

Modern
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2021
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2021

Columbia
University

Engineered Transparency

Glass in Architecture and Structural Engineering

Wood Auditorium, Avery Hall
GSAPP, Columbia University

September 26, 27 + 28, 2007

Convened by

Graduate School of Architecture,
Planning and Preservation (GSAPP),
Columbia University

Mark Wigley, Dean

Michael Bell, Professor, Conference Chair

Fu Foundation School of
Engineering and Applied Science,
Department of Civil Engineering
and Engineering Mechanics,
Columbia University

Christian Meyer, Chair and Professor

Institute of Building Construction,
Technische Universität Dresden

Bernhard Weller, Director and Professor

The conference will be accompanied by the exhibition *Through Glass*
Curated by Rosana Rubio-Hernandez
On display in Avery Hall, 200 level September 24 — October 12

After its role in the last century's call to a radical new architecture and urban life, glass architecture is today more ubiquitous than ever. A highly engineered product, glass has emerged in a new light as an apparently culturally accepted material in design and construction. Its new incarnation, however, reveals a virtually new product replacing the glass used even twenty years ago. The innovations are observable and have direct use. Offering new modes of visual pleasure and spatial experience to building occupants—glass has also been the beneficiary of major advances in engineering that are decidedly less visible—structural innovations, new control and design engineering at the level of optics, thermal properties, and expanded fabrication limits as well as installation methods have quietly reconfigured the extent and reach of glass applications. We are so continually surrounded by such discretely functioning glass that we do not even see it. This interdisciplinary conference aims to bring an ordinarily extraordinary material back before our eyes.

WEDNESDAY
SEPTEMBER
26

6:30-8:00 PM

Welcoming Remarks and Introduction
Mark Wigley
Dean, GSAPP, Columbia University

Welcoming Remarks from
Oldcastle Glass

Keynote Lecture
Kazuyo Sejima
Architect, SANAA, Tokyo

THURSDAY SEPTEMBER 27

10:00-10:30 AM

Introductions
Mark Wigley
Dean, GSAPP, Columbia University
Michael Bell
Professor of Architecture, GSAPP,
Columbia University
Christian Meyer
Chair and Professor,
Department of Civil Engineering
and Engineering Mechanics,
Columbia University
Bernhard Weller
Director and Professor,
Institute of Building Construction,
Technische Universität Dresden

10:30 AM-12:00 PM

Is Glass Still Glass?
Moderator: Michael Bell
Professor of Architecture, GSAPP,
Columbia University

In its early 20th-century appearances, glass architecture—in designs by Walter Gropius or Mies van der Rohe, or writings by Paul Scheerbart—was both fact and metaphor. A signal of cultural and material production in major upheaval, it promised a new if not radically altered interior world and a new relation to production.

Does glass architecture still signify cultural transition; do the depth of engineering and the control of risk in new work reduce or enlarge the cultural project of glass today? Is glass still glass?

Typically associated with either the architectural innovations of the 1920s or the recent technical and decidedly global innovations tied to energy issues, new coatings, and new adhesion techniques, glass architecture has—like many aspects of high-end, capital-intensive building products—ceased to be as anything less than inevitable. New work in architecture and engineering is by now seemingly expected to conflate aesthetic aims with engineering goals.

Has the very understanding of glass changed from a politically radical material to a financially conventional building product?

Roberto Bicchiarelli
Executive Vice President, Permasteelisa
Cladding Technologies, LP
Laurie Hawkinson
Professor of Architecture, GSAPP,
Columbia University
Reinhold Martin
Professor of Architecture, GSAPP,
Columbia University
Detlef Mertins
Professor and Chair, Department of
Architecture, University of Pennsylvania

12:00-1:30 PM

Break

1:30-3:00 PM

Connections: Visual and Mechanical
Moderator: Kenneth Frampton
Ware Professor of Architecture, GSAPP,
Columbia University

Evolutions in the fabrication of glass and its mechanical components—framing systems, gaskets, adhesives, sealants, as well as assembly procedures and potentials—have re-written the curtain wall and its application in building. In the course of doing so there has been a steadily revised but open-ended discussion about the cultural aspects of the transparent building. What are the new connections in glass architecture—both visual and mechanical—that have allowed this new reach for architecture and how do they affect your work?

James Carpenter
Architect, James Carpenter Design
Associates, New York City
Guy Nordenson
Professor of Structural Engineering,
School of Architecture,
Princeton University
François Roche
Professor of Architecture, GSAPP,
Columbia University
Architect, R&S(e)n, Paris
Hans Schober
Engineer, Schlaich Bergermann
and Partner, Stuttgart

3:15-5:00 PM

Glass at the Limits
Moderator: Antoine Picon
Professor of the History of Architecture
and Technology, Graduate School of Design,
Harvard University

In an era of ubiquitous and inexpensive global communications and increasingly expensive energy costs, what are the critical implications for glass in building over the next decade? Will energy issues force a major change in transparent architecture?

Have concepts of transparency, so fully embedded in architectural theory and history, been dislocated to new modes of transparency? Have newly mobilized forms of mathematics unlocked programs of information transparency, self-generated and navigated forms of media, new forms of community made architectural transparency. Does architecture have a chance to affect these conditions?

What are the new limits of glass—as technical instrument or social and political metaphor?

Beatriz Colomina
Professor, School of Architecture,
Princeton University
Elizabeth Diller
Architect, Diller, Scofidio + Renfro,
New York
Matthias Schuler
Engineer, TRANSSOLAR, Stuttgart
Bernhard Weller
Director and Professor,
Institute of Building Construction,
Technische Universität Dresden

5:00-6:00 PM

The Near and Far Futures of Glass
Moderator: Mark Wigley
Dean, GSAPP, Columbia University

The technical limits of glass seem to have reached a new plateau: is it still possible to consider glass architecture a frontier project for the new generation of architects and engineers? Or do its ultimate material limits; in bending, stress and strain, cost, energy loss, modularity, and seeming standardization require a new mode of seeing glass architecture as inevitably embedded in a new stratum of capital-intensive and ubiquitous building materials? Is glass now a fully conventional material?

