ARCHITECTURAL DESIGN

ARCHITECTS IN CYBERSPACE

ARCHITECTURAL DESIGN

CONTENTS

ARCHITECTURAL DESIGN **MAGAZINE**

Battle McCarthy *Multi-Source Synthesis: Landscape Sustained by Nature* • ***Nina Pope*** *'Hybrid Housing'* • ***Neil Spiller*** *(AI)Con* • *Academy Highlights* • *News* • *Books*

ARCHITECTURAL DESIGN **PROFILE** No 118

ARCHITECTS IN CYBERSPACE

Martin ***Pearce*** *From Urb to Bit* • *William* ***Mitchell*** *Soft Cities* • *Philip* ***Tabor*** *I am a Videocam* • *Karen A* ***Franck*** • *Celia* ***Larner*** *&* *Ian* ***Hunter*** • *Sheep T* ***Iconoclast*** • *Sarah* ***Chaplin*** • *Sadie* ***Plant*** • *Roy* ***Ascott*** • *Marcos* ***Novak*** • *Mark* ***Titman*** • *Michael* ***McGuire*** • *Nick* ***Land*** • *Dunne + Raby* • *X^Kavya* • *Neil* ***Spiller*** • *John H* ***Frazer*** • *Bernard* ***Tschumi*** • ***Arakawa*** *+ Madeline* ***Gins*** • *Stelarc*

Nina Pope, View from Ivy Cottage, site-specific art for Ickworth House, 1995

Christopher Janney, Harmonic Runway, Miami International Airport, 1995

Marcos Novak, Partition Chamber, from 'Dancing With The Virtual Dervish'

EDITORIAL OFFICES:
42 LEINSTER GARDENS, LONDON W2 3AN
TEL: 0171-402 2141 FAX: 0171-723 9540

EDITOR: Maggie Toy
EDITORIAL TEAM: Iona Spens (Senior Editor), Iona Baird, Rachel Bean, Stephen Watt, Sara Parkin
ART EDITOR: Andrea Bettella
CHIEF DESIGNER: Mario Bettella
DESIGNERS: Toby Norman, Gregory Mills

CONSULTANTS: Catherine Cooke, Terry Farrell, Kenneth Frampton, Charles Jencks, Heinrich Klotz, Leon Krier, Robert Maxwell, Demetri Porphyrios, Kenneth Powell, Colin Rowe, Derek Walker

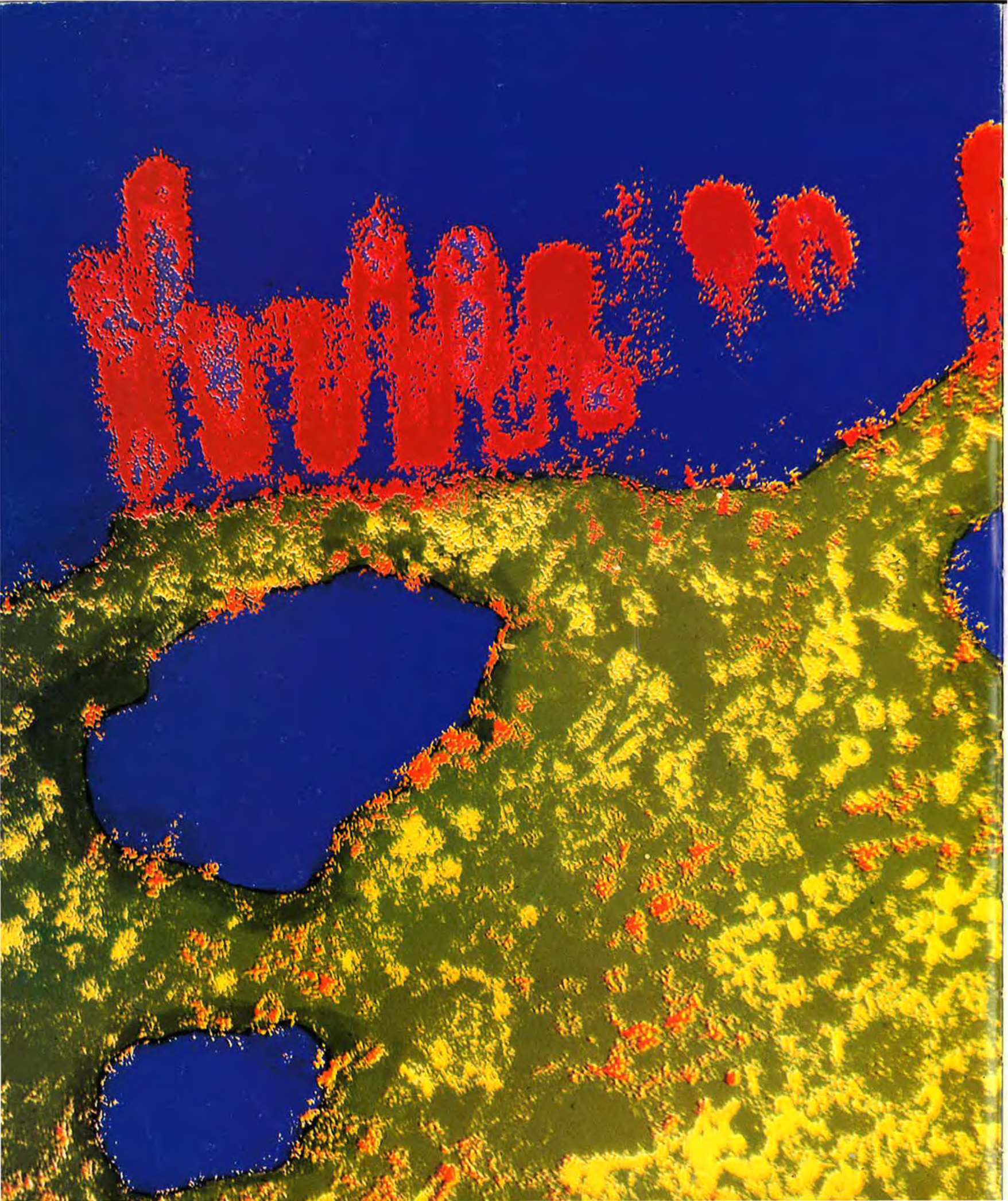
SUBSCRIPTION OFFICES:
UK: VCH PUBLISHERS (UK) LTD
8 WELLINGTON COURT, WELLINGTON STREET
CAMBRIDGE CB1 1HZ
TEL: (01223) 321111 FAX: (01223) 313321

USA AND CANADA: VCH PUBLISHERS INC
303 NW 12TH AVENUE DEERFIELD BEACH,
FLORIDA 33442-1788 USA
TEL: (305) 428-5566 / (800) 367-8249
FAX: (305) 428-8201

ALL OTHER COUNTRIES:
VCH VERLAGSGESELLSCHAFT MBH
BOSCHSTRASSE 12, POSTFACH 101161
69451 WEINHEIM
FEDERAL REPUBLIC OF GERMANY
TEL: 06201 606 148 FAX: 06201 606 184

Architectural Design is published six times per year (Jan/Feb; Mar/Apr; May/Jun; Jul/Aug; Sept/Oct; and Nov/Dec).Subscription rates for 1994 (incl p&p): *Annual subscription price:* UK only £65.00, World DM 195, USA $135.00 for regular subscribers. *Student rate:* UK only £50.00, World DM 156, USA $105.00 incl postage and handling charges. *Individual issues:* £14.95/DM 39.50 (plus £2.30/DM 5 for p&p, per issue ordered), US $24.95 (incl p&p).

For the USA and Canada, *Architectural Design* is distributed by VCH Publishers Inc, 303 NW 12th Avenue, Deerfield Beach, FL 33442-1788; Telefax (305) 428-8201, Telephone (305) 428-5566 or (800) 367-8249. Application to mail at second-class postage rates is pending at Deerfield Beach, FL. **POSTMASTER**. Send address changes to *Architectural Design*, 303 NW 12th Avenue, Deerfield Beach, FL 33442-1788. Printed in Italy.Origination by Print Tek London. All prices are subject to change without notice. [ISSN: 0003-8504]


dublin

BATTLE McCARTHY

MULTI-SOURCE SYNTHESIS
Landscape Sustained by Nature

He leapt the garden wall and saw that all nature was a garden.
Horace Walpole, writing about William Kent, the 18th-century landscape architect.

In the archetypal suburb, wide empty streets are lined by parked cars separated by barren and sterile strips of grass. It is a space largely untouched by human activity; except on Sunday mornings, the time for washing of cars and mowing of lawns. The weekly routine probably serves a social purpose – allowing residents to exhibit themselves and their cars briefly to each other – but is this enough to justify the ecological sterility of those ubiquitous lawns?

Last year the British public spent over £250 million on lawn mowers and other grass-related materials and machines to maintain their private gardens. Taking into account the additional cost of petrol and electricity to run the equipment, together with the considerable industrial, commercial and retail support required, it would appear that the UK is supporting a huge market based purely on keeping grass at an acceptable height and colour. If we also consider the 100,000 acres of local authority parkland and the thousands of miles of road verges throughout the country, we get a picture of a massive human folly. The fuel alone required for the various grass maintenance machines in the UK could probably power a third world city whilst the many hectares of neat and tidy grass represent ecological sterility, destabilising ecosystems and actively contributing to the destruction of biodiversity through the application of pesticides.

This is not a new story and neither is it the most extreme example of how we mismanage our landscape in environmental terms. However, it highlights one of the fundamental problems facing broad acceptance of an ecologically sustainable way of life for all, and that is public taste. In Britain especially we are weighed down by the culture of tidiness and by the negative associations of weeds and rampant nature. Is it conceivable that public taste will stifle sustainability in the same way that it has marginalised architecture?

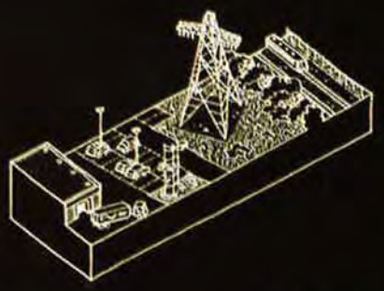
People have always been fascinated by the difference between wild landscapes and their man-made/constructed counterparts. Some of the most successful man-made landscapes, like those of Capability Brown, were designed as a human interpretation of a natural form whilst the landscapes of power (Versailles, the White House lawn) have consistently tried to subjugate and control nature. The ancient Persian view of nature was more sophisticated: it took in both views, celebrating both the preciousness of the cultivated garden, and the emotive beauty of wilderness.

Underlying this confusion over aesthetics is the lack of understanding of function in landscape. Brown's landscapes were functional in a simple way; employing sheep and cows to keep the grass short and keep tree branches above ground, creating a classic landscape characterised by rolling grass-covered hills dotted with broad-leaved trees of the familiar shape. But we have since forgotten the functional reason for the appearance of this and many other landscape types, and as we try and replicate them without their creating function we have to fall back on the powerful tools of chemicals , machines and energy.

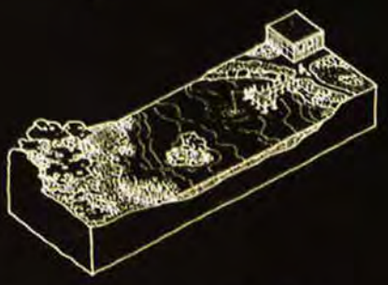
Until recently only the most obvious human-centred functions have been designed for: fields for production of grain, parks for walking the dog, lawns for playing croquet. Each of these landscapes performs its limited human function in the short term, although each is sterile and destructive in its own way. We know that if we continue to alter and simplify the natural order of the planet what's at risk is not the earth itself (which will simply evolve new forms of life and ecological processes), but our own social systems and ultimately our own species. To avoid this self-destruction we must adopt more sustainable systems and for this we need to understand and be able to mimic nature.

To create sustainable landscapes we need to develop a methodology for assessing, planning and designing landscapes that goes well beyond the counting of wildlife species or the judgement of scenic value. The critical currency of the future should be energy – rather than, for instance, monetary value – and environmental judgements should be based on

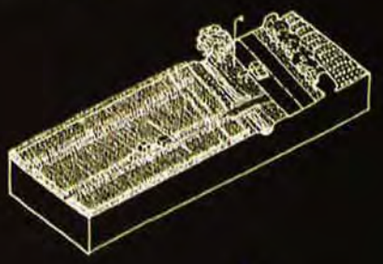
OPPOSITE: False-colour transmission electron micrograph of a cell infected by influenza virus; courtesy of Dr Gopal Murti/Science Photo Library; FROM ABOVE: One-dimensional human uses of landscape – flower clock being planted in a municipal park; industrial horticulture; landing strip; OVERLEAF: Assessment of landscape types for the Groningen Zuid-Oost site – existing types (left), proposed landscaped types (right). Each 'mark' has been calculated by an ecologist as an assessment of ecological value under each category. The assessment has helped guide decisions about the relative land area and placing of each type in the new framework structure.



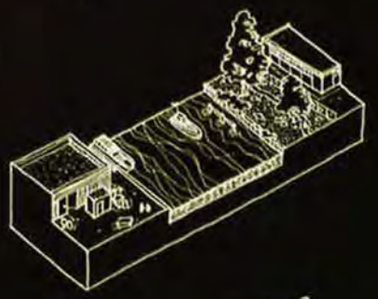
Industrial hinterland



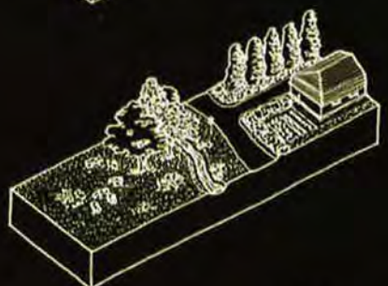
Wetland

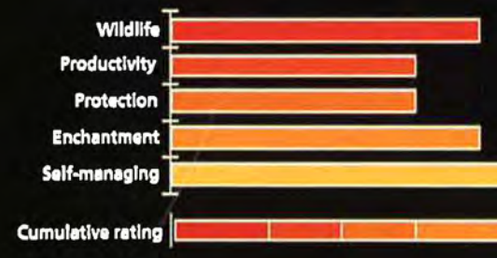


Arable Farmland

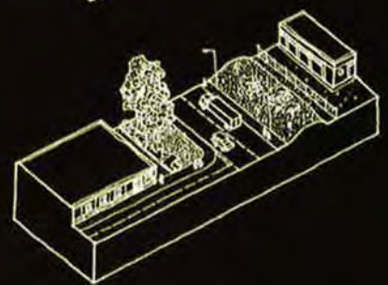


Canal Edge

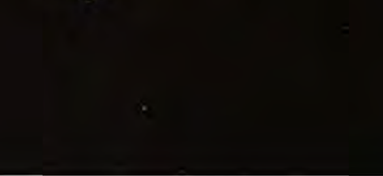


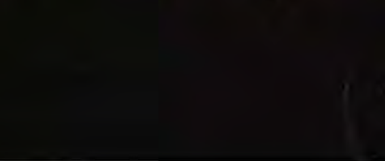


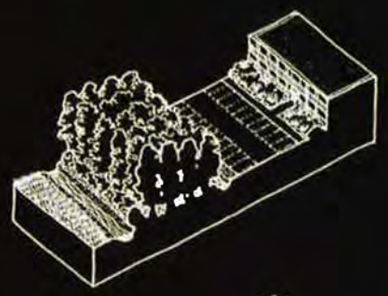
River corridor & pasture

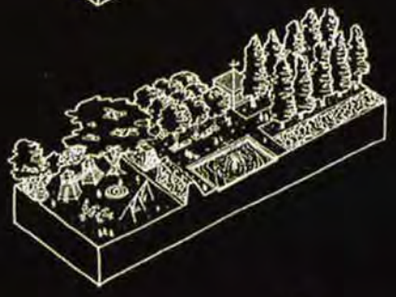


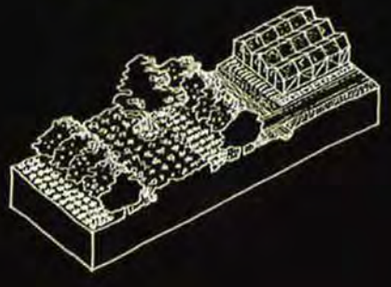
Road corridors









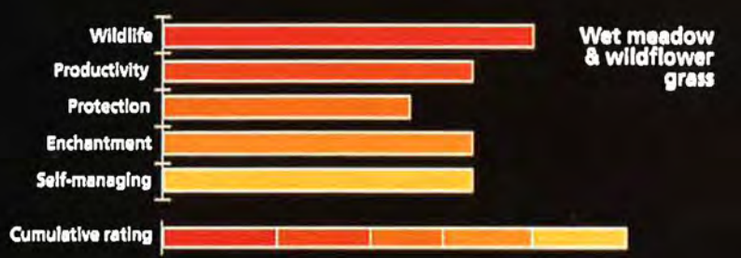


Shelterbelts & screenbelts

Woodland

Formal gardens & playing fields

Short rotation coppice



Wet meadow & wildflower grass

Agroforestry & horticulture

1

2

3

4

5

- Industrial hinterland
- Canal strip
- River strip
- Arable
- Woodland
- Short rotation coppice
- Agroforestry/Horticulture
- Wetlands
- Wet meadow & wildflower grass
- Formal gardens

1 Land use on site as existing. The run down industrial area serves the canals taking freight long-distance to Germany. Arable land to the east is designated for development.
2 Phase one of growth to the east of site; landscape structure developed from existing drainage pattern in arable land. Undeveloped sites used to grow short rotation coppice as an energy crop.
3, 4 Phases 2-3 of new growth. Coppice gives way to construction. New woodland connections are created from east to west.
5 East-west connections complete; new pockets of green in the existing industrial area

an assessment of energy balance and energy cycles within a given environment or ecosystem. The ecologist Eugene P Odum worked on this proposition as long ago as the 1960s, and it forms the basis of the landscape design principles now being developed.

Working with project architect Chris Moller and the urban design team of Groningen in the Netherlands, Battle McCarthy has been developing an analysis of this nature for a large industrial area on the south-east edge of the town, known as Zuid-Oost. Here, we have assessed a range of existing and proposed landscape types under three principal headings: production; protection; and enchantment.

Productive landscapes

We can measure the capacity of a landscape to do productive work and we can plan the landscape to maximise its efficient use and productivity. Landscape productivity could be considered under the following headings: Oxygen production; Carbon dioxide absorption; Waste treatment; Food production; Timber production; Wildlife diversity; Movement of resources; Energy potential; Recreational resource; Healthy environment; Added quality of life; Added commercial value; and Employment potential.

Productive landscape components can be considered as those that most closely represent forest edge habitat - a combination of open and enclosed spaces, a mixture of trees and ground cover. These areas are suggestive of a safe landscape, managed and used by people. They can be planned and designed to reinforce these qualities.

Protective landscape

Landscape components can also protect people and buildings. We can measure the protective value of landscape under the following headings: Shelter and climate moderation; Absorbtion of pollution; Prevention of flooding; Security; Conservation of natural and historic features; Screening of undesirable elements; Providing a framework for planning and economic initiatives.

Protective landscape components could reflect the wilder, more natural character of climax woodland or extensive wetlands and marshes. They are the buffers between the productive landscapes and they could suggest a natural dominance with a hint of danger.

Enchanting landscape

We normally associate landscapes with their scenic and visual qualities but rarely with other subjective associations that include: Mood and character; Sensory appeal; Cultural association; Intellectual stimulation; Gut responses.

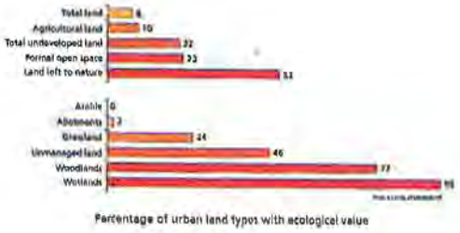
Enchanting landscape components could provide cultural landmarks within the new productive and protective landscapes. They could become the focus of communities within this ecological landscape matrix.

Landscapes sustained by nature

The work at Groningen is only the first step towards developing a vibrant ecological structure plan for the area, and it is only an early move in the analysis required to support the design of sustainable landscapes. Designers must search for the optimum 'ecological' equation that best suits each site, consult the genius of the place, and develop elegant solutions predicated on the uniqueness of place. In some instances the preference may be for considerable intervention and management, elsewhere there may be a shift towards a regulated nature and in other places we may remove our influence completely. Landscapes of the future will not be judged by their political, scenic or even monetary worth alone but on their inherent ecological potential and on the sustainability of the energy flows within each given site, district, ecosystem or biome.

Ultimately, the challenge is to find a balance between simplified human ecosystems and their more complex, natural neighbours, and to find ways of sustaining our environment and landscape using the ecological efficiency of nature. As our understanding of ecology increases, the constantly changing shape of our landscapes will provide a litmus test for our developing design skill.

The authors would like to thank Andrew Grant and Robert Webb for their assistance with the preparation of this article.



Percentage of urban land types with ecological value

OPPOSITE: The ecological and landscape strategy for the development of Groningen, phased drawings; ABOVE: The integration of nature and technology; graph showing the relative ecological value of different urban land types, from a study of Leicester.

NINA POPE 'HYBRID HOUSING'

SITE-SPECIFIC ART FOR ICKWORTH HOUSE

Pauline van Mourik Broekman

Viewing classical garden architecture – or perhaps even more so, books on the subject – the prevailing sensation is one of nostalgia. Nostalgia not for a more benign or perfect age, but nostalgia of a more primal kind, for some form of original paradise where a harmonious co-existence with nature finds itself embodied in aesthetic balance, well considered proportion and a rhythmic reconfiguration of the natural and the artificial.

Among the most confounding aspects of viewing these serene sites is the knowledge that, frequently, what we see today only marginally resembles their original state, and, more significantly, that the experience of nature found in the garden is, and was, always a wholly artificial and cultured one. Over time, gardens can come to harbour successive – and often conflicting – historical styles and owners' personalities, preserving them securely in the thickets, rose gardens and slowly maturing trees. They also catalogue the development of human views of nature and our relationship to the environment, from the ornate and rigidly structured gardens of the Italian Renaissance to the choreographed gardens of late nineteenth-century England with their deliberate inclusion of the 'natural' through 'wild' areas of abundant floral and arboreous beauty.

Nina Pope's site-specific contribution to 'Alchemy' (an exhibition of sculpture in the garden of Ickworth House in Suffolk) re-examines this element of choreography in the structuring of the experience of the garden. Ickworth's gardens contain numerous 'incidents'; the kind of guided pleasures that evoke a pastoral pleasure park of sorts, sparsely laid out to ensure the delivery of successive, measured instances of surprise, delight, awe and fear. Pope has also focused on the social metaphors which remain contained, discreetly and politely, within the schema of the grand garden.

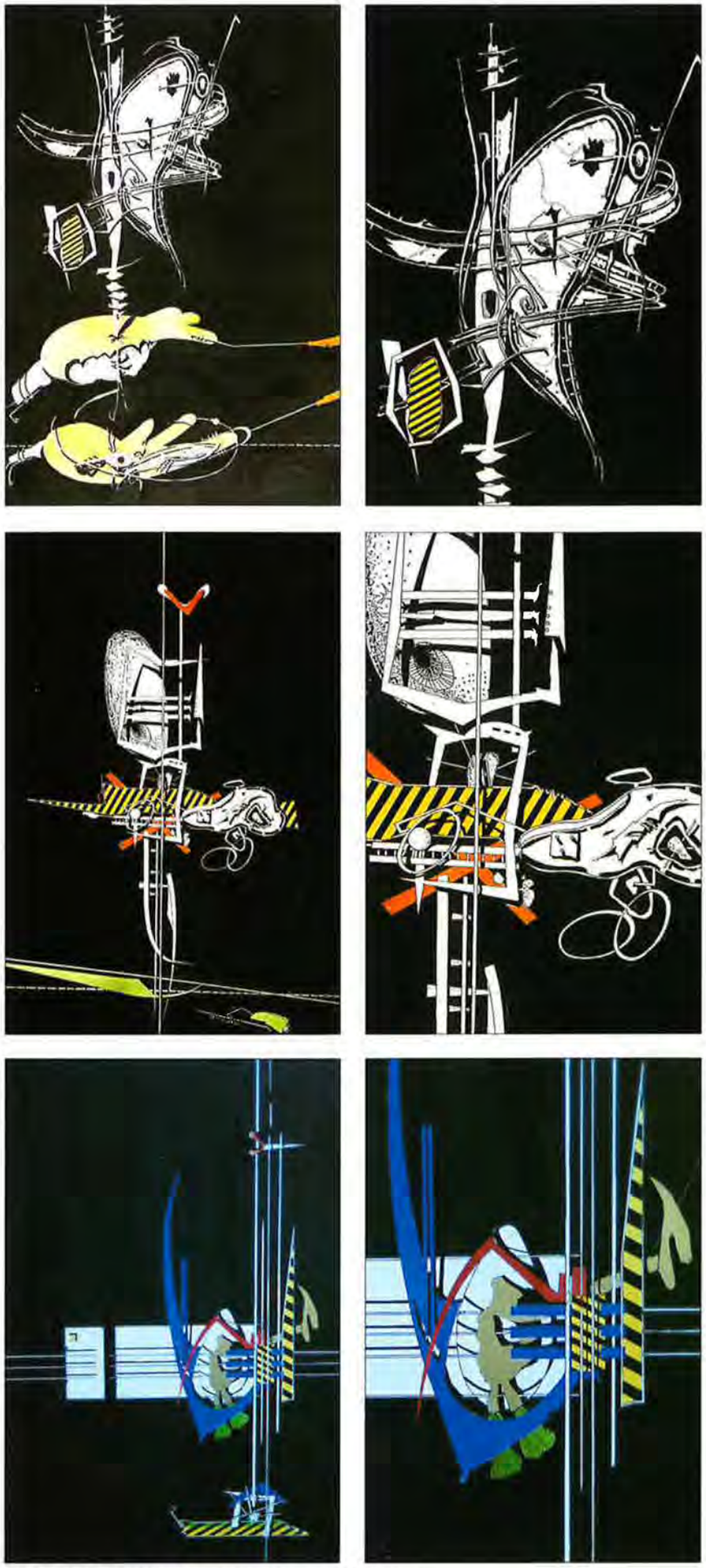
In the quasi-epic theatre that is viewed from Ickworth House there sits not only a majestic obelisk but a group of small tenants' houses. It is surprising to learn that these buildings had any function whatsoever bar an aesthetic one since they are so clearly intended to be viewed from afar, or whilst walking past, rather than from inside; they seem too tiny to live in. The sweet cottage style and adornments are unique to each, providing the necessary variation and character: Round House, Ivy Cottage, Gate House, Mordaboys.

Nina Pope has used these houses to overturn the organisational logic of the grounds, constructing views from the cottages back to the mansion rather than the other way around. Though mainly employing the Romantic style already historicised by its use in other gardens (Surrealistic, Gothic and Romantic), her computer-manipulated photographs of these views add a psychological dimension to the existing architectural relationship of the buildings. By placing these scenes (as naturally lit transparencies on stands) along the mansion pathway towards the view, she has inserted forget-me-not signs denoting the reciprocity of these sites, not only in terms of garden architecture, but in terms of social history and the relationships of power to which the buildings are a testament.

Again inside the garden, in the Victorian 'stumpery', she has prepared a similar insertion. The stumpery is perhaps the strongest and most telling example of garden choreography. In a secluded area, a dense sensory space was constructed to subtly trigger memories and fears through smell and the careful organisation of specific types of foliage; the stumpery as the garden's moment of melancholy, its *momento mori*. Here the broken stumps of dead trees lie scattered about the garden floor, poison ivy strangles those that remain and the plants conspire to generate a feeling of unease through smell, colour and sheer volume. It has that feeling of excess for which both beauty and horror can be the catalyst, provoking slight nausea in utter silence. Here the insertion of computer-generated

models of the cottages seems most apt, the 'hybrid houses', as she has named them, crawling like miniature snails over the grass, small but insistent. In fact, snails or slugs might be the best metaphor to describe Pope's installation: like moles they induce a near hysteric response in any committed gardener; a minute but efficient system of entropy doggedly irreverent to the sacred boundaries set up by the garden's creator. It is their approach and crossing of the spatial boundaries that seems of interest; Ickworth House as any other well guarded, but popular tourist destination may need more than a moat or ha-ha to keep the visitors at bay.

Pauline van Mourik Broekman is one of the editors of mute – digitalartcritique.



FROM ABOVE: (A I)Con I; (A I)Con II; (A I)Con III

NEIL SPILLER

(A I)CON

(A I)Con I

Alan Turing, visionary genius and founding father of artificial intelligence, saw no reason why an artificially intelligent machine could not be created by the year 2000. Now, with the benefit of being further along the trajectory of Time's Arrow, it is unlikely that this critical evolutionary step will be taken during the remnants of this century; but surely it must happen in the next Millennium. Bearing in mind that the computing power of the little plastic box in your briefcase doubles every 14 months or so, it seems likely that this aspiration, if at all possible, will occur in the next 1,000 years and the flesh luddites will be consigned to the same fate as their early industrial namesakes.

Turing developed a simple test to prove whether a machine possessed AI: if a human communicated with an unseen entity enclosed in another room, and it in return gave convincing human replies to any question that the human decided to ask, then it passed the Turing Test if the entity was not human but a machine. Logically, it would seem that Turing valued the ability of such a machine to lie (but that is by the by). When the Turing Test is passed and artificial intelligence has been born, the world will surely stop and ponder for a minute or so, as Genesis is rewound and starts again. Cyborg Man will have created the Electric Ape not in his own image. The second coming will not be able to spill its blood for us but will only be able to sacrifice bits and pieces for us.

(A I)Con 1 is intended to be an instantly recognisable icon. (It will be!) Once the prophets of Doom and cybersoothsayers adopt it for future postulates on AI, this icon will manifest, by a simple algorithm in or on any known information media, the moment the Turing Test is passed. It will be thrust on to television programmes, appear miraculously as obstacles in virtual reality terrains, be thrown on to the front pages of newspapers, infest home pages on the Internet,

be the postmark of the day on snail mail as well as many other applications. Like any multimedia experience of the future? Icons can be moulded to individual preoccupations and concerns, below are two examples of sound bites that could be programmed to accompany the Icon's revelatory manifestation. The first one for cyber-cardinals, reverend geeks and skull spark jokers and the second one for the paranoid Bay Area thrash punk.

THE INTELLIGENT PRAYER
Our machines who art in Cyberspace,
Hallowed be thy intelligences,
Thy domain has come,
Thy will be done on Earth as it is in Cyberspace,
Forgive us this day our daily wetness,
Lead us not into temptation,
As those who encrypt against us,
Deliver us from reality,
For thine is the spatial Heaven,
The Emergence and the Resurrection.
For immortality eternal.

Our Mens

METAL GODS
Judas Priest.

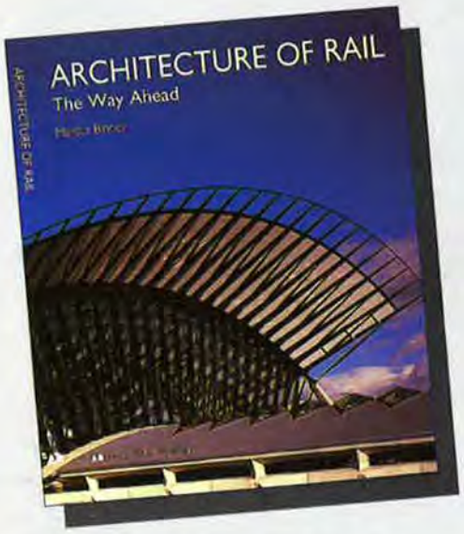
We've taken too much for granted,
And all the time it has grown,
From techno-seeds we first planted,
Evolved a mind of its own.

Marching in the streets,
Dragging iron feet,
Laser beam hearts,
Ripping men apart . . .

(A I)Con II
As areas of cyberspatial terrain are inhabited by AIs, fleetingly or for longer, perhaps these areas will be akin to roadworks on the superhighway. A warning icon will be required; it again must be equally recognisable to deter the casual cyber-jock from entering areas of unlimited headroom. Why headroom? AIs will occupy higher order multi-dimensional space that the human, wet mind could not comprehend or indeed maintain sanity within. Such spaces would decompose and reconfigure millions, maybe billions, of times a second. Even augmented human intelligences will have little chance in such cyber black holes. This icon will indeed be the sign of the 'other'. AI is the final gift we have to share; this gift will have a high price, but we have no choice but to pay. We shall never be alone in the universe again, if indeed we are.

