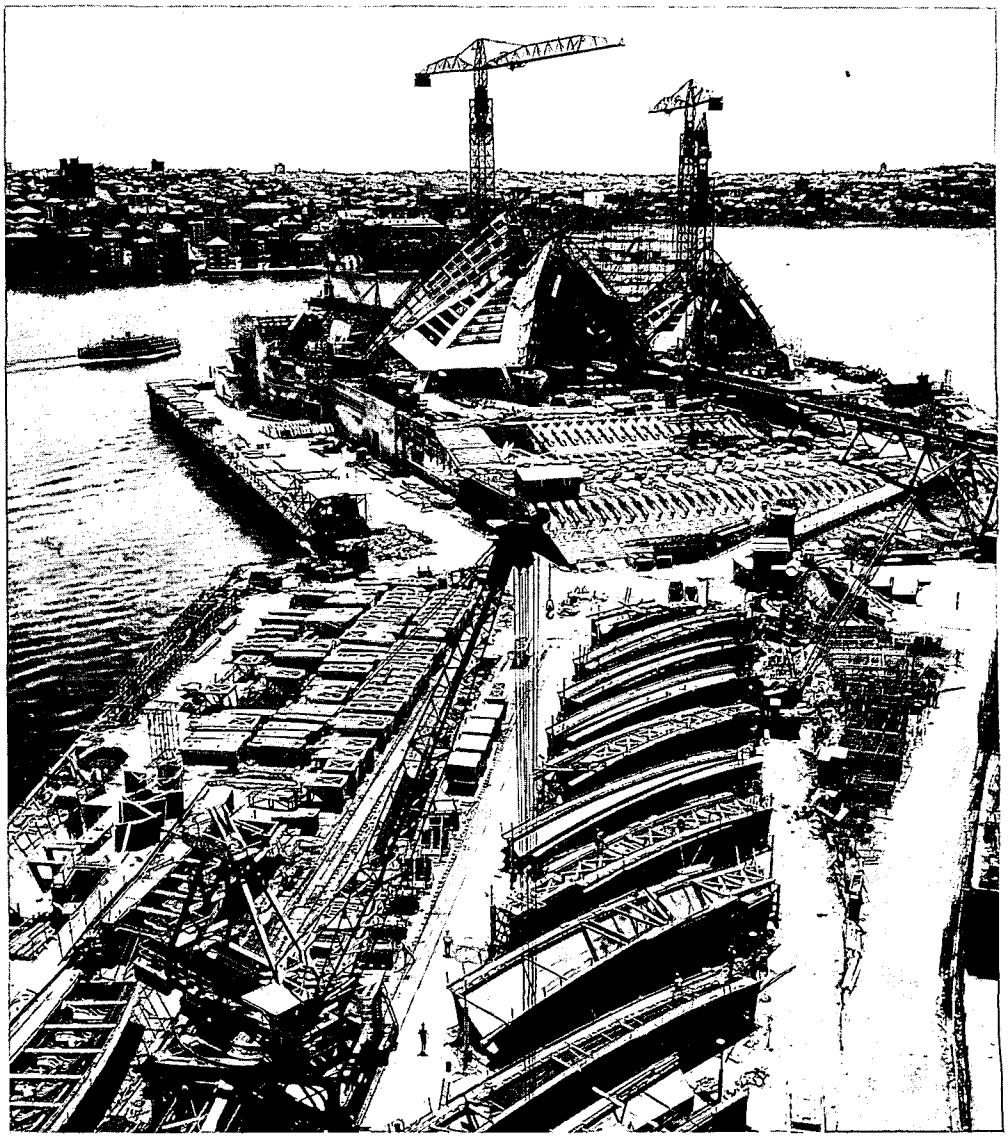
Dec. 3: At 5:00 p.m. the opera house competition closes, 233 designs having been submitted. Of these, 61 are from Australia, 53 from Great Britain, 26 from West Germany, 24 from the United States, six from Switzerland, five from France, three from Japan, one from Ethiopia, and one from Iran.



Above, Utzon's derivation for the forms of the shells as fragments of the same sphere. Below, early models of the design. Right, the shells under construction.







Photographs courtesy of the Australian News and Information Bureau

1957: Jan. 29: Cahill announces the competition winners: Jørn Utzon of Denmark, first; J. Marzella, L. Loschetter, W. Cunningham, W. Weissman, N. Brecker, R. Geddes, and G. Qualls of the United States, second; and Boissevain and Osmond of London, third. The cost to complete the Opera House is estimated at $7 million.

Jan. 30: Utzon, reached by telephone in Denmark, says that he worked six months on the design, has never been in Australia, but looked at photographs. When asked what he will do with the prize money, he replies, "Spend it, of course."

July 29: Utzon, all 6 feet 9½ inches of him, arrives in Sydney.

Ove Arup begins analysis of roof structure. He makes two models: one to test for wind forces and the other to check gravity loading. These tests continue until early 1961.

1958: Jan. 10: The government holds the first "Opera House" lottery.

March: Utzon returns to Australia to present his "Red Book," which further develops his competition concepts. Ove Arup & Partners is listed as consultant. The roof vaults are drawn with ribs as structure. Arup comments, "The superstructure of the Opera House consists partly of a series of large shells. The structural design of the latter is obviously quite a problem and has only just been touched upon."

May 12: Engineers of the Sydney Maritime Services Board sink test bores on Bennelong Point to find bedrock.

Aug. 18: Wrecking crews begin demolition of Bennelong Point tram sheds.

September: The mayor of Sydney makes a public appeal for funds to build the Opera House. A final accounting of the appeal shows $1,456 spent for fund solicitors and stationery, and $960 collected; the net loss is $496.

Nov. 3: Utzon returns to Australia and calls for bids on the first stage of the Opera House. R.S. Jenkins, an Arup senior partner, arrives in Australia to inspect tenders.

1959: January: Tenders for the podium close; six Australian firms bid.

Feb. 4: The state cabinet accepts the lowest bid, and Civil and Civic Contractors Pty. Ltd., of New South Wales, is

frame that also held the plywood interior structure.There is plenty of depth available, and the frame would not have needed to be very heavy. I have been told by somebody—I cannot remember whom, all this happened 30 years ago—that Utzon refused to consider this solution. I also was told that Utzon said the brick cone that supports the outer dome of St. Paul's in London is a deplorable example of structural deceit.

"I have met Utzon, and this rings true to me. I regard Wren's structural design for the dome as a work of genius. It is the lightest of all the great domes of the Renaissance. I would have been far happier with the Opera House if more intelligence and less truthfulness had been used," Cowan concludes.

Lev Zetlin, an often controversial but widely respected design and investigative engineer, also remembers arguments concerning the structure of the Opera House. "The concept of the structure was a series of shells with undevelopable surfaces," he says. These, like seashells, cannot be spread flat, as can a tube or a cone. To express them mathematically, a number of simple surfaces are developed and then joined. This demands mathematical acrobatics, and accuracy is difficult to verify.

"The partner in charge of the Sydney Opera House for Arup was Donald Jenkins, a very capable engineer who had written a mathematical book on the design of shells," Zetlin continues. "Jenkins visited me in New York. I asked him why [the structural design] took so long. He described the difficulty of fitting the mathematical surfaces together to achieve continuity."

Zetlin believed that this approach would not result in the true structural behavior of the shell. He proposed instead a "limit design," which, even though inaccurate, would indicate collapse and the ultimate strength of the shell more accurately than elastic theory. With limit design, stresses do not have to be verified, but the load at which the shell collapses does.

"Shortly after, the French built a pavilion at the Brussels World's Fair that was an undevelopable shell," Zetlin recalls."They estimated 5,000 hours of calculations and completion in four months. It took 50,000 hours and was completed almost at the end of the fair. The estimated cost was $50,000; the actual cost was $500,000. A year later came my turn to tackle the problem. A Madison Avenue designer had drawn a roof for the Eastman Kodak Pavilion at the New York World's fair [1964-65]. It looked like a cloud on columns as much as 200 feet apart. I submitted three proposals. One to build it of wood trusses; another was a steel space frame with the cloud six to eight feet thick. The third was a concrete shell varying in thickness between six and 12 inches that would cost half that of the wood or the steel. Of course, the shell was accepted."

At the time, Zetlin was convinced that his limit design theory and model testing would work, even though he did not yet have a full mathematical analysis. "The Kodak Pavilion was an $8 million project," Zetlin says, "and I estimated my cost at $40,000 for design, $15,000 for model testing, and I considered $50,000 a comfortable fee. But I did not want to commit to a fixed fee, and suggested that I work on a cost-plus contract. The client, however, vehemently objected because he was aware of the increase in the cost of engineering for the Brussels Pavilion and for the Sydney Opera House. I then calculated what the fee would have been if I had followed the same procedures as Jenkins and the French engineers, cut it in half, and proposed a figure of $230,000. The client accepted immediately."

Zetlin developed the limit design theory and tested it with a model. His costs were $6,000 for the model, and his total expenses, he says, were $13,000 plus three or four sleepless nights developing the theory. After the World's Fair was over, the pavilion was loaded to destruction as a scientific experiment, and it proved the limit design theory. "This was the first real financial killing I ever made in engineering," Zetlin says.

Maintain it or grow ivy on it

Harold Roper, professor of civil engineering at the University of Sydney and a specialist in the durability of building facade materials, was quoted in the Sydney *Morning Herald* as refusing to comment "officially" on the Opera House. He did say casually, however, that if the building were being built today it probably would be covered with disposable cladding materials to avoid the maintenance of 1 million permanently fixed tiles.

Roper said that the common belief among architects of the '50s and '60s was that facades could be made indestructible with chemical-based bonding agents. The practice of mechanically waterproofing joints by overlapping and flashing died suddenly with the introduction of epoxy resins. But what did not follow,

awarded the contract. Utzon and Cahill place a specially designed plug into a brass plaque designed by Utzon for establishing the datum for the Opera House.

March 2: Work begins.

Cahill dies.

1961: The government of New South Wales creates the Opera House Trust and assigns it four tasks: administer and maintain the building; administer the halls as performance areas; promote artistic taste; and encourage new forms of entertainment.

Ashworth announces that the Opera House will cost $13 million.

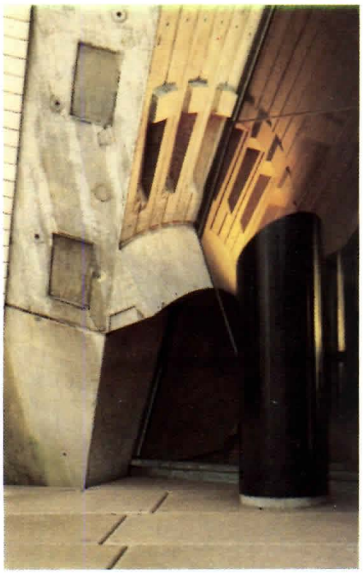
It is generally agreed that the roof shape will be elliptical paraboloids formed by a double roof of two concrete membranes separated by ribs.

1962: Utzon proposes that the Opera House roofs be constructed of prefabricated sphere segments. Its ribbed vaults are to be curved inward and connected by a curving central spine covered by a light skin of ceramic tile. Arup accepts this concept and is confident it can be built. The problem is to break the news to those who worked for years on another design. Important members of the Arup firm resign. But most difficult is telling the client that more than three years of expensive investigation, including model tests and computer time, are to be abandoned and that a new idea, needing more investigation and more funding, is to be substituted.

Goossens dies.