How have the roles material plays in design changed and to what extent can we consider any material extraordinary today, when we extended the capability to engineer material performance and to reduce risk?

Steven Holl
Professor of Architecture, GSAPP,
Columbia University
Werner Sobek
Engineer, Werner Sobek Engineering
and Design, Stuttgart
Professor of Architecture,
University of Stuttgart

Reception

FRIDAY SEPTEMBER 28

9:30–11:00 AM

Structural Glass, Structure and Glass
Moderator: Richard L. Tomasetti
Engineer, Thornton Tomasetti, Inc.,
New York

Conventional goals for installation of glass have isolated and maintained the brittle material in conditions that assure minimal intrusion of stress and strain. Today, new means of testing and modeling loading, and of verifying the effects of the behavior of integral systems on each other have allowed more dynamic interaction of comprehensive ensembles of structure, glass, and framing systems. This panel examines the role of structural engineering in glass architecture and in particular new means of testing and projecting the behavior of systems.

Ulrich Knaak
Professor of Architecture, Technical
University, Delft
Nina Rappaport
Publications Director, School of Architec-
ture, Yale University
Jens Schneider
Professor of Engineering, University of
Applied Sciences, Frankfurt

11:15 AM–12:30 PM

Optics and Climate Engineering
Moderator: Joan Ockman
Director, Temple Hoyne Buell Center for
the Study of American Architecture at
GSAPP, Columbia University

The economic impact of recent environ-
mental energy savings laws has usually
been understood for overt if not linear
decreases in energy consumption. Yet the
emergence of a new standard of climate
engineering also has produced architec-
tures that are efficient but not decidedly
driven to reducing consumption so much
as allowing for a new type of architectural
experience.

Glass architecture has been the
recipient of many of these engineering
advances and its visual qualities regis-
ter against and sustain a history of early
glass projects. But the visual aspects of
glass have also been transferred from the
experience of the user to a wider ex-
amination of material performance. The
optic project is one of discrete examina-
tion and calculation of a finer gradient of
affects. A finer visualization of the prop-
erties of glass as material and what these
properties can allow architecturally raises
the expectations for climate engineer-
ing, building design, and ultimately for
energy studies in architectural design.

Michelle Addington
Associate Professor,
School of Architecture, Yale University
Robert Heintges
Professor of Architecture, GSAPP,
Columbia University
Wilfried Laufs
Engineer, Werner Sobek, New York
Toshihiro Oki
Architect, SANAA, Tokyo

12:30 PM–2:00 PM

Break

2:00–3:15 PM

New Materials/Conversion of Light
Moderator: Scott Marble
Professor of Architecture, GSAPP,
Columbia University

During the early 1990s a shift in direction
occurred in architectural design that
began to place greater emphasis on
the performance capabilities of building
materials—indeed the performance capa-
bilities of architecture in its widest sense.
Decades of academic work that relied
on theories of meaning often taken from
linguistic criticism have been increasingly
displaced as the dominant method in
both architectural education and building
design. As an overall catch phrase, “new
materials” has indicated a wide range of
meanings, but in general it has indicated
materials that will by their very nature
change what we design—and possibly for
whom we design.

What are potentialities that lie within
the term “new materials” for glass ap-
plications today? How are new glass
materials re-writing what we do with
glass and for whom we work?

Graham Dodd
Engineer, ARUP, London
Susanne Rexroth
Researcher, Institute of Building
Construction, Technische Universität
Dresden
Thomas Richardson
Material scientist, Lawrence Berkeley
National Laboratory,
University of California, Berkeley
Stefan Röscher
Architect, Diller Scofidio + Renfro

3:30–5:00 PM

Security, Safety, and Blast Loading
Moderator: Michael Bell
Professor of Architecture, GSAPP,
Columbia University

Moderator: Christian Meyer
Chair and Professor, Department of Civil
Engineering and Engineering Mechanics,
Columbia University

Impact loadings have been a concern of
the engineering community for decades,
in particular in those geographic regions
that regularly experience hurricanes and
tornadoes. Blast loadings were added
to the set of loads on a large scale with
the first attacks on U.S. embassies
abroad, without really entering the public
consciousness, because those attacks
happened at a distance. Today, all land-
mark and important structures need to be
re-engineered under a new set of design
criteria. How do these new demands
affect the glass installations as defined in
earlier sessions of this conference? How
does the engineering community respond
to this challenge?

No realm of technical research outside
of blast loading and security in glass
applications seems so at odds with what
we have historically expected of glass
architecture. A construction possessed
of a delicacy supplied by transparency—
essentially fragile even as it has often
been presented as anything but, in terms
of social or political effect—glass archi-
tecture has routinely been understood
as causing a re-evaluation of social or
political hegemony. This tenuous quality
has been a metaphor for the breaking
of social relations within which the work
situates itself.

Yet blast loading and security issues
suggest that the limits we have placed
on glass to sustain impact have been ex-
panded—and indeed glass architecture's
continued presence, even acceleration in
contested sites in an era of security risks

would have us re-write glass as an act of
securing stability rather than up-ending it.

What are the new means of increas-
ing—or sustaining—glass applications in
security situations? How do we evaluate
these in the context of the historical
themes of glass as brittle and indeed
fragile?

Albrecht Burmeister
Engineer, DELTA-X, Stuttgart
H. Scott Norville
Professor and Chair, Department of
Civil and Environmental Engineering,
Texas Tech University
Robert Smilowitz
Engineer, Applied Sciences Division,
Weidlinger Associates, New York

Closing Remarks

MICHELLE ADDINGTON

An Associate Professor at Yale University's School of Architecture, Michelle Addington also taught at Harvard University for ten years and before that at Temple University and Philadelphia University. Her background includes work at NASA/Goddard Space Flight Center, where she developed structural data for composite materials and designed components for unmanned spacecraft. Addington subsequently spent a decade as a process-design and power-plant engineer as well as a manufacturing supervisor at DuPont, and after studying architecture, she was an architectural associate at a firm based in Philadelphia. She conducts research on discrete systems and technology transfer and serves as an adviser on energy and sustainability for many organizations, including the Department of Energy and the AIA. Her writings on energy, environmental systems, lighting, and materials have appeared in many books and journals; she is a co-author, with Daniel Schodek, of *Smart Materials and Technologies for the Architecture and Design Professions* (Architectural Press, 2004).