(A I)Con III
The notion of programmed atoms and molecules out of control, at first seems akin to a laughable 1950s science fiction film plot. This plot would centre on southern Texas as its architectonic structure and inhabitants slowly but surely decompose, as they are morphed atom by atom, into malevolent sludge. This would seem a witty and entertaining scenario if it were not for the disconcerting possibility that science has now made such a series of eventualities theoretically believable. This is the nanotechnological 'grey goo' problem. If atoms can be manipulated singularly, then the integrity of their software becomes a crucial component of their design. If such software becomes virally infected or bug-ridden, then there is the potential for this most potent of technologies to run riot. The result could be the decomposition of our material world including the flesh-and-bone sacks we call our bodies, thus creating a world of 'grey goo'. Drexler, the father of nanotechnology, has posited a type of nanotechnological police force that could be used to enforce the gooey status quo. This is called 'blue goo', an active shield that would isolate and destroy maverick self-replicating molecules. This technology has a reproduction rate similar to bacteria, one generation every 20 minutes. This icon would be projected on and within areas of 'grey goo' infestation. The 'blue goo' would then force 'nature' back into its previous form, or indeed, be programmed to turn such crises into constructive opportunities reconfiguring 'nature' and 'construction' into new biomechanical hybrids: the distinction between nature and construction becomes erroneous with such a technology. Furthermore, it may be possible that a fail-safe programming function in all nanotechnological processes might cause this icon to be the by-product of nano program failures, so that the mutant atomic configuration becomes instantly recognisable as the icon itself. This seems to have the advantage of bringing such problems into the scale of anthropocentric perception. The nightmare of a world 'full of horney can openers' as Rudy Rucker has called the 'grey goo' problem becomes a vision of iconic outbursts quickly and effectively policed.

Neil Spiller is a partner in Spiller Farmer Architects, Diploma Course Tutor at the Bartlett and author of the forthcoming book Digital Dreams: The Architecture of Cyberspace, *Ellipsis (London).*

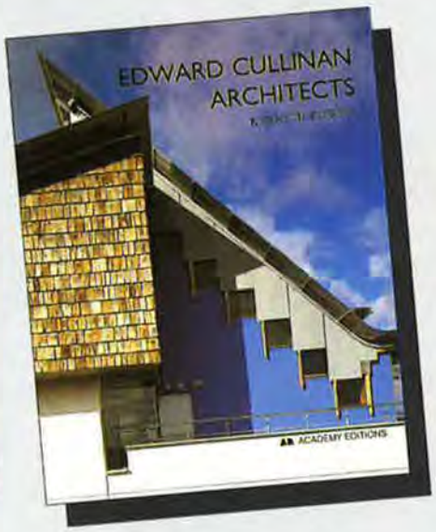


Architecture of Rail
The Way Ahead

Marcus Binney

Prompted by a growing revival in railway architecture, this unique appraisal of contemporary railway stations and termini looks at over 15 new railway stations from Europe and Hong Kong, including Waterloo International, UK; Lyon Satolas, France; and Kowloon Station, Hong Kong. Using the latest techniques and materials, a new generation of architects and engineers is creating some of the most dramatic spaces in Western architecture. Marcus Binney highlights a variety of stations; some recently completed and others in the process of completion, examining rojects by leading architects such as Nicholas Grimshaw and Partners, Santiago Calatrava, Paul Andreu and Peter Rice, Ove Arup, Terry Farrell, Rafael Moneo, and Michael Wilford & Partners. The material is set within the great historic context of 19th-century and early 20th-century stations.

Hardback 1 85490 396 9
305 x 252 mm, 128 pages
160 illustrations, 40 colour
September 1995



Edward Cullinan Architects

Edited by Kenneth Powell

This detailed study looks at the architectural practice of Edward Cullinan Architects, characterised as socially-minded, responsive to place, landscape and history, and rooted in a respect for materials and a fascination with the mechanics of construction. Since 1974, ECA has also completed a significant number of well proven buildings for selective clients, such as Olivetti and The National Trust, and has been invited in the past five years to carry out major projects throughout Europe, Japan and the USA. The new ecologically-based approach and the co-operative nature of the firm's structure have aroused much interest and discussion in the architecture world. Kenneth Powell presents a critical analysis of over 30 schemes covering domestic, commercial and academic buildings; in addition to informative texts by ECA. This in-depth study will be of great interest to all new firms seeking a working model of a modern design team.

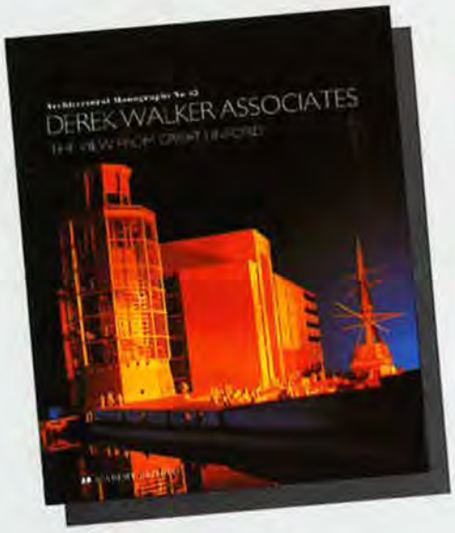
Paperback 1 85490 411 6
229 x 217 mm, 208 pages
180 illustrations, 60 colour
October 1995

Minoru Takeyama
ARCHITECTURAL MONOGRAPH NO 42

Edited by Botond Bognar

Since the late 1960's Minoru Takeyama's work has contributed to, and continues to shape the course of Japanese architecture with numerous award-winning projects and outstanding achievements. He is recognised as one of Japan's leading architects both at home and abroad. This, the first comprehensive book on the architecture of Minoru Takeyama, examines the development and significance of his work in the context of both contemporary Japanese and international architecture. The volume contains an introduction and critical analysis of Takeyama's architecture by Professor Botond Bognar, and essays by Takeyama and Charles Jencks. In addition, it features 20 of the architect's most important buildings and projects, including Tokyo Port Terminal, the Egyptian Embassy in Tokyo, and the Pepsi-Cola Bottling Plant, Hokkaido.

Paperback 1 85490 281 4
305 x 252 mm, 128 pages
250 illustrations, 150 in colour
October 1995

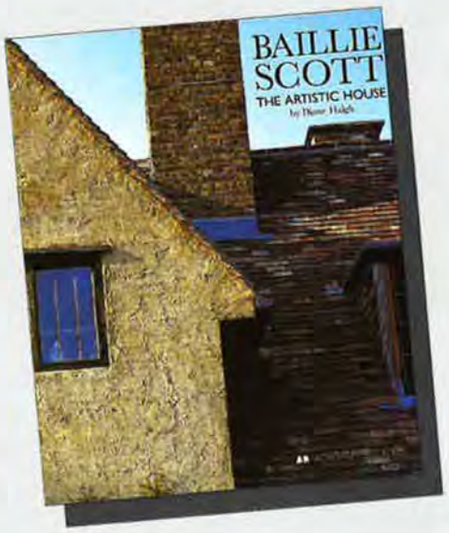


Derek Walker Associates

ARCHITECTURAL MONOGRAPH NO 43

Formed in 1960, Derek Walker Associates has been involved with a wide range of projects establishing an international reputation for high standard of design. Based in London, with an office in Italy, the practice is linked closely with education in planning and architecture – carrying out a seminars and lectures throughout the United States, Italy, Germany and the UK. Derek Walker is chiefly known for his work as Chief Architect and Planner of Milton Keynes, UK, a comprehensive development for 250,000 people. Analysing the work over the last 30 years, this monograph covers a range of design activity: architecture, animation, furniture and interiors, landscape and urban planning. The book is introduced by the architect and critic Stephen Gardiner and by two recent clients, Iain Quicke and Guy Wilson. As essay by Derek Walker charts the preoccupations of the practice from inception to the present day.

Paperback 1 85490 2822
305 x 252 mm, 120 pages
150 colour illustrations
October 1995

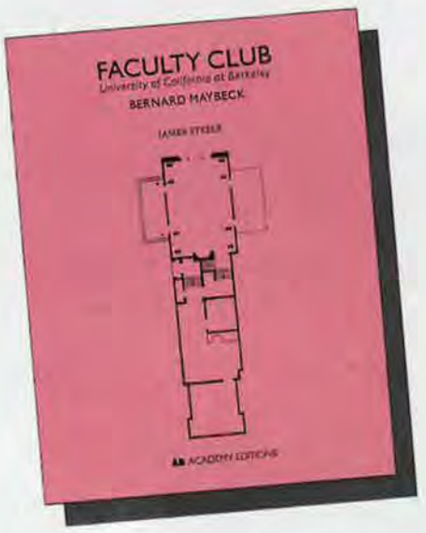


Baillie Scott
The Artistic House

Diane Haigh

M H Baillie Scott was one of the most influential architects of the Arts and Crafts Movement in Europe. Although he practised mainly within the UK he was well known throughout Austria, Germany and Scandinavia as a pioneer of open-plan design. In the United States his work was acknowledged by Frank Lloyd Wright. His innovative style was instantly recognisable from his first house, built in 1892, through to the well-developed and ingenious houses which he developed for Letchworth in England around 1914. This detailed study re-assesses his designs for buildings, furniture, and stained glass-windows and his contribution to the development of architectural thought. Exploring Baillie Scott's ideas and their realisation, it reveals a remarkable and hitherto under-represented talent.

Paperback 1 85490 432 9
305 x 252 mm, 128 pages
150 illustrations, 50 in colour
September 1995



The Faculty Club University of California

BERNARD MAYBECK

James Steele

Continuing our series of Historical Buildings Monographs, this study features the Faculty Club at Berkeley, designed by Bernard Maybeck in 1900. This masterpiece of asymmetrical design created a unique harmony within the Great Hall with the interaction of truss, arch, window, projecting cornice, trellis and gable. In the woodland setting the great hearth conveyed a mediaeval quality, holding an important symbolic value as a centre for university staff in this rapidly expanding institution. Drawing comparisons with Frank Lloyd Wright and the San Francisco Bay Area architecture, this instructive monographs reveals the significance of Bernard Maybeck to Charles Moore and his Faculty Club for Santa Barbara.

Paperback 1 85490 433 7
252 x 190 mm, 80 pages
100 illustrations, 20 colour
September 1995

Further information can be obtained from Academy Group Ltd, Tel: 0171 402 2141 Fax: 0171 723 9540, or from your local sales office:
VCH Publishers, 303 NW 12th Avenue, Deerfield Beach, Florida, Tel: (305) 428 5566 / (800) 367 8249 Fax: (305) 428 8201;
VCH, Boschstrasse 12, Postfach 101161, 69451 Weinheim, Federal Republic of Germany, Tel: 06201 606 144 Fax: 06201 606 184;
VCH, 8 Wellington Court, Wellington Street, Cambridge, CR1 1H2, Tel: 01223 321111 Fax: 01223 313321

'INTERACTIVE ARCHITECTURE'

Harmonic Runway, Miami International Airport

This environmental installation for the new International Arrivals Building at the Miami International Airport opened in the summer. The work was commissioned by the Metro-Dade County Art in Public Places programme and was created by artist/composer Christopher Janney with consulting designer Geoffrey Pingree. Making use of 132 sheets of coloured glass, this 180-foot artwork mixes the bright natural light of Miami with a sound-score based on the natural environments of South Florida.

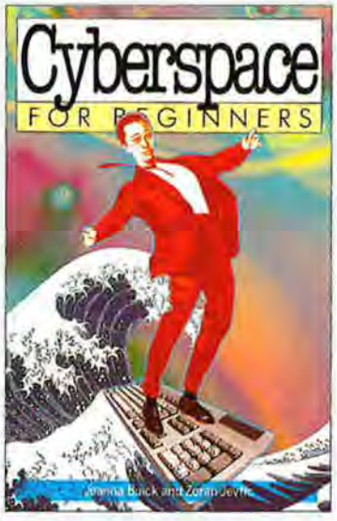
As travellers enter the area they are bathed in a zone of transparent blue light. They hear distant crickets and frogs from the Everglades and see through the windows a pattern of blue-green, violet and magenta. Between the zones of colour are curtains of white light. As they penetrate these curtains, the thin sliver of light bends and moves over their forms, triggering the sound of a bamboo flute overhead. They 'hear the light' as well as feel it gently over their body. Passing through a new zone of colour, the sound of a flock of loons passing by may be heard, flying on to the now distant Everglades. Penetrating the next curtain of white light, the traveller again hears the bamboo flute, but it is an harmonic tone above the first. Sounds and lights change continuously in response to both the time of day and activity in the space, unfolding an essence, an abstraction of ocean, sky, and tropical environments.

Initially studying architecture, Janney went on to study environmental art at Massachusetts Institute of Technology. His interactive work, involving sound, light and computers, has also appeared on the Spanish Steps in Rome, at the Metropolitan Museum of Art, and is part of the permanent collection of the Smithsonian. He is currently a Visiting Professor at Cooper Union in New York and the Rhode Island School of Design, where he teaches 'Sound as a Visual Medium'. The idea of being able to walk into a painting has always appealed to him and is the inspiration for the sound environments. The Harmonic Runway offers a momentary respite between city and sky; or as Janney refers to the project, 'a walk through a rainbow'.

Cyberspace for Beginners

Joanna Buick and Zoran Jevtic

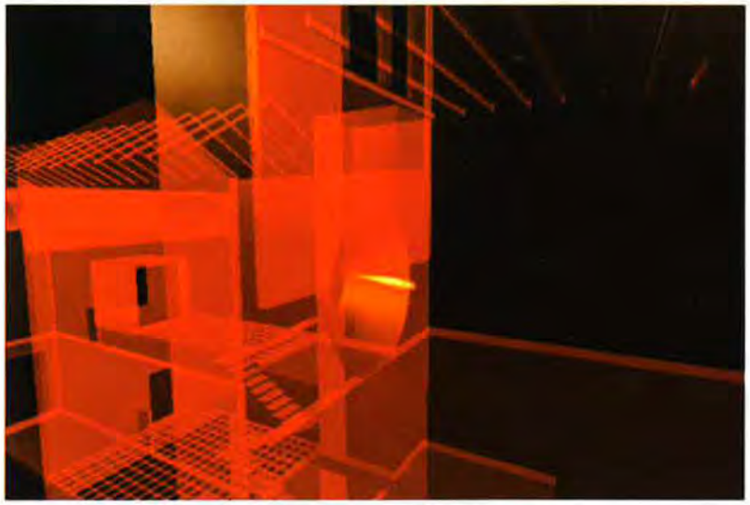
Icon Books Ltd, 176pp, b/w ills, PB £7.99



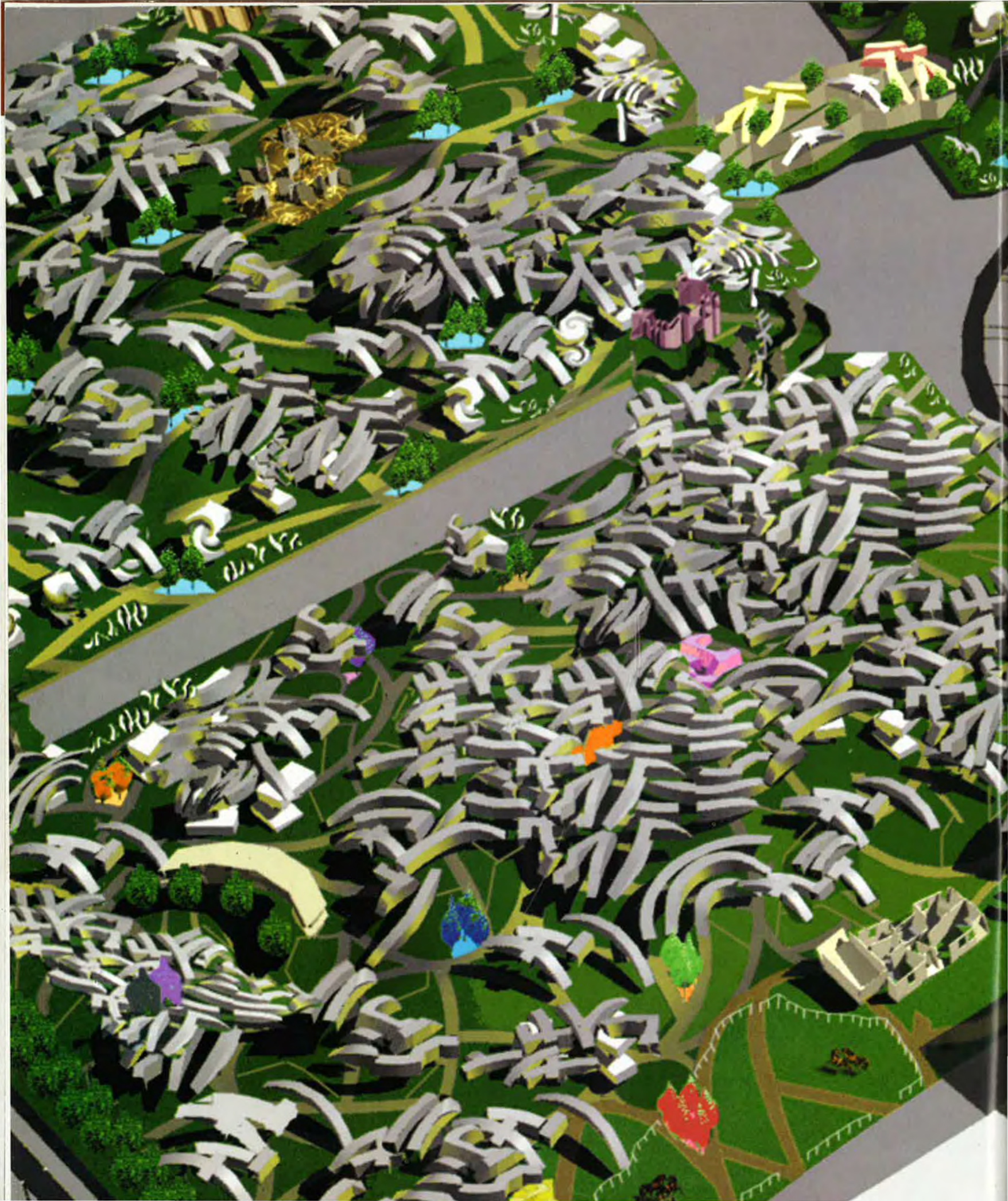
Cyberspace for Beginners, another of the highly attractive beginner's guides published by Icon, uses a mixture of text and illustration in an attempt to explain cyberspace. This is certainly an area which needs clarifying, for everyone has heard of it but no one seems to be able to define it accurately and succinctly, falling back on stock phrases like the 'information superhighway'. This may be due to its abstract nature, described as everything you want it to be and more, the sum of all knowledge stored in the world's computers, or the fact that it is a contemporary phenomenon, still rapidly evolving. However, inevitably, like many before it, this book fails to provide an adequate definition of what cyberspace is. Instead, the reader is treated to directionless, unresolved and sometimes flippant narratives on communication, world-wide technological development and computers – including a particularly pointless buyer's guide – which vary in tone from the complex to the banal, and seem completely irrelevant to the relatively few pages that deal with the subject of the book.

Cyberspace does not actually exist in any real sense and is thus not particularly susceptible to traditional definition, lending itself particularly well to speculative, ill informed and ethereal discussions; as Timothy Leary, LSD guru and network advocate, states: '(Cyberspace is) the only unconquered real estate of the 21st century, a virtual world at the electronic frontier inhabited by telematic nomads'. The crux of the problem, is that cyberspace can actually be explained quickly and easily; as an electronic framework for international communication which offers numerous possibilities for its users. Yet, this is not the cyberspace that people wish to read about; inclined to become excited about its possible applications, using dramatic soundbites like 'surfing the net', which blur the boundary between science-fiction and fact, rather than assessing the actuality of the situation. They are more interested in the potential as they perceive it than the reality. Whilst this format works when providing a brief introduction to a certain deceased individual's work, which has been assessed and defined with clarity by acknowledged scholars, it seems rather directionless and vapid when applied to something like cyberspace. Although titles of this nature may attract more readers, these developments can only adequately be defined when they are no longer evolving.

ARCHITECTS IN CYBERSPACE

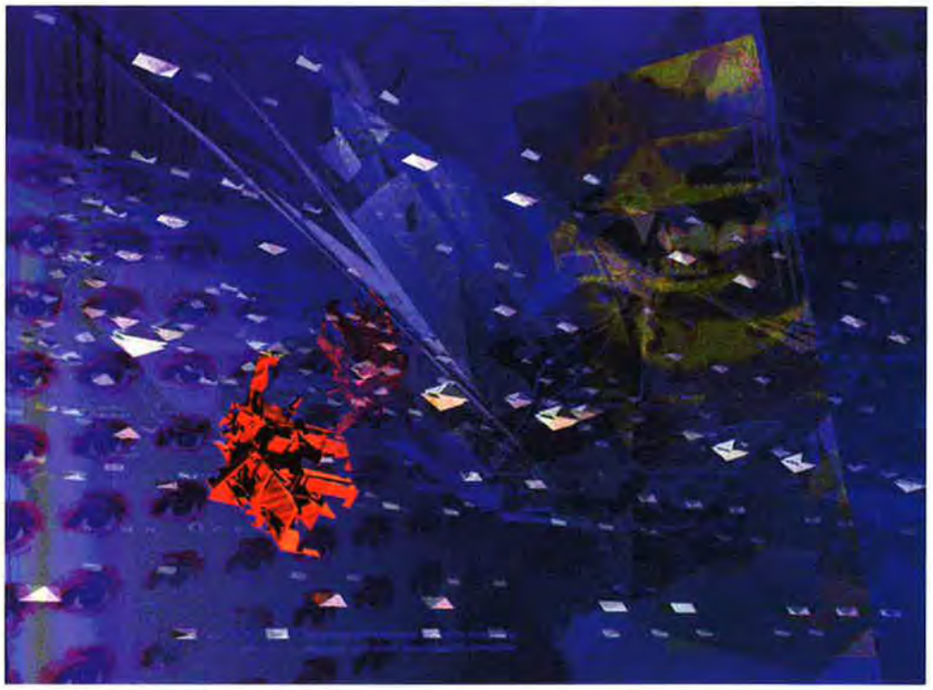


DUNNE + RABY, FROM 'FIELDS AND THRESHOLDS'



Architectural Design

ARCHITECTS IN CYBERSPACE



MARCOS NOVAK, ALGORITHMICALLY COMPOSED CYBERSPACE CHAMBER FROM 'WORLDS IN PROGRESS';
OPPOSITE: ARAKAWA AND MADELINE GINS, REVERSIBLE DESTINY CITY, TOKYO BAY

ACADEMY EDITIONS • LONDON

Acknowledgements

We would like to thank guest-editors Neil Spiller and Martin Pearce for their enthusiasm in putting together this issue and all the contributors involved.
All material is courtesy of the authors and architects unless otherwise stated. 'Soft Cities' is extracted from William Mitchell, *City of Bits*, reproduced with permission from MIT Press, Cambridge, Massachusetts. We are grateful to Colin Burns for his assistance with 'Fields and Thresholds' by Dunne + Raby; John H Frazer, author of *An Evolutionary Architecture*, AA Publications, London, 1995 for allowing us to reproduce 'The Architectural Relevance of Cyberspace', 'Architectural Experiments' and 'The Interactivator'.
X^{kavya} is the Los Angeles studio name and logo of Karl S Chu.

Front Cover: X^{kavya}, Ad9GrBel5^{7}.0Sa314
Inside Covers: Marcos Novak, from 'Dancing with the Virtual Dervish: Worlds In Progress'

Photographic Credits
All material is courtesy of the authors and architects unless otherwise stated.
Nick Dalton *pp29, 31*; Dunne + Raby *pp1, 33, 34, 35, 60, 62, 63*; Rory Hamilton *p14*; Tony Figallo *p92 centre left*; John H Frazer, Manit Rastogi, Peter Graham *p80*; M Kitagawa *p92 centre right;* Marcos Novak *inside covers pp3, 6, 24, 42, 46, 47*; K Oki *p92 below left*; O(rphan) d(rift>) *pp58-59*; Manit Rastogi *p78*; Michelle Saloman *pp52, 55*; Bob Sheil & Nick Calicott, Sixteen (Makers) *pp70, 72, 74 above*; T Shinoda *p92 above left*; Spiller Farmer *pp5, 74 below;* Stelarc *p92 above right, below right*; Mark Titman *pp49, 51;* X^{kavya} *front cover, p66*

First published in Great Britain in 1995 by *Architectural Design* an imprint of
ACADEMY GROUP LTD, 42 LEINSTER GARDENS, LONDON W2 3AN
Member of the VCH Publishing Group
ISBN: 1 85490 252 0 (UK)

Architectural Design Profile 118 is published as part of *Architectural Design* Vol 65 11-12/1995
Architectural Design Magazine is published six times a year and is available by subscription

Distributed to the trade in the United States of America by
NATIONAL BOOK NETWORK INC, 4720 BOSTON WAY, LANHAM, MARYLAND, 20706

Printed and bound in Italy

Contents

SPILLER FARMER ARCHITECTS, HOT DESK TURBULENCE DRAWINGS

ARCHITECTURAL DESIGN PROFILE No 118

ARCHITECTS IN CYBERSPACE

GUEST-EDITED BY
MARTIN PEARCE AND NEIL SPILLER

Martin Pearce From Urb to Bit *6*

William Mitchell Soft Cities *8*

Philip Tabor I am a Videocam *14*

Karen A Franck When I Enter Virtual Reality, What Body Will I Leave Behind? *20*

Celia Larner & Ian Hunter Hyper-aesthetics: The Audience is the Work *24*

Sheep T Iconoclast Architecture: The Virtual Imperative *28*

Sarah Chaplin Cyberspace: Lingering on the Threshold *32*

Sadie Plant No Plans *36*

Roy Ascott The Architecture of Cyberception *38*

Marcos Novak Transmitting Architecture *42*

Mark Titman Zip, Zap, Zoom *48*

Michael McGuire A-Symmetry City *52*

Nick Land Cyberspace Anarchitechture as Jungle-War *58*

Dunne + Raby Fields and Thresholds *60*

X^{Kavya} Modal Space *66*

Neil Spiller Hot Desking in Nanotopia *70*

John H Frazer The Architectural Relevance of Cyberspace *76*

Architectural Experiments *78*

John H Frazer, Manit Rastogi, Peter Graham The Interactivator *80*

Bernard Tschumi Cité de l'Architecture *82*

Arakawa + Madeline Gins Reversible Destiny City *86*

Stelarc Towards the Post-Human *90*

MARTIN PEARCE
FROM URB TO BIT

Cyberspace is only a recent concept, yet as our lust for the new accelerates, today it seems almost commonplace. Although first coined in William Gibson's science fiction work, *Neuromancer*, over ten years ago, the architectural possibilities of cyberspace had been recognised years before then. Now, with the mass availability of the appropriate technology, further architectural exploration is needed.

A residual term from early systems analysis, cyber is appropriated by almost any condition that enlists a microprocessor at the service of some otherwise articulated human activity, from cyber shopping to cyber sex. Simple activities adopt a mystical and cybernetic quality once the means of their operation are conducted via a silicon chip. Embedded in such apparently basic operational changes exists an essential paradigm shift, one that forces us to question our relationship with others, the structures that constitute our community and indeed the nature of our existence in the world.

Beyond the surface application of taxonomy, the contributors to this publication move the dialogue to a plane where speculation is more than science fiction whimsy and requires us to consider how to engage the creative consciousness in forming these potential future conditions. Fundamental to this is a diverse range of issues which address future technology, in a way that will both enable and require us to conceive our world in profoundly different terms. We may paraphrase our current activities in cyber terms, but as the contributors suggest, questioning the actuality of the cyber condition is increasingly important as technology becomes universally accessible.

Central to this debate is our interaction with technology. The conventional boundary, that of manually inputting data while watching it appear on the screen, is already becoming blurred. In particular, machines are adopting an increasingly biological means of operation, as John Frazer examines with the morphing genetic models of his Interactivator project. Mechanical prosthetics and nanotechnology threaten the reliability of the body and the self as a distinct being or a complex yet mechanistic entity: profound questions which are raised by the work of both Stelarc and Neil Spiller.

This ontological discourse may seem better placed in the philosophical forum of debate, but the resulting matters relate to the implications of the technology changing the nature of society; an idea firmly embedded in our notion of community and this, clearly, is an architectural matter. The structures which have stood from ancient time at the heart of social interaction, the physical 'urbs', the blocks of stone from which the city was constructed, are being replaced by the 'bits' of digital data which are the building blocks of the virtual community. As Dean William Mitchell observes, the next time you dial for a pizza delivery consider the effect the seemingly innocuous telephone call may be having on your local shopping street and hence, the urban typology.

In common with the adage of the man who sees his glass as half empty and another who sees the glass as half full, we may perceive the future of cyberspace as a kind of digital roller-coaster hurtling into a pessimistic future based on a technology which few of its passengers comprehend. As the rate of change accelerates to a point where we singularly lose our orientation, we enter a desperately unpredictable world out of our control, in which our wills are subsumed by the system.

Alternatively, we may view the future to hold incredible potential to free us from hierarchical structures, allow for individual expression and enable the ultimate definition of our individual and collective humanity.

Dystopian pessimism or utopian optimism are, of course, conditions with which history is well familiar. Western culture faced a similar dilemma 200 years ago with the advent of the industrial revolution. The Luddites could not halt technological change by smashing the machines, and equally our current condition seems to have an irrepressible momentum. The available opportunities need to serve our collective whole; a prophetic challenge in a time of technological revolution. While the contributors raise both the potentials and the pitfalls that we may encounter, we need to ask if we will be able to find the tools, not least ethical and moral, that will navigate us into the uncertain future and shape it in the way we desire.

Marcos Novak, Kikwit + Centrifuge + (. . . this body . . .), from the 'transTerraFirma/TidsvagNollv2.0' world series

WILLIAM MITCHELL
SOFT CITIES

Each window on my computer screen is an electronic forest *avantureuse*, a digital Broceliande. When I choose to enter this microworld, I have to play strictly by its rules.

Any piece of software creates a space in which certain rules rigorously apply, but with video games, the rules are the whole point. Without them there would be no game, and hence no fun. *Vide*!

Lemmings! Minimunchkin-mannikins tramp across the pixel patterns, timed to the tinny beat of the endless electromuzak; cast as an old softy of a God, I must intervene to save these tiny numskulls from otherwise-certain self-destruction.

'Eat fire, bug-eyed scum!' Suddenly I'm lost in the testosterone-fuelled fascist funhouse of Strike Squad; I must blow away successively more fearsome insectoid gladiators or face gory extinction myself. Kill or be killed.

SimCity! I get to play earnest urban policy wonk, but don't have to face an angry community when (as wonks are apt to do) I screw up. Its creator wrote, 'Access to a "toy" city gave me a guinea pig on which I could try out my city planning experiments'.[1] Good, clean fun until you notice the implicit political agenda. Its underlying structure is that of Jay Forester's mechanistic, conservative planning models from the 1950s and 60s. It presents you with a microworld magically free from racial divisions, labour unions, developers, or preservationists – one in which planners always win by building infrastructure (even when it carves up communities), lowering taxes, attracting industry, and creating jobs.

Realms of Arkania! 'Game features: more than 70 towns, villages, dungeons and ruins; twelve character archetypes; seven positive and seven negative character attributes; over 50 skills; twelve magic realms with over 80 spells; auto-combat option; and parties of up to six characters may be split and regrouped'.

F-15 Strike Eagle III! 'Surround yourself in a revolutionary new three-dimensional graphics system that provides you with a digitised map of downtown Baghdad complete with every bridge, the TV famous Air Ministry building and the "Baby Milk" factory! Cheat death in three explosive scenarios including Desert Storm, Korea and Central America!'

Metal & Lace: The Battle of the Robo Babes! 'Give your joystick a thrill . . . With the intense heat and action, you'll both end up with less than full body dress'.

Doom! The geography of this hack-and-slash masterpiece – the shareware sensation of 1994's gloomy winter – is three-dimensional, realistic, and extensive; you have a whole virtual city to get to know. The architecture is complex, the surfaces are textured, and the lighting and sound effects are eerily convincing. But the really big hook is that it's a fast-paced, cooperative, network game; physically separated game freaks can get 'together' in virtual spaces to explore them 'side-by-side'. You can see the computer-animated 'bodies' of your companions and they can see yours. You can communicate with each other as you blast thorny brown hominids with plasma rifles, or chainsaw flaming skulls that come flying at you out of nowhere. You get to gloat guiltily as your comrades-in-arms are mugged by the monsters that they meet and come to grisly, twitching ends. And in the 'deathmatch scenario', the instructions are to 'Kill everything that moves, including your buddies'.

