NC STATE UNIVERSITY COLLEGE OF DESIGN

The STUDENT PUBLICATION

volume 34

Explores the critical dialogue between ideas and designers.

GREATNESS IS EMERGENT FROM DIFFICULTY

These are difficult times. Design professionals are experiencing a period unlike any other since the Depression. Yet this is also a time when every sector of business and society is looking to the creative spirits among us to lead the way. We are most vital when new forms of practice spring from the passion, the irresistible urge to make and do. The designerly way of knowing is a passport to travel the many diverse roads of innovation and invention.

It has been observed that for a period of some thirty years in Italy under the reign of the Borgias it was a time of war, murder and bloodshed. The journey between towns was unsafe during the day and frequently impassable at night. It was a period when even the commerce between regions was difficult because of the unreliable exchange of wealth. The wealthy became wealthier at the expense of the poor and military power was intermingled with religious authority. Yet this was also the time of Michelangelo, da Vinci and the Renaissance, arguably one of the pinnacles of human existence. The accomplishments of these people in the most challenging of times not only dwarf others of the same period in places of tranquility but also challenge us to consider our contributions to world culture.

Certainly more is demanded of those who can see what does not yet exist. These are the individuals who will address our country's need for affordable housing, for the next generation of industry and for systems of information that do not only react to technological innovation but drive it. These are the individuals who understand that creativity in all of the design professions begins with openness to ideas and challenges of all kinds. And, these are the individuals who understand that genius emerges from the most difficult questions because the best design thinkers among us begin with the project to be addressed rather than a preconceived style. These are the individuals who have the ability to provide us with a special perspective about our time and culture. This is a perspective that will define us. It is this perspective that continues the rich legacy of American ingenuity.

The creative life will be measured by the willingness to explore, experiment and evolve. It will be measured not by a single project but by a portfolio of work. It will be measured by the enhancement of the lives of others. Time must be allowed for the fragile spirit to mature as mistakes are made and corrected. The contributions of the creative life emerge from the blossoming of dreams, the ripening of ideas and the fruits of realization. Greatness is struck from difficulty. The fruits that spring from the most difficult soils and unfriendly environmental conditions can be the sweetest with proper care.

Greatness emerges from difficulty but it is best addressed by a network of committed individuals from many interactive and complementary disciplines who work together for the good of all.

Marvin J. Malecha, FAIA
Dean, NC *State University College of Design*

The Student Publication Volume *34*
NC State University College of Design

The Student Publication of the College of Design
North Carolina State University
Marvin J. Malecha, Dean

"In Chloe, a great city, the people who move through the streets are all strangers. At each encounter, they imagine a thousand things about one another; meetings which could take place between them, conversations, surprises, caresses, bites. But no one greets anyone; eyes lock for a second, then dart away, seeking other eyes, never stopping."

—Italo Calvino, *Invisible Cities*

Great ideas are not born of the mind alone, in fact, they are not born at all. Great ideas are synthesized from the whole host of intellectual and haptic stimuli to which we are exposed. It follows then, that an increase in engagement with the world and other thinkers will foster a greater number of meaningful ideas. Every chance we have to engage artists, designers, scientists, philosophers, and all others who are involved in the creation and understanding of the world, embodies the potential for innovation.

Chloe is not a city of the dead, but a great city, as the author says, one on the verge of an explosion; for as imagined and possible interactions become real, ideas will take root in unexpected and seemingly unrelated places.

This volume of the Student Publication of the College of Design explores various instances of potential interaction relevant to architects. The work discussed here touches on a broad range of issues that fall on the periphery of the practice of architecture. These issues: ritual, material, community, and education, form areas of exploration in which there is the potential for expanding the boundaries of architecture. The articles presented here are proof of that potential. To foster this exploration is to foster the innovation which will ultimately expand the reach, relevance, and potential of the profession of architecture.

—Miller Taylor, Ryan Tevebaugh, Kevin Wade
Editors, The Student Publication: Volume 34

"A designer is an emerging synthesis of artist, inventor, mechanic, objective economist and evolutionary strategist."

—R. Buckminster Fuller

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OPERATING ON THE FRINGE

By Matt Miller

A return to citizenry, a strengthening of design activism through community engagement

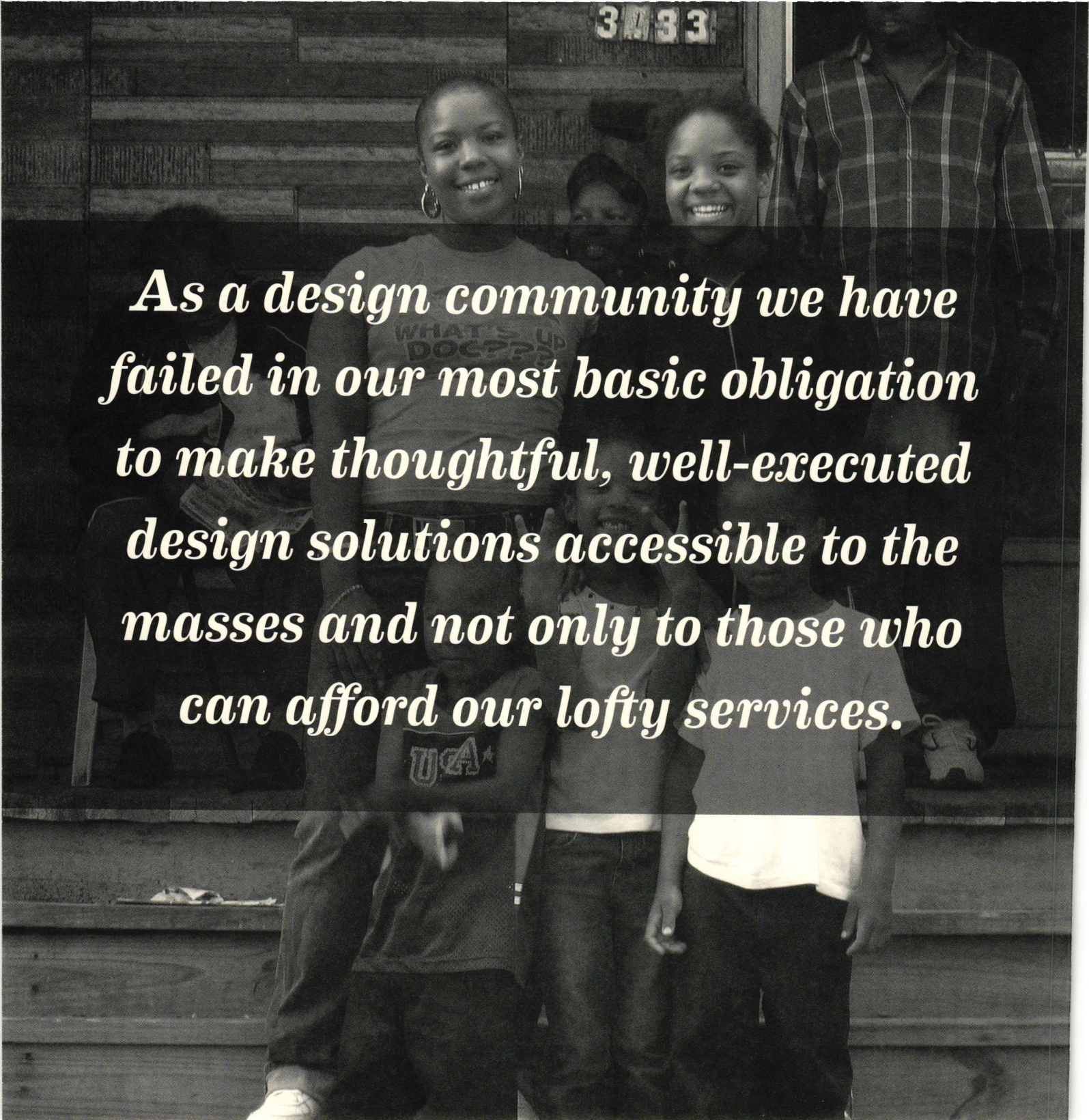
We must begin to understand the limits of design's ability to catalyze social change. Instead of simply designing for people, Matt Miller advocates working on the fringes of the architectural profession to gain a true understanding of a place and its social conditions. Only then can architecture evolve beyond the traditional "design-as-charity" model into something truly able to affect sustainable, social change.

—Eds.

Reflecting on the dilemma of the modern intellectual, Rem Koolhaus wrote: "Confronted with the masses, whom he admires theoretically, in the flesh, he suffers from an acute distaste. He cannot admit to this disgust; he sublimates it by identifying external exploitation and corruption as the reason for the masses' aberrations." So true is this statement of the architectural profession today that I have been forced to operate on the fringe of the establishment. It also explains why I believe so strongly that as a design community we have failed in our most basic obligation to make thoughtful, well-executed design solutions accessible to the masses and not only to those who can afford our lofty services.

We emerged from the darkness of post-modernism embracing new technologies in production, a younger, more savvy clientele, "starchitect" credentials, massive outlets for publication, and a renewed sense of entitlement in our position. We had again become shapers of modern culture and society, yet had lost all of the core values, ostensive as they may be, of the modernist movement in architecture. Fortunately, there have been a few great champions of the fringe who have recognized our neglect of the underserved and underrepresented, those who are fed up with our pandering to the bourgeoisie and who are exciting change within the student ranks. But there is a lesson to be learned from this work that must be taken in great earnest—for design with good intentions does not necessarily result in good design.

To prove a point I offer this case study: a single-family home, inspired by the work of Samuel Mockbee and the Rural Studio, sponsored by Architecture for Humanity, designed and built by my firm HousingOperative, and ultimately the fulfillment of my thesis obligation to Cranbrook Academy of Art.



As a design community we have failed in our most basic obligation to make thoughtful, well-executed design solutions accessible to the masses and not only to those who can afford our lofty services.

With its seemingly intractable challenges of unemployment, poverty, crime, school drop-out rate, homelessness, hemorrhaging economy, and concomitant despair and hopelessness, Detroit has become shorthand for post-industrial urban blight and anomie. Our site, 2126 Pierce Street, bore no exception. A vacant lot among vacant lots, once populated by a vibrant community of homes formerly known as Black Bottom, the neighborhood now resembles an urban prairie. Of the dozen or so structures remaining, four were known crack houses. Prostitutes strolled an adjacent street at all hours of the day. This was our hood, day after day, for nine months while constructing the first single-family residence in Black Bottom in over 80 years.

We designed and built the home for a single African American mother of four (two boys and two girls) selected from a pool of 30+ applicants. Construction commenced in April of 2007, and with the help of volunteers, architecture students from RISD and Cranbrook, a few neighborhood characters, and the occasional subcontractor, we had a Certificate of Occupancy just before Christmas and were able to move the family in on January 11, 2008. By November 15th of that same year we were forced to evict her by court order after she failed to meet the terms of our lease agreement.

The terms were simple enough and required only minimal reimbursement for taxes, utilities, and insurance ($400/month) over the course of two years, at which time ownership would be transferred to the resident at no cost. Our expressed goal was to help an under-housed family safely transition into a safe habitat by providing them the means to build equity, put a stake in the ground and gain a foothold on the generational poverty that is so widespread in Detroit. We failed, however, to recognize the burdens faced growing up among generations of poverty and tenancy, moving often from one rat-infested home to another while navigating the bureaucracy of the social welfare system. We failed to understand the effect this has on a person's self esteem and

*Looking down the vibrant Pierce Street in the 1960s (**top**) and the current state of vacancy (**aerial**).*

awareness of the world around them. We blindly assumed that giving a family a home would automatically make them responsible homeowners—that it would reshape their lives for the better and provide hope for the younger generation. We were wrong.

This is where I must talk about the limits of the powers of architecture, how design alone is not going to change the world and why, as I said before, design with good intentions does not always prove to be good design. When it comes to education we failed. This exercise proved to be a tremendous learning experience for us as architects, builders, and developers, but for the family we intended to help we hurt. By not educating her about the nuances of home ownership, by not helping to build a sense of pride and responsibility around that ownership, we succeeded in propagating this country's sense of entitlement and belittling the core values of the American Dream—that if you work hard and take responsibility for your actions you can achieve prosperity. Design is a holistic practice and does not begin and end with the drawing or construction of a home. It takes serious commitment to a place, the education of its people, and a thorough understanding of its social and cultural context to evoke real, sustainable change. Without a deeper, more systemic look at the consequences of our actions we may be doing more harm than good. Design is not charity.

I am advocating a return to citizenry, a strengthening of design activism through community engagement and not altruistic projects that put the end user as a distant beneficiary after we have fulfilled our own sense of "giving back." As designers and architects we must do a better job at putting the users' needs first and allowing our egos to take a back seat. My greatest fear is that these failures and miseducations go unrecognized and continue to happen in places like Detroit, New Orleans and Hale County, Alabama where deluded strategies of importing design talent to solve local issues are rampant.

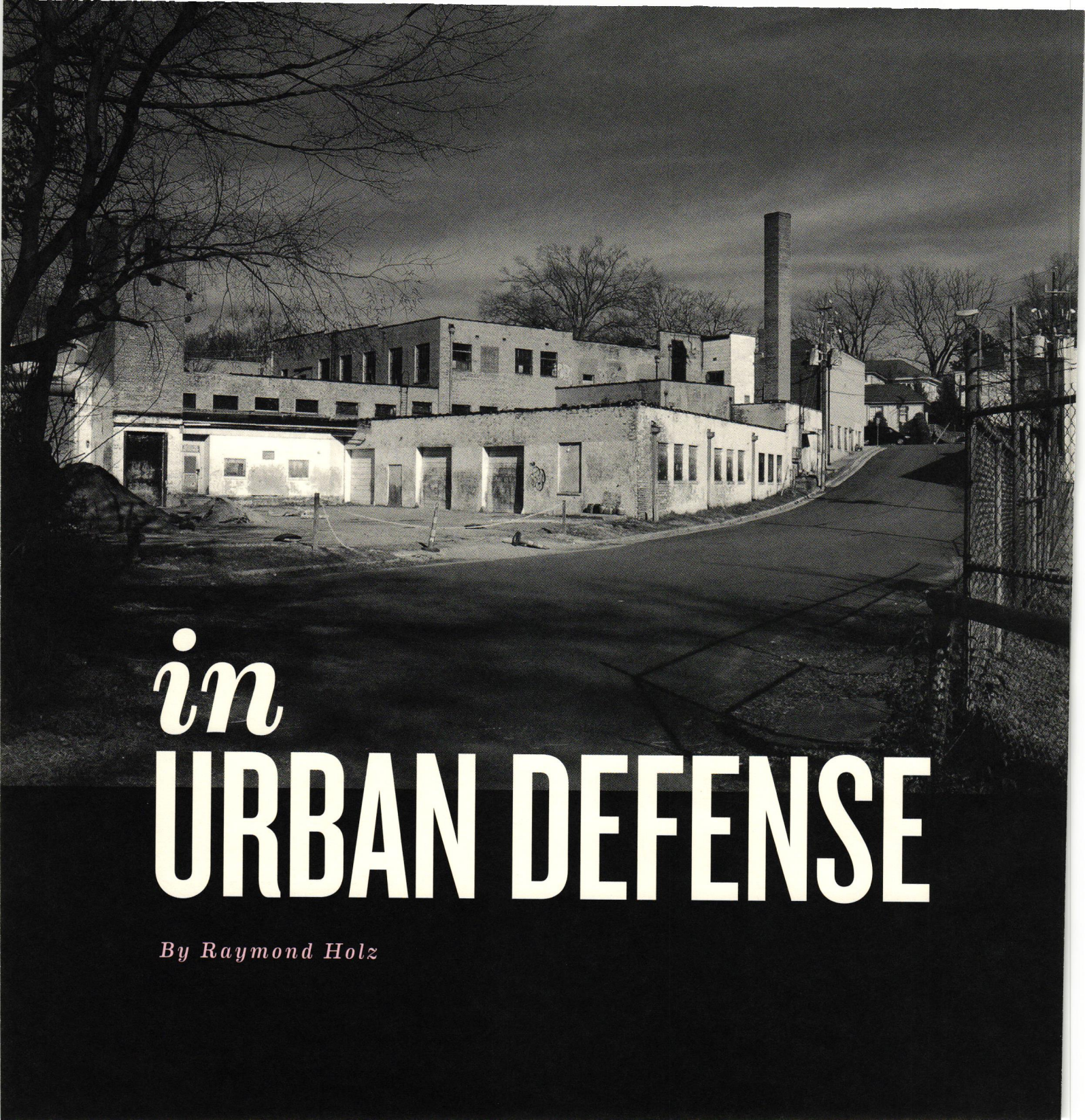
We succeeded in propagating this country's sense of entitlement and belittling the core values of the American Dream.

Working on the fringe requires adaptation. In the Fall of 2010, my partner Emily Pilloton (founder and executive director of Project H Design) and I will begin our latest professional redirection as we begin teaching a high school level design / build curriculum in Bertie County, the poorest county in North Carolina. Our goal is simple: to empower a generation of underserved students through hands-on design education and critical problem solving. Ultimately, our students will build a series of architectural projects within the county, fostering a renewed pride in the community to which they belong. These projects will serve as beacons of hope for younger students and transcend the popular trend of "design" in high school that is little more than glorified art with no significant impact. We are not in the profession of recruiting design students; we are providing a generation of students with the critical life skills to become leaders in their community by learning to communicate their ideas through the built environment.

I see this work as a direct reaction to 2126 Pierce Street, its shortsighted design goals and lack of deep local engagement. Teaching at the

Our goal is simple: to empower a generation of underserved students through hands-on design education and critical problem solving.

high school level in an impoverished rural community is the next step in rewriting what the profession is to me. It is not easy to operate outside of our comfortable cubicles or the monastic walls of academia; it is not easy to confront the masses, learn from them and work together to create the healthy, sustainable communities we all deserve. But change takes time; it takes commitment to a place, a recognition of past mistakes and an absolution of blind idealism and optimism. Working in the mainstream is easy; it requires little risk and even less effort to maintain the status quo, but if we are going to make any progress in this profession, it may take bucking the establishment and learning to operate on the fringe.



in URBAN DEFENSE

By Raymond Holz

Urban redevelopment cannot turn a blind eye to existing socioeconomic conditions. By doing so it fails to address the realities of urban life, and undervalues human capital in favor of economic growth. Raymond Holz provides a defense of urbanity, arguing that functioning communities should be preserved and improved upon regardless of economic bracket.

— Eds.

Recent economic interest in urban regeneration, redevelopment of existing city centers, is resulting in rapid transformation of urban and social fabrics. Common knowledge among urban professionals is the world migration from rural to urban centers. A trend that will likely bring 75 percent of the world's population into urban living within 50 years, creating immensely developed urban mega-cities.[1] By evaluating the effectiveness of urban regeneration projects on the improvement of economic, physical, social, and environmental conditions it can be said that current urban regeneration trends are insufficient in accomplishing these four conditions congruently. In the introduction of *Critical Cities*, Ricky Burdett stresses the realized gap formed between "those who inhabit and those who build the city."[2] Our opportunity for urban growth will occur as Burdett says, "in areas where poverty and deprivation are rife; where cities have the potential to either integrate or separate."

We must connect those who build cities and those who inhabit them.

The urban environment is left with a unique future. It has the greatest opportunity to develop into a more efficient community through its ability to satisfy a multitude of human needs. A critique of current urban redevelopment, 'New Urbanism,' yields the realization that our social need for a vibrant integrated city are not being met and are being compromised by the economic benefit of others.[3] The structural foundation of 'New Urbanism,' being mixed-use, three storey, stucco clad, cheap construction, yada yada...yields the obvious critique that homogeneity thrives in these new "communities." Urban practitioners cannot allow the gentrification of these present urban neighborhoods, with the creation of unintegrated and very separate neighborhoods. Urban neighborhoods are functioning working communities that serve a multitude of human needs, the necessity of public transportation, walkable communities, employment proximity, etc. Burdett's work continues to integrate urban practitioners with urban neighborhoods. As designers, our focus needs to be on the sociological workings of urban areas undergoing urban regeneration.

Designers who integrate sociological study and theory into their design process will undoubtedly understand the structure that exists in economically deprived neighborhoods which perpetuates the denial of social capital. As we know, urban neighborhoods will see future regeneration, and future urban growth must meet the needs of both current inhabitants and future residents. We must connect those who build cities and those who inhabit them by

*Descending towards downtown Raleigh, the lofts are an example of urban diversity that shouldn't be overlooked (**above**). Raymond Holz and Ms. Caroline, the neighborhood matriarch, chat about life around Ashe Avenue and always manage to keep the spirit of community alive (**opposite**).*

developing personalized growth that weaves existing economic, physical, social, and environmental conditions with future development.

Applying sociological analysis and theory to the urban environment is nothing new. Urban Practitioners like Kevin Lynch, Donald Appleyard and Oscar Newman have educated us over the last 40 years on urban form, livable urban streets, and personal responsibility for space. Current sociological theory can teach designers and allied professionals to become more aware of the urban environment, in terms of human needs and how social/physical environment can restrict individual agency. In his research Dr. Michael Schwalbe, of NC State's Sociology Department, discusses the process of personal social awareness as being "sociologically mindful."[4] Dr. Schwalbe's method of social awareness reveals the patterns that make our social & physical environment unique and subsequently the disparity that maintains our social world. He does this in terms of human experience, idea, feeling, desires, bodies, and habits.

It is during the design discovery phase that designers have the opportunity to integrate sociological theory and study into the design process. This idea culminated in my final design studio in the Bachelors of Landscape Architecture program at NC State. The challenge was to study sociological theory and apply it to my personal observation of a mixed socio-economically diverse neighborhood undergoing urban regeneration during the design discovery process. The site was a small neighborhood just west of downtown Raleigh running along the Northern portion of Ashe Avenue, where my neighbors include a 100 unit efficiency loft apartment complex, which houses stereotypical urban poor: drug dealers/users, the poverty stricken, and ex-felons. Single family homes are scattered among converted two and four unit apartments. Residents of the neighborhood include downtown municipal workers, architects, the homeless, college students, young professionals, and zany individuals.

Over the last three years I was able to connect with this neighborhood. My daily routine incorporated regular interactions with the people I lived around. My morningly, open front door, paper retrieval routine was always met with a five minute conversation with the local homeless man, Willy. Some days filling his water bottle out of the spigot, others just passing by, but mostly I greeted him as he greeted the day sitting across the street in the morning warmth. Although a habitual alcoholic, he was honest and told great stories. A master plumber and a self expressed simple man, he never wanted anything extraneous. A man who had found a simple neighborhood that satisfied all his human needs became a close daily friend.