MICHAEL BELL

Michael Bell is a Professor at Columbia University's Graduate School of Architecture, Planning and Preservation, where he is Director of the Core Design Studios. He is the founder of Michael Bell Architecture, based in New York City. His design work has been shown at The Museum of Modern Art, New York; the Venice Biennale; Yale University's School of Architecture; the University Art Museum, University of California, Berkeley; and Archi-Lab, France. Bell has received four Progressive Architecture Awards, and his work is included in the collection of the San Francisco Museum of Modern Art. Books by Bell, published by The Monacelli Press, include *16 Houses: Designing the Public's Private House* (2000), *Michael Bell: Space Replaces Us: Essays and Projects on the City* (2000), and *Slow Space* (1998). He is a founding editor, along with Yung Ho

Chang and Steven Holl, of the urbanism journal *32*. Bell has taught at the University of California, Berkeley; Rice University; and Harvard University's Graduate School of Design. In 2000–02 he led a team of architects to provide research, planning, and design for 2,100 units of housing on a 100-acre parcel of oceanfront land owned by the city of New York. The work was funded to assist in the city's future planning and development goals. Bell also founded "16 Houses," a low-income housing design program in Houston, Texas. Bell's recently completed Binocular House will be included in Kenneth Frampton's Rizzoli publication *American Masterworks*.

ROBERTO BICCHIARELLI

Roberto Bicchiarelli is Executive Vice President of Permasteelisa Cladding Technologies, LP, based in Windsor, Connecticut. Bicchiarelli oversees sales and estimating for the company—a division of the worldwide Permasteelisa Group—which specializes in the design, fabrication, and installation of facades for monumental buildings, in particular, innovative curtain walls and metal claddings. Among the firm's projects in the United States and Europe are the headquarters of Goldman Sachs and the Hearst Building, New York City; Connecticut Center for Science and Exploration, Hartford; Millennium Bridge, Chicago; and new terminals for the Rome Airport. As a graduate student in architecture at the University of Rome, Bicchiarelli began working for one of the Permasteelisa Group's Italian companies, where he ultimately became a Director and a Partner. Between 1995 and 1997 he established and managed operations for his own company in Germany. After Permasteelisa Cladding Technologies had been created in 1998, Bicchiarelli joined the operations in the United States to contribute as a liaison between the Permasteelisa Group companies and the recently established U.S.-based office. In addition to giving lectures and presentations, Bicchiarelli has led seminars for architecture students at the University of Pennsylvania, University of Virginia, and Georgia Tech University.

ALBRECHT BURMEISTER

Since 1988, Albrecht Burmeister has been a partner and Managing Director of DELTA-X GmbH, an engineering firm based in Stuttgart, Germany that specializes in lightweight steel structures, structural glazing, structural dynamics, and the use of finite element method (FEM) in the engineering design process. He previously worked on bridge projects at the Ed. Züblin AG headquarters and as a scientific assistant at the Institute of Structural Mechanics at the University of Stuttgart, from which he received a civil engineering degree. His dissertation was awarded the Professor-Fritz-Peter-Müller-Foundation Prize in 1987 by the University of Karlsruhe (TH), where he is an Assistant Professor of structural dynamics. He is also on the engineering faculty of the University of Applied Science, Rosenheim. Burmeister is a member of the standardization committee that oversees design and application regulations for the use of glass in buildings and civil engineering projects and directs the working group Bomb-Blast-Resistant Design (Fachverband Konstruktiver Glasbau).

JAMES CARPENTER

A leading architect in the development of new and emerging glass and material technologies, James Carpenter heads James Carpenter Design Associates, which has advanced architectural design by focusing on the integration of natural light into the structure and design of large buildings. The firm specializes in developing enclosure systems, glass structures, skylights, and building skins for major projects, which have included World Trade Center Tower 7, Time Warner Jazz@Lincoln Center, and the new MTA Transit Center at Fulton Street, all in New York City; as well as Gucci Tokyo.

BEATRIZ COLOMINA

Beatriz Colomina is a Professor at the School of Architecture and Founding Director of the Program in Media and Modernity at Princeton University. She is

the author of *Domesticity at War* (ACTAR and MIT Press, 2007), *Doble exposición: Arquitectura a través del arte* (Aka, 2006), and *Privacy and Publicity: Modern Architecture as Mass Media* (MIT Press, 1994), and the editor of *Architecture Production* (Princeton Architectural Press [PAP], 1988), *Sexuality and Space* (PAP, 1992), and *Cold War Hot Houses: Inventing Postwar Culture from Cockpit to Playboy* (PAP, 2004). Colomina has organized the exhibition *Clip/Stamp/Fold: The Radical Architecture of Little Magazines 196X-197X* at the Storefront for Art and Architecture in New York and the Canadian Centre for Architecture in Montreal. The exhibition will travel to several cities in the United States, Europe, and Asia, starting with Documenta 12 and the Architectural Association in London. Colomina is currently working on her next research project, "X-Ray Architecture: Illness as Metaphor."

ELIZABETH DILLER

Architect Elizabeth Diller is a principal in the collaborative interdisciplinary design studio Diller Scofidio + Renfro, based in New York City. Among the firm's current projects are the Juilliard School, Alice Tully Hall, and the School of American Ballet, for Lincoln Center; a park situated on the High Line, an obsolete railway running through the Chelsea neighborhood; and the Kopp Townhouse, a private residence in NoLiTa. Diller Scofidio + Renfro's new building for the Boston Institute of Contemporary Art (ICA) opened in December 2006.