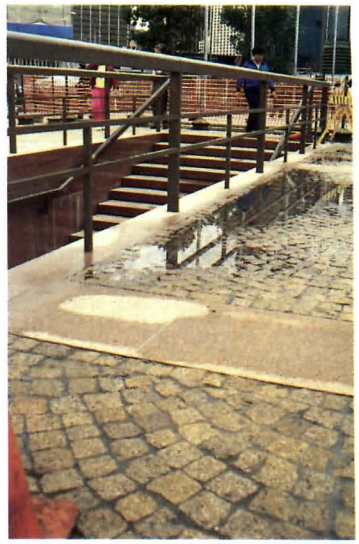
April 12: Stage 1 is summed up in a report to the technical advisory panel by Jack Zunz of Arup & Partners, who writes in part, "The architect and the consulting engineers are dissatisfied with contractor's workmanship, leadership, and supervision. The contractor is critical of way his claims dealt with by the consulting engineers, and feels he is not being reimbursed sufficiently for tasks [he is] asked to perform." Zunz also reports that the work was rushed and that construction began with approximate schedules of approximate quantities. The drawings are incomplete, and extras have doubled the original tender price. The final costs for Stage 1 are settled at $5,160,000.

August: Robert Heffron, premier of New South Wales (succeeding Cahill), announces that the Opera House, complete







Photos indicate the minor repairs needed as the Opera House marks its 16th birthday. Note the state of the tiles in the two photos to the far left. The photos directly above and to the immediate left show concrete damage; discarded cola in trash can ate the concrete finish below it. Far right photo shows ponding at stair.

Photographs by Forrest Wilson

and ready for use, will cost $25 million.

Utzon submits the "Yellow Book," whose cover shows a whirling mass of intersecting spheres. Tinted yellow areas illustrate shape of roof shells, derived from a sphere 246 feet in radius. A single segment can be used to prefabricate many sections. The roof system will have 2,194 precast elements, including rib segments, crown pieces, and others. Only the pedestals of the roof arches and a few other elements need be cast in place. All casting is done in a yard set up on the site, using resin-treated plywood forms over steel framework. The ribs are hollow and Y-shaped.

1962: March: Zinz and Utzon face the technical advisory panel to break the news of the change in the roof design. The minister for works, P.N. Ryan, gives permission to go ahead.

Oct. 18: The contract for the ribbed vaults is let to M.R. Hornibrook (N.S.W.) Pty. Ltd. Hornibrook receives a management fee, and the government assumes all other costs. The estimated cost is $3.6 million and estimated time is 27 months.

The columns on the underside of the podium are blasted out because they were sized based on previous calculations that assumed the roofs would be light concrete shells. Mick Lewis, Arup's resident partner in Sydney, says the contractor is finding it difficult to key new concrete work to the existing concrete. Workers must drill into the existing pillars, fill the holes with explosives, and explode charges that peel columns "like bananas" in order to expose the reinforcing cages. Some of the new columns are eight feet square.

1963: March 26: Arup requests that he be released from responsibility for consultants other than those involved with structural and civil engineering. The document, called "Arup's declaration of independence," bases its claim, according to John Yeomans, on "the fact that it is the architect, and rightly so, who chooses these specialists and directs their work. Anyhow, we are ourselves under the direction of the architect, and cannot direct anybody else without reference to him." The government agrees.

Corbet Gore invents telescopic rib centers, reminiscent of those used for the erection of the pointed arches of Gothic

according to Roper, were maintenance practices to check the deterioration of the new materials. He speculates that the structure of the Opera House has an infinite life potential but that its external fabric will need refurbishment. The Opera House must be maintained as a prestigious building, he concludes, or you might as well grow ivy over it.

John Zadaricchio, engineering services manager for the Opera House, and Tamas Bishops, a consultant, concur that maintenance is the major cost issue for the Opera House today. "No major structural problems have appeared, and the present excavation of the harbor tunnel nearby should have no effect on the Opera House because its foundations are solid sandstone," says Zadaricchio. "Access to the Opera House is the problem—how to get to the roof to inspect and replace deteriorated elements, and how to repair concrete damage underneath the podium."

Additionally, according to Zadaricchio and Bishops, no provision was made for maintenance or inspection of the vast areas of the tiled vaults. Consequently, a cable-suspended motorized winch "tile climber" was invented. It worked well, they report, but it could not climb fast enough for the vast areas to be inspected. A group of Melbourne-based Czech mountaineers skilled in restoration work was considered as an alternative.

Zadaricchio and Bishops say that another potential maintenance problem is the sealants. The sealants originally used had an expected life span of 15 years, which they speculate has probably been shortened by the ultraviolet heat. Once the sealants are penetrated, the Y shape of the ribs will provide a natural drainage channel underneath the tile "lids," but corrosion of the prestressed concrete rib sections might be a serious problem.

The real need is for a decision to invest in consistent maintenance, Zadaricchio and Bishops agree.They intend to present a comprehensive catch-up maintenance plan to the Australian government, and the department of public works is coordinating a six-year program of investigation and maintenance planning. As an example, there are normal maintenance problems with the internal concrete and the plywood. Zadaricchio and Bishops also agree that more research is needed in concrete deterioration, but neither they nor other professionals contacted in Sydney could define the term "concrete cancer," so popular in Australian press reports. The highest priority is maintenance of the roof, and studies are under way to measure the extent of problems in other areas. For instance, corrosion investigations of the sea wall and supporting structure for the northern end of the walkway are reported to cost $500,000 a year. The curtain walls also have leakage and corrosion problems.

The Opera House is not unique in its maintenance problems, says Zadaricchio. Many of the standard curtain-wall buildings that were built adjacent to the Opera House in Sydney's business district during the same period already have been torn down and replaced. Moreover, architecture faculty and students at the University of New South Wales scanned 100 buildings completed between 1965 and 1975 for signs of distress and found all had problems. A similar investigation would give the same findings in most major cities of the world.

The Opera House is well built. Prefabrication of its ribs and tile lids gave these components high levels of quality control. Zadaricchio and Bishops say that new materials and ideas were used boldly by skilled builders and that Ove Arup & Partners is one of the world's great engineering firms. However, says Bishops, "it is the most public of buildings, and all repairs become public knowledge. We cannot, like doctors, bury mistakes."

There is also the economic return on investment to consider. The five restaurants operating on the site generated profits of more than $1 million in 1987-88. An advertising agency promotes the Opera House by extolling "more complete nights" with dinner and a show, and advertisements invite people to take in "Bach and a bite." A 1988 popularity poll showed 56 percent of Sydney's 3.5 million population to be "favorably disposed" toward the performing arts. However, of these 1,960,000 people, only 250,000 (13 percent) visit Bennelong Point. Still, the people of Sydney considered it an embarrassment when Bond Television used the Opera House sails as a giant laser billboard. In short, the good citizens of Sydney can take opera or leave it alone, but this has not decreased the value of the Opera House.

Kevin Rice, a principal of Rice Daubney Architects in Sydney, speculates that, yes, Australia would undertake another Sydney Opera House. "We have the skills and imagination. Australians put forth a national effort and paid for it, although grudgingly, and today are proud of what they did. The intent was not to create an icon—that was the outcome. Another such effort is possible, and the Parliament House in Canberra is proof. It is the result of the same conditions, although the response was

cathedrals, in order to do away with temporary scaffolding. Centers can be contracted or extended for varying rib sizes, propelled horizontally, and pivoted at the base.

1964: May 3: R.W. Askin, leader of the government opposition in the House of Parliament, says, "The ever increasing cost of the Opera House has become a public scandal." The ultimate cost is estimated at $36 million.

June: Utzon gives his latest estimate of $34.8 million (without car park) and a completion date of March 1967. Utzon designs a house for his family. The building code officials reject his application for a building permit.

Utzon wins first prize in an international competition to design a theater with two auditoriums in Zurich.

1965: Management of the Opera House project contributes directly to the fall of the New South Wales government.

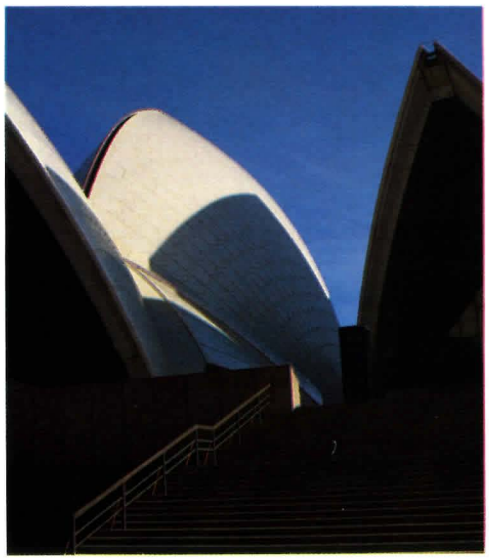
Utzon is elected a Fellow in the Royal Australian Institute of Architects.

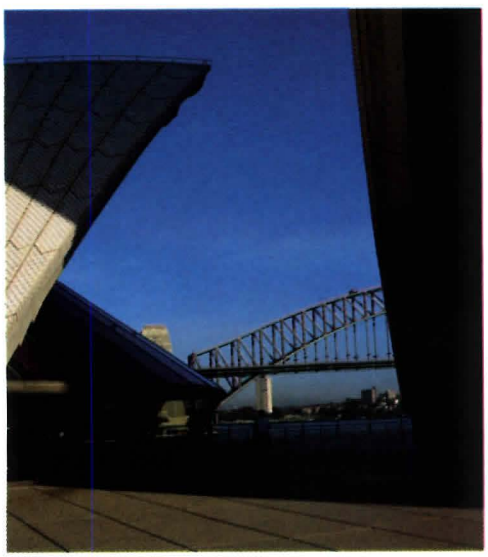
Soprano Joan Sutherland returns to her native Australia for a 14-week tour. The opera company suffers a loss of $48,000; people go to the opera only on nights that Sutherland sings.

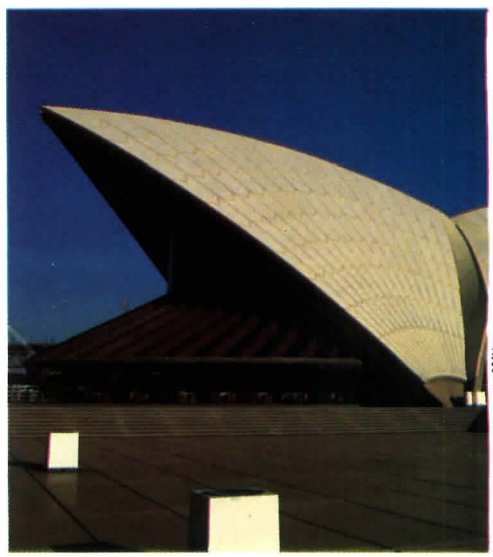
1966: Feb. 28: Utzon resigns verbally as architect of the Sydney Opera House during a meeting with David Hughes, the minister for works. The next day Utzon sends a letter of resignation that Hughes accepts. Hughes says Utzon resigned for two reasons: first, he was not paid $102,000 that he claimed was due for engineering services; second, Hughes had not adopted the architect's recommendations for the use of plywood in constructing the ceilings of the major and minor halls.

March 7: Utzon and Hughes meet again. Utzon asks to be "the designer" with others in charge of construction. The Opera House is to be completed by a panel of Australian architects. Arup & Partners will remain consulting structural engineer for Stage 3 but will not administer the work or prepare working drawings. Utzon is given four days to decide.

March 15: Utzon agrees to work with consultants but refuses to be reduced to a "design architect" under panel control.







The omnipresent Opera House provides a multitude of images from different vantage points. Compare color renditions of different natural lights in the photos on the top left, the top right, and on the following page. The photo immediately above shows the power of the tile motif. Right, evocation of Saarinen's TWA terminal.

Photographs by Forrest Wilson

He calls the proposal impractical and unacceptable. The government announces that Utzon's previously submitted resignation remains in force.

April 19: Hughes announces Utzon's replacements, all Sydney architects: E.H. Farmer, the chief government architect of New South Wales; Peter Hall, design architect, formerly on the government architect's staff; and D.S. Littlemore, partner of Rudder, Littlemore & Rudder, in charge of supervision.

April 28: Utzon leaves Sydney.