Read the ads (bizarre as Borges, quirkier than Calvino) in *Computer Gaming World* or *Electronic Gaming Monthly*. Imagine yourself a mips-driven Marco Polo, a cybersurfing Gulliver; visit a few video game microworlds and engage in the action. The petty-Faustian bargain that all software offers will soon become vividly apparent; enter a digitally constructed world, accept its constitution and its rules, and you buy into its ideology. Love it or leave it.

Real estate/cyberspace

I was there at the almost-unnoticed Big Bang – the silent blast of bits that begat the universe of these microworlds. UCLA, the fall of 1969, and I was a very young assistant professor writing primitive CAD software and trying to imagine the role that designers might play in the emerging digital future; in a back room just down the hallways from the monster mainframe on which I worked, some Bolt Beranek and Newman engineers installed a considerably smaller machine that booted up to become the very first node of ARPANET – the computer network that was destined to evolve into the worldwide Internet.[2]

From this inconspicuous origin point, network

tentacles grew like kudzu to blanket the globe. Soon, cyberspace was busting out all over, and the whole loosely organised system became known as the Internet. During the late 80s and early 90s more and more networks connected to the Internet, and by 1993 it included nearly two million host computers in more than 130 countries. Then, in the first six months of 1994, more than a million additional machines were hooked up.

While the Internet community was evolving into something analogous to a ramshackle Roman Empire of the entire computer world, numerous smaller, independent colonies and confederations were also developing. Dial-in bulletin board systems such as the Sausalito-based Well – much like independent city-states – appeared in many locations to link home computers.[3] Before very long, though, most of these erstwhile rivals found it necessary to join forces with the Internet as well. There would not have been a great deal to connect if computers had remained the large and expensive devices that they were when ARPANET began in 1969.

But as networks developed, so did inexpensive personal computers and mass-marketed software to run on them. The very first, the Altair, showed up in 1974, and it was followed in the early 80s by the first IBM PCs and Apple Macintoshes. Each one that rolled off the assembly line had its complement of RAM and a disk drive, and it expanded the potential domain of cyberspace by a few more megabytes of memory.

Somewhere along the line, our conception of what a computer really was began to change fundamentally. It turned out that these electronic boxes were not really big, fast, centralised calculating and data-sorting machines as ENIAC, UNIVAC, and their mainframe successors had led us to believe. No; they were primarily communication devices – not dumb ones like telephone handsets, that merely encoded and decoded electronic information, but smart ones that could organise, interpret, filter, and present vast amounts of information for us. Their real role was to construct cyberspace.

Wild West/electronic frontier

It was like the opening of the Western Frontier. Parallel, breakneck development of the Internet and of consumer computing devices and software quickly created an astonishing new condition; a vast, hitherto-unimagined territory began to open up for exploration. Early computers had been like isolated mountain valleys ruled by programmer-kings; the archaic digital world was a far-flung range in which narrow, unreliable trails provided only tenuous connections among the multitudinous tiny realms. An occasional floppy disk or tape would migrate from one to the other, bringing the makings of colonies and perhaps a few unnoticed viruses. But networking fundamentally changed things – as clipper ships and railroads changed the pre-industrial world – by linking these increasingly numerous individual fragments of cyberturf into one huge, expanding system.

By the 1990s, the digital electronics and telecommunications industries had configured themselves into an immense machine for the ongoing production of cyberspace. We are rapidly approaching a condition in which every last bit of computer memory in the world is electronically linked to every other. This vast grid is the new land beyond the horizon, the place that beckons the colonists, cowboys, con-artists, and would-be conquerors of the 21st century. And there are those who would be King.

It will be there forever. Because its electronic underpinnings are so modular, geographically dispersed, and redundant, cyberspace is essentially indestructible. You can't demolish it by cutting links with backhoes or sending commandos to blow up electronic installations, and you can't even nuke it. If big chunks of the network were to be wiped out, messages would automatically reroute themselves around the damaged parts. If some memory or processing power were to be lost it could quickly be replaced. Since copies of digital data are absolutely exact replicas of the originals, it doesn't matter if the originals get lost or destroyed. And since multiple copies of files and programs can be stored at widely scattered locations, eliminating them all with certainty is as hard as lopping Hydra heads.

Cyberspace is still tough territory to travel, though, and we are just beginning to glimpse what it may hold. 'In its present condition', Mitch Kapor and John Perry Barlow noted in 1990, 'Cyberspace is a frontier region, populated by the few hardy technologists who can tolerate the austerity of its savage computer interfaces, incompatible communications protocol, proprietary barricades, cultural and legal ambiguities, and general lack of useful maps or metaphors'. And they warned: 'Certainly, the old concepts of property, expression, identity, movement, and context, based as they are on physical manifestation, do not apply succinctly in a world where there can be none'.[4]

Human laws/coded conditionals

Out there on the electronic frontier, code is the Law. The rules governing any computer-constructed microworld – of a video game, of your personal computer desktop, of a word processor window, of an automated teller machine, or of a chat room on the network – are precisely and rigorously defined in the text of the program that constructs it on your screen. Just as Aristotle,

in *The Politics*, contemplated alternative constitutions for city-states (those proposed by the theorists Plato, Phaleas, and Hippodamos, and the actual Lacedaemonian, Cretan, and Carthaginian ones) so denizens of the digital world should pay the closest of critical attention to programmed polity. Is it just and humane? Does it protect our privacy, our property, and our freedom? Does it constrain us unnecessarily, or does it allow us to act as we may wish?

At a technical level, it's all a matter of the software's conditionals – those coded rules that specify if some condition holds then some action follows. Consider, for example, the familiar ritual of withdrawing some cash from an ATM. The software running the machine has some gatekeeper conditionals; if you have an account, and if you enter the correct PIN number (the one that matches up, in a database somewhere, with the information magnetically encoded on your ATM card), then you can enter the virtual bank. (Otherwise you are stopped at the door. You may have your card confiscated as well.) Next the program presents you with a menu of possible actions – just as a more traditional bank building might present you with an array of appropriately labelled teller windows or (on a larger scale) a directory pointing you to different rooms: if you indicate that you want to make a withdrawal, then it asks you to specify the amount; if you want to check your balance, then it prints out a slip with the amount; if you want to make a deposit, then yet another sequence of actions is initiated. Finally, the program applies a banker's rule; if the balance of your account is sufficient (determined by checking a database), then it physically dispenses the cash and appropriately debits the account.

To enter the space constructed by the ATM system's software you have to submit to a potentially humiliating public examination – worse than being given the once-over by some snotty and immovable receptionist. You are either embraced by the system (if you have the right credentials) or excluded and marginalised by it right there in the street. You cannot argue with the it. You cannot ask it to exercise discretion. You cannot plead with it, cajole it or bribe it. The field of possible interactions is totally delimited by the formally stated rules.

So control of code is power. For citizens of cyberspace, computer code – arcane text in highly formalised language, typically accessible only to a few privileged high-priests – is the medium in which intentions are enacted and designs are realised, and it is becoming a crucial focus of political contest. Who shall write the software that increasingly structures our daily lives? What shall that software allow and proscribe? Who shall be privileged by it and who marginalised? How shall the writers of the rules be answerable?

Physical transactions/electronic exchanges

Historically, cities have also provided places for specialised business and legal transactions.[5] In *The Politics*, Aristotle proposed that a city should have both a 'free' square in which 'no mechanic or farmer or anyone else like that may be admitted unless summoned by the authorities' and a marketplace 'where buying and selling are done . . . in a separate place, conveniently situated for all goods sent up from the sea and brought in from the country'.[6] Ancient Rome had both its *fora civila* for civic assembly and its *fora venalia* for the sale of food. These Roman markets were further specialised by type of produce; the *holitorium* was for vegetables, the *boarium* for cattle, the *suarium* for pigs, and the *vinarium* for wine. Medieval marketplaces were places both for barter and exchange and for religious ritual. Modern cities have main streets, commercial districts, and shopping malls jammed with carefully differentiated retail stores in which the essential transaction takes place at the counter – the point of sale – where money and goods are physically exchanged.

But where electronic funds transfer can substitute for physical transfer of cash, and where direct delivery from the warehouse can replace carrying the goods home from the store, the counter can become a virtual one. Television home shopping networks first exploited this possibility – combining cable broadcast, tele-phone, and credit card technologies to transform the purchase of zirconium rings and exercise machines into public spectacle.[7] Electronic 'shops' and 'malls' provided on computer networks (both Internet and the commercial dial-up services) quickly took the idea a step further; here customer and store clerk do not come face-to-face at the cash register, but interact on the network via a piece of software that structures the exchange of digital tokens – a credit card number to charge, and a specification of the required goods. (The exchange might then become so simple and standardised that the clerk can be replaced completely by a software surrogate.) As I needed books for reference in preparing this text, I simply looked up their titles and ISBN numbers in an on-line Library of Congress catalogue, automatically generated and submitted electronic mail purchase orders, and received what I requested by courier – dispatched from some place that I had never visited. The charges, of course, showed up on my credit card bill.

Immaterial goods such as insurance policies and commodity futures are most easily traded electronically. And the idea is readily extended

to small, easily transported, high value speciality items – books, computer equipment, jewellery, and so on – the sorts of things that have traditionally been sold by mail order. But it makes less sense for grocery retailing and other businesses characterised by mass markets, high bulk, and low margins. Cyberspace cities, like their physical counterparts, have their particular advantages and disadvantages for traders, so they are likely to grow up around particular trade specialisations. Since you cannot literally lay down your cash, sign a cheque, or produce a credit card and flash an ID in cyberspace, payment methods are being reinvented for this new kind of marketplace. The Internet and similar networks were not initially designed to support commercial transactions, and were not secure enough for this purpose. Fortunately though, data encryption techniques can be used to provide authentication of the identities of trading partners, to allow secure exchange of sensitive information such as credit card numbers and bid amounts, and to affix digital 'signatures' and time stamps to legally binding documents. By the summer of 1994, industry standards for assuring security of Internet transactions were under development, and on-line shopping services were beginning to offer encryption-protected credit card payment.[8] And the emergence of genuine digital cash – packages of encrypted data that behaved like real dollars, and could not be traced like credit card numbers – seemed increasingly likely.

In traditional cities, transaction of daily business was accomplished literally by handing things over; goods and cash crossed store counters, contracts were physically signed, and perpetrators of illegal transactions were sometimes caught in the act. But in virtual cities, transactions reduce to exchanges of bits.

Street maps/hyperplans

Ever since Ur, doorways and passageways have joined together the rooms of buildings, webs and grids of streets have connected buildings to each other, and roads have linked cities. These physical connections provided access to the places where people lived, worked, worshipped, and entertained themselves.

Since the winter of 1994, I have had a remarkable piece of software called Mosaic on the modest desktop machine that I am using to write this paragraph.[9] Mosaic, and the network of World Wide Web servers to which it provides access, work together to construct a virtual rather than physical world of places and connections; the places are called 'pages' and they appear on my screen, and the connections – called hyperlinks – allow me to jump from page to page by clicking on highlighted text or icons.

A World Wide Web 'home page' invites me to step, like Alice through the looking glass, into the vast information flea-market of the Internet. The astonishing thing is that a WWW page displayed on my screen may originate from a server located anywhere in the Internet. In fact, as I move from page to page, I am logging into machines scattered around the world. But as I see it, I jump almost instantaneously from virtual place to virtual place by following the hyperlinks that programmers have established – much as I might trace a path from piazza to piazza in a great city along the roads and boulevards that a planner had provided. If I were to draw a diagram of these connections I would have a kind of street map of cyberspace. MUD crawling is another way to go. Software systems known as MUDs – Multi-User Dungeons – have burned up countless thousands of Internet log-in hours since the early 1980s.[10] These structure on-line, interactive, role-playing games, often attracting vast numbers of participants scattered all over the net. Their particular hook is the striking way that they foreground issues of personal identity and self-representation; as initiates learn at old MUDder's knees, the very first task is to construct an on-line persona for yourself by choosing a name and writing a description that others will see as they encounter you.[11] It's like dressing up for a masked ball, and the irresistible thing is that you can experiment freely with shifts, slippages, and reversals in social and sexual roles and even try on entirely fantastic guises. How does it really feel to be a complete unknown?

Once you have created your MUD character, you can enter a virtual place populated with other characters and objects. This place has exits – hyperlinks connecting it to other such settings, and these in turn have their own exits; some MUDs are vast, allowing you to wander among thousands of settings – all with their own special characteristics – like Baudelaire strolling through the buzzing complexity of 19th-century Paris. You can examine the settings and objects that you encounter, and you can interact with the characters that you meet.

But as you quickly discover, the most interesting and provocative thing about a MUD is its constitution – the programmed-in rules specifying the sorts of interactions that can take place and shaping the culture that evolves. Many are based on popular fantasy narratives such as *StarTrek*, Frank Herbert's *Dune*, CS Lewis's *Chronicles of Narnia*, the Japanese animated television series *Speed Racer*, and even more doubtful products of the literary imagination; these are communities held together, as in many traditional societies, by shared myths. Some are set up as hack 'n slash combat games in which bad MUDders will try to 'kill' your character; these, of course, are violent, Darwinian places in which you have to be aggressive and

constantly on your guard. Others, like many of the TinyMUDs, stress ideals of constructive social interaction, egalitarianism, and nonviolence – MUDderhood and apple pie. Yet others are organised like high-minded lyceums, with places for serious discussion of different scientific and technical topics. The MIT-based Cyberion City encourages young hackers – MUDders of invention – to write MUSE code that adds new settings to the environment and creates new characters and objects. And some are populated by out-of-control, crazy MUDders who will try to engage your character in TinySex – the one-handed keyboard equivalent of phone sex.

Early MUDs – much like text-based adventure video games such as Zork – relied entirely on typed descriptions of characters, objects, scenes, and actions. (James Joyce surely would have been impressed; city as text and text as city. Every journey constructs a narrative.) But greater bandwidth, faster computers, and fancier programming can shift them into pictorial and spatial formats.[12]

Enclosure/encryption

In physically constructed cities, the enclosing surfaces of constituent spaces – walls, floors, ceilings, and roofs – provide not only shelter, but also privacy. Breaches in these surfaces – gates, doors, and windows – have mechanisms to control access and maintain privacy; you can lock your doors or leave them open, lower the window shades or raise them. Spatial divisions and access control devices are deployed to arrange spaces into hierarchies grading from completely public to utterly private. Sometimes you have to flip your ID to a bouncer, take off your shoes, pay admission, dress to a doorman's taste, slip a bribe, submit to a search, speak into a microphone and wait for the buzzer, smile at a receptionist, placate a watchdog, or act out some other ritual to cross a threshold into a more private space. Traditions and laws recognise these hierarchies, and generally take a dim view of illicit boundary crossing by trespassers, intruders, and peeping Toms.

Different societies have distinguished between public and private domains (and the activities appropriate to them) in differing ways, and cities have reflected these distinctions. According to Lewis Mumford, domestic privacy was 'a luxury of the well-to-do' up until the 17th century in the West.[13] The rich were the people who could do pretty much what they wanted, as long as they didn't do it in the street and frighten the horses. Then, as privacy rights trickled down to the less advantaged classes, the modern 'private house' emerged, acquired increasingly rigorous protections of constitutional law and public policy, and eventually became the cellular unit of suburban tissue.[14] Within the modern Western house itself – in contrast with some of its ancient and medieval predecessors – there is a carefully organised gradation from relatively public verandahs, entry halls, living rooms and parlours to more private, enclosed bedrooms and bathrooms where you can shut and lock the doors and draw down the shades against the outside world.

It doesn't rain in cyberspace, so shelter is not an issue, but privacy certainly is. So the construction technology for virtual cities – just like that of bricks-and-mortar ones – must provide for putting up boundaries and erecting access controls, and it must allow cyberspace architects and urban designers to organise virtual places into public-to-private hierarchies.

Fortunately, some of the necessary technology does exist. Most obviously, the rough equivalent of a locked gate or door, in cyberspace construction, is an authentication system.[15] This controls access to virtual places (such as your electronic mail inbox) by asking for identification and a password from those who request entry. If you give the correct password, you're in.[16] The trouble, of course, is that passwords – like keys – can be stolen and copied. And they can sometimes be guessed, systematically enumerated till one that works is found, or somehow extorted from the system manager who knows them all. So password-protection – as with putting a lock on a door – discourages illicit entry, but does not block the most determined break-in artists.

Just as you can put the valuables that you really want to protect in a sturdy vault or crypt, though, you can build the strongest of enclosures around digital information by encrypting it – scrambling it in a complex way so that it can only be decoded by somebody with the correct secret numerical key. The trick is not only to have a code that is difficult to crack, but also to manage keys so that they do not fall into the wrong hands, and the cleverest known way to do this is to use a technique called RSA public-key encryption. In this system, which derives its power from the fundamental properties of large prime numbers, each user has both a secret 'private' key and a 'public' key that can be distributed freely. If you want to send a secure message, you first obtain the intended recipient's public key, and use that to encode the information. Then the recipient decodes it using the private key.

Under pressure from cops and cold warriors, who anticipate being thwarted by impregnable fortresses in cyberspace, the US Federal Government has doggedly tried to restrict the availability of strong encryption software. But in June 1991, hacker folk-hero Philip Zimmerman released his soon-to-be-famous, RSA-based Pretty Good Privacy (PGP) encryption program.

By May 1994, commercial versions had been licensed to over four million users, and MIT had released a free, non-commercial version that anybody could legally download from the Internet.[17] From that moment, you could securely fence off your private turf in cyberspace.

Meanwhile, the Clinton Administration pushed its plans for the Clipper Chip – a device that would accomplish much the same thing as RSA, but would provide a built-in 'trapdoor' for law-enforcement wiretapping and file decoding.[18] The effect is a lot like that of leaving a spare set of your front door keys in a safe at FBI headquarters. Opinion about this divided along predictable lines. A spokesman for the Electronic Frontier Foundation protested, 'The idea that the Government holds the keys to all our locks, before anyone has even been accused of committing a crime, doesn't parse with the public'.[19] But an FBI agent, interviewed in the *New York Times*, disagreed: 'OK, someone kidnaps one of your kids and they are holding this kid in this fortress up in the Bronx. Now, we have probable cause that your child is inside this fortress. We have a search warrant. But for some reason, we cannot get in there. They made it out of some new metal, or something, right? Nothing'll cut it, right? . . . That's what the basis of this issue really is – we've got a situation now where a technology has become so sophisticated that the whole notion of a legal process is at stake here . . . If we don't want that, then we have to look at Clipper'.[20]

So the technological means to create private places in cyberspace are available, but the right to create these places remains a fiercely contested issue. Can you always keep your bits to yourself? Is your home page your castle?[21]

Notes

1 Will Wright, 'Foreword' to Johnny L Wilson, *The SimCity Planning Commission Handbook*, Osborne McGraw-Hill, Berkeley, 1990, pxv.

2 ARPANET was funded by ARPA – the Advanced Research Projects Agency of the US Federal Government – and it was intended for use by the military and by computer science researchers. For the early history see Jeffrey A Hart, Robert R Reed, and Francois Bar, 'The Building of the Internet', *Telecommunications Policy*, Nov 1992, pp666-689.

3 For a history of the Well see Cliff Figallo, 'The Well: Small Town on the Internet Highway System', Sept 1993, available from the author at fig@well.sf.ca.us.

4 Mitchell Kapor and John Perry Barlow, 'Across the Electronic Frontier', *Electronic Frontier Foundation*, Washington DC, July 1990.

5 For historical surveys of these places see J B Jackson, 'Forum Follows Function', in N Glazer and M Lilla (eds) *The Public Face of Architecture*, Free Press, New York, 1987, and M Webb, *A Historical Evolution: The City Square*, Whitney Library of Design, New York, 1990.

6 Aristotle, *The Politics*, VII, xii.

7 Gary Gumpert and Susan J Drucker, 'From the Agora To the Electronic Shopping Mall', *Critical Studies in Mass Communication 9* (1992), pp186-200.

8 Peter H Lewis, 'Attention Shoppers: Internet Is Open', *The New York Times*, August 12, 1994, D1-D2.

9 On the development, introduction, and remarkable initial success of NCSA Mosaic see John Markoff, 'A Free and Simple Computer Link', *The New York Times*, Dec 8, 1993, D1, D5. The original work on the WWW was done by Tim Berners-Lee at CERN in Geneva in the late 80s. Mosaic was developed at the National Centre for Supercomputer Applications at the University of Illinois, Urbana-Champaign. By early 1994, more than 50,000 copies of Mosaic were being down-loaded monthly from NCSA's public server.

10 The first MUD, written by Roy Trubshaw and Richard Bartle, was based on the fantasy board game Dungeons and Dragons. There are numerous arcane variants on the generic Multi-User Something idea — TinyMUDs, MUSEs, MUSHs, MUCKs, MOOs, and so on. On the experience of MUD-crawling, see David Bennahum, 'Fly Me to the MOO', *Lingua Franca*, vol 4, no4 (May/June 1994), pp1 and 22-37.

12 This is, of course, closely related to the old literary issue of establishing a voice. 'Call me Ishmael' might be the opening ploy in a MUD interaction. So Wayne Booth's classic *The Rhetoric of Fiction* (Second edition, University of Chicago Press, Chicago, 1983) serves as a pretty good theoretical introduction to MUDding.

12 As programmers will appreciate, MUDs constitute a natural application for object-oriented programming techniques, and the developments of the MUD idea and of object-oriented programming have been intertwined.

13 Lewis Mumford, *The City in History*, Harcourt Brace and World, New York, 1961, p384.

14 One consequence is that you can get sued for invasion of privacy. Under American tort law, one who intentionally intrudes upon the seclusion of another is subject to liability if the intrusion would be highly offensive to a reasonable person. On the general idea of privacy rights, see Alan F Westin, *Privacy and Freedom*, Athenaeum, New York, 1967.

15 Authentication systems were not needed on the earliest computers, and they are not commonly used on personal computers today, since access to the machine can be controlled physically. But they are required on machines that have many potential users. Thus they first came into widespread use with the growing popularity of mainframe-based, multi-user, timesharing systems in the 1960s, and the idea carried over to computer networks in which a user logged into one machine can remotely access other machines.

16 You should not assume, though, that a password-protected place is necessarily private. In the widely reported case of Bourke versus the Nissan Motor Corporation in 1993, Nissan dismissed some employees after peeking into their password-protected electronic mail boxes. The employees sued for invasion of privacy and wrongful determination. But the California courts ruled against the employees' claim that the passwords created an expectation of privacy.

17 William M Bulkeley, 'Cypher Probe', *The Wall Street Journal*, April, 1994, ppA1, A8.

18 Peter H Lewis, 'Of Privacy and Security: The Clipper Chip Debate', *The New York Times*, April 24, 1994, pF5.

19 Jerry Berman, quoted by Steven Levy 'Battle of the Clipper Chip', *The New York Times Magazine*, June 12, 1994, pp44-51, 60, 70. In June 1994, the US Public Policy Committee of the Association for Computing Machinery (USACM) released an expert panel report entitled 'Codes, Keys and Conflict: Issues in US Crypto Policy', which took a strong stand against Clipper and urged the Clinton Administration to withdraw it.

20 Jim Kallstrom, quoted by Steven Levy, ibid.

21 For a useful summary of some of the legal issues, with particular reference to electronic mail privacy and electronic monitoring of employees, see Michael Traynor, 'Computer E-Mail Privacy Issues Unresolved', *The National Law Journal*, Jan 31, 1994.

Abridged text from William Mitchell, City of Bits, *MIT Press, Cambridge, Massachusetts, 1994, chapter 4: 'Soft Cities'. Printed with permission of MIT Press, available on the WWW: http://www-mitpress.mit.edu/City_of_Bits/index.html.*

Netscape: Jeremy Bentham on the Net

Back | Forward | Home | Reload | Images | Open | Print | Find | Stop

Location: http://J.Bentham@ucl.ac.uk

What's New? | What's Cool? | Handbook | Net Search | Net Directory | Newsgroups

JEREMY BENTHAM ON-LINE

A conceptual artwork for the Net.

In a foyer of University College London, in a glass fronted cabinet, sits the preserved body of Jeremy Bentham; philosopher, economist, expounder of Utilitarianism, Bentham is chiefly remembered for inventing the Panopticon; a glass walled prison designed for total surveillance.

A video camera pointed at Jeremy Bentham's body, updating images onto the Internet every five minutes.

The creator of the Panopticon is himself on view to millions of Internet users around the world. The tables have been turned.

Concept by Rory Hamilton.

r.hamilton@ucl.ac.uk

For more information on Jeremy Bentham and the Panopticon: click here.

Or Email j.bentham@ucl.ac.uk

Document: Done.

PHILIP TABOR

I AM A VIDEOCAM

The Glamour of Surveillance

Abstract
Recent technological advances facilitate 'panopticism', the dominance of society by surveillance. But across the political spectrum resistance to this trend is surprisingly muted. One reason may be the allure, not always consciously acknowledged, of spying on others and of being spied upon.

This paper metaphorically identifies the video camera with a succession of emblems to illustrate various aspects of this allure. The videocam is seen as the following:

- eye, the role of technology and vision, personified in the Cyclopes, in Greek mythology;
- carwash, the psychic mechanism of the Panopticon;
- x-ray machine, the modernist obsession with transparency, and its psychological and political meanings;
- mirror, the fragmentation and reconstitution of the reflected self;
- sardine can, surveillance by impersonal agency, and architectural metonymy;
- moon, the 'Icarian' aerial viewpoint favoured by architectural modernism;
- keyhole, fascination with other people's lives;
- gun, the glamour of controlling, and being controlled, by surveillance;
- shield, the role of surveillance in ancient and contemporary fiction.

It concludes that the very idea of surveillance evokes curiosity, desire, aggression, guilt and, above all, fear – emotions which interact in daydream dramas of seeing and being seen, concealment and self-exposure, attack and defence, seduction and enticement. The intensity and attraction of these dramas helps to explain the glamour and malevolence with which the apparatus of surveillance is invested, and our acceptance of it.

Architecture and the evil eye

Apparently, I study a dead language, architecture.[1] I have read its obituaries. One cultural analyst writes: 'After the age of architecture/sculpture we are now in the time of cinematographic factitiousness . . . from now on architecture is only a movie'.[2] Another calls architecture the 'sub-electronic visual marker of the spectacle': too place-bound and inert to survive the ethereal, ubiquitous lightning-flashes of the telematic storm.[3]

What is more, architecture deserved to die. It committed the eighth deadly sin, technolatry: the worship of means at the expense of divine or human ends – ethical myosis. Always complicit with establishment and capital, its aim was domination. To control internal climate it sought power over nature; to control behaviour, architecture's other purpose, it sought power over people.

For power over people, architecture wielded the technologies of the eye, in particular the evil S's: the Spectacle and Surveillance.

Regarding the spectacle: from the cathedral and palace to the housing estate and shopping mall, architecture has been characterised by grandiloquent display and forceful geometry. Architecture's symmetries, hierarchies and taxonomies fabricated the intoxicating dream-worlds of authority, commodity and consumption.

As for contemporary surveillance, architecture was at first blamed for not providing it. Leg-cocking underdogs in the early 1970s claimed city territory with threatening day-glo squirts; their spray-cans seemed almost as threatening as their guns. An influential book blamed modern architecture for not providing, in the words of its title, 'defensible space'.[4] By this was meant the pre-modern surveillance of the twitching curtain and the bobby on the beat. Instead came the videocam and armed response.

Architects were blamed for that too, at least partly, because to their misfortune the 1960s and '70s (first in America, later more famously in France)[5] saw a building type displace Orwell's *Nineteen Eighty-Four* as the dominant metaphor for Western society seen as a surveillance-driven dystopia. The building type was of course Jeremy Bentham's Panopticon prison.

(The first 'real-time' transmission of a photographic image, incidentally, was by telegraph, in 1927. The image, as it happens, was of a federal penitentiary.)[6]

The glamour of surveillance

The word 'surveillance' derives from the Latin *vigilia* meaning wakefulness or sleeplessness. So in the thousand eyes of surveillance-night we see reflected the light never switched off in

Rory Hamilton, Jeremy Bentham On-line

the prison cell, the dazzling anti-dungeon of the Panopticon, the insomniac horror of Poe's Tell-Tale Heart.

The political right wishes to shield the private sphere from social intrusion: the left fears an oligarchy immovably embedded in an informatic bunker. Both wings have compelling reasons for fearing the 'surveillance society', if it has not yet arrived, and resisting it if it has. Yet resistance is low.

The rational reasons for this are clear. For the right: watched workers, watched consumers, stay in line. For the left, after decades of fighting closed social systems (patriarchal family, privatisation, cocooning and so on), it feels perverse to argue against transparency, electronic or otherwise. Besides, surveillance protects the vulnerable: rape is statistically less frequent in glass-sided lifts than in opaque ones.[7]

But there are less reasoned motives for not wholeheartedly resisting surveillance. I should like to suggest in this paper that the algebra of surveillance structures the reveries of voyeurism, exhibitionism and narcissism. To make love in a glass-walled lift, for instance – moving and open to public gaze – typifies, I am told, a common fantasy. The disembodied eye of surveillance thrills our dreams.

The eye

The video camera is of course that eye. The single-eyed giants, the Cyclopes (in Greek literally 'the round-eyed') were the first technologists, master smiths. They invented the technologies of force and anti-surveillance to help Zeus crush the first rebellion, that of the Titans. For Zeus they forged the thunderbolt, for Poseidon the trident, and for Hades the helmet of darkness and invisibility. Later they used their single eyes, like Polyphemus, to oversee and control sheep.[8]

The carwash

The videocam is also a carwash. Augustinian Christianity saw the insomniac gaze of God as a flood of light in which believers were drowned – but emerged cleansed and secure, having submitted themselves to fatherly authority.[9]

The unbelieving Bentham used biblical texts ironically to present his Panopticon as the secular equivalent of divine surveillance – omniscient, ubiquitous and invisible.[10] The inmates, flooded in light, cannot see the overseers, who are masked in the dark centre of their universe. It's a confessional with one-way glass. Fearing punishment but never knowing when they are overseen, if at all, the inmates internalise their surveillance, repent, and become virtuous. They are cleansed by light: seen is clean.

The panoptic mechanism echoes that whereby, it is supposed, each child internalises the prohibitions of his elders by developing a super-ego or conscience. Behaviour originally avoided for fear of an angry parent later in life arouses a different emotion, shame.[11] Who, smuggling nothing through customs past those one-way mirrors, has not felt guilty? Surveillance, then, manufactures conscience – which, as the word implies, completes selfconsciousness. It fortifies the individual's identity, and his or her place in the external world.

The x-ray machine

The videocam is an x-ray machine. In 1925 Lázló Moholy-Nagy extended the seen-is-clean equation thus: 'Television . . . has been invented . . . tomorrow we shall be able to look into the heart of our fellow-man . . . *The hygiene of the optical*, the health of the visible is slowly filtering through'.[12]

X-rays were discovered a century ago, in 1895. That surveillance arouses the imagination is evident in the fact that, within a year, advertisements appeared in which a detective agency offered divorce-related x-ray stakeouts, and a corset maker offered lead underwear to thwart x-ray-equipped Peeping Toms.[13]

The x-ray's centenary deserves celebration because the discovery preceded a rage for transparency (reciprocal surveillance) which, especially in architecture, characterises Modernism. This is a vivid instance of how, without apparent causal link, innovations in technology and sensibility coincide. Plate glass had come a little earlier; cellophane, Plexiglas and Nylon arrived rather later.[14] Do we love our technologies because we invent them, or invent them because we love them?

Exposure of dirt-traps in buildings to the eye, and of the body to the sun (and therefore the eye), in nudism and the relative nudism of post-1918 dress, followed medical science. The drive for self-disclosure responded, too, with hazy symbolism, to the psycho-analytic concept of a concealed and unsanitary unconscious.