GRAHAM DODD

As a mechanical and facade engineer at ARUP, based in London, Graham Dodd specializes in the design, manufacture, and construction of structural glass and facade systems. He has led teams of facade engineers involved in all aspects of glazing design and contracting activity for projects in Europe, Asia, and North America. His expertise has developed the firm's knowledge of the structural use of glass and Dodd has contributed his specialist skills to numerous innovative

projects for ARUP. His early experience with varied industries has resulted in knowledge of a wide range of materials, manufacturing, and product-design processes. Dodd has worked in the field of glass structures and design since 1988.

KENNETH FRAMPTON

Kenneth Frampton is the Ware Professor of Architecture at the Graduate School of Architecture, Planning and Preservation at Columbia University. He trained as an architect at the Architectural Association School of Architecture, London, and has worked as an architect and architectural historian and critic in England, Israel, and the United States. He is the author of such distinguished books as *Modern Architecture: a Critical History* (1980), *Modern Architecture and the Critical Present* (1980), *Studies in Tectonic Culture* (1995), *American Masterworks* (1995), *Le Corbusier* (2002), and *Labor, Work and Architecture* (2002). An updated and expanded fourth edition of *Modern Architecture: A Critical History* was released in the summer of 2007.

LAURIE HAWKINSON

Laurie Hawkinson is a partner of Smith-Miller + Hawkinson Architects—a New York City-based architecture and urban planning firm. The firm's projects include the expansion of the Corning Museum of Glass, Corning, New York; the Museum of Women's History and the Wall Street Ferry Terminal at Pier 11, both in New York City; and the Outdoor Cinema and Amphitheater at the North Carolina Museum of Art in Raleigh. The firm was a finalist for the Olympic Village Design Competition sponsored by the NYC 2012 Olympic Committee. Among its current projects are the U.S. Land Ports of Entry at Champlain and Massena, New York, for the General Services Administration. Hawkinson is also a Professor of Architecture at Columbia University's Graduate School of Architecture, Planning and Preservation.

ROBERT HEINTGES

Robert Heintges is principal of Heintges & Associates, an international consulting firm that provides a wide range of services to architects and building owners for the design and implementation of curtain walls, cladding, and specialty glazing. Since its inception in 1989, the firm has consulted on more than 30 million square feet of facades throughout the world, including many high-profile and award-winning projects. Heintges is also an Adjunct Professor at the Graduate School of Architecture Planning and Preservation at Columbia University, where he has taught since 1990. He currently teaches an advanced seminar and technical studio on the curtain wall.

STEVEN HOLL

Steven Holl has realized cultural, civic, university, and residential projects both in the United States and internationally. In 1976 he founded Steven Holl Architects, which currently operates offices in New York and Beijing. The firm has been recognized around the world with numerous awards and accolades, and its work has been widely published and exhibited. In June 2007, Steven Holl Architects opened the highly acclaimed Nelson-Atkins Museum of Art (Kansas City, Missouri). Currently under construction are the Linked Hybrid mixed-use complex (Beijing, China), Nanjing Museum of Art and Architecture (Nanjing, China), Vanke Center (Shenzhen, China), Herning Center of the Arts (Herning, Denmark), and facilities for New York University's Department of Philosophy (New York City). Recent international design competitions won include the Cité du Surf et de l'Océan (Biarritz, France), Sail Hybrid (Knokke-Heist, Belgium), and Meander (Helsinki, Finland). Holl studied architecture at the University of Washington, Seattle, and later in Rome, Italy, in 1970; in 1976 he undertook post-graduate work at the Architectural Association in London. An accomplished author, he is also a Professor of Architecture at Columbia University's Graduate School of Architecture, Planning and Preservation.

ULRICH KNAACK

Ulrich Knaack completed his architecture studies at RWTH Aachen. He went on to lecture in structural design and glass construction at the university, and in 2000 joined the architectural firm RKW- Architektur und Städtebau, based in Düsseldorf, where he was responsible for the design and planning of numerous large-scale and fast-track projects. He has taught at the University of Applied Sciences, Detmold, and in 2005 was appointed Professor of Structural Design at the School of Architecture/TU (Technical University) Delft. Knaack's main areas of focus and research are facades, new materials, and industrial building methods.

WILLFRIED LAUFS

Wilfried Laufs studied structural engineering and architecture at RWTH Aachen, Germany, where he obtained a PhD in the field of steel-and-glass structures in 2000, and continued his research with grants in Lausanne, Barcelona, and London, before joining Werner Sobek Engineering and Design in Stuttgart to work on the Bangkok International Airport project in Thailand. Since 2005, as Executive Vice President, he has headed the New York City branch of the firm, Werner Sobek New York (WSNY), which focuses primarily on glass in high-end facades and landmark structures.

SCOTT MARBLE

Scott Marble is a founding partner of Marble Fairbanks, based in New York City, and a Professor of Architecture at Columbia University where he is the director of the Avery Digital Fabrication Research Lab. The work of Marble Fairbanks has been published and exhibited around the world and is in the permanent collection of The Museum of Modern Art in New York and the Nara Prefectural Museum in Japan. The firm has won numerous AIA Design Awards, American Architecture Awards, a Progressive Architecture Award, and, most recently, an ID Magazine Award. In

2005 and again in 2007, Marble Fairbanks was selected as one of 24 firms to participate in the NYC Department of Design and Construction's Design Excellence Program and is currently working on several projects in New York, including a new public library for Queens. *Marble Fairbanks: Bootstrapping*, featuring recent projects along with critical essays on the firm's work, was published in 2006 by the University of Michigan Press.

REINHOLD MARTIN

Reinhold Martin is Associate Professor of Architecture in the Graduate School of Architecture, Planning and Preservation at Columbia University, where he directs the PhD program in Architecture, and the MS program in Advanced Architectural Design. He is a founding co-editor of the journal *Grey Room*, a partner in the firm of Martin/Baxi Architects, and has published widely on the history and theory of modern and contemporary architecture. Martin is the author of *The Organizational Complex: Architecture, Media, and Corporate Space* (MIT Press, 2003) and co-author, with Kadambari Baxi, of *Entropia* (Black Dog, 2001) and *Multi-National City: Architectural Itineraries* (ACTAR: 2007). He is currently working on a book that re-theorizes postmodernism.