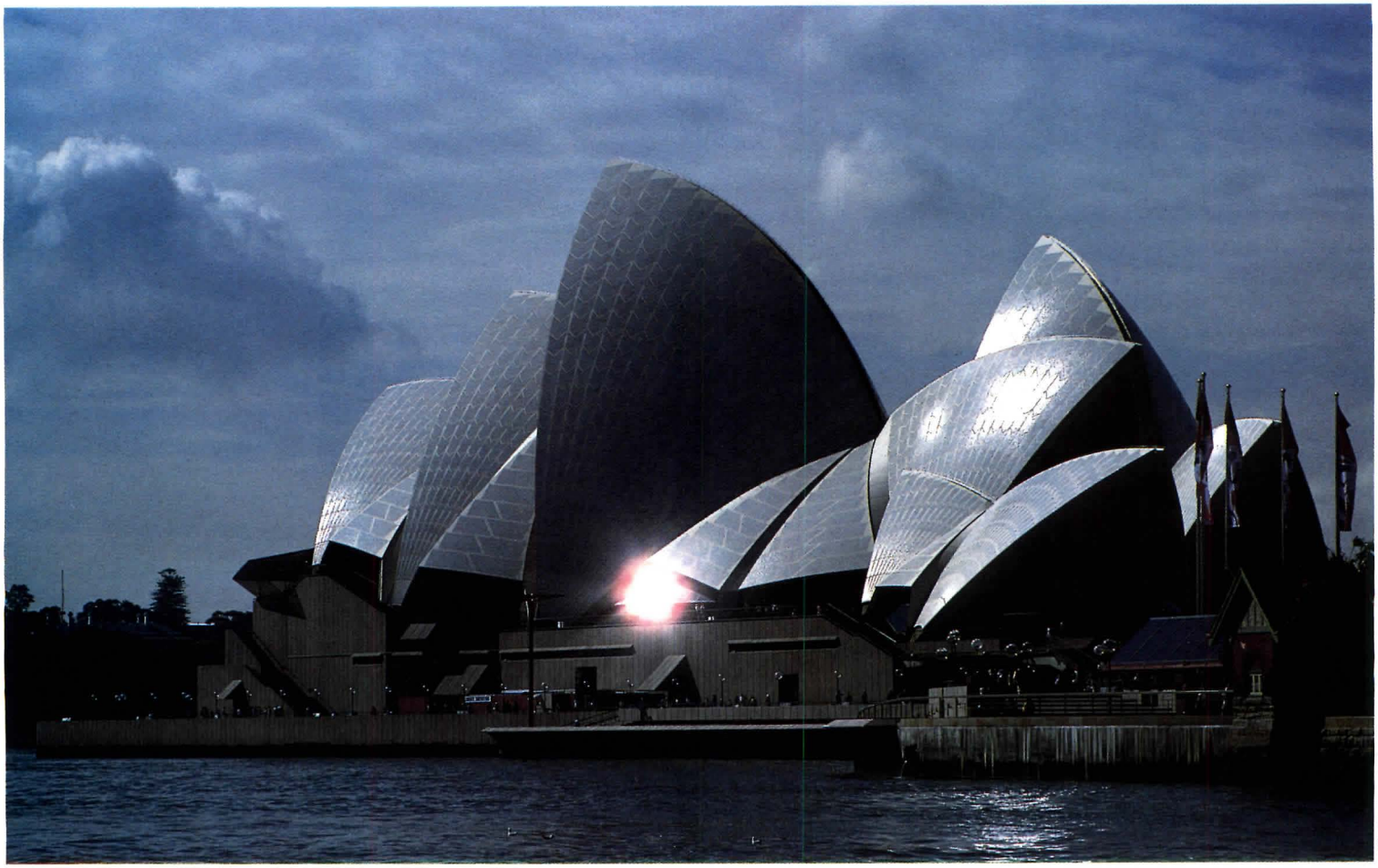
Dec. 1: Stage 3, the last stage, begins. It includes paving; cladding of the podium; installing the major glass walls; filling the northernmost and southernmost shells of the Concert Hall, Opera Theatre, and principal restaurant; building interior walls, floors, and ceilings for all theaters; installing the furniture and coordinating the installation of the stage machinery, stage lighting, and mechanical, electrical, and acoustic systems. The work is to be completed by the Australian team of Peter Hall, Lionel Todd, and David Littlemore. The team submits a "review of programme" that proposes to alter the intended use of interior spaces. The main hall is to be for concerts only. Stage machinery is to be removed and a fixed stage constructed for the Sydney Symphony. The space under the podium is assigned for art cinema and chamber music. The minor hall will be used as a drama theater.

1967: Jan. 9: The government's consultant on the future management of the Sydney Opera House submits a report stating that, "in musical circles abroad, the building is not an Opera House . . . so much as a cultural supermarket enclosed by a magnificent shell."

1972: Dec. 28: The first test concert with a major orchestra and full audience is held in the Concert Hall.

1973: Sept. 28: The first opera is presented in a minor hall. Oct. 20: The Queen of England officially opens the Sydney Opera House. □

This time line is based on The Other Taj Mahal, *by John Yeomans. (Longman Australia Pty. Ltd., Camberwell, Victoria: 1973.)*



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different. There was a political decision, a political will, similar to the one that made the Opera House possible."

If the Opera House was a "deception" of the public, the same might be said of the Parliament House. "It is an infuriating characteristic of Australian society, and others as well, to complain bitterly while this is going on, but once completed to say, 'Isn't that lovely?' No worry at all. This happened at the Opera and Parliament House, and it can happen again," Rice says. "The circumstances that gave rise to cathedrals no longer exist. Their place may be taken by shopping centers. The success of the Opera House and Parliament House makes it easier to have another great building. The latent grudging pride in Australia to do the right thing is getting closer to the surface. The public would accept and applaud another such enterprise without having to be conned by politicians. It will be interesting to see where and how it will happen."

Summing up: value, price, and profit

Media coverage of architecture gleefully reports mistakes, arguments, and failures as exceptional events. They are not, except in the building of uninspired buildings. Speculative office buildings are built by the thousands without any media comment at all. In contrast, risk taking is the stuff great architecture is made of, and it comes with the territory.

We know that Phidias, the sculptor of the Parthenon, died in jail. Pericles, its developer, was banished from Athens. The cathedral at Beauvais fell down and was rebuilt three times. In Boston, the Hancock building's windows fell out, its foundation endangered surrounding buildings, and the building itself was in danger of toppling over in the direction of its long axis (see March 1988, page 68).

'Like all great architecture, the building is a bargain.'

In all discussions of the failings of the Sydney Opera House, cost overrun is uppermost. One must wonder why. Like all great architecture, the building was a bargain. Thirty years of media attention have increased its value to an extent that, like the Parthenon, it cannot be thrown away. The government tourist offices of both governments would rip out the tongue of anyone who dared whisper such sacrilege.

Great architecture always has been good for business. The churches in Chaucer's time were essential features of the pilgrimage and thrived accordingly. All today's packaged tourists need to see in Australia is the Opera House in order to say they have been there. All else is window dressing.

The Opera House pays off in terms of the hard bottom line as well. The estimated price was $7 million dollars, and the final cost has been quoted at $120 million. Its replacement was priced at $500 million in 1988, roughly a 420 percent increase in about a 15-year period. This is an impressive return on investment, even for junk bonds.

Which would you rather have? □

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Case Histories of Structural Failures

Lessons from Australia. By Henry Cowan, A.O.

A major structural failure today is a rarity in developed countries, where an architect or a structural engineer is well over a hundred times more likely to be killed in an automobile accident than to be involved in a major structural failure. The greater occurrence of structural failure in regions of Third World countries subject to earthquakes or hurricanes is due partly to the continued use of traditional methods that do not ensure the necessary resistance and to lack of enforcement of building regulations, often associated with bribery.

The major structural failures that occur, comparatively rarely, in countries such as the United States and Australia are due generally to outright mistakes or to the neglect of a secondary effect, such as the possibility of a local buckling or shear failure.

Lack of adequate theories and inadequate factors of safety had been the main causes of failure prior to the 18th century. I have not come across a major failure since the end of World War II that can be attributed to those causes; in eliminating them we have been spectacularly successful.

Even though comparatively few structural failures occur in this country, our knowledge of them is limited because many are never described in the professional literature. These failures do not become known to more than a few people. If nobody is killed or seriously hurt, and if the damage is not obvious to passersby and to the press, it is in the interest of all those involved in the failure to keep it quiet. Evidently it is unlikely to enhance the prestige of the structural engineer, the builder, and the other professionals involved. Nor does it help the owner of, say, a factory that produces women's stockings to let it be known that the factory has suffered a defect. The public might draw the quite unwarranted conclusion that the stockings also are defective. If the parties concerned can reach agreement, they will settle the question of damages privately.

Even if the failure becomes widely known, the truth about it will not necessarily emerge. Statements by interested parties often are misleading; they may not contain any untruths but they may omit essential information. Press reports often are wrong because journalists lack the necessary expertise and tend to concentrate on colorful details.

In a public inquiry, which can compel witnesses to give evidence under oath, the complete story of the failure usually will become known. Although such inquiries are rare, their reports are of particular value.

Three avoidable failures

A few failures in which I was involved happened more than 30 years ago, and I think it is proper to talk about them now.

The first was the collapse of a Bailey bridge during World War II. The Bailey bridge was invented for the British Army in the 1930s. Its structure consists of braced panels that support the bridge floor. All the components are small enough to be manhandled, and they are assembled with pins that are pushed through circular holes.

As the bridge gets longer, it is rolled forward over the river, but its center of gravity is always kept on land. When the bridge has reached its full length, it is therefore almost halfway across the river. Panels then are added beyond the bridges proper length so that its center of gravity stays on dry land. These extra panels are dismantled when the bridge reaches the opposite side of the river. In this case, for some reason there were not enough panels. This was a frontline operation, and the officer in charge decided to push the bridge across anyway. It fell, of course, into the river when its center of gravity moved out over the water before the far end had reached the opposite shore. There was nothing wrong with the structure; it was used incorrectly.

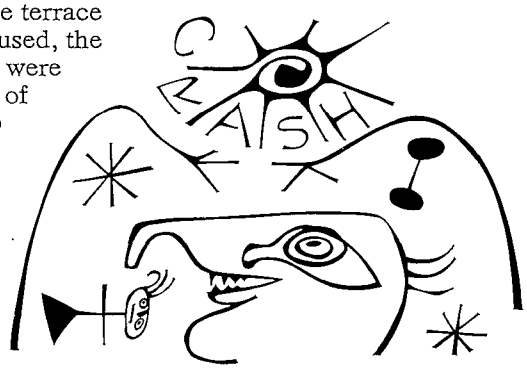
The second failure also was due to a mistake. Shortly after I left the Army, in the late 1940s, I was employed as a structural designer by a company manufacturing prefabricated aluminum houses. The structural problem was not primarily one of strength but of preventing buckling. Structural aluminum previously had been used almost exclusively by the aircraft industry. The design manual therefore was written in terms of ultimate strength. Nobody explained that to me because all my colleagues were aircraft designers who took ultimate strength methods for granted, whereas I, as a civil engineer taught in the 1930s, had never heard of them. That the stress of aluminum in the formulas was rather high did not strike me as odd, as I had no idea what the strength of this alloy ought to be.

Consequently, during my first week in this job I designed a roof structure, using working loads but with ultimate strength formulas; in other words, I designed it with a factor of safety of one. My calculations were duly checked by a colleague, approved by the chief engineer, and checked again by the client. Fortunately, it was decided to build a prototype and load-test it. The roof collapsed at precisely the working load, which at least proved the accuracy of my calculations.

My third failure story relates to an ordinary terrace house bought by a small cutlery company that

Mr. Cowan is a structural engineer, author, and professor emeritus at the University of Sydney. This article was adapted from his presentation at the International Conference on Case Histories of Structural Failures, held in Singapore in March 1989.

owned a factory where it polished, sharpened, and engraved cutlery blanks that it bought elsewhere. As business expanded, the company needed extra storage space. When the terrace house first was used, the boxes of blanks were stored in stacks of two (one on top of another), a practice that seemed very modest from the point of view of using the volume of the room.