It took an uncontested leap of faith between the neighborhood characters and myself, an almost blind eye to their economic status, in order to interact with them in their

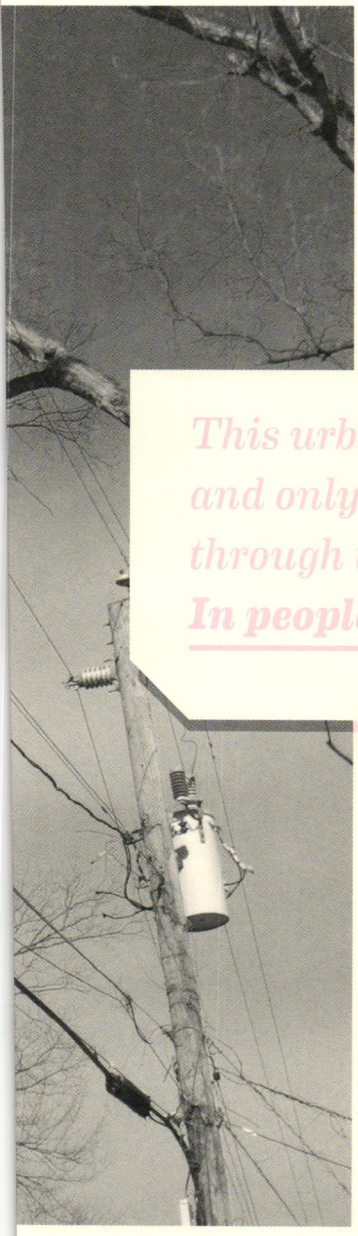
daily lives. I personally have a great passion for conversation, to meet new people, and hear their stories. This undoubtedly helped to close the gap between my social status as a middle-class, son-of-a-cultural-anthropologist, college student and that of the extremely low income residents of Ashe Avenue. A lot of this social interaction was forced upon me. The built structure of Ashe Avenue dictated a social environment, a true mixed use neighborhood with a corner store, restaurants, a bike store, hair salon, dive bar, and public transportation. Structurally a New Urbanite's dream neighborhood, a vibrant street with the constant activity of people coming and going. Front porches line the neighborhood, offset five to 15 feet from the sidewalk, culminating in a very strong sense of community. Everyone knows everyone.

There isn't a stronger case for neighborhood bond than in the heart of our neighborhood matriarch, Ms. Caroline. She has christened me her 'white son,' refers to us all as her 'babies,' and knows just about everyone on the street. I met Ms. Caroline near the end of Ashe Avenue's drug infestation. When I first moved to the street my home was framed on two sides by abandoned and condemned homes, serving as crack hangouts, homeless shelters, and trash bins. Within three months the lots were bought by a developer and the houses torn down, instantly thrusting

Ashe Avenue into a period of neighborhood regeneration. Soon other rundown homes were being bought by young professionals, repaired, and lived in, giving the neighborhood a strong sense of a working community.

The neighborhood always seems to help its own, helping each other by giving each other opportunities. One simple example is that I needed my lawn mowed but had no mower. Squirrel, another friend and neighborhood character who lives in the loft apartments, worked for a lawn company and had access to a mower; $10 every two weeks and my problem of needing my lawn mowed was solved. The neighborhood is always willing to share. The most humbling effect is that everyone benefits from this kind of mutualism. Everyone is served by the neighborhood, in its proximity to downtown, NC State University, and local public services. This is the precise reason that as urban designers we must understand the social fabrics that exist in the areas to be developed. Through my friendship with Squirrel I realized that although Ashe Avenue may have included drug users and ex-felons, much of the population lived there out of necessity. They absolutely needed to live within walking distance to stores, transportation, and family. Whether it is the blind man who knows he doesn't have to cross a major road to get to a bus stop or Ms. Caroline who needs to walk to get medication, there is a great population that is being served efficiently in the urban environment; much more is going on in our urban neighborhoods than drugs and poverty.

The urban design process is an intricate equation filled with unknown and uncontrolled variables that cannot be solved by a single model. Mixed-use neighborhoods with public transportation and services should be the base for urban regeneration projects. Planners



should focus on integrating existing socio-economics with future growth, and improving the existing economic, physical, social, and environmental conditions. The transfer of human capital is in the knowledge of your next door neighbor. The social problems that plague our urban areas can be solved by the structure with which we chose to rejuvenate our cities. We must design cohesive urban environments where access to social services are close and convenient, not ones that are socially divided by city blocks. The urban environment must achieve efficiency in terms of function. A more efficient environment that meets a higher number of human needs across all socio-economic levels must be our goal.

This urban defense has been one of immense personal change and only realized through the loving people of Ashe Avenue, through their gracious hearts and blindness to accept.
In people who have the least, I have found the most.

NOTES

[1] Nail, Deepa, and Trenton Oldfield. *Critical Cities: Ideas, Knowledge and Agitation from Emerging Urbanists*. London, UK: Myrdle Court, 2009.

[2] Ibid.

[3] Atkinson, Rowland, and Gary Bridge. *Gentrification in a Global Context: the New Urban Colonialism*. London: Routledge, 2005.

[4] Schwalbe, Michael. *The Sociologically Examined Life Pieces of the Conversation*. Mountain View, CA: Mayfield Company, 2000.

THE NEED *and* THE POTENTIAL

Architectural internships in public service

By Georgia Bizios, FAIA, & Katie Wakeford

"It is not prudent for the architect to sit back and rely on the corporate world, science, and technology experts to decide what problems to address. It is in our own self-interest to assert our ethical values and our talents as citizen architects."[1]

—Samuel Mockbee

The architectural profession currently undervalues public service. A greater availability of service opportunities for young architects will reorient the profession to better serve the public good and reach a wider audience. Georgia Bizios, FAIA, and Katie Wakeford propose the addition of new educational avenues for architects that would not only benefit their communities, but also provide them with important learning tools.

—Eds.

There is a critical need for the architectural profession to contribute more effectively to the public good. Although the profession has a proud tradition of public service, current levels of outreach and advocacy are insufficient in the face of such problems as the shortage of affordable housing, the destruction of buildings by natural disasters, and the environmental toll imposed by our built environment.

Many universities provide community engagement opportunities. Architecture students enthusiastically participate in service-learning studios, design/build workshops, and off-campus and study-abroad experiences focused on humanitarian issues. Unfortunately, graduates discover a scarcity of internship opportunities outside of traditional practice modes.[2] A recent estimate suggests there are fewer than ten public or nonprofit internships annually for approximately four thousand professional-degree graduates.[3]

The dearth of public service internship opportunities does a disservice to fledgling professionals, the profession, and our communities. Civic-minded interns are left without the jobs they most desire. The profession is denied an important opportunity to reach out to a wider audience. Most importantly, our communities miss out on a rich source of creativity, design expertise, productivity, and economic development. In light of the social, economic, and environmental issues facing us, we must create new public service internships so that our enthusiastic architecture graduates can apply their energy and skill to bear on these problems.

EXISTING MODELS

The most well-known public service internship is the Enterprise Rose Architectural Fellowship. Founded in 2000 and administered by Enterprise Community Partners, this program has supported 31 fellows working in partnership with nonprofits to create sustainable communities.[4] Hallmarks of this prestigious fellowship include a three-year term to allow sufficient time for building partnerships, a market-rate salary with benefits, and mentorship support. Nine fellows are currently working with nonprofit partners nationally. Up to 100 applicants are likely to apply for the three fellowships that will be awarded in late 2010.

Other models exist. DesignCorps, a nonprofit architecture firm in Raleigh, North Carolina, also offers internship positions through the Americorps Vista program. Fellows in this program design for underserved communities, frequently migrant farmworkers. Public Architecture, a design advocacy organization in San Francisco, offers highly competitive summer associate positions. If hired, students are required to secure funding from their school or another organization. Summer associates participate in all aspects of the organization's work, from web design and marketing to community mobilization and social justice research.

A few community design centers employ interns, such as the Gulf Coast Community Design Studio (GCCDS) in Biloxi, Mississippi. Under the leadership of Professor David Perkes of Mississippi State University, the GCCDS employs interns in its post-Katrina recovery work. The GCCDS functions like a traditional firm, but its design efforts are sustained by subsidies from state, federal, and private funders. Interns work on all phases of the firm's projects in an interdisciplinary context that includes landscape architects and planners, and they receive Intern Development Program (IDP) credits.

At North Carolina State University in Raleigh, the Home Environments Design Initiative, founded by Professor Georgia Bizios, supports interns with service grants. This program allows students and recent graduates of NC State's School of Architecture to earn competitive wages and IDP credits. The interns contribute significantly to the initiative's community partnership projects, and they receive a supportive, rewarding transition from academia to the professional world.

ENHANCED PROFESSIONAL TRAINING

Public service internships differ from traditional architectural positions in a number of ways. For instance, these programs emphasize participatory design skills. Participatory design requires cultural and social sensitivity and the ability to listen well and communicate effectively, both verbally and visually, with varied stakeholders. According to Katherine Williams, Rose Fellow 2005–2008, "One of the biggest aspects of the fellowship is learning to navigate between the needs and concerns of residents and the desires of [developers] who want to build in those communities."[5]

Asset-based development strategies are extremely beneficial for designers working in disadvantaged or underserved communities. "In contrast to the private design sector, where time is money, community design allocates adequate time to discover a community's strengths before the design process begins," write community activists Amanda and Seth Hendler-Voss, who participated in a Design Corps summer design/build.[6] The process of inventorying the strengths of stakeholders is a way of gathering resources and establishing a

project's context, but this process is typically not taught in the architectural studio.

Public service interns must also be prepared for the pace and tenor of community work. "One of the most valuable lessons I have learned is the importance of patience, persistence, and partnerships with other individuals and organizations," recounts Tara Siegel, Rose Fellow 2004–2007.[7] Projects often proceed according to stuttering schedules dependent upon funding cycles, volunteer boards, and nonprofit partners who are spread too thin. Interns must learn to accommodate schedule changes and relinquish expectations about when a project will be completed.

Fundraising and grant writing are critical components of public service work. Interns may need to write proposals for partnerships with nonprofits or participate in "brick and mortar" fundraising. The sobering realities of seeking money to execute a project will often encourage entrepreneurial instincts and financial savvy.

Interns also need to acknowledge their limitations. For example, familiarity with nonprofit management, finance, and real estate development would be advantageous, but it would be unreasonable to expect any one intern to be proficient across all those areas. The complexities of project delivery require professional collaborations. This kind of teamwork is not emphasized by architectural education, where young designers usually labor alone and must defend siloed proposals, but community work demands integrative skills and multidisciplinary solutions. Bankers and politicians are teammates, not adversaries. Negotiation and compromise are strategic tools. Design proposals improve as a result of community feedback, budget realities, and holistic project evaluation.

Clearly, public service internships stimulate the development of a broadened knowledge base and a diversified skill set. We believe these enhanced skills support quality design, ultimately allowing practitioners to be more versatile and nimble.

YES WE CAN

Several of the models of internships in public service architecture presented here can be replicated, in part or in total. For example, the university-based models seem particularly ripe for expansion. Many universities already consider it part of their mission to share knowledge and experience with their communities while providing students with real-world learning. Universities are well-positioned to seek funding for interns and to leverage faculty expertise for supervision. If, for example, every accredited school of architecture in the United States employed two interns supervised by one registered faculty member, this would be equivalent to a firm of more than 200 people working under the supervision of more than one hundred experienced professionals in the service of the nation.

Architects have too often been missing from the public policy table, and internship positions could provide a way to open new dialogues.

Private firms are also reinvesting in public service by providing free or low-cost services. These efforts sometimes lead to full-fee projects.

Traditional offices could establish internships that are specifically committed to pro bono (for the public good) projects. A half-time or six-month internship with such a firm could be a coveted opportunity that would still be manageable for an office to fund and administer. Such positions would attract, train, and retain valuable talent.

Municipal community development and housing departments would also benefit from the energy and skill of architectural interns. State and federal governments could profit from architectural thinking and the design perspective. Architects have too often been missing from the public policy table, and internship positions could provide a way to open new dialogues.

These models would foster much-needed growth of public service internships. Other venues are worthy of investigation, some of which would bring about a wider change in the architectural profession. Programs such as Teach for America and AmeriCorps Vista offer valuable precedents. The public health and legal aid systems provide intriguing parallels. It is important to note that intern architects in public service must be compensated with salaries and benefits close to market rate so they do not suffer economic hardship and to help make these positions prestigious opportunities that attract exceptional talent, regardless of economic circumstances.

For interns, the new types of jobs suggested here will offer vital design training and enormous personal reward. Work in public interest architecture provides diverse, demanding experiences that will prove beneficial in an intern's future career, whether in nonprofit or traditional practice. A recently published assessment suggests that the experience that public service interns gain — being entrepreneurial, working closely with clients, and producing high-quality design — makes them sought-after employees if and when they choose to work in traditional practices.[8]

Internships often influence the direction a student will take in professional life. If only a few public service architectural interns embark on a career path dedicated to meeting community needs, we will have reaped a significant benefit. If the rest maintain a public service ethic as they establish themselves in traditional practice, the ripples will expand, and the architecture profession will serve a wider audience and more effectively contribute to the public good.

This article is supported by a grant from the National Endowment for the Arts.

NOTES

[1] Samuel Mockbee, "The Role of the Citizen Architect," in *Good Deeds, Good Design*, ed. Bryan Bell (New York: Princeton Architectural Press, 2003), 56.

[2] Internship is the period of an architect's training between receiving a professional degree and completing licensure exams. Interns work under the supervision of a licensed professional and accrue training units in sixteen design/construction categories.

[3] Casius Pealer, "Nonprofit Work Experience: Beneficial for All, but Far Too Rare," *Architectural Record*, August 2007, 63–64.

[4] Enterprise Rose Architectural Fellowship Web site, http://www.rosefellowship.org (accessed April 2, 2010).

[5] Enterprise Rose Architectural Fellowship, "Fellow Profile: Katherine Williams," http://www.rosefellowship.org/fellows/byyear/katherinewilliams (accessed April 21, 2010).

[6] Amanda Hendler-Voss and Seth Hendler-Voss, "Designing with an Asset-Based Approach," in *Expanding Architecture: Design as Activism*, ed. Bryan Bell and Katie Wakeford (Los Angeles: Metropolis Books, 2008), 124-131.

[7] Enterprise Rose Architectural Fellowship, "Fellow Profile: Tara Siegel," http://www.rosefellowship.org/fellows/byyear/tarasiegel (accessed April 21, 2010).

[8] Casius Pealer, "Nonprofit Work Experience."

CHANNELING DESIGN

Advocacy planning to open irrigation canals in Puerto Rico as eco-tourism trails

by Jorge Rigau, FAIA, & Alberto Rigau

The ability to affect the built environment is not limited to architecture and planning. Designers must learn to use activism and community awareness to better the built environment. Using design to stimulate conversation, Jorge Rigau, FAIA, and Alberto Rigau re-imagine Puerto Rico's 80 year-old industrial canals as a public space, exploring the future possibilities of the island's industrial past.

— Eds.

How do you convince government, a rural community, the media, and the general public about the potential and beauty inherent to an 80 year-old water irrigation system that runs for over 35 miles in the north of Puerto Rico?

Through design.

In response to a public call from the local architects' association to submit projects for grant funding, a team composed of architects, landscape architects, urbanists, engineers, archaeologists, and a graphic designer was awarded $12,000 to design, coordinate and produce a pilot project aimed at articulating the contemporary possibilities of what today represents, undoubtedly, a key component of the island's extended, early industrial legacy.

The pilot plan was designed to garner support from government officials, institutions, and the general public for the development of these waterways as a key ecotourism attraction in Puerto Rico. Maintenance paths that run continuously next to the canals could today be refashioned as nature trails and made accessible to the general public, children, senior citizens, and handicapped people alike.

Still in operation since having been built in 1927, the system of canals comprises a group of diverse waterways and their complementary engineering components. These are "grafted" into the Puerto Rican landscape, sometimes fairly evident to passersby, occasionally disguised within the topography and encircling vegetation. As they spin along different routes, they traverse through meadows, hills, and forests, but also reach residential areas, schools, and heavily used roads. Many houses are flanked on their back by these silent streams. Most impressive is the fact that, since its inception, the irrigation system operates completely by gravity — an ode to human ingenuity and, of course, sustainable thinking.

The canals ("canales") travel across areas of varying micro-climate, flora, fauna, and views. Throughout the years, the local Power Authority has been in charge of their upkeep. Their relevance as water suppliers for agricultural industry and residential uses remains, to this day, undiminished.

After public access to these facilities had been denied for 80 years, one kilometer of canals was opened up for two days, attracting an audience of over 3,000 registered people,


POURQUÉ

including key decision-makers such as mayors, legislative officers and Puerto Rico's Interim Governor at the time. Wide media coverage and incessant inquiries and requests for reservations forewarned us about exceeding expectations regarding public attendance. Environmental leaders and university professors, cyclists, students, boy scouts... many ended up joining long lines of visitors from all over the island. Professionals, academics, architecture and landscape architecture students — as well as high school volunteers — joined to implement this on-site demonstration project, centered on a guided tour along the canal to make participants aware of the potential of these canals from which the island's natural landscape and its early-20th century industrial heritage can be enjoyed.

How did we go about it? Design, design, design. As participants strolled alongside the canals, they were instructed about the history, design, and implementation of the irrigation system, how it works, its cultural impact, and the changes endured by the neighboring rural landscape. A graduate student of Landscape Architecture and a high school student trained in Marketing and Tourism Interpretation led each group.

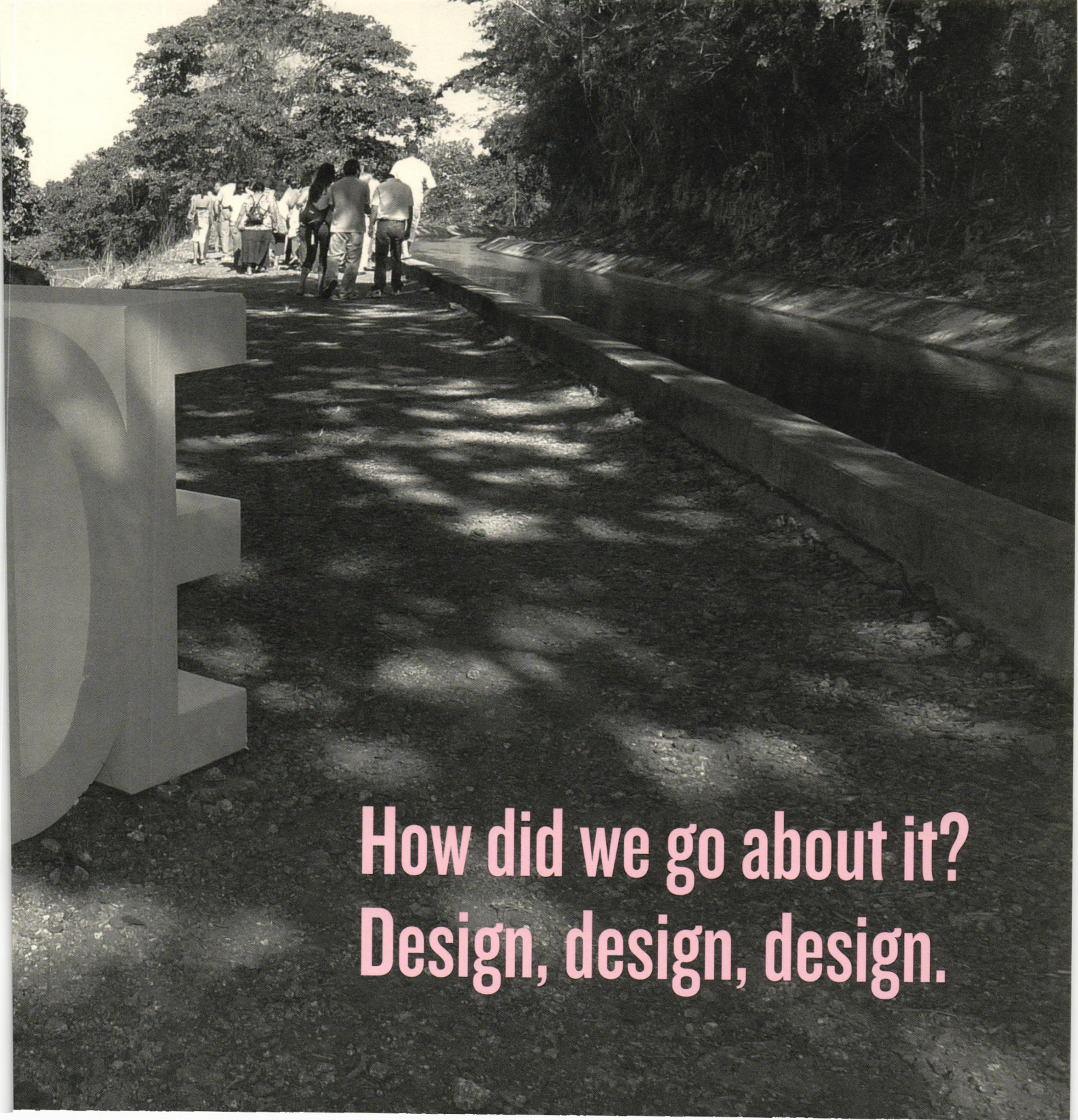
Over-sized words (made with environmentally-sensitive foam) were "sprinkled" along the route to underline key questions concerning both the system and the proposed project: *What? Where? How? Why? When?* Insertion of texts within the landscape through which the water canals run owes much to the reinterpretation of well-known precedents: Robert Smithson's site-specific works; Jenny Holzer's linkage of words to movement; Robert Indiana's super-sized treatment of typeface; as well as Dieter Kienast's joint validation of typographic strokes and counters, using the latter as windows unto the landscape. Elements that required a "footnote" from the interpreters were highlighted with an asterisk: a floodgate, a drinking trough, or a location at which a specific geological formation becomes evident, among others. An additional interpreter — this time an architect — was stationed next to each word; his/her job was to answer the question posed by the huge letters to all participants.

In endorsement of sustainable tourism practices, local involvement was integral to the initiative. Community members assisted in the organization, played host to the event, and offered bits of oral history, while walking alongside those experiencing the canal for the first time.

The day's experience was further enhanced by providing complementary information on the canal system: trees and flowers along the route, landscape features not to be missed, conservation concerns, and others. Participants were requested to fill an assessment form, freely formatted to accommodate ideas, concerns, and recommendations. Upon completing the forms, each person received an informative brochure urging to action.

Advocacy is often linked to public demonstrations, more than often committed to stop something from happening. In our case, we chose to demonstrate otherwise: How something can, in fact, happen. Letters of support have started to come and decision makers — already engaged — have invited us to sit and dialogue about opening up the canals to the public on a year-round basis. This is what we designed to happen.