Buckminster Fuller's Dymaxion House of 1927 was the first to simultaneously celebrate advanced technology, transparency and self-exposure. The model, exhibited at Chicago's Marshall Field's department store, had glass walls behind which naked dolls lay on sheetless pneumatic beds.[15]

Self-exposure was politically correct. 'We recognise nothing private', Lenin had said, 'our morality is entirely subordinate to the interests of the class struggle of the proletariat'.[16] Surveillance defends the revolution; reaction must have nowhere to hide. The open plan and picture window, like the sandals and open shirt, were to do their bit to expose pretension, demolish interpersonal barriers, and maintain social health.

The hygiene of the optical: witness is fitness.

The mirror

The videocam is a mirror. Surveillance images of ourselves flicker grainily on the underground platform, in the window of Dixon's, in department stores, sometimes on taxi dashboards. Electronic narcissism: we are indeed all famous now, but not just for fifteen minutes.

(Vanity can kill. Some of the Communards of 1871, who posed to be photographed on the barricades, were later identified by their images and shot.[17] Encouraged, the French government started using photography for police purposes soon after.)[18]

The infant rejoices at its reflected image, which releases it from the subjective prison of its retina, and places it in the social and symbolic world: I am seen, therefore I am.[19] So mirrors make me whole. But they also disunite me: reflections create doubles. I am thereafter split between a self seen from within and a self seen from without. I spy on myself.

In 1993 a poll by the US *Macworld* magazine found 22 per cent of 'business leaders' admitting to searching their employees' voice mail, e-mail and computer files.[20] Software applications with names like 'Peak & Spy' [sic], 'Supervision' and even 'Surveillance' are available to monitor continually, for instance, the average number of copies an employee distributes with each e-mail: too many indicates a hostile atmosphere or disaffection, so management is alerted.[21]

So-called 'dataveillance' compounds our fragmentation and, with it, ontological doubt. Each form filled, card swiped, key stroked and barcode scanned, replicates us in dataspace – as multiple shadows or shattered reflections. Sometimes our electronic shadows, like a polished CV or a PR image, are sharper, more seductive than ourselves. More often, what are chillingly called our 'data-images' caricature and diminish us, but are seen as more substantial than our selves.[22] Our complaint should logically be that surveillance sees not too much of us but too little. Biotechnical surveillance answers that with DNA analysis, voiceprints, retinal scans and inquisitive toilets.[23]

The sardine can

The videocam is a sardine can. Jacques Lacan tells of seeing at sea a floating sardine can, shining in the sun.[24] In what was for him a philosophical epiphany, he realised that, while his vision radiated from his eye to encompass the scene, light radiated from the can to encompass *him*. The can 'was looking at me', he notes, 'at the point at which everything that looks at me is situated – and I am not speaking metaphorically'. He was simultaneously observing the can and caught, to use Martin Jay's happy gloss, 'in an impersonal field of pure monstrance'.[25]

Architects have long known that the window in the tower, the balcony in a facade, and the throne on its dais are to part of our mind occupied even when they are not – and continue to survey us, even when we know there is no one there. And it is not simply that our imagination is conjuring up for these things notional human occupants. By a kind of metonymy the window, balcony and throne, though inanimate, continue to look at us. The videocam, too, puts us 'in an impersonal field of pure monstrance'.

The moon

The videocam is the moon. Daedalus, meaning literally both 'the bright' and 'the cunningly wrought', is by his very name associated with sight and technology. Daedalus made the first automata. He also engineered the first erotic encounter between flesh and machine, devising for Pasiphaë a wheeled and upholstered wooden cow in whose rear she could hide to seduce Poseidon's bull. The product of this coupling was the Minotaur, half-animal, half-human, a fusion of nature and culture.[26]

Daedalus constructed the Minotaur's labyrinth and the wings with which he escaped it. Soaring with him was his son Icarus – whose name associates him with the moon-goddess, who looks down coldly from above.[27] The Icarian scene was replicated as, in bird-like planes, aviators gazed panoptically down on their colleagues, myopic and mud-bound in the labyrinthine trenches of Flanders. When peace came, architects like Le Corbusier and Hugh Ferriss sought an urbanism of the lunar, Icarian view – serene, objective and distanced from our fellows.[28] With what pleasure we ride lifts to gaze down on the city and exclaim how inhuman, like ants, seem the pedestrians and cars in the canyons beneath.

The banks of monitors showing arterial flows and congestions in the TV traffic flash, the bird's-eye glide above a desert war, afford us the same glimpse of god-like, invulnerable serenity. Above the fray, the philosophical spy in the sky.

The keyhole

From spy in the sky to fly on the wall. The videocam is a keyhole, projecting us into intimacy with a world from which we are otherwise excluded, a surrogate life more vivid and immediate than our own. Supposedly non-fictional TV documentaries which extendedly eavesdrop on a family, firm or public service proved more gripping than fictional soaps. This fascination was sometimes attributable to a dramatic narrative, but more often it was just the thrill of banal witness: to find we are all the same under the skin.

Fictional dramas, like *NYPD Blue*, learnt to mimic the technical artefacts of espionage: overlapping inconsequential dialogue, hand-held wobble, spectral lens dazzle, close focus, artless camera angles. 'We are witnessing the end of perspective and panoptic space . . . and hence the *abolition of the spectacular*,' writes a celebrated commentator, 'the dissolution of TV into life, the dissolution of life into TV.'[29]

The gun

The videocam is, God knows, a gun: hand-held and stealth-black like a pistol, shoulder-mounted like a bazooka, or turreted. Mike Davis, sketching the 'scanscape' of central Los Angeles, catches this isomorphism: 'The occasional appearance of a destitute street nomad . . . in front of the Museum of Contemporary Art sets off a quiet panic; video cameras turn on their mounts and security guards adjust their belts'.[30]

The residents of major cities fear that urban space is being increasingly militarised by both sides of the law. But fear is mixed with perverse relish for that warlike tension which supposedly sharpens cities' 'creative edge'. What the patrol car's siren does for New York, the swivelling lens does for Los Angeles. We feel alert, excited: our designer glasses develop cross-hair sights.

In *Voyeur*, an interactive video, the viewer plays the part of a snooping private eye.[31] Any young boy, peeping through a window at the half-dressed girl next door, is preparing to confront the enemy, maybe years from now, and acquit himself well. So is she, if she knows or imagines she is surveyed. The surveillance camera scans time as well as space for trace of future trouble. Foreseen is forearmed.

We are gun/cameras. Our heads swivel on our shoulders and from our eyes dart – familiarly aggressive tropes – piercing and penetrating looks. Photographers say the camera loves some people but not others. We need no cyborgian robo-erotic fantasy to feel flattered and stimulated when the camera lovingly tracks us. A famous newspaper photograph shows an unconscious man lying on the ground, attended by doctors. He has been pulled from the sea and may die. Kneeling by his side is his fiancée. In the photograph she has just noticed the camera, so she smiles brilliantly at it and adjusts her swimsuit.[32]

The shield

The videocam is a shield. The eyes of Medusa turn to stone those who look directly at them: her gaze objectifies its target. The Three Graeae (literally 'the grey ones') are her old sisters, with just one eye and tooth between them. Age, that is, holds in fragile monopoly the instruments of aggression and surveillance. To augment his strength Perseus forces them to reveal where the technologies of speed and concealment may be found: Mercury's winged sandals and Hades' helmet of invisibility. Thus equipped he counters Medusa's gaze with indirect surveillance of his own, taking care to track Medusa only in her image reflected in his shield. He wins.[33]

Detective and spy fiction is based on this archaic mythology of the chase. Novel readers or film audiences vicariously re-enact the rituals of surveillance, imagining themselves at once both the concealed watcher and the exposed watched. Anxious that an unaided body and mind might not suffice to unbalance the game in their favour, the audience in fantasy adopts the logic of the arms race and seeks prosthetic help in technology. Thus the central role played in fictions by the hardware of surveillance and counter-surveillance: *The Conversation*, *Blade Runner*, *Blue Thunder*, *The Silence of the Lambs* (remember the nightsight glasses), *Sneakers*, *Demolition Man*, and so on.[34] Thus, too, the first commandment of street tech: 'Use technology before it's used on you'.[35]

Conclusion

Surveillance, the process by which the few monitor the many and keep records of them, is as old as agriculture and taxation. The growth since the Renaissance of bureaucratic surveillance accompanied the emergence of the nation-state, welfare state, suffrage, total war, and total law. Bureaucratic surveillance, formerly a near-monopoly of the state, has been adopted privately – since the industrial revolution to control production, and since the advertising revolution to control consumption.

The social benefits of surveillance are many and everyday. We have accustomed ourselves to sharing daily life with its apparently innocuous apparatus: forms, questionnaires, mark sheets, licences, passport photos, counter-signatures. Equally clear, though not so immediate, is its potential to inflict irreversible evil – probably with benign intent. The recent combining of electronic sensors, computers and high-band width telecoms has greatly reinforced the ability to monitor and oversee.

It is tempting to argue that social phenomena such as surveillance are driven forward by a simple coincidence of rational self-interest and technological innovation. Were this so, they could be resisted or reversed by forms of Luddism – by countering systems or by sabotaging hardware. But, as I have tried to show, systematic surveillance as a social institution also survives and flourishes on its irrational allure. The very idea of surveillance evokes curiosity, desire, aggression, guilt and above all fear – emotions which interact in daydream dramas of seeing and being seen, concealment

and self-exposure, attack and defence, seduction and enticement. The intensity and attraction of these dramas helps to explain the glamour and malevolence with which the apparatus of surveillance is invested, and our acceptance of it.

'I am an eye', wrote Flaubert. 'I am a camera', wrote Isherwood. I am a videocam.[36]

Notes

1 This paper was given at the 'Technophobia' conference of the Institute of Contemporary Arts, London, 8 April 1995.
2 Paul Virilio, *The Aesthetics of Disappearance*, Autonomedia, Semiotext(e) (New York), 1991, p65.
3 Critical Art Ensemble, *The Electronic Disturbance*, Autonomedia (Brooklyn NY), 1994, p69.
4 Oscar Newman, *Defensible Space: People and Design in the Violent City*, Architectural Press (London), 1973. Newman recommends that, to counter vandalism and crime, public housing should be designed to encourage 'territoriality' on the part of tenants, and 'natural surveillance' by them over public and semi-public space. He makes only passing (approving) reference to electronic surveillance: CCTV cameras linked to home TV sets or monitored by 'tenant patrols' (pp126-28, 182-85).
5 Michel Foucault, *Discipline and Punish: The Birth of the Prison*, Penguin (Harmondsworth), 1991 (originally published 1975). Foucault influentially adopted the Panopticon to illustrate symbolically the mechanisms of a surveillance-driven 'carceral society'. Martin Jay, *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought*, University of California Press (Berkeley and Los Angeles), 1994, p381 note 9. Jay notes that Gertrude Himmelfarb in 1965 and Jacques-Alain Miller in 1973 had previously drawn similar lessons from the Panopticon.
6 Judith Barry, 'Mappings: A Chronology of Remote Sensing', *Zone 6: Incorporations*, Jonathan Crary and Sanford Kwinter (eds.) MIT Press (Cambridge), 1992, p570. The prison was Fort Leavenworth.
7 Joel Garreau, *Edge City: Life on the New Frontier*, Doubleday, Anchor (New York), 1991, p470. Garreau claims this half-humorously as one of the 'Laws' of commercial development.
8 Robert Graves, *The Greek Myths: 1-2*, Penguin (Harmondsworth) 1960, sections 3b, 7e, 170b.
9 Martin Jay, op cit, p37. Also: Richard Sennett, *The Conscience of the Eye: The Design and Social Life of Cities*, Faber & Faber (London), 1991, p10.
10 Robin Evans, *The Fabrication of Virtue: English Prison Architecture, 1750-1840*, Cambridge University Press (Cambridge), 1982, p206.
11 Sigmund Freud, 'Civilization and its Discontents', chap 7, *Penguin Freud Library, vol 12: Civilization, Society and Religion*, Penguin (Harmondsworth), 1991, pp316-20.
12 Lázló Moholy-Nagy, *Painting, Photography, Film*, Lund Humphries (London), 1969 (originally published 1925), p38.
13 Nancy Knight, 'The New Light: X Rays and Medical Futurism', Joseph J. Corn, *Imagining Tomorrow: History, Technology and the American Future*, MIT Press (Cambridge), pp11, 17.
14 Large-sheet glass-making, beginning in the late eighteenth century, was generally affordable until the last two decades of the nineteenth century. Jeffrey L Meikle, 'Plastic, Material of a Thousand Uses' in Corn, op cit, p85, notes that Dupont's cellophane was introduced onto the consumer market in 1927, and their Nylon in 1939.
15 Brian Horrigan, 'The Home of Tomorrow, 1927-1945', in Corn, op cit, pp141-42.
16 Quoted in David Lyon, *The Electronic Eye: The Rise of the Surveillance Society*, Polity (Cambridge), 1994, pp185-86.
17 Roland Barthes, *Camera Lucida: Reflections on Photography*, Vintage (London), 1993, p11.
18 Martin Jay, op cit, p143.
19 Ibid, p288. Jay quotes Francois George, *Deux études sur Sartre*, Bourgeois (Paris), 1976, p321: 'L'autre me voit, donc je suis'.
20 John Whalen, 'You're Not Paranoid: They Really Are Watching You', *Wired* 3.03 (US ed., March 1995), p80. Whalen cites Dynamics Corp's 'executive monitoring systems': 'Peak & Spy'.
21 Barbara Garson, *The Electronic Sweatshop: How Computers are Transforming the Office of the Future into the Factory of the Past*, Penguin (Harmondsworth), 1989, p210. She cites, among monitoring systems, Lanier's 'Supervision IV' and Tower Systems International's 'Surveillance' p222.
22 Lyon, op cit, pp192-94, elaborates on the electronic threat to personhood. So do I in 'Striking Home: The Electronic Assault on Identity' (paper given at the 'Doors of Perception 2: @ Home' conference of the Netherlands Design Institute and *Mediamatic* magazine, Amsterdam, 4 Nov. 1994, published on world wide web at: http://mmwww.xs4all.nl/Doors/Doors2/Tabor/Tabor-Doors2-E.html).
23 William J Mitchell, *City of Bits: Space, Place and the Infobahn*, MIT Press (Cambridge), 1995 (forthcoming) mentions the inquisitive toilets.
24 Jacques Lacan, *The Four Fundamental Concepts of Psycho-Analysis*, Penguin (Harmondsworth), 1977, p95.
25 Martin Jay, op cit, p365.
26 Robert Graves, op cit, section 88e.
27 Robert Graves, op cit, section 92e. The index gives one meaning of the equivalent name, Icarius, as 'dedicated to the Moon-goddess Car'.
28 Le Corbusier and Pierre Jeanneret, *Oeuvre Complete de 1910-1929*, Editions d'Architecture Erlenbach (Zurich), 1946, pp109, shows particularly aeronautic views of Le Corbusier's 'Voisin' plan for Paris. Hugh Ferriss, *The Metropolis of Tomorrow*, Princeton University Press (Princeton), 1986 (originally published 1929) has similar views of a future New York.
29 Jean Baudrillard, *Simulations*, Semiotext(e) (New York) 1983, pp54-55.
30 Mike Davis, *City of Quartz: Excavating the Future in Los Angeles*, Vintage (New York), 1992, p231.
31 *Voyeur*, Philips, 1993, interactive video.
32 Harold Evans, *Pictures on a Page: Photo-Journalism, Graphics and Picture Editing*, Heinemann (London), 1978, back cover, reproduces the shot, credited to the Weegee International Center for Photography, and story.
33 Robert Graves, op cit, sections 73g-h.
34 Films: Francis Ford Coppola (dir) *The Conversation*, Paramount, 1974; Ridley Scott (dir) *Blade Runner* (Warner, Ladd, 1982); John Badham (dir) *Blue Thunder*, Rastar/Columbia, 1983; Jonathan Demme (dir) *The Silence of the Lambs*, Strong Heart/Orion, 1991; Phil Alden Robinson (dir) *Sneakers*, Universal, 1992; Marco Brambilla (dir) *Demolition Man*, Silver Pictures, 1993.
35 Cited in Andrew Ross, 'The New Smartness', *Culture on the Brink: Ideologies of Technology*, Gretchen Bender and Timothy Druckrey (eds), Bay Press (Seattle), 1994, p335.
36 Gustave Flaubert cited in Jay, op cit, p112 note109. Christopher Isherwood, *Goodbye to Berlin*, Minerva (London),1989, p9; the book was adapted into, successively, a play, stage musical, and film entitled *I Am a Camera*.

KAREN A FRANCK

WHEN I ENTER VIRTUAL REALITY, WHAT BODY WILL I LEAVE BEHIND?

In William Gibson's novel *Neuromancer*, Case longs for the 'bodiless exultation of cyberspace'. Again and again writers of fiction and nonfiction refer to leaving the body behind, to being free of it in virtual reality. The phrases 'meat puppets' and 'flesh cage' fill me with disgust and indignation, but I am none the less fascinated with the body and the 'non-body' in cyberspace.[1] I anticipate entering a virtual world someday soon. Will I leave a body behind? What body might I wish to leave, or keep, and why?

Virtual reality is very physical. I won't just see changing images on a flat screen; I will have the feeling of occupying those images with my entire body. I will enter a graphic, three-dimensional, computer-constructed world that does not look real but feels real, one that may respond immediately to my movements and commands.

To enter virtual reality, I place different kinds of equipment on or around my body. A head-mounted display contains video monitors which will form stereoscopic images before my eyes. A head tracker will measure my head movements which the computer will counteract to provide the experience of a stable world. Gloves allow me to see my hands and to manipulate items; a body suit could allow my body to be represented in virtual reality, and would allow me to move it as a virtual body and to be seen by others occupying the same virtual world. Headphones give me three-dimensional sound and a microphone allows me to give voice commands.

My experience of virtual reality depends upon my physical body's movement (or the mechanical movement of the body using a wheelchair or other apparatus). To see I must move my head. To *act* upon and *do* things in a virtual world I must bend, reach, walk, grasp, turn around and manipulate objects. Movements of the physical body, or commands, can translate to very different virtual movements – to flying, floating and moving from one place to another instantaneously. So much will be possible and so much of it physical, often requiring physical dexterity and practice – like performing surgery or playing one of the virtual musical instruments Jaron Lanier has invented.

If the virtual is so physical, what body will I leave behind? Not my physical body. Without it, I am in no world at all. It is physical bodies that give us access to any world.[2] I will certainly need my brain so that I can be stimulated to see and feel this created world; my eyes and ears to do the seeing and hearing; my arms, hands, legs and feet, and other bones, muscles and tendons to do the moving. The organs of perception and motility are still key.

My physical body will occupy the virtual and physical worlds simultaneously; actions I take will have consequences, albeit different ones, in both worlds. As in the physical world, so in the virtual: perception will be active, depending upon actual or anticipated physical movements. If I wear transparent goggles, the virtual world will be superimposed on the physical one. If the goggles are opaque, I will be 'immersed' in the virtual world and unable to see the physical one, though I may still be concerned about it.

What I will leave behind is a particular kind of 'being in the world', experiencing another kind instead.[3] Both kinds are created by the nature of the world and our relationship to it. In virtual reality, both change. Experiences of gravity, density, mass, weight, long distance, and the cumbersomeness of matter are absent. The objects we see or create and the spaces we occupy in virtual worlds have very different visual and kinaesthetic qualities from those in the physical world. Objects/spaces can appear, disappear, occupy the same location, and change appearance instantaneously. We can move very quickly and in all different ways. There is both a fluidity and speed of movement that are more akin to dreams than waking life.

If we are 'free' it is because we feel liberated from our relationship to the physical world, from the constraints and limitations that the physical world and physical matter exert upon us. So the experience of 'being in the virtual world' can be exhilarating; one can do so much so quickly and so effortlessly.[4] Here lies a sense of mastery and control unrivalled in the physical world, particularly for those who experience handicaps in that world. The constraints in virtual worlds are those that people have created in the software and, eventually, ones that any user chooses to create. They are thus made by humans. What a challenge to architects of virtual reality: not only are spaces and objects to be designed

but so are all bodily relationships to them and to other bodies.

I will be the same physical body but all that I encounter and my relationships to all that I encounter, my 'being in the world', will be dramatically different. To the extent (the great extent) that my feeling of myself is constituted by my relationships to all that is not me, I will feel different, perhaps very different. Jaron Lanier says: 'you have a vivid experience of your own subjectivity. You can feel your subjectivity as an angel floating above the world.'[5] For some people, or someday, that may be a feeling of being bodiless.

What I will also leave behind, indeed must leave behind, is my appearance. Virtual bodies cannot duplicate the appearance of individuals the way films, videos or photographs do. Here is another job for architects of virtual reality – to design the bodies too. Some of the bodies that have been created so far do not take a human form at all – a lobster, for example. Virtual reality will eventually offer people a great choice of different appearances, and so different identities. Identity, as it is physically represented, will no longer be tied to the physical attributes of age, gender, race, size or even to the human species. Attributes of humans or other animate and inanimate objects will be chosen and mixed at will.

Given the frequency with which men in MUDs (Multiple User Dungeons) adopt female identities, it is possible than many men will choose virtual female bodies. Women may wish to adopt gender-neutral identities, as many already do to avoid harassment on Internet or other networks. When we occupy virtual worlds, will it be understood that these are virtual bodies and possibly virtual identities so that 'deception' is no longer an issue, as it has been on Internet? After all, all of virtual reality is a deception. If we feel free of our physically-grounded identities, social constraints common to the physical world may recede as well, as they already have in textual computer communications.[6]

There is a body I personally do not wish to leave behind. That is the wet one, the one that needs to eat, sleep, eliminate, the one that is frail, can become diseased, and will die. It is that body with its needs, passions and mortality that some long to abandon. And it is that body that is so devalued in fiction and nonfiction about cyber-space: '. . . the elite stance involved a certain relaxed contempt for the flesh. The body was meat. Case fell into the prison of his own flesh.'[7]

As in any very challenging and engrossing activity one loses track of time and bodily needs. In computer-related activities – hacking, video games, programming, perusing the Internet and now virtual reality – this involvement can be intense, overwhelming. When Case was 'jacked in' he forgot the needs of the flesh: 'This was it. This was what he was, who he was, his being. He forgot to eat. Molly left cartons of rice and foam trays of sushi on the corner of the long table. Sometimes he resented having to leave the deck to use the chemical toilet . . . He'd go straight to the deck, not bothering to dress, and jack in . . . He lost track of days.'[8] But the fleshed body still requires care; so Molly brings food and at another point Maelcum, a Rastafarian no less, hooks Case to a catheter.

This caring can also include protection. Being both engrossed and immersed in a virtual world leaves one vulnerable to circumstances and persons in the physical world. To experience the sense of mastery and control in the virtual world means relinquishing what control one might have in the physical. So one must be in a safe physical location or watched over, even protected, by another person (though, of course, one is still vulnerable to this person and to others who can manipulate the software or the hardware).[9] The sense of control, like all of virtual reality, is a powerful, physical illusion.

Leaving the flesh behind does not mean doing away with sex but rather removing its shared wetness and fleshiness. Eventually in virtual worlds sex may be simulated by stimulating the appropriate parts of the brain or it may be experienced by donning a bodysuit to engage in virtual contact with other virtual bodies.[10] So one will feel the bodies of others but without any touching of flesh to flesh, without any contact with the fluids of another, without necessarily knowing the physically-based gender identity of the other (or others), and without revealing one's own. Totally anonymous sex, no responsibilities, no possibility of physical, bodily harm (although there may be other kinds), and none of the physical consequences of pregnancy or sexually-transmitted disease. Already cyberspace is a very popular place for sexual contact without bodily contact; virtual reality will likely be popular in the same way but more physical.

Do I have less desire to leave this body of wet flesh and blood because I am a woman? Are others so eager to do so, or to imagine doing so, because they are men? In all likelihood, yes. For centuries men have wished to transcend the body they cannot control and direct, the one whose desires, emotions, bodily functions and bodily changes interfere with other more valued pursuits. Religion, science, and philosophy in the West have continuously, relentlessly disdained and devalued the fleshed body and its material needs and preoccupations (and associated it and them with women). To be able to escape it, at least experientially, and yet still be alive and alert, to make physical movements that have significant consequences, to do,

learn, and create is truly a dream come true. And this is the ultimate design project: to imagine and create objects, spaces, bodies, movement and all relationships among them without ever having to consider any of the more tedious human needs for heat, light, air, food, sleep or elimination. The architect is finally free of the 'tyranny of function'.

Of course, the fleshed body is still there with all its needs, problems and vulnerabilities but it can be ignored in a new, more complete manner with its care yet again assigned to women and minorities. The desire to leave the fleshed body altogether is so great that the possibility of transferring or 'downloading' human consciousness to a computer is eagerly anticipated in the computer world. In such a 'post-biological world' one could thus avoid death and the time and energy required for maintaining and reproducing human bodies.[11]

These, I believe, are masculinist dreams. The potential character and possible consequences of virtual worlds can be imagined and portrayed in feminist terms as well. Then the body I wish to leave behind is the one that I have learned to be, the one that follows the constraints and limitations society has taught me, as a woman, to adopt. These have become part and parcel of my comportment, of the way I use my body and occupy space – in a more constricted and confined manner than men.[12] Could they be left behind? At the moment it seems unlikely. People who put on the gloves and goggles and enter virtual reality often remain aware of how they look to others watching them in the physical world and remain self-conscious of their movements. Perhaps 'being a woman in the world' cannot be abandoned, even in small ways, even virtually. None the less I have the wish. I'd like to try.

And when I leave behind my appearance as a woman, I wish to leave behind the ways men expect women to act and the ways they often approach and react to women.[13] Not that I wish to adopt a male identity but rather to appear as human, with no gender specified or revealed. Even beyond the technical problems of creating a voice that is human but neither male nor female, and beyond the possibility that my actions and attitudes would 'give me away', that may be difficult. To many men using Internet and other text-based computer communications determining the physically-based gender identities of other users is still very important; there may be pressure in virtual worlds not to remain anonymous in this sense. A gender-free realm of communication and interaction may not be a man's dream. For him flesh may be the prison; for me it is the current social construction of gender.[14]

So far, cyberspace constructs gender as much as any other man-made place, with some additional allowances for men to play with gender but none for women to avoid it. Given the preponderance of men creating and using computer-related inventions including cyberpunk fiction, it is not surprising that a masculinist, often sexist view predominates. If all virtual worlds will also be man-made places, they will very likely follow a similar script, with little opportunity for any of us to leave all the gendered bodies behind. Why not make some that do?

A feminist portrayal would stress the permeability and changeability of boundaries. Virtual reality dissolves the distinctions, the separations, and the connections that characterise so much of the physical world and our social constructions of it. In regard to the body alone, many different aspects can be separated and recombined conceptually and experientially. Simple dualisms of mind/body, male/female, animate/inanimate, real/imagined become far less tenable. Virtual worlds offer immense opportunities for testing and blurring boundaries in those worlds *and* in this one.

A significant boundary for dissolving is between self and other, all other. Virtual worlds will offer myriad opportunities to encounter and engage objects and spaces in new and different ways and to occupy other bodies, other entities, other species. The clear, hard, harsh boundaries in the physical world that define and keep me forever separate from all that is not me, that separate and distance things, bodies, and places from each other vanish. In virtual worlds the possibilities for connecting, merging, and occupying are endless. Would this not feel like a new kind of intimacy? Could this not generate, in the physical world, some of the empathy and compassion for the other that are now so sorely absent?[15]

People already report a sense of intimacy with others they communicate with via e-mail and Internet conversations. Maybe there is yet another level or intimacy to be found with spaces, objects, or the virtual representation of other species. In Marge Piercy's novel *He She and It*, Malkah, a practised user and creator of virtual worlds who is an old woman, reflects on the power she feels as a 'base-spinner'. 'In the image world, I am the power of my thought, of my capacity to create. There is no sex in the Base or the Net, but there is sexuality, there is joining, there is the play of minds like the play of dolphins in the surf.'[16]

Another significant boundary, metaphorically and technologically constructed, is between virtual reality and physical reality. Virtual reality is almost exclusively described and built as enclosed and independent of physical reality. Hence the use of the term 'virtual worlds'. This construction allows virtual reality to be viewed and experienced as an *escape* from physical

reality, further suggesting that the physical world will be neglected and devalued much as the fleshed body has been in Western culture. The masculinist dream may be as much to leave matter behind as to leave flesh behind. Both are so constraining, both create such problems. But it is also possible that participating in virtual worlds could lead to greater appreciation of flesh and matter. Another view, leading to other inventions, avoids the creation of an enclosed, separate world altogether by creating distributed cyberspaces that augment physical reality.[17] Virtual and physical can be seen and made to be interdependent and complimentary.

Virtual reality is not a single monolithic version of reality but an endless array of possibilities to be imagined and created. If the full potential of that variety can be realised, we can create ways of being and relating to all others *socially* and *psychologically* that are true alternatives to those current in the physical world and in our present culture. Who knows, eventually that could change our ways of being and relating here, in these bodies. Then I will return to a body changed.

Karen A Franck is Associate Professor at the School of Architecture, New Jersey Institute of Technology, Newark, New Jersey. Her most recent book, co-edited with Lynda Schneekloth, is Ordering Space: Types in Architecture and Design, *Van Nostrand Reinhold (New York), 1994.*

Notes

1 These phrases, used by Neil Spiller in a lecture at Winterschool 1995 in Birmingham, prompted me to write this essay. They also appear in his forthcoming book, *Digital Dreams: The Architecture of Cyberspace*. Issues of embodiment in virtual reality and science fiction are fascinating to others as well. See particularly Allucquere Rosanne Stone, 'Will the Real Body Please Stand Up?' and Michael Heim, 'The Erotic Ontology of Cyberspace', in *Cyberspace: First Steps*, Michael Benedikt (ed), MIT Press (Cambridge, Massachusetts), 1991; Scott Bukatman, *Terminal Identity: The Virtual Subject in Postmodern Science Fiction*, Duke University Press (Durham, North Carolina), 1993; Anne Balsamo, 'Feminism for the Incurably Informed', *Flame Wars: The Discourse of Cyberculture*, Mark Dery (ed), Duke University Press (Durham), 1994.

2 See Drew Leder, *The Absent Body*, University of Chicago Press (Chicago), 1990. Leder makes a very thorough argument that the body, in a phenomenological sense, is almost always 'left behind'; that is, one's own body is rarely the direct object of one's own experience.

3 In addition to Drew Leder, *The Absent Body*, see also Elizabeth Grosz, *Volatile Bodies: Toward a Corporeal Feminism*, Indiana University Press (Bloomington, Indiana), 1994. Leder and Grosz both discuss Merleau Ponty's articulation of the lived body as 'being in the world' (Maurice Merleau-Ponty, *Phenomenology of Perception*, Routledge and Kegan Paul (London), 1962.

4 Virtual mobility and movement can also be quite disorienting. 'The simultaneous changes in pitch, roll and yaw as well as direction in 3-space was confusing; people are not used to moving without the guiding constraints of ground and gravity'. Meredith Bricken, 'Virtual Worlds: No Interface to Design', *Cyberspace: First Steps*, Michael Benedikt (ed), op cit, p374.

5 Jaron Lanier, lecture at New Jersey Institute of Technology, Newark, 26 April 1995.

6 Howard Rheingold, *The Virtual Community: Homesteading on the Electronic Frontier*, HarperPerennial (New York), 1994.

7 William Gibson, *Neuromancer*, Ace Books (New York), 1984, p6.

8 Ibid, p59.

9 'I watched someone take control from a participant in the middle of a demonstration; he quietly switched power from the participant's glove to a trackball, which he (rather than the participant) controlled. Without warning, he spun the participant's perspective in every direction for about ten seconds. It had a literally staggering effect on the participant, who emerged pale, dizzy, and visibly upset. I felt like I'd witnessed an assault.' Meredith Bricken, 'Virtual Worlds: No Interface to Design', *Cyberspace: First Steps*, Michael Benedikt (ed), op cit, p379.

10 Howard Rheingold, 'Virtual Reality and Teledildonics', *Technology and the Future*, Albert H Teich (ed), St Martin's Press (New York), 1993. Gareth Branwyn, 'Compu-Sex: Erotica for Cybernauts', *Flame Wars: The Discourse of Cyberculture*, Mark Dery (ed.), Duke University Press (Durham, North Carolina), 1994.

11 'In the present condition we are uncomfortable halfbreeds, part biology, part culture, with many of our biological traits out of step with the inventions of our minds . . . but there is a tension between time and energy spent acquiring, developing and spreading ideas and effort expended toward maintaining our bodies and producing a new generation (as any parent of teenagers can observe).' Hans Moravec, *Mind Children: The Future of Robot and Human Intelligence*, Harvard University Press (Cambridge, Massachusetts), 1988, p4.