Drawings by Forrest Wilson

Failure of a multistory brick building

In the early 1950s, some trouble was encountered with brick buildings in Sydney, Australia, particularly those with long walls, due to the expansion of the bricks. Sydney clay bricks—and indeed many other clay bricks—expand over time, just as concrete bricks shrink. Very serious cracks occurred at the corners of a large building, because one long wall was expanding relative to a cross wall. In my opinion, the fault lay not with the bricks but with the way in which they were used. At the time, there was a serious shortage of bricks. As a result, bricks were used fresh from the kiln, sometimes even before they were quite cool, instead of being given a rest. Some of the expansion that normally would have occurred during storage took place after the bricks had been built into the walls, so that the expansion of the brickwork was greater than usual. It would have been advisable to insert additional expansion joints, but this was not done and a large part of the building had to be demolished and rebuilt.

Failure of an aircraft hangar

In 1957, a new aircraft hangar was built at Sydney Airport. A European company offered to design and fabricate the steelwork at a price considerably lower than that offered by any Australian company. However, a local construction firm was used to erect it.

The frame was made from high-tensile steel, which then was rarely used in Australia, and the fabricator spent considerable effort on accurate design to achieve steel economy. The construction company was accustomed to structural-grade steel and to designs that used material more lavishly. Through careless handling, one of the frames was dropped and bent out of shape. The foreman ordered it to be straightened with a welding torch. Apparently he did not appreciate that the heat treatment would reduce the strength of the steel. This happened on a Friday, and by the end of the day the frame had not been fully secured. The foreman thought it would be all right to leave it as it was over the weekend, as he did not want to cause complications by ordering overtime work. That weekend there was an exceptionally high wind, and the airport site offered no protection. By Monday morning the hangar had collapsed.

Failure of two concrete domes

In theory, the dome is the most efficient structural system for materials with high compressive and low tensile strength, such as masonry or concrete. For reinforced concrete, it has the additional advantage that the horizontal thrust generated by any curved structure can be absorbed within the surface of the dome.

In practice, the dome is quite expensive to build by traditional methods because, just as one cannot peel an orange without tearing the skin several times, one cannot build the timber formwork for a dome without a great deal of cutting. Domes with timber formwork therefore have been replaced more and more by other shell forms.

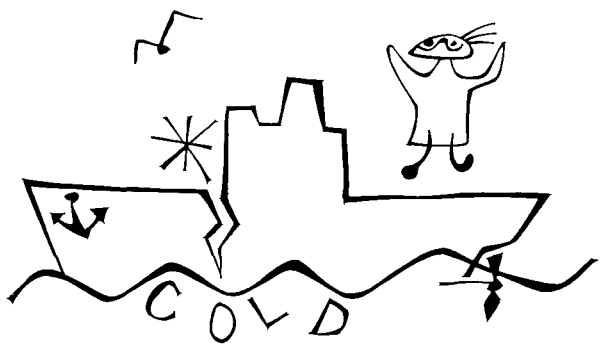
It also is possible to cast a dome by blowing up a balloon, fixing reinforcement over it, and spraying it with concrete. Unfortunately the weight of the liquid concrete distorts the balloon on whatever side is sprayed first.

Dante Bini, an Italian architect, developed a most ingenious method whereby the balloon is folded on a concrete platform and reinforcement is stretched across it. This reinforcement consists of springs that can expand as the dome is formed. Concrete then is placed on this horizontal circular surface. As soon as the casting is complete, the balloon is inflated with an air compressor, and within an hour the concrete that was flat on the ground is transformed into a dome, reinforced by the steel springs cast into it. When the concrete has hardened sufficiently, holes are cut into it for windows and doors, and the entire dome then is coated with insulation outside and inside.

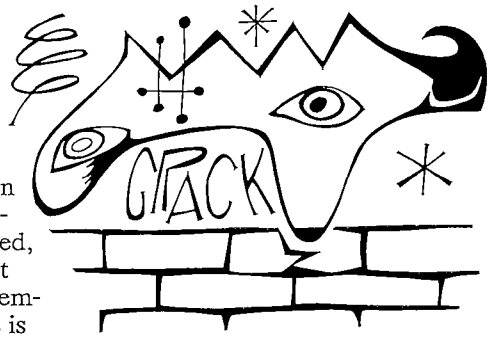
There have been at least two collapses of these domes in Australia. The first occurred two days after the casting operation for that dome. The weather was very hot during the day. At night there was a storm with heavy rainfall and a drop in temperature of about 18 degrees Fahrenheit (10 degrees Celsius). The dome buckled inward with an almost circular circumferential fracture and two radial fractures.

I do not think this can be counted as structural failure because the dome was incomplete—it lacked its insulation. Stress analysis held that, while the stresses due to the weight of the dome and any likely live loads were quite small, high stresses would be set up by a change in temperature because of the restraining effect of the rigid baseplate. Therefore, the collapse was predicted under adverse weather conditions, and the dome was, of course, unoccupied. It was not a failure but a collapse that must be anticipated under exceptionally adverse loading conditions. The slight possibility of such a collapse must be allowed for in the costing of a dome.

The second collapse, however, was a failure. A dome being used as a school library collapsed during the night, and therefore nobody was hurt. Reports of the failure have been vague. There has been an inquiry, and tests of some kind have been



performed. As far as I know, no results or conclusions have been published. Therefore I can only guess at the cause.



The reinforcement in this kind of dome construction, as I mentioned, consists of springs that are fixed above the membrane before concrete is added. The concrete is vibrated under and above the springs, and the springs expand appreciably as pneumatic pressure forms the dome. The idea is excellent, but, because concrete is not transparent, one cannot tell to what extent the springs remain along "great circle" lines and in the middle of the concrete shell. Thus the dome may lack essential reinforcement locally, or it may be located too much to one face of the dome, so that it is unable to provide resistance to even quite small bending stresses. Some bending stresses must occur in the top portion of the dome, where the radius of curvature is very large.

Thus, while most domes will perform satisfactorily, there may be one where imperfections in the placement of the reinforcement occur at critical locations in the dome. The stresses due to temperature change are more severe than those due to the loads, and I think it is likely that this caused the collapse of the school library dome.

Although they have been fully reported, I would like to comment on two structural failures in Australia that have resulted in the setting up of Royal Commissions during the last 30 years. A Royal Commission is an expert committee that has the powers of the Supreme Court to compel witnesses to appear before it and give evidence on oath. These inquiries dealt, of course, with failures far more serious than those I have discussed so far. However, because they have been fully described in the reports of the two commissions; I will comment on them only briefly.

The Kings Bridge in Melbourne, a welded steel girder bridge over the moderately sized River Yarra, collapsed in midwinter, July 1962, 15 months after its completion. Nobody was hurt. The failure was due to the use of a technology that had not been adequately tested for local conditions. Low-alloy steel was then still a novel material, and the type produced by the Australian company had too high a carbon content; the carbon content also was unexpectedly variable. As a result, a number of the welds cracked. These cracks remained in the girders because they were discovered neither by the fabricator nor by the inspectors of the client, the Country Roads Board. In addition, the steel supplied for the tension flange had a low notch ductility, and the cracks thus were able to propagate.

During World War II, a number of welded ships had broken up in the Arctic Ocean while conveying military supplies to Russia, because the low temperature turned the steel brittle. Because the collapse of the Kings Bridge occurred early on a winter morning, reports appearing in the press suggested a similar cause. However, Melbourne is not cold enough for that, even at night in winter.

The bridge already was cracked when failure occurred. This is proven by the fact that paint had penetrated into some of the cracks. It just needed a heavy vehicle (which weighed, however, less than the maximum design load) to cause the collapse.

The second Royal Commission report was occasioned by the collapse of another bridge in Melbourne on Oct. 15, 1970; however, this failure was due to mistakes rather than new technology. Thirty-five people were killed, and many more were injured. The Westgate Bridge is a cable-stayed steel box girder bridge, 2,782 feet long, with a center span of 1,102 feet. The collapse occurred in one of the shorter steel girders, spanning 367 feet.

The box girder was erected in two halves. When it was placed in position, there was a difference in camber of about 4½ inches between them; this was remedied by ballast in the form of seven concrete blocks, each weighing eight tons. This heavy weight of concrete caused some of the steel plates to buckle, and to remove this buckle about 30 bolts were removed while the steel girder carried its full weight. Consequently, it collapsed. Some of the people killed were on it, and others were under it.

Stating the case this briefly is perhaps unfair. The Royal Commission distributed the blame fairly widely among the senior management of the consulting engineers and the original and the final contractors for the erection of the steelwork. The work had been plagued by disputes between the trade unions and the contractors and by further "demarcation disputes" between various unions to decide which union should do the work. These labor disputes had received much publicity in the press, and the erroneous impression thereby was created that they were the cause of the collapse.

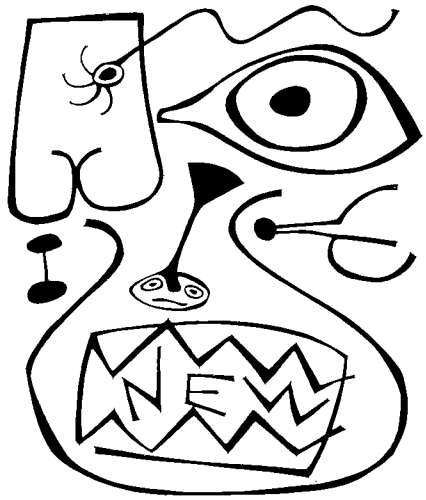
Why do structures fail?

What conclusion can we draw from these very different failures?

First of all, they would not have been prevented if higher factors of safety or higher load factors had been used. They might have been delayed slightly.

Second, they would not have been prevented by checking the mathematics of the design. What was at fault were not the calculations but the data used in them.

There is no simple answer to the problem. Some of the failures were due to the use of new technologies, as in the case of the Kings Bridge in Melbourne. The first thing that would have been necessary to prevent the failure was to have recognized that a technology was involved that differed from what had been used previously. Low-alloy steels were not entirely new when the Kings Bridge was built, but the Australian steel differed from the American steels that were familiar. Perhaps some lateral thinking would have helped.



The majority of the failures I have discussed were, however, basically due to mistakes made by the people in charge. In each case, clearer thinking about the problem could have prevented the failure, and so could genuinely independent checking by other persons who might look at potential problems from a different angle. □

Drawings by Forrest Wilson

How Architects Are Using 3D CADD

They are experimenting with modeling and rendering. By Oliver R. Witte

A new phase in the development of computer-aided design is unfolding as significant numbers of architects begin to experiment with 3D systems for modeling and rendering. The advent of 3D promises to have a more profound effect on the design process and on design quality than 2D, which has been confined largely to the drafting room.

Defining true 3D can get complex in a hurry. The simplest definition is any program that stores information about the height, width, and depth of its objects. Users should be able to obtain isometric, axonometric, and perspective views. They should be able to view the object from any position. They should be able to move around it and through it at a speed that approximates smooth motion.

Most early CADD programs were purely 2D. The second generation was called 2½D because height could be extruded (i.e., pulled straight up) from the plan view, but the user could not manipulate the view. Next came 3D faces, and now all the major CADD programs running under DOS have full 3D databases.

