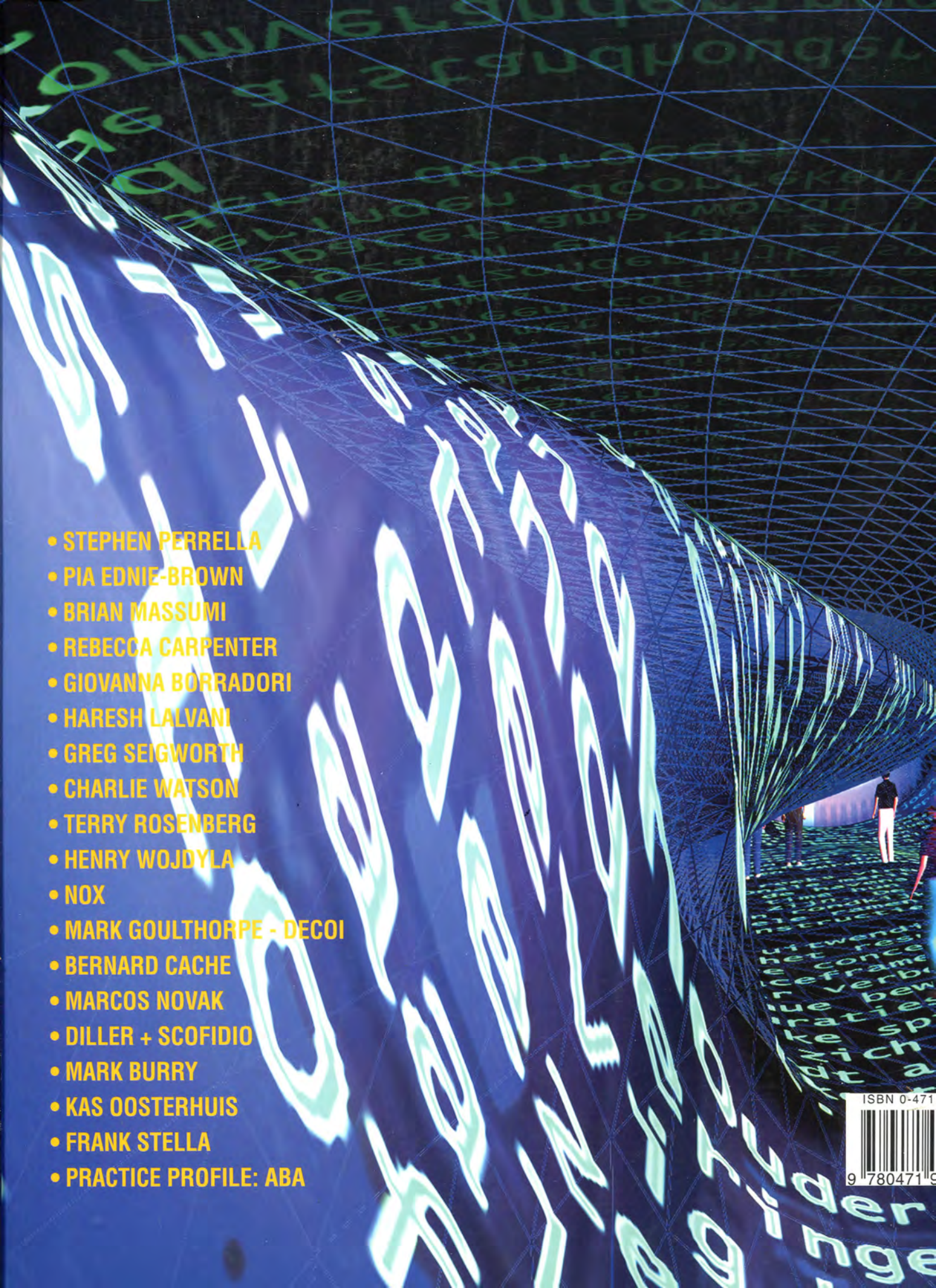




HYPERSURFACE ARCHITECTURE II

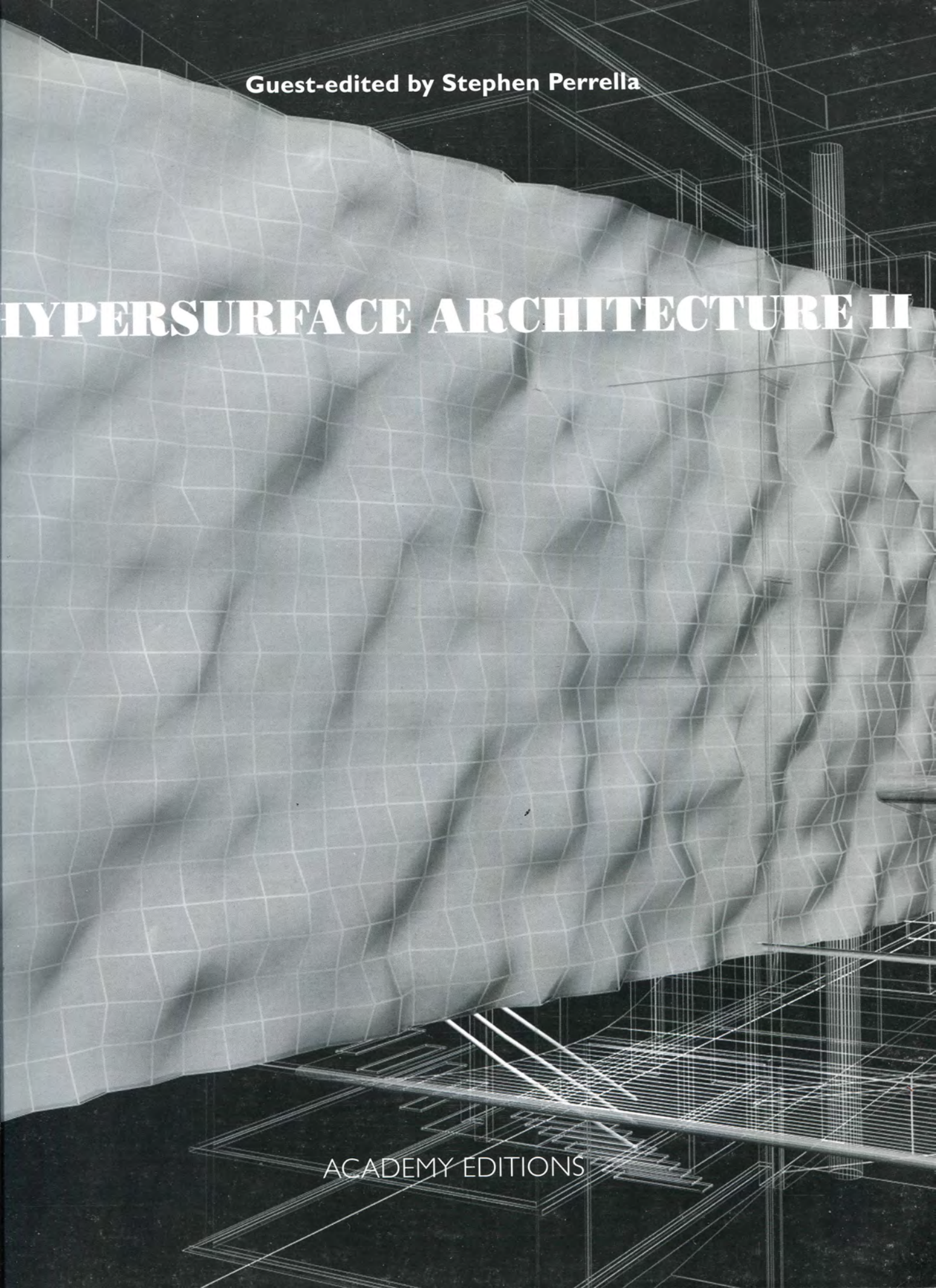


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- STEPHEN PERRELLA
 - PIA EDNIE-BROWN
 - BRIAN MASSUMI
 - REBECCA CARPENTER
 - GIOVANNA BORRADORI
 - HARESH LALVANI
 - GREG SEIGWORTH
 - CHARLIE WATSON
 - TERRY ROSENBERG
 - HENRY WOJDYLA
 - NOX
 - MARK GOULTHORPE - DECOI
 - BERNARD CACHE
 - MARCOS NOVAK
 - DILLER + SCOFIDIO
 - MARK BURRY
 - KAS OOSTERHUIS
 - FRANK STELLA
 - PRACTICE PROFILE: ABA