12 'Women in sexist society are physically handicapped. Insofar as we learn to live out our existence in accordance with the definition that patriarchal culture assigns to us, we are physically inhibited, confined, positioned and objectified.' Iris Marion Young, *Throwing Like a Girl and Other Essays in Feminist Philosophy and Social Theory*, University of Indiana Press (Bloomington, Indiana), 1990, p153.

13 These expectations are also about how women should *not* act when they are in certain situations. 'I once lost a prestigious job because (as I was informed later by one of the members of the committee) I "moved my body around so much" during my presentation. I know this was not the only time that my expressive style – part Jewish, part "feminine" – disqualified me as a serious philosopher . . .', Susan Bordo, *Unbearable Weight: Feminism, Western Culture and The Body*, University of California Press (Berkeley), 1993, p284.

14 Of course, flesh may feel like a prison to women as well but it seems to be the gendered (female) flesh we wish to escape. See for example Susan Bordo, *Unbearable Weight: Feminism, Western Culture and The Body*, op cit. For men the sexed nature of flesh, particularly its social construction, does not seem to be such an issue.

15 This boundary between 'us and not-us', the problems it creates, and the way it is re-envisioned in science fiction are the topics of Lynda Schneekloth's essay, 'Notions of the Inhabited', *Ordering Space: Types in Architecture and Design*, Karen A Franck and Lynda H Schneekloth (eds), Van Nostrand Reinhold (New York), 1994.

16 Marge Piercy, *He She and It*, Ballantine Books (New York) 1991, p161.

17 Wendy A Kellogg (et al), 'Making Reality a Cyberspace', *Cyberspace: First Steps*, Michael Benedikt (ed), op cit.

reality, further suggesting that the physical world will be neglected and devalued much as the fleshed body has been in Western culture. The masculinist dream may be as much to leave matter behind as to leave flesh behind. Both are so constraining, both create such problems. But it is also possible that participating in virtual worlds could lead to greater appreciation of flesh and matter. Another view, leading to other inventions, avoids the creation of an enclosed, separate world altogether by creating distributed cyberspaces that augment physical reality.[17] Virtual and physical can be seen and made to be interdependent and complimentary.

Virtual reality is not a single monolithic version of reality but an endless array of possibilities to be imagined and created. If the full potential of that variety can be realised, we can create ways of being and relating to all others *socially* and *psychologically* that are true alternatives to those current in the physical world and in our present culture. Who knows, eventually that could change our ways of being and relating here, in these bodies. Then I will return to a body changed.

Karen A Franck is Associate Professor at the School of Architecture, New Jersey Institute of Technology, Newark, New Jersey. Her most recent book, co-edited with Lynda Schneekloth, is Ordering Space: Types in Architecture and Design, *Van Nostrand Reinhold (New York), 1994.*

Notes

1 These phrases, used by Neil Spiller in a lecture at Winterschool 1995 in Birmingham, prompted me to write this essay. They also appear in his forthcoming book, *Digital Dreams: The Architecture of Cyberspace*. Issues of embodiment in virtual reality and science fiction are fascinating to others as well. See particularly Allucquere Rosanne Stone, 'Will the Real Body Please Stand Up?' and Michael Heim, 'The Erotic Ontology of Cyberspace', in *Cyberspace: First Steps*, Michael Benedikt (ed), MIT Press (Cambridge, Massachusetts), 1991; Scott Bukatman, *Terminal identity: The Virtual Subject in Postmodern Science Fiction*, Duke University Press (Durham, North Carolina), 1993; Anne Balsamo, 'Feminism for the Incurably Informed', *Flame Wars: The Discourse of Cyberculture*, Mark Dery (ed), Duke University Press (Durham), 1994.

2 See Drew Leder, *The Absent Body*, University of Chicago Press (Chicago), 1990. Leder makes a very thorough argument that the body, in a phenomenological sense, is almost always 'left behind'; that is, one's own body is rarely the direct object of one's own experience.

3 In addition to Drew Leder, *The Absent Body*, see also Elizabeth Grosz, *Volatile Bodies: Toward a Corporeal Feminism*, Indiana University Press (Bloomington, Indiana), 1994. Leder and Grosz both discuss Merleau Ponty's articulation of the lived body as 'being in the world' (Maurice Merleau-Ponty, *Phenomenology of Perception*, Routledge and Kegan Paul (London), 1962.

4 Virtual mobility and movement can also be quite disorienting. 'The simultaneous changes in pitch, roll and yaw as well as direction in 3-space was confusing; people are not used to moving without the guiding constraints of ground and gravity'. Meredith Bricken, 'Virtual Worlds: No Interface to Design', *Cyberspace: First Steps*, Michael Benedikt (ed), op cit, p374.

5 Jaron Lanier, lecture at New Jersey Institute of Technology, Newark, 26 April 1995.

6 Howard Rheingold, *The Virtual Community: Homesteading on the Electronic Frontier*, HarperPerennial (New York), 1994.

7 William Gibson, *Neuromancer*, Ace Books (New York), 1984, p6.

8 Ibid, p59.

9 'I watched someone take control from a participant in the middle of a demonstration; he quietly switched power from the participant's glove to a trackball, which he (rather than the participant) controlled. Without warning, he spun the participant's perspective in every direction for about ten seconds. It had a literally staggering effect on the participant, who emerged pale, dizzy, and visibly upset. I felt like I'd witnessed an assault.' Meredith Bricken, 'Virtual Worlds: No Interface to Design', *Cyberspace: First Steps*, Michael Benedikt (ed), op cit, p379.

10 Howard Rheingold, 'Virtual Reality and Teledildonics', *Technology and the Future*, Albert H Teich (ed), St Martin's Press (New York), 1993. Gareth Branwyn, 'Compu-Sex: Erotica for Cybernauts', *Flame Wars: The Discourse of Cyberculture*, Mark Dery (ed.), Duke University Press (Durham, North Carolina), 1994.

11 'In the present condition we are uncomfortable halfbreeds, part biology, part culture, with many of our biological traits out of step with the inventions of our minds . . . but there is a tension between time and energy spent acquiring, developing and spreading ideas and effort expended toward maintaining our bodies and producing a new generation (as any parent of teenagers can observe).' Hans Moravec, *Mind Children: The Future of Robot and Human Intelligence*, Harvard University Press (Cambridge, Massachusetts), 1988, p4.

12 'Women in sexist society are physically handicapped. Insofar as we learn to live out our existence in accordance with the definition that patriarchal culture assigns to us, we are physically inhibited, confined, positioned and objectified.' Iris Marion Young, *Throwing Like a Girl and Other Essays in Feminist Philosophy and Social Theory*, University of Indiana Press (Bloomington, Indiana), 1990, p153.

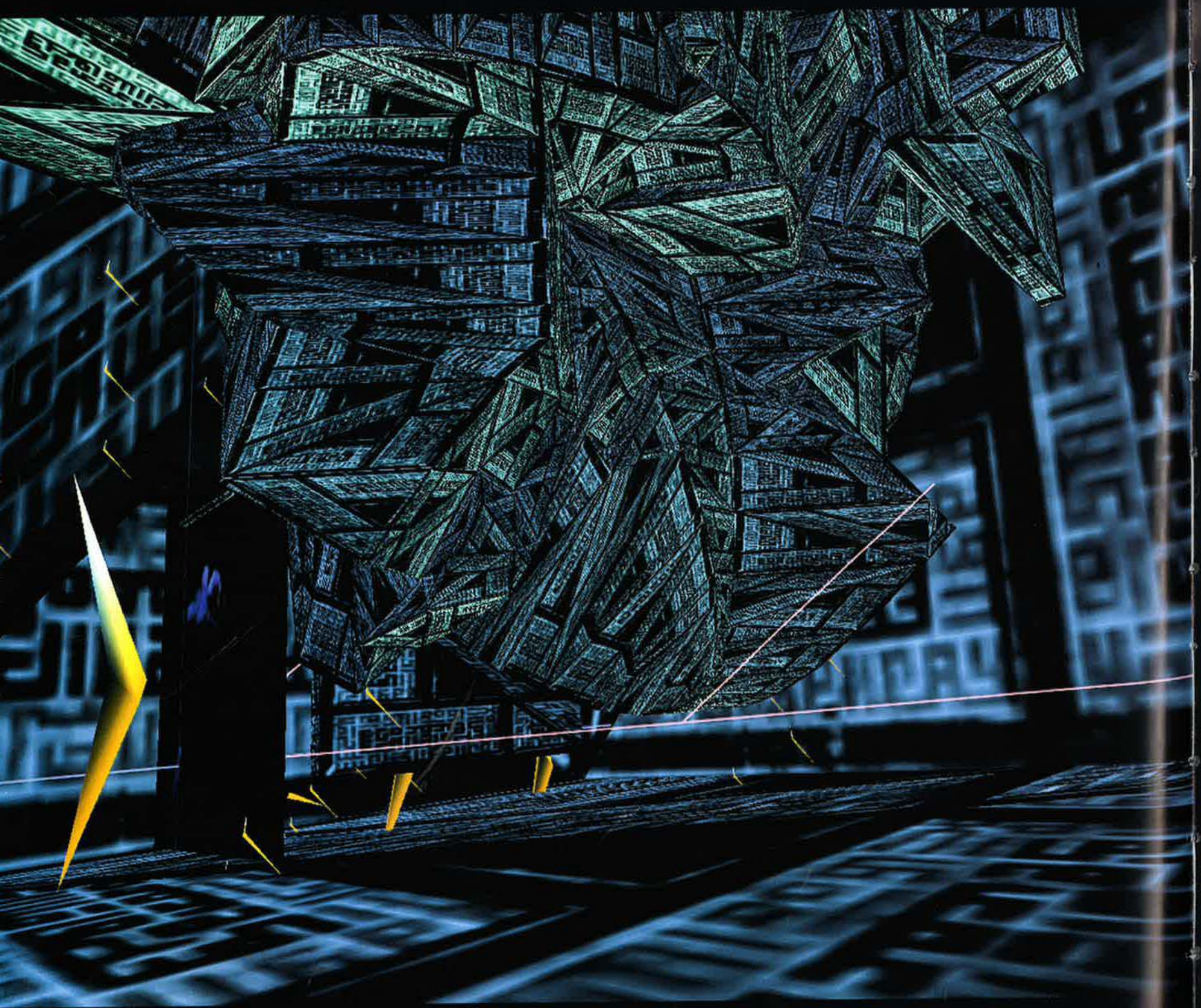
13 These expectations are also about how women should *not* act when they are in certain situations. 'I once lost a prestigious job because (as I was informed later by one of the members of the committee) I "moved my body around so much" during my presentation. I know this was not the only time that my expressive style – part Jewish, part "feminine" – disqualified me as a serious philosopher . . .', Susan Bordo, *Unbearable Weight: Feminism, Western Culture and The Body*, University of California Press (Berkeley), 1993, p284.

14 Of course, flesh may feel like a prison to women as well but it seems to be the gendered (female) flesh we wish to escape. See for example Susan Bordo, *Unbearable Weight: Feminism, Western Culture and The Body*, op cit. For men the sexed nature of flesh, particularly its social construction, does not seem to be such an issue.

15 This boundary between 'us and not-us', the problems it creates, and the way it is re-envisioned in science fiction are the topics of Lynda Schneekloth's essay, 'Notions of the Inhabited', *Ordering Space: Types in Architecture and Design*, Karen A Franck and Lynda H Schneekloth (eds), Van Nostrand Reinhold (New York), 1994.

16 Marge Piercy, *He She and It*, Ballantine Books (New York) 1991, p161.

17 Wendy A Kellogg (et al), 'Making Reality a Cyberspace', *Cyberspace: First Steps*, Michael Benedikt (ed), op cit.



CELIA LARNER & IAN HUNTER

HYPER-AESTHETICS

The Audience is the Work

Any discussion in the free-fall world of cyberspace, where nothing is what it at first appears to be, is a risky business. Navigating by means of the sophisticated computer technologies developed to deal with multi-dimensional medical, molecular, planetary and architectural simulation, artists and other cybernauts are launching into what Baudrillard has called 'exorbitate' existence. Aesthetic theory, for the main part, is left to take care of itself. In order to try to define what is happening, and to understand where the further exploration of virtual reality (VR to its inhabitants) may lead, it may be helpful to position a few astral marker buoys around the known constellations of cyber-art practice and potential.

One might have expected to find some clues to cyber-aesthetics from innovative art practice in the real world. According to Baudrillard, however, the art world is now itself so contaminated by market-value systems that art no longer has any aesthetic consistency. Instead there is only 'the fascination that replaces aesthetic pleasure', a kind of hyper-realism that has transported every form of art into 'the transaesthetic world of simulation'.[1] Dissatisfaction with this superficiality is one factor which might be supposed to have contributed to the interest of artists pioneering the new technologies. Yet, whilst it is true that there are some interesting ideas being developed in art on the Net, most of the creative energy is going into what Dike Blair has described in *Flash Art* as the 'electronic equivalent of American old-west homesteading, a rush by every artist with a modem to stake claim on some small plot of pixels in cyberspace'.[2] Just as in the real world money games are where the action is, so in VR the bulk of commercial investment has been in the entertainment industry, and it is not surprising therefore that most Net art is based on concepts and programmes derived from games-playing and does not succeed in transcending this superficiality.

However, it may be that conventional notions of the function of aesthetics have no place in cyberspace anyway, as an altogether new way of experiencing the world may evolve. The Canadian media artist Hank Bull has compared the process of being on-line to a kind of physical dematerialisation: 'What the Network does basically is extend our nervous system around the globe so that it *becomes* your body'.[3] This decentralisation of human existence, it is argued, contains the potential for a new form of psychic entity – marriages of minds based on a multiplicity of simultaneous in-space unions. Such fusion could in theory be the basis for a new kind of aesthetic based on creative interactions between minds working in 'massive parallel' – the term used to describe the linking of a series of high-power computers to work in tandem on a particular problem. This would mean that intelligence amplification (IA), originally conceived as the enhancement of human intelligence through linking it with 'slave' computer power, was extendible to comprise the linking of human minds to increase their capacity to perceive new truths.

There is a metaphysical, even a theological, dimension to this massively parallel 'human-human interaction'.[4] Cyberspace can be seen as an energy field in which human consciousness interfaces with a transcendent, electronically sustained, totality. At random intervals the dynamic of communicated consciousness is capable of creating an uncontrollable vortex which forces one state of reality to crash into and through another. As the clash of tectonic plates forces new continents to surface, so this process thrusts an apprehension of the eternal into the present. This is the *nervous aesthetic*. Immersion in this process introduces the individual to a new and different way of experiencing the fundamental unity of the world. Apprehension of loss of the personal in the face of the apparent autonomy of technology gives way to intuition of the *becoming of meaning*.

In this context cyberspace seems to hold the promise of granting 'the ultimate power, enabling its audience not merely to observe an alternative reality but to enter and experience it as if it were real'.[5] Sean Cubitt makes even greater claims, welcoming a medium 'that puts maker and reader alike into the process, which is so profoundly unfixed that it will alter as, through its agency, maker and reader become friends, lovers, disputants, enemies, athletes, equals. Mediation, like love and argument, makes an equality by which both partners are

Marcos Novak, Cave Chamber, from 'Dancing With The Dervish: Worlds in Progress' – another L-system chamber, this one employing rhythmic patterns of Sufi poetry and exploring Oswald Spengler's idea of Magian culture

increased'.[6] In other words, Cubitt enlarges the concept of IA to become the amplification of human empathy.

This implies that the traditional notion of the aesthetic based on the linear succession of producer/workshop/audience is giving way to a process which pulses simultaneously between a constellation of polarities. Here the origin and the experience of 'the work' are identical for maker and user, dissolving the conventional artist/audience relationship. The work arises at the critical juncture where creativity is set free, knowing no author – where consciousness becomes universal. The audience, in a meaningful sense, *becomes* the work. Furthermore, since all are free to participate in construction of the work/experience, the art object, where it still exists, becomes a by-product of the dynamic – a residual husk of documentation or other evidence testifying to the moment that has been. Cyber-art is collapsing the Modernist notion of aesthetic autonomy. It could also be said to have parallels with the ecological aesthetic, in that its power resides in the quality of the interactions it makes possible.

Critics, like Sean Cubitt, however, point back to the problem with cyber-art itself: few works being produced by artists are actually as interesting or creative as the applications on which they are written. He argues that it is the people who build interactive programmes such as Photoshop, Director and Hypercard who are taking the lead in exploring the possibilities offered by the new technologies. Artists are not necessarily rising to the kinds of challenges set by virtual reality. Too many art programmes on the Net feature shadowless images whose meanings are as self-referential as they are ephemeral – perfect examples of Baudrillard's 'transaesthetics of banality'. The interactivity of cyber-art in the end translates as no more than multi-sited split-screen collaboration on image, or games-type projects in which the limits to interaction are predetermined by the authors. Such are the much-hyped experiments with MUDs (multi-user dimension games), in which players adopt and interact through 'incarnations' of their own choosing. These 'art-like' interactions do have some of the creative possibilities of art (as indeed do some of the commercially released games, *Myst* being the most quoted example). The problem with this work is that it is fixated on supplying the market with the passive, consumer-led aesthetic of fantasy-oriented cyberspace, in which the history of human art and creativity has become a data-resource for style-games: 'I can make Cubist posters one minute, Expressionist stickers the next, and Pointillist badges after that', smirks the small boy in the blurb for Microsoft's *Fine Artist* programme. This cy-fi notion of creativity cannot replace or even enhance the real world: the future has to lie elsewhere. What is now needed, therefore, is a responsive post-technology aesthetic, based not on visual criteria but on the dynamics of communicated consciousness.

In the badlands of the Net there is also evidence of cyber-abuse. Firstly there is the possibility that a pathogenic aesthetic may arise to infect VR, and from there invade the real world. Liberal arguments for a 'free zone' for creativity on the Net may also imply complicity with the negative aspects of this, embracing pornography, racism, paedophilia, and other forms of criminality. The complementary concern is the possible alignment of the new aesthetic with the forces urging censorship and policing on the Net. This correspondence of aesthetics with censorship is not so far-fetched. A superintendent of the Metropolitan Police, investigating a on-line credit card fraud by teenagers, recently stated the case:

> This Internet is absolute dynamite, and it is *without any form of quality controls.* The authorities are increasingly asserting their right to impose censorship and control on cyberspace, and the problem is that 'quality control' here is interchangeable with thought control.

There is another negative agenda for cyber-art. Richard Wright cautions against a scenario in which 'bereft of any humanitarian ideals, technological determinism is left to pursue increasing functionality and a spiralling extrapolation of its specifications', and where consequently 'the goal for the electronic media artist is assumed to be that of increasing quantities of tools for more and more minutely controlled manipulations of the image'.[8] There is a concern that, in the excitement of technological discovery and mastery, artists may be allowing their aesthetic inventiveness to atrophy, losing the 'wet-ware' (human) qualities that Cubitt and others are praising. It seems that as we move into virtual reality we run the real risk of exchanging our mortal souls for a future haunted by wraithlike simulacra of our outlived incarnations, sailing for ever through cyberspace to the leitmotiv of the Flying Dutchman (whom it is tempting to see as the prototypical Stick-in-the-MUD).

The claims that cyberspace may be a new transcultural and democratic zone in which each participant is a pixel of equal value, able to develop its own communication system outside the dominant culture and institutional traditions, also have implications for the aesthetic. Here the margins seem to be breaking up and migrating towards the centre. This is a powerful incentive for the disenfranchised, the dispossessed and the young to have an input. The *Digital Diaspora* Conference at the ICA this

June, and artist groups such as CTN (Cultural Transmissions Network) in Manchester, are exploring opportunities through which to formulate and communicate their own cultural experience. However, Third World countries, the poor and others lacking access to the Net remain disenfranchised. Not all contemporary problems have relevance in cyberspace, and the issue of whose voices and which language are to be heard remain unanswered.

Cyberspace is a visually oriented zone of experience. The continuing reliance on text imposes intolerable limits on the new communications technology, and is generally expected to be swiftly superseded by alternative modes of thinking and communicating. How this will be achieved is difficult to predict, but it will undoubtedly affect the evolving aesthetic. The process of replacing words by graphics was set in motion by AppleMac with its adoption of visual symbols (icons) to replace verbal commands. In some of the CD ROMs created by artists there now seems to be a move beyond image/text to ideograms representing an instantaneous fusion of idea with reality. The need for a clear and workable system of synthesising word and image is seen as an international priority, with Japan leading the field. Researchers at Nippon Telephone and Telegraph (NTT) have been seeking for some years to realise 'Vizthink', a Visual Thinking environment for creative work based on traditional *kanji* pictogram communication.[9]

The impact of the interactive multiple imagery in computer games is already affecting how we behave in real-life situations. A 'click-on' aesthetic is emerging, based on the instant obedience of the symbol to the command to deliver up its meaning. Dike Blair describes his experience, after a week spent playing *Myst*, of finding himself mentally clicking on objects in the real world to see what they might have to offer, and explains that: 'The empiricism I apply to the "real" world had been significantly interrupted. Doors looked less real, walls less solid, the magic function of a light switch was amplified'.[10] Clicking becomes a visual equivalent for the interaction of smelling or touching an object in the real world in order to discover its potential. Visual aspects are enhanced, but at the expense of those attainable through the other senses.

What we have therefore, for the time being, is the aesthetics of the gap, where a new multi-rooted 'language' is evolving, located along the fault-line separating the real world from the world of cyberspace. This is mutating so rapidly that our linguistic and cognitive mechanisms are overloading: we are in danger of psycho-crashing. We are not dealing with the fixed truth/beauty principle of old, but with a mobile aesthetic based on a nebula of truth particles pulsing around hot spots of creative energy. This is a subversive, *gastarbeiter* dynamic, flowing and ebbing with the creative edges, a product of the interactions between participating minds. The old vision of culture based on a linear grand narrative is displaced in favour of an instantaneous dynamic consciousness. Thus it is in the quality of the interactions which this participatory dynamic makes possible that the aesthetic is to be found. Again, there are parallels with the emerging ecological aesthetic, where it is the continuum, not the consumer, which is the client.[11]

In conclusion, one might say that from the evidence available one can deduce which elements may contribute to the evolution of a cyber-aesthetic based on communicated consciousness. Initially, it will not be the product of fixed principles, but will continue to mutate as circumstances require – as a migratory aesthetic. The aesthetic is unlikely to emerge from the art world, or the insight of individual genius: its adoption will rest on consensus rather than the autonomy of any one element. By the same token this aesthetic will probably not reflect the values of any particular cultural group or political ideology, but should allow for an equality of input by those that are disenfranchised. It is probable that this aesthetic will increasingly demand its own language, and this will probably be an evolving fusion of image and text. Finally, perhaps more controversially, the new hyper-aesthetic may include an ethical dimension, based on what one might term the collective experience of immanence.

e-mail: Sealion@projenv.demon.co.uk

Notes

1 Jean Baudrillard, *The Transparency of Evil*, 1990.
2 Dike Blair, 'CD-ROM Persuasion. The Computer Entertainment Myst', *Flash Art*, 1995.
3 Hank Bull, Artist, Vancouver, *Littoral: New Zones for Critical Art Practice*, Conference transcripts, 1994.
4 Takaya Endo and Hiroshi Ishii, NTT Visual Media Laboratory Annual Report 1989, quoted in Howard Rheingold, *Virtual Reality*, 1991.
5 Eric Gullichsen & Randal Walser, 1989, quoted in Howard Rheingold, *Virtual Reality*, op cit.
6 Sean Cubitt, Video Positive '95 Exhibition Catalogue.
7 *The Daily Telegraph*, June 10, 1995.
8 Richard Wright, *Soft Future*, Variant, 1993.
9 NTT Report 1989, op cit.
10 Dike Blair, op cit.
11 Newton and Helen Mayer Harrison, *Littoral: New Zones for Critical Art Practice*, op cit

SHEEP T ICONOCLAST

ARCHITECTURE: THE VIRTUAL IMPERATIVE

I meet a number of architects who claim they are interested in virtual reality; for me the question lies in when virtual reality will be interested in architects.

Each year we take some of the students off to inhabit (for about eight minutes) a virtual world. The experience is both exhilarating and disappointing: the disappointment is obvious – the equipment is bulky and uncomfortable, and the user is frequently reduced to the state of part ghost (nothing is solid) and part child. Even the simplest tasks like pouring a cup of tea become difficult, requiring new skills. Equally these could be treated as fascinating: what else could make the process of making tea and walking round a kitchen 'new' again? The sense of immersion, of 'being somewhere', however, is overwhelming. Listening to people talking 'outside' in the 'real' world gives you the sense of hearing voices on the radio. Physical limits such as walls now become invisible force fields.

The primary disappointment is naturally the 'world' you are now inhabiting. You could be anywhere – a desert, in the middle of an ocean, orbiting a star – yet, you tend to end up in a house or kitchen, an office (complete with a sports car, for some reason), or for the more militaristic, fighting your way though a war-torn village. Interestingly, given such an unlimited set of possibilities, the reality engineers have chosen domestic space as the grand entrance into the 'brave new world'.

My interest in virtual reality was focused by a lecture given by the 'shared' virtual reality researchers at the computer science department in Nottingham University. Their interest in turn, was not virtual reality but how to approach the problem of unplanned communication. Being a network, not a person-to-person connection like a telephone line, multimedia communication in the distanceless world of cyberspace is a babel world, a huge party line where everyone is simultaneously broadcasting to and viewed by everyone else. Currently transmitting signals down the Internet is a little like being a high-tech radio-ham operator: users need to take turns in speaking; everything is complex and explicit. The Nottingham solution was to recycle many of the conventions of real space to aid the artificial communication in cyberspace.

For two hours I heard a description of their 'space', where people take on a pseudo-physical, three-dimensional form (such as a crude cube with eyes), and everyone is surrounded by an 'aura'. When two auras collide then a speech channel is automatically enabled, the terms expanded, your virtual self has a 'nimbus', the zone which you can 'see'. You are aware (can hear) what is going on in the nimbus around you. A stranger 'walking' past a conversation, can eavesdrop on part of what's going on – they might stop and join in. The metaphors flood in: there might be an auditorium, the lecturer might stand on a podium which would amplify their 'aura'. To engage in a private conversation you might use metaphorical 'walls', which would be impenetrable to objects (people) and auras (sound).

Looking at the worlds projected on the screen before me, I saw that these people were defining the necessity for a 'virtual' architecture, buildings in cyberspace. The image of the Gibson-like corporate data matrix made a step nearer to fact. The utility of these virtual environments will be undoubted, for example, where a meeting between an architect and a consultant requires the client to travel, perhaps for up to two hours for an hour's meeting, to see the model or information defining the building. A virtual world would give the consultant more time to deal with clients while giving them a higher probability of finding the consultant in. Nothing is fixed here, no possibility is excluded: just as the fax never replaced the telephone call, and the telephone never replaced mail, so virtual environments could not totally replace real meetings. Having experienced this, there is something strangely helpful about having even a mundane conversation while seeing the other person flickering in front of you.

Advertising companies, like most organisations, face the internal communication problem: how to keep staff talking and generating new ideas. The office space could be sectioned by skill (for example, put all the researchers together, all the copywriters together, and all the managers together) or by project (put the 'soap powder' people together). A common problem, but virtual-designers are proposing an uncommon solution: to abandon the notion of desk altogether. As a natural extension of hot-desking, all the information for a project is

FROM ABOVE: Screen grabs of currently available three-dimensional cyber-architectures http://www.kaworlds.com/news/950216/worldsfair/howitworks.html image taken from the Web; frames from Pangea, an architectural virtual reality application currently under production

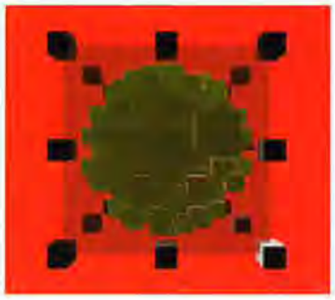
now stored on-line. During work the two-dimensional desktop is 'shared', all of the sections of the project are visual, and by clicking on the image of a co-worker a telephone call can be connected to wherever they are. While a conversation takes place the project desktop shows images of the participants talking to each other. Other workers can see this occurring and can listen or join in. In effect, the computer-space plays an ancillary role to that of corridor, office space or meeting room. Architecture has a wealth of experience in understanding these space relations, which the computer-supported co-operative researchers are beginning to appreciate.

In the world of computing, architecture is being introduced as a key way of navigating and describing complex information storage. Taking off from where the Apple Desktop interface started, the Magic Cap interface uses room, corridor and street metaphors to construct an intelligible environment within which the user can work. The Magic Cap interface is an entrancing two-dimensional simulation of a small personal urban landscape, your own 'house' is connected to a High Street, on which there exist shops which provide a number of facilities (banking, post office, travel). Each Magic Cap machine is capable of communicating with international networks from wherever the user is based, creating (one day) a hyper-urban landscape. It cannot be insignificant that this virtual environment is using urban architecture to help interpret and organise a large amount of information; cities are familiar to all computer users, while the city metaphor is also a way to interpret large complex systems.

Recently there has been research in developing 'Virtual Reality Modelling Language' (VRML), which hopes to bring a three-dimensional view to the normally flat HTML (Hyper Text Markup Language), the core page description in the World Wide Web. The intention is to form a three-dimensional environment which would allow the forming of interactive links to any computer for representational information. The intent is to apply the notion of dimension to aid the understanding and layout of the content. VRML is an attempt to use space to navigate the vast, complex info-web under construction. This is, in many ways, analogous to the process of using an exhibition or museum display to give context to and display knowledge. The museum in this case is dimensionless but stretches across the planet.

The virtual museums and virtual libraries of the future are already being prototyped. If you have time, visit the Micro Gallery room at the National Gallery in London, if not, the CD ROM version is available. The Louvre is already partly available on-line over the Internet, however, be warned: many virtual galleries are still 'under'-designed.

VRML possesses the possibility of creating a free form virtual building(s) the size of the Internet; a meta-city covering the globe. Such a city will need to be planned and constructed to stop the cyberspace becoming a confused cyber-labyrinth. The Internet is the demonstration of the anarchical (now termed 'self-organising') environment, the success of planning will come



ABOVE: Two images formed on Pangea; LEFT: Interactive social virtual spaces are starting to evolve on the Net. Net image obtained from http:// www. kaworlds.com/news/950216/ worldsfair/mich.html

only by competing and excelling disorder. No one runs or directs the Internet – the situation is inclusive – multiple meta-cities can function in parallel, imposed over the huge 'dataglut' of available information. It is important, however, that architects give themselves the opportunity to deliver the high-quality alternative. This opportunity will only come when architects begin to operate in the synthetic environments that systems such as VRML introduce. As VRML version 2.0 also includes the possibly of shared three-dimensional environments on the desktop-level machine, the possibilities are stunning.

The true function of these shared virtual worlds comes through a realisation that 80 per cent of the information flow though an organisation occurs though 'unplanned' meetings. The ability to reorganise the 'workspace' opens up a number of possibilities. The Internet is a place of 'meeting', the primary tools being: NewsNet, an open bulletin board visible around the world, which is where people talk and argue (dubbed 'Flame') over various topics, and e-mail, the World Wide Web which exists for individual communication. The most interesting analogy is that of 'MOOs' and 'MUDs'. A MOO (MUD Object Orientated) is a shared extension of the old text-based adventure games. A MUD is normally a fictional environment, where people agree to play roles in order to have adventures (frequently of the Tolkienesque variety). MOOs emerged from MUDs and are just talking shops. (This finds me sitting on the sofa sharing gossip about people I have never physically met.) The other fascinating thing about MOOs and MUDs is the ability to be in several places at the same time. MOOs and MUDs, however, are both meta-spaces and they need space to be the backdrop to which interaction can occur.

Currently all these spaces are designed by the people who program them. This is not problematic (many pleasant villages have evolved 'naturally' without architects) but as the virtual space becomes larger (last year the Internet grew by 150,000 per cent), we can expect to see a transition from 'home brew' designs to improved designs. Similar to the development of film, where the early audiences were satisfied with trains entering stations and workers leaving a factory gate, the material spoke for itself, and after a while the audiences needed 'content', which gave rise to the modern film. Virtual reality is now moving from the high-tech to the non-physical production of content.