The user's understanding of 3D is a mixture of modeling and visualization systems. Generally recognized options include:

- Wire frame with all 12 lines of a cube visible, even lines representing edges that normally would be hidden if the cube were solid. Removing hidden lines normally is a separate process that the program performs on demand.
- Flat shading. Colors are placed on surfaces, which cover the hidden faces.
- Solid modeling. The program keeps track of objects. Thus a cube is defined as one object, not as lines or faces. Whether an architect needs solids modeling is controversial.
- Photorealism. The goal is a lifelike representation of the effect of light. It includes shadows, gradations of color, textures, reflections, and degrees of translucency.
- Motion. A series of images are captured for quick redisplay that simulates a movie. Applications might include a simulated walk around or through a building.
- Time lapse. This might be considered 4D. It can be used to consider, for instance, the changing angles of the sun according to time of day, season, and latitude.
- Stereographics. Images are shown in apparent 3D rather than in a 2D respresentation of 3D. Special glasses are required but the effect makes a stunning impression. One major software developer became this spring the first PC-CADD program to take advantage of this technology. The next step is a 3D glove that can be used to reach in, grab an object and move it.

Although speed and color are important in 2D computer drawings, they are crucial in 3D. Expect another magnitude of price in order to take full advantage. You'll want:

- A computer with the fastest clock speed.
- A fast coprocessor. A "supercharger" can double the speed again for programs that support it.
- Auxiliary input devices such as a scanner and video capture board. They can do tricks like picking up a picture of an actual building site on which the architect can insert a computer model of a proposed building.
- A graphics card with display list processing and the ability to display at least 256 colors. And 16 million colors are perceptibly better.
- A high resolution output device (printer or film recorder). Output is the Achilles heel of 3D rendering. The dazzling realism that can be displayed on the screen is difficult to duplicate on paper or film at a modest price.

The tab for all that gear exceeds $20,000. Of course, you don't have to have it all, but you'll want it.

The good news is that the software isn't necessarily expensive. Some CADD programs include 3D at no additional cost. Or you can buy a stand-alone 3D program for as little as $99.

In the DOS world, at least four major 2D programs have added 3D modules in the last year. 1989 marks the first year that all the leading CADD vendors running under DOS offered 3D as part of their packages. In the Macintosh world, there are more pure 3D programs than pure 2D programs intended for use by architects.

No pure 3D program has sold well. More commercially successful has been the addition of 3D capabilities to programs that are purchased primarily for drafting. But surveys show that a minority—a small minority, in some studies—of architects actually use the 3D features of their software.

One of the most interesting recent attempts at improving 3D accessibility, developed by the U.S. Army Corps of Engineers and licensed to a private manufacturer under the government's technology transfer program, is Visual Guidance System. The system provides a 3D grid, a 2D plane that can be moved in space to define the surface on which you want to work, and a pointing cursor. The 3D grid is presented in perspective with a vanishing point, so that a symbol gets larger or smaller as it is moved closer or farther.

Architects in the forefront of 3D cite these benefits:

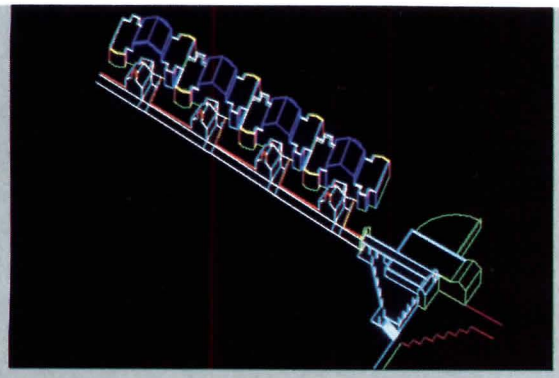
- Improved design quality, as a direct result of being able to test out design ideas quickly. Innovation is more safely proposed.
- Fewer change orders. A computerized model improves understanding of the proposed design both inside and outside the office. Computerized models have the potential to make buildings more efficient to construct, operate, and maintain.
- Faster, more informed approval of schematic design. The effect is greater client satisfaction. Innovation is more readily accepted.
- More flexibility to respond to changes.
- A significant competitive advantage over firms that have not advanced beyond 2D technology and an ability for a small firm to compete with the largest firms in auxiliary design services to major clients.

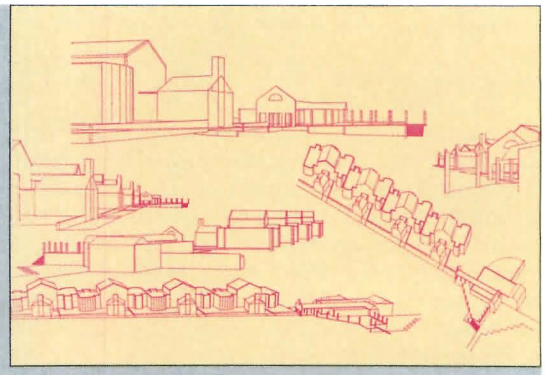
Computer-aided modeling enables designers to explore more options—from the obvious to the bizarre—in less time than hand sketching and tracing. Further, computerized models enable architects to perform analyses and extract information that would be impossible with a physical model.

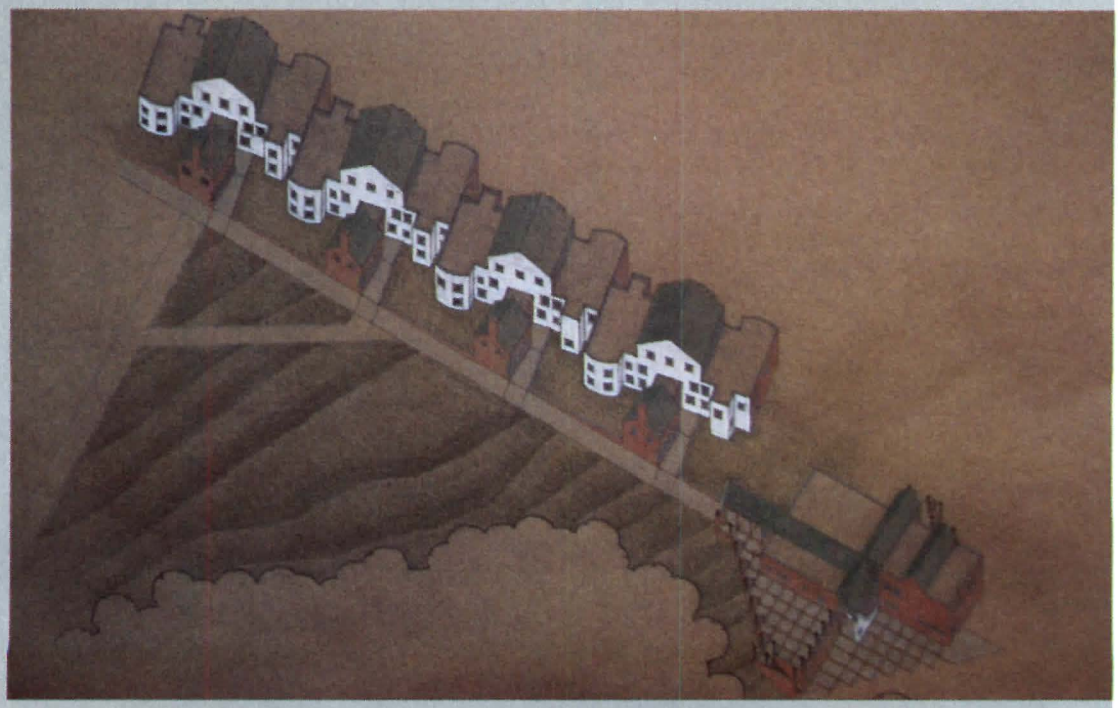
Moore/Weinrich Architects of Brunswick, Maine, feel strongly that the quality of their design for this 200-bed residential facility at the University of Maine at Orono owes a great deal to the use of CADD. "It enabled us to quickly produce drawings of a consistently high quality," said Philip C. Hart, job captain for the project. "This in turn allowed the client to recognize problems and respond to our queries."

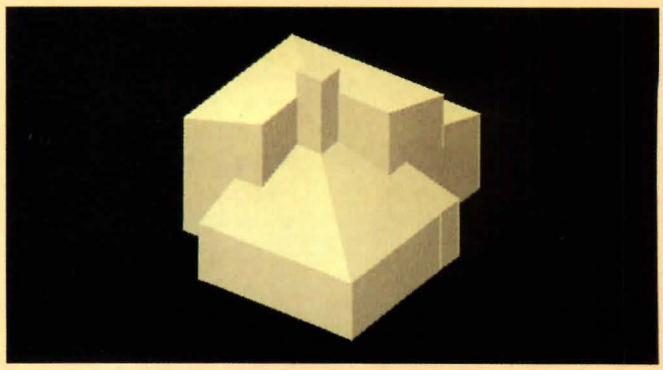
John R. Weinrich, AIA, a principal of the firm, hand-colored the rendering (below) over a plot from the simple screen axon (lower left). The cluster of images (lower right) offers a view of the project plotted on kraft paper. It was instrumental in obtaining approval of the firm's schematic design.

Moore/Weinrich used Datacad for both modeling and drafting, transferring files via DXF to its mechanical/electrical consultant, who used Versacad DOS, and its structural consultant, who used Versacad Macintosh.









Although true 3D programs have been available on microcomputers since 1983, early versions offered primitive rendering capabilities and were painfully slow and difficult for both man and machine. Only recently have advances in realism, speed and ease of use enabled architects to begin exploring the potential of 3D.

This project is a vacation home for G. Peter Vander Heide, AIA, vice president of Curtis Cox Kennerly, Philadelphia. It's real, and has just been built, but he undertook the design on Arris to learn 3D modeling.

The shape of the home was worked out through a series of massing studies. He started directly in 3D rather than 2D. The scheme Vander Heide selected is shown above right. His "client" in this case was his wife, and Vander Heide still marvels at how much easier it was for them to exchange design ideas with computer models than with words and hand sketches.

Among the first problems he discovered was the limitation of the tree symbols that were included with the program. Not only did they look like tinfoil on a stick but they cast unrealistic shadows. So Vander Heide built his own tree symbol and developed a routine to place it randomly around the property to resemble the heavily wooded site. To create a realistic background forest, he took a part of an image from a view of trees on his lot and pasted it repeatedly on the screen.

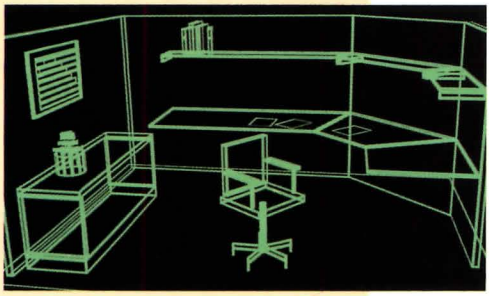
Representing the sky also caused problems for early 3D CADD programs. A brightly lighted building casting normal shadows against a black sky looked silly to Vander Heide. Efforts to set the color to medium blue offered a slight improvement. His first attempt at a graduated tone produced bars of color, which was better but still not quite right. The best solution came from an obscure utility that mapped a color among Arris's shadeable color ranges. By mapping each intermediate color, he was able to shade one color band to a bluer color rather than to a grayer color when the light intensity diminished.

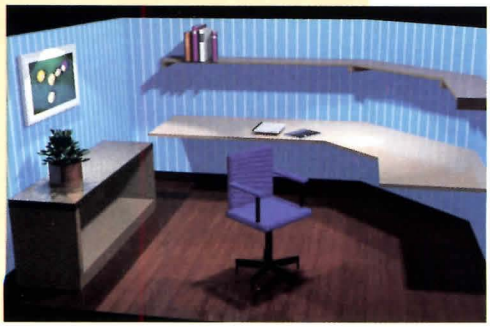
The final touch was transparent surfaces for windows. Vander Heide said he "took a lot of guff" from his colleagues over the "funny pattern of pixels" from early attempts. Instead, he changed the intensity of colors on the surfaces that appeared behind the windows, reducing intensity for outside views and increasing intensity for inside views.