DETLEF MERTINS

Detlef Mertins is Professor and Chair of the Department of Architecture at the University of Pennsylvania. From 1991 to 2003 he taught at the University of Toronto where he held the Canada Research Chair and directed the graduate program. He is a contributing author of *Zaha Hadid* (Guggenheim Museum, 2006), *Mies in America* (Canadian Centre for Architecture, 2001), *Mies in Berlin* (The Museum of Modern Art, 2001), and the English edition of Walter Curt Behrendt's *The Victory of the New Building Style* (Getty Trust Publications, 2000). His publications related to glass and transparency include *The Presence of Mies* (1994); his PhD dissertation, *Transparencies Yet to Come: Sigfried*

Giedion and the Prehistory of Architectural Modernity (Princeton University, 1996); "The Enticing and Threatening Face of Prehistory: Walter Benjamin and the Utopia of Glass," in *Assemblage* 29 (1996); "Walter Benjamin and the Tectonic Unconscious," in *ANY* 14 (1996); and "Transparency: Autonomy and Relationality," in *AA Files* 32 (1997). He recently authored "Same Difference," in *Foreign Office Architects, Phylogenesis: FOA's Arc* (Actar, 2004); "Bioconstructivism," in Lars Spuybroek, *NOX: Machining Architecture* (Thames & Hudson, 2004); and "Where Biology and Architecture Meet," in *Interact or Die!* (NAi, 2007).

CHRISTIAN MEYER

Christian Meyer is Professor and Chair of the Department of Civil Engineering and Engineering Mechanics at Columbia University. His areas of research include analysis and design of concrete structures, concrete material science and technology, structural engineering, earthquake engineering and structural dynamics, and computer analysis of structures. Meyer has consulted for organizations such as the California Department of Transportation; Stone and Webster Engineering Corp. in Boston; Weidlinger Associates in New York; Auton Computing Corp. in Edison, New Jersey; the U.S. Army Armament Research and Development Command in Dover, New Jersey; the New York City DEP; and the MTA Bridges and Tunnels in New York City. His published work includes more than 160 technical papers and reports on various topics in structural and concrete engineering, including a textbook on the design of reinforced concrete structures. Meyer received a Vordiplom from the Technische Universität Berlin, and MS and PhD degrees from the University of California, Berkeley. He is a registered professional engineer in Massachusetts, New Jersey, and New York

GUY NORDENSON

Guy Nordenson is a structural engineer and Professor of Structural Engineering at Princeton University's School of Architecture. He is also a Faculty

Associate at the Princeton University Center for Human Values. After studying at MIT and the University of California, Berkeley, he began his career as a draftsman in the joint studio of R. Buckminster Fuller and Isamu Noguchi in Long Island City in 1976. Nordenson has worked as a structural engineer in San Francisco and New York. He established the New York office of Ove Arup & Partners in 1987 and was its director until 1997, when he began his own practice, Guy Nordenson and Associates Structural Engineers, LLP. In 1993–94 he was a Loeb Fellow at Harvard University. In 2003 he was the first recipient of the new American Academy of Arts and Letters Academy Award in Architecture for contributions to architecture by a non-architect. He was appointed Commissioner of the NYC Art Commission in 2006 by Mayor Michael Bloomberg and the NYC City Council, the first engineer appointed since the Art Commission was established in 1898.

Nordenson was the structural engineer for the Museum of Modern Art expansion in New York, the Jubilee Church in Rome, the Simmons Residence Hall at MIT in Massachusetts, the Disneyland Parking Structure in California, the Santa Fe Opera House, and more than 100 other projects. Recently completed or current projects include The Nelson-Atkins Museum of Art in Kansas City, the New Museum of Contemporary Art in New York, the World Trade Center Memorial Museum Slurry Wall bracing structure, and five major pedestrian bridges in Manhattan. Nordenson is active in earthquake engineering, including code development, technology transfer, long-range planning for FEMA and the USGS, and research. He initiated and led the development of the New York City Seismic Code from 1984 to its enactment into law in 1995. In 1996 he co-founded the Structural Engineers Association of New York. He was co-curator, with Terence Riley, of the exhibition *Tall Buildings* held at MoMA QNS in 2004. His drawings and models for the 2003 World Trade Center Tower 1 design are now in the collection of The Museum of Modern Art.

H. SCOTT NORVILLE

H. Scott Norville, a registered professional engineer in the state of Texas, serves as Professor and Chair in the Department of Civil and Environmental Engineering at Texas Tech University, which he joined in 1981. He received his BS Degree in Civil Engineering from the University of Toledo in 1974, and MS and PhD degrees from Purdue University in 1976 and 1981, respectively. Shortly after arriving at Texas Tech, he began conducting research on the strength of architectural glass and its behavior under extreme loadings. In conjunction with his research, he spearheaded the use of rational approaches in determining reasonable design load resistance values for laminated architectural glass. Norville serves currently as co-chair of ASTM Task Group E06.51.13 on glass strength, chair of ASTM Task Group F12.15 on blast-resistant glazing, and as a member of several other committees related to glass design. He also consults on blast-resistant glazing design. Norville played an instrumental role in the formulation and implementation of the windborne debris impact standards currently in place for hurricane-prone regions. He is the author or co-author of numerous papers and reports addressing architectural glass strength and behavior as well as blast-resistant glazing performance and design. He is also a co-author of computer programs that facilitate architectural glass design, blast-resistant glazing design, and determination of wind loads.