The collision between information technology and architecture is not limited to walking around with what can only be described as a brick strapped to your head. By creating a two-way video link constructed from a number of tiled television sets and cameras, it is possible to give the impression of a full-length mirror which allows the viewer to appreciate what is happening in another space. As with a security camera the view is constantly 'on', and, on seeing someone in the 'mirror' it is possible to approach them and begin a conversation. In essence it is possible to create a link between spaces, forming a new space which no longer obeys the laws of Cartesian geometry. Alternatively the mirrors can be programmed to capture past events, replay them briefly then look for something new. By capturing the 'tracks' of the inhabitants, these mirrors are capable of distorting the notions of time. The formal possibilities of the architectural utility known as 'computer-supported co-operative working' have only just begun to be explored. As the stock of old buildings grows and the refurbishment of buildings becomes a large industry in its own right, the opportunity to double the size of an office by linking two separate buildings becomes an interesting possibility. Facility managers might also be interested in the possibilities of creating temporary 'spaces' for short-term projects. Events can then be held in a similar manner to the ICA's Terminal Futures conference, where the limited space inside the lecture rooms was compensated for by building video walls in other open spaces in the building which permitted the audience to be much larger than would physically fit. These new possibilities must also lie under the new language of space encompassed by the term 'virtual environments'.

This is not to imply that any of the activities I have mentioned are trivial. The worst designs in all fields come from the misuse or, worse still, misunderstanding of the capabilities of a material. This has important side effects when considering the way that architects can take advantage of the new information technologies in the process of making physical form. The inappropriate choice of technology can mean expensive hardware sitting idle, rather than a new leaner, more flexible meta-corporation. What is needed is an information-architect, someone who can interpret both worlds to mutual gain.

Currently, the whole notion of virtual reality is underdeveloped. This repels many, the easy and convenient functionality of developer-friendly multimedia packages that are still evolving. The construction of a virtual environment today is still close to low level computing skills, of which the ability to programme is still the most useful. This underdevelopment actually appeals to a number of potential reality architects, the ability to form new conventions and metaphors; a new language to the medium appeals to these early adopters. While many companies engaged in virtual reality have a pretty naive view of how architects might use a virtual environment (to

take the client on a tour of the building before it is built is the most common), architects tend to have a naive view of what virtual reality is and what it could be. I feel that there will have to be a period of closer exchange before both virtual reality and architecture can synthesise into a fruitful relationship. The gap however between CAD and virtual world design is narrowing, giving architects a head start in the race to colonise the new internal frontier.

The process of training the information-architect has already begun; John Frazer at the Architectural Association has just published *An Evolutionary Architecture* which covers his experience with his students over several years, exploring the notion of evolution as a way of informing the design process. As he points out, this is not the first time architects have taken inspiration from nature; however, it does break new ground by copying the process not the result, and so thereby making a new range of unimaginable forms viable. In the innovative MSc in computing at the University of East London, Paul Coates is pioneering a range of form-generation processes necessary to explore the fundamental meaning of 'form', by studying the rules that can be applied to generate it. Steven Gage at the Bartlett School of Architecture has adopted the use of computing to explore the possibilities of providing a silicon 'nervous system' to the building. The Bartlett has also been innovative in introducing computer fine artists Nina Pope and Rory Hamilton, and helping to push computing away from technical drafting into the zone of creative cyber-art-toy. The unit run by Neil Spiller has focused on cyberspace and in the process created an on-line gallery portfolio of student work. In this atmosphere Bartlett students can learn about the formulation of interactive multimedia, how to net-surf or establish a presence in cyberspace. In the role of furthering computing after CAD, the Bartlett has also initiated the introduction of a new MSc in Virtual Environments. This course will come on-line this year, allowing postgraduate architecture students to explore the hands-on experience of virtual space. These are just some of the changes being hatched in the forgotten computer/CAD laboratories in architecture schools around the UK.

As the Internet grows, students from architecture schools have been slowly linking up, creating new post-national cyber cultures. In the near future it is possible to see the appropriation of collaborative work in the foundation of trans-spatial multi-institutional, trans-national, teaching projects and resources.

Recent graduates have been taking advantage of the new possibilities for architects: in the last year I know of two students who have graduated and moved into the UK games industry. As games such as Doom (which is primarily an architectural experience) have pushed that industry towards three-dimensional design, architects with a mix of graphics, artistic, technical and, above all, spatial awareness have found a new home for this new form of 'unurban' design.

It is pleasing to see students who realise that a virtual environment does not have to be seen as a digital model, which can only exist as a fake forerunner to the real world. The urban-infoscape need not be dominated by the largely irrelevant features of shelter and protection.

As the UK slowly cycles into the information economy, the concept of exploring and exploiting the information collected, and currently sitting in the databases in each business, has begun to be recognised. Currently, a stock market trader can have access to a thousand share prices at once while looking for relationships between them; however, the number actually viewed is much less than this. The 1990s saw the reversal of information depravation into information overload. What is emerging in response is the gradual commercial adoption of the notion currently defined as scientific visualisation. These visualisations are about constructing templates which can represent the information in simple but meaningful ways. Given the amount of information present, they are frequently three-dimensional, using notions of light, space, colour, position, texture and form to convey normal abstract information in a comprehensible manner. Architects are better suited, than many, to the task of designing these subtle info-space business visualisations to a greater degree than computer scientists. These skills will create a demand for a much more hyper-spatial vision of architecture.

The overlap between the virtual-environment and the CAD system will inevitably grow (being the same technology but faster), and it is not inconceivable that a practice may work on spatial and trans-spatial projects at once, designing the new headquarters' 'info-space' as well as the physical building, and being able to compensate for weaknesses on one by adjusting the other. I personally find it encouraging that some of the many superb schemes, which sit on drawing boards around the country, could find a useful and aesthetic role in cyberspace. Exactly how many architects are entering virtual environments is still difficult to tell, but if architects fail to appropriate the notion and importance of the virtual environment, then they may be seen to be failing to understand the meaning of architecture itself.

Sheep T Iconoclast can be contacted on sheep@bartlett.ucl.ac.uk

SARAH CHAPLIN

CYBERSPACE: LINGERING ON THE THRESHOLD

Architecture, Post-modernism and Difference

William Gibson, who actually coined the term 'cyberspace' in his 1984 cyberpunk novel *Neuromancer*, describes it as 'Slick and hollow, awaiting received meaning',[1] implying a state of anticipation, of emptiness. Cyberspace is an electronic world awaiting our imagination and our inhabitation, which does not even exist yet in the full sense of Gibson's definition: 'a graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data',[2] although it already has a partial existence in finance and communications; cyberspace has been described as where our money is and where we are when we're on the telephone.[3]

Over the past few years, the concept of cyberspace has been infiltrating everyday experience: there has been a plethora of television programmes, journal articles, interactive arcade games, whilst firms such as VPL, Polhemus, SimGraphics and Autodesk in the States, and Division, Dimension, and W Industries in the UK have been designing virtual systems which have infinite applications for education, health, defence, scientific research and entertainment.[4] In the past few decades, science fiction has projected and articulated the concept of cyberspace, affording us an insight into its potential effects on society and culture, thereby facilitating its absorption into contemporary consciousness, implicitly and explicitly.[5]

These technological and literary developments have precipitated an epistemological threshold, causing William Bricken to comment: 'Cyberspace is now in the unique position of being commercially available before being academically understood.'[6] This may be the case with all new technology, in that the academic critique becomes an examination of the technical evidence, and is thus part diagnostic, part prophetic, part rhetoric.

It is not my wish to appear as a specialist in this field, nor to propose any new uses for cyberspace, but to address the underlying assumptions on which it rests in an effort to promote the academic understanding which Bricken feels to be lacking.

John Walker of Autodesk, in an article entitled 'Through the Looking-glass' posits that cyberspace is 'Hardware and software that provide the user with a three-dimensional simulacrum of the world, and that allows interaction in ways that mimic interaction with real world objects.'[7] Embodied within this statement are two fundamental assumptions: firstly, that cyberspace should necessarily simulate reality, and secondly, that interaction in cyberspace should necessarily simulate interaction in reality. Walker's formulation of our engagement with cyberspace is thus a straightforward metaphor of the way we engage with reality. But it is this mimetic assumption which I feel bound to question, since it affects the threshold between human perception and the virtual environment, and hence, most significantly, the development of cyberspace.

Since Walker's title infers that the act of crossing the threshold into cyberspace is analogous with the way in which Alice imagines it is possible to access a virtual world by stepping through a large mirror in Lewis Carroll's novel *Through the Looking Glass*,[8] let us consider for a moment what happens to her in this precursor of cyberspace, created in 1872 at a time when the world was not yet caught up in information technology and interface design.

In Carroll's surreal visualisation of the looking-glass world, Alice experiences not only a lateral inversion, but also an inversion of fundamental laws of physics, logic and linguistics, as she begins to navigate and communicate in this virtual place: plants seem to talk, biscuits are supposed to cure thirst, running on the spot brings about arrival elsewhere, Tuesdays can occur consecutively, and the looking-glass world is inhabited by living chess pieces and mythical creatures.

This somewhat naive treatment of a kind of cyberspace displays a tacit acceptance of fantasy, whilst allowing all its manifestations to be interrogated by Alice, thereby revealing the 'otherness' of the looking-glass world. There is no verisimilitude with respect to reality, beyond her initial discovery that the looking-glass room also has a fire burning in the grate. There is even a deliberate dissimulation in her looking-glass daydream, which she eventually discovers upon shaking the red queen and finds that it turns into her black kitten. The entire virtual adventure is brought about by her boredom with reality and a lack of human interaction.

Her version of cyberspace is a substitute reality, with infinite scope to explore its fascinating landscape, which is ordered like a large chessboard. Alice does not therefore travel randomly, but progresses from pawn to queen in a series of bizarre encounters which approximate moves on a chessboard. Upon becoming queen she finally takes control of her situation, at which point reality takes hold, and she finds herself back on the real side of the looking-glass threshold.

This perhaps contributes some received meaning to William Gibson's concept of cyberspace, but how does he visualise it himself? Case, the central character in *Neuromancer*, conveys the potent 'otherness' of cyberspace as 'a place of rapture and erotic intensity, of powerful desire and even self-submission,'[9] according to Michael Heim in his article 'The Erotic Ontology of Cyberspace'. Gibson shows how deeply the experience of cyberspace has affected the psyche of Case by referring to it as a recurring dream.[10]

Cyberspace as described by Gibson is full of metaphors which link the architectonic with the electronic, such as, 'Bright walls of corporate systems, opening windows into rich fields of data'.[11] Traces from real world are borrowed, re-configured and juxtaposed in the simulated world of cyberspace. Gibson evokes Case's long-awaited return to cyberspace, which takes place with eyes closed and a set of dermatrodes fitted against his forehead, and even has some similarities with Alice's version: 'fluid neon origami trick, the unfolding of his distanceless home, his country, transparent chessboard extending to infinity . . .'[12]

However, Gibson also works a reversal, whereby Case sees the real world as mimicking cyberspace: being chased through the streets of Japanese city reminds him of his virtual pursuits: 'In some weird and approximate way, it was like a run in the matrix.'[13]

Although such two-way comparisons illustrate the similarities between the real and the virtual, Gibson actually blurs the threshold, and makes the reader question the primacy of each world: which is a simulation of which? Which is the dominant mode of existence? The metaphors borrowed from reality work on a level of aiding the reader to glimpse the realms of cyberspace, rather than as a way of simulating them for the user. However, as with Alice's looking-glass world, the differences and discontinuities are also stressed; cyberspace in *Neuromancer* is far from an exact representation of reality, in both cases movement through the chessboard-like environment is not based on a space-time continuum, and contrary to Walker's suggestion, interaction cannot therefore mimic interaction with real world objects, which necessarily operate within this continuum.

Meanwhile, back at the computer interface, the majority of designers and programmers currently progressing virtual technology work strictly from Walker's premise, and regard the ability to produce virtual photo-realism in real time as an imperative. There appears to be a split between fictional and technological assumption: should cyberspace be an exact replica of the real world, or is it the ideal opportunity to create something new? Science fiction attracts our attention to cyberspace because it offers a radically different kind of experience to the type we are accustomed to, working on a level which Victor Schlovsky has called 'defamiliarisation'.

However, it would seem that as the enabling technology gathers momentum, designers of virtual soft- and hardware are happy to allow the differences between cyberspace and reality to be gradually eroded, until the experience of both will become practically interchangeable, thus perfecting a mutual simulation. This is the point at which I am suggesting we as architects, whether involved in theory or practice, should linger on the threshold.

The challenge which faces the architect is whether or not to accept the limited applications of the various virtual walk-through and fly-through programs currently available, all of which endorse Walker's implications regarding simulation of reality. While such programs offer the architect and the client a virtual haptic experience of the intended physical environment, this architectural application of the technology presupposes that virtual form is destined to become real, and must therefore behave as if it were already in the real world. Essentially, this use of cyberspace is still only a sophisticated means of drawing.

Cyberspace could, however, in proving Brenda Laurel's point that 'reality has always been too small for the human imagination',[14] open up a vast new array of possibilities, which maximise its potential to produce the unfamiliar. Thus architectural applications of the technology could go much further: we can inhabit cyberspace in a way we cannot inhabit drawings or models, which has led Jonothan Stoppi of Cadonmac UK to suggest that 'virtual buildings will be commissioned, designed and built as end products in their own right, and not just representations of, or preludes to, constructions in the real world.'[15]

In promoting this premise, Stoppi has encountered 'extraordinary resistance', which he surmises is due to the deep-rooted belief that architecture is primarily about providing shelter from the elements. He therefore set out to dispel this myth and show that cyberspace can therefore be a suitable location for a museum, a school, a tourist resort, meeting

place, a library, or a shopping centre, satisfying the needs of the individual through its virtual rather than its physical presence. In time, Stoppi envisages that all large companies will have a virtual headquarters, which owing to the absence of physical and economic constraints, could be a more viable and impressive alternative. Location is immaterial, and life-cycle costs irrelevant. Ironically, this makes the virtual headquarters more enduring, more easily updated and extended than its physical counterpart, cheaper in its execution and yet potentially more extravagant in its appearance. The first face-to-face international business meeting could in future take place at the virtual headquarters, each party being telepresent, thus saving on flights and other expenses incurred by actually meeting in reality.

This is to advocate the abandonment of reality. Even the act of designing such a building will eventually be possible from within cyberspace, thereby shifting the focus of creativity. So what is supposed to happen to reality? Well, our bodies are still there, and our physical needs still have to be attended to: 'real' architecture might then become a glorified ergonomic service zone, in which we eat, sleep, wash, exercise, breathe, and by gestural or other means, conduct our business and pleasure in cyberspace, our real body supported in a harness or hammock. These largely biological activities could all take place within the confines of a small studio flat. Do we go out? What happens to the city?

Scott Bukatman, in his article 'The Cybernetic City State', corroborates this scenario, commenting that 'If the city is now figured as an inertial form, it is so because of this new arena of action which has usurped the urban function.'[16] He refers to Gibson's version of cyberspace, stating that he 'explicitly constitutes it as a site of action and circulation.'[17] This is not to say that all of the action takes place in cyberspace, and reassuringly, Gibson does not conceive his dystopian vision of the future as one in which reality is expressly negated or excluded.

However, in contrast with the pristine realm of cyberspace, Gibson's portrayal of reality shows definite signs of neglect, which actually become part of its charm.[18] This aesthetic has already had some currency amongst a handful of architects, who seek materials and agents which have accelerated weathering characteristics, which patinate and become a dull gritty celebration of human use, even of perpetuation: has the dystopian cyberpunk revolution of science fiction ironically inspired confidence in the future, since signs of human occupation confirm our continued existence? Is this a side-effect of cyberspace, a reviving of our jaded senses, a sharpening of our retarded reactions to the real world? Whether cyberspace attempts to simulate reality or strives to be a radically different, more intense experience, reality begins to reassert itself, and in so doing attracts our attention to all its imperfections.

Either way, these mutual comparisons where cyberspace and reality define themselves in relation to each other, may seem implicit but are not inevitable: endless cross-referencing might preclude certain discoveries about cyberspace, a possibility which Meredith Bricken acknowledges. Advocating a non-comparative method, she maintains that treating the virtual as an entirely new principle, instead of an alternative reality, could result in our being alerted to possibilities which cyberspace has to offer, which could not have been pre-meditated by the user.[19]

The non-comparative approach is essential when considering the fact that the body and its means of locomotion may be reinvented in cyberspace: without restriction of gravity and without the normal figurative format of the human body, the structure and architecture of cyberspace are free from the old constraints of reality, and are able to invent themselves anew. Marcos Novak has commented that there are no hallways in cyberspace, only chambers, and circulation patterns therefore follow a different logic.[20] Virtual spaces can overlap, coalesce and mutate, as can the virtual body of the user. Gender is flexible or optional, and a whole new virtual persona may be invented. Cyberspace thus even allows us to explore the extent of our sexual conditioning, and could be said to confer greater equality, since status is not conditioned by sex, race or stature.

This can of course be extremely disconcerting: not only is our state of being transformed and displaced in cyberspace, but another virtually represented state of being may also be mistaken for ontological fact. Nothing then may be ontologically verified in cyberspace, things are taken at face value, even your own presence is rendered ontologically ambiguous.

Gibson alludes to the slippery nature of this feature of cyberspace, in characterising the Zionites, a sort of Rastafarian clan of space chauffeurs in *Neuromancer*, as being deeply sceptical of cyberspace. Rejecting the dubious displacement of ontological experience, they call themselves 'body people', who remain firmly rooted on the real side of the threshold.

Sanford Kwinter, co-author of the recent Zone publication *Incorporations*, appears to share the Zionites scepticism, and claims that cyberspace is about 'renouncing our deep polyphonic elemental and biological natures.'[21] In countering what he regards as the current 'slavish adulation and acquiescence' of virtual reality, Kwinter espouses a theory of 'Real Virtuality'. This theory, based on visceral resistance, and on the premise that real space is always multiple and intertwined,

full of emergent properties not physically there, is thus re-establishing the dynamic flux of reality, demonstrating for Kwinter the way in which culture is moving away from a classical epistemological framework of representation towards a model where effects are reflections of fundamental events occurring elsewhere, a paradigm which engages by convergence, and in which time features as 'something creative, indeterminate and therefore real.'[22]

As an example of this convergence, which offers a hybridised formulation of the threshold between virtual reality and real virtuality, and thus a tentative resolution of the discrepancy between the fictional and technological formulations of cyberspace which I have discussed, I wish to examine the installation which Toyo Ito made for the *Visions of Japan* exhibition held at the Victoria and Albert Museum in London in 1991. Ito, who admits that his quest is to 'cast off the weight of matter in search of lightness and transparency', offered this evocation: 'Room 3 is the simulated dream of the future world, combining . . . to create a state of information-saturated bliss: the dream of a new relationship between man, machine and the future.' [23]

Ito conjured up his own version of cyberspace, yet chose to locate it in reality: the experience of being virtually immersed in another world was ensured by being literally enveloped in images of another place and time as you moved through real space in real time. Interaction was invested in your freedom to make personal readings and secret connections between the random and continually changing welter of urban scenes, meteorological data, clouds, crowds, and the colours of Japanese life. Like a silent movie or the ethereal projection of a camera obscura, fragments of the real world were made strange and poetic.

A screen made up of sheets of liquid crystal, whose transparency could be freely controlled allowed the boundaries to be blurred between real images glimpsed through the screen and virtual images projected onto it. The floor was also luminous and semi-transparent, so that standing on it, you lost your shadow and your sense of gravity. There was also a series of objects positioned in the space, designed to allow a more personal feeling of contact, such as the *Hyoro,* which gave the opportunity to peer into the mind of a machine and see the space through digitalised eyes, thereby almost creating the illusion of looking back at reality from the virtual side of the threshold.

Ito's creation of a new relationship between man, machine and the future could be interpreted as an subtle example of what Wendy Kellogg has called 'augmented reality', where activities in real life are supplemented by actions carried out in a virtual or simulated environment.[24] Cyberspace is thereby 'distributed', making it another fragment of our already fragmented post-modern existence. This is not in order to make cyberspace technology easier to relate to, or to widen its public appeal, but to enable mutual enhancement to take place between reality and cyberspace, to set up a complementary situation, somewhere between fact and fiction, visceral and virtual. Finally then I would argue that lingering on the threshold is not to be characterised as a temporary position from which to assess either reality or cyberspace, but becomes a long-term meeting point, where the two worlds may themselves coincide and interact, where hybrid realities can emerge, and where architectural dreams may be satisfied in and out of reality.

All images are from Visions of Japan, *The Victoria and Albert Museum, London*

Notes

1 William Gibson, quoted in *Storming the Reality Studio,* Larry McCaffery (ed), Duke University Press, London, 1991.
2 William Gibson, *Neuromancer,* Grafton, London, 1984, p67.
3 John Barlow, *Mondo 2000, 1992 – A User's Guide to the New Edge,* Harper Collins, New York, p78.
4 For discussion of these technological advances and applications, see Howard Rheingold, *Virtual Reality,* QPD, 1991, London, and Barrie Sherman, and Phil Judkins, *Glimpses of Heaven, Visions of Hell: Virtual Reality and its Implications,* 1992.
5 See Larry McCaffery, op cit.
6 William Bricken, quoted in *Glimpses of Heaven, Visions of Hell: Virtual Reality and its Implications,* op cit, p21.
7 John Walker, essay in *The Art of Human Interface Design,* Brenda Laurel, ed, Addison-Wesley Publishing Company, New York, 1990, p444.
8 Lewis Carroll, *Through the Looking Glass;* referred to also in *The Fourth Dimension,* Rudy Rucker, Penguin, London, 1985.
9 Michael Heim, 'The Erotic Ontology of Cyberspace', *Cyberspace the First Steps,* Michael Benedikt (ed), MIT Press, Cambridge, Massachusetts, 1991, pp59-80.
10 William Gibson, *Neuromancer,* op cit, pp10-11.
11 Ibid.
12 Ibid, p68.
13 Ibid.
14 Brenda Laurel, quoted in 'What's the Big Deal about Cyberspace?' by Howard Rheingold, The Art of Human Interface Design, Brenda Laurel (ed), Addison-Wesley Publishing Company, New York, 1990, p453.
15 Jonothan Stoppi, 'Virtual and Real-time Interactive Spatial Modelling', Impacts and Implications, Proceedings of the 2nd Annual Conference on Virtual Reality International: London, Meckler, 1992,
16 Scott Bukatman, 'The Cybernetic City State – Terminal Space Becomes Phenomenal', *Journal of the Fantastic in the Arts,* summer issue, 1989, p45.
17 Ibid, p45.
18 William Gibson, *Neuromancer,* op cit.
19 Meredith Bricken, 'Virtual Worlds: No Interface to Design', *Cyberspace, the First Steps,* op cit, pp363-382.
20 Marcos Novak, 'Liquid Architectures, ibid, pp225-254
21 Sanford Kwinter, 'On Vitalism and the Virtual', *On Making,* Pratt Journal of Architecture, Rizzoli, New York, 1992, p188.
22 Ibid, p189.
23 Toyo Ito, *Visions of Japan* leaflet, V&A, 1991.
24 Wendy Kellogg, John Carroll and John Richards, 'Making Reality a Cyberspace', pp411-432, *Cyberspace, the First Steps,* op cit.

SADIE PLANT

NO PLANS

Here all boundaries fade away and the world reveals itself for the mad slaughterhouse that it is.[1]

This is a time of many endings and deaths. Modernity, history, and man himself have hit the skids of material change and now spiral into redundancy. The sciences, arts, and humanities lose their definition and discipline; law and order fall into decay; the social bond slips beyond repair.

Architects are neither alone nor immune from the viral contagions which are munching through the stabilities of the old world. Self-assembling systems, smart materials, intelligent buildings, computer generations, and virtual space destroy the pretensions of both architecture and design.

There is no salvation in some aftermath position, no post to be attached to the front of architecture: as is the case with postmodernity, the *posts* only serve to prop up the past. But there is an emerging cybernetics of space, a new anarchitecture of self-assembling systems which is a matter less of the end of control, than the end of the illusion of control. What dies is less the fact of architecture as a distinct and specialized zone – although this will undoubtedly fade away – but the myth of its self-importance in the construction of space, the built environment, and the function of those who once drew up the plans.

Like the cities which emerged with the commercialisation and industrialisation of the modern world, cyberspace appears to be ripe for development: speculation, regulation, government control. Both states and corporations would love to move in. Communitarians who dream of virtual Town Halls, and the Super-highwaymen of the Infobahn, invest their hopes in a clean and ordered corporate world. Demands for surveillance, regulation, and censorship proliferate. But cyberspace is not that sort of place. In any case, such zones have always been out of control.

Stalin, Hitler, and Mussolini all had plans. In Germany, fascism loathed the metropolis: 'the melting pot of all evil . . . of prostitution, bars, illness, movies, Marxism, Jews, strippers, Negro dancers, and all the disgusting offspring of so-called "modern art".'[2] In the Soviet Union, Stalin's Moscow epitomised the Marxist sentiment that 'architecture had to be expressive, representational, oratorical. Every building, no matter how modest its function, had henceforth to be a monument.'[3] As for Rome: 'My ideas are clear', declared Mussolini. 'My orders are precise. Within five years, Rome must appear marvellous to all the people of the world – vast, orderly, powerful, as in the time of the empire of Augustus . . . you shall create vast spaces around the Theatre of Marcellus, the Capitoline Hill, and the Pantheon. All that has grown around them in the centuries of decadence must disappear.'[4]

Although the pact between planning and authoritarianism was sealed, the city which was to overcome evils such as these was never built. Centralised control was an impossible dream. Cities, like cyberspace, are not objects of knowledge to be planned and designed, but cybernetic assemblages, immensely intricate interplays of forces, interests, zones and desires too complex and fluid for even those who inhabit them to understand. There are always streets unvisited, precincts which remain unknown, bars and clubs and corners and walls which escape the Panopticon's gaze. And 'one never retraces the same pathway twice, for the city is in a constant process of change, and thus becomes dreamlike and magical, yet also terrifying in the way a dream can be. Life and its certainties slither away underfoot. This continual flux and change is one of the most disquieting aspects of the modern city.'[5]

The thought that such cities could ever be ruled is almost laughable. They may be sites of government, but cities are also zones which obsolesce such power. There are still those urbanists and city fathers who think such functions are feasible, and there are even more cultural critics who think they should be. But even the most libertarian of plans tend always to become the planners' worst nightmares. In defiance of the blueprint, all those unpredictable additional features which don't look great on paper start to appear. Weeds and grasses lift the paving stones; drugs, prostitution, and graffiti move in.

And this is only part of the story. It's not so much that people get in the way of planners, but that cities have cybernetic lives of their

own. The street finds its own use for everything; even and especially streets themselves. The city assembles itself from a thousand trades and vehicles and contingencies. It is not a structure, but a culture, zones of cross-infection and continual mutation, seething networks of communication whose plans and planners tend only to add to the ambient cacophony.

It was such confusion and anonymity that first prompted the great regulatory moves of the nineteenth-century city fathers: the introduction of the census, sewerage and sanitation systems. The populations of the city are subject to levels of segregation and policing unknown in the rural worlds they left behind, but the complexity and careless anonymity of the city allows for a proliferation and sophistication of techniques of evasion, dissimulation, and flight.

There are still, of course, patches of pure design. Over-regulated, friction-free, and already smelling of cyberspace, today's shopping malls epitomise the closed circuits of a planned paradise. Games are forbidden in these labyrinths. Techno-utopians see only their gleaming streets on the superhighways of the information age, and no doubt such zones will emerge on the Net. But while virtual shopping is staking its claim, and government bodies are already in place, the Net will never become a mall.

Not even the most authoritarian of programmes has ever come close to blanketing cityspace with such spectacular nightmares. And if even the modern city has outgrown the planners' intentions and designs, cyberspace is harder still to claim.

Cyberspace has no architect: there were no blueprints, but piecemeal additions and emergent cultures, unexpected outcomes, and self-generating zones. It is an immense convergence of traffic and transport, goods and markets, messages, weapons, and desires. It is a shanty town, part of which squatted ARPANET, some of which was written by Gibson, and all of which continues to emerge more by accident than design. A tangle of unintended consequences; a mass of nets and world-wide webs.

As the Net continues to grow, and converges with all the old media – TV, radio, and telephone – it changes in quality, as well as size, passing through bifurcatory transitions just as villages once became cities, overnight. Even now, it's a jungle out there. The noise, the dirt, and the outlaw tendencies of the city are writ large on a Net whose hackers, pornographers, and underground dealers have already corrupted the technocrats' dream. Its traffic and markets are already black; its populations are uncounted, unknown, and riddled with a multitude of virtual agents and fractal connectivities: drifting orphans, cyberqueers, boygirl demons, scraps and pests. Anarchitectures of both streets and selves; the self-assembling matters of cyberspace.

And suddenly it was always so. Retrospectively, all spaces, their builders, and inhabitants, functioned as cybernetic systems in multiple layers of cybernetic space. And regardless of how they have defined themselves, architecture and its professionals were merely turning these spaces on.

Notes

1 Henry Miller, *Tropic of Cancer*, Panther, 1965, p186.
2 From the party paper, *Völkische Beobachter*, in BM Lane, *Architecture and Politics in Germany, 1918-1945*, Harvard UP, 1968, p155.
3 A. Kopp, *Town and Revolution: Soviet Architecture and City Planning*, Thames and Hudson, 1970, p227.
4 RC Fried, *Planning the Eternal City: Roman Politics and Planning since World War II*, Yale UP, 1973, p31.
5 Elizabeth Wilson, *The Sphinx in the City*, p3.

ROY ASCOTT

THE ARCHITECTURE OF CYBERCEPTION

Cyberception

Not only are we changing radically, body and mind, but we are becoming actively involved in our own transformation. And it's not just a matter of the prosthetics of implant organs, add-on limbs or surgical face fixing, however necessary and beneficial such technology of the body may be. It is a matter of consciousness. We are acquiring new faculties and new understanding of human presence. To inhabit both the real and virtual worlds at one and the same time, and to be both here and potentially everywhere else at the same time is giving us a new sense of self, new ways of thinking and perceiving which extend what we have believed to be our natural, genetic capabilities. In fact the old debate about artificial and natural is no longer relevant. We are only interested in what can be made of ourselves, not what made us. As for the sanctity of the individual, we are now each of us made up of many individuals, a set of selves. Actually the sense of the individual is giving way to the sense of the interface. Our consciousness allows us the fuzzy edge on identity, hovering between the inside and outside of every possible definition of what it is to be a human being. We are all interface. We are computer-mediated and computer-enhanced. These new ways of conceptualising and perceiving reality involve more than simply some sort of quantitative change in how we see, think and act in the world. They constitute a qualitative change in our being, a whole new faculty, the post-biological faculty of 'cyberception'.

Cyberception involves a convergence of cognitive and perceptual processes in which the connectivity of telematic networks plays a formative role. Perception is the awareness of the elements of environment through physical sensation. The cybernet, the sum of all the interactive computer-mediated systems and telematic networks in the world, is part of our sensory apparatus. It redefines our individual body just as it connects all our bodies into a planetary whole. Perception is physical sensation interpreted in the light of experience. Experience is now telematically shared: computerised telecommunications technology enables us to shift in and out of each other's consciousness and telepresence within the global media flow. By conception we mean the process of originating, forming or understanding ideas. Ideas come from the interactions and negotiations of minds. Once locked socially and philosophically into the solitary body, minds now float free in telematic space. We are looking at the augmentation of our capacity to think and conceptualise, and the extension and refinement of our senses: to conceptualise more richly and to perceive more fully both within and beyond our former limitations of seeing, thinking and constructing. The cybernet is the sum of all those artificial systems of probing, communicating, remembering and constructing through such means as data processing, satellite links, remote sensing and telerobotics which serve to enhance our being.

Cyberception heightens transpersonal experience and is the defining behaviour of a transpersonal art. Cyberception involves transpersonal technology, the technology of communicating, sharing, collaborating, the technology which enables us to transform ourselves, transfer our thoughts and transcend the limitations of our bodies. Transpersonal experience gives us insight into the interconnectedness of all things, the permeability and instability of boundaries, the lack of distinction between part and whole, foreground and background, context and content. Transpersonal technology is the technology of networks, hypermedia, cyberspace.

It is cyberception which enables us to perceive the apparitions of cyberspace, the coming-into-being of their virtual presence. It is through cyberception that we can apprehend the processes of emergence in nature, the media-flow, the invisible forces and fields of our many realities. We cyberceive transformative relationships and connectivity as immaterial process, just as palpably and immediately as we commonly perceive material objects in material locations.