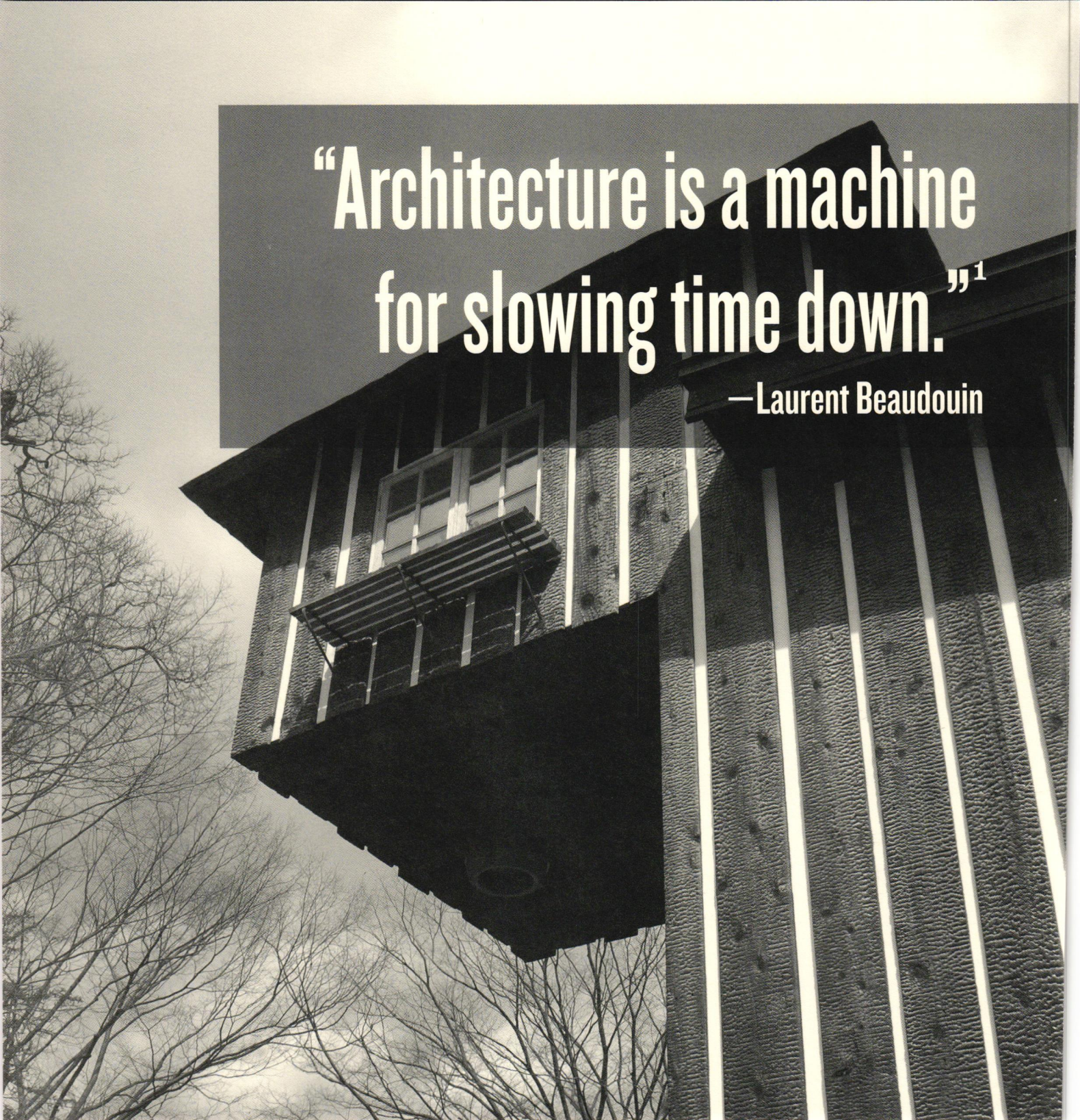
View along the irrigation canals that divide the Puerto Rican landscape. Large, graphic installations placed along the paths asked provoking questions about the future of the canals.


How did we go about it?
Design, design, design.

MAKING SMALL BUILDINGS LARGE

Ritual in architecture & construction

By Dana Buntrock


"Architecture is a machine
for slowing time down."[1]
—Laurent Beaudouin

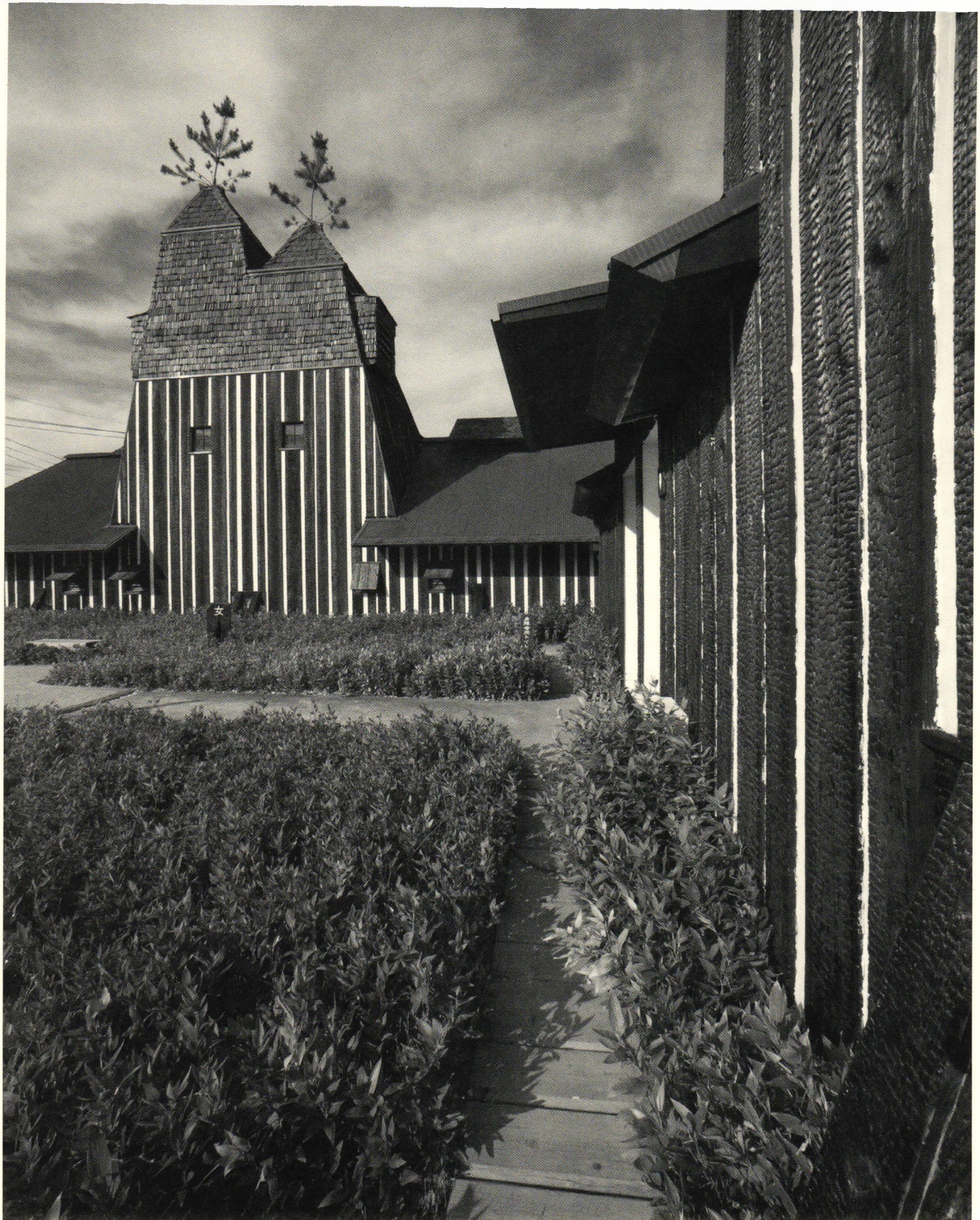
Ritual can manifest itself in the things we create and use. It allows us to slow time and gain a greater understanding of our world. The use of ritual in the construction and habitation of contemporary Japanese architecture serves to engage clients and bonds them to the building in a meaningful way. Ritual provides the opportunity to create an architecture that stems from a larger social consciousness.

— Eds.

Some time ago, I arranged for a group of students to witness a ceremony in the U.S.: ironworkers, architects, and clients signed the last steel beam to be attached to a structure, one decorated with a flag and a small evergreen tree, and it was raised into place. The acts of this "topping off" ceremony are, as is often the case in rituals, a combination of unfamiliar gestures and those that heighten or exaggerate familiar activities. I had arranged for the students to see the concealed but quotidian moments involved in installing a beam, but, as novices unfamiliar with the event, they focused on the peculiar absurdity of the "Christmas tree."

The reasons for a topping off ceremony are only loosely agreed upon (good fortune for future inhabitants, workplace safety, etc.). Few seem to actually believe it will have any effect at all — but the ceremony nonetheless remains commonplace. In fact, throughout the world the two most important ceremonies in construction probably remain the groundbreaking ceremony and some sort of topping off ceremony.[2] It is interesting that both these enduring construction rites occur during construction, with more flexible and less ritualized ceremonies held at the moment a building is completed and danger is past.

Scholars suggest two key reasons for maintaining rituals: marking significant life moments and reinforcing community ties. The groundbreaking and topping-off ceremonies endure perhaps because they underscore ties a client, and society, have to the building at the point when the structure remains an abstraction. And while the ostensible reason for a topping off ceremony may be courting good fortune, at a deeper level, it also reinforces bonds between the design/construction team and clients.



However, while the ground-breaking and topping off ceremonies remain exciting to those unfamiliar with the ritual (such as clients or my students), the architects and contractors who participate regularly are often inured to their effects, and the ceremonies thus are potentially of less value in forging bonds than they once might have been. It seems to me also that the arid formality of these ceremonies in Japan, with greater emphasis on the correct angle of a bow or well-coordinated clapping by a group, can prevent unaccustomed participants from transcending action and causing them to remain emotionally impacted by the ritual.

Furthermore, while it makes sense that construction rituals can strengthen interpersonal relationships,[3] architects are often dismissive of ritual. Scientific knowledge replaced the naïve hope that an evergreen tree attached to a beam might assure anything, and industrialized societies shrugged off their rituals; people who are highly educated and identify themselves with scientific knowledge are the first to question such ceremonies, especially when acceptance might challenge scientific expertise. Interestingly, the University of Tokyo professor and noted designer Terunobu Fujimori shows no such qualms, encouraging ritual-like practices during both the construction and the inhabitation of his buildings. Fujimori, however, must walk a tightrope no less challenging than a floating steel beam being installed at a topping off ceremony, mediating between the scientific rejection of ritual by his educated peers and the rigidified nature of many rituals in Japan. In truth, the study of ritual in Japan has become such a romanticized feature of anthropology that I am almost reluctant to mention this issue in Fujimori's work—and yet Fujimori has discovered lessons worth closer study.

INVENTING RITUAL

Anyone who spends much time on Japanese construction sites will become aware of irregularly practiced moments that involve ritual. At the technologically sophisticated Sendai Mediatheque, for example, the initial installation of the remarkable steel tubes was rescheduled after it became apparent that the planned day was marked as *sakimake* within the Buddhist calendar, suggesting one would begin with a loss. (Intriguingly, as I describe in my 2001 book, *Japanese Architecture as a Collaborative Process*, the tubes did indeed involve significant set-backs early on in construction.) And at the construction site of a university building in Saitama some years back, I was asked to remove my hardhat so that a lion mask could be shaken over my head, then I was given sake to drink—something that I found particularly odd first thing in the morning on a construction site. This latter ceremony was one many others on the site were also unfamiliar with, a ritual the community insisted upon.

The openness Japanese builders hold towards ritualized moments not encountered before easily accommodates the introduction of new ritualized practices. In this context, Fujimori has added activities to the construction of his projects which are clearly secular in nature (thus more suitable to his educated cohort), especially activities related to the acquisition and modeling of an aesthetically important column. Just as my students showed heightened awareness of the components of the topping off ceremony that were unfamiliar, Fujimori may in this case be encouraging mindfulness among those participating through introduced ritual practices interwoven with conventional ones. I do not think that he consciously embarked on the establishment of new construction rituals to be repeated at subsequent buildings; these practices evolved over time.

In his first building, *Jinchokan Moriya Shiryoukan*, Fujimori referenced highly formalized rituals associated with Suwa Shrine, as a way of indicating ties between his modest structure (intended to exhibit religious artifacts) and the more hierarchically significant shrine. In retrospect, this was a crucial moment. Fujimori was forced to reconsider the original form of established ritual and borrow less obvious, more accessible, symbols and practices which still had the potential to remain recognizable. The Suwa Shrine's *Onbashira* Festival is probably best known for the dramatic moment when hefty logs begin a downhill plummet to the shrine, a ceremony called *yamadashi*. Yet an imitation of this iconic moment would involve not only potential damage to Fujimori's more delicate timber (and perhaps extensive preliminary working of the hillside), but also had the potential to be only a rather

*Fujimori preparing the cedar boards to be charred (**above**). The process reveals Fujimori's ritualistic approach to his buildings (**opposite**).*

absurdly tiny simulation of a highly regarded event, more farcical than effective. Fujimori instead wisely incorporated modest but still familiar gestures, such as implanting a notched piece of metal in the shape of a bird (called a *nagigama*) in selected timber, a gesture used at the *Onbashira Matsuri* to indicate that the selected trees are sacred.

Furthermore, while initially the act held no specific ritual value, Fujimori chose to collect logs from property near the construction site, on land his family had rights to, for practical reasons. (It was free, suitable, and nearby.) In his second project, Tanpopo House, wood was again collected from this site; over time, it has become symbolically important that Fujimori repeatedly collects timber from the same area. By using the hillside to which he has familial rights, he reinforces easily understood ties between his household and each new building, and also between his family and those from the client's circle who participate in selecting and finishing the timber. He has thus brought many clients to his birthplace, and client and designer together select a tree to be cut, the timber to be used for a building under construction elsewhere.

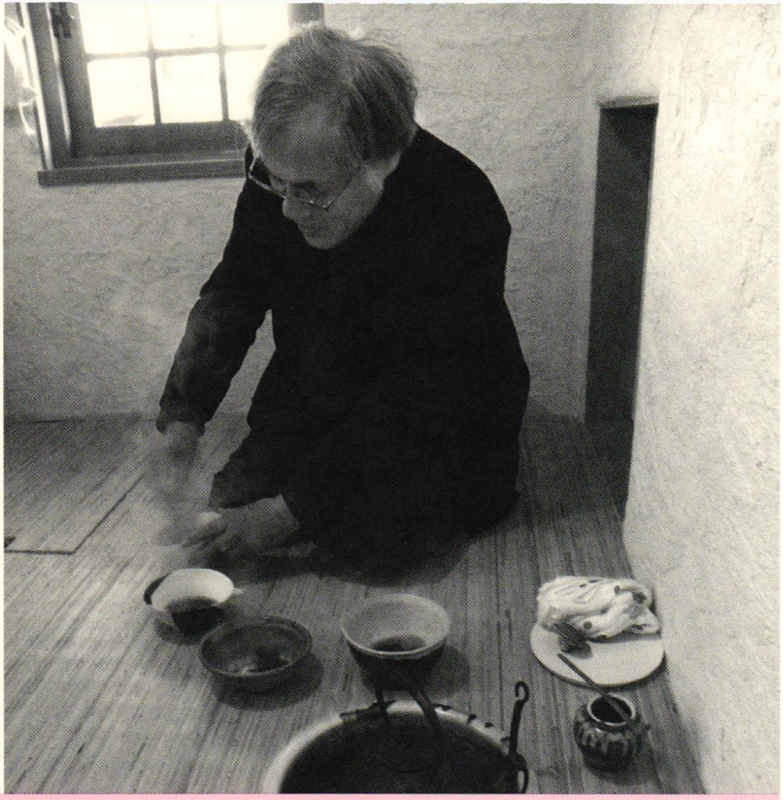
The logs are most often used as an aesthetically distinct and spatially highlighted column, possibly referencing the traditional *daikokubashira*.[4] Often, Fujimori and the client (or the client's family) roughly carve the log into its final shape, binding client and constructors together through ritual-like practices at an early stage of the construction process. In at least one case, this act of binding those around the client to Fujimori also appears to have led to a new commission; the son of the elderly artist Akino Fuku worked a column in the museum Fujimori designed in her name on her behalf (as she was nearing ninety at the time, and it was suggested she might not be able to weild a chainsaw). Ultimately, he commissioned a teahouse by Fujimori, Kyoto's Kuan.

This invented ritual establishes trust between designer and client at a crucial moment; in addition, I think the sense of playfulness embodied in Fujimori's ritualized reworking of the column also has the benefit of

making clients take a more open and playful attitude toward the design of their building. Sociologists point out that rituals of role-or status-reversal can lead to a giddy shaking off of inhibitions; clearly the act of imitating the laborer or craftsman, complete with the appropriate clothing, offers Fujimori's educated clients just such a role reversal.

While the use of uniforms and role-reversal at specific moments of construction presents more to discuss than I can take on in this brief essay, there are other examples to be considered in Fujimori's work; I would only briefly note that many of the actions of the *Jomon Kenchiku-Dan* might be analyzed as ritualized performance, and that artists who have similarly ritualized performance share with Fujimori an effort to make all people involved participants in the event, rather than observers. Furthermore, many of Fujimori's former clients participate in the construction of subsequent structures, not only strengthening and maintaining their ties to Fujimori, but also tacitly encouraging a new client at a crucial stage of construction.

Once Fujimori's buildings are completed, his use of ritual shifts—yielding different, but equally interesting results. Most people familiar with Fujimori's output are probably aware of the significant number of tea rooms and teahouses, so it is surely not surprising that upon inhabitation of these spaces, one is often greeted with a breezy version of the tea ceremony. (In fact, Fujimori's use of informal tea ceremonies predates his design of spaces to accommodate them; I can remember him hosting me in just such a highly abstracted version of the tea ceremony in the early 1990s.) The visitor to his buildings—whether structures explicitly designed for tea such as



"For the most part, architects have abandoned ritual."

Takasugian, or projects such as his own home and a recent, teahouse-like entrance foyer for his parents — will find themselves participants in a ritual at once familiar for its references to the traditional Japanese tea ceremony, but also highly altered. There is little emphasis on one's position in a space or society, and in fact the tearooms that Fujimori has designed cleverly undermine the hierarchy of up/down or guest/host found in the traditional *chashitsu*. There is no *tokonoma*, and the pinched form of the single entrance, used by both host and guest, prevents it from spatially impacting participants' reading of interior hierarchy. In Fujimori's abstracted ritual, gestures are casual and unpretentious; the conventional choreography found in the Japanese tea ceremony — bowing, admiring utensils, or engaging in prescribed actions such as turning and wiping bowls — have no place.

Nonetheless, Fujimori's are recognizably tea spaces for tea ceremonies, supporting the heightened act of sitting together in a small, carefully articulated space, enjoying a sweet and sipping whisked tea from a bowl. Fujimori has appropriated aspects of the tea ceremony with the same care taken when he considered the stages of the *Onbashira Matsuri*. As one example, his tiny teahouses are used infrequently and rarely have mechanical means of lighting or heating them. Thus prior to a guest entering the space, the host takes the time to prepare it, sweeping out insects and cobwebs, and bringing charcoal inside to create a source of heat in the winter. If you have arrived with Fujimori, he will require you to wait outside — and while he has not yet begun to build convenient little benches for one to linger, this moment of waiting does decelerate momentum and establish a break between the pace of the outside world and the interval set aside within. As one slows down, one also focuses more deeply on Fujimori's architecture — there is little distraction, in my experience, as Fujimori has no interest in garden design or secondary structures. Similarly, Fujimori does not add frippery such as a hanging scroll or a flower inside; as a result, one instead becomes conscious of the details of the architecture. A small knot in the wood, the gentle swell of plaster, and the beauty of bubbled glass — each are highlighted.

Shortly before writing this essay for a Japanese journal, I visited the exhibition *Nihon no Gendai Jutaku* [Japan's Modern Houses] at Gallery Ma.[5] Frankly, I was first charmed and

then mystified by the inclusion of Fujimori's "Too Tall Teahouse" (*Takasugian*) in this collection of iconic residences spanning 20 years. It is hardly a house. I would propose, however, that it is the manner in which the ritual inhabitation of Fujimori's buildings slows time and demands a greater awareness that has caused his tiny structures to be enthusiastically acknowledged by the architectural community, even when other lovingly designed diminutive structures have been overlooked.

I indicated earlier that, for the most part, architects have abandoned ritual. Fujimori, in contrast, is unconcerned with the values of the profession as such, and instead holds much in common with those artists who invoke performance and ritualized play. I see parallels, for example, in the extraordinary scrap wood secular temples initiated by the San Francisco Bay Area artist David Best and built for many years at a West Coast festival called "Burning Man."[6] Over the course of a week, people filled each temple with mementos of loss; on the final day of the event, the temple was burned to the ground in a moving ceremony of loss, purification, and healing. In my highly secularized West Coast community, where people have lost the rituals that mark important life passages, the temple builders of Burning Man found a way to fill that void. Perhaps in Japan, where lack of faith does not prevent one from turning to shrine and temple for rites related to birth and loss, it is more acceptable to revive and reestablish the fading rituals which bond people together.

NOTES

[1] Laurent Beaudouin, "Manifesto for Slow Architecture," A+U, March 1998, p. 4.

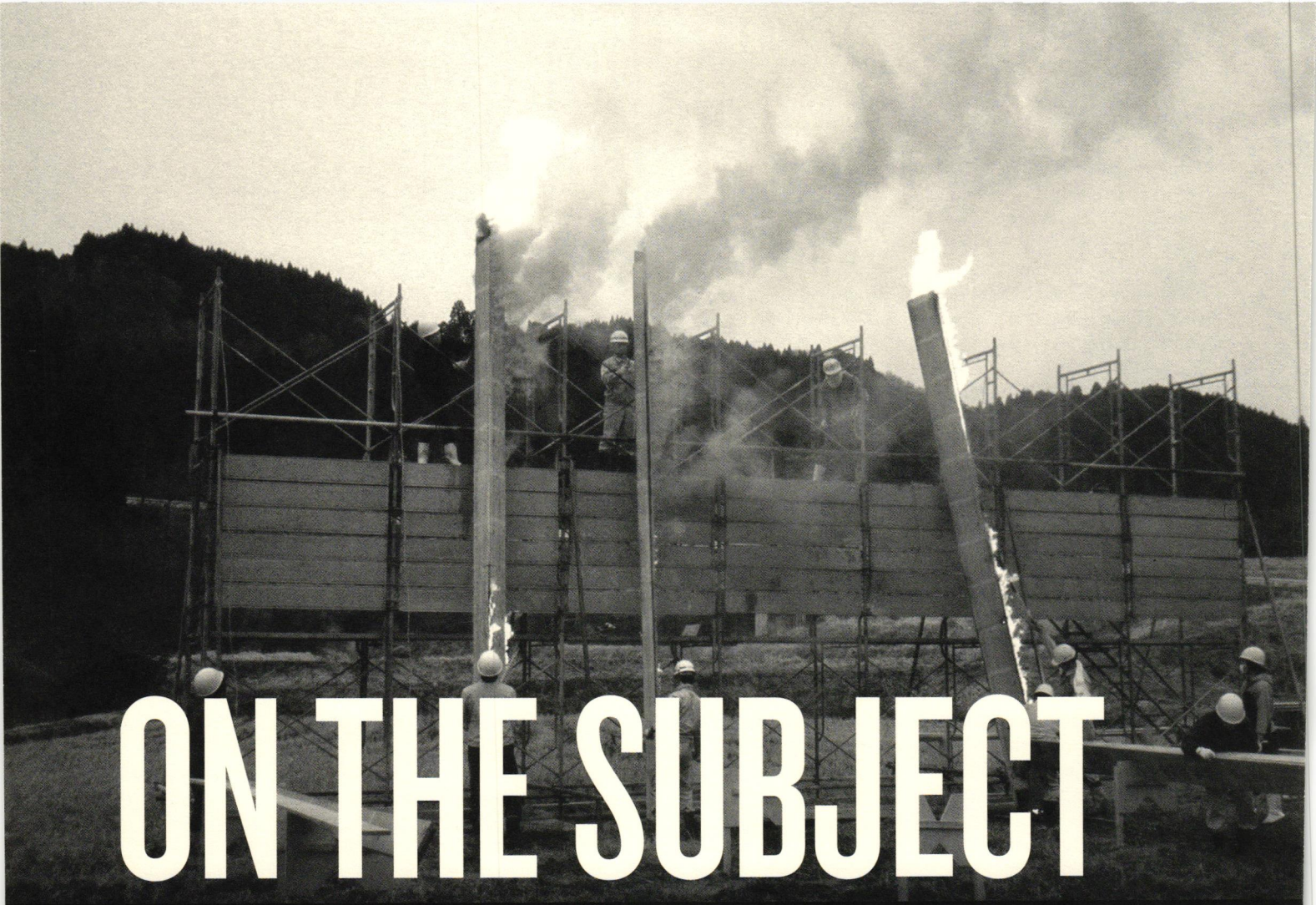
[2] In Japan, the ground-breaking ceremony is called the jichinsai and the completion of the building structure many be acknowledged by a ceremony called muneage or joyoto shiki.