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The image is a black and white abstract architectural graphic. It features a large, translucent, wavy surface that resembles a liquid or a flexible material, overlaid with a white wireframe grid. This surface dominates the left and center of the frame. In the background, there are faint, white wireframe outlines of architectural structures, including rectangular frames, a tall cylindrical column, and various intersecting lines that suggest a complex spatial design. The overall composition is layered and geometric, with a strong sense of depth and form.

Guest-edited by Stephen Perrella

HYPERSURFACE ARCHITECTURE II

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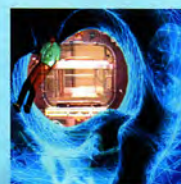
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contents

4 Maggie Toy
Editorial

5 Stephen Perrella
Electronic Baroque

8 Pia Ednie-Brown
Falling into the Surface

72 Marcos Novak
Eversion

77 Diller + Scofidio with Paul Lewis
Jump Cuts

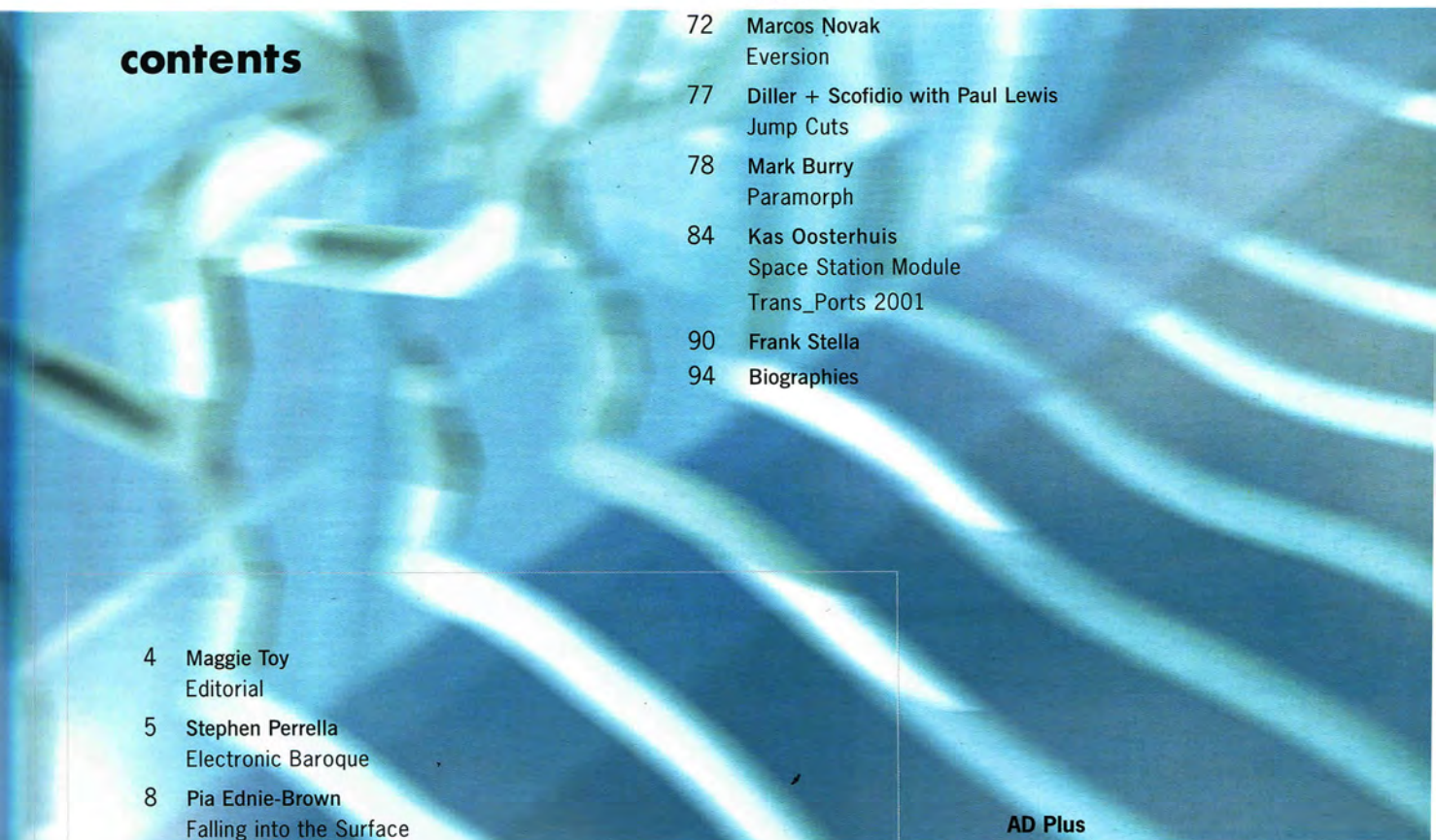
78 Mark Burry
Paramorph

84 Kas Oosterhuis
Space Station Module
Trans_Ports 2001

90 Frank Stella

94 Biographies

AD Plus



contents

4 Maggie Toy
Editorial

5 Stephen Perrella
Electronic Baroque

8 Pia Ednie-Brown
Falling into the Surface

72 Marcos Novak
Eversion

77 Diller + Scofidio with Paul Lewis
Jump Cuts

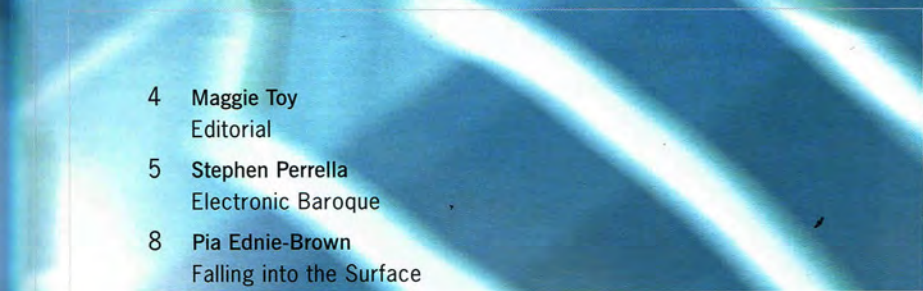
78 Mark Burry
Paramorph

84 Kas Oosterhuis
Space Station Module
Trans_Ports 2001

90 Frank Stella

94 Biographies

AD Plus



4 Maggie Toy
Editorial

5 Stephen Perrella
Electronic Baroque

8 Pia Ednie-Brown
Falling into the Surface

12 Brian Massumi
Strange Horizon

20 Rebecca Carpenter
Force Affect

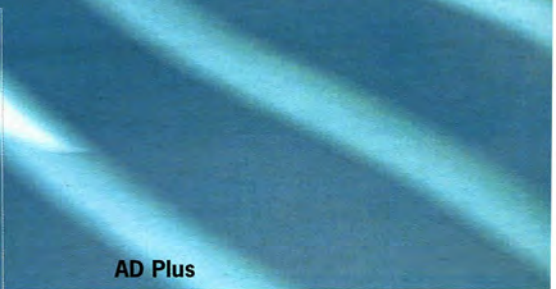
26 Giovanna Borradori
Against the Technological Interpretation of Virtuality