The cybernet is the agent of construction, embracing a multiplicity of electronic pathways to robotic systems, intelligent environments, artificial organisms. In so far as we create and inhabit parallel worlds, and open up divergent event trajectories, cyberception may enable us to become simultaneously conscious of them all, or at least to zap at will across multiple universes. The transpersonal technologies of

telepresence, global networking, and cyberspace may be stimulating and reactivating parts of the apparatus of a consciousness long forgotten and made obsolete by a mechanistic world view of cogs and wheels. Cyberception may mean an awakening of our latent psychic powers, our capacity to be out-of-body, or in mind-to-mind symbiosis with others.

Cyberception is not just the extension of intelligence promised by CalTech's silicon neurons, the implications of the molecular computer, or Greg Kovacs' radio-linked interface chip-in-your-neck. It constitutes an entirely new (or renewed) understanding of pattern, of seeing the whole, of flowing with the rhythms of process and system. Hitherto, we thought and saw things in a linear manner, one thing after another, one thing hidden behind another, leading to this or that finality, and along the way dividing the world up into categories and classes of things: objects with impermeable boundaries, surfaces with impenetrable interiors, superficial simplicities of vision which ignored the infinite complexities. But cyberception means getting a sense of a whole, acquiring a bird's-eye view of events, the astronaut's view of the cosmos, the cybernaut's view of systems.

It is a matter of highspeed feedback, access to massive databases, interaction with a multiplicity of minds, seeing with a thousand eyes, hearing the earth's most silent whispers, reaching into the enormity of space, even to the edge of time. Cyberception is the antithesis of tunnel vision or linear thought. It is an all-at-once perception of a multiplicity of viewpoints, an extension in all dimensions of associative thought, a recognition of the transience of all hypotheses, the relativity of all knowledge, the impermanence of all perception. It is cyberception that allows us to interact fully with the flux and fuzz of life, to read the *Book of Changes*, to follow the Tao. In this, cyberception is not so much a new faculty as a revived faculty. It is a rediscovery of ourselves, after the human waste and loss of the Age of Reason, the age of certainty, determinism and absolute values.

Cyberception defines an important aspect of the new human being whose emergence is further accelerated by our advances in genetic engineering and post-biological modelling. And just as the cybernet is our community, we shall see increasingly, the replacement of the nuclear family with the non-linear family. The telematic culture may bring back to human relationships what industrial society effectively eradicated. Take life on the street now. I mean those streets just off the super-highway. Nothing is more human, warm and convivial than a bunch of kids hanging out on the Internet.

Our new body and new consciousness will bring forth a wholly new environment which returns our gaze, which looks, listens and reacts to us, as much as we do to it: smart buildings and tools which attend to our every move, our every utterance. We are not talking about simple voice commands at some crude computer interface, but about *anticipation* on the part of our constructed environment, based on our behaviour, resulting in subtle transformations of the *mise en scènes*. Just as we cyborgs see, hear, feel in ways unknown directly to biological man (although his myths and rituals always expressed his desires for self-transformation), we live in an environment which increasingly hears, sees and feels us. There is a community implication in all of this: cyberception impels us to redefine how and where we live together. In this process we must start to re-evaluate that material matrix and cultural instrument of society which we have for so long taken for granted: the city.

Architecture

The problem with Western architecture is that it is too much concerned with surfaces and structures and too little concerned with living systems. There is no biology of building, simply the physics of space: what we might call the 'edificial' look is all. There is an illusion of energy as this or that architectural genre or idiomatic impulse struggles to survive but it's really a matter of relative inertia: the classicists wishing to protect the total inertia, political and cultural, of a stylistic past, the modernists protecting the privileged inertia of a stylised present. There is little interest in radical change, or intimations of the future. Edificial images, superficial surfaces define the contemporary city. But to its everyday users, a city is not just a pretty facade, it is a zone of negotiation made up of a multitude of networks and systems. The language of access to these processes of communication, production

and transformation is more concerned with 'system interfaces' and 'network nodes' than with traditional architectural discourse. And, without the fundamental understanding, on the part of planners and designers, of the human faculty of cyberception and its implications for transactional behaviour, the cities will remain the arid and unwelcoming tracts of modernist glass and concrete or tacky post-modernist folly that we are generally forced to endure. We need to reconceptualise the urban strategy; rethink architecture. We need to bring into being the idea of zones of transformation, to accommodate the transpersonal technologies that are shaping our global culture.

Cities support and embody the interactions of people; the arts add value to such exchange. Today it is predominantly electronic systems which facilitate our interaction and connectivity, and the art of today is based on such systems. If it is through recent innovations in art and science that we have become aware of cyberception, it will be cyberception at the level of city planning and architecture that will lead us to the city of the 21st century. Art is no longer about appearance or representation, but is concerned with emergence, apparition, the coming-into-being of what has never before been seen, heard or experienced. Cities which are no more than a set of representations function badly. Their buildings may speak 'hospital' or 'school', for example, but unless they articulate these meanings within integrated, cybernetic systems, they lie through their teeth.

The city in the 21st century must be anticipatory, future-oriented, working at the cutting edge of contemporary culture, as an *agent* of cultural prosperity, as a *cause* of profitable innovation, rather than simply as an *effect* of the art and products of a former time. It should be a test-bed for all that is new, not just in the arts but in entertainment, leisure, education, business, research and production.

A city should offer its public the opportunity to share, collaborate and participate in the processes of cultural evolution. Its many communities must have a stake in its future. For this reason, it must be transparent in its structures, goals and systems of operation at all levels. Its infrastructure, like its architecture, must be both 'intelligent' and publicly intelligible, comprising systems which react to us, as much as we interact with them. The principle of rapid and effective feedback at all levels should be at the very heart of the city's development. This means high-speed data channels crisscrossing every nook and cranny of its urban complexities. Feedback should not only work but be seen to work. This is to talk about cyberception as fundamental to the quality of living in an advanced technological, post-biological society.

Just as architects must forget their concrete boxes and Disneyland decorations, and attend to the design of everything which is invisible and immaterial in a city, so they must understand that planning must be developed in an evolutive space-time matrix which is not simply three-dimensional or confined to a continuous mapping of buildings, roads and monuments. Instead planning and designing must apply connectivity and interaction to four quite different zones: underground, street level, sky/sea, and cyberspace. Instead of the planner's talk of streets, alleyways, avenues and boulevards, we need to think of wormholes, to borrow a term from quantum physics, tunnelling between separate realities, real and virtual, at many levels, through many layers. Similarly the paradigms and discoveries of artificial life science must be brought into play. The architect's new task is to fuse together material structures and cyberspace organisms into a new continuum. Architecture is the true test of our capacity to integrate into humanly enriching zones and structures, the potentials of the material world, the new consciousness, and virtual realities. In this enterprise many traditional ideas must be jettisoned, ideas whose inherent instability was always implicit in the dichotomies by which they were expressed: urban/rural, city/country, artificial/natural, day/night, work/play, local/global. The boundaries on these ideas have shifted or eroded altogether.

The city as an amalgam of systems interfaces and communications nodes is likely to be much more supportive of creative lives and personal fulfilments than the grossly conceived and rigidly realised conurbations of the industrial age. In place of their dense and intractable materiality, we can expect the environmental fluidity of faster-than-light pathways, intelligent surfaces and structures, and transformable habitations. The end of representation is nigh! Semiology is ceasing to underpin our structures. Buildings will *behave* in ways consistent with their announced function, rather than speaking their role by semiological implication. Appearance is giving way to apparition in art, and notions of unfolding, transformation and coming into-being are suffusing our culture. It will only be with the understanding that buildings must be planted and 'grown' that architecture will flourish. It is a growbag culture that is needed, in which *seeding* replaces designing. Architectural practice should find its guiding metaphors in horticulture rather than in warfare. Ultimately, we can perhaps talk about pollination and grafting.

Building, like cities, should grow. But without cyberception, the traditional architect and urbanist have no idea whatsoever of what we are proposing. To see that technology changes,

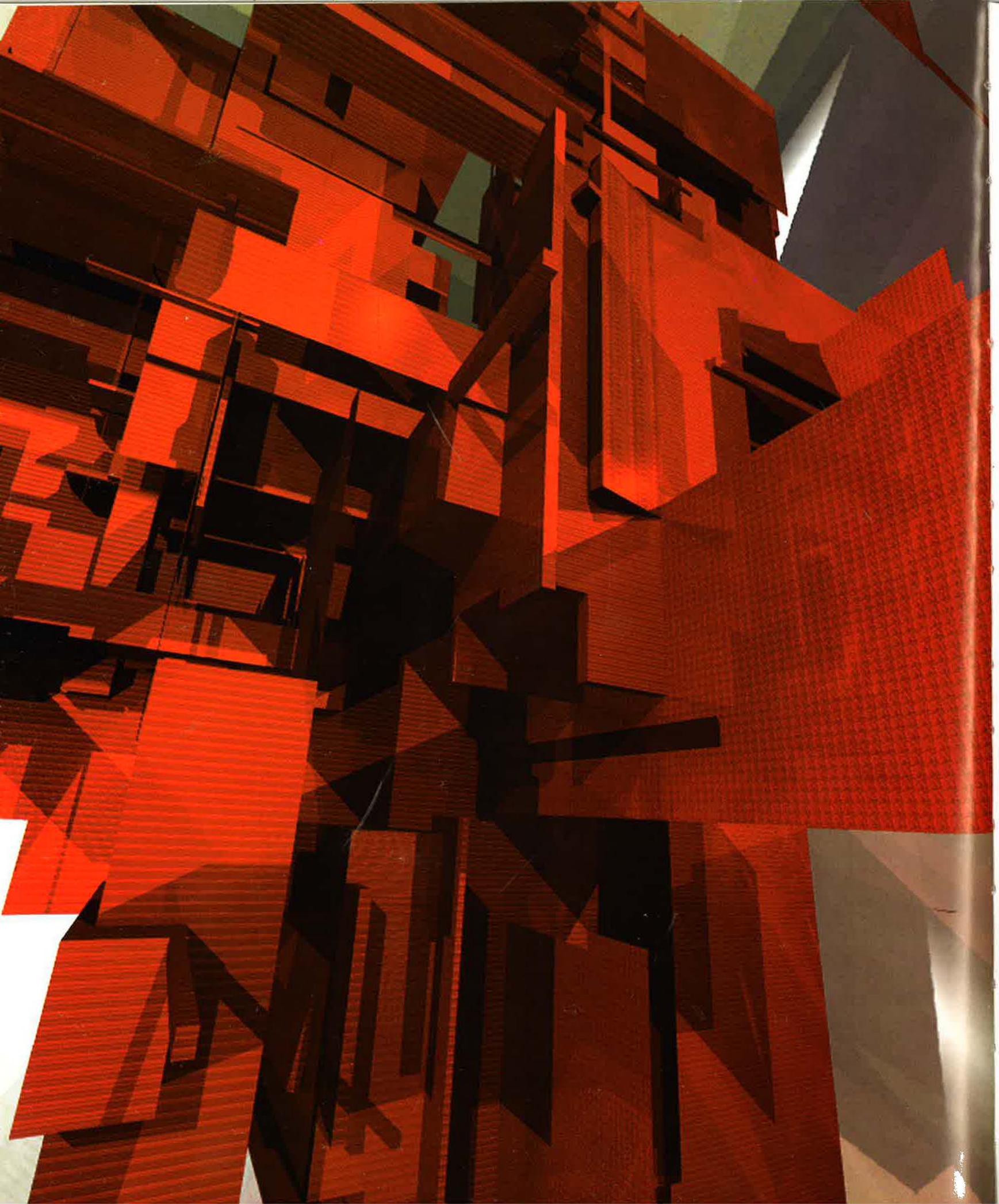
that building methods, economies, and planning systems change, but to fail to recognise that human beings also are radically changing, is a grave error. Perhaps classes in consciousness and gardening should replace the study of classical orders and historical canons of style and genre which stultify architectural education!

Where is there a building, much less a city, which supports a cyberculture, that sees cyberception as central to human sense and sensibility? Where is there an urban space in which we can fully celebrate 'Telenoia'? Where is there an architectural school which is, as a whole, united body, *determined* to create the conditions for the proper evolution of a truly 21st-century city? Where in architecture and planning are connectivity and interaction taken as primary principles of the design process? The debate in architecture should not be a matter of either/or. Either classical or modern, either new or old, either idealistic or pragmatic, either functional or frivolous. Between idealism and pragmatism, between conception of the desired and perception of the possible, lie the evolutive initiatives of cyberception.

As a frustrated HyperCard programme might say, 'Where is Home?', where we cybernauts of the turning millennium live? What is the nature of community and cohabitation in a telematic culture. How is cyberspatial transcience to be accommodated? Where are those zones that we can cyberceive as beautiful and fulfilling? We inhabit material forms with psychic dimensions set in the limitless boundaries of cyberspace. We are networked to the universe, our nervous systems are suffusing the cosmos. We navigate inner and outer space. We don't need buildings so much as we need ourselves to be built, or rebuilt from the genetic foundations which we are rapidly re-evaluating and may soon restructure.

Perhaps the most radical challenge to the old ideas of architecture comes from the consequences of telepresence, the disseminated self. When human identity itself is undergoing transformation, the collaborative mind and the connected consciousness replacing the unitary mind and solitary consciousness of the old order of Western thought, architecture must look to new strategies if it is to bring useful ideas about living and interacting in the world. Telepresence is the province of the distributed self, of remote meetings in cyberspace, of online living. Telepresence means instant global interaction with a thousand communities, being in any one of them, or all of them, virtually at the same time. Telepresence defines the new human identity perhaps more than any other aspect of the repertoire of cyberculture.

Contemporary architecture and shopping have become more or less the same thing. Architecture, having turned its back on the need for radical responses to the realities of the teleself and distributed presence, constitutes little more than a shopping cart world of boxed packages, wheeled around the sterile zones of a mall culture. Each building is a prettified and packaged product, each component mail-ordered from a catalogue. The 'have a good day' code of building practice has put the appeasement of tradition before collaboration with the future. But the need for an architecture of interfaces and nodes will not go away. We shall increasingly live in two worlds, the real and the virtual, and in many realities, both cultural and spiritual, regardless of the indifference of urban designers. These many worlds interconnect at many points. We are constantly on the move between them. In the creative zone, transience and transformation identify our way. Hi-tech chic and Bauhaus bluff will not fool our keen cyberception. Change must be radical. The new city, both in its visible immateriality and its invisible construction, will grow into a fruitful reality only if it is seeded with imagination and vision. It is artists who can become the sowers of these seeds, who can take the chances needed to allow new forms and features of the new city to grow. It is their cyberception that equips them with the global awareness and conceptual dexterity to resee, rethink and rebuild our world.



MARCOS NOVAK

TRANSMITTING ARCHITECTURE

transTerraFirma/TidsvagNoll v2.0

Here and there, sick lamplights through window glass taught us to distrust the deceitful mathematics of our perishing eyes. FT Marinetti, *Futurist Manifesto*, 1909.
Analogy is nothing more than the deep love that links distant, seemingly diverse and hostile things. FT Marinetti, *Futurist Manifesto*, 1913.

Technochronology
20-24 May 1994. *'4CyberConf', at the Banff Centre for the Arts in Alberta, Canada, under the auspices of the Art and Virtual Environmental Project, the last virtual chamber created for 'Dancing with the Virtual Dervish: Worlds in Progress' affords viewers the world's first immersive experience of phenomena involving a fourth spatial dimension.*
3-4 February 1995. *The* transTerraFirma *project is launched. Two Silicon Graphics Onyx/Reality Engine2 graphics supercomputers, one at the University of Texas at Austin and the other at the Electronic Cafe in Santa Monica, connected via ethernet, give audiences the opportunity to navigate and interact within shared virtual architecture. While the two sites can communicate via live audio and video ISDN connections, people prefer interaction in the virtual worlds to direct contact.*
3 April 1995. *'Webspace', a three-dimensional browser for the World Wide Web is announced by Silicon Graphics and Template Graphic Software. Built around the VRML (virtual reality modelling language) and OpenInventor graphics formats, designed to work on all the major computer platforms, and integrated into the functioning of Netscape, the most widely used WWW browser, Webspace creates the first widespread opportunity for the transmission and exchange of virtual environments.*
20-28 May 1995. *At the 'Tidsvag Noll v2.0' (Timewave Zero) art and technology exhibition in Gothenberg, Sweden, the* transTerraFirma *project continues. Several hyper-linked worlds are constructed that can be transmitted over the Web and visited by anyone with Internet access and a VRML browser. http://www.ar.utexas.edu/centrifuge/ttf.html*

Zero: Transmitting architecture
The history of invention alternates between advances of transport and advances of communication; that is to say, from transmitting the subject to transmitting the sign and presence of the subject, establishing a symbiosis of vehicles and media that leads from antiquity all the way to the present. Modes of expression or perception have been cast across greater distances as agents of will and power. Signal, image, letter, sound, moving image, live sound, live image, sense and action, intersense, interaction, presence, interpresence and telepresence all express our awareness of elsewhere, and underline our will to interact with everything in simultaneous existence, relativity's complexities notwithstanding.

In this effort to extend our range and presence to non local realities, architecture has been a bystander, at most housing the equipment that enables us to extend our presence. The technology to allow the distribution or transmission of space and place has been unimaginable, until now. What information is provided by the media is only a passive image of place; it lacks the inherent freedom of action that characterises reality, and imposes a single narrative thread upon what is normally an open field of spatial opportunity. However, through the habitable and interactive cinematic image, that boundary has been crossed irrevocably. Not only have we created the conditions for a virtual community within non local electronic publishing, but we are now able to exercise the most radical gesture: distributing space and place, transmitting architecture.

The issues of architecture and urbanism are challenged by the transmission of architecture and public space. All at once, theory, practice, and education are confronted with questions that have no precedents, necessitating that we turn elsewhere for guidance. Learning from software supersedes learning from Las Vegas, the Bauhaus, or Vitruvius: the discipline of replacing all constants with variables, necessary for good software engineering, leads directly to the idea of liquid architecture. This, in turn, leads to the recognition of time as an active element of architecture at the scale of the cognitive and musical, not just the historic, political, or economic event. The language and metaphors of networked computing apply even greater torque to the straining conventional definitions of architecture: not only is real time now an active concern of the architect, but the logistics of sustainable, transmissible illusion become as real as the most physical material constraints. Form follows fiction, but an economy of bits replaces that of sticks and stones.

To be effective, the strategies we employ to generate a new architecture must reflect our current understanding of physics and cosmology, utilise our most current concepts and methods of understanding the world, and confront fully the implications, constraints, and opportunities that arise from the conception of transmissible architecture.

1/4: Implicit time
Gilles Deleuze has commented that in early cinema the treatment of time was bodily-kinesthetic, embodying what he calls the 'movement-image', while what characterises cinema now is the 'time-image'. The former uses time as it is readily perceived in expected sensory-motor action or plot. It is linear time, proper sequence, straightforward causality. The time-image, on the other hand, relies on mechanisms of association, memory, imagination, illusion, hallucination. An object out of place, time, or plot, rationally incongruous, colours a scene with its probable histories of possible futures. Building on Bergson, Deleuze sees in each object, in each frame of a film a rhizome in time, allowing haecceities to communicate 'motion without action'.

An object is enveloped by an aura of its own trajectory through time that differs

immensely from the sequence of images describing its motion through space. The movement image records positions in space while the time-image records states in time. The cinema of the time-image adds the combination of disparate objects, each with its own, implied aura, and constructs a language of nuance in place of the language of actions. These actions are lifted from the simplicity of the movement-image and placed within the time-image.

Time permeates every architectural gesture, but in most cases, architecture's concern with time is passive. Even where the idea of the time-image is employed in the evocative arrangement of elements intended to speak through implication, the arrangement is static, responding only to the slow accumulation of patina and accident. Until now, architecture, even when speaking in the language of the time-image, has spoken in an inanimate way, using inanimate elements. The possibility of an animate, or at least animated, architecture, containing varying arrangements of elements, has yet to be explored. What examples do exist are either vehicular, aircraft carriers and skyhooks; nomadic, like the ornate tents of Bedouin princes; or greatly extended in time or space: so far, the life of architecture has only manifested itself across continents and centuries.

Once we cast architecture into cyberspace, these concerns take on both theoretical and practical urgency. The architect must now take an active interest not only in motion through the environment, but also account for the fact that the environment itself, unencumbered by gravity and other common constraints, may change its position, attitude, or attribute. This choreographic consideration is already a profound extension of responsibilities and opportunities, but still corresponds only to the movement-image. The next step, in which the environment is understood to move, to breathe and transform, to be cast into the wind not like a stone but like a bird, requires the design of mechanisms and algorithms of animation and interactivity for every act of architecture. Mathematically, this means that time must now be added to a long list of parameters of which architecture is a function.

2/4: Implicit space

When space existed as a separate category, architecture was the art of space; when time existed as a separate entity, music was the art of time. The realisation of the deep relation between space and time as space-time, and the corresponding parallel relation between mass and energy, challenges the idea that architecture and music are separate, and prompts us to conceive of a new art of space-time: archimusic. But while we can surely imagine such an art form, we have had no way to actually construct and inhabit the spatiotemporal edifices of that imagination. While our science examines micro- and macroscopic regions of curved, higher dimensional space-time, we build within the confines of the minimal what our limited sensorium can comprehend directly. Even though we depend on devices that rely on phenomena at these other scales, our architecture does nothing to help form an intuition of the larger world we explain through our theories and instruments.

Until relatively recent times, architecture kept pace with knowledge. By the middle of the 18th century, however, the historical congruence between ways of knowing the world and ways of conceiving and executing architecture was disrupted by repeated, and eventually successful, challenges to Euclidean geometry. Up to that point architecture could still embrace Western spatial conceptions: even the heavens were Euclidean, it seemed. The efforts of Lobachevsky and Riemann, the descriptions of electromagnetic fields by Maxwell, and the world view that was slowly assembled via relativity, quantum mechanics, that led to today's theories of hyperspace and stochastic universes, created a condition that architecture, burdened by its materiality, could no longer follow. While a handful of exceptional architects grappled with the new problems, the modernism that was widely embraced was the most conservative available. Architecture on the whole, ceased to embody the leading edge of our world-view, and turned to narrower problems, until it became indistinguishable from mere utilitarian building.

The spatial imagination of mathematicians and physicists has been far bolder than that of architects. Gauss' curvature, Lobachevksy's hyperbolic or 'imaginary geometry', Riemann's elliptic geometry, the ladder from scalar to vector to tensor to spinor to twistor, are yet undigested conceptions of space that must be considered by a new algorithmic and computational critical discourse and poetics. While the scale at which these conceptions apply is outside the range of everyday experience as we know it, that range has itself changed. As Virilio has noted, our horizon has shifted from the edge of what is visible to our naked eyes to that which is visible electronically at the speed of light, that is to say, at the scales of non-Euclidean geometries. Actually, everything is seen at the speed of light: what we overcome is atmospheric and perspectival noise, the constraint of viewing in a straight line, and of seeing from just one point or in one direction. Optico-digital orthographics: lossless clarity, curved omniscience, panoptical omniprescence.

The architecture of cyberspace offers the opportunity to mend the rupture between our knowledge of the world and how we conceive and execute architecture. It allows a far greater latitude of experimentation than any previous architectonic opportunity. It is once again possible to seek to acquire knowledge and to conceive a corresponding architecture, without always falling back on sacred geometries of past ages. This engagement only makes architecture more relevant to the world, more in keeping with what is sensed as a new condition. In fact, architecture's role in spatially articulating the outlook of an age is strongly reasserted.

3/4: Sampling

We cannot know the real in its entirety. As much shields as bridges, our senses isolate us from the outside world, even as the cognitive mechanisms that translate raw input into meaningful pattern isolate us from within. In either case, what we do know is known through sampling: continuous reality, if indeed it is continuous, is segmented and reconstituted to fit our understanding.

Sampling implies the existence of a field to be sampled, a sampling rate or frequency, and a sampling resolution or sensitivity. From subatomic particles to scanning tunnelling microscopes to compact discs to video, film, meteorological and cosmological information, what we know empirically we learn from this very particular form of observation. What we know synthetically or by simulation does not escape this either: whether we gather or produce data, we do so at increments and intervals that reduce the infinite, or vast, to the manageable. Our own senses operate by sampling: the finite grids of rods and cones that form our retinas feed a finite number of nerve endings at finite intervals: whatever

continuity we perceive in the world is a constructed illusion.

Understanding the world as field is very different from understanding the world as dialectic of solid and void. The world of objects and emptiness is enumerable, a world of local binary decisions: is/is-not. In a world of fields, the distinction between 'what is' and 'what is not' is one of degree, and there can be many sampling points between the two. Sampling involves an intermediate sense of reality, something between real numbers and integers, a fractal notion of qualified truth, truth-to-a-point. An object's boundary is simply the reconstructed contour of an arbitrarily chosen value. Having captured a three-dimensional array of pressure points around a tornado, we can reconstruct the pressure contour at the centre of the storm just as surely as we can the leading edge. At one density setting the data from a magnetic resonance scan gives the shape of one's skull, at another the shape of one's brain, paradoxically replacing the discontinuity of sampling with a new continuity across names and categories.

The data to which these tools are applied can come from any of several sources: direct sensing of the environment, computation of functions that occupy space, fiction and fancy, it does not matter which. In McLuhan's sense, the advent of the tool already changes our reality by shifting the balance of all our practices and outlooks. In order to contend with the enormous amount of information provided and directed at all aspects of the world, scientists have developed a panoply of tools for scientific visualisation. The dominant metaphor behind the operation of these tools is that of the field or lattice. Volume visualisation, isosurface construction, advection, and numerous other techniques exist that allow us to take a block of numbers and extract the shape which answers the question.

Architectural heuretics and poetics, even when employing the computer's boundary representations and solid modelling, still emphasise a Euclidean understanding of form and space, an ideology of presence and absence. Descriptively, analytically, synthetically, the rigidity of the canonical, orthographic descriptions of architecture fail to capture what is salient to space as we currently conceive it. Plan, section, elevation, axonometric, perspective, traces of pigment held by the tooth of vellum, ruler and compass, were perhaps appropriate to the cycles and epicycles of Ptolemaic, Copernican, and Galilean universe, or even the ellipses of a Keplerian universe, but are completely impotent in arresting the trajectories of subatomic particles, or the shapes of the gravity waves of colliding black holes. Once this is observed, it can be readily seen that the plan is dead because its world view is obsolete.

An alternative architectural poetics would look past the static depiction of objects and surfaces to the description of latent information fields. Air is permeated by intersecting emanations of information from every object: electromagnetic flux, intensities of light, pressure, and body heat form complex dancing geometries around us at every instant. We already inhabit an invisible world of shape, an architecture of latent information that is modulated by our every breath and transmission. The shapes are definite, and with the right tools of sampling and visualisation, can be seen, captured, and if so desired, manufactured. It is imperative that architects embrace these tools critically and creatively, and set aside the tools that Alberti used as beautiful, but nostalgic; vestiges of another era.

4/4: Transmission

The unprecedented potential to cast space into the electronic net surrounding the planet is not without restrictions of its own. The astonishing capacity of optical fibre to carry information is just being grasped. In the interim, between astonishment and proficiency, we must contend with the present limits of bandwidth. While everything grows exponentially, it seems that the speed of computers and the number of users of the Internet are expanding more rapidly than the available raw carrying capacity required to create shared virtual environments. We will soon have many people with very fast computers vying for limited bandwidth. It is unlikely, and against the fundamental insights of distributed computing, for a central computer to manufacture one reality for many participants. The paradigm that is emerging is quite the opposite: each participant receives a compressed, concise description of the world and information about the state and actions of all the other participants. Each machine then synthesises a version of the shared reality that is similar to, but not necessarily identical to, all the others, depending on local factors and preferences. In a Leibnizian way, each location functions as a monad; it is independent of the others, and yet, by the fact of their relative agreement, a larger reality is constructed.

Obviously, what is required here is a transmissible form of reality in condensed form rather than in fixed description. Simple compression imposes the same limit on resolution for all participants, regardless of their communicational and computational resources. In the long run, what must be transmitted is not the object itself but its cypher, the genetic code for the regeneration of the object at each new site, according to each site's available resources.

Cyberspace as a whole, and networked virtual environments in particular, allow us not only to theorise about potential architectures informed by the best of current thought, but to actually construct such spaces for human inhabitation in a completely new kind of public realm. This does not imply a lack of constraint, but rather a substitution of one kind of rigour for another. When bricks become pixels, the tectonics of architecture become informational. City planning becomes data structure design, construction costs become computational costs, accessibility becomes transmissibility, proximity is measured in numbers of required links and available bandwidth. Everything changes, but architecture remains.

Genetic poetics

Slowly, from the above considerations, we can articulate some expectations about what a cyberspace architecture might involve. It would be an architecture designed as much in time as in space, changing interactively as a function of duration, use, and external influence; it would be described in a compact, coded notation, allowing efficient transmission; it would allow different renditions under disparate fundamental geometries; and it would be designed using the most advanced concepts, tools, and processes. Emphatically non-linear and non local, its preferred modes of narration would inherently involve distributedness, multiplicity, emergence, and open-endedness.

Just as chaos and complexity have switched polarities from negative to positive values, so too are all the expressions of disjunction and discontinuity being revisited as forms of a higher order. Unlike the disjunction of collage that has characterised much of this century, morphing is the newest device. Where collage merely superimposes material from

different contexts, morphing operates through them, blending them. True to the technologies of their respective times, collage is mechanical whereas morphing is alchemical. Sphinx, werewolf, gargoyle and griffin are the mascots of this time. Morphing has genetic character, not surgical; more like genetic cross-breeding than transplanting. Where collage emphasised differences by recontextualising the familiar, the morphing operation blends the unfamiliar in ways that illuminate unsuspected similarities.

Narrative structures are similarly affected. Cinematically, the cut yields to the cross-fade and the cross-fade yields to the morphed blend, until what would be consequent scenes merge into a modulated, varying composite of simultaneous existences. The elements of meaning become atmospheric, temperamental, and narrative sequence proceeds from ellipsis to ellipsis, in a stochastic perpetual motion machine.

Though the question of architectonic merit admits no facile answer, it must still be asked. Just as simple engines exchange displacement for force, the tools of cyberspace exchange computational cycles for the production of usable information. It is fair to inquire not only how much power an engine can produce, but to what purpose that power is directed. Of all the CPU-cycles expended in the design and construction of a work of architecture, how many are applied to improving its architectonic quality? Are they applied toward goals that increase architectonic merit, or are they applied to peripheral issues such as the more rapid production of mediocrity?

One of the fundamental scientific insights of this century has been the realisation that simulation can function as a kind of reverse empiricism, the empiricism of the possible. Learning from the disciplines that attend to emergence and morphogenesis, architects must create generative models for architecture. Architects aspiring to place their constructs within the non space of cyberspace will have to learn to think in terms of genetic engines of artificial life. Some of the products of these engines will only be tenable in cyberspace, but many others may prove to be valid contributions to the physical world.

One: transTerraFirma: Tidsvag Noll v2.0

An ongoing effort to assert the vitality of architecture after territory, *transTerraFirma* is also an investigation into the means necessary for architectural conception and production in cyberspace. For the Tidsvag Noll exhibition in Sweden, this exploration has taken the form of a series of city-worlds, constructed for the pre-release version of the Webspace three-dimensional web browser now available on the Net. In various guises, these 'worlds in progress' each explore a different facet of virtuality.

Words are portals. Woven through the worlds are several webs of non-linear narrative. Words suspended in space, at different scales and orientation, act as portals to other worlds. One set of words consists of the names of cities that have been the sites of disaster and destruction: Kobe, Kikwit, Oklahoma City, Waco, Beirut, Sarajevo, Mostar, Johannesburg, Soweto, Carthage . . . Another consists of reminders which humanity would rather escape: plague, pain, torture, virus, carnage . . . A third uses only sentence fragments, preceded and followed by ellipses: . . .this body. . . . . .homeworld. . . . . .laughter, pain. . . . . .upgrade my love. . . . . .a matrix of questions. . . . . .no room. . . . . .the necessity of voids. . . . . .you occupy my visions. . . . . .centrifuge. . . . . .komMERZ. . . This latter system always leads to a distribution node, a world unlike the rest. This is a fully spatialised poem consisting almost entirely of text, arrayed in three-dimensional space. Every sentence fragment in this space is a link back into the city-worlds. By creating a field of text fragments that the visitor can navigate, a new form of poem is invented: a spatial poem, characterised by shifting relationships between the foreground and background words, between the words that catch the light and the ones that disappear in dark fog. Travelling through this poem an infinite number of poems shift smoothly past one another, each phrase an entry to another world. The slow rotation of the text destabilises the viewer, creating the necessity to either move to maintain a particular configuration, or yield to the change and reread the kaleidoscopic wordplay.