[3] Those in the construction industry, facing a high degree of danger on a daily basis, may also be unwilling to abandon rituals in countries where some sense of omnipresent gods remains (such as Japan), as subsequent accidents would surely be ascribed to the absence of appropriate ritual acts. I want to thank Terunobu Fujimori for making this point in a review of this paper.

[4] I find it notable how often Fujimori incorporates an avatar-like freestanding column in his relatively tiny spaces; it is only with the recent Kuan, Takasugian and Chashitu Tetsu that the column has again moved to the exterior of his structures.

[5] "Chiisa na Tatemono wo Ookiku Suru Koto/Making Small Buildings Large" Inax 10+1 (Special issue: Fujimori Terunobu: Houhou to shite no Aruku, Miru, Kataru [Terunobu Fujimori's Methods: Walking, Looking, Talking]) 2006 October, no. 44.

[6] For more on the ritual nature of Burning Man, see Gillmore, Lee and Mark Van Proyen, *Afterburn: Reflections on Burning Man*. (Albuquerque: University of New Mexico Press, 2006). David Best is not involved in the temples built today, having turned this effort over to Mark Grieve and the "Temple Crew," but he continues to build temples elsewhere, beyond the confines of Burning Man.



ON THE SUBJECT OF CHARRED WOOD

By Terunobu Fujimori • Translated by Dana Buntrock

Materials gain meaning from the processes used to create them. Terunobu Fujimori continues the tradition of charring wooden boards for architectural construction, taking great care in the creation of the carbonized material. The process blackens the cedar siding, the boards becoming both the fire's chimney and fuel.

— Eds.

In Japan, one architectural craft you may still find is that of charring the surface of boards, which are then applied to a building's exterior. The result is often called "*yaki ita*" ("charred boards") or "*yakisugi*" ("charred cedar"). The reason for this craft is that it increases durability; specialists argue that a board that might not last even 20 or 30 years normally can, without a doubt, last 80 years when treated this way. Outside of Japan, the craft of charring wood was once found in Korea — but there it has now been lost.

The history of *yaki ita* in Japan is entirely unknown, although most would agree that the practice began during the Edo Era (1603–1887); nobody is really concerned with pursuing this point further right now.

Its distribution is quite interesting. *Yaki ita* is only seen from Shiga Prefecture westward — to Kyoto and Osaka, in Western Japan. From Gifu Prefecture to the east, in areas of Eastern Japan like Tokyo, it is not seen at all. East of Gifu Prefecture, *sumi* (paint made from lampblack and soot) was instead brushed on for durability. I am guessing this was easier as it omitted the labor involved in charring.

Until 2004, when I used charred cedar at the Yoro Insect Museum, there were no examples of architects using the material. Well, to be more precise, before me, Kyoshi Seike used it for one part of a house in the 1960s, but the building was not well received critically and he did not use the material again. I got to thinking that it was odd that architects in the region where *yaki ita* is still seen, Kyoto or Osaka, did not seem to use it, so I asked a Kyoto architect. He told me that *yaki ita* is associated with modest houses and with carpentry, not something an architect would use. "The expression or woodcraft of architects," he answered, "is restricted to the lineage of tea houses and tea rooms, or of the *shoin* style, valued more highly than the vernacular of everyday homes." As I was born and grew up in Eastern Japan, I did not know this, but in Kyoto and Osaka, in this region where the history of architecture is a long one, even building materials and the manner of construction reveal class differences.

My own attraction to *yaki ita* was not only because of its greater durability. It's the fact that it is a charred — carbonized — construction

Detail of the charred — carbonized — cedar wood. Not only is the wood very durable, but the carbonized wood relates to the soil and its origins.

material. Saying that carbon is the ultimate expression of a materiality derived from soil would not be too farfetched, and it plucked at my heart. I strongly emphasize the personality of the carbon. Normally, *yaki ita* is charred to about a 3 millimeter depth on a 12 millimeter thick board — but I let the fire permeate to a depth of 10 millimeters on a 20 millimeter thick board.

Here is a simple outline of how wood is charred:

First, the type of wood used is not limited to cedar; pine also works, as does *hinoki* (Japanese cypress). I have not tried deciduous trees, and can't speak for whether they might work. The thickness of the board should be between 10 and 40 millimeters. Usually, the length is no more than 2 meters, but I have charred boards as long as 8 meters. One important point is to make certain that the wood is thoroughly dry.

Three boards are brought together and lightly bound with wire, then stood up. Insert a single sheet of crumpled newspaper and set it on fire, making sure there is sufficient space for air to be drawn inside the shaft created by the three boards. The fire will spread from below to the top, and a board of 2 meters in length should be done completely within about 10 minutes.

If you insert a scythe or some other thin metal tool between the boards as the fire is burning, wiggling it as needed, you can control the amount of air drawn within and burn the surface more evenly.

The odd thing about this process is that even though you char the wood from the bottom to the top, and thus the bottom is exposed longer to fire and the top for less time, it is usually the case that the bottom and top are consistently charred. Perhaps in the area near the bottom where the fire is first lit, as a layer of char is built up it acts as a sort of insulation and the rate of charring slows — that is what I think is happening, anyway.

When someone thought to do this, or who came up with it, I have no idea. But the way in which the boards play the role of both chimney and wood for the fire makes this a remarkable technique.

TRANSLATOR'S NOTE:

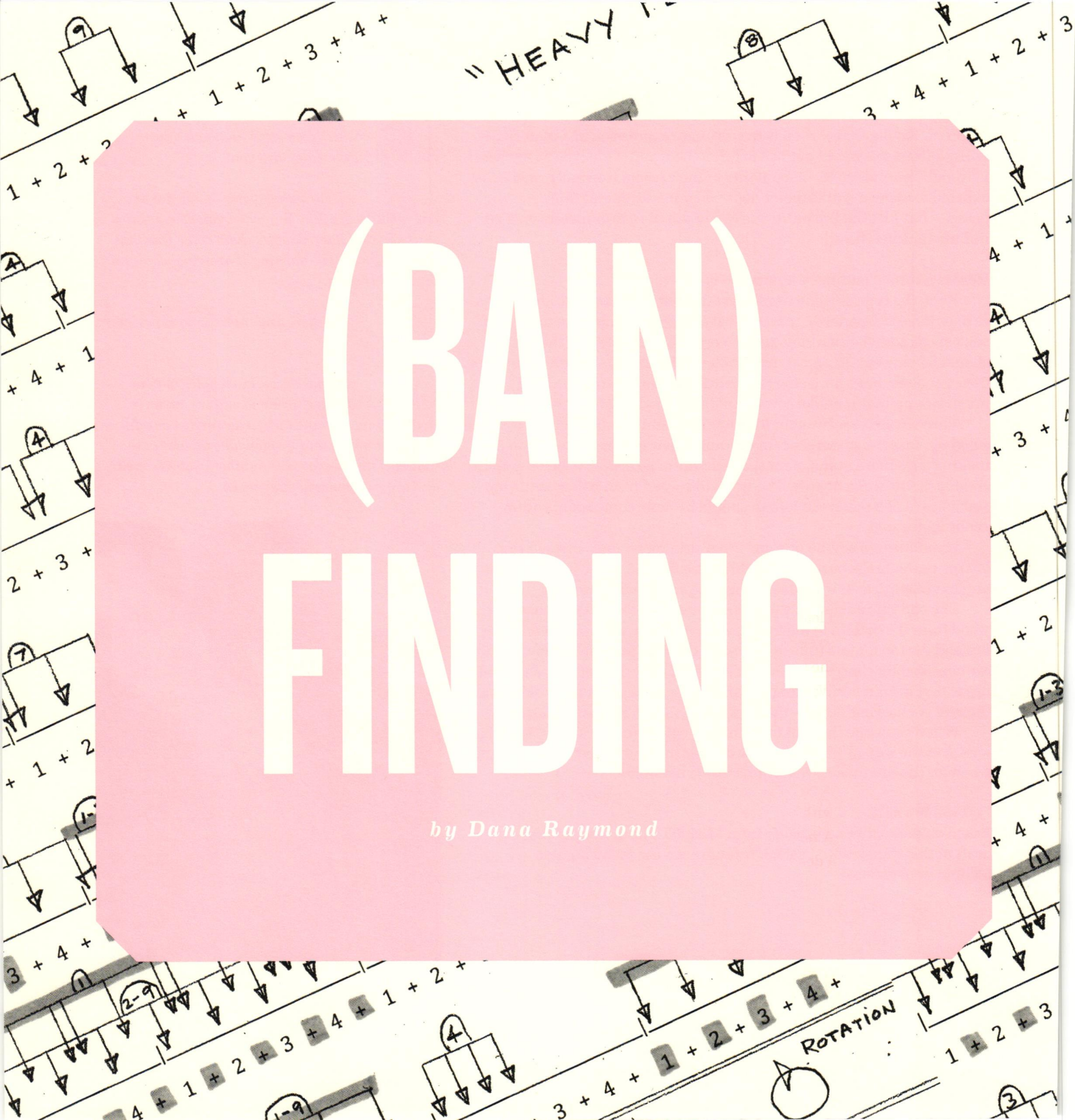
Based on perceptive comments from Michael Timmer regarding the draft of this translation, I asked Fujimori-san the following two additional questions:

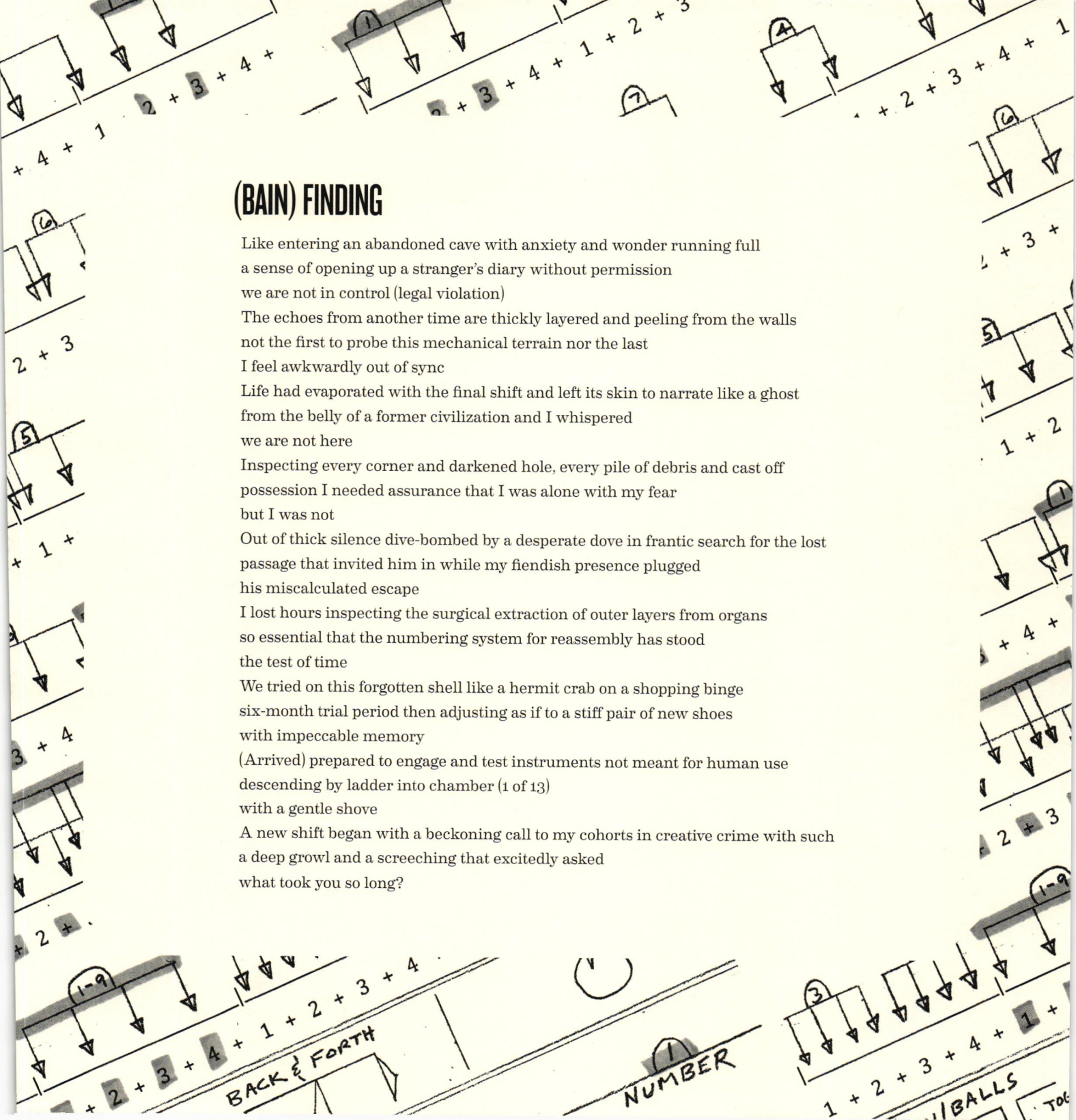
Buntrock: *You did not explain about how you put out the fire with water, did you?*

Fujimori-san: *Throwing water on the fire or not — both work fine. But when you do not throw water on the charred wood, there is the fear that parts might still be burning. Throwing water on the wood is safer.*

Buntrock: *Were there any interesting experiences you've had?*

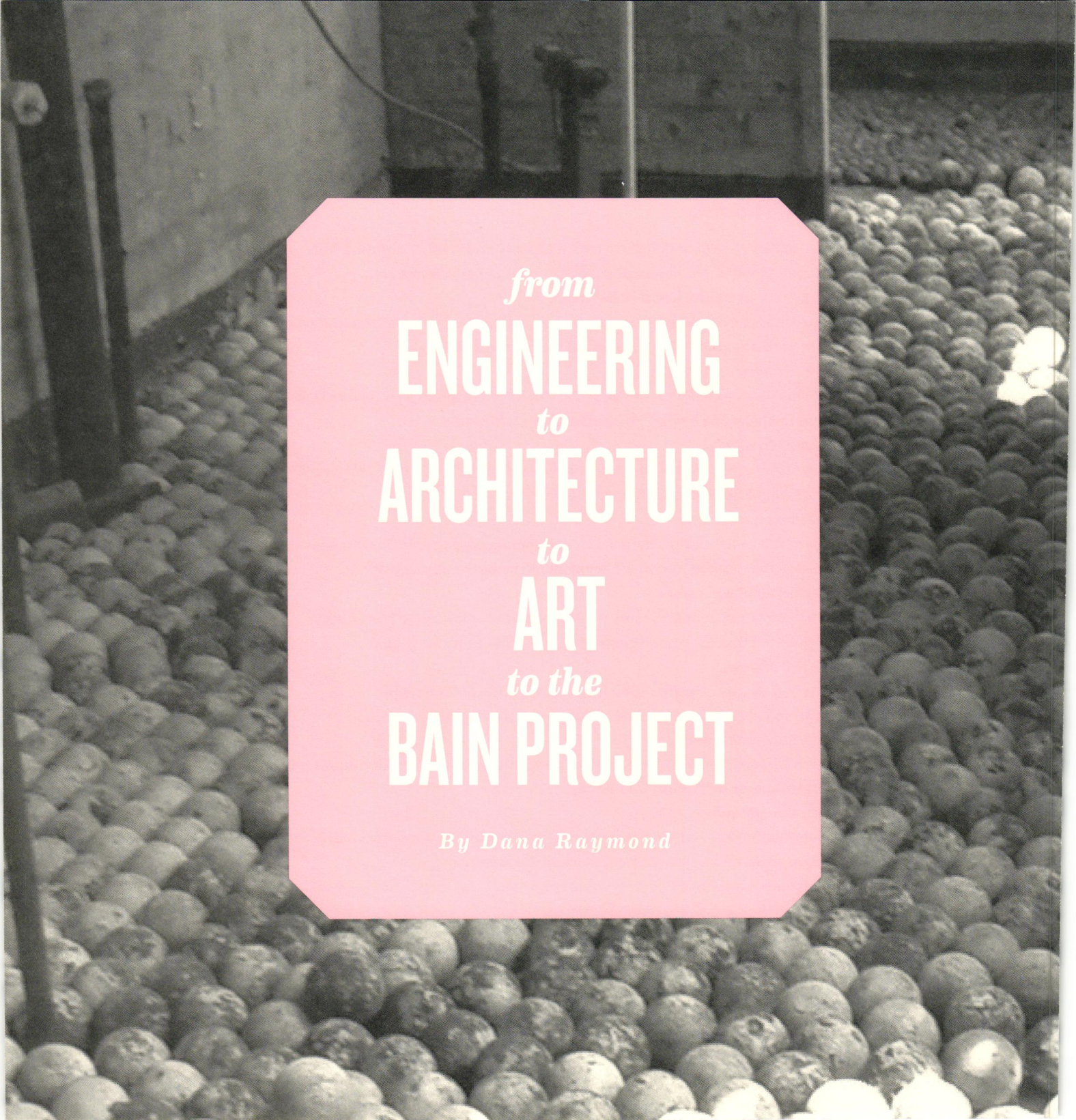
Fujimori-san: *Sparks can burn holes in your clothing. And so we've had to endure burns in clothing and on hands when we are not careful enough. I notice that women take greater care. Cotton clothing is good — synthetic fabrics melt and are particularly dangerous.*


(BAIN)
FINDING
by Dana Raymond



(BAIN) FINDING

Like entering an abandoned cave with anxiety and wonder running full
a sense of opening up a stranger's diary without permission
we are not in control (legal violation)
The echoes from another time are thickly layered and peeling from the walls
not the first to probe this mechanical terrain nor the last
I feel awkwardly out of sync
Life had evaporated with the final shift and left its skin to narrate like a ghost
from the belly of a former civilization and I whispered
we are not here
Inspecting every corner and darkened hole, every pile of debris and cast off
possession I needed assurance that I was alone with my fear
but I was not
Out of thick silence dive-bombed by a desperate dove in frantic search for the lost
passage that invited him in while my fiendish presence plugged
his miscalculated escape
I lost hours inspecting the surgical extraction of outer layers from organs
so essential that the numbering system for reassembly has stood
the test of time
We tried on this forgotten shell like a hermit crab on a shopping binge
six-month trial period then adjusting as if to a stiff pair of new shoes
with impeccable memory
(Arrived) prepared to engage and test instruments not meant for human use
descending by ladder into chamber (1 of 13)
with a gentle shove
A new shift began with a beckoning call to my cohorts in creative crime with such
a deep growl and a screeching that excitedly asked
what took you so long?



from ENGINEERING *to* ARCHITECTURE *to* ART *to the* BAIN PROJECT

By Dana Raymond

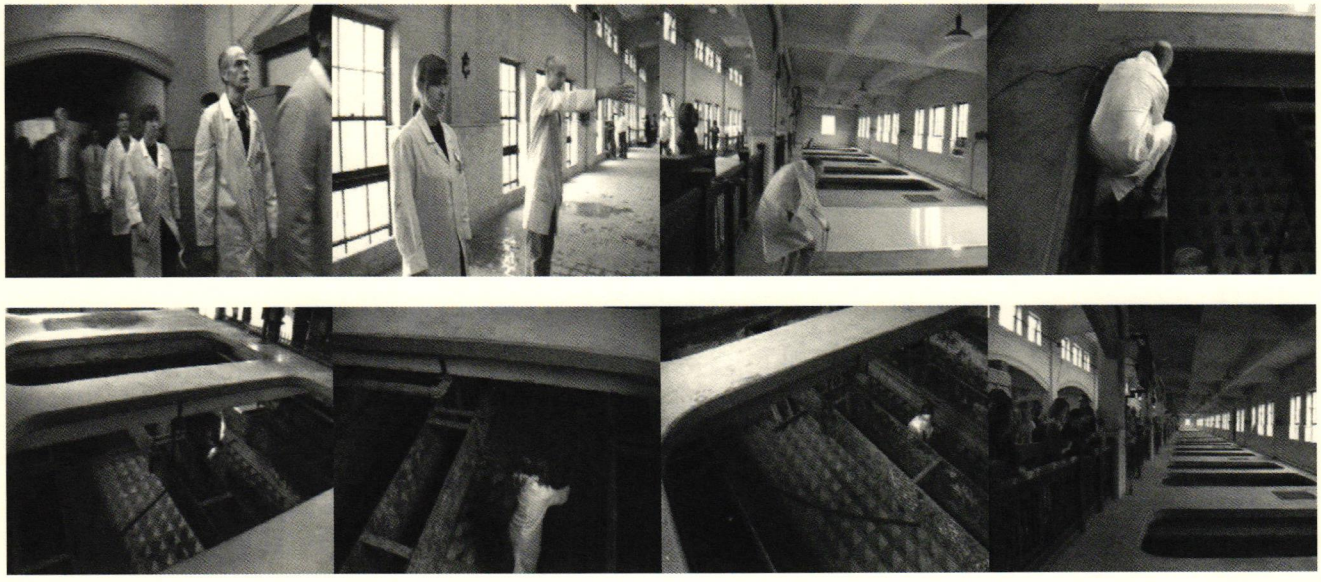
Performance and ritual have the ability to engage and transform the built environment. Dana Raymond's sonic performance revitalizes the Bain Waterworks, bringing new life to an abandoned space. He re-imagines the ornate and decaying structure as a complex musical instrument, using its moving parts to perform an industrial score. The performance challenges traditional function, forcing participants to experience the built environment in new and profound ways.