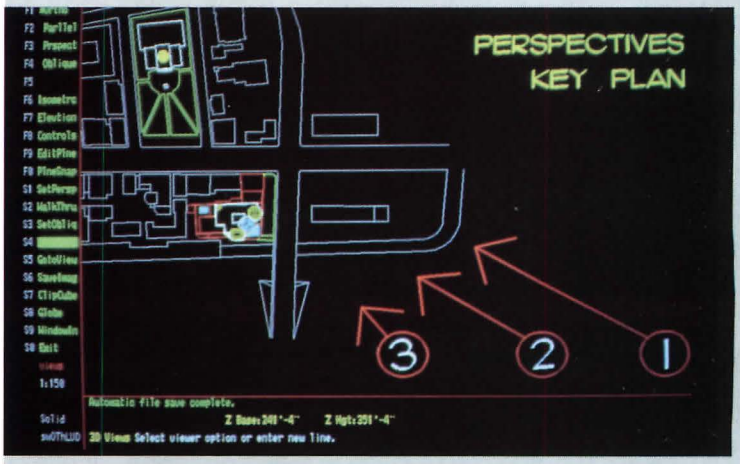
Micro-computer rendering has come far in the last three years (lower left). The office is shown first in wire frame. The middle image was rendered in AutoShade, which was introduced in 1987, and shows a typical example of flat shading by using a constant color on each surface. The bottom view demonstrates the lighting and texturing effects that are possible with Pixar's Renderman technology, which will be introduced to the PC market early next year.

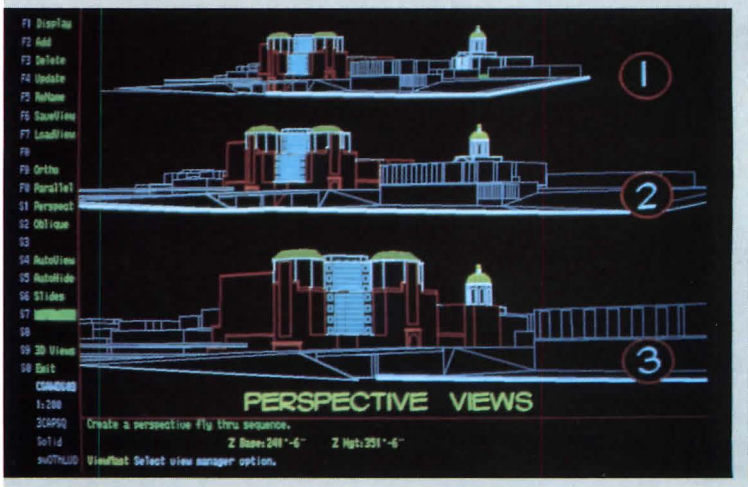
Lower right: Capitol Square, a mixed-use development proposed for Concord, N.H., violated by 10 feet a zoning regulation intended to preserve views of the state capitol. Through computer modeling in Datacad, the architects, McGowan Brook Reno, were able to get a variance. The three perspectives simulate views from a motorist driving south along the interstate highway in Concord. The submission also included computer-generated elevations and tray models built by pasting computer plots of the plans onto chip board.

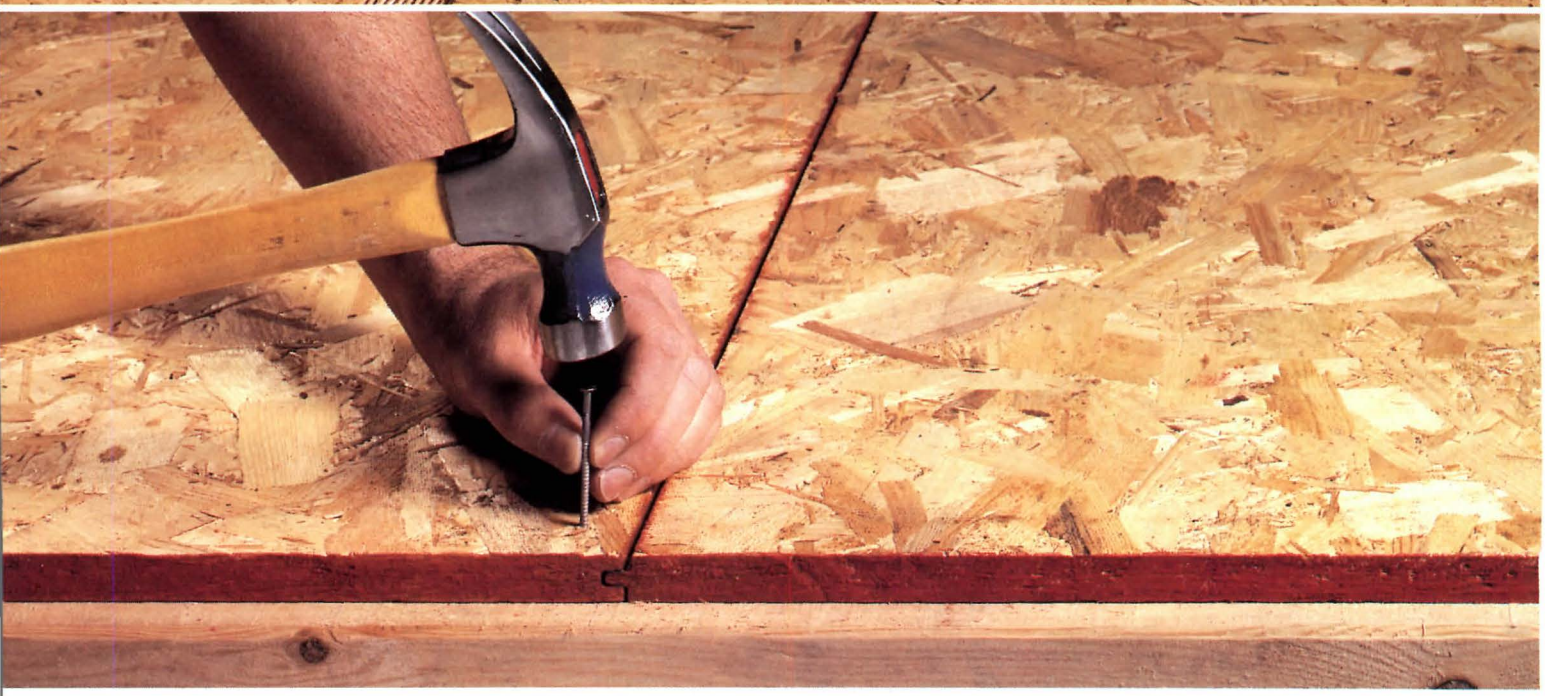
Left: Lewis T. Iglehart, AIA, Brooklyn, N.Y., uses Architrion II for illustration and design. He did both for a study of a lobby renovation in Newark, N.J., for Hartz Mountain Industries. Hartz wanted quick preliminary design ideas for prospective tenants. Iglehart gets rapid feedback sketching with the computer. For illustration, he prints out a viewpoint and sketches over the top in pencil or marker. The contribution of the computer is not obvious, as the lobby rendering demonstrates.











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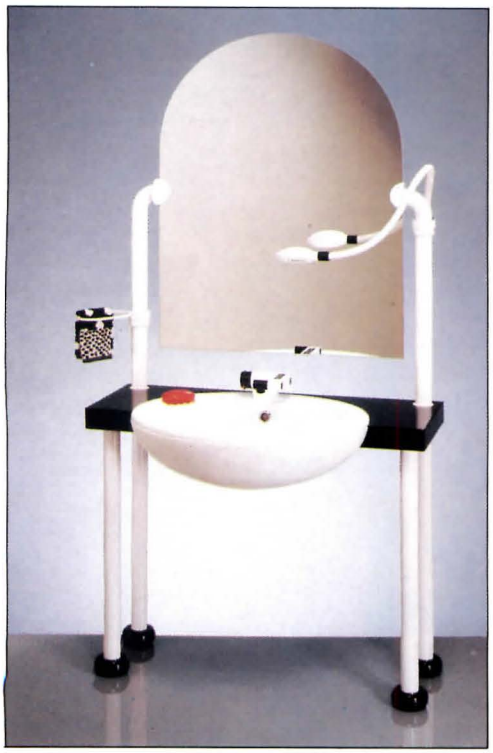
PRODUCTS

Bathroom Vanity
The Hastings Tile and Il Bagno Collection's all-in-one "Alien," bathroom vanity, below, has a white acrylic basin semi-cased in a glossy black lacquer countertop. Tubular legs support the countertop and extend to hold the floating arched mirror. A pivoting makeup light and towel ring connect to the supports on either side.
Hastings Tile and Il Bagno Collection
Circle 402 on information card



Large Format Pen Plotters
The Designer series of large format pen plotters, the 23000 A-D and the Z 4000 A-E, above, are available from Zericon Inc. The models will handle media sizes from 8½x11 inches up to 24x36 inches and 36x48 inches, respectively.
Zericon Inc.
Circle 403 on information card

Ergonomic Office Seating
The System 28 seating line, below, designed by Simon Desanta for Comforto, a Haworth Co., supports the user in a variety of tasks in either an upright or reclining position, and has a pneumatic-lift control for seat height adjustment. A wood trim is available with the executive model. The stacking chair, background in photo, flexes to mold to the user's body.
Comforto, A Haworth Company
Circle 401 on information card

Products is written by Amy Gray Light

VPI rolls out two great flooring advances.

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Circle 105 on information card

Coming to agreement.

Shepley Bulfinch Richardson and Abbott designed a multimillion dollar addition to a large medical facility. They specified a flooring they had used many times before for the operating rooms.

Shortly after installation, the floor began to bubble. The hospital was forced to close its operating rooms because of risk of infection, and was understandably upset at the loss of revenue. Although it was unclear what the problem was, the hospital wanted Shepley Bulfinch to side with it in a lawsuit against the contractor. The architectural firm was apprehensive that it would somehow get drawn into the suit, even though its relationship with the hospital was excellent. Shepley Bulfinch was also reluctant to line up against the contractor, since it felt the contractor had performed in a responsible manner and was actively seeking a solution to the problem.

Leo McEachern called Jim Raymond, DPIC's Eastern claims manager, and after some discussion of the situation, Jim asked if Shepley Bulfinch would be willing to try mediating the dispute. He explained the nature of the non-binding procedure. Leo said yes, and Jim put him in touch with a mediation firm DPIC has used successfully many times.

The mediation firm worked hard to assemble the parties to the dispute: Shepley Bulfinch, the hospital, the flooring manufacturer, the flooring subcontractor, and the general contractor. They met at 10:00 one morning in the architect's office. The mediator asked everyone to state his case individually in an open forum. He then met with each party in a private session. He suggested a settlement in which each of the parties involved contributed a proportionate sum toward the approximately $200,000 the hospital needed to remedy the problem. By 3:00 that afternoon, agreement had been reached, all parties were satisfied, and all that remained was obtaining releases from all parties. No lawsuit was ever filed.

Jim Raymond is manager of DPIC's Eastern Division office in Clifton, New Jersey. He has over a dozen years of experience in handling professional liability claims.

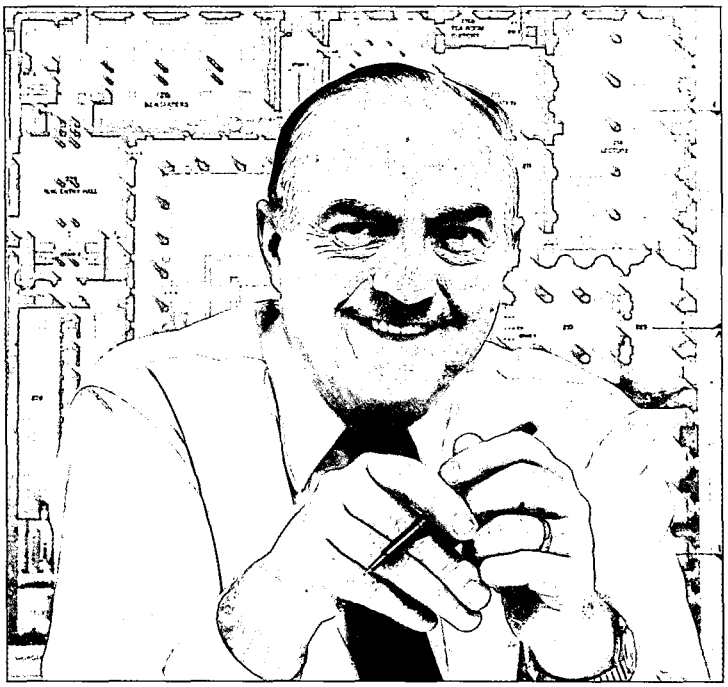
James Raymond

Claims happen. It's what you do when they happen that shows the stuff you're made of.