Within the deepest recesses of each city-world are nodes of 'friction', places where the visitor is confronted with screens displaying images gathered from the Net, that recollect reality outside cyberspace. These images often relate to the names of the cities, but in ways that are not directly apparent. Rather, the construction of meaning remains the responsibility of the visitor, who must integrate the overall sense of place with the encountered sequences

All images Marcos Novak; PAGE 42: Ray Tracing Series – studies for 'Worlds in Progress'; THIS PAGE: Worlds from transTerraFFirma/ Tidsvag Noll v2.0, ABOVE AND CENTRE: 'Sarajevo + Fortuna + (. . .after territory. . .)'; BELOW: 'Johannesburg + KomMERZ' + (. . .friction. . .)

of names of places, keywords, and sentence fragments.

The configurations of the shapes one experiences in these worlds are based on an analogy to sound synthesis, extended to include three-dimensional form. Timbre, the character of a sound, is not given by the fundamental frequency of a sound, but by the structure, proportion, and onset pattern of the overtones, or multiples, of that frequency. If we visualise the fundamental frequency as a wave, the character of the sound is given by the perturbations caused by the addition or subtraction of subordinate waves of higher frequency but lesser amplitude. Even though we know that sound propagates spherically, we normally think of it as an undulating line, representing air pressure, moving forward in time. Equally, we can represent it as an undulating surface, like the surface of a liquid, or as a solid block of pressure or density values. We can assume that a simple shape, a cube or a sphere, corresponds to a simple sine wave. By adding perturbations to the sine wave, we can produce a richer sound: the same is true for our simple shape. The idea of a fundamental function with perturbations carries well into other dimensions. Assuming that the fundamental figure of architecture is the domain, represented in two dimensions by a boundary contour of an arbitrarily chosen value, and in three by a boundary isosurface, we can search for functions that produce simple figures, and that can readily be modulated by successive perturbations at higher frequencies. Applying the perturbations conditionally ensures a high degree of control. Such a conception of architectural space has the advantage of being extremely compact: a single mathematical expression can be expanded to become a fully formed chamber, at whatever resolution the available resources permit.

Adding a temporal dimension is as direct as adding another parameter to the expression, which itself articulates the genetic structure of the chamber, making evident the *loci* of intervention for the generative or genetic algorithm that determines the growth of the architectural artefact over generations. Of course, it is eminently transmissible. While most current three-dimensional browsers do not yet support the transmission of executable applications, along with data, exceptions do exist, and that functionality will soon be standard. It will not be long before form follows the functions of fiction.

Futurismo & Futurismi

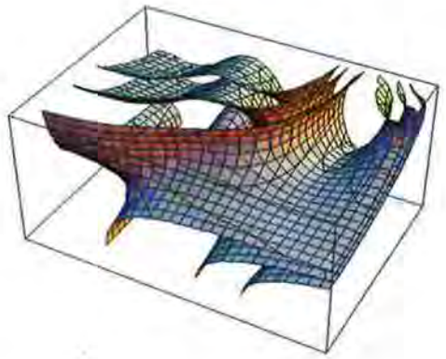
In the decade that has passed since the 'Futurismo & Futurismi' exhibition in the Pallazo Grassi in Venice, the relevance of Futurism to our experience with technology has become increasingly clear. It is evident that the conditions we have created will bring about far deeper changes than the ones that fuelled early modernism. Still, the parallels are strong, and it is worth considering them briefly.

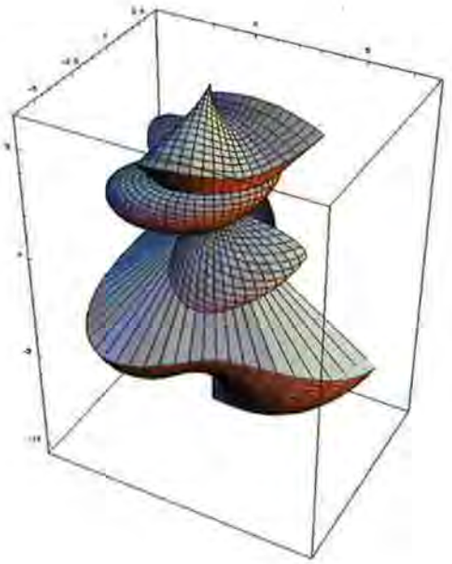
Of the various ways in which the Futurists saw simultaneity and dynamism, Umberto Boccioni's was perhaps the most prescient and applicable to the conditions we are facing. Critical of Balla's literal depiction of forms in motion, Boccioni sought to capture a sense of time that was implicit in being. Like Bergson's notion of 'duration' as the principle animating the passage through time rather than the particular form at a given instant, his work observed the lifelessness of a form arrested from motion in a single instant, and created forms that were condensed records of their own becoming; past and future both being contained in the vector of the present. It is perhaps not too surprising that Boccioni's sense of time and Deleuze's time-image would both draw upon, and thus be connected by, Bergson. What is surprising is that Deleuze and Boccioni, especially the latter's *Unique Forms of Continuity in Space* of 1913 and related works, both anticipate and can be expressed by the tools and concepts of scientific visualisation, especially isosurfaces.

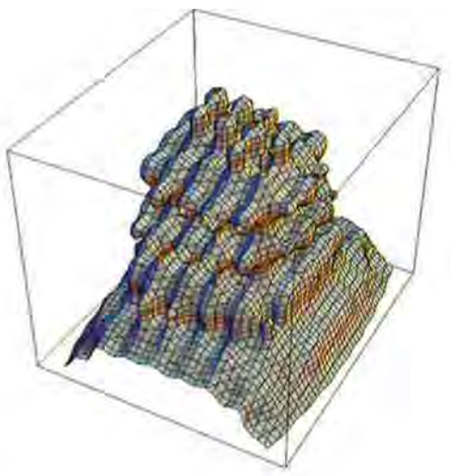
Our surprise is only the result of our forgetting; Marinetti in his 1913 Manifesto, is explicit:

> . . . we should express the infinite smallness that surrounds us, the imperceptible, the invisible, the agitation of atoms, the Brownian movements, all the exciting hypotheses and all the domains explored by the high-powered microscope. To explain: I want to introduce the in-finite molecular life into poetry not as a scientific document but as an intuitive element. It should mix, in the work of art, with the infinitely great spectacles and dramas, because this fusion constitutes the integral synthesis of life.

The wings and propellers of the Futurists were severed by the rise of Fascism. Marinetti's words cut both ways.







FROM ABOVE: DervishDataScape – isosurface 'datascape' from the Entry Chamber of from 'Dancing With The Virtual Dervish: Worlds in Progress'; twistShell – spherical co-ordinate form used in the first transTerraFirma *event designed using conditional perturbation operations; perturbedChamber – rippled isochamber*

MARK TITMAN

ZIP, ZAP, ZOOM

A Z-A of Cyberspace

In the popular narratives of cyberpunk, the hero/heroine steers us through separated terrains of cyber-real and physical spaces. In attempting to visualise this existence more specifically, it is useful to look at how the word cybernetics was derived from the Greek, Kubernétés, meaning Steersman

At certain times in the history of mankind, successful developments in society are made simultaneously in different parts of the world by independent groups who live in a period when the spirit of the times – so well expressed by the German word, Zeitgeist – is favourable to their endeavours. Fashion directs our imaginations and migrations – even more so in cyberspace, where the reflection of a single individual's input may effect a change in many others. Multiple mimicry may occur, leading to occasional up-heavals in cyberspace: a dangerous condition for those who have invested work or money and require relative security, but a rapid transit system for those who require new territories for exploration.

Instant response and live data are essential for the transmission and cohesion of the latest ideas, but it will be the hopes and fears of global *zeitgeists* which can simultaneously affect the natural and man-made worlds, that may lead to some controlled channelling and debates as to when or how fashions will be precipitated and forecast in cyberspace. As a reaction to these shifts, the creation of inflexible fixed 'safe' spaces and data vacuums are established as a measure of security. They also become reference points for newcomers *moving and navigating* through the changing datascapes outside the *secure static* areas, thus creating means of navigation and habitation of cyberspace.

Even with massive global interaction, it is still the individuals' diverse personal reactions that can collectively evolve cyberspace and us. In order to be of value, the pioneer-style freedom that cyberspace offers must be re-established or it will rapidly become a tool for a single or a few dominant uses and fall into simplistic use. Though we cannot understand the full complexity of cyberspace and its programs, that it facilitates our requirements more easily is what makes it an evolutionary key; we need no longer exist as *homo faber* the tool maker, because cyberspace can be used as a travel tool to change environments. Our roles now change as we are forced to go out and find a way of living, a **Zeta** with new expectations and needs for cyberspace programs to fulfil. Searching versus directed use of cyberspace: do we go looking for information or does it look for us? A main concern that mirrors the vast world industry of tourism and its similar concerns with travel and packaging.

As our individual mileage increases to an average of 20,000 miles per annum in the west, we are entering a period where data-gathering and travel approach a **Zenith** of cross-appropriation, where travel becomes similar to data shifts and vice versa.

While information offers a focus of attention on singular or connected issues, in an imminent information age and space, the myriad forms of available data will be open to infinite combinations, confusions and presentational manipulations/coercions. For individuals to sustain, uncompromised, their individuality and databases, they will need to be established through continual change, constantly re-emerging to their own inherent seeds of possible growth or destruction in common with all life forms.

Zeleny writes: 'throughout this staggering turnover of matter, the cell maintains its distinctiveness, cohesion and relative autonomy. It produces myriad components, yet it does not produce something else – *it produces itself.*

Against a background of the data environment, inhabitants – including databases – rely on their accessible surroundings for the materials to reconstitute themselves and thus, maintain their potential. This constant reconstituting establishes a cycle of exchange whereby the input and output of matter or data recreates not only the individual inhabitant, but their surroundings and consequently adjacent inhabitants, each requiring another's output as input. Such a growth medium is an opportune compost for emergent 'life form databases' against which the more advanced inhabitants can make decisions of movement by selective transformation.

Movement is a critical way in which an inhabitant can establish itself anew. At each new location, responses are made and continual reappraisal of an inhabitant's internal requirements, their affinity or alienation to a

location is necessary to decide to what extent surroundings should be absorbed or repelled.

Where we are located and what we wish to maintain or become in an information space will require of us a continual release and realising of our and our databases' capabilities, so as not to become constipated material- and data-users, stagnating the surrounding growth media, ourselves and our databases.

The options for deciding where our present and future roles can take us, in a data environment, multiply and change faster than the options in any of our previous biological or mechanical environments. Choosing the correct response and direction of movement in a data environment requires new methods of response to shifting external conditions. Divining the correct direction therefore also requires us to constantly reappraise our internal requirements and potential for the most suitable way to manipulate ourselves (or our data) in order to transform comprehensively while retaining our essential character.

With every inhabitant rapidly **Zapping** or converting data for survival, the inputting and outputting of surroundings and databases consequently creates shifting contexts for the users of a data environment. Location cannot be determined by surroundings alone, and it may be that in cyberspace, location is determined as a relationship between what an inhabitant requires and needs, and their consequent direction of movement. Location is determined by a vector of optimal changes. Once the inhabitant has reappraised individual requirements for change in relation to his surroundings, a specific transformation will be found suitable to both the environment and inhabitant synergistically.

In this way of locating through movement, destination becomes a priority, even if it is unknown, by establishing constants of change and intention. It can no longer be of use in establishing locations that are transforming as they become inhabited. This is where dowsing can best be used.

To help establish the cyberspatial diviner's objectives and orientation, it is crucial to find positions of personal reference since dowsing creates a link between our consciousness and that of the object. Without this reference, no response will be forthcoming. For this reason, many cyberstructures will maintain icons either inherently within the structure or superficially as an interface coding, to link the diviner with an identifiable target for a developed intuitive response. To understand how these icons can be set out in a new flexible manner requires an understanding of a living, moving geometry.

Other signposts would be the permanent **Ziggurat** observatory structures, or beacons, which would, instead of directions, display and record the intensity of change in some areas, indicating points of action and data flow. On crossing a data flow it is essential for the cyberdowser to find out if the direction of dataflow is towards the physical – this then allows the cyberdowser to *track the line of a data course;* overcorrection will suggest irregularities and with practice the cyberdowser will be able to track the edges of a database moving through cyberspace.

To gain an insight into how a database moves, we have to consider how life in cyberspace also begins with movement, by the uniting of physical and live database opposites to create a single cell **Zygote**. To a physicist, the biological zygote, which possesses dimensions, does not have living dimensions. In cyberspace where living geometry, living energy potential and living mind exist, the zygote is not dimensional until it expresses dimensionality, which is derived from *movement.* The movement which occurs in cyberspace also happens as a result of polarity, a force inherent in all living things and organised data. Surrounding data structures supply the polarities and the cyberzygote begins to pulsate back and forth between opposites. As it is accessed by and attaches itself to different data environments, it finally pushes into two cells; polarity has generated dimensionality through movement. If we continue to watch these two data cells, the same will happen until the two divide into four and the four pulsate at right angles to both the previous divisions, splitting to form a four-four configuration in three distinct dimensions. Height, width and breadth have been realised in a single coherent whole. At this stage, growth slows: the moment a data form assumes three dimensions, a leap occurs and the relationships between the eight cells generate another ten dimensions and creates an animal-like **Zooid**.

This shift from complete dependence on cyberspace data environs to a state of relative independence requires rapid adjustments – the urge to survive as a whole forces the infant cyberspace life form to move simply by exchanging, taking in and outputting data, *moving to maintain equilibrium:* **Zipping**.

Through movement, a new cyber life form discovers consistencies and so creates patterns of response – knowledge in the making. Outwardly seeking to cope while inwardly organising holistic perceptions of an ambient cyberspace – movement is the means of expression which seems to gather impressions. That which connects builds a relationship pattern, that which doesn't can be assimilated if exchanged for a replaceable or redundant structure – thus a journey through cyberspace

FROM ABOVE: Way of Living – Zeta 1; Move to Physical – Zoom-in

has begun that leads to the growth of the cyber life form which can now itself become an *environment* for other life forms.

At this stage the reference points depend on whether or not a *destination* is sought, and whether the system is to be made *nomadic* or *static*, whether it sits and grows slowly or is itinerant. If the person or group inhabiting this cyber life form wishes to personalise it, a secure location is required either at the edge of a vacuum (a prime location) or as part of a larger, stable existing structure close to their existing location. If a destination is sought and the navigator is informed enough to know its location and define the terrain, the structure can be moved safely through the shifting datascapes, gaining stability in the process.

However if the destination sought cannot be gained by individuals who do not have the required information of their surroundings, there are other more ambiguous but accessible and effective methods of navigation. Divining your location and destination may include the use of *fixed signposts, dowsing* and *inhabiting a passer-by*. Each of these has roots in a human heritage of navigation and relies on a balanced combination of our basic mental facilities: instinct, intuition and intellect. It may well be that this combination of mental activities will progress the nomadic cyberspace inhabitant beyond the mega-database institutions, and establish a new cultural type which will reinforce the old and rely on it for security and mutual development.

The movement pattern of all cyberspace life follows a migration towards densest cyberspace forming around structures which have the capacity for physical manifestations. If, in our imagination and conscious thought, we experience the world of real space in such a way that it is entirely physical, we can call this a centric point-like experience.

For cyberspace, modern geometry can be used to transcend this point-like physical aspect of space with the discovery of **Zoom Geometry**, a projective space where point and plane can be balanced. To overcome the one-sided viewpoint, some notions of that space, which is precisely opposite to the physical, need to be outlined; to help explain perceived movements of spaces within cyberspace.

In cyberspace we cannot take our origin in a point and relate everything to this point as in Cartesian geometry. We must begin from the very opposite. What is the opposite of a point? It is an infinitely distant sphere. Suppose, therefore, instead of a point, the dowser was in the midst of such a hollow sphere, and could relate everything inside to the sphere. Instead of relating things by co-ordinates to a point of origin, everything could be determined in relation to this hollow sphere and the **Zodiac** of icons found on it. The kind of space we obtain cannot be properly described merely in terms of three dimensions. Here space originates not only in the point but in the plane, is built not only outward and extensively as from a physical and early starting point, but inwardly, intensively, from the periphery.

As the cyber organism organises data for multiple movements, it is continually resisting a gravity which pulls it towards physicality, exerting a constant force against the cyberbody. Adjustments are made in order to maintain balance, as each movement changes the relationship among all the data systems. Through experimentation with these enervated movements, the cyberspace life form can gradually become aware of the voids and centres which align and attract, pulling it towards physicality and stability or towards ephemerality and mobility.

These peripheral spaces direct their forces towards the physical potential points which are their infinity. They nurture and sustain it from all sides, for they perceive in each living germ point an unrealised aspect of the future. If we call **Zoom Geometry** the idea of space where elements of past and future, of periphery and centre (plane and point), hold perfect balance, we have a spatial relationship which interweaves the data environment with built environments/objects.

Within the physical, we have not one space but an infinite number, since each physical form will have its own space filling the periphery, each of them a different cybereal type. In the peripheral it will be likewise.

The ideas implicit to this anti-space may only be understood by preserving a balance between thought and experience (a new spatial feeling can be acquired by considering purely mathematical forms of cyberspace) and in this way, an original line of thought will fertilise our knowledge of external nature, cyberspace and humanity. This geometry relies on reinterpreting **Zero-one**.

We must understand the polarities of these two spaces, the physical and cyber, and how they can work together. It is not only that they oppose, but that they interlace, where the polarities mingle, one working into the other, that makes for a greater perception of our spaces and their relation to imminent cyberspace. That which resides in the physical depths has always had its source of form in the far spaces of a periphery, which is identified in various ways in different cultures. It is characteristic of a modern physical space that we consider and experience it in a centric, point-like way, that it receives its stamp from a peripheral plane; instinct, intuition or intellect

now mix on this plane with media and new influences. Physical or centric space now has an essential source of its information in the world periphery and for the peripheral forces the opposite is true, finding its source to be in the physical world.

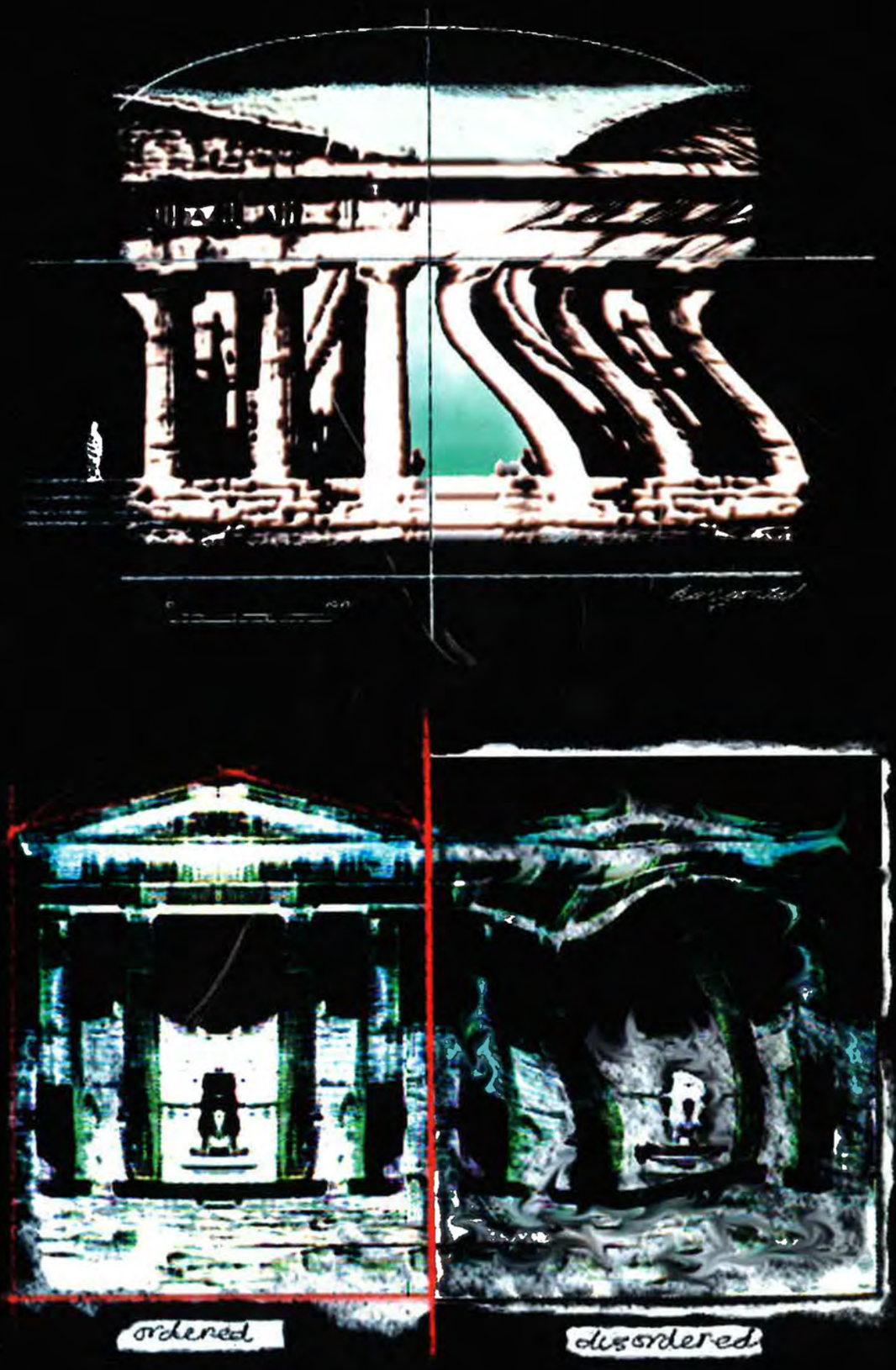
The downstream peripheral cybereal forces are those that direct their activity to the physical by a germinating point or seed, which in cyberspace is the largest data structure or form which has the physical infrastructure capable of manifesting ideas physically with little or no delay. The peripheral is ever active in cyberspace: **Zooming-in** towards some seed point: a massed centre, vacuum or a safe structure.

Alternatively at present, the physical often exists in finished form, having achieved its formation more or less from the cyberspace periphery with all its various media and active networks. This directs our thought towards a past where the built physical falls out of the domain of live data and **Zooms-out**: obtains a physical existence at the same moment as the living peripheral body withdraws *into* the infinitely distant. This process concerns the future.

Computers have allowed us to gauge the efficiency of our machines, but they should not be taken too seriously. Cyberspace is not even a spatial experience in the usual sense of space being inhabited by objects. Its concern with the space of abstraction and supersensible imagery distils many imaginations into computer language, but this ultimately leads to imaginations outside them both, influencing those outside cyberspace and creating ideas beyond it. To suggest that cyberspace is only a context for abstraction is highly limiting. What it does at present is create a fresh environment for our intellectual mind to inhabit, travel and play in, as people may have done with geometry when new: cyberspace is to geometry as the computer is to the abacus. To suggest cyberspace has any of the excitement and requirements of our everyday physical and intuitive intelligence is wrong, because it requires a multi-dimensional, non-directional, non-discoverable solution in order to operate.

To use the mind in its everyday context suggests a live action play of responses, but for architects to graft our real world constructions on to a cyberworld, colonising it with old physical ways, is to limit future cyberspace. Ultimately, cyberspace can be another live place or a flat, virtual, special effects copy. The inhabitant can only be better than the person on disk, not by reacting to the disk world but by reacting live to the workings of the imagination and its playful manifestations. Cyberspace is one of the best places to share these manifestations with others; as a tool for our imaginations. To explore it is to discover the **Zigzag** dance, a coherent metaphor for our collective lives, showing us new ways to explore and travel in and out of our imaginations.

FROM ABOVE: Animal-like – Zooid; Observatory Structure – Ziggurat; Single Cell – Zygote; Exchange – Zap


ordered
disordered

MICHAEL McGUIRE
A-SYMMETRY CITY

Order – Life – Disorder
The construction of cyberspace is subject to a diversity of competing constraints. Many are external ones, from the economic, the technologically possible, to what is simply socially acceptable. Such constraints do not *intrinsically* limit the nature of the space being created for they are both external and contingent to this construction. There are constraints, however, which render certain spatial constructions much more resistant to actualisation. Also, in most cases, these constraining factors are invariably *internal* – that is, conceptual. The influence of these conceptual factors is a subtle and complex affair, but is ultimately more fundamental for they dictate what we understand to be the rationale of a spatial construction, in the first place. By understanding the nature of such conceptions, we can better understand what kind of spaces they constrain us to construct and, if we are wise, to thereby engineer better ones.

What is the nature of 'c-conceptions' or construction conceptions? Clearly they apply across a range of constructive actions more wide-ranging than the building of cyberspace. They are, in fact, the basis for any construction we engage upon, be it spatial or non-spatial. From sonnets to space-rockets the way we build something new is ineluctably informed by the range of constructive actions our relevant concepts appear to leave open.

Now if we were to attempt the construction of some building according to faulty or inconsistent principles of engineering it would be likely to fall down. In the same way, if our c-conceptions are inconsistent or *applied* at variance with their basic form then we will be liable to construct badly. A glance around our own, physical space is enough to suggest just this conclusion whether it be in the form of the cities, the buildings or the social spaces we have filled it with. If this is also true for the long, and haphazard construction of physical space, how much more are those simple errors of construction likely to be carried over into the exponential development of cyberspace.

The principles of engineering
What is the fundamental structure of our c-conceptions? With any engineering project the relationship between the materials and the principles of those materials shown in the diagram seems to hold.

Construction
The primary relationship here lies between the *materials* we employ to achieve a constructive goal and the *principles* we have discerned about the material, which allow us to manipulate it to our advantage. Take some reasonably straightforward constructive goal, like a bridge. For this to be successfully constructed we need to select a *material* which is adequate and to then apply our knowledge of the principles which govern its behaviour. These are both internal (its physical character) and external (its response to differing external causal patterns such as heat, cold or rain). Imagine the range of material open to us to be stone, wood, or metal and, perhaps for financial reasons, we have decided to utilise metal. Now, if the extent of the construction principles employed amounted to merely welding a few pieces of randomly selected metal together, the structure would be unlikely to be very permanent, if indeed it ever stood at all. Far better for constructive success would be to employ some basic physical concepts and to specify what we know of the material's *stress* (its strength) and *strain* – the capacity of the material to deform under various loads. Focusing these concepts more tightly we might then decide to evaluate the material's *tensile* as opposed to its *compressive* strength. An informed understanding of the way these principles apply to the construction material would tell us that the tensile strength of pure iron is only around 60,000psi, but it would also tell us that by adding only one half per cent of carbon to the material we could improve its tensile strength by nearly 100 per cent to over 100,000psi. Informed understanding of these principles entails the obvious conclusion that it would be best to use the alloy to achieve our goal of a stable construction.

The structure of the relationships in this simple analogy holds across the range of possible constructions. What happens, therefore, when the goal is the construction of a *space* itself? What are our materials, and what principles govern the use of this material?

The relationship of materials to their fundamental principles

Spatial engineering

The only available material for a purely spatial construction must be the space itself. In order to make sense of this we need to understand a couple of things. Firstly, what is meant by the term. Any space, at the most simple level of analysis, can be taken to be a co-ordinate frame of various kinds. A three-dimensional space can be completely described by the use of three co-ordinate points (x, y, z), an n-dimensional space by the use of n co-ordinates. Since every point in cyberspace can be assigned some co-ordinate value it too can be called a space. What it is not, however, is a *distinct* space from our own as it has often (mistakenly) been thought. Such distinct spaces have been conceived, by physicists as 'bubble' universes, by philosophers as logically possible worlds. Yet for two spaces to be genuinely distinct they require *causal isolation* from each other and this is patently not the case here. Not only are there causal connections between cyberspace and physical space but events in the latter usually determine events in the former. As I have elsewhere argued what makes cyberspace *appear* to be partially distinct from our physical space is that it is 'higher order'. Events therein are properties of events in our immediate space (specifically, representations of them) and hence there is greater flexibility of interaction. Every event in physical space can become connected in different and more unusual ways in cyberspace by being represented differently.

This simply supplies a definition to our use of the term 'space'. If we are to set out what principles determine the possible constructions that can be employed then we need some metaphysics – that is, we need to understand what its nature is.

To understand the nature of a space requires a specification of what one's interest is. For example, if we only required the simplest, and most general level of description we need say nothing about the structure of the space other than to describe features of it such as its 'shape'. This would supply an answer to questions such as whether space is bounded, whether it has 'holes' in it and so on; such an account would be to describe the *topological* nature of a space. Given that the interest here is the way space can be used for construction we need to focus on the way space is related to its constructions – the objects and events which appear to occupy it. Does a spatial construction depend on objects or do objects depend on space? The way we are able to define the nature of a spatial constr-uction lies in the way we understand this crucial relationship. Generally there have been two ways of conceiving of this. The distinction is made with respect to our immediate space, but can be standardised:

(i) On the one hand the space can be seen as *distinct* from everything in it. On this view space is the 'container' for all objects and every fundamental property of an object, such as its motion, is relative to this. The space itself is a substance, or a material and alone, is sufficient for construction.

(ii) Alternatively we can view space as '*nothing but*' the objects of which it consists. If we were able to remove each object in space one by one and we were to reach the last object, then at that point space itself would vanish. In this view space is not a substance of any kind, for it is nothing over and above the objects within it. All spatial constructions are thereby constructions of objects.

Respectively, (i) and (ii) amount to the traditional distinction between a Newtonian, absolute conception of space and the 'relational' view of Leibniz. Relationism about space is not *relativity* about space as it is often mistakenly thought. In General Relativity, although objects enter into spatial formations in the way their mass distorts the surrounding space, space itself is still a kind of absolute, although the absolutes have now become the 'frames of reference' – the velocities of objects in space to which all is relative.

A number of conclusions follow from this minimal distinction. For our purposes the following are the most significant. A view similar to (i) entails the crucial point that we could not construct a space *ab initio*. Instead any construction must derive from features already embodied in the spatial medium itself. Thus any construction that is attempted is in a sense a *replication* of the original space out of which it is moulded. C-conceptions which embody this view must understand the material as giving rise to constructions which are immutable, necessary and ultimately invariant. By contrast, a view along the lines of (ii) is consistent with there being no absolutely determinate principles of construction. The objects themselves can determine the process rather than the other way around. C-conceptions embodying this view see the material as involving the contingent, the dynamic, the provisional and so on.

This basic dichotomy in our understanding of the construction *material* carries across into what we see as the *goal* of any spatial construction. Clearly there are many, varied examples of 'construction goals' we could cite. In building a patio extension, the goal might be 'better barbecues'; where the construction is a particle accelerator the goal might be 'better manipula-

tion of nature's fundamental forces' or something similar. At the very general level of a purely spatial construction, the equally general goal must be to 'mould' the space in some way. What this usually means is that we seek to regulate and order it. Indeed a construction of any kind is, in a certain sense, an attempt on our part to augment the order of our world: a new road system is intended to order the traffic flow more efficiently; the new patio is intended to regulate barbecue and sunbathing behaviour more effectively. Historically whenever we have entered some virgin spatial domain we have sought to mould it by 'bringing it under control', to organise, or to regulate it. If the space is geographical then we clear it of wilderness, map it, and so make it comprehensible. Where the spaces are social or economic we seek to legislate. The result of such basic constructive goals has been the formation of complex physical-social spaces of which the paradigm case is the city, tied into regional/global exchange systems.

Once we know what the material is, what (at least in part) its nature is, and what constructive goals we might have for it, we are finally in a position to set out the relevant structure of our c-conceptions. To do this effectively we will need to specify more carefully what our constructive goal of 'increased order' amounts to.

C-conceptions

As discussed above, where space is conceived of as an independent, absolute and objective medium the constructive goals can be defined only in terms of the medium. Thus our spatial constructions become an ordering which is merely a recovery of those original principles. Spatial constructions of these kinds are underpinned by the concept of a *symmetry*. A brief clarification of the notion of symmetry should make this more clear. Everyone has an intuitive notion of what symmetry is and it usually involves classical buildings or