PERMANENT CHANGE
PLASTICS IN
ARCHITECTURE
AND
ENGINEERING

THE FOURTH
COLUMBIA CONFERENCE
ON ARCHITECTURE,
ENGINEERING
AND MATERIALS

MARCH 30—APRIL 1, 2011
Abstract

PERMANENT CHANGE: PLASTICS IN ARCHITECTURE AND ENGINEERING

Plastics have become the most ubiquitous and increasingly permanent materials in construction. The material capabilities of plastics both as a generic material nomenclature and as specific polymers and the processes that underlie them suggest a potential to reshape design and the roles of architects and engineers in construction. While plastics are perhaps the most deeply engineered building materials today, they are still in their nascent stages of understanding in terms of their potential applications and uses. Permanent Change sheds new light on these materials and their implications for the fields of architecture and engineering.

Traced through history, plastics in the overarching sense reveal aspects that are often completely contrary to assumptions. Permanent Change undertakes to reexamine the histories and reassess the futures of polymers, exploring their origins in industry and science as well as their role in domestic and public realms, up through recent advances in composites and the new forms of fabrication assembly these portend. Materials that originally anticipated easily molded, re-formed shapes have become a permanent measure and control point in design. From their means of production to their assembly and to their presence in design, polymers have continually been redeployed and developed in ways that often do not align with either the early scholarship or technical forecasts of their capabilities. Plastic, as both broad material nomenclature and specific polymer, may no longer be capable of sustaining the breadth of cultural ambitions the term has held at various historical points. As a material that is still being engineered and increasingly leads to composite assemblies, how are the multiple histories and mediatic aspects of its developments being remade?
PLASTIC SPACE: PLASTIC MATERIAL

In architecture and engineering the term plastic has historically referred to aspects of space and form; that is, how building forms become virtually active, complex in shape and contour or visually compelling as form. In engineering plastic refers to a material's ability to sustain itself and recover at the limits of its elastic capability. Both aspects of the term are deeply historical if not ancient — they are fundamental aesthetic and technical aspects of architecture, engineering and materials.

Yet during the second half of the 19th century, these broader artistic/cultural and technical meanings of the term were essentially revised if not fully replaced. Plastic literally came to mean a new and engineered synthetic material rather than the aesthetic or technical attributes of a material. Polymers dramatically affected the historic, i.e., “plastic,” modeling of form, shape and color but also garnered the technical capacity afforded by research and development. They are old and unprecedented simultaneously: the hybridization of plastic as quality and as an engineered material conflates experience and material science and leaves both terms inadequate to describe their social meaning and potential.

The advent of polymers and the 100-year evolution of the chemical engineering of polymers prior to the 1950s met with a mid-20th-century strain of commercial mass media, mass production and social upheaval that today is quasi-historical but also still evolving and shaping both culture and production. Polymers are everywhere in construction, but they are also not at all evident in architecture in ways that they were prophesied as recently as the 1950s. What is the state of plastics as both a broader term and also as the more specific strains of polymers that are embedded in building today, and how do the current manifestations relate to the waves of promise that drove much of our last century's fascination with the material?

With any shape seemingly possible, plastics have often reproduced or mimed existent forms rather than deliver new shapes: aspects of imitation of forms already known (imagine a 1970s car dashboard molded in thermoplastic simulating the experience of a jet-fighter cockpit) have been a component of plastics as the bearer of artificial or contrived experience. But conversely, they have also allowed and at times prompted newly responsive and ergonomic experiences; easily molded with new efficiency, lightness, ease of production and, often, durability, they drive a consortium of industrial design devices that have became newly personal, bearing private experience.

If the cultural connotations of plastic include artificiality and at times superficiality, the term also connotes all manner of technical innovation if not new levels of authentically original modes of experience. Plastics are ubiquitous and have increasingly become essential to construction and to the entire built world, from transportation to architecture to electronics and equipment. They are as likely to be part of a medical or food production process as embedded in industrial procedures, but they have almost never delivered a capability to shape architecture in a fuller sense. In fact, they have seemingly become more invisible and have enabled architecture to sublimate technical concerns to substrata of performance (weatherproofing, insulation, electrical casing) and consign overall figure and design to a host of linguistic signifiers. That is, polymers are doing work beneath the surface while the surface is free to look like anything it wants. Yet this is once again changing, as composites — polymers, fused with carbon and other materials — are increasingly reshaping the production of planes and other results of technologically sophisticated industrial production, of highly capitalized processes. In these cases we are again at a threshold where polymers are perhaps beginning anew to reshape their own cultural/technical legacy: to revise their promise as both technical and aesthetic revolution in ways that challenge both the design and technical capacities of other materials but also the initial waves of design and engineering that polymers have activated since the mid-19th century. Composites promise change in how things are made and what they can do but also in what they look like, what they connote and the network of professionals who form the development teams.

The more precise annotation for what we call plastics, the subset of polymers — vinyl, PVC, resins, to be specific, but more broadly, composites and the processes that define their formation — are a stark contrast to the easy use of the term plastic and the complex range of capabilities for specific materials. Plastics have reshaped construction, yet the ways in which architects and engineers view their role in construction has been the subject of less scholarship than have materials such as glass or concrete. One reason for this may be the gap between the promise of plastics at mid-century and its later implementation. In addition, the lack of a technical vantage or understanding of the chemical engineering and specific "plastic"
behavior of polymers has slowed architectural design and scholarship related to the materials. Plastics still constitute an essentially new genre of materials and while they are perhaps the most deeply engineered building materials today, they are still in their nascent stages of understanding in light of potential applications and uses. When coupled with a commensurate rise in research and development, they become the recipient of a focused and tremendously sophisticated range of innovations.

Permanent Change brings these materials to a new light: materials that promised tremendous flexibility and complex modeling are now becoming the most ubiquitous and increasingly permanent materials in construction. From silicones to sheathing, to electrical casing and plumbing, vinyl and PVC — plastics of all types are often the most long-lasting warranted and tested materials in construction. They also portend a deep set of ecological issues that are only recently becoming fully addressed. Plastics remain the most easily shaped, contoured and aesthetically and functionally formed materials but they are not alone in complex modeling or innovations in chemical engineering: fiber-reinforced concrete, glazing and new modes of laminated glass and coatings, as well as new metal alloys, all have acquired more elastic capabilities and all are less easily identified as discrete from other materials. What then are the futures of plastics in design, and how can we begin a more comprehensive project of segregating the complex aspects of polymers and the host of issues that they create and portend?

Permanent Change: Plastics In Architecture and Engineering is the fourth in a series of conferences convened by Columbia University. The conference includes new participants and also reconvenes leading engineers, architects and scholars from our previous conferences on glass, concrete and metals.

Michael Bell
Professor, GSAPP, Columbia University
Conference Chair
WEDNESDAY
MARCH 30

6:30 – 8:00 PM

WELCOMING REMARKS
MARK WIGLEY
Dean, GSAPP, Columbia University
Remarks on behalf of The Vinyl Institute

CONFERENCE KEYNOTE LECTURE
GREG LYNN
Architect, Greg Lynn FORM, Venice, California
Professor, UCLA and Institute of Architecture, University of Applied Arts, Vienna

THURSDAY
MARCH 31

9:30 – 10:00 AM

INTRODUCTION TO THE CONFERENCE
MARK WIGLEY
Dean, GSAPP, Columbia University

RAIMONDO BETTI
Chair, Department of Civil Engineering and Engineering Mechanics
The Fu Foundation School of Engineering and Applied Science, Columbia University

MICHAEL BELL
Professor, GSAPP, Columbia University, Conference Chair
THE EMERGENCE OF POLYMERS: NATURAL MATERIAL — INDUSTRIAL MATERIAL

The emergence of polymers since the middle of the 19th century occurred in specific phases of development and within a broad range of relationships to natural sources as well as to the seeming and actual inorganic aspects of the urban and industrial world. The natural origins of polymers seem to be virtually forgotten today, at least in terms of the popular perception of plastics as artificial or lifeless, but at the outset polymers such as vulcanized rubber existed at a precipice between industry and nature. They conflated the industrial and natural in ways that today seem misunderstood if not simply forgotten. Is it possible to still see polymers as natural, or have they migrated so far from these beginnings that they have become something else altogether?

What is the outcome of how these materials are understood historically; has the history of polymers been irrecoverably lost? Was it possible to still see polymers as natural, or have they migrated so far from these beginnings that they have become something else altogether? What is the outcome of how these materials are understood historically; has the history of polymers been irrecoverably lost? Charles Goodyear’s patent on vulcanization in 1844 paved the way for a new industrial procedure for rubber that would lie at the heart of the automobile industry and paved the way for vulcanized rubber becoming intrinsic to urban landscapes. What aspects of the history of polymers have been deflected, undervalued or misrepresented, if not simply lost, in the ensuing period leading up to the 1950s, when one encounters plastics in the full as both material and as a spectacular component of modernization?

The first 100 years of polymers seem distinct from the postwar American and European period during which a conflation of polymers as material, media and branding seems to increasingly present polymers as almost without history and without origin — as unbreakable, infinitely formable and as segregate from and thereby safe from contaminating partner materials and contagions. Did polymers’ relationship to nature decline or was their participatory relationship to their environment simply modified?

PERMANENT CHANGE: HOW LONG DOES A FLEXIBLE MATERIAL LAST?

Plastics have promised deeply engineered parameters that assure material stability and described if not warranted parameters for degradation over time. Yet plastics have also often been understood to inevitably offer a component of aesthetics or stylistic change — any shape is achievable and plastics are understood to offer both tremendous flexibility but also defined limits. Are plastics different from other materials in terms of life spans in building; are they tested, documented and adhered to for safety and investment parameters in unique ways? Do the wider public or legislative bodies understand plastics well enough to gauge their safety, their uses or post-consumer potentials?

Degradation, loss of elasticity, loss of color — these are all aspects of a material’s commodity value and liability determinations. What are the design limits of plastics in this realm? Is there a clef between life span engineering and formal pliancy that one assumes with plastics? Are there long-term attributes to plastics that alter their environmental determinants, or applications and quantities of use and implementation that register in how a polymer performs in relation to public health, reuse or recycling? How do these attributes come together in plastics in ways that are unique or different from concrete, wood, metals or glass where life span and design potential are also often highly managed?

Plastics have promised a unique relationship to history — altering the life span of building components but also surprisingly engaged in keeping partner materials in new forms of duration: window gaskets suspending glazing in a differential time span; metals sustained by polymers in acrylic paints. Polymers have altered the relationship of given materials and thereby re-engendered their properties and architectural meaning.

How do polymers alter the readings of permanence in building and what if any relationship exists between historical values associated with the term permanence and the performance of polymers today?
In an era of harvesting energy, pushing boundaries, recovering lost energy and convening new means of cross-fertilization if not purposeful conflation of means, do plastics add a particular value or are they one of many newly liquid materials in the fields of design and engineering? Has the status of the architectural work gained or lost distinction in this regard—that is, is there an overt architectural significance to plastics today, or are they so fully embedded in work that they assume a less overt but nonetheless more pervasive role? Are current designers more beholden to performance or strategic purpose than in prior generations and do plastics today signify something far more distributed and codified; or are plastics simply purposed as other materials with their own unique design instincts and parameters?

In the mid-1950s the promise of plastics took on a utopian guise but also a full-figured image of total design: is it possible that plastics heralded an era of synthetic and ultimately engineered plastics that were beneath, within and around the torrents of heterogeneous practices and convening new means of cross-fertilization if not purposeful conflation of means, do plastics add a particular value or are they one of many newly liquid materials in the fields of design and engineering? Has the status of the architectural work gained or lost distinction in this regard—that is, is there an overt architectural significance to plastics today, or are they so fully embedded in work that they assume a less overt but nonetheless more pervasive role? Are current designers more beholden to performance or strategic purpose than in prior generations and do plastics today signify something far more distributed and codified; or are plastics simply purposed as other materials with their own unique design instincts and parameters?

Are we still concerned with the term plastic and its negative aspects and would we even concern ourselves with these connotations today—or ever?

The 1950s and '60s iconic images of plastic architecture such as the Monsanto House of the Future had a corollary in the pervasive yet nonfigurative uses of plastics in plumbing, electrical wiring and waterproofing. If this is a divide that perhaps some saw in advance, it seems to have also cast the project of a plastic architecture—a figural plastic/plasticity—into a kind of nostalgic kitsch approached as a signal of a nascent but unrealized former future. The House of the Future seems to be received today as a figural as well as material prophecy come undone—a trajectory that lost ground in light of other imperatives. In its place, have we realized a world of plastic versions of previous building components—that is, vinyl-clad wood windows, vinyl versions of wood siding, etc.? Plastics are employed in ways that sustain former vernaculars and our gaze is cast forward materially and backward formally in time.

There seems to be little overt, i.e., expressive, plastic architecture today, but polymers such as vinyl are called upon increasingly to abet an array of design strategies. As opposed to being the manifest strategy of both meaning and form, plastics enclose former meanings in airtight containers. The deep and pervasive use of polymers in building mechanics and discrete systems—from paint and coatings to wire casing, plumbing, windows and siding—seem to continually reveal a divide where plastics migrate to pragmatic architectural problems rather than expressive proposals of form or shape.
What is the future of polymers in regard to expected and forecast potentials in the chemical engineering of polymers and also as building materials in a wider sense? Will polymers offer a future malleability that allows one to alter their chemical structure after production: that is, can we reengineer polymers and extend, alter or reroute their post-consumer uses? Are there financial or economic imperatives that could sustain or thwart taking polymers back to their atomic origins: returning the material to chemical origins for reassembly or purpose? Polymers gain strength and are shaped by way of initial thermal processes and exhibit properties of entropy prior to applications of heat: while thermoplastics can be heated and given shape and then melted again to be re-formed, thermoset polymers cannot be reshaped after their initial formation. Thermosetting of polymers induces molecular cross-linking; once formed the molecular structure becomes permanent, giving the material strength but also the inability to be re-formed. The thermosetting and its inherent cross-linking effectively block the flow of one molecule past another, thwarting potential reuses. Thermoset polymers are not as easy to either reuse or reengineer — to recycle.

- How does design affect the post-production use of polymers?
- Will the future environmental implications of polymers involve a renewed attempt to alter the chemical structure of discarded polymeric materials or to reengineer what would otherwise be unusable polymers? Are there techniques that will keep polymers out of landfills altogether: can they be reengineered and thus transform the expectations for what would have been discarded material?
- The reuse of polymeric building materials is usually done within a thermal recycling process; the melting, grinding and washing of polymeric materials prior to re-forming has limits and sets parameters for polymer reuse, reapplication and recycling.
- What aspects of polymers — either by way of chemical engineering or the limits imparted by initial chemical engineering — will be critical to the future environmental factors of polymers? How are these stages as applied to polymers different from metals or other predominant building materials?
Designers tend to portray polymers as infinitely moldable and easily shaped, but their limits are highly defined and as such are perhaps more ambiguous and misunderstood by architects than are metals, concrete or glass. Are there tectonic aspects to plastics and do they follow and abide by the attributes of metals and other ductile materials? How do polymeric materials alter our basic concept of architectural or engineering structure and dislocate the work and the potential of architectural design and experience?

Increasingly, aspects of polymers and composites are present in heavy construction and operate in a realm where steel or other metals once predominated. That is, polymers are taking on plastic attributes of steel — or joining with steel and concrete — but with a completely unique array of structural techniques, both at the level of assembly and by way of chemical engineering. But polymers also shape a vast array of other building components where plasticity and movement are critical.

- The structural properties of polymers achieved by thermosetting, cross-linking and other chemical engineering techniques are rarely discussed in architectural design, but they comprise a unique component and strain of plastics that is distinctly different from thermoplastics. Polymers tend to be discussed in generic terms and/or with degrees of strength, flexibility and other parameters. They often seem to moderate other material conditions more than serve as distinct components. Are polymers a subset of construction or can they be seen as emerging as central to it?

- Composites are increasingly seen as the heir to a wide range of historic building materials such as metals and concrete and in some ways have already changed the discussion of tectonics and assembly in architectural design and engineering: do you expect to see a wider range of composites in design?

Plastic has long signified cultural change and contemporary life: but what are the term’s other uses today? Does plastic space still survive as a useful term or does the term and facts of plastics cast us into a very different contemporary world of ecological concern and transformed meaning of what was once the material of the future?

What is the emergent role of bio-plastics in design and how do these materials alter the relationship of plastics to the body and to the long-held popular image of plastics? Materials such as vinyl have long held a role in all modes of design related to the body — from seating to automobile interiors — but what new roles do polymers play in more invasive or medical/biological roles in regard to bodies?

Have we passed a threshold where the bodily or haptic aspects of plastics — from the ergonometric of the hand-held, to electronic circuitry or the pervasive use of plastics in food packaging — actually comprise a former frontier whose effects, while far from certain, are more traceable or directly corporeal when compared to the bio-engineering of plastics we see today?
Is plastic the first material for which it is possible to claim that material precedes concept — did plastic emerge without a mandate or with seemingly eased constraints compared to wood, stone, glass or metals? That is, does the term plastic as an adjective or material nomenclature fail to live up to what the material could have been or could have prompted?

Embodying in polymers, the aspects, effects and qualities of luster, reflection, surface or even weight all seem to have been often seen in light of other more historically qualified materials: do plastics need an entirely new language of art history, of artistic qualities?

Have plastics found the depth of their potential or were they short-circuited by applications of earlier mandates, or earlier material constraints on image, shape and design? Are plastics still today a material in search of a concept?
PAOLA ANTONELLI
Paola Antonelli is Senior Curator in the Department of Architecture and Design at The Museum of Modern Art, New York (MoMA), where she has worked since 1994. Through her exhibitions — including “Design and the Elastic Mind,” 2008 — teaching and writing, she strives to promote a deeper understanding of design’s transformative and constructive influence on the world. She is particularly proud of her recent acquisition for MoMA’s Permanent Collection: the@sign. She is working on several exhibit concepts and the book Design Bits, about basic foods as examples of outstanding design.

JACK ARMSTRONG
Jack Armstrong, Leader of BASF—The Chemical Company’s Construction Markets for North America, graduated with a degree in chemical engineering from the University of Texas and began working for BASF in 1989. His projects have included Regional Marketing Manager for BASF South America, Brazil for Acrylic Polyfunctional Polymers, for General Manager for Polyurethane Systems, Americas (based in Brussels, Belgium) and Business Manager for Styropor Expandable Polystyrene Systems, Americas (based in New Orleans, France). He specializes in Housing Design Studios and also leads the school’s housing design studios.

Raimondo Bettum was a research fellow at the Oslo School of Architecture and headed a nationally funded research project on polymer composite materials in architecture; his doctoral thesis focuses on architecture and fiber-reinforced composites.

Craig Buckley is the Director of Print Publications at Columbia University’s Graduate School of Architecture Planning and Preservation, where he is also a Professor. He is the coeditor of Clipp/Stamp/Fold: The Radical Architecture of Little Magazines 196x-197x (Actar, 2010), co-edited with Craig Buckley.

Hernan Diaz Alonso
Hernan Diaz Alonso is the principal and founding partner of Diaz+Hernández and founder of Xefirotarch, an award-winning firm based in New York City. The New York Department of Housing and Preservation and Development (NYHPD) has commissioned him to design 2,100 units of housing on a 100-acre site in New York City, the largest affordable housing project in the city history. His architecture designs have been exhibited at the Venice Biennale, “metamorphose; and art exhibitions, including the 2004 Venice Bienale, “Metamorphose; Archilab, Orleans, France; “The Naked City,” Beijing Biennale, “Glamour; San Francisco Museum of Modern Art (SFMoMA); and in “Viruses, Universidade de Costa Rica.

Winka Dubbeldam
Winka Dubbeldam is the principal of Archi-Tectonics, which she founded in 1994. Archi-Tectonics is created as an open network—a team of highly qualified architects and designers with a close connection to Dubbeldam’s team of engineers and consultants. The team spirit expresses itself in an aim to rethink, reinvestigate and reinterpret all pertinent details. Archi-Tectonics’ recent built works include the 80,000-square-foot mixed-use GW 497 building in New York City, the 13-story American Loft Tower in Philadelphia, the 20,000-square-foot GT residence and guesthouse in upstate New York and the 3000-square-foot Prefab Dub Residence in Rotterdam. Current projects under construction are the nine-storey residential Vest Street building, the LRH mixed-use building and a townhouse in Chelse, all in New York City. Commercial work includes the flagship stores for Ports 1961 in London, Paris and Shanghai, and a school (orphanage in Liberia). The works of Archi-Tectonics have been exhibited recently at The Museum of Modern Art, New York; the Museum of Contemporary Art, Los Angeles; and the Venice Biennale and The Tel Aviv Museum of Art.

Dubbeldam’s role as Professor of Practice and Director of the Post-Professional Program at the University of Pennsylvania and her teaching at Columbia University and Harvard University further assist in the constant innovation for which the office

PARTICIPANTS

Team of the Plastics Division of the American Chemical Society.

Michael Bell
Michael Bell is an architect and a Professor of Architecture at Columbia University’s Graduate School of Architecture, Planning and Preservation. GSAAPP. Bell is the founding Chair of the Columbia Conference on Architecture, Engineering, and Materials. Michael Bell Architecture was established in 1989 and specializes in housing and urban redevelopment where housing is a key component. In 2001, Bell led a team of architects who provided research, planning and design for 2,100 units of housing on a 100-acre parcel of oceanfront land owned by the New York Department of Housing Preservation and Development (NYHPD). The project was commissioned by the Architectural League of New York and the NYHPD as a research proposal to help shape city planning. Bell is a partner in the design firm Visible+Wejjeong Seong.

Raimondo Betti
Raimondo Betti is Professor of Civil Engineering in the Department of Civil Engineering and Engineering Mechanics, of which he is Chair, at The Fu Foundation School of Engineering and Applied Science, Columbia University. He specializes in the areas of structural dynamics and earthquake engineering with particular emphasis on the analysis of dynamic soil-structure interaction effects for horizontally extended structures. His research interests include the dynamic response of embedded foundations to earthquake excitation, analysis and determination of Green’s functions for homogeneous and layered semi-infinite domains, effects of the spatial variation of ground motion on the seismic response of bridges, active and hybrid control systems for the vibration control of structures subject to constant and/or wind excitation and damage detection for bridges using data correlation analysis. He is a member of the Earthquake Engineering Research Institute (EERI), the American Society of Civil Engineers and Sigma Xi.

Johan Bettum
Johan Bettum is Professor of Architecture and Program Director of the Sustainable Design Class, University of Amsterdam. The Architecture Institute and Insinbruck University, among many other institutions, and is currently also a guest professor at the EPFL in Lausanne. He studied at the Architectural Association after receiving a Bachelor of Arts degree with a major in biology from Princeton University. From 1998 to 2002, Bettum was a research fellow at the Oslo School of Architecture and headed a nationally funded research project on polymer composite materials in architecture; his doctoral thesis focuses on architecture and fiber-reinforced composites.

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strives. Dubbeldam is a graduate of the Faculty of Architecture, Rotterdam (1990); she received her M.Arch.AAD from Columbia University in 1992.

ANNA DYSON
Anna Dyson teaches design, technology and practice at the School of Architecture at Rensselaer Polytechnic Institute. She is Director of The Center for Architecture, Science and Ecology (CASE), which hosts the Built Ecologies graduate program. Dyson received a Baccalaureat Général from Université Jean Vigo in 1994 and attended Yale University. She has worked as a design architect and product designer in France, the United Kingdom, and the United States. As Director of Materialab and then CASE, she has directed interdisciplinary systems research sponsored by the US DOE, NYSTAR and NYSERDA. Dyson has received numerous design awards and holds multiple international patents for building systems inventions.

BILLIE FAIRCLOTH
Billie Faircloth is Research Director at KieranTimberlake, an internationally recognized architecture firm and academic research f aculty of Architecture, Rotterdam strives. Dubbeldam is a graduate of the Faculty of Architecture, Science and Ecology (CASE), which hosts the Built Ecologies graduate program. Dyson received a Baccalaureat Général from Université Jean Vigo in 1994 and attended Yale University. She has worked as a design architect and product designer in France, the United Kingdom, and the United States. As Director of Materialab and then CASE, she has directed interdisciplinary systems research sponsored by the US DOE, NYSTAR and NYSERDA. Dyson has received numerous design awards and holds multiple international patents for building systems inventions.

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MARK GOLTHORPE
Mark Goulthorpe is an Associate Professor in the Department of Architecture at MIT School of Architecture + Planning, where he teaches in undergraduate, gradu- ate and post-graduate programs, and conducts ongoing research in digital material and design fabrication. His current research centers on robotic fabrication and a variety of composites fabrication methodologies.

LAURIE HAWKINSON
Laurie Hawkkinson received her Master of Fine Arts degree from the University of California at Berkeley, attended the Whitney Museum of American Art Independent Study Program in New York and received her Professional Doctorate in Architecture from the Cooper Union. She is Professor of Architecture at tenure at Columbia University and is currently the Director of the Advanced Studios at the Graduate School of Architecture, Planning and Preservation. Significant completed projects include the Corning Museum of Glass, the Wall Street Ferry Terminal, “Strategic Open Space,” and the design for the NYU School of Law.

GEORGE JERONIMIDIS
George Jeronimidis is Director of the Centre for BiometRICS, at the University of Reading, UK, where he is also Professor of Digital Media and Art. He is the editor of “EcoDesign: Remedies for an Ailing Planet,” “a special issue of Architectural Design (AD) magazine. She is also the author of the ECOsuri online nonprofit educa- tional resource for ecological expe- riments. He has lectured widely and has published numerous books, including Archlogging (1989), Parafflax (2000), and the Nelson-Atkins museum of Contemporary Art in Kansas City. Jeronimidis was born in Rome, Italy, and holds a Bachelor of Architecture degree from the University of Rome in 1970. His previous academic posi- tions include Scientific Officer at Laboratory for Environment and Nature Research (LERN), in Rotterdam, and Researcher at Day for Engineering, University of Reading (1975–80) and Lecturer and Senior Researcher in the Department of Engineering, University of Reading (1980–85).

LUDIA KALLIPOTI
Lydia Kallipoti is Assistant Adjunct Professor in the Department of Architecture at Rensselaer Polytechnic Institute. She is also a practicing architect, engineer and theorist living in New York. She holds architecture degrees from the Aristotle University of Thessaloniki in Greece, MIT and Princeton University School of Architecture, Planning and Preservation. She has lectured widely and has published numerous books, including Archlogging (1989), Parafflax (2000), and the Nelson-Atkins museum of Contemporary Art in Kansas City. Jeronimidis was born in Rome, Italy, and holds a Bachelor of Architecture degree from the University of Rome in 1970. His previous academic posi- tions include Scientific Officer at Laboratory for Environment and Nature Research (LERN), in Rotterdam, and Researcher at Day for Engineering, University of Reading (1975–80) and Lecturer and Senior Researcher in the Department of Engineering, University of Reading (1980–85).

KRAI BANE
Bran is an assistant professor of music at Yale University. His research explores the intersection of music theory, philosophy and contemporary music. He has been published in such journals as the Journal of Music Theory, Contemporary Music Review, and Philip C. Ross. Bane is also the author of Archlogging (1989), Parafflax (2000), and the Nelson-Atkins museum of Contemporary Art in Kansas City. Jeronimidis was born in Rome, Italy, and holds a Bachelor of Architecture degree from the University of Rome in 1970. His previous academic posi- tions include Scientific Officer at Laboratory for Environment and Nature Research (LERN), in Rotterdam, and Researcher at Day for Engineering, University of Reading (1975–80) and Lecturer and Senior Researcher in the Department of Engineering, University of Reading (1980–85).
The MÀTs Portable Light Project, a nonprofit global initiative to create energy-harvesting textiles, is a 2011 Buckminster Fuller Award Finalist, and the recipient of a 2009 U.S. Congressional Award and a 2009 Energy Globe Award for technology that benefits humanity. The work of KVA’s MATs has been exhibited at the Biennale Architettura 2010 in Venice, the Rotterdam Biennale, the Vitra Design Museum, the TED conference and The Museum of Modern Art, New York. Kennedy’s work appears in journals of architecture and design culture and on National Public Radio, BBC World News, CNN News and National Geographic Voices and in Wired, Science News, Elle Magazine, The Economist, the Wall Street Journal and the New York Times.

JAN KNIPPERS
Jan Knippers, Prof. Dr. Ing., is a partner in Knippers Helbig Advanced Engineering. He compiled his engineering studies at the Technische Universität Berlin in 1992, receiving a Ph.D., and founded his own firm together with Thorsten Helbig in 2001 in Chemnitz and in 2009 in New York City. The focus of their work is on efficient structural design for structures and architecturally demanding projects. Jan Knippers specializes in complex parametrically generated geometries for roof and facade structures as well as the use of innovative materials such as glass-fiber reinforced plastics. Since 2000, he has headed the Institute for Building Structures and Structural Design, Faculty of Architecture and Urban Design at the University of Stuttgart. Since 2005, he has participated in many research projects on plastics in architecture.

CRAIG KONYK
Craig Konyk is an architect and Adjunct Assistant Professor of Architecture in the Graduate School of Architecture, Planning and Preservation at Columbia University, where he most recently co-taught with Jorge Otero-Pailos a Joint Preservation and Design Studio-X, which traveled to Rio de Janeiro. Konyk was invited to participate in the History Channel’s “City of the Future” Design Challenge where he presented “Cloud 09,” an information-based work/recreation proposal for Manhattan. His design for the UPIN (University of Pennsylvania) building at the 2004 Venice Biennale was commissioned by DWELL magazine and sponsored by The Vinyl Institute, a nonprofit trade association that incorporates innovative translucent vinyl wall/ceiling/floor panels, was selected for inclusion in the Cooper-Hewitt National Design Triennial of 2006. Konyk’s work has been shown widely throughout the United States. He has presented at numerous conferences and publications as well as of Assemblage. He is the author of several articles and books, including Architectures of Time: Toward a Theory of the Event in Modernist Culture (MIT Press, 2000), Far From Equilibrium: Essays on Technology and Design Culture (Actar, 2001), and The City at the Turn of the Millennium. He is currently at work on a book on Africa and the origin of form.

SYLVIA LAVIN
Sylvia Lavin, Professor and Director of the Architectural History, Theory & Criticism Program at Harvard University, has received the John F. Kennedy Award for scholarship and her criticism in contemporary architecture and design. She received a 2011 Arts and Letters Award in Architecture. She has twice been a Getty Research Institute Scholar and writes for an international spectrum of journals. Her recent book is Kissing Architecture, published by Princeton University Press (April 2011). She is currently completing her next book, The Pan and Other Forms of Architectural Contemporaneity. Lavin is also a curator of experimental work in architecture and design; recent and forthcoming exhibitions include “Ultra Expo,” JANM, Los Angeles; “Craig Hodgetts: Playmaker” (ACE Galleries); “Take Note,” exploring the repurposing for which Terry Deacon and others, writing, at the Canadian Centre for Architecture, Montreal; and a new project, a series of talks on architecture and design at the Hammer Museum, Los Angeles.

GREG LYNN
Greg Lynn is a leading pioneer at the intersection of technology and architecture. His architectural designs have been exhibited internationally at both architectural and art venues, including the 2000 Venice Biennale where he represented the United States in the American Pavilion, and at the Venice 11th International Architecture Exhibition in 2008. He is currently at work on architecture and writing, at the Canadian Centre for Architecture, Montreal; and a new project, a series of exhibits on architecture and design at the Hammer Museum, Los Angeles.

FABIAN MARCACCIO
Fabian Marcaccio is an artist based in New York. His work investigates what aspects of the past and present of medium can survive in the digital age. He has used printmaking and transfer techniques to make paintings and books that are intaglio prints for his manipulations of the conventions of painting. More recently, he has relied on digital and industrial techniques to infuse his painting process with spatial and temporal concerns. The results are environmental paintings, animations and installations, including the 2006 digitaly manipilated imagery, sculptural form and three-dimensional painted surfaces.

Marcaccio was born in 1963 in Rosario, Argentina, where he attended the University of Philosophy. He has exhibited widely throughout the United States, Europe and South America. In 2004 a retrospective of his work was organized by the Kunstmuseum Liechtenstein, the same year that a solo exhibition of his work was mounted at the Miami Art Museum. He regularly exhibits with galleries in New York, Los Angeles, Paris, Cologne and Barcelona. He has participated in numerous group exhibitions, including the 1999 Venice Biennale, Contemporary American Painting, Corcoran Gallery of Art, Washington, DC in 1995; Summer Projects at PS1 Contemporary Art Center, New York in 2002 and Documenta 11, Kassel, Germany in 2002. His multidisciplinary collaborative projects include projects with collaborator Greg Lynn that resulted in an exhibition at the Walker Center for Contemporary Art in 1996 and projects with composer Claudio Baroni creating animated operas and a 2005 scored, paintball performance at Westin Walton in Horatio.

MICHAEL MEREDITH
Michael Meredith is principal in the architecture firm MOS and an Associate Professor at Harvard University.


SHEILA KENNEDY
Sheila Kennedy is Professor of Practice, MIT School of Architecture + Planning, where she is aToDoATX, an interdisciplinary design project with projects in architecture, eco-infra-structure, digital technologies and the emergent public realm. Current work includes the IBA-Hamburg SOFT Housing in Germany, the Minneapolis Minnesota Fair at New York’s trendy East 34th Street Public Ferry Terminal in New York. Kennedy directs KVA’s Material Research Division, aToDoATX, which has created designs for DuPont, Siemens, OSRAM, Herman Miller, Procter & Gamble, The North Face and the United States Department of Energy. The MTA’s Portable Light Project, a nonprofit global initiative to create energy-harvesting textiles, is a 2011 Buckminster Fuller Award Finalist, and the recipient of a 2009 U.S. Congressional Award and a 2009 Energy Globe Award for technology that benefits humanity. The work of KVA’s MATs has been exhibited at the Biennale Architettura 2010 in Venice, the Rotterdam Biennale, the Vitra Design Museum, the TED conference and The Museum of Modern Art, New York. Kennedy’s work appears in journals of architecture and design culture and on National Public Radio, BBC World News, CNN News and National Geographic Voices and in Wired, Science News, Elle Magazine, The Economist, the Wall Street Journal, the New York Times and the New York Times.
HARTMUT OLIVER SINKWITZ

Hartmut Oliver Sinkwitz is the Director of the Institute of Competence at Daimler AG (since 2008). He leads all relevant activities for Lightweight Design and Education Design to C&T Design. Prior to joining the Mercedes-Benz Design Team he worked as Car Designer at the Mazda Design Center in Frankfurt (1991–95). He joined Mercedes-Benz Design in 1995 and was Senior Car Designer (1995–2000) before becoming Chief Designer for Smart at Mercedes-Benz, where he led the design of a number of microcars, including the Roadster, After, EcoFour, ForTwo, ForFour, Crossblade and severa尔 show cars.

WERNER SOBEK

Werner Sobek is Mies van der Rohe Professor at the Illinois Institute of Technology and head of the Institute for Lightened Structures and Conceptual Design (ILEK) at the University of Stuttgart, which special- izes in research into new materials and new concepts for lightweight and adapt- ible structures. Sobek studied archi- tecture and structural engineering at the Technical University of Munich. His firm, Werner Sobek Engineering and Design, is one of the leading engi- neering consultancies in Europe. It excels through excellent engineering combined with first-rate design of con- structional elements and sophisticated University Graduate School of Design. The work of MOS has been widely published and received numerous awards. In 2009, MOS was awarded the PSJ/ MoMA Summer Pavilion.

ERIK OLESEN

Erik Olsen is a climate engineer known for his passionate focus on high-com- fort, low-impact environments. As Managing Director of TRANSOLAR Climate Engineering’s New York office, he works collaboratively with clients, architects and other engineers worldwide to develop and validate low-energy, architecturally integrated indoor climate and energy concepts. His work includes the completely passive Raising Malawi Academy for Girls to the groundbreaking Angelos Law Center at the University of Baltimore. In addition to his specialist work at TRANSOLAR, he has worked as a consulting mechanical engineer on a variety of building types and launched and directed the City of Chicago’s Green Perm Program.

JERE OTERO-PAÍLOS

Jorge Otero-Païlos is a New York-based architect, artist and theorist specializing in experimental forms of preservation. He teaches at the Graduate Center, CUNY. His major project, Pre- servation. He is the founder and School of Architecture, Planning and Urbanism, and develops and launches projects. He teaches in such as

THEODORE HUM PRUDON

Theodore H. Prudon is a practicing architect in New York City, received master’s degrees in architecture from the University of South Carolina, and currently divides his time between San Francisco and Incline Village, Nevada.

WERNER PREUSKER

Werner Preusker is an attorney and is the Managing Director of the P&C and Environment Working Group (Arbeitsgemeinschaft PVC und Umwelt—AgPU) based in Bonn, Germany. AgPU has expertise in environmental and consumer protection in relation to the PVC industry. More than 60 companies in the PVC supply chain support the goals of the AgPU through their membership. As a service partner, the AgPU advises its member companies on the environment, sustainable development and consumer protection. It creates dialogue with decision mak- ers from politics, trade, the economy and NGOs. Preusker is also the spokes- person of PVC, a PVC information ini- tiative supported by companies that produce PVC, additives, products such as windows profiles, pipe, film, flooring and roofing, or recycle PVC products. Previously, he served as Assistant to the Council of Environmental Advisors (1980–83) and worked in the Environmental Department of the Confederation of the German Chemical Industry (1983–89).

FRANCOIS ROCHE

François Roché is a licensed archi- tect (DPLG) in France and received a diploma in architecture from Versailles, U.F.B., no. 3. In 1987 and 1989 he founded R&Sie(n) with Stéphanie Lavaux and Jean Navarro, based in Paris. The organic, oppositional archi- tecture of the firm explores the bond between building, context and human relations. R&Sie(n) con- sider architectural identity to be an unstable concept, defined through temporary forms in which the vegetal and biological become a dynamic ele- ment. The firm is currently under- taking a critical experiment with new concepts to prompt archi- tectural “scenarios” of cartographic distortion, substitution and genetic warping technologies to prompt archi- tectural projects of the firm explore territorial mutations. R&Sie(n)’s proj- ects have been exhibited at the Tate Modern, London; Columbia University; UCLA; ICA, London; Mori Art Museum, Tokyo; Centre Georges Pompidou, Paris; Musée d’Art Moderne, Paris; and Pantheon, Paris, as well as in Barcelona and chairs the orga- nization’s International Scientific Committee on Theory and Education.

HILARY SAMPLE

Hilary Sample is a Professor at the Yale School of Architecture. Prior to join- ing Yale, Hilary Sample taught at SUNY Buffalo, where she was awarded the Reyner Banham Teaching Fellowship, and at the University of Essex, UK. She is a founding principal with Michael Meredith of MOS, an interdisciplinary, architecture and design practice based in New York City. Projects designed in her office have been published widely; have been exhibited at the Venice Biennale, The Museum of Modern Art, New York and the Art Institute of Chicago; and have received numerous awards, including a Design Award from Progressive Architecture and New York City Architectural League Emerging Voices. In 2010, Sample received an Academy Award in Architecture from the American Academy of Arts and Letters. Built projects include PSJ/ MoMA Afterparty, Hill House and the Floating House. Current work includes a villa in Ordos, Inner Mongolia, a com- munity center in Uganda, a teen center in Lowell, Massachusetts, and an Eco-luxury House in New Mexico. Sample was a visiting scholar at the Centre Pompidou in Paris and the University of Montreal. She is also the managing Director of Architecture and Planning, and was involved in the design of the Museum of Modern Architecture, Tokyo; Centre Georges Pompidou, Paris; Musée d’Art Moderne, Paris; and Pantheon, Paris, as well as in Barcelona and chairs the organization’s International Scientific Committee on Theory and Education.

FELICITY SCOTT

Felicity D. Scott is Director of the Program in Critical, Curatorial and Conceptual Practices in Architecture of the Graduate School of Architecture, Planning and Preservation, Columbia University, where she is Assistant Professor. She is also the founding co-editor of Grey Room, a quarterly jour- nal of architecture, art, media and politics published quarterly by MIT Press since Fall 2000. In addition to publishing numerous articles in jour- nals and anthologies, she has written the books Architecture and Techno-Utopia: Politics After Modernism and Living Archive? A. Ant Farm (Actar, 2008). She recently completed a manuscript for a book on the Austrian émigré architect Bernard Rudofsky, entitled “Cartographies of Drift: Bernard Rudofsky’s Encounters with Modernity.”
... concepts for sustainable buildings. Werner Sobek has offices in Stuttgart, Cairo, Dubai, Frankfurt, Istanbul, Moscow, New York and São Paulo.

GALIA SOLOMONOFF

Galia Solomonoff is a licensed architect and principal of SAS/Solomonoff Architecture Studio, based in Manhattan. Recent projects range from Dia Beacon a 300,000-square-foot contemporary art museum, to residences and artist’s lofts. Solomonoff earned an M.Arch. from Columbia University (1984), where she was awarded the McKim Prize for Excellence in Design, and a William Kline Fellowship. She received a Bachelor of Science in Architecture degree from City College, City University of New York (1991), from which she graduated magna cum laude. Originally from Argentina, Solomonoff has lived in New York since 1987. She is currently Associate Professor of Architecture at Columbia University’s Graduate School of Architecture, Planning and Preservation and is, together with artist Liam Gillick, leading a design/build pavilion studio in spring 2011.

HEIKO TRUMPF

Currently a Principal at Werner Sobek Engineering and Design in New York, Heiko Trumpf joined Werner Sobek Group in 2006 after finishing his Ph.D. dissertation on the ‘stability of pultruded glass-fiber reinforced polymer profiles’ at the Institute of Steel Structures at Katholieke Universiteit Leuven (Belgium). A full professor since 1990 in the Department of Metallurgy and Materials Engineering at the Katholieke Universiteit, he directs a group of eight postdoctoral researchers and 20 Ph.D. students, carrying out research in the areas of meso-mechanics of textile-based composites, nano-engineered composites, natural-fiber reinforced biopolymers and advanced production methods for composites. He is the author of more than 140 journal papers, close to 400 conference papers and 3 books, and holds 12 patents.

Verpoest is past President of the European Society for Composite Materials, and of the International Committee on Composite Materials. He has won several awards, most recently the Descartes Prize for Science Communication from the European Commission (2004), the International Fellowship of the Society for Advancement of Materials Processing and Engineering (2009), and an award from the International Committee on Composite Materials (2009).

GEORGE WHEELER

George Wheeler is Director of Conservation in the Historic Preservation Program of the Graduate School of Architecture, Planning and Preservation at Columbia University. He joined the program after 25 years at the Metropolitan Museum of Art as a research scientist, a position he continues to hold part-time. He has published extensively in the field of conservation, including his recent book Akasyakanon and the Consolidation of Stone, issued by the Getty Conservation Institute. Wheeler is a Fellow of the American Institute for Conservation, the International Institute for Conservation, and winner of the 1997 Rome Prize in conservation. He holds a Ph.D. in Chemistry from New York University, a Graduate Certificate in Conservation from the Institute of Fine Arts and a Master’s Degree in Art History from Hunter College-CUNY.

MARK WIGLEY


THE GRADUATE SCHOOL OF ARCHITECTURE, PLANNING AND PRESERVATION (GSAPP)

The Graduate School of Architecture, Planning and Preservation at Columbia University (GSAPP) offers six master’s degree programs: Master of Architecture, Master of Science in Architecture, Master of Science in Design, Master of Science in Urban Design, Master of Science in Environmental Engineering, Master of Science in Historic Preservation. 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 a 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 rethink 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 AT THE FU FOUNDATION SCHOOL OF ENGINEERING AND APPLIED SCIENCE

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 M.S. degree, the professional degrees of Civil Engineering and Water Resources and the Doctor of Engineering Science (EngScD) and Doctor of Philosophy (PhD) degree. These programs are flexible and allow for concentrations in structures, construction engineering, reliability and random processes, soil mechanics, fluid mechanics, 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 FOR LIGHTWEIGHT STRUCTURES AND CONCEPTUAL DESIGN (ILEK)

Both in its research and teaching, the Institute for Lightweight Structures and Conceptual Design (ILEK) at the University of Stuttgart unites the aspect of design with a focus on analysis and optimization used in structural engineering and the materials sciences. On the basis of a holistic-oriented-approach, the Institute is concerned with the conceptual development of all types of construction and load-bearing structures, using all types of materials. The areas of focus span construction with textiles and glass all the way to new structures in reinforced and prestressed concrete. From the individual details to the whole structure, the approach focuses on the optimization of form and construction with respect to material and energy use, durability and reliability, recyclability and environmental sustainability. The results of this work are published in the bilingual (German/English) serial from the Institute or published individually in special research reports on particular topics. ILEK offers undergraduate and postgraduate classes to students in Architecture and Civil Engineering. Students from the two sectors work jointly on common projects, thus enabling them to overcome traditional barriers between the disciplines.

www.uni-stuttgart.de/ilek

THE VINYL INSTITUTE

The Vinyl Institute (VI), founded in 1982, is a U.S. trade association representing the leading manufacturers of vinyl, vinyl chloride monomer, vinyl additives and modifiers and vinyl packaging materials. Working to ensure vinyl is the global plastic of choice for infrastructure and diverse applications, the mission of the VI is to advocate the responsible manufacture of vinyl products and the promotion of the value of vinyl to society. Specifically, the VI is committed to working with architects and engineers to demonstrate the range of solutions vinyl provides for the design challenges of today and tomorrow. For information about vinyl—its benefits, uses, and issues.

www.vinylinfos.org or www.vinylindesign.com
Acknowledgments

Permanent Change: Plastics in Architecture and Engineering is the fourth installment of the Columbia Conference on Architecture, Engineering and Materials. The series of conferences originated with the goal of reinvigorating the academic and professional collaborations between the Schools of Engineering and Architecture. In the fall of 2007, Mark Wigley, Dean, Graduate School of Architecture, Planning and Preservation (GSAPP), Christian Meyer, Professor, Department of Civil Engineering and Engineering Mechanics, and Michael Bell, Professor of Architecture, organized the initial conference as a new model of exchange. The first conference in the series, Engineered Transparency, on glass, established a focus on materials as a shared substrate of design, academic research, scholar- ship and industry, and included a wide group of participants in the profes- sional and academic fields of structural and mechanical engineering as well as architecture, materials science and industry. The second con- ference, Solid States, focused on a renewed potential for concrete and was held at GSAPP in fall 2008. The third conference, on metals, was held at GSAPP in fall 2009.

Permanent Change represents an ongoing collaboration between GSAPP and The Fu Foundation School of Engineering and Applied Science. Christian Meyer, professor; and Raimundo Betti, Chair, Department of Civil Engineering and Engineering Mechanics, have each sustained this partnership during the past year. Dean Fenicsky Peña-Mora has generously endorsed our shared work and plans for the next stages. This conference adds the Institute for Lightweight Structures and Conceptual Design (ILEK), University of Stuttgart, Germany, as a collabor- ating academic partner. Directed by Werner Sobek, ILEK has contributed to bringing a new scope of research to the conference. Special thanks go to Heiko Trumpf, of Werner Sobek Engineering and Design.

Permanent Change and the entire Columbia Conference on Architecture, Engineering and Materials series has benefitted from the critical insight and ongoing support of Mark Wigley. At GSAPP the context of openness and experimentation has allowed our team to reach out to new colleagues in academia and industry with creative energy that has both grounded our work and offered a chance for new momentum.

Gregory Bocchi, President of The Vinyl Institute as well as George Middleton, Sylvia Moore and Kevin Mulvane, Vice President of Marketing and Communications, provided direction at every stage of planning. William F. Carroll, Vice President, Industry Issues, Occidental Chemical Corporation, generously helped to establish new relations with the field of chemical engineering. Judith Nordgren, former Vice President of Marketing and Communications, initiated our collaboration with The Vinyl Institute, whose generous support as our Exclusive Sponsor made this event possible. The Institute’s engage- ment with GSAPP provides a critical bridge to industry and was under- taken with a deep regard for the tradi- tions of scholarship and practice in our speakers’ work.

Greg Lynn provided tremendous energy in working with us to build the conference roster. Sylvia Lavin offered encouragement in taking on the topic of plastics and lent her time and critical and editorial skills to our planning. We are grateful to Rosana Rubio Hernández, who has conceived inven- tive exhibits for each of the four con- ferences, assisted this year by Mara Sánchez Llorens and Carlos Fernández Piña. Our thanks also go to Yoshiko Sato for creating an installation this year interrogating conference goals, assisted by Shuning Zhao and John Hooper. We thank Stretch Marquises and Fabric Structures as well AZEK for in-kind materials and fabrication sup- port of Sato’s installation, and Mark Wasueta, Director, GSAPP galleries, and his team members, Greg Bugelad and Brittany Drapac.

The following additional members of the GSAPP community have provided wide-ranging assistance and talent for this conference:

Development: Devon ERCOLANO, Provost, and Julia Fishkin, Associate Director, who assisted in fundraising on the entire confer- ence series; and Danielle Smoller, who worked to secure the optimal facilities for the event.

Audiovisual assistance: John RAMALHO, Executive Director of Information Technology; Lou FERNANDEZ, Kevin Allen, Audio Visual Office; and Student Assistants Brendan SULLIVAN, Michael Christopher GEORGOPOULOS and Koosoo Jung. Web design: Gabriel Bach, Manager, GSAPP Online. Woodshop: Mark A. TAYLOR, Director of Operations, and Nathan Carter, Building/Model Shop Manager. Fabrication Lab: Phillip ANZALONE, Director, and BRIGETTE BORDERS, Manager. For printing and mailing, we thank Sal BERNARDINO, Manager, Columbia University Print Services; and Sarah RIEGELMANN of Highroad Press.

Finally and foremost, without the vision, curiosity, rigor and goodwill of the Conference Chair, Michael Bell, Permanent Change and the ongoing Columbia Conference on Architecture, Engineering and Materials series would not have achieved its remarkable momentum in challenging assumptions and asking the most penetrating ques- tions of our shared future.

For more information about GSAPP events, contact: Benjamin Prosky, Director of Events and External Affairs, GSAPP, Columbia University 212.854.9248 bp2171@columbia.edu www.arch.columbia.edu/events Conference graphic identity, poster and program design: Thumb

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THE COLUMBIA CONFERENCE ON ARCHITECTURE, ENGINEERING AND MATERIALS IS A MULTI-YEAR RESEARCH PROJECT.

2007
ENGINEERED TRANSPARENCY: GLASS IN ARCHITECTURE AND STRUCTURAL ENGINEERING

2008
SOLID STATES: CHANGING TIME FOR CONCRETE

2009
POST DUCTILITY: METALS IN ARCHITECTURE AND ENGINEERING

2011
PERMANENT CHANGE: PLASTICS IN ARCHITECTURE AND ENGINEERING

2012
LIGHT IN ARCHITECTURE AND ENGINEERING