32 Haresh Lalvani
Meta Architecture

38 Stephen Perrella
Commercial Value and Hypersurface

40 Greg Seigworth
Protegulum

48 Charlie Watson
Cool World



AD Plus

97	Howard Watson Beyond Expression?
100	Helen Castle Organic Ablutions
102	Practice Profile ABA
107	Helen Castle Shaping a Generation
108	Miles Glendinning Private Lives, Public Lives
110	Book Reviews
112	Site Lines Circular Thoughts

EDITORIAL

MAGGIE TOY

Since Architectural Design published 'Hypersurface Architecture I', over a year ago, there has been a wealth of innovations and new explorations. The first edition clearly presented an analysis of contemporary culture that identified two simultaneous and interpenetrating trends. On the one hand there was the confines of avant-garde architecture and on the other there were the practices of everyday commerce. 'Hypersurface Architecture II' demonstrates the convergence of these two forces that radicalises form and deterritorialises subjectivity and investigates further the way in which effects emerge within and around architecture. For this second issue, Stephen Perrella has once again collected together an impressive array of designers, innovators and projects that demonstrate the expanding field of hypersurface theory. The continuing need to stretch the boundaries of architecture in every direction is being satisfied with this relatively new exploration. The existence and possibilities that begin with the computer, and its expansive opportunities, are being explored by many. The direction taken by Perrella and others included in this issue shows a potential new way forward for architects, perhaps a solution for many who are looking for positive methods by which to fully utilise the techniques open to them.

Rebecca Carpenter discusses the ideas of events in architecture and how the construction of space can be the result of topological transformations. Architecture ceases to be a backdrop for actions, becoming an action itself. This helps define the properties of the subject. Brian Massumi continues his argument from the first issue, as well as opening a different argument in discussing the sense in the paperless studio and the growing familiarity with technology. He spotlights what is rotten on the shelf of spatial-awareness theory and suggests a way forward and around these issues. Massumi defines and illustrates the many discussions and terms created by hypersurface theory and presents them in an exciting and graspable language. He also explains the complexities of the synaesthetes and perceivers contribution to the ideas behind the notions demonstrated, leaving the reader reeling with intrigue. Giovanna Borradori draws against the technological interpretation of virtuality explaining that in architecture as in philosophy the representationalist approach entails a conception of the new as foreseeable possi-

bility whereas by contrast, from a perspectivist angle, novelty corresponds to the actualisation of virtual presences: presences virtually contained in the real, but not yet actualised. Nietzschean interpretations are used to assist this comprehensive analysis. As in the last issue, the brilliant work of Marcus Novak draws in the observer with the imagination of the imagery and with the philosophies that aid their creation, which are equally as hypnotic. The brilliance of this combination clearly demonstrates that he is one of the world leaders in this field. The work of Nox Architecture, the group, consolidates this by showing the development made in realising this architecture, quelling earlier arguments that the ritual and the real are by nature conflicting. Their schemes for domestic and traffic barring, as well as a laboratory, display and inspirational medley of imaginary and reality. Decoi architects were not included in the previous edition, but their contribution here, 'Aegis Hyposurface', adds yet another component to this complex area by exploring the shifts in architectural production from a psychological perspective. The trauma of the ongoing cultural adaptation of society to an electronic environment is analysed, placing emphasis on the positive environment that can evolve. Their project work displays an inventive use of the computer environment. Hareesh Lalvani discusses meta-Architecture and the manipulation of morphologically structured information, via algorithms and genetic codes. Lalvani suggests a method by which the architect could be liberated from the building process as an artificial genetic code enables growth, adaptation, evolution and replication of buildings, permitting architecture to design itself. Perhaps this is the future of the collaborative use of computers within architectural design.

Overall this issue shows that this new movement has established itself as a new force within architecture and investigation, breaking new boundaries and hatching new ideas and directions. As the refining of digital construction and manufacturing systems means that much which had previously remained conjective or ritual can be built, those such as Lalvani and his fellow exponents continue to project themselves forwards to a future that will fully grasp the potential that fast developing technologies present.

BIOGRAPHIES

STEPHEN PERRELLA <haptic@columbia.edu> is an architect and editor at Columbia University School of Architecture, Planning and Preservation. He is the graphic designer and editor of the GSAP's newspaper Newsline and managing editor of Columbia Documents of Architecture and Theory. Since 1991 he has been investigating the relationship between architecture and information. He has taught architecture at various universities in the USA and has lectured internationally. He is also president of Hypersurface Systems, Inc, a design firm created to explore broader architectural interfaces for electronic technology. Website: www.columbia.edu/~sp43/hypersurface.html

REBECCA CARPENTER, who lives in London, received a Master of Architecture from Columbia University GSAP in 1996. She is the recipient of numerous awards from the school including the AIA medal and the Lucille M Lowenfish Memorial Prize.

BRIAN MASSUMI teaches in the English Department of the State University of New York, Albany and is the author of *A User's Guide to Capitalism and Schizophrenia: Deviations from Deleuze and Guattari* and *First and Last Emperors: The Absolute State and the Body of the Despot* (with Kenneth Dean). He is the editor of *The Politics of Everyday Fear*, and co-editor of the University of Minnesota Press book series 'Theory Out of Bounds'. His translations from the French include Gilles Deleuze and Felix Guattari's *A Thousand Plateaus*. His work in progress on sensation, virtuality, and modes of cultural expression is forthcoming from Harvard University Press.

PIA EDNIE BROWN <pia@iii.rmit.edu.au> is a lecturer at the School of Architecture and Design at the Royal Melbourne Institute of Technology (RMIT). She is currently undertaking a doctorate at RMIT jointly through the School of Architecture and Design and the R&D body, the Interactive Information Institute. Her research aims to negotiate the potential for digital technology to assist in implementing the expansion of architectural design processes beyond the privileging of vision.

GIOVANNA BORRADORI is an Ass. Professor of Philosophy at Vassar College. Author of *The American Philosopher* and the editor of *Recoding Metaphysics: the New Italian Philosophy*, she concentrates on Hegel, Nietzsche, Bergson, Heidegger, French poststructuralism, and the philosophy of architecture.

MARCOS NOVAK <marcos@aud.ucla.edu> is a 'transarchitect', artist, and theorist investigating the emerging tectonics of technologically-augmented space. He is the leading proponent of virtual environments as autonomous and fully architectural spaces and of the Internet as an unprecedented, non-local, transurban, public domain. His work seeks to combine non-Euclidean conceptions of space with aspects of algorithmic emergence and morphogenesis. He lectures worldwide and is Visiting Associate Professor of Architecture at UCLA (CA). Information on Marcos Novak can be found at: www.aud.ucla.edu/~marcos/

BERNARD CACHE conducted strategic studies for companies like Philips, Canal Plus and France Telecom as a senior consultant in image telecommunications and digital television. He has written articles on communication economics and policy in *Libération*. As an architect, he developed Objectile software and in 1996 he founded the Objectile company, together with Patrick Beaucé and Jean-Louis Jammot. Since September 1998, Bernard Cache is Associate Professor at the Faculty of Architecture, Landscape and Design at the University of Toronto.