— Eds.

For many design professionals, sculpture and architecture inhabit two opposite ends of the spatial spectrum. One end is governed by the fanciful whims of the expressive artist, and the other end is calculated via applied function and relevance. The differences that seem to fuel much debate, and attachments to schools of philosophy tend to blind some stubborn adherents to the wealth of fusion/overlap. As in Buddhist philosophy, these attachments cause suffering. And, as in spiritual/religious differences, relief from struggle can be achieved simply by focusing on the commonalities.

I began my college career in engineering, first mechanical then civil. Dissatisfied, I attempted architecture at two schools, after which I finally landed in art school. My disillusionment with the architecture programs I entered was simply that they were engineering based, and that was the world I was then rejecting, for better or worse. I have no doubt that had I found a program such as the College of Design or Harvard, I would most likely be an architect or an architecture faculty member today instead of a sculptor/teacher. Or, was this simply my destiny?

As fate would have it, both my engineering tendency and my architectural fascination would eventually combine with my sculptural obsession. I never predicted this fusion while studying art, primarily due to the simple fact that my professors forbade me to bring my rational thinking to the class projects. It would be many years before I opened back up to balancing the seemingly contrary characteristics in my personality. The warning I will share here is that one may not realize who he/she is unless given the freedom to express naturally. As I was developing the pure intuitive side of my creativity, I surely believed I



A series of snapshots of the performance at the Bain Waterworks taken from footage by Matthew Willson. Along with 9 other performers, Dana Raymond performed John Symphony No. 2 in front of 1500 attendees.

knew who I was at that moment. But, did I really? No, I was only elevating my awareness of this other facet that I had yet developed. Ultimately, it provided me with the very balance I needed to be able to choose direction, analyze expectations (my own or others), and evaluate objectives.

If anyone wonders about how I cope with the rational vs. the irrational, that remains a mystery to me and I am happy leaving that as my resolution. My concerns are not with the audience's response to any of my explorations, but rather the equilibrium I achieve within as I realize the world I am imagining.

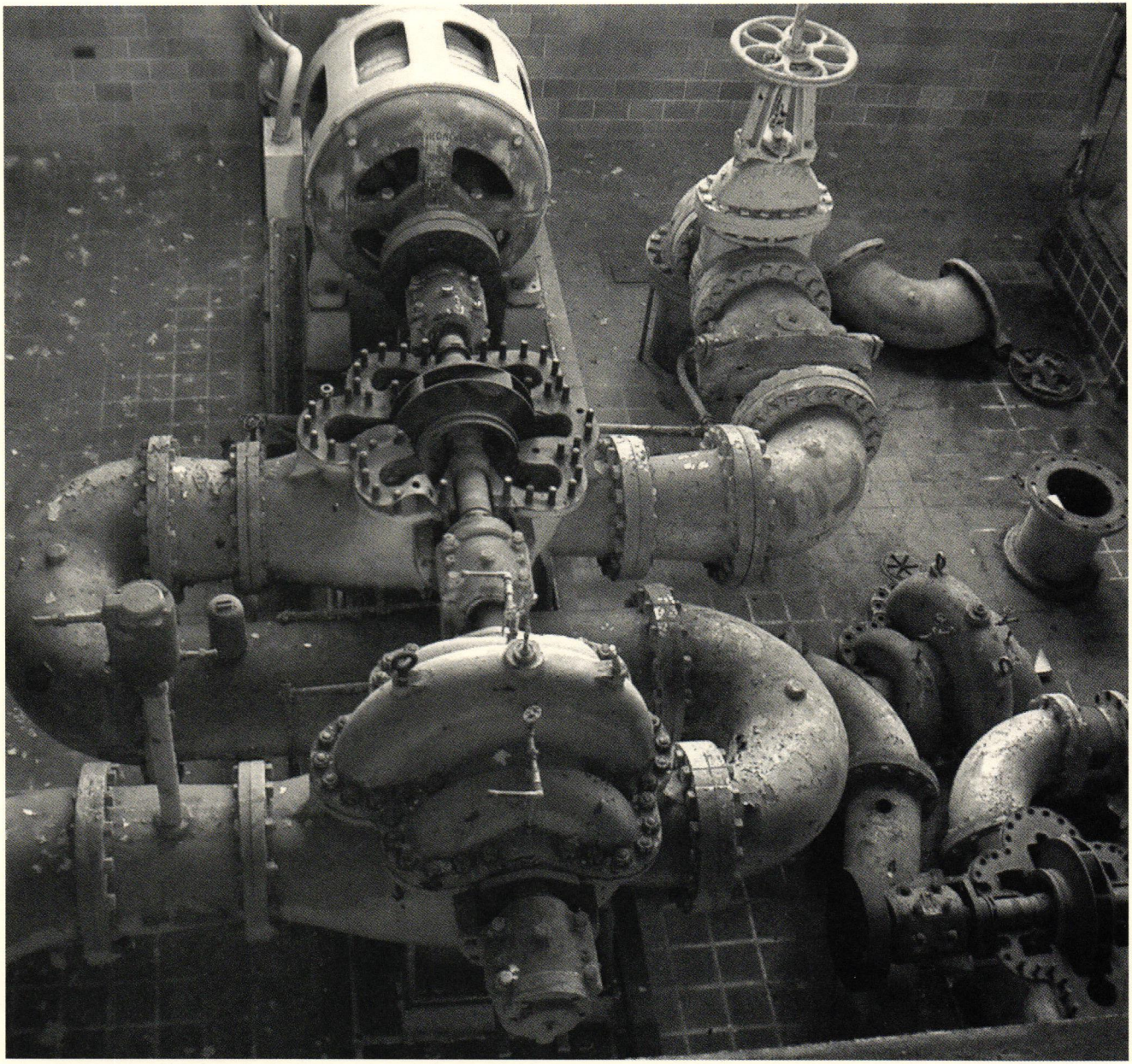
For over 30 years, architectural spaces have provided me with spatial, historical, and conceptual inspiration. The real beginning happened when I was about 10-12 years old. While visiting one of my friends, we wandered across the street behind an old gas station. I came across a discarded carburetor (not that I knew what it was at that time) and took it home with me for later exploration. I really was curious about what was inside this odd-looking contraption, so I disassembled it completely. My fascination with all the intricate parts (from the float to the springs to the gaskets) as well as the voids/spaces/chambers left me feeling like any explorer going into the unknown. To me, this was architecture. My mind was racing!

I still experience that same feeling today when I explore an unknown machine component or a vacant building. This is the very passion that drew me to apply for the Bain Project here in Raleigh, NC. My first steps into the old Bain Waterworks facility evoked the same feelings I have experienced so often, starting way back with that carburetor. Life, as

the building had intended, had all but ceased back in the 1980s, except for the regular homeless and vandals seeking a new value or purpose in its potential. My first inclination was to explore all the spaces; where did these stairs lead, what was through that door, and what secrets lie in those pitch black spaces below ground? It didn't take long before I became overloaded with excitement and curiosity, not to mention overwhelmed by the enormous scale of the spaces. This is the point at which I turned, as always, to the functions of the building.

My awe for all the enormously scaled equipment eventually drew me down into one of the thirteen filtration tanks in the main galley. My nature seems to dictate that, if something moves, I will find it. And I did. I gave one of the 18' long sprayer nozzles (pivoted in the center for balance) a little push, and the building woke up with a big yawn and a searing screech. That was my hook and my calling for the next six months. My rational/analytical side kicked in immediately and I climbed down into all thirteen tanks, testing the various responses from each sprayer nozzle. The rest of the story is history, and documented quite thoroughly. In the end, nine "musicians" performed my John Symphony No. 2, as well as two improv sessions, over the course of two weekends in May 2009. Words cannot begin to describe the experience that was shared by about 1,500 in attendance, but I will say that the building seemed to be back in full operation, simply with a very different personality.

The Bain Waterworks, an abandoned water-treatment plant, was transformed into a complex musical instrument for Raymond's performances ***(above & opposite)****.*



LEARNING *by* MAKING

Will Bruder's educational journey and experience

By Will Bruder, AIA

The love of making can send you down many paths. Will Bruder's architectural path stems from his lifelong interests in making, developed through his training in sculpture and internships under Gunner Birkerts and Paolo Soleri. These interests are manifest in the 450+ projects completed by his office since its founding in 1974.

— Eds.

My education was an old model, traditional at the time, and common among my contemporaries. The formal, academic education of architects really didn't start until the late 19th century, with the Beaux-Arts school. Thomas Jefferson is a good example, a real Renaissance man who had many interests and architecture was one of them. If you look at Mies and Corb and people like Bruce Goff and Frank Lloyd Wright it is clear that learning about architecture was just a process of making. Architectural education consisted of learning to make buildings by being draftsmen; the thing was narrower, it had more contextual relationships. This was before we started to look more globally, with both knowledge and transportation. As a young man I was interested in making, and whether it was from an interest in the work of my grandfather, who was a cabinet maker, or from shop class and art class, I became interested in the arts.

I thought at first that I would be an industrial designer. There was a scholarship program that GM had back in the 50s based on designing a car. I competed four times and never won big, but at one point I won regionally and got to go to Detroit to learn about the styling and design of cars and met Eero Saarinen in his tech center. I had won a scholarship of sorts to go to the General Motors Institute and I thought that would be my ticket into a real design school. Through doing this I saw a bit of the industry and decided I didn't particularly like it so I began to look around for something I could really sink my teeth into. I immediately homed in on architecture.

So I get it in my head that I'm going to be an architect. As a fairly pragmatic Midwestern guy, I just went out and started meeting some

He had a couple of rebels in the back studio who could draw like God and had attitude.

architects in Flint, trying to find out what it was all about, and started reading a bit in the library. Libraries are good. I looked at some Alden Dow works and at Frank Lloyd Wright. After that I applied to IIT in Chicago because somehow it had captured my imagination as a rigorous program. I was accepted and so I left the GMI and headed back home.

Through a friend's dad I heard of an architect in town, a guy he knew through the Boy Scouts. The next day I was standing on this guy's doorstep when he came to work at his little office in the country. He turned out to be hot as a pistol, just coming of age. He had graduated with highest honors in architectural engineering but with a focus in design and he was really cutting his own turf. He had a couple of rebels in the back studio who could draw like God and had attitude. They were starting their own lives, building some houses and doing a little moonlighting.

So I show this guy some of my cars and some sketches and he says, "So do you want to come back tomorrow or just start now?" And so it was that I took off my coat, rolled up my sleeves and was building a model about an hour later. At night I'd head out with one of the other guys in the office and work on their projects, nailing up soffit boards and things like that. One guy would teach me how to do some of the working drawings because he needed a cheap set of hands on one of his projects. So I got a pretty good grounding in architecture here and there and got to be part of all of this energy in the office. By the end of the summer I was enjoying myself so much that I decided not to go to IIT but instead to work full time and go to school full time.

I enrolled myself at the University of Wisconsin-Milwaukee to get a Bachelor of Fine Arts in Sculpture, but I didn't only do the art stuff. I also took calculus, and mechanics, and

structures in concrete, steel, and wood. I did some urban planning, some philosophy, and a lot of art and architectural history. It was a time when I took a lot in; I was still working at that same office, moonlighting, taking trips to Chicago to see Louis Sullivan and Frank Lloyd Wright's work, and doing school. Really enjoying myself.

In the fall of '66 we found out at the office that Milwaukee was considering building a bridge across the harbor. Michael Johnson called in Paolo Soleri who was interested in bridges as a hobby of sorts. So he came in and displayed three sketches — and when I say sketches I mean 90-foot long drawings done on butcher paper with crayon — at the museum. I was able to meet him and see his work, and eventually did a summer program he ran at ASU. The next summer I went to Arizona to work for five weeks on Cosanti. I was smitten by this and began to get interested in jumping ship and moving on to the next step. So in January of 1968 I call up Soleri and tell him that I'm going to take a semester off of school and come apprentice with him.

I went to Cosanti — Arcosanti was just a twinkle in his eye at that point — and found him working on the Arcology book, *City in the Image of Man*. I have a credit in the front, which I don't know that I deserved but was very happy to get. I worked on some of the layouts and charts and diagrams, and it was a good to be a part of. As an apprentice I oversaw the students building the new drafting room, which was an amazing making/building experience. I spent eight months there and then went back to school to finish my fine arts degree.

I graduated in the summer of '69, probably should have gone on to a masters program at that point but what I did was to put a portfolio together and write nine letters. I wrote three to architects in Toronto because I really liked the city of Toronto. My parents would go there on holiday and I would go there in the summers; it's really an exceptional place. I wrote to Kahn, to the Boston City Hall guys, to Paul Rudolph, Roche and Dinkeloo, Victor Lundy, and a guy named Gunnar Birkerts who was a student of Saarinen back in Michigan. So I made a loop out of it and headed to Toronto first. I interviewed there and got two out of the three jobs and figured, hell, I had two jobs in the city I wanted to be in and I didn't have any money, so I just walked the streets of Toronto until three in the morning when the next bus left for Detroit and I hopped on. I washed up at the bus station and called Birkert's office and asked if I could have my interview a week early. So I went in and interviewed and got another job.

The reason I didn't go to Toronto really was that the Canadians were going to make me get another degree to get licenced and the Americans would let me take the exams with an apprenticeship and the degree I already had. And so I spent a very interesting year with Birkerts; we had an oil-water/love-hate relationship. I was young and knew everything, and he was already starting to sell out. He pegged me as a design type and made me the lead designer for a contemporary art museum he was doing down in Houston, Texas. We did the design of that and I asked to do the working drawings too because I thought it would be much more valuable for me to see the whole thing through. I think it disappointed him on one level, but he respected me for it.

Near the end of that year I became interested in going back to the desert. It was a place where people had given up the

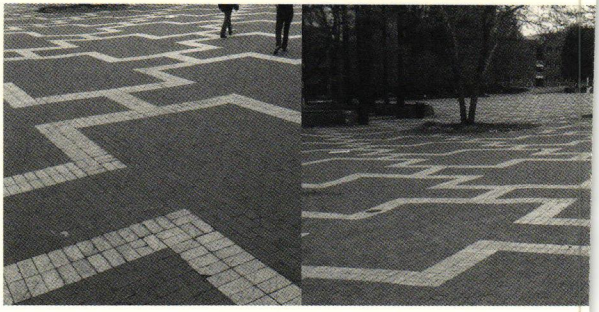
normal landscape and were probably willing to think differently about how they might live. So I moved there, continued to travel, knock on doors, moonlight a bit, and teach. I took my exams in 1974, all of them in three days because that's how they were done at the time, and luckily passed on the first attempt. I got my license in February of 1974 and the firm I was with offered me a partnership, which they knew was in vain because I already had a course of action plotted.

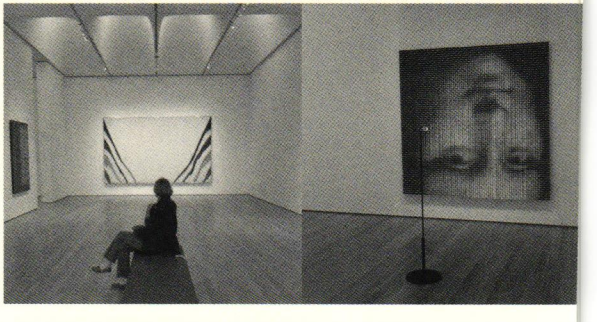
So I proceeded to open my own studio with a small cabin in the mountains that was a 10,000 sq. ft. project with $1,000 in fees and two patios, but I was doing my thing.

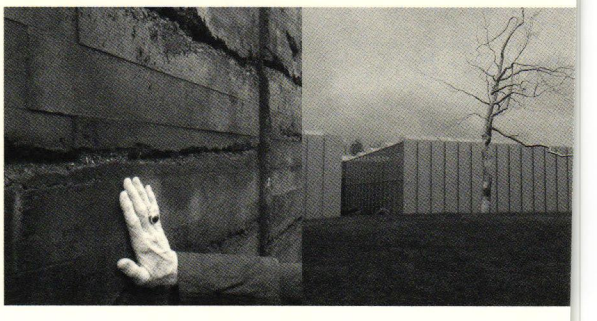
In retrospect, if I was in your boots, I think the idea of some sort of Bauhaus liberal arts, even general art education would probably be what I would advocate for, because the Bauhaus design foundation gives you

If you just do something that's comfortable, you're going to set off towards a mediocrity...

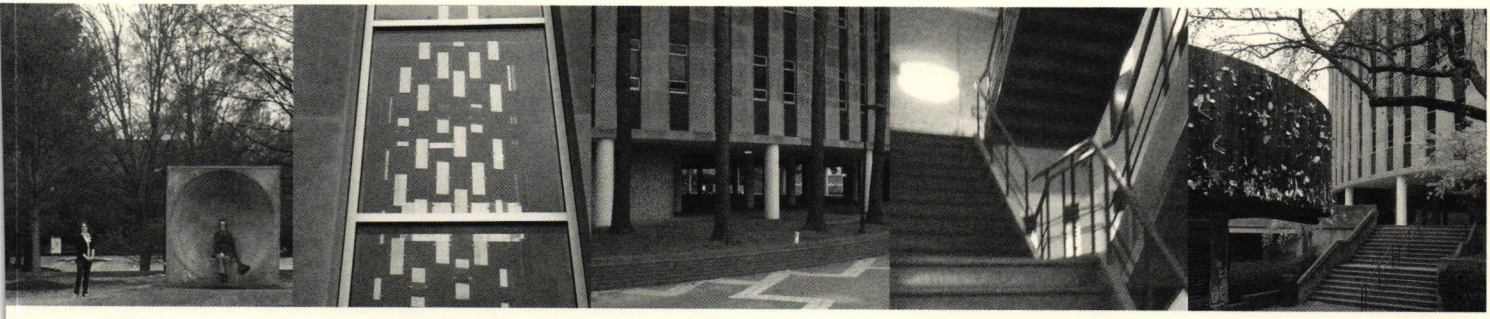
basic tools for understanding aesthetics and design that are not only tied to making a building. It's important for you to expand yourself, travel, learn, and set the bar high. Don't just go and say, "I'm going to work for somebody conveniently for a little bit." Look at somebody you really, really, want to work for and write those letters. Position yourself so that you're going to be that person because if you just do something that's comfortable, you're going to set off towards a mediocrity that will never let you really discover whether you are the man or the woman who will aspire and rise to another level.

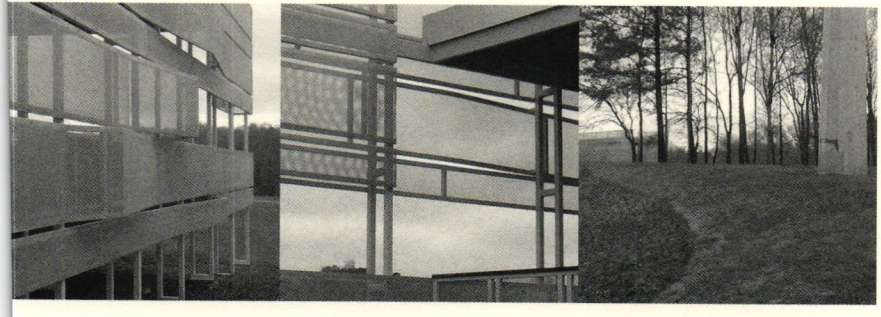






Will Bruder's adventure through the campus of NC State and the surrounding sites of Raleigh, NC. Using a phone, his modern day sketchbook, he was able to document the things he saw in the form of: textures, light patterns, materials, spatial experiences, art, etc.





SMALL ROOMS FOR BIG IDEAS

An addition to the Circular Congregational Church in Charleston, South Carolina

by Frank Harmon, FAIA

Architecture can be both respectful and progressive if it stems from the needs of its community. Navigating both a fiercely preservationist review board and the client's requirements for a sustainable building, Frank Harmon, FAIA created a site-sensitive and responsive church that lived up to the congregation's ideal that doing good for the environment is doing good for others.

—Eds.

The U.S. Department of Energy estimates that buildings consume over 40 percent of the energy used in America, 30 percent of the forests we cut, and 25 percent of our fresh water. Clearly, if we wish to create a more sustaining environment, buildings are a good place to start. The following is an account of such a beginning—a Sunday school addition for a church in Charleston's Low Country, inspired by the climate, the people, and faith that shaped it.

For much of my life I've had mixed feelings about the city of Charleston. As a child I visited Charleston often with my mother, who adored its buildings, food, and antique furniture. It would be many years before I understood that this city of beauty and languid charm was underpinned by slavery and decades of racial injustice. During the civil rights movement of the Sixties, I found it hard for me to think of the historic buildings of Charleston without being reminded of human bondage. So for about twenty years I looked to other places, many European, to learn about urban design.

When I began teaching architecture at NC State in the 1980s, I discovered Savannah, Georgia, another historic port city, with its rational plan of streets and squares laid out by James Oglethorpe in the early 1700s. I was forced, then, to consider this plan in contrast to Charleston's more organic layout. Soon I began using the two Southern cities as sites for projects in my design studios. My students and I had much to learn from the urban plan, scale, and especially the adaptation to climate witnessed in these two cities. And today I realize that the weave of buildings and gardens in Charleston is an expression of the most basic of building materials: site, climate, and place.

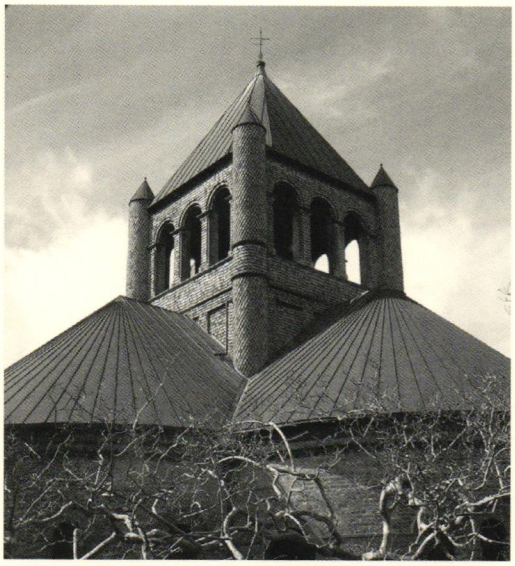
In 2004, Whitney Powers, a member of the Circular Congregational Church of Charleston, contacted me about the design of a new Sunday school building for their church on Meeting Street. The Circular Church is the oldest church in Charleston, founded in 1681, and has a long history of progressive thought, exemplified by its circular plan, which celebrated equality in worship; the Circular Church admitted African Americans to its congregation years before the Civil War. Would I be interested, Whitney asked, in designing a thoroughly modern, inherently

sustainable addition to the oldest church in historic Charleston?

Several years earlier, Whitney had served as architect for the renovation of the 1854 Lance Hall at the Circular Church, and as a church member thought that it was more appropriate to ask a fellow architect to design the new building. She would serve on the Building Committee and would offer invaluable advice on dealing with the historic regulations and building culture of Charleston. Whitney introduced me to the Building Committee, and in December 2004 my firm was contracted to build the new addition. The Building Committee's brief was simple and direct: Give us as much space as we can afford, make it as sustainable as possible, and make it a statement about our belief in the sanctity of God's creation — that doing good for the environment is doing good for others. There was one more caveat: The new building had to be acceptable to the Board of Architectural Review, known in Charleston as the BAR.

The Charleston Board of Architectural Review is the oldest historic review board in the country, renowned for its insistence on historic propriety. Traditional architecture is a subject of passionate discussion in Charleston. The Charleston Post and Courier regularly prints editorials and fierce letters to the editor excoriating the "modern desecration" of the city's architectural heritage. One well-known New Urbanist architect opined that modern architecture should be kept on the outskirts of the city, banished beyond the ramparts of historicism. Clearly, the church's request that I design a modern building that would be acceptable to the BAR was the elephant in the living room, so to speak, as we began to design the Sunday school.

The church decided that the new addition would be built in the churchyard adjacent to Lance Hall, which was occupied by a mature



The original steeple of the Circular Congregational Church in Charleston, SC. Frank Harmon was asked to design a modern addition while respecting the tradition and history of the city.

elm tree, three palmettos, and the graves of over 30 church members interred since the early 1700s. The building committee contacted every living descendent and polled the congregation, who confirmed that the remains of its members could be moved respectfully to another part of the church grounds, as had happened in 1854 when the then-new Sunday school, Lance Hall, was built.

On December 15, 2004, I attended church, sang in the choir, and with three other people from my office observed the pattern of learning and worship at this church. During the church service, I shared with the congregation my belief that, together, we could make a building that lived comfortably with the past while serving the present. I didn't realize how soon I

would have to deliver on that promise. Immediately after the service, Whitney told me the building committee needed a design in two weeks to begin fundraising!

Normally, I like to have a longer gestation period to design as I absorb the local character and needs of a client. But two weeks later, in January 2005, I sent the Building Committee my initial sketches of the design, which would be remarkably close in principle to what was eventually built. The sketches showed a two-story building embracing the courtyard, with good solar orientation and geothermal heating and cooling.

Over the next several weeks I returned to the church to refine and develop the concept of the original sketch.

Charleston has mild winters, muggy summers, and delightful weather in spring and fall. From its earliest days, Charleston house types included porches, or piazzas, where people could live part of the year outdoors. These house forms, called the Charleston "single," are believed to have originated in Barbados. Porches are common in parts of Africa for the same climatic reasons. I thought that I would use piazzas as hallways at the new Sunday school, so that one-third of the building would need neither heating nor cooling and every room would have operable windows on both sides for cross-ventilation. The piazzas themselves could become places for learning and socializing, as porches have always been in the South.

I wanted our modern building to have the rhythm, proportion and scale of the older city...

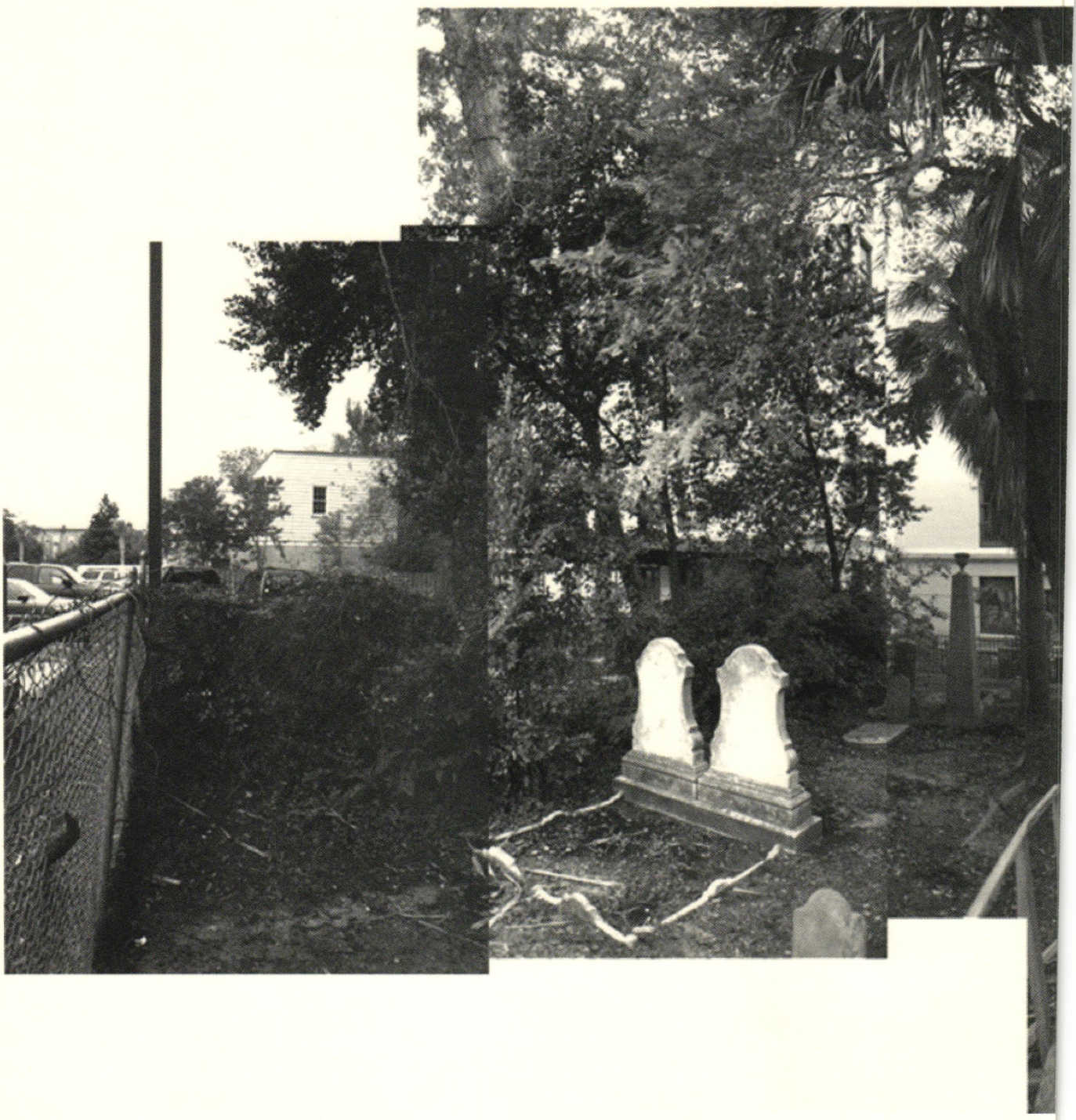
Much of historic Charleston is built of masonry, often covered in stucco and wood, with wrought iron for balconies and railings. The appearance of the town is not homogenous, but rather a quilt of wood, stucco, masonry and iron interspersed with palmettos and courtyard gardens. I would use all of these traditional materials to make our non-traditional building.

I decided to have the Sunday school building hug the edge of the property so I could create a courtyard where churchgoers could stroll on their way to service. I also would give the new building a flat roof covered with plants — a green, vegetated roof. I had promised the congregation that, though we had to cut down the elm tree to build the Sunday school (it was later found to be diseased), I would make the new building as green as the original churchyard had been. The vegetated roof helped fulfill that promise. The roof would collect rainwater that we would store in an underground cistern — another 18th century Charleston tradition — and use the water to nourish the plants in our new courtyard.

The program requirements were as follows: four Sunday school rooms ("Small rooms for having big ideas," one church member said), two of which could be combined to make a larger room; bathrooms (not in its nearly four hundred years had the church enjoyed decent bathrooms); a shower so that youth groups could use the building overnight; and an elevator so that Lance Hall could become accessible for the first time in its history.

Although new buildings in Charleston adhere to historic guidelines, they also comply with the latest building code. Because the church is in an urban district, the new code required that building walls at or near the property line had to be non-combustible. Since our building was built on the property line, I decided to make the bathrooms, stair, and elevator into a thick "wall of rooms" on the south property line. The walls would be made of stucco-covered masonry. By setting the classrooms back eight feet from the east property line I could make the classroom walls of wood. Combined with steel columns and railings at the piazza, the Sunday school became a microcosm of the typical building materials of Charleston — a tapestry of different colors and textures. I wanted our modern building to have the rhythm, proportion and scale of the older city, yet without the historic freight of white columns and classical pediments. Our piazzas and columns, I chose to think, were descended from Africa by way of Barbados. The final design gave us rooms with daylight on two sides, good cross-ventilation,

Plan of Frank Harmon Architect's addition. The architecture and landscape architecture complement each other and blend the distinction between old and new, modern and traditional.



The appearance of the town is not homogenous, but rather a quilt of wood, stucco, masonry and iron interspersed with palmettos and courtyard gardens.

and deep overhangs to shade the windows and doors in the summer. The sun would shine into every room on Sunday mornings, and the classrooms would have unanticipated views of St. Michael's steeple to the east.

Piazzas in Charleston usually faced into a sheltered garden, as ours would, so that a couplet of house and garden formed the basic building block of the town. Thus the garden is as important as the building and the choice of landscape architect is as important as the choice of architect. The Circular Church chose well, asking Gregg Bleam from Charlottesville, Virginia, to be the landscape architect for our project. I had created a children's courtyard on the east boundary, which Gregg would pave with brick salvaged from the site. In the major courtyard garden he would plant live oaks and ficus, both well-loved in Charleston, and beneath them he would pave walkways with local stone. The balance of the space would be covered with gravel screenings, forming the floor of an outdoor Sunday school room under live oak trees.

After the building design was in place, NBM Builders were chosen as the contractor and John Schneider as the superintendent. With the fundraising complete, there remained only the approval of the Board of Architectural Review. Whitney Powers had guided us deftly through steps leading up to the review. We met with the Historic Charleston Foundation to explain our design: how the green roof, for example, was lower than the eaves of Lance Hall; how the new building did not touch the old, so that the historic building was "recoverable" in the Foundation's terms; and how the corner of Lance Hall next to our addition was visible (another benefit of moving in the east wall eight feet from the property line). After the Foundation's preliminary review, it was time to appear before the BAR, which I looked forward to with foreboding. Recently the Clemson School of Architecture had held an international design competition for a new school of architecture on a nearby street. The winning modern design was soundly rejected.

On a balmy summer evening, Bert Keller and I presented the project to the board. "At the Circular Congregational Church," Bert said, "we believe that building sustainably is a moral imperative." I sensed we were off to a good start. Then I followed his remarks with a description of the church's design. I had spoken for about five minutes when the Chairman of the board interrupted me.

"I have been on the BAR for eight years," he said, "and I have never seen a contemporary building I approved. Until this one. This is exactly the kind of contemporary architecture Charleston needs. My only regret is that it's not more visible."

Looking back, I believe the board approved the design because of its balance and proportion, its mix of familiar materials, and most of all because of its sustainable design. It was a building that not only saved energy and conserved materials, but that continued a way of building unique to the particular place of Charleston. And so, the ghost at the banquet disappeared.

On Earth Day 2006, the children of the church dug up the first ceremonial shovels of earth on a sunlit patch of ground next to Lance Hall. Whitney Powers spoke about the design, Bert Keller spoke about how the new space would serve the church and its urban mission, and Susan Dunn, the assistant pastor and also a building committee member, led a prayer. Also in attendance were undertakers from Fielding Funeral Home, who had volunteered to remove the graves of the church ancestors. Then the children sang a closing hymn and we had lunch in the courtyard.

The first order of construction was the removal of the graves. This turned out to be far more time-consuming than anyone expected, but after their relocation, NBM began drilling the well holes that would contain piping for the geothermal heating and cooling system. Unlike conventional systems, geothermal systems are silent, so at the Circular Church on Sunday mornings the only sound you hear through the open windows are the songs of birds.

With the wells in place, the structure of the new building could begin. Our structural engineer, John Moore of 4SE, had worked with me on the design of my brother's house in Mount Pleasant, South Carolina. I respected his ability to think in three dimensions, and he could draw better than most architects. A professional photographer as well as an engineer, John loved the texture of Charleston

And today I realize that the weave of buildings and gardens in Charleston is an expression of the most basic of building materials: site, climate, and place.

as much as I did. He designed the foundation for the south walls as a concrete raft two feet thick. Above that, he used eight-inch-thick concrete masonry units for the walls, filling the cores with concrete and steel reinforcing. The result was a very solid building on the south face. By contrast, John structured the classrooms and porches with lighter materials: wood framing with steel at critical points. The steel columns are one of my favorite details. A double steel channel column supports the wood floor beams and the space between the channels forms a niche for the copper roof drain. John Schneider then assembled the structure with the sense of craft John Moore had given it.

By Christmas the building was framed in. At a local lumberyard we found Spanish cypress siding for the walls of the classrooms. Because mildew is a perennial issue in Charleston, I wanted the cypress installed over wooden vertical battens so that the siding became a rain screen. The air space behind the siding allows the wood to dry out on all four sides. We researched the most weather resistant natural finish for wood and chose a Sikkens two-part urethane system commonly used on wooden boats. The same lumberyard found recycled heart pine we could use for the upper floors. They estimated that the wood was at least 400 years old, given the age of the original trees that were cut in the 19th century.

The new Sunday school, courtyards, geothermal system, landscaping and renovations to Lance Hall together cost $1,117,237 and were completed on April 21, 2007. On April 22, Earth Day 2007, the Chairman of the Building Committee, Dr. Stephen Cofer-Shabica, told the congregation: "This will be our generation's contribution, and a lasting testament to being sensitive to the church, the city, and the earth."

LIQUID METAL ARCHITECTURE

Flexible electronics and injectable wires for architectural applications

by Ju-Hee So & Dr. Michael Dickey

New materials are allowing buildings to communicate. This technology has the potential to change the way we build and inhabit structures. Ju-Hee So and Dr. Michael Dickey, researchers at NC State, have developed a material that can relay real-time information about structural loads and performance. Technology such as this will allow buildings to adapt to changing conditions and the needs of its users.

— Eds.

OVERVIEW

Our research group at NC State is studying a liquid metal that architects may find useful for incorporating electronics into architectural structures or flexible building materials. In a sense, the liquid metal is like a water bed: it is a low-viscosity liquid that has a thin, solid-like, oxide skin on its surface. The skin allows the liquid to be molded into useful shapes. Unlike a water bed, however, the liquid metal can be induced to flow by pushing on it with sufficient force to rupture the skin. The skin reforms spontaneously to stabilize the liquid metal when flow ceases. The metal can be used in an unconventional manner for constructing metallic components (e.g., antennas, wires, sensors) by injecting it into tubing or channels embedded in diverse materials. Conventionally, metal encased inside of construction materials is used to strengthen the composite structure, such as steel reinforced concrete. The fluid metal, in contrast, has different applications from solid metal. It is water-like and therefore does not alter the mechanical properties of the composite structure. In fact, the metal flows in response to deformation and thus can maintain electrical continuity in flexible substrates. The resulting metallic components therefore adopt the mechanical properties of the encasing material. Injecting the metal into channels formed in rubber-like substrates, for example, produces highly flexible, stretchable, and deformable electronic structures. This article describes some of the work in our laboratory and speculates on some applications that may be of interest for architects.

THE LIQUID METAL

The metal, which is a commercially available mixture of gallium and indium, has several fascinating properties: (1) It is a liquid at room temperature (its melting point is 15°C) with a viscosity similar to water, (2) it has a thin, solid-like oxide skin that allows the liquid to be micromolded into non-spherical structures that "self-heal" when cut, (3) it can be injected readily into small tubing to form metallic structures that maintain their shape despite being liquid, (4) it does not evaporate, (5) it can make electrical connections with other

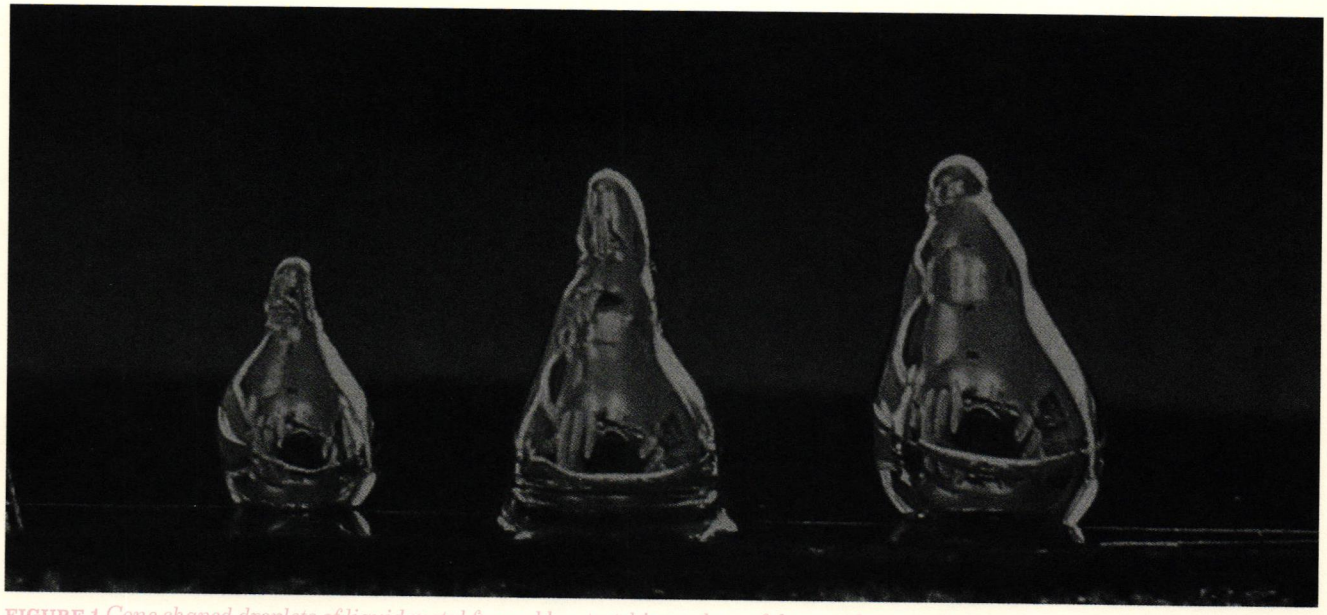


FIGURE 1 *Cone shaped droplets of liquid metal formed by stretching a drop of the metal at room temperature (each drop is ~1 mm wide). The bulk viscosity of the metal is like water, but the presence of a thin oxide skin allows it to be micromolded into non-spherical shapes and provides mechanical stability.*

materials spontaneously without any solder or other connections, and (6) it has a low level of toxicity. The oxide skin distinguishes this metal from familiar liquid metals, such as mercury (a toxic liquid metal), which tend to bead up to minimize their surface energy and are therefore difficult to manipulate. A familiar example of this behavior is water beading up on a waxed car or a stream of water from a faucet breaking into droplets.

FIGURE 1 is a photograph of several liquid metal droplets molded into non-spherical cone shapes. Whereas most low-viscosity, high-surface tension liquids (e.g., water or mercury) form two hemispheres when bifurcated, this liquid metal forms two cone shaped tips (as small as one micron in diameter). The cone shapes are stabilized by the thin oxide skin that surrounds the inner liquid metal. The stability of the structures in FIGURE 1 implies that the liquid metal can be molded into other, non-spherical shapes. We have harnessed this material property to fabricate wires and antennas with radically new mechanical properties, as described below.

FABRICATING FLEXIBLE ELECTRONICS:
We have fabricated several proof-of-principle electronic devices by injecting the metal into tubing or molded channels. The metal flows readily into these capillaries as long as the applied pressure is sufficient to rupture the skin. Based on our measurements, the required pressure is inversely proportional to the

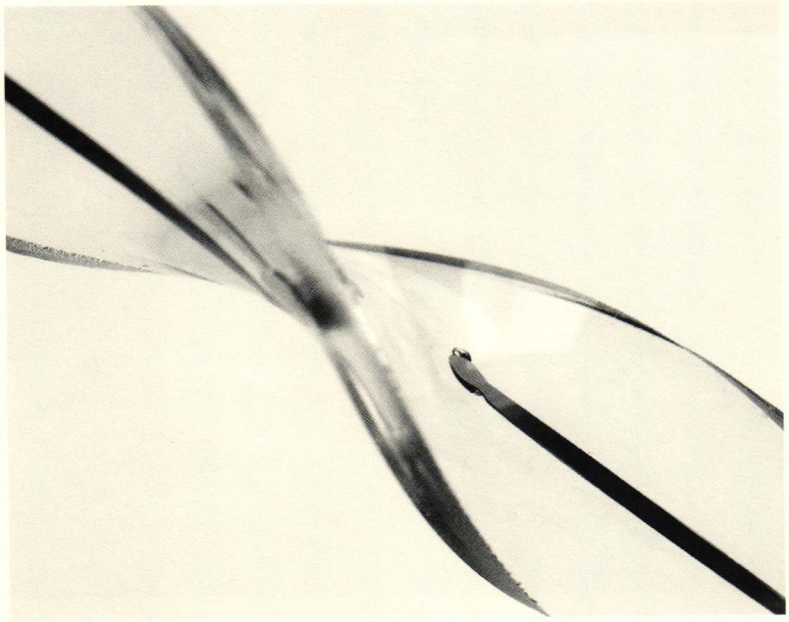


FIGURE 2 *Photograph of a highly deformable antenna formed by injecting liquid metal into elastomeric channels. The antennas can be twisted, deformed, and can "self-heal" after being cut in half.*

diameter of the tubing (i.e., smaller tubing requires greater pressure for injection, as expected). The required pressures are modest even for small micro-tubing; simply pushing the plunger of a syringe by hand is sufficient to induce flow into small capillaries. Once the metal is inside the tubing, it forms mechanically stable structures since the skin on the metal reforms spontaneously in the presence of air. The oxide skin creates a membrane that prevents the metal from leaving the tubing. By contrast, mercury (a familiar liquid metal that does not oxidize readily), withdraws spontaneously from the tubing to minimize its surface energy and is therefore not suitable for making electrical components.

We fabricated highly stretchable wires by injecting the liquid metal into hollow elastomeric fibers, which were produced by the College of Textiles at NC State. These wires resemble those used in iPod headphones, but can be stretched up to ten times their original length. The wires maintain electrical continuity during stretching and return back to their original length when relaxed without any degradation in performance.

We also fabricated stretchable "dipole" antennas using the liquid metal. A dipole antenna is simply two parallel wires separated by a small gap between their ends (television "bunny ear" antennas are dipoles). The resonant frequency of a dipole antenna is inversely proportion to its length. We fabricated an antenna that measured approximately three inches in length, which corresponds to a resonant frequency of approximately two gigahertz. Stretching the antenna changes the length and thus, the resonant frequency. A stretchable antenna, therefore, is a wireless sensor of strain.

We fabricated the antennas by first molding channels into a common silicone rubber that resembles a transparent bathroom caulk. We injected the metal into the channels using a syringe. These elastomeric antennas can be fabricated easily compared to conventional copper antennas, which are generally formed by milling. Because the conductive element of the antenna is a fluid, the mechanical properties and the shape of the antenna are defined by the rubber encasing material, as seen in FIGURE 2. The antennas are like a rubber band and can be stretched, twisted, and bent.

The fluidic antennas self-heal (i.e., they retain their conductivity) after being cut with a razor blade. We cut entirely through the metal

The ability to measure strain using simple, embedded sensors with wireless transmission capabilities may be useful for detecting expansion and contraction in architectural structures.

portion of the antenna (perpendicular to the long axis), but left some of the elastomeric encasing material surrounding the antenna intact. Within the gap formed at the site of the cut, it was apparent that the razor blade created two distinct metal–air interfaces, suggesting the metal remained flush with the cut interface (i.e., it did not reflow into or out of the channel). After removing the razor blade, the electrical resistance through the antenna returned to its pre-cut value. The elasticity of the encasing material is primarily responsible for reconnecting the broken wires and the soft interface of the fluidic antenna facilitates reliable healing. This property should be useful for creating durable electronics.

FEATURES USEFUL FOR ARCHITECTS:

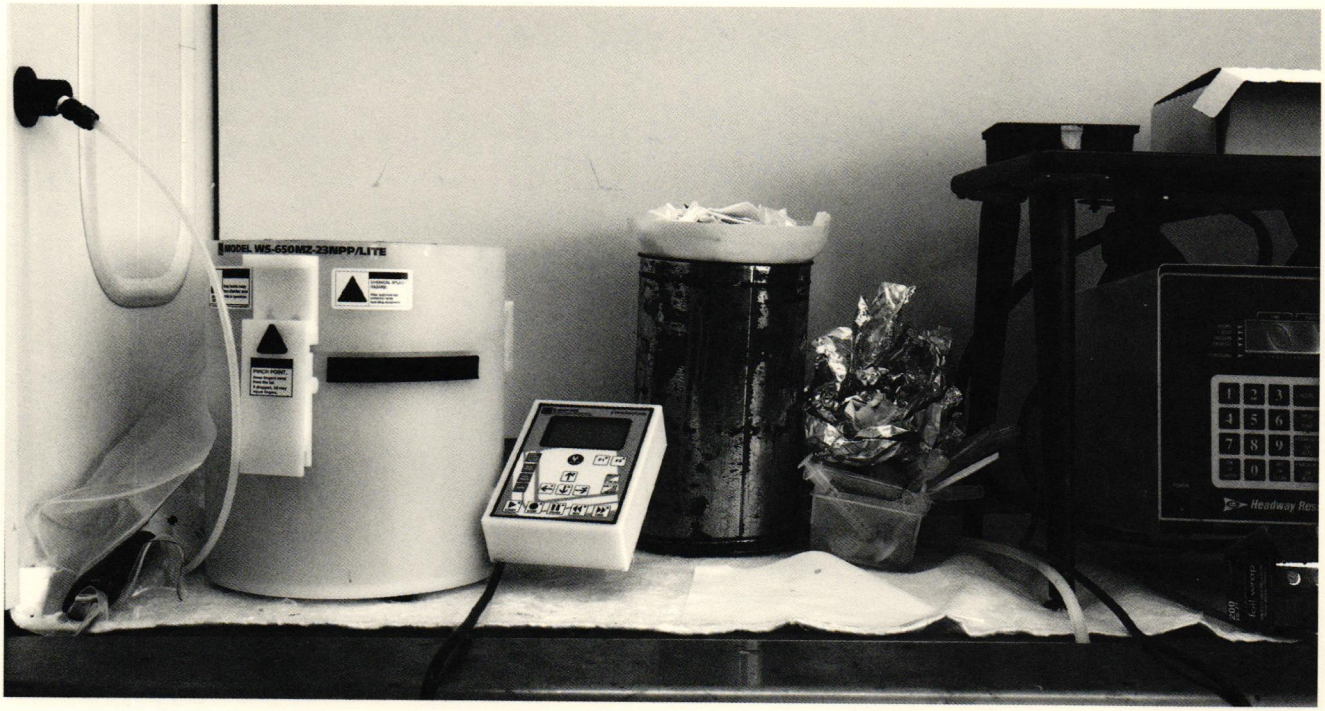
1. FLEXIBILITY The metal can be used to form flexible electronics such as wires and antennas. Since the metal is a liquid, it takes on the mechanical properties of the encasing material. Thus, injecting the metal into flexible substrates (e.g., rubber) will produce flexible wires that maintain electrical continuity upon stretching. This characteristic may be useful for creating metallic components in flexible, stretchable, or decorative building materials. The metallic components could be used as wires (to transmit electricity), antennas (to transmit information wirelessly), sensors, resistive heaters, or electromagnets. The flexibility of these metallic components allows them to be conformably coated over curved surfaces. The liquid wires may also be more durable than conventional solid wires since they can deform in response to stress, rather than break.

2. INJECTABILITY The liquid-like nature of the metal offers new routes to constructing electronic devices by injecting the metal into tubing, capillaries, and molded channels embedded inside of building materials. This approach to fabrication offers a new paradigm in which the encasing material is produced first and then the metal is added second (in contrast, wires are typically fabricated out of metal and then subsequently insulated). One advantage of injecting the wires is that they will be perfectly aligned (as defined by the embedded capillaries) and will be embedded (and thus, out of sight).

3. FUNCTIONALITY Metal is effectively a sensor because the liquid can flow in response to external stimuli, such as strain or pressure. The metal itself can be used simultaneously as a sensor and an antenna; thus, it is a wireless sensor. We have demonstrated stretchable antennas that change resonant frequency in response to elongation. It is also possible to measure elongation by measuring the change in resistance through the wire as it is elongated (and therefore, narrowed). The ability to measure strain using simple, embedded sensors with wireless transmission capabilities may be useful for detecting expansion and contraction in architectural structures (e.g., bridges). Depending on the encasing material, these sensors can be tuned to respond to different forces.

LIMITATIONS

One major drawback of the liquid metal is its cost. Gallium is as abundant in the earth as lead, but gallium is not minable (it is an impurity that is removed during aluminum processing) and is therefore expensive. The cost of the material to make the antennas shown in FIGURE 2, however, was only ~1 penny. The additional cost of this material can be justified in instances where new functionality is warranted.



SUMMARY

We have described a moldable liquid metal that may be useful for architects interested in incorporating electronics into flexible or stretchable substrates. The metal is a low viscosity fluid (like water), but can be molded into stable structures due to a thin, solid-like oxide skin that forms spontaneously on its surface. We demonstrated the ability to make stretchable antennas, and highlighted ways in which the metal may be used by architects.

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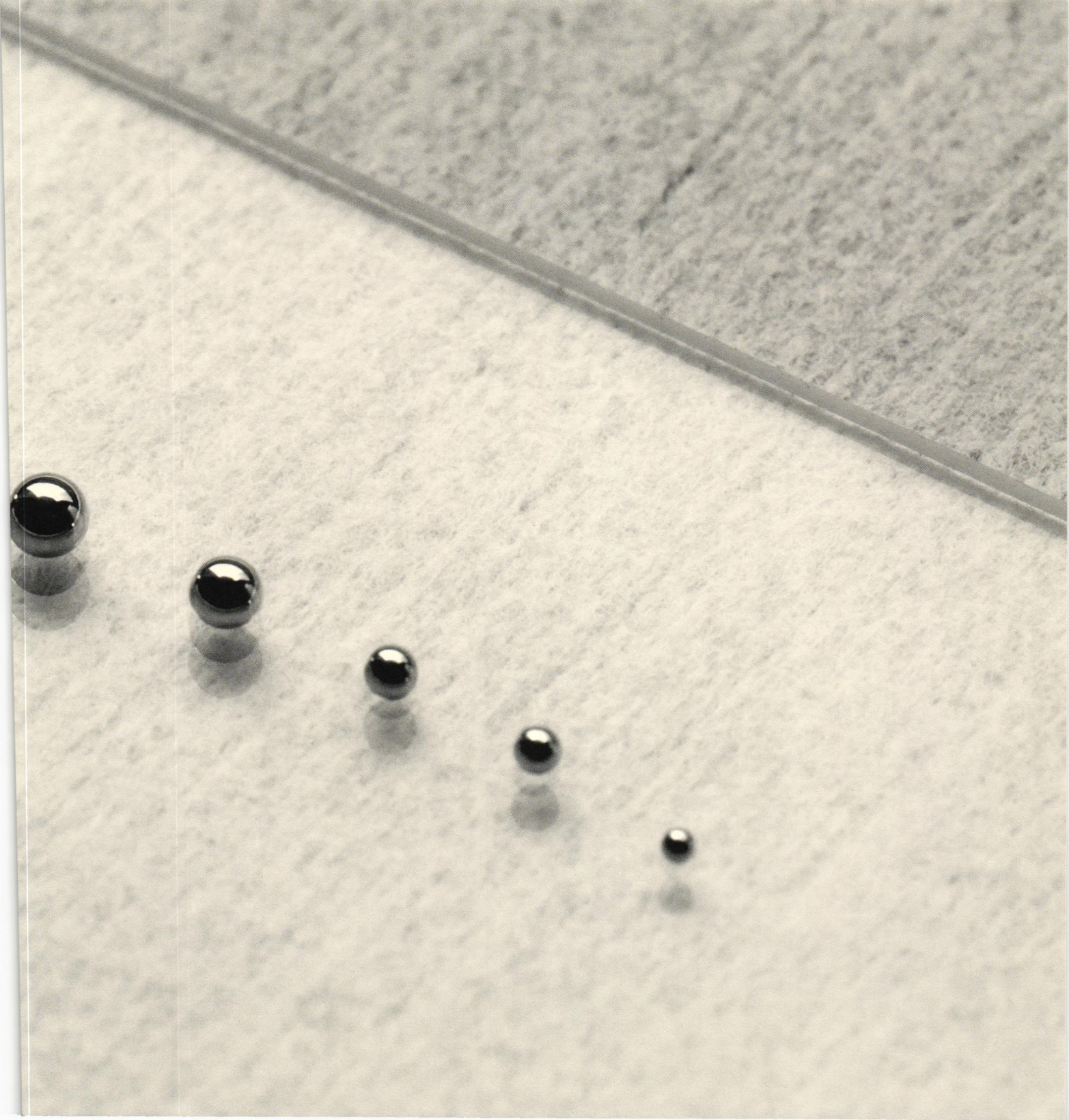
The wires maintain electrical continuity during stretching and return to their original length when relaxed without any degradation in performance.



biomanufactured

BRICK

by Ginger Krieg Dosier

New materials can create a more sustainable environment. Moving beyond the traditional material palette of concrete, glass, steel, and wood, Ginger Krieg Dosier has developed a new process to grow architectural materials with the aid of micro-organisms. Using a nonpathogenic soil bacterium naturally found in wetlands, she has bioengineered a process to create materials that can be both pollution free and contain low embodied energy.

— Eds.

INTRODUCTION

BRICK: early 15c., from O.Fr. briche "brick," Gmc. source akin to M.Du. bricke "a tile," lit. "a broken piece," from the verbal root of break. [Merriam-Webster]

Etymologically the word "brick" is related to the word "break," leading to a popular belief that bricks used in construction were not whole units, rather broken pieces. Perhaps more speculatively, bakers who broke up their dough to bake loaves used a similar word for these broken-off portions, and this word became applied to a material that was baked.[1] The first recorded mention of "fired" or baked brick was 3,000 years ago originating in China. "Born on dates" and craftsman initials were cast into these bricks[2] establishing the beginnings of quality control in brick standardization.

Throughout history, the humble brick grew in popularity as an economical material that could be used as both structure and enclosure. Material economy is inherent to the rectangular brick, acting as an alternative to stone construction due to abundant material availability, and the reduced skill-level required for laying the units. The brick is an essential unit of construction and represents a ubiquitous connection to global architecture. The form and dimensions are designed in conjunction with the human body, represented in a width that fits the hand of the mason.

Today, brick construction continues to make up a large part of the built environment, consisting of both load bearing and veneer construction. Globally, traditional brick manufacturing produces over 1.23 trillion

units per annum[3] with a heavy dependency on non-renewable natural resources. Traditionally firing brick (commonly practiced in third world countries) uses an estimate of 400 trees for 25,000 bricks. Clay bricks manufactured in coal-powered kilns emit 1.3 pounds of carbon dioxide per unit.[4]

Biologically manufactured bricks are "grown" rather than "fired" and do not require a heat process to fuse raw material. Replacing traditionally fired bricks would result in a reduction of 800 million tons of carbon dioxide per annum.

BACKGROUND

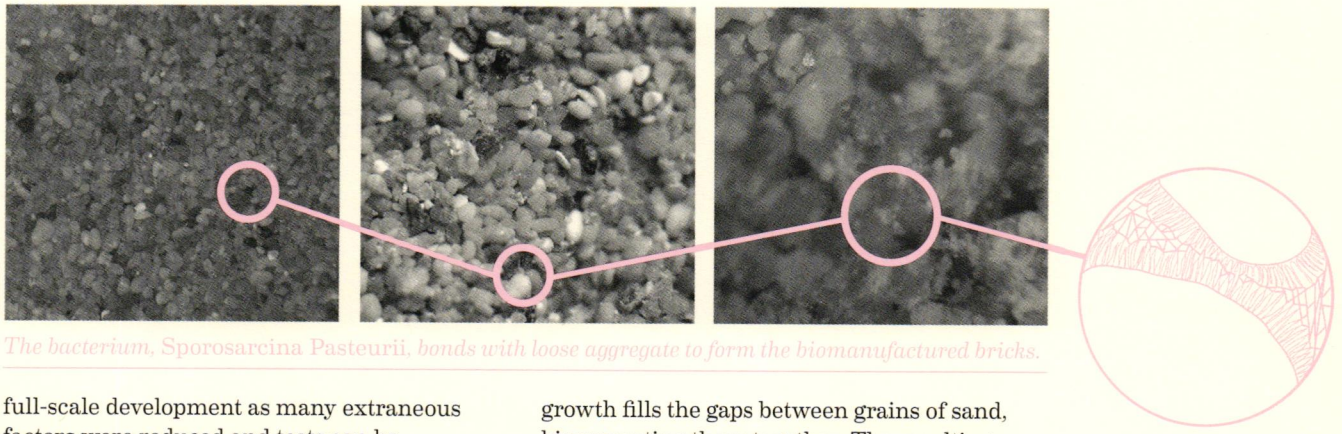
In May of 2005, I accepted a visiting teaching fellowship position at NC State College of Design, having previously completed a Master of Architecture degree at Cranbrook Academy of Art, with a thesis titled: *Material Choreography*. Investigations included the use of calcium carbonate, salt, and neutralizing additives to fabricate disposable furniture; a column (pillar) made of calcium carbonate and salt; and finally, a handrail made of calcium carbonate and salt that was programmed to last a year and seasonally dissolve into a porous scaffold.

This research led to a deeper question in my investigations: "What if we could grow architectural materials?"

During the first semester of my appointment at NC State I audited courses in Material Science to gain a deeper understanding of how materials were developed. Of specific interest was how to naturally grow a material much like the growth of coral, without the use of high-embodied energy heat processes. These courses, compounded with research into biomineralization, led me to further articulate the initial question as: "What if we could grow architectural materials with microorganisms?"

In 2005 I began meeting with Dr. Jose Bruno-Barcena, a microbiologist at NC State, to discuss microbes that biomineralize or biofossilize. At the time my research led me to study the bacterium, *Sporosarcina Pasteruii* (formerly named *Bacillus Pasteurii*) used by other researchers because of its ability to induce bioprecipitation. Meetings with Dr. Barcena were held to discuss "growing a material" with microbes. He helped narrow the research focus by simplifying the overall process and scale. Initially, my pursuit was to grow the brick in full scale using only microbes and minerals. Dr. Barcena suggested using "Poroaver" (small recycled glass beads) as an aggregate with the microbes and media. It was hypothesized that the microbes would saturate the pores of the material, and mineralize the aggregate from the inside out. Patrick Rand, professor of Architecture at the College of Design at NC State and I met as well to discuss the research. Many explorations of porous materials were made with calcium carbonate to be used as scaffolds with hopes of developing a skeleton that the bacteria would precipitate into and "fill." My research at NC State primarily occurred in my second bedroom turned amateur lab. I continued porosity studies in my position as Assistant Professor at the American University of Sharjah, where I began to "program" the pores for specific performance criteria such as insulation and structure. The objective was to produce larger pores to allow more space filling of bacteria precipitation.

Since my arrival in the UAE, I have moved my research into a proper biology lab, where experiments can be performed in a controlled environment using reagent grade (pure) materials. This was an essential move toward



The bacterium, Sporosarcina Pasteurii, *bonds with loose aggregate to form the biomanufactured bricks.*

full-scale development as many extraneous factors were reduced and tests can be performed around the clock. Though many aggregate materials could be used in the biomineralization process, sand was selected due to its ready availability in the UAE region and throughout the world.

PROCESS

Sporosarcina Pasteurii, a nonpathogenic, common soil bacterium is used to create a biocement material in which loose grains of aggregate are fused. A hardened material is formed in a process known as microbial induced calcite precipitation[5] (MICP). The bacteria are inoculated in a liquid solution of urea and allowed to grow. Once the desired concentration of bacteria is reached, they are incorporated into a new media containing calcium chloride and dispensed over loose sand constrained inside formwork. Bacteria use urea as a source of energy, producing ammonia and carbon dioxide, increasing the pH level of the solution. The bacteria then act as nucleation sites, attracting mineral ions from the calcium chloride to the cell wall, forming calcite crystals. Mineral growth fills the gaps between grains of sand, biocementing them together. The resulting material exhibits a composition and physical properties similar to natural sandstone, and can have the consistency of marble with longer growth time. Serving as replacement to fired brick with similar physical properties, biocementation takes less than a few days to complete, and can be economically controlled by recycling media and materials.

Manufacturing can occur as either traditional formwork-cast, or mass customized using a 3D printer to deposit bacterial media in layers. There are many possibilities of other forms using both traditional and digital processes as material units do not have to be rectangular or small units. This material could also potentially be used as an alternative to concrete pre-cast modules, tilt-up or cast in place construction. The potential of the brick form is that it allows the material research to be readily implemented into the construction

Mineral growth fills the gaps between grains of sand, biocementing them together.

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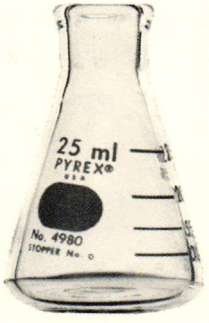

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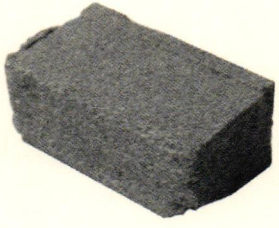

BIOLOGICAL CONCRETE

industry without requiring the radical revising of construction processes. Additionally, the biomanufactured bricks do not require the traditional use of Portland cement mortar, as they can capitalize on the same biomineralization process for unit bonding. During the construction process, bricks would be "dunked" into a slurry of bacteria, growth media, and sand prior to placing them together. The bricks then fuse together over the next few weeks through bacterially induced precipitation.

"Architecture starts when you carefully put two bricks together. There it begins."

— Ludwig Mies van der Rohe

While there are numerous positive environmental savings using biological manufacturing processes, there are also many environmental factors that must be considered and resolved. From the outset, the system has been proposed as being "closed-loop," meaning that all materials used and by-products produced can be either recycled or used for other processes. It would be detrimental not to consider potential hazards that exist if material waste were allowed to penetrate groundwater. Current laboratory scale tests (1:5 scale) are closed loop, recycling waste within the system. *Sporosarcina Pasteurii* bacteria are aerobic (they need oxygen to grow) and are cultivated in a liquid broth media. The best means of getting oxygen to the organisms is to rotate the liquid media during the growth cycle. Solar bio-reactors are also being designed to harness energy from the sun to gently rotate the media during growth, rather than using electrically powered mechanisms. Following completion of the current small-scale laboratory testing, this research will begin migration to full scale production including the further development of environmental constraints: material procurement, closed loop industrial systems, and physical testing. Further advancement will require the development of new collaborations at a PhD level with a team of microbiologists, environmental scientists, and various consulting engineers. There are opportunities over the coming year in Africa and the Middle East, which provide ideal environments for in-situ testing, while simultaneously contributing to humanitarian efforts.

NOTES

[1] The Century Dictionary.

[2] Brook T., "The Confusions of Pleasure: Commerce and Culture in Ming China," University of California Press, 1998.

[3] Clean Air Task Force, Joe Chaisson.

[4] Burke, M, *Journal Times*, March 31, 2009.

[5] Stocks Fisher et al: *Kinetics of Selective Microbial Cementation*, South Dakota School of the Mines and Technology, Rapid City, SD, 1997.

The brick is an essential unit of construction and represents a ubiquitous connection to global architecture.

THE STUDENT PUBLICATION OF THE COLLEGE OF DESIGN *volume* 34

NORTH CAROLINA STATE UNIVERSITY

Marvin J. Malecha, FAIA
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Published by NC State University College of Design

ISSN NO. 0078-1444
LC 04417343

This volume was printed and bound in the United States by Telepathic Graphics in Raleigh, NC. The primary typefaces used are *Eames Century Modern*, designed by Erik van Blokland & House Industries, and KNOCKOUT, designed by Hoefler & Frere-Jones.

750 copies of this public document were printed at a cost of $8 per copy.

EDITOR THANKS

It would have been impossible to produce this publication without the help and support of many people, and we would like to thank a few of them here.

Paul Battaglia, for his advice and guidance throughout the editorial process.

Our board of advisors, for their insightful comments and suggestions.

The graphic designers of this publication, whose talent and dedication brought life to these articles.

and

Dean Marvin Malecha, and all those at the College of Design who worked with us to ensure that this publication could be printed.

This publication inherits a long and impressive legacy from the past Student Publications of the College of Design at NC State. For many years it was an important part of being a student at the College of Design. It exists still today largely through the gifts of generous donors, the dedication of our administrators, and the continued interest of students. We hope that in the future there will be more students who will experience the challenges and rewards of working on this great publication, and who will continue to record and share the thoughts and spirit of the student body of the College of Design.

The Student Publication is available online through design.ncsu.edu.

volume

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These gifts and pledges were inspired by a substantial challenge bequest from Fred and Bobbie Adams.

Special thanks as well to the Publication Campaign Committee led by Steve Schuster, AIA (1973) of Clearscapes and David Ramseur, AIA (1968) of Ramseur-Peterson Architects. The committee included John Cort, AIA (1967), Ligon Flynn, FAIA (1959), Don Lee, FAIA (1961), Wes McClure, FAIA (1969), and Lloyd Walter, FAIA (1960).

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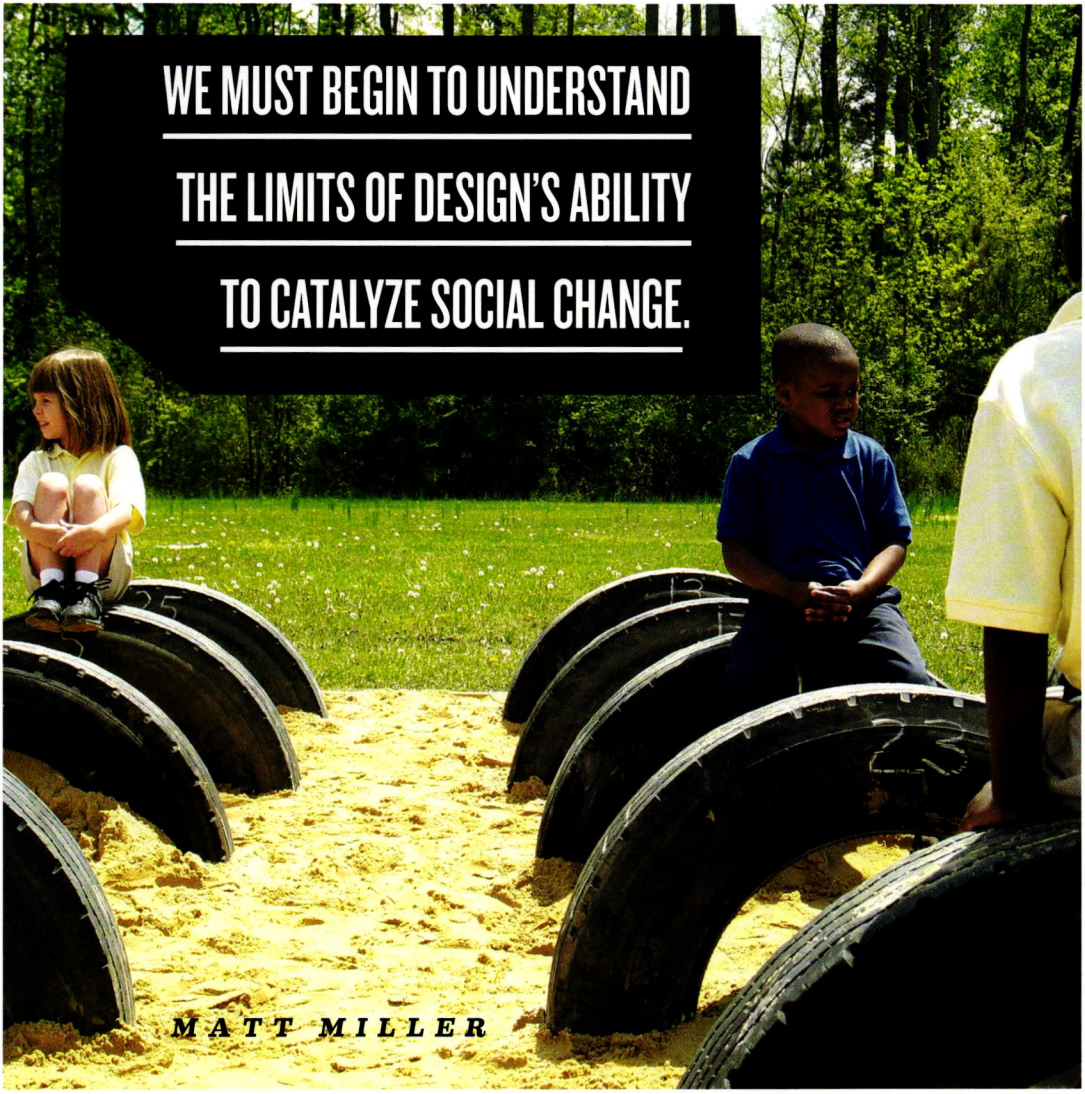
WE MUST BEGIN TO UNDERSTAND
THE LIMITS OF DESIGN'S ABILITY
TO CATALYZE SOCIAL CHANGE.
MATT MILLER


Urban redevelopment cannot
turn a blind eye to existing
socioeconomic conditions.
RAYMOND
HOLZ

THE ARCHITECTURAL
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UNDERVALUES
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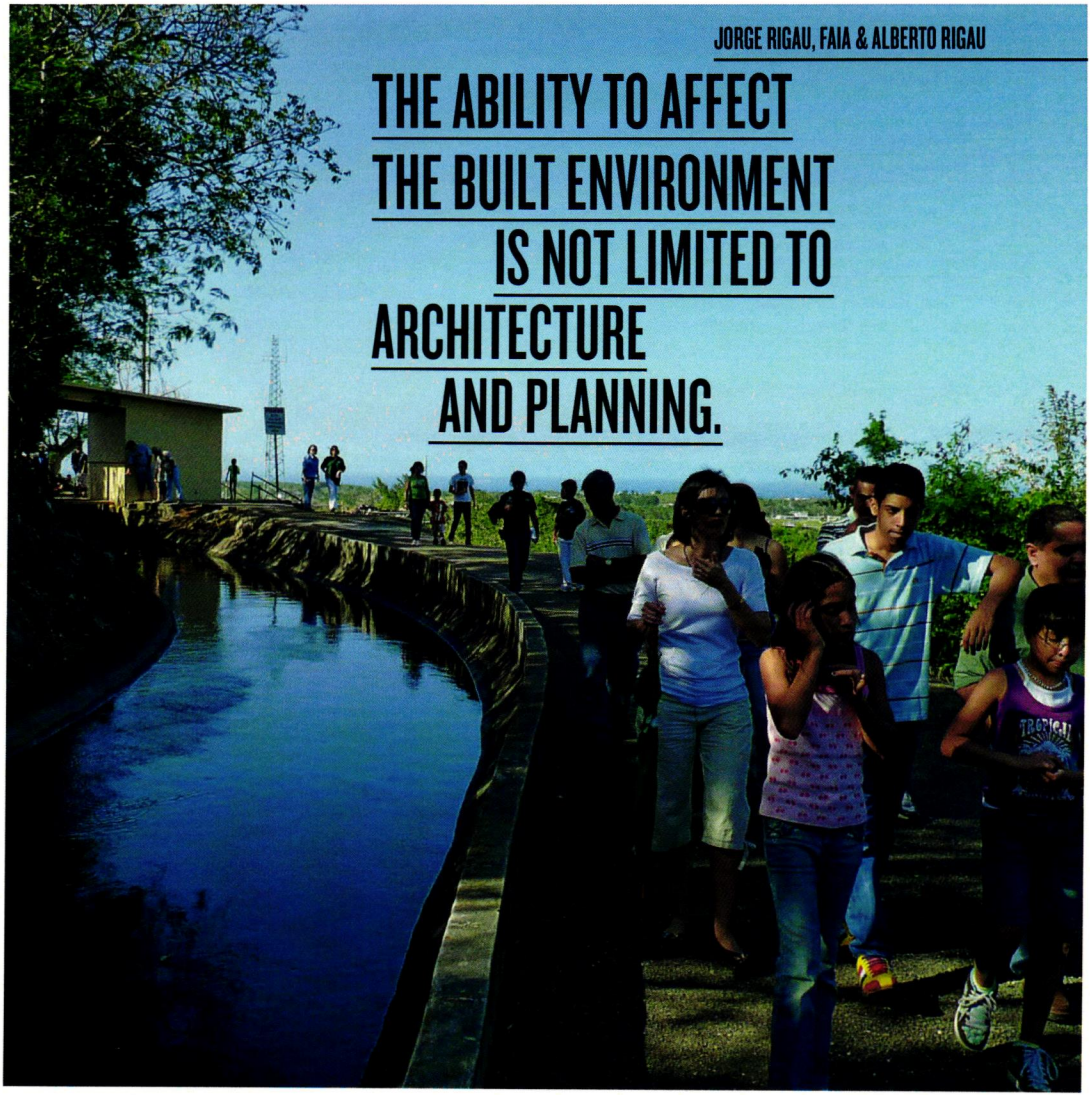
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THE ABILITY TO AFFECT
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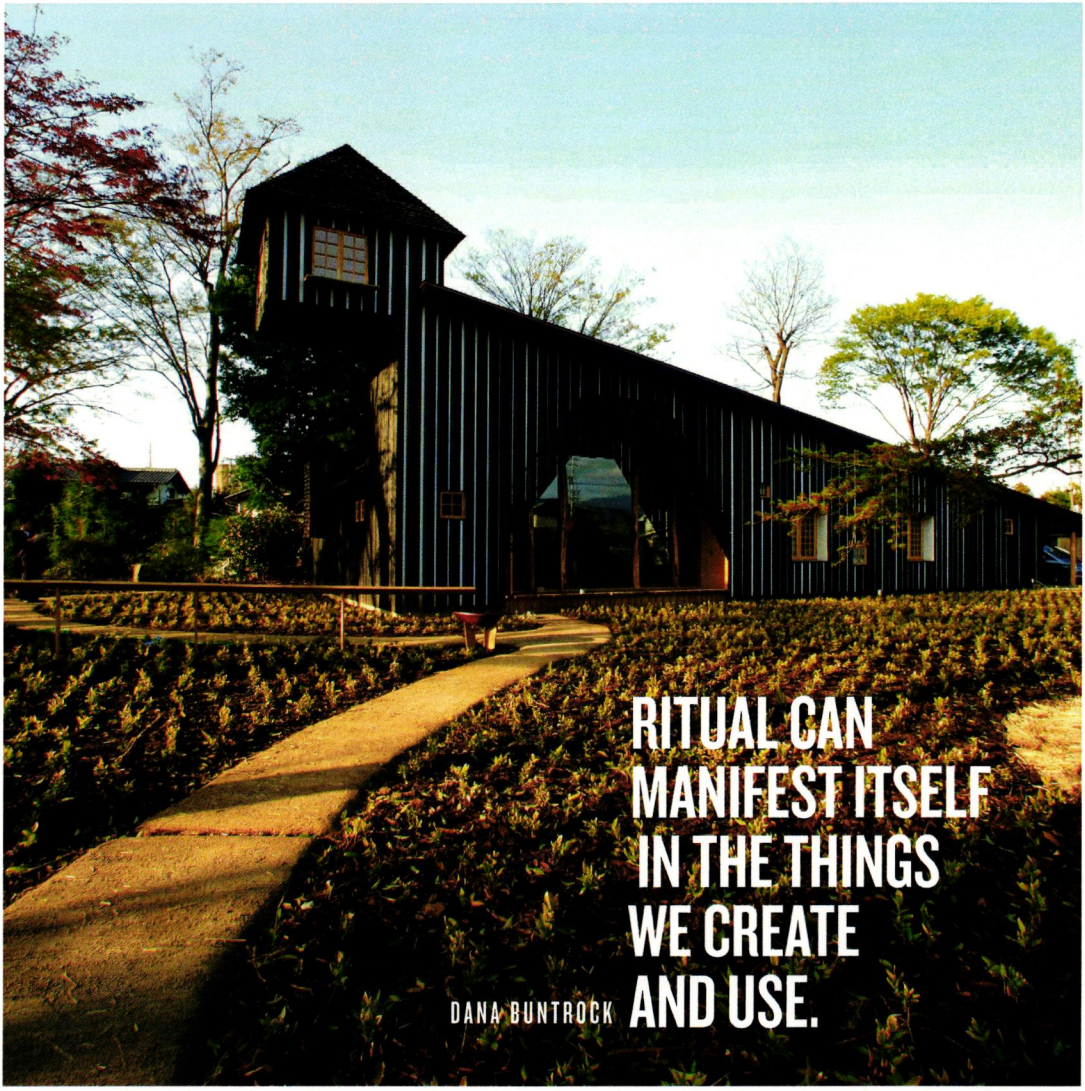
RITUAL CAN
MANIFEST ITSELF
IN THE THINGS
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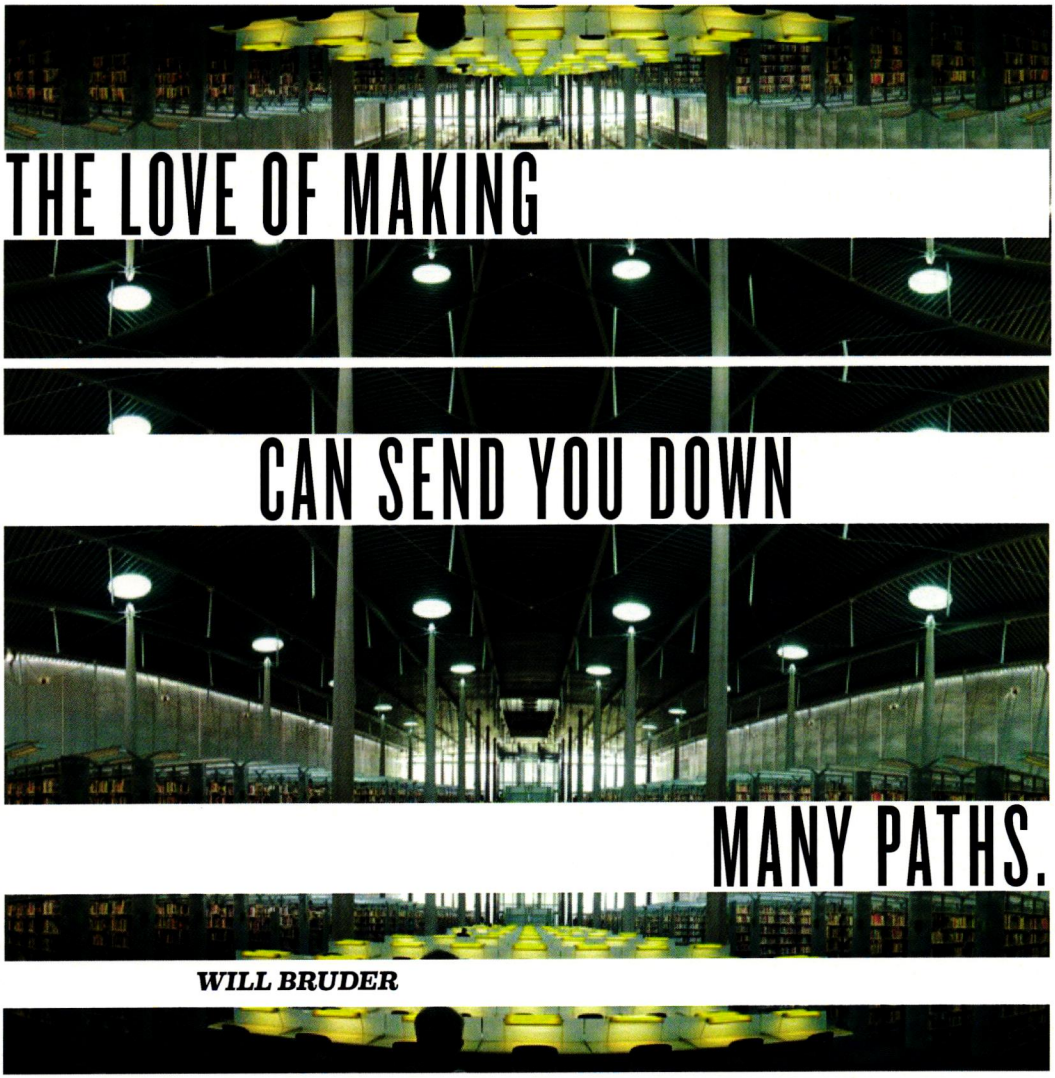
AND USE.
DANA BUNTROCK

Terunobu Fujimori

MATERIALS GAIN MEANING FROM THE PROCESSES USED TO CREATE THEM.


PERFORMANCE AND RITUAL HAVE THE ABILITY TO ENGAGE AND TRANSFORM THE BUILT ENVIRONMENT.
DANA RAYMOND



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RESPECTFUL AND PROGRESSIVE
IF IT STEMS FROM THE NEEDS
OF ITS COMMUNITY.
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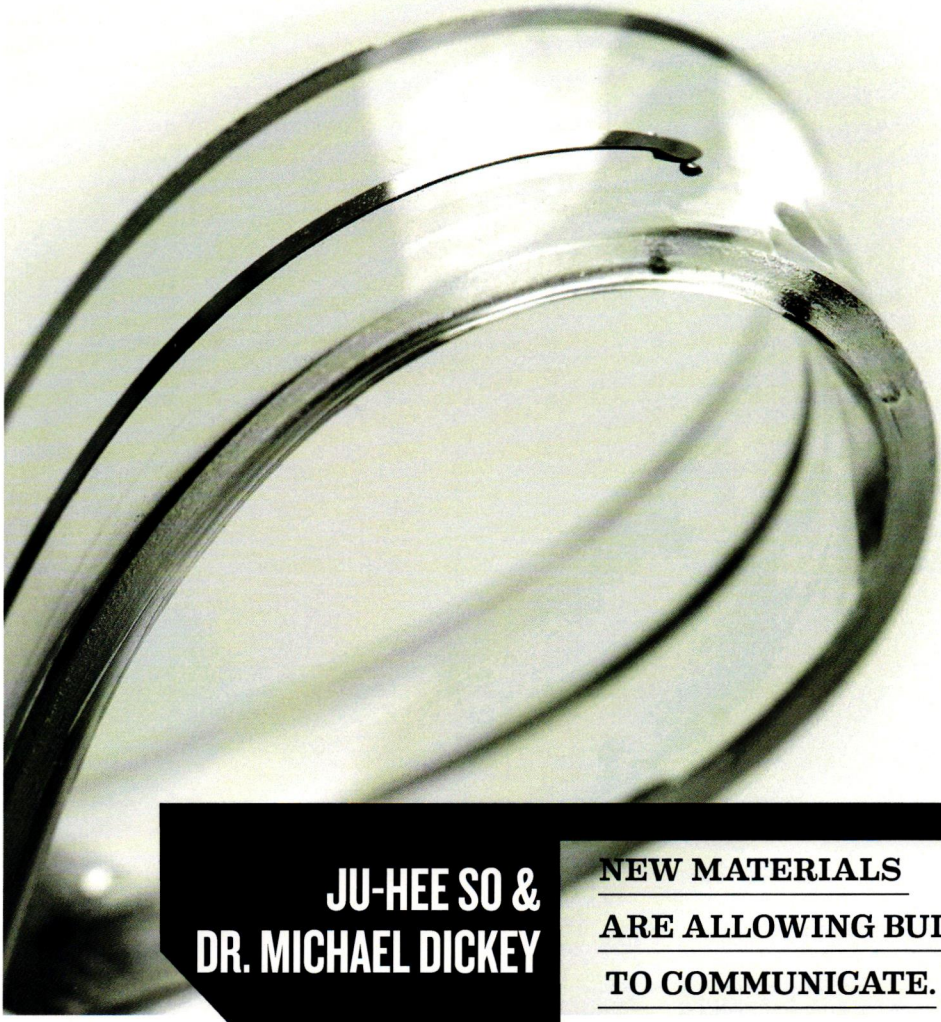
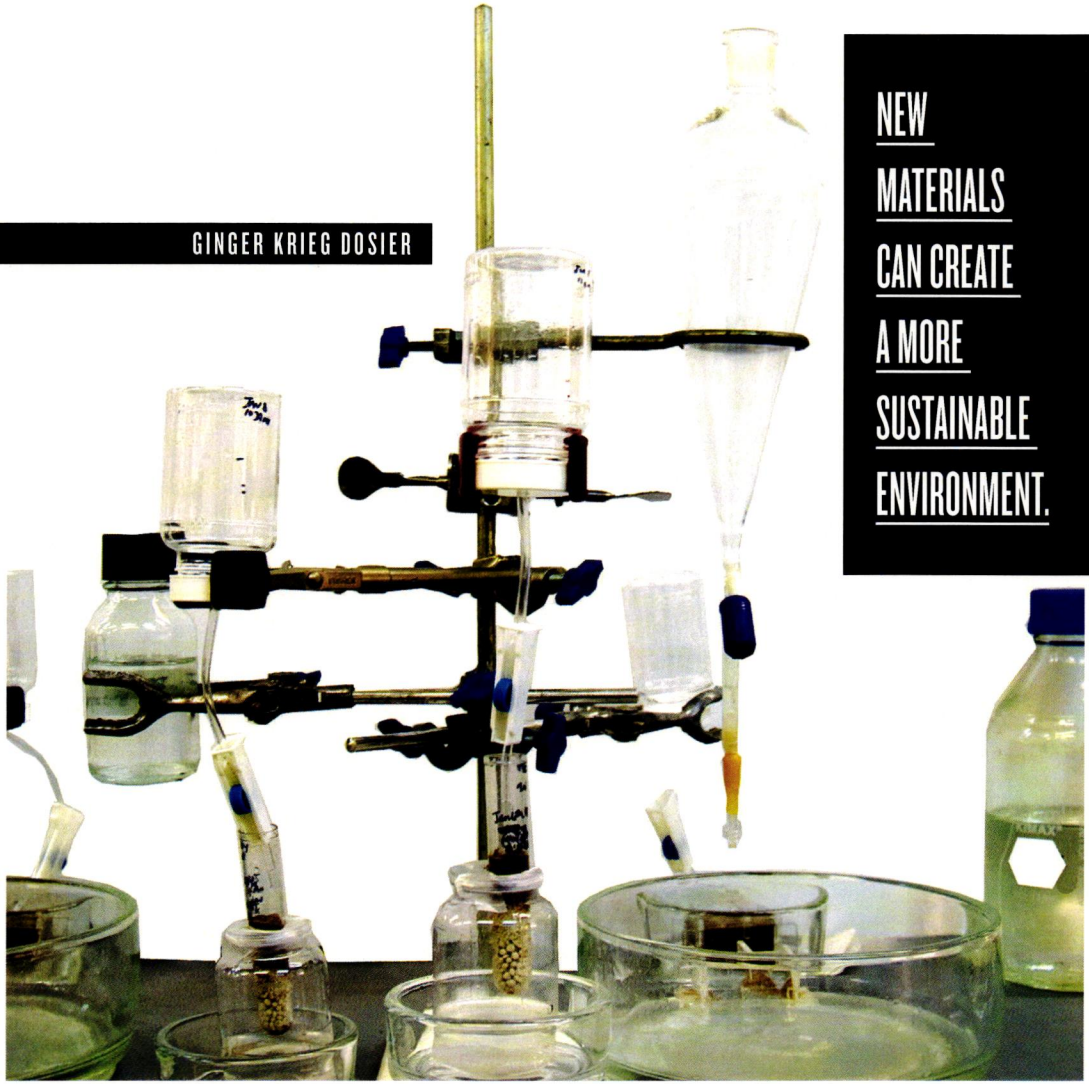


JU-HEE SO & DR. MICHAEL DICKEY

NEW MATERIALS ARE ALLOWING BUILDINGS TO COMMUNICATE.

GINGER KRIEG DOSIER



NEW MATERIALS CAN CREATE A MORE SUSTAINABLE ENVIRONMENT.

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Dr. Michael Dickey
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1. REMOVE INSERTS

2. STICK ON WALL

3. ENJOY