JOAN OCKMAN

Joan Ockman is the Director of the Temple Hoyne Buell Center for the Study of American Architecture at Columbia University's Graduate School of Architecture, Planning and Preservation, where she has taught history, theory, and design of architecture since 1985. This year she also held guest teaching appointments at the Berlage Institute, Rotterdam, where she taught a master class as part of the Rotterdam Biennale; and the State University of New York, Buffalo, where she was Clarkson Visiting Chair. Among the many publications she

has edited, her award-winning book *Architecture Culture 1943–1968: A Documentary Anthology*, originally published in 1993, is in its fourth edition. Her most recent publication is *Architourism: Authentic, Exotic, Escapist, Spectacular*, which appeared in 2005. In 2003 she was honored by the American Institute of Architects for distinguished achievement. She holds a professional degree in architecture from the Cooper Union School of Architecture and formerly worked in the architectural offices of Richard Meier and Peter Eisenman.

TOSHIHIRO OKI

Toshihiro Oki is a licensed architect who worked in New York City for seven years before joining the firm SANAA, in Tokyo, in 2003. He is currently based in New York for SANAA and oversaw the Toledo Museum of Art Glass Pavilion to completion in 2006. He is currently working on the design for the New Museum of Contemporary Art in New York City, which is scheduled to be completed at the end of 2007. Oki received a BArch degree from Carnegie Mellon University.

ANTOINE PICON

Antoine Picon is Professor of the History of Architecture and Technology at Harvard University's Graduate School of Design where he is also serving as Director of Doctoral Programs. He has published extensively on the relationship between architecture, urban design, science, and technology, with a special focus on construction history and theory. Among other publications, he is the author of *French Architects and Engineers in the Age of the Enlightenment* (1988; English trans. Cambridge University Press, 1992), *Claude Perrault (1613–1688) ou la curiosité d'un classique* (Picard, 1988), *L'Invention de l'ingénieur moderne* (Presses de l'École Nationale des Ponts et Chaussées, 1992), *La ville territoire des cyborgs* (Editions de l'imprimeur, 1998), and *Les Saint-Simoniens: Raison, Imaginaire et Utopie* (Belin, 2003). In

1997 he edited a dictionary of the history of engineering for the Centre Georges Pompidou, *L'Art de l'Ingénieur: Constructeur, entrepreneur, inventeur*. In 2003 Picon edited, with Alessandra Ponte, *Architecture and the Sciences: Exchanging Metaphors* (Princeton Architectural Press, 2003). He recently completed a monograph on the work of the architect and engineer Marc Mimram.

NINA RAPPAPORT

Nina Rappaport is an architectural critic, curator, and educator. She is publications director at Yale University's School of Architecture and editor of the biannual publication *Constructs* as well as a series of books on studio work at Yale. She is the author of *Support and Resist: Structural Engineers and Design Innovation* (The Monacelli Press, forthcoming 2007), for which she received NYSCA and Graham Foundation grants. Her essay "Deep Decoration" appeared in *30/60/90* (Fall 2006). Rappaport has contributed essays to *Architecture, Architectural Record, Praxis, Future Anterior*, and *Tec21*. She has taught seminars on the post-industrial factory and on innovative engineers at New York City College and Yale, and is currently an Adjunct Professor at Parsons School of Design. She was a Design Trust for Public Space Fellow and co-authored *Long Island City: Connecting the Arts* (Episode Books, 2006).

SUSANNE REXROTH

Prior to her training in architecture, Susanne Rexroth completed MA studies in German Literature, History, and European Ethnicity at Albert-Ludwigs-Universität Freiburg, Germany. After receiving an architecture degree from the Technische Universität Berlin, Rexroth worked as an architect in the planning office Löhnert & Ludewig and at Langeheinecke & Claussen, both in Berlin. She served as a researcher in the School of Architecture and Design at the Universität der Künste in Berlin, where she also earned a doctorate for her work on the design potential of solar panels,

with a focus on historic buildings. She currently teaches at the Institute of Building Construction, Technische Universität Dresden.

THOMAS RICHARDSON

Thomas Richardson earned a BS degree in Chemical Physics at Michigan State University and a PhD in Inorganic Chemistry at the University of California, Berkeley. He leads a materials research team for the Windows and Daylighting Group, Building Technologies, Department of Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory (University of California, Berkeley). He also heads a group of chemists developing lithium batteries for the U.S. Department of Energy's Batteries for Advanced Transportation Technologies (BATT) program and another pursuing lightweight hydrogen storage solutions for fuel cell cars. His work in the field of electrochromic windows has concentrated on dynamic reflecting coatings that act as switchable mirrors in both the visible and near infrared regions of the solar spectrum. These windows have the potential to reduce energy consumption for heating, cooling, and lighting of commercial and residential buildings while at the same time improving user comfort and productivity. Richardson won an R&D 100 Award in 2004 for this technology.

FRANÇOIS ROCHE

François Roche is a licensed architect (DPLG) in France and holds a diploma 1987 Versailles, U.P.A. no. 3. In 1989 he founded R&Sie(n) with Stéphanie Lavaux and Jean Navarro, based in Paris. The organic, oppositional architectural projects of the firm explore the bond between building, context, and human relations. R&Sie(n) considers architectural identity to be an unstable concept, defined through temporary forms in which the vegetal and biological become a dynamic element. The firm is currently undertaking a critical experiment with new warping technologies to prompt

architectural "scenarios" of cartographic distortion, substitution, and genetic territorial mutations. R&Sie(n)'s projects have been exhibited at the Tate Modern, London; Columbia University; University of California, Los Angeles; ICA, London; Mori Art Museum, Tokyo; Centre Georges Pompidou, Paris; Musee d'Art Moderne, Paris; Pavillon de l'Arsenal, Paris; Orléans/ ArchiLab International Architectural Conference; and the Venice Biennale. Roche has taught at the Bartlett School, London; TU, Vienna; ESARQ, Barcelona; ESA, Paris; and the University of Pennsylvania's Department of Architecture. He is currently a Visiting Assistant Professor at Columbia University's Graduate School of Architecture, Planning and Preservation where he teaches an advanced studio.

STEFAN RÖSCHERT

Born in Geneva, Stefan Röscher worked with Ateliers Jean Nouvel, in Paris, and Skidmore Owings & Merrill, in New York, before joining the architectural firm Diller Scofidio + Renfro. He has worked extensively in the area of branding as a strategist, consultant, and designer for several New York- and Paris-based companies, and in 1999 founded his own firm in Berlin (with subsequent offices added in Tokyo and New York), urbanautics, conceived with a broad focus on private clients in architecture, consulting, and design as well as on European competitions and theory. Röscher received his Diplom-Ingenieur in Architecture with distinction from the Technische Universität Berlin. He earned his MS degree in Architecture at Columbia University in 2001. He has been the recipient of numerous prizes, including the Briand-Stresemann Scholarship and the Erwin Stephan Award, as well as the German Academic Exchange Service (DAAD) and Rotary International Foundation scholarships.

JENS SCHNEIDER

Jens Schneider is an engineering consultant at Goldschmidt Fischer und Partner, Heusenstamm, Germany,

specializing in structural engineering. He was previously an engineering consultant at Schlaich Bergemann und Partner in Stuttgart, specializing in glass structures, and a scientific assistant at Darmstadt University of Technology, Institute for Structural Analysis, Department of Civil Engineering. Schneider holds a PhD in structural engineering from Darmstadt University of Technology and is the author of more than 30 publications on glass. He is a Professor of Engineering at the University of Applied Sciences, Frankfurt, and has been a lecturer on steel structures at the Institute for Structural Engineering and Structural Mechanics at the university. He was also a lecturer on Glass Structure in Construction Engineering at the Hochschule für Technik (HT) Stuttgart.

HANS SCHOBER

Hans Schober has been the President of Schlaich Bergemann and Partner (SBP) LP, since 2005. Schlaich Bergemann, a leader in glass construction, has realized various projects in Germany, the United States, Hong Kong, Singapore, Saudi Arabia, Spain, England, China, and Italy. The firm's work includes the design and detailing of pedestrian bridges, glass roofs, glass facades (including cable-net facades), bridges for high-speed railways, and rail terminals. In addition, the firm is responsible for the design and development of the unique free-form glass structures (scale-trans-surface) for the Berlin Zoo's Hippo House; the Museum of Tolerance, Jerusalem; DZ Bank Berlin; and the New Trade Fair Milan; and developments in the design and manufacture of high-performance steel castings for highway and railway bridges. Most recently, SBP, New York, designed glass roofs and walls for the Time Warner Center and Moynihan Station as well as the antenna structure and glass walls for Freedom Tower. Schober was a Partner with SBP, Stuttgart from 1992 to 2005 and prior to that a structural engineer with Contractors Philipp Holzmann AG, Frankfurt. He received a PhD from the University of Stuttgart, where he served as a scientific assistant and lecturer at the Institute for Concrete Structures.

Schober's professional affiliations include VDI (Verein Deutscher Ingenieure), VBI (Verband Beratender Ingenieure), AISC (American Institute of Steel Construction), AIA (American Institute of Architects), and ASCE (American Society of Civil Engineers).

MATTHIAS SCHULER

Matthias Schuler is a Managing Director of TRANSSOLAR Energietechnik in Stuttgart. Trained as a mechanical engineer at the University of Stuttgart, as a scientific assistant at the university he participated in international research projects on low-energy commercial buildings. In 1992, based on this work, he founded the company TRANSSOLAR, a climate-engineering consulting firm, whose aim is to ensure in buildings the highest possible comfort at the lowest possible environmental impact. The firm today has offices in Stuttgart, Munich, and New York, and Schuler has worked on national and international projects with architects such as Kazuyo Sejima, Frank O. Gehry, Steven Holl, Ben van Berkel, and Helmut Jahn. Schuler, a co-author of *Glascalas* (Birkhäuser, 1999,) is also currently a Visiting Professor in Architecture at Harvard University's Graduate School of Design.

KAZUYO SEJIMA

Kazuyo Sejima founded the architectural firm SANAA, with Ryue Nishizawa, in Tokyo in 1995, after establishing Kazuyo Sejima & Associates in 1987. Previously, Sejima, who holds an MArch degree from Japan Women's University, had worked for Toyo Ito & Associates. Among SANAA's recently completed projects are the Theater for the Almere Cultural Arts Center in the Netherlands; Toledo Museum of Art Glass Pavilion in Ohio; Zollverein School of Management and Design in Essen, Germany; Novartis Campus Building in Basel, Switzerland; and Naoshima Ferry Terminal in Japan. Current projects include the New Museum of Contemporary Art, in New York; Louvre-Lens in Lens, France; Learning Center EPFL in Lausanne,

Switzerland; Vitra Factory Building, in Weil am Rhein, Germany; House for China International Practical Exhibition of Architecture in Nanjing, China; and the expansion of the Institut Valencià d'Art Modern (IVAM) in Spain. The firm has realized many major works in Japan, such as S-House in Okayama, N-Museum in Wakayama, M-House in Tokyo, K-Building and Koga Park Café in Ibaraki, O-Museum in Nagano, and the 21st Century Museum of Contemporary Art in Kanazawa, as well as stores for Issey Miyake and Christian Dior, both in Tokyo.

SANAA's work was included in the exhibition *City of Girls* in the Japanese Pavilion at the Venice Biennale in 2000 and in the Garden Café at the 7th International Istanbul Biennale, in Turkey. In addition, the firm's work has been exhibited in Tokyo, New York, Vienna, Essen, and Valencia. SANAA was awarded the Golden Lion at the 9th International Architecture Exhibition at the Venice Biennale in 2004, and the 46th Mainichi Shinbun Arts Award (Architecture Category) in 2005.

Sejima is also a Professor at Keio University, Tokyo.

ROBERT SMILOWITZ

Robert Smilowitz is a Principal in the Applied Sciences Division of Weidinger Associates, based in New York, and Adjunct Professor of Engineering at the Cooper Union. He earned a PhD degree from the University of Illinois at Champaign-Urbana. Smilowitz has more than thirty years of experience participating in the protective design and vulnerability studies of numerous federal courthouses, federal office buildings, embassy structures, airline terminals, and commercial properties. He analyzed the World Trade Center underground parking garage slabs in response to the 1993 bombing; analyzed the Khobar Towers, in Saudi Arabia, in response to a terrorist vehicle bomb attack; served as a member of the ASCE/FEMA World Trade Center Building Performance Study; and developed protective design retrofits of the Pentagon facade related to the aircraft impact of September 11, 2001. Smilowitz also has participated in the

explosive testing of full-scale curtain-wall systems and is a principal developer of analysis software for evaluating curtain-wall response to an explosive terrorist threat. He is GSA National Peer Professional, a National Associate of the National Academies, and a registered professional engineer in New York and California.

WERNER SOBEK

Trained as both an architect and as a structural engineer, Werner Sobek has been a Professor at the University of Stuttgart since 1995. He has headed the University's Institute for Lightweight Structures and Conceptual Design since 2000, succeeding Frei Otto. He is also the founder of Werner Sobek Engineering and Design, one of the leading engineering consultancies worldwide. The firm, established in 1992, currently has offices in Stuttgart, Frankfurt, Moscow, and New York. Sobek holds a PhD in structural engineering from the University of Stuttgart and previously worked at Schlaich, Bergermann und Partner in Stuttgart. In 2004 his work was the subject of an exhibition entitled *Show Me the Future*, held at the Pinakothek der Moderne Museum in Munich.

RICHARD L. TOMASETTI

Richard Tomasetti is Chairman of Thornton Tomasetti, Inc., based in New York, an international engineering firm that has provided structural engineering for the world's two tallest buildings in the world—the Petronas Towers in Kuala Lumpur and Taipei 101 in Taiwan—as well as for the recently completed New York Times Building in New York City. Many of his firm's projects include innovative uses of glass for aquariums, winter gardens, atriums, curtain walls, and protective design. Among his numerous honors and awards are election to the National Academy of Engineering, the 2006 AIA NY Chapter Award, and the New York Association of Consulting Engineers' 2002 Engineer of the Year Award. Tomasetti is an Adjunct Professor in the Department of Civil Engineering and

Engineering Mechanics at Columbia University and at New York University. He is also an active author, lecturer, and recognized investigator of structures in distress.

BERNHARD WELLER

Bernhard Weller is a Professor of Civil Engineering and Director of the Institute of Building Construction at the Technische Universität Dresden. His areas of expertise include the design and testing of glass structures and building skins. A main focus of his research is the structural use of glass and glass bonding. After earning a degree in civil engineering at RWTH Aachen, Weller worked as an engineering consultant in structural design, after which he was appointed Professor of Building Construction at the Technische Universität Dresden. In 2005 he was a Visiting Professor at Columbia University in New York.

MARK WIGLEY

Since 2004, Mark Wigley has served as Dean of Columbia University's Graduate School of Architecture, Planning and Preservation. Prior to joining Columbia in 2000 as Director of Advanced Studios, Wigley taught from 1987 to 1999 at Princeton University. He received both his BArch (1979) and PhD (1987) degrees from the University of Auckland, New Zealand. Wigley has also served as guest curator for exhibitions at The Museum of Modern Art, New York; The Drawing Center, New York; Canadian Centre for Architecture, Montreal; and Witte de With Center for Contemporary Art, Rotterdam. An accomplished scholar and design teacher, he has written extensively on the theory and practice of architecture, and is the author of *The Architecture of Deconstruction: Derrida's Haunt* (MIT Press, 1993); *White Walls, Designer Dresses: The Fashioning of Modern Architecture* (MIT Press, 1995); and *Constant's New Babylon: The Hyper-Architecture of Desire* (Uitgeverij 010, 1998). In addition to numerous essays on art and architecture, he co-edited, with Catherine de Zegher, *The Activist*

Drawing: Situationist Architectures From Constant's New Babylon to Beyond (MIT Press, 2001) and is one of the founding editors of *Volume* magazine.

ORGANIZING INSTITUTIONS

The Graduate School of Architecture, Planning and Preservation at Columbia University (GSAPP) offers six master's degree programs: Master of Architecture, Master of Science Advanced Architectural Design, Architecture and Urban Design, Urban Planning, Historic Preservation, and Real Estate Development. With an enrollment of 650 students from some 55 countries, the School serves as a leading laboratory for testing new ideas about the environmental designer's role in a global society. It cultivates an atmosphere in which all of the disciplines devoted to the built environment are invited to think differently, to move beyond the highest level of professional training, opening a creative space within which the disciplines can re-think themselves in order to find new settings and new forms of professional, scholarly, technical, and ethical practice.
www.arch.columbia.edu

The Department of Civil Engineering and Engineering Mechanics is one of nine departments in the Fu Foundation School of Engineering and Applied Science at **Columbia University**. Offering undergraduate programs in civil engineering and engineering mechanics, it provides students with a firm technical basis while nurturing decision-making and leadership potential. The civil engineering program, accredited by ABET, has four concentrations: structural engineering; geotechnical engineering; construction engineering and management; and water resources and environmental engineering. On the graduate level, the department offers programs leading to the MS degree, the professional degrees of Civil Engineer or Mechanics Engineer, and the Doctor of Engineering Science (EngScD) and Doctor of Philosophy (PhD) degrees. These programs are flexible and allow for concentrations in structures, construction engineering, reliability and random processes, soil mechanics, fluid mech-

anics, hydrogeology, continuum mechanics, finite element methods, computational mechanics, experimental mechanics, acoustics, vibrations and dynamics, and earthquake engineering, or any combination thereof, such as fluid-structure interaction.
www.civil.columbia.edu

The Institute of Building Construction at Technische Universität Dresden is devoted to both research and teaching in all areas of building construction. Research and development activities are carried out in close collaboration with industrial and institutional partners and thus reflect and address the current and future demands of the building industry. The main fields of research at the Institute are the use of glass in construction and the energy-efficient performance of building envelopes. Important topics are the structural use of glass, the use of composite construction materials, and the structural bonding of glass elements, especially the use of adhesive bonding. In the field of energy efficiency in relation to building envelopes, the aesthetic and structural design of photovoltaic elements and the building physics of facades are subjects of current interest.
www.bauko.bau.tu-dresden.de

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