"Everyone went away reasonably happy. It was our first exposure to mediation and it was a good one. I can't speak for others, but I would certainly opt for mediation as a first try. If it doesn't settle, it doesn't impair your other avenues of action.

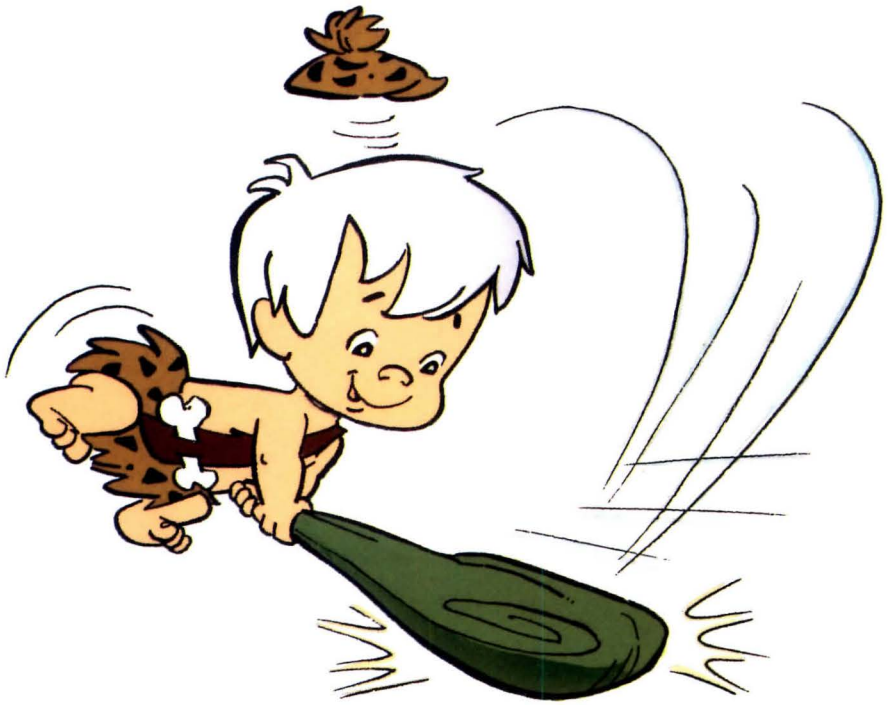
The mediation cost—in the range of $5000-6000 for all parties—was not a great sum when you relate that to the potential cost of litigation and all of the lawyers involved. Not to mention the time of the parties involved answering all the questions and providing documentation.

I meet on an informal basis every month with managerial people from some of the larger architectural firms in the greater Boston area, and one of the things we often talk about, of course, is professional liability and the trends associated with it. I notice that more and more of our peers are now in DPIC's stable. There is more of an awareness about DPIC, what they do and the benefits that accrue to the firm by going with DPIC. The educational programs, the loss prevention —they've all been very much interested in that. They are all faced with the same concerns that we have."

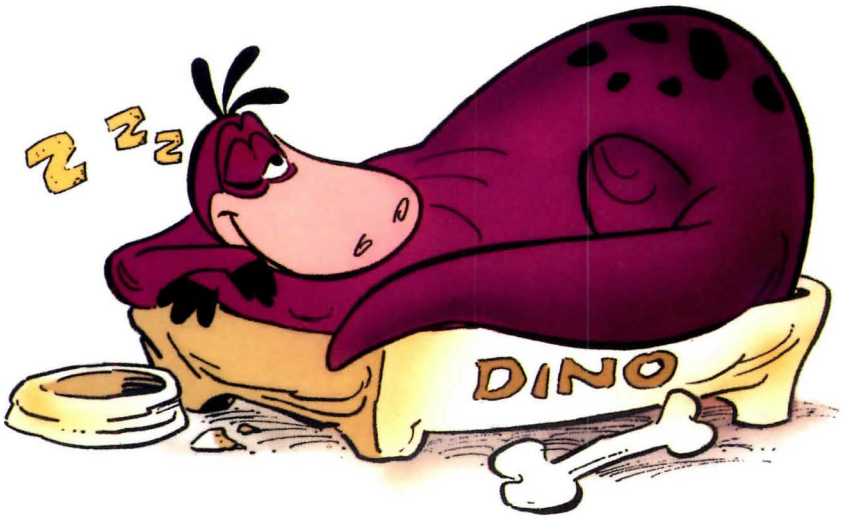


Leo McEachern

Leo McEachern is a principal in Shepley Bulfinch Richardson and Abbott, a 138-person, 115-year-old firm based in Boston, Massachusetts. He is responsible for the firm's financial and business operations. We value our relationship with his firm and thank him for his generosity in talking about an important subject for design professionals.



You just can't beat CarpetBoard for keeping things quiet.



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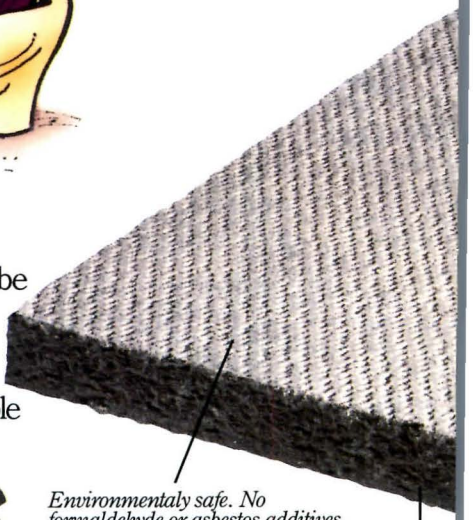


Environmentaly safe. No formaldehyde or asbestos additives.

Acoustically rated IIC 65 and STC 48 on wood subfloor/ceiling assembly.

Circle 109 on information card

Escape Path Lighting
Loctite Luminescent Systems Inc., manufactures Lifeline, an electroluminescent (EL) emergency exit path lighting system. The system consists of a flat, continuous strip of path lighting and exit markers and is designed for wall installation just above floor level. It is lighted only for emergency use when activated by a fire alarm, smoke detection system, or emergency backup system. A backup rechargeable battery is available.

Lifeline is made of long, flat, flexible lengths of EL lamp material sealed in lengths of extruded polycarbonate. Floor-proximity markers are sealed in glass-fiber-reinforced plastic. The light source emits an even glow across the entire length and breadth of the EL lamp, unlike the illumination from a typical incandescent lamp, which can be absorbed and diffused by smoke, making it difficult to detect.

Loctite is working with UL and building code groups to establish national standards for the system, which already meets California building code requirements.
Loctite Luminescent Systems. Inc.
Circle 419 on information card

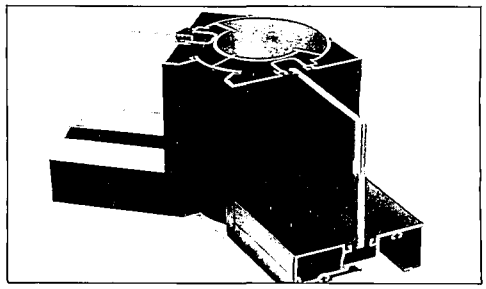
Wall Mirror System
Robern Inc., manufacturer of bath cabinets, introduces a wall mirror system called RE:Flect, which integrates arched or rectangular beveled mirrors with the firm's bath cabinets for a variety of designs. The system may be recessed or surface-mounted and uses a concealed and fully adjustable mounting device that can be used with all Robern series B- and C-style cabinetry. Custom widths are available.
Robern Inc.
Circle 408 on information card

Asbestos Management Software
A software program developed by InfoShare Inc. simplifies, structures, and maintains an asbestos management plan by standardizing input and building report formats and by keeping building records current by allowing editing, replacement, and correction of data.

The software program, called AMSS, or Asbestos Management Support System, runs on any DOS-based, hard-drive PC. The program produces and prints the management plan or required reports, including periodic surveillance reports, medical monitoring, short-duration and other operation and maintenance efforts, and fiber release episodes.

An unlimited number of buildings may be managed through the program. Demonstration disks are available upon request.

InfoShare helped asbestos management planners and school officials meet the requirements of the Asbestos Hazard Emergency Response Act (AHERA) for the nation's school districts.
InfoShare Inc.
Circle 413 on information card



Hinged and Flexible Mullions
YKK's Architectural Products division introduces two new products for its Storefront Systems: a hinged mullion and a flexible mullion. The hinged mullion adjusts up to 15 degrees, allowing for designs using curved and S-shaped walls. Mitering is not necessary. Because the angle is formed by rotation at the center of the glass, glass sizes do not change. The flexible corner mullion is available in both insulated and single-glazed storefront framing in both the YES and the YFL Entrance series. The YES Series is expandable from 93 to 170 degrees. The YFL (Fine Line Series) is expandable from 90 to 160 degrees. Manufactured of extruded members, the flexible mullions are watertight and may be interior-glazed. A standard 90-degree corner mullion for insulated and single-glazed framing is also available.
YKK Corporation
Circle 412 on information card
Products continued on page 153

Light without glare, continued.

This is the new Peerless 7″x 3″ Rounded fixture.

It uses the same breakthrough technology that distinguishes our Open Office Fixture, wrapped in a remarkable extrusion.

Note the slim profile, and how it distributes the maximum amount of light from the minimum amount of fixture.

Look around the picture. Try to find any glare or harsh reflections, on the VDT screen or anywhere else. See how smooth the light is on the walls and ceiling.

Then look at the sculptured end cap and the flared lens that gives the 7″x 3″ Rounded its unique cross section. The lens gives a continuous line of light—a soft, crystalline glow that's never darkened by a lamp socket or a fixture butt, never brighter than the ceiling above the fixture, and only available from Peerless.