DECOI ARCHITECTS, established in 1991 and based in Paris and London, is a design atelier committed to stimulating new developments in architecture. Their work inquires as to the liberating potentials of current technological developments, which extend to new modes of creativity and entirely new working practices. The members of Decoi lecture and teach widely, which gives insight into a rapidly-changing scene, but their central mandate is to operate as an efficient and skillful architectural practice building sophisticated architectural projects.

HARESH LALVANI is a tenured Professor at Pratt Institute's School of Architecture, New York, where he has taught since 1970. He is known for his original contributions in architectural and basic morphology, especially in areas of higher-dimensional, non-periodic and transformational space structures. He is currently working with Milgo-Bufkin, New York, on sheet metal structures using innovative metal-forming techniques.

KAS OOSTERHUIS/NOX studied architecture at the Technical University in Delft. Director of the multidisciplinary practice Oosterhuisassociates where architects, artists and programmers join forces, Kas Oosterhuis is the co-founder of the Attila Foundation (1994) which pursues the electronic fusion of art and architecture. Recent works can be viewed on <http://www.oosterhuis.nl>

FRANK STELLA's early work addressed the formal aspects of modernism, focusing his attention on a picture's surface and structure. As a sculptor, he had made massive metal objects for Chicago, Luxembourg and Tokyo. As an architect, he had completed extensive scenographic decorations for the princess of Wales Theater in Toronto and designed buildings in Europe for the cities of Groningen and Dresden.

MARK BURRY occupies the Chair of Architecture and Building at Deakin University in Melbourne, Australia. He is a practising architect with an interest in realising 'difficult buildings' without compromising design intent. Since 1979 he has been Consultant Architect to the foundation who commissioned Antoni Gaudí to design the Sagrada Família Church in Barcelona in 1882. Burry's role has included unravelling the mysteries of Gaudí's use of second order geometry (ruled surfaces) for the nave design.

GREG SEIGWORTH teaches cultural theory and media production courses in the Department of Communication and Theatre at Millersville University of Pennsylvania, USA. He is currently co-editing a special issue of the journal *Cultural Studies* devoted to the work of Deleuze and Guattari.

CHARLIE WATSON currently works as a director of commercials and music videos out of Rhythm and Hues, a production company based in Los Angeles. He has also directed through the production companies Limelight, the End, and RSA for such clients as Coca-Cola, Nike and Budweiser. His body of work also includes documentaries and short subject films. He won a 1999 Clio Award in Film Animation for Mazda "Cool World".

TERRY ROSENBERG <ATRR@aol.com> is an artist whose Generatrix sculpture has concentrated on the scoring and folding of flat surfaces into curved space. The work explores the integration of dimensions through motion, most recently with paintings and drawings related to dance. His work has been exhibited internationally and is included in several museum and private collections.

HARESH LALVANI

META ARCHITECTURE

Architect-morphologist Hareesh Lalvani has developed a technique to modulate sheet metal into a wide range of new configurations that can be easily manufactured using a patent fabrication process he developed with M Igo-Bufkin. Here he discusses the development of his theory of Meta Architecture, his application of the term Hypersurface, and his work with Milgo-Bufkin which is currently launching his new design series.

Meta Architecture is based on manipulating morphologically structured information via algorithms and genetic codes that encipher the formal possibilities of architecture. These possibilities are determined by mapping them in a unified morphological universe,¹ a higher dimensional meta space which (theoretically) encodes all past, present and future morphologies. It also maps all their transformations. The coding of structures within this universe leads to an artificial genetic code.² This is a universal morphological code³ and acts as a driver for organising shaping building and transforming architecture over short-term and long-term time scales. Coupling the code with manufacturing processes, both at the macro level of current computer-aided manufacturing and the micro level of nanotechnologies and genetic engineering enables the direct translation of the code into the physical process of building. Coupled with biological (DNA-based) or other chemical physical building processes, the artificial genetic code enables growth, adaptation evolution and replication of buildings, permitting architecture to design itself and eventually liberating it from the architect. Architecture as we now know it will end when self-architecture begins.⁴

Within this overall premise, several examples from my ongoing work in Meta Architecture, and the related visual product, Hyper Space Architecture or Hyper Architecture), are presented. The work offers an alternative paradigm to 'digital architecture' which has emerged in the last decade. Increasingly sophisticated computer graphics tools have enabled architects to visualise relatively complex spatial environments in virtual space without recourse to physical models or in some instances as in Frank Gehry's museum at Bilbao), to digitise complex built models directly. These digital visualisations, all conceived in virtual space, are admittedly visually spectacular and are conceived 'top down' both visually and spatially. However they are neither informed by construction methods or the properties of physical materials, nor by any morphological principles of space and structure, which impose strong constraints on architecture. Architecture, shaped by these constraints and modelled by

morphological principles – including Meta Architecture – is architecture that proceeds from the 'bottom up'.

The works presented here exemplify the bottom-up approach in two different ways: one driven primarily by higher-dimensional geometry and the other by combining geometry with manufacturing process in making physical form out of real material. Both examples show the unprecedented possibilities for shaping architecture opened up by recourse to basic morphological principles (geometric, topologic, structural etc). The images demonstrating the first approach are excerpted from my folio 'Hyperspace Architecture' which shows the various applications of higher dimensions for architecture,⁵ and the second approach is from an ongoing experiment currently being carried out with Milgo/Bufkin, a leading metal fabricator in New York.

Highly ordered geometry is used in the first approach (figs 1 and 2) as a basis for generating irregular hyperstructures, in this case, hypersurfaces. The term 'hypersurface' here is used according to its original meaning defined in the strict geometrical (mathematical) sense: ie having spatial dimensions greater than three. This definition contrasts with the usage in this and the previous special issue of *AD*, edited by Stephen Perrella, entitled 'Hypersurface Architecture' where the term 'hyper' is used as a meta-dimension of the surface and not its spatial dimension. Interestingly in the first example shown here (figs 1a, b), the term has a double meaning. The two tiling designs are identical in their base geometry which comprises an assembly of identical crescent-shaped tiles⁶ based on two-dimensional projections from five-dimensional Euclidean space. The crescents are thus hyper-tiles. In addition they have a superimposed pattern of dark lines, echoing the other meaning of 'hypersurface' as used by Perrella). While the designs appear random each tile is identically marked in both cases. The image captures the paradigm that irregular and random-looking designs can be constructed from identical modules, an idea of great significance for architecture as it visually blends order with chaos.

Another example (figs 2a–c) further exemplifies this juxtaposition between order and disorder in a three-dimensional structure. The irregular surface, a true hypersurface projected from higher-dimensional space, hovers like a cloud over a space that, when extended, is non-periodic. The structure can be constructed from a single-node design,⁷ a single-strut element and flat panels. Additional stabilising features would most likely be needed for its structural stability. This is just one example of the unlimited and varied architectural compositions that can be constructed from this new morphological invention.



Fig. 1a



Fig. 1b

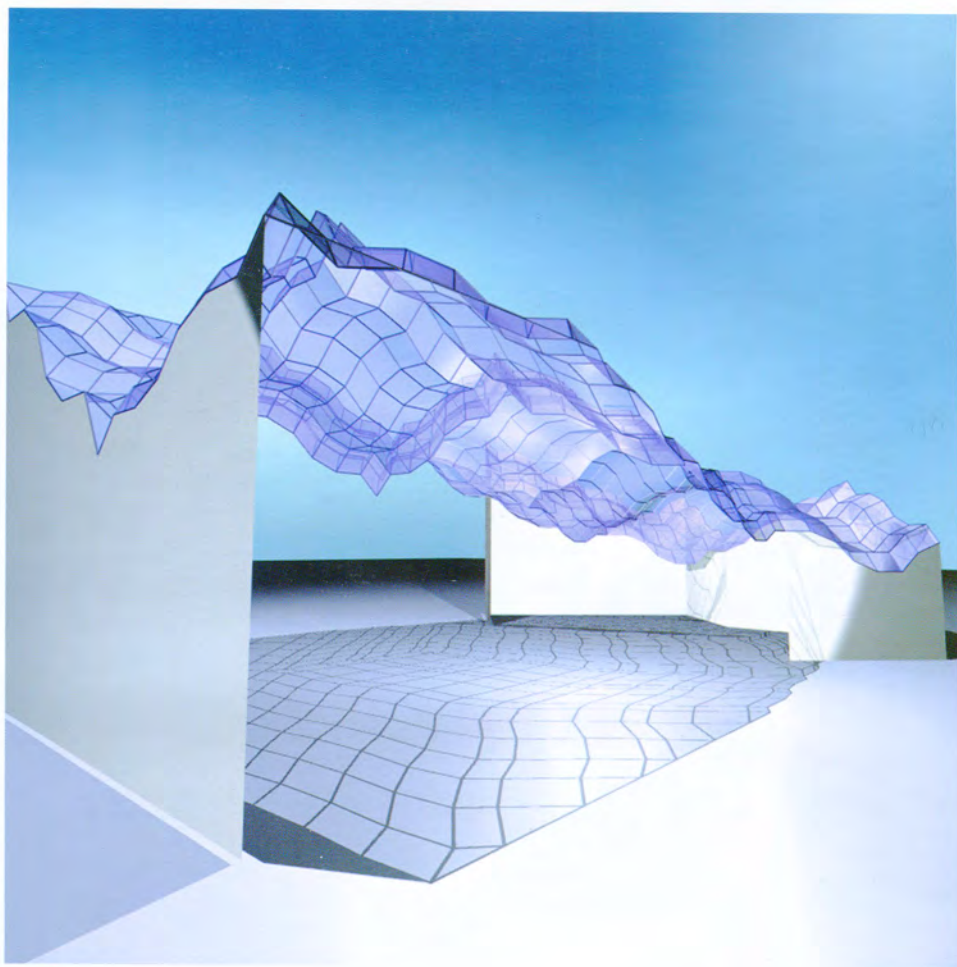


Fig. 2a

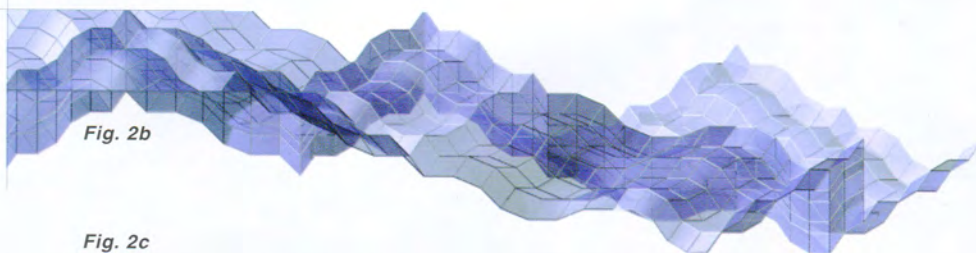


Fig. 2b

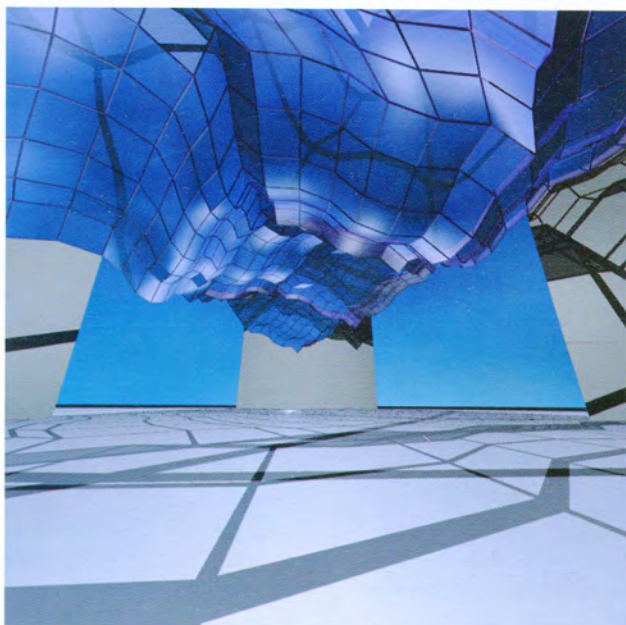


Fig. 2c

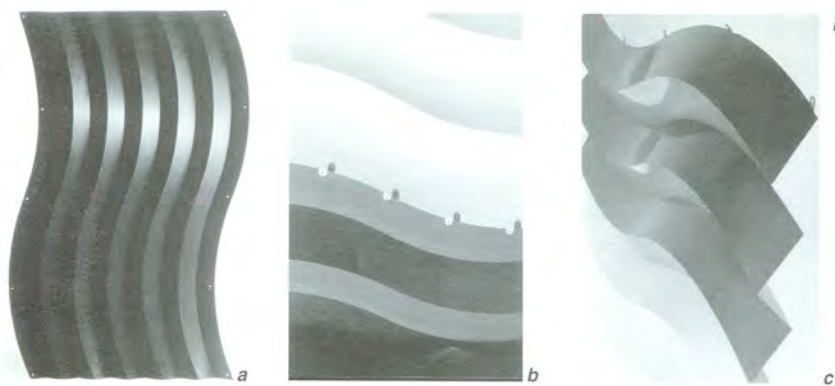
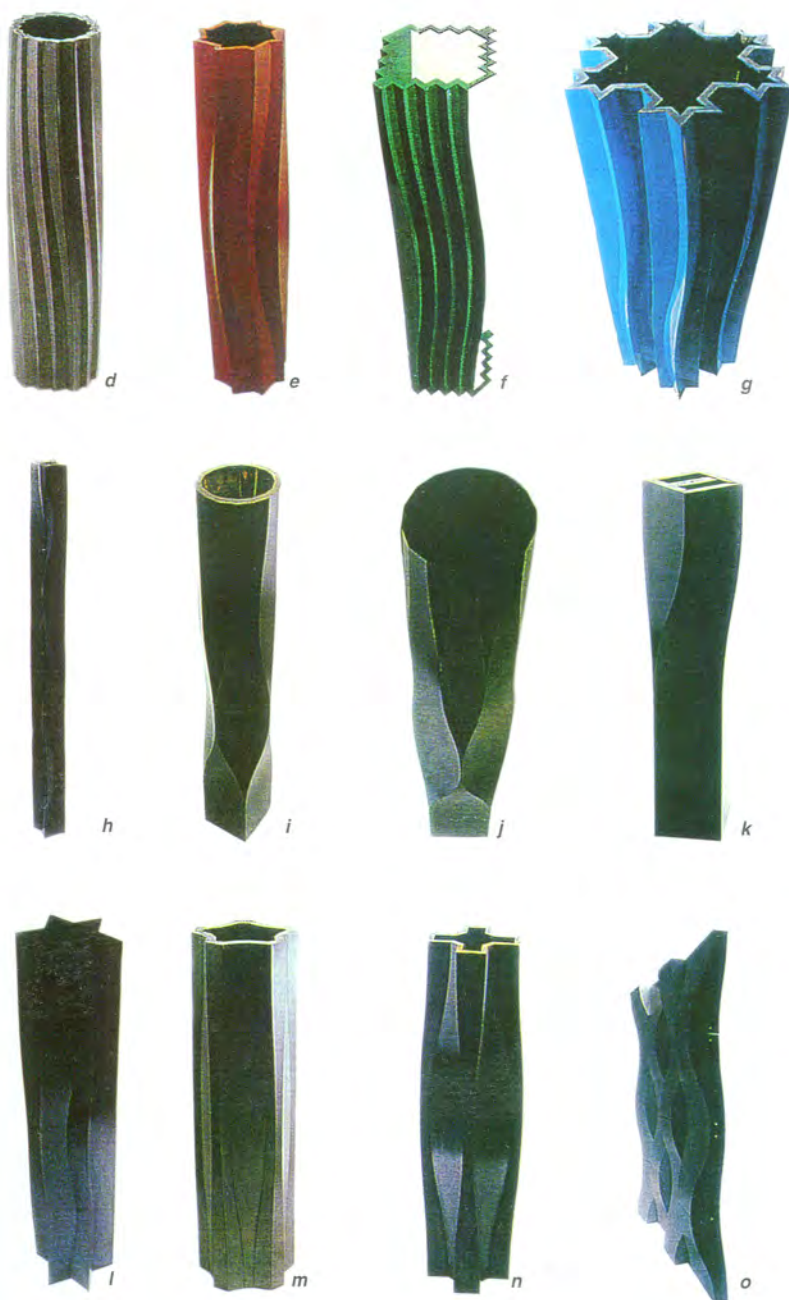


Fig. 3



The next group of images (figs 3a–o) exemplifies the second approach. The project deals with software-driven fabrication of sheet metal for architectural surface structures⁸ and is being carried out at Milgo/Bufkin's manufacturing facility. Though columns, capitals, wall and ceiling panels are immediate architectural applications of concern for Milgo's business interests, the project provides a unique opportunity to experiment with broader Meta Architectural concepts, especially the relationship between an artificial 'genetic code' and the manufacturing process. All sheet-metal structures shown here were generated using a morphologically encoded algorithm, which provides the possibility to generate endless 'variations on a theme' by manipulating the code. As a result, no two structures need be alike, so each individual in the world if desired could have their own unique structure. A procedure was developed whereby single continuous metal sheets could be marked by computer-driven equipment and then folded (manually for now). The resulting structures not only have a new look, but appear to be structurally advantageous at the same time. Architectural and industrial design products as well as complete environments based on these structures are currently being developed (figs 4–8). The algorithmic approach permits the structures to be modelled, transformed and fabricated with ease. We expect that the morphologic elegance in the shaping of these structures would also translate into an economy in building.

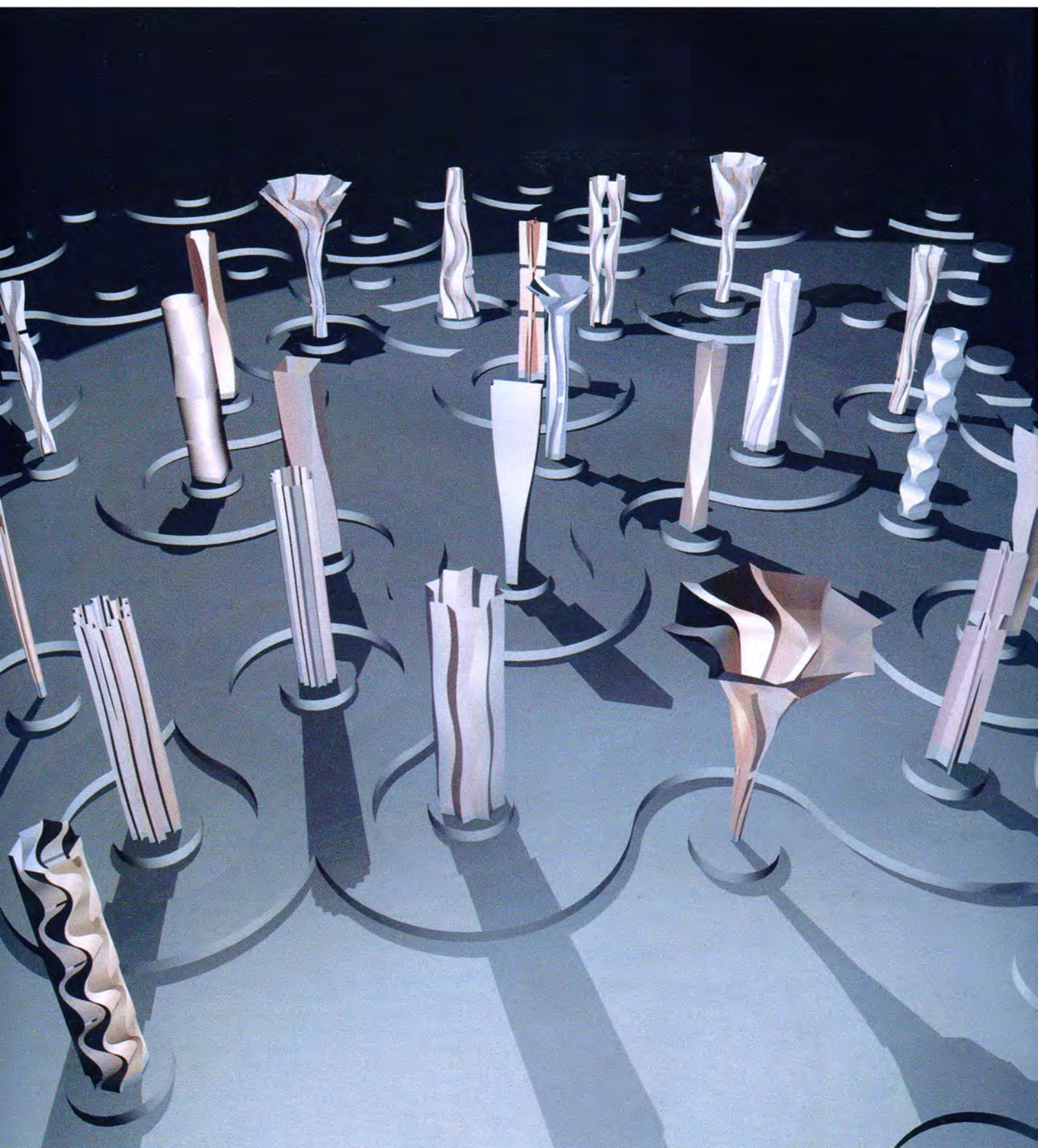


Fig. 4

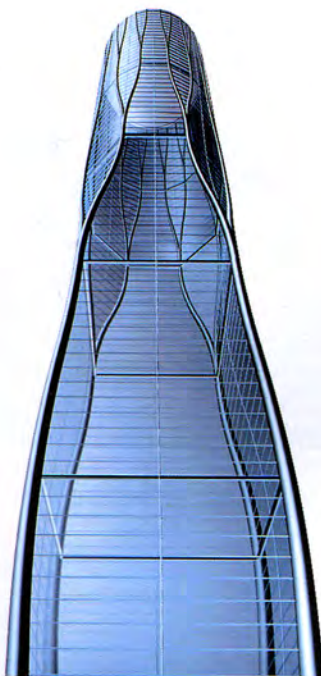


Fig. 5



Fig. 6



Fig. 7

Column Museum (fig 4) shows a sampling of the morphologically encoded columnar structures being prototyped and fabricated at Milgo. *Fractal High-Rise* (fig 5) shows a branched fractal column concept applied to a glass skyscraper. *Umbrellas* (fig 6) utilises the twisted fold for a freestanding structure in an open-air environment. *Transitions* (fig 7) shows flat, wavy and irregularly curved walls within the same spatial layout, using the same material and fabrication technology. *WaveKnot* (fig 8) employs a continuous rippled surface for a ceiling or roof defined by a simple topological knot space.

The undulating look of these structures resulted from an interest in the fundamental behaviour of sheet material under forces. Material 'flows' under its own weight and other forces according to predetermined morphologic laws, which pertain more to fluid motion than to static objects. Constructing architectural elements from rigid rectilinear units (such as bricks and beams) has 'frozen' this inherent flowing nature of architectural envelopes. The wrinkles on our skin, the surfaces of plants and skins of animals, waves and cloud forms, display this fluid-like quality in nature. Curvilinear architectural forms constructed using standard building methods have usually raised concerns of economy.

However, our experiments at Milgo suggest that advanced software-driven manufacturing processes, coupled with powerful morphological underpinnings, can easily and possibly economically generate a wide repertoire of new curvilinear vocabulary unavailable to architects in the past. Paradoxically, high technology representing the opposite pole in the man-nature dichotomy permits fluid shapes not possible earlier in a simple and elegant manner and in doing so, brings us closer to forms in nature. This is true not only in visible forms, but also in the concept of the genetic code, which permits each one of us to be unique yet encoded by the same basic genetic alphabets (DNA bases). These sheet metal structures are morphologically coded in a similar way.

Notes

I am indebted to the following for their contribution to the project: computer modelling and rendering, Neil Katz and Mohamad Al-Khayer; photography, Robert Warren; product development, prototyping and fabrication, Milgo-Bufkin with Bruce Gitlin and Alex Kveton. More information on these projects with Milgo-Bufkin, Brooklyn, New York, can be found on their website <www.milgo-bufkin.com> from January 2000.

- 1 Hareesh Lalvani, 'Morphological Universe, Expanding the Possibilities of Design and Nature' unpublished, 1998, based on a lecture presented at ACSA conference, Dalhousie University, Nova Scotia, October 1998, on the theme: 'Works of Nature: The Rhetoric of Structural Invention'
- 2 My interest in the genetic code of architecture dates back to 1975; my first published work on morphological coding was in the context of Islamic patterns (1982). In 1993, I proposed 'architectural genetics' as an emerging science.
- 3 I have been developing such a code for over two decades. Early interim results appeared in 'Multi-dimensional Periodic Arrangements of Transforming Space Structures' PhD Thesis, University of Pennsylvania (1981), self-published as *Structures on Hyper-Structures* (1982). Subsequent extensions of this work have been published in various papers, and applications to various structural morphologies have been in progress since the early 1990s.
- 4 For the origins of 'growing' architecture, see William Katavolos, *Organics*, Steendrukkirij de Jong & Co (Hilversum), 1961. Vittorio Giorgini, 'Early Experiments in Architecture using Nature's Building Technology' in H. Lalvani (ed), *The International Journal of Space Structures*, vol 11 nos 1-2, special issue, 1997.

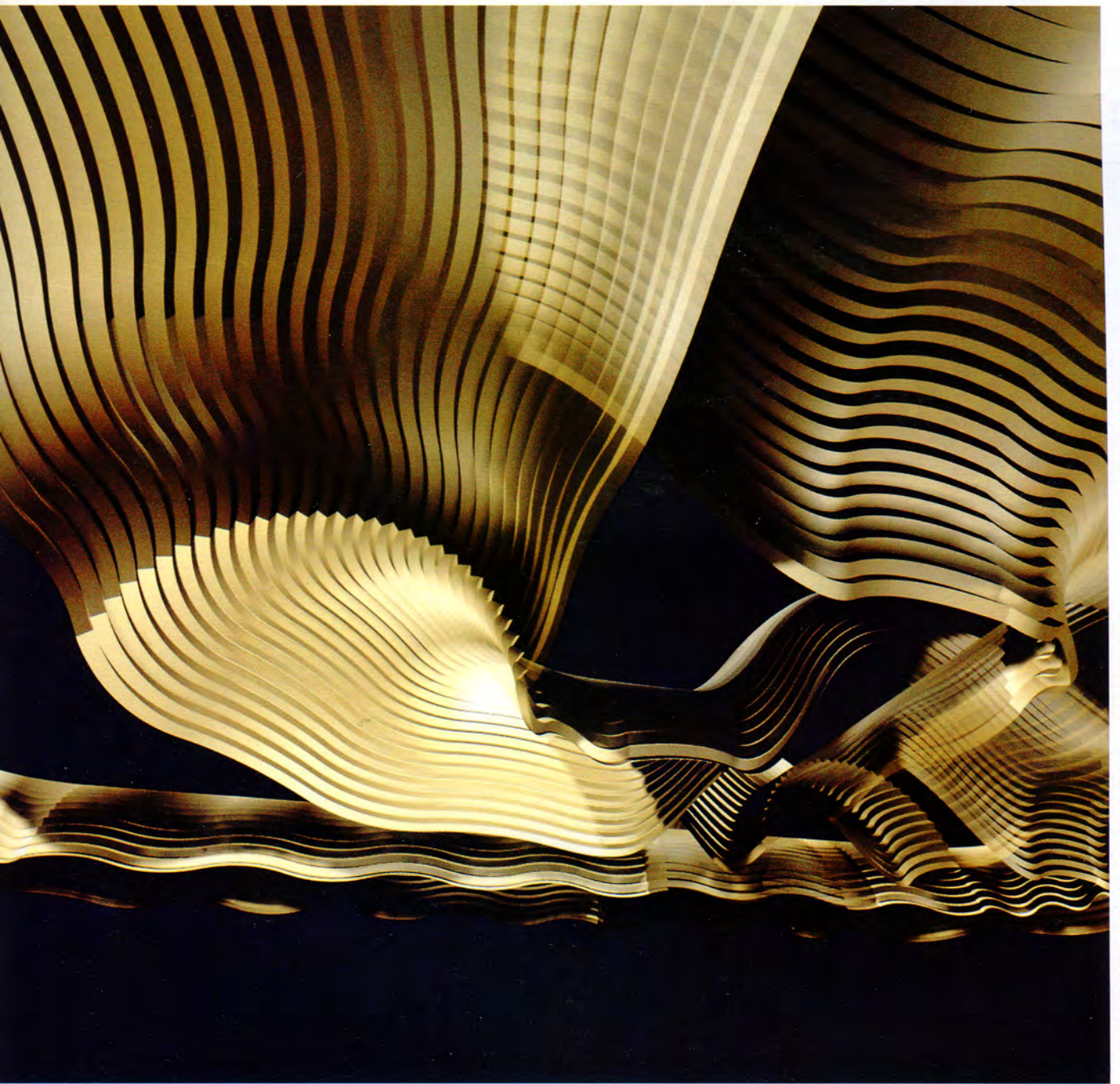


Fig. 8

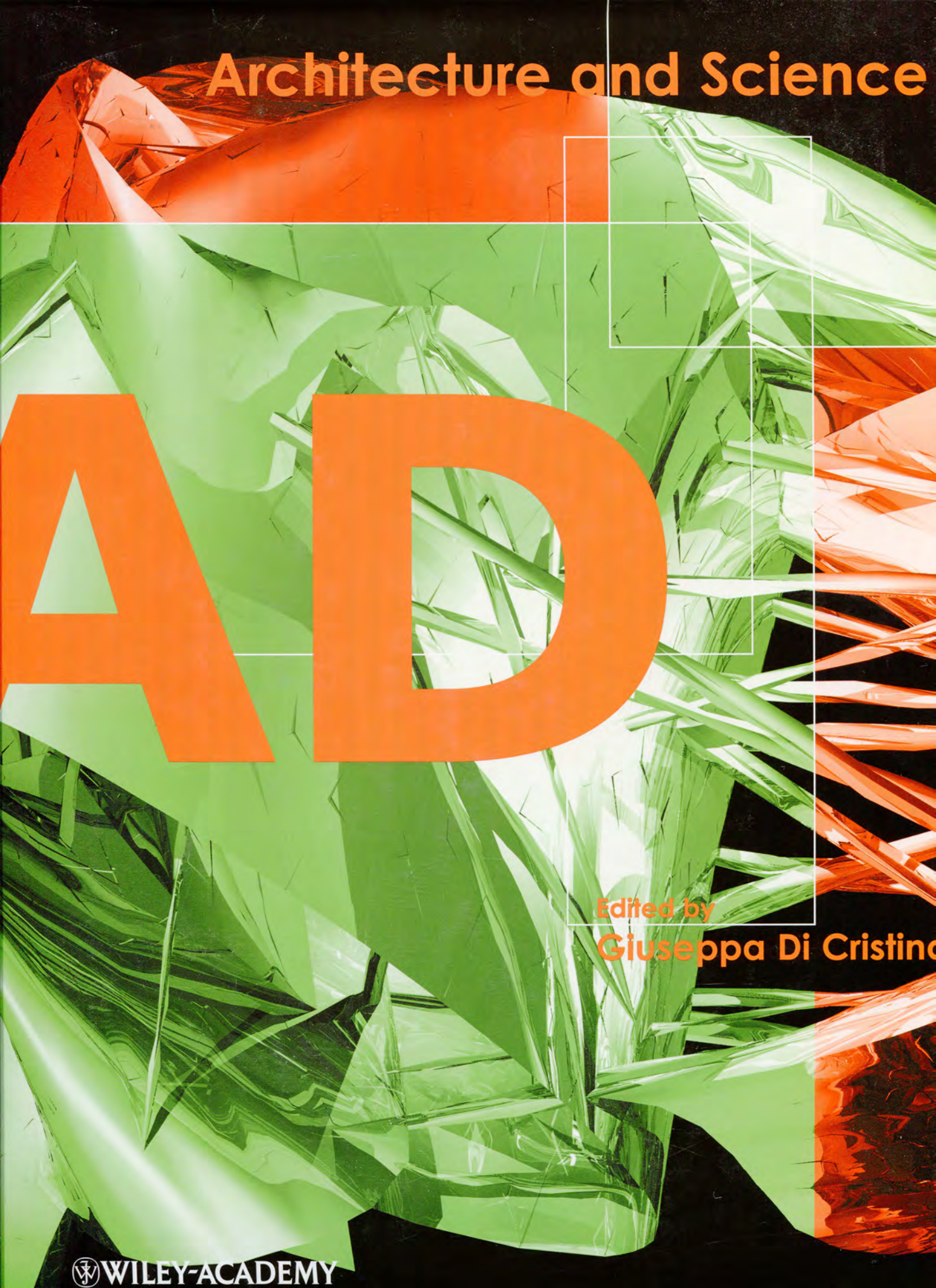
My work in this concept came via genetic engineering and was proposed in 'Towards Automorphogenesis, Building with Bacteria' unpublished, 1974, the source of which goes back to the question asked by my thesis of 1967: 'Why don't we build with bone and spider silk?' In recent years, John Johansen has been proposing growing architecture using 'molecular engineering'

5 Lalvani, 'The Architectural Promise of Curved Hyperspaces' 2nd International Seminar: 'Application of Structural Morphology to Architecture' University of Stuttgart, 1994; 'Hyperstructures' in P Dombernowsky and T Wester (eds), *Engineering a New Architecture, Conference Proceedings*, Aarhus School of Architecture (Denmark), 1999.

6 Lalvani, US Patent 4,620,998, 1986.

7 Lalvani, US Patent 5,505,035, 1996.

8 Patent pending.



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Page 2: Peter Eisenman, Rebstock Park, Frankfurt, view of the model

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Contents

- | | | |
|--|--|---|
| 6 Giuseppa Di Cristina
The Topological Tendency in Architecture | 74 Frank O Gehry
The Guggenheim Museum, Bilbao, Spain | 148 Stephen Perrella
Electronic Baroque |
| 14 Kenneth Powell
Unfolding Folding | 78 Daniel Libeskind
Between the Lines, Berlin | 152 Marcos Novak
Transarchitectures and Hypersurfaces |
| 16 Jeffrey Kipnis
Towards a New Architecture | 84 Daniel Libeskind
The Victoria & Albert Museum Boilerhouse
Extension, London | 158 Stephen Perrella with Rebecca Carpenter
The Möbius House Study |
| 26 Greg Lynn
Architectural Curvilinearity | 88 Foreign Office Architects
Yokohama International Port Terminal,
Yokohama, Japan | 160 Claude Parent
The Oblique Function Meets Electronic
Media |
| 34 John Rajchman
Out of the Fold | 94 Van Berkel & Bos
The Erasmus Bridge, Rotterdam | 164 Lars Spuybroek
Motor Geometry |
| 38 Gilles Deleuze
The Fold – Leibniz and the Baroque | 98 Kolatan/Macdonald Studio
Raybould House Addition, Sherman,
Connecticut | 172 Nox/Lars Spuybroek with
Joan Almekinders
Blow Out |
| 44 Reiser + Umemoto with David Ruy and
Jeffrey Kipnis
Water Garden | 100 David Gosling
Eisenman Architects. Aronoff Center for
Design and Art, University of Cincinnati | 174 V2 LAB (part of V2 Engine)
Renovation within the V2 Building,
Rotterdam |
| 46 Claire Robinson
The Material Fold | 110 Peter T Saunders
Nonlinearity | 178 Haresh Lalvani
Meta Architecture |
| 48 Frederik Stjernfelt
The Points of Space | 116 Mae-Wan Ho
The New Age of the Organism | 184 Michael Speaks
It's Out There . . . |
| 50 Peter Eisenman
Folding in Time | 124 Neil Spiller
Vacillating Objects | 190 Brian Massumi
Strange Horizon |
| 54 Peter Eisenman
Rebstock Park Masterplan, Frankfurt,
Germany | 128 Bernard Cache/Objectile
Topological Architecture and the
Ambiguous Sign | 198 Brian Massumi
Sensing the Virtual, Building the
Insensible |
| 56 Peter Eisenman
Alteka Office Building, Tokyo, Japan | 132 Stephen Perrella
Computer Imaging | 208 Giovanna Borradori
Against the Technological Interpretation of
Virtuality |
| 58 Bahram Shirdel
Nara Convention Hall | 133 Stephen Perrella
Interview with Mark Dippe, Terminator 2 | 214 Karen A Franck
It and I |
| 62 Carsten Juel-Christiansen
The Anhalter Folding | 136 Ammar Eloueini
The Roppongi, Tokyo | 218 Rebecca Carpenter
Force Affect |
| 64 Greg Lynn
Stranded Sears Tower | 138 Stephen Perrella
Hypersurface Theory: Architecture > Culture | |