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New optics, new form, new elegance

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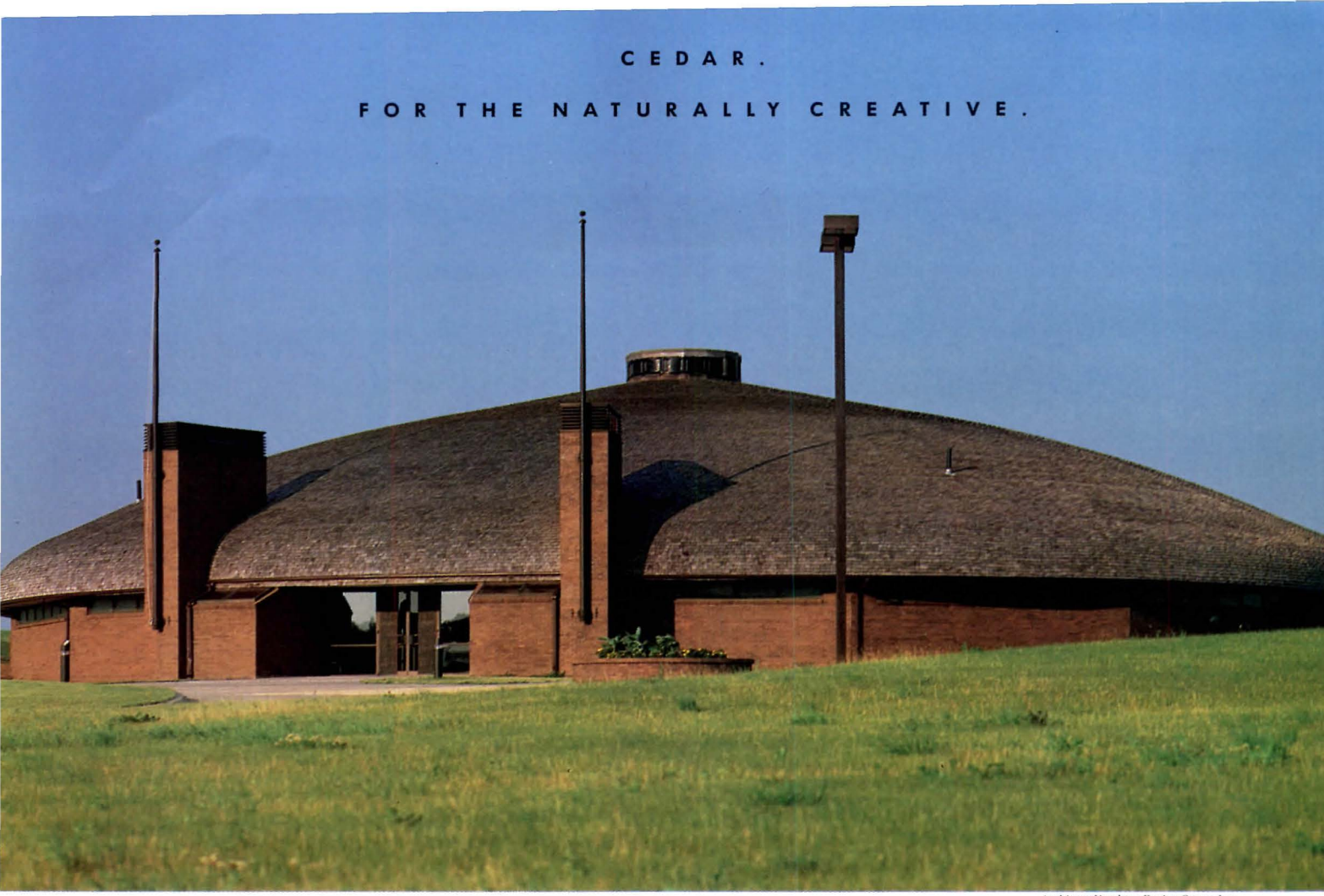
Circle 111 on information card

Faux Fresco Fragments
Douglas Bouman & Associates employs a stable of artists and technicians to create hand-painted reproductions and original faux fresco fragments in a cracked plaster finish (above) in a variety of sizes and formats, either as one of a kind or in a series. The fragments can be framed or bordered with plaster molding. Murals, friezes, or panels are painted on canvas in the studio and installed or are painted on location. Color sketches and renderings of elevations and reflected ceilings can be developed to assist the client in visualizing the end result. The company also specializes in *trompe-l'oeil*, faux finishes, marbleizing, stenciling, wall glazing, metal leafing, screens, hand-painted wall coverings, and polychroming.
Douglas Bouman & Associates
Circle 411 on information card

Fire Alarm Control Panels
Power-limited fire alarm control panels from Electro Signal Lab Inc. feature one-, three-, and five-zone capacities. The 1500 Series also has modular options to suit individual program requirements. The control panels accommodate Class A or B wiring. Standard features include a basic master board with system functions for alarm, supervisory, and fault monitoring, along with one initiating circuit and two signaling circuits for 24 VDC signals, and an integral battery charger. An additional feature is a dual-zone expander module, which provides alarm and fault indicators and LED's for two initiating zones. One expander module is supplied for the three-zone model, and two expander modules are supplied for the five-zone models. The panels may be configured with a number of different features to suit specific requirements. All models are UL-tested and meet various NFPA codes. The three- and five-zone models can provide sprinkler supervisory operation on one zone.
Electro Signal Lab Inc.
Circle 417 on information card
Products continued on page 155



Architect: Voorhees Design Group, Inc.

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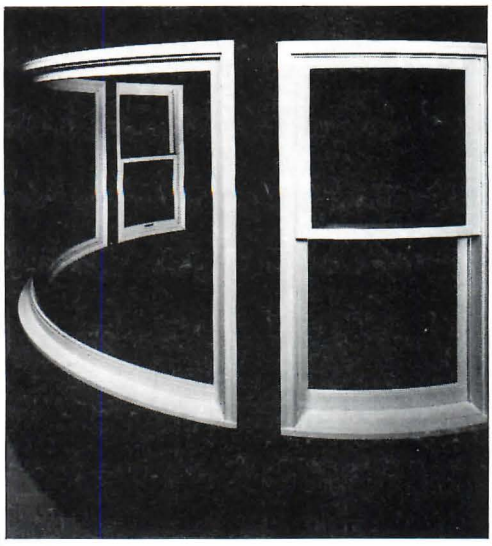


Bent Glass for Residential Windows
Marvin Windows now offers a new line of bent glass, wood windows for the residential market. The bent glass windows (above) are manufactured by the Dlubak Corp. and are available in either single-hung or picture-window configurations. Single-hung windows come in nine standard sizes; curved picture windows in 10 sizes. Additional sizes and products are in development.
Marvin Windows
Circle 404 on information card

Glass Products
The Dlubak Corp. manufactures custom-laminated bent architectural glass and architectural bent aluminum, as well as supplying curved glass, wood windows to Marvin Windows. Dlubak also produces single-piece, smoothly bent showcase windows in annealed, laminated, or insulated glass, and Deco Glass, which encapsulates fabric and other design material between two sheets of safety glass.
The Dlubak Corporation
Circle 405 on information card

Protective Treatment for Wood
Chesapeake Wood Treating Co. introduces Wood+Plus, a chemically treated wood that is designed to be termite-proof, rot-proof, and water-repellent. The wood comes with a 50-year guarantee.

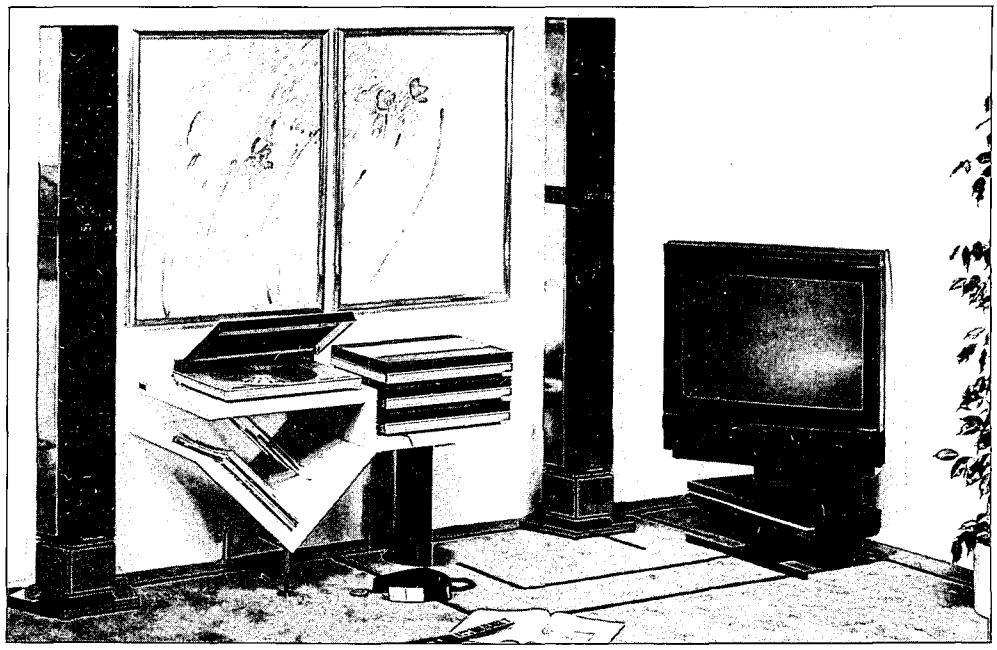
The Wood+Plus treatment penetrates to the heart of the wood. The hydrocarbon polymer water repellent enables it to bead initially when water is poured on it. Eventually the water stops beading due to surface wear, but the wood still remains water-repellent. The water-resistant characteristics also reduce the amount of water that can be absorbed into the wood. The wood can still be sanded, painted, stained, or glued if desired, and, because the treatment penetrates through to the heartwood, exposed edges still are protected. The wood is available in a variety of sizes and specialty products.
Chesapeake Wood Treating Company
Circle 424 on information card

Products continued on page 156

Glass Finishing Block
Pittsburgh Corning Corp. introduces EndBlock, a glass block unit with a finished surface on one edge. The block is designed for use with eight-inch-square, regular series GlassBlock products, in either the Decora or Vue patterns and features the same physical properties as the regular series. A horizontal application using EndBlock allows a uniform top course, while a vertical installation produces a compatible edge for GlassBlock partitions and walls.
Pittsburgh Corning Corporation
Circle 421 on information card

Plastic Coating for Glass
Shat-R-Shield Inc. specializes in plastic-coating glass products, from fluorescent lamps to laboratory equipment and glass lenses. The clear, flexible plastic is of a Du Pont material called Surlyn, designed to resist punctures and abrasions and to have a high-impact strength.

Among these products, Shat-R-Shield's fluorescent lamps come in one unit, ready for installation. They are reputedly energy-efficient because the coating does not insulate the lamp to avoid heat buildup and premature burnout. Because of the tight coating there is no air space where dirt, dust, and oils can accumulate. The lamps offer maximum light output, and the coating will not turn yellow.
Shat-R-Shield Inc.
Circle 423 on information card



Fully-Integrated Audiovisual System
Bang & Olufsen's Video System 5000 can be teamed with any Bang & Olufsen music system to form an audiovisual system. The system (above) works in one or more rooms, up to 16, in a house. Bang & Olufsen's Beolab Penta floor standing speakers and Beosystem 5500 are among the music systems that can be connected to the Video System 5000 for fully integrated, single remote-control audiovisual operation. The TV monitor, video recorder, and motorized stand occupy less than four square feet of floor space. A proprietary data-link bus allows components to communicate with one another, and an on-screen menu provides assistance, control, and programming options. The motorized stand rotates the TV monitor, and a favorite position can be programmed so that the monitor automatically turns to this position every time the TV is turned on.
Bang & Olufsen
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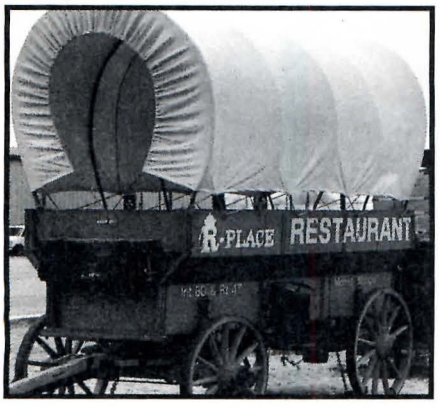

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Mount Sinai Hospital Medical Center, Chicago, Illinois

Chinn's Crab House, Wheeling, Illinois

Tropicana Hotel & Casino, Atlantic City, New Jersey

O'Hare International Airport, Chicago, Illinois

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Sloan OPTIMA® systems use electronic sensor technology to eliminate typical washroom worries. Fixture operation is on-demand and automatic—not left to user discretion. And the total "no-hands" restroom concept offers some very real advantages for today's buildings.

OPTIMA systems reduce water and energy usage—up to 43% in some applications. Daily maintenance requirements are reduced, too. And then there's sanitation. "Touchless" operation means users enjoy the highest level of sanitation possible.

OPTIMA systems meet building code requirements and install easily in new and retrofit applications. The line includes faucets, soap dispensers, faucet/soap dispenser combinations, flushometers, hand dryers, shower heads and more.

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Did you miss valuable information offered by advertisers in last month's issue of ARCHITECTURE?

The manufacturers listed below and on the following page were advertisers in last month's issue who are anxious to provide you with their latest product information and literature for your planning needs. To receive this helpful information, just circle the appropriate numbers on the adjacent self-addressed, postage-paid response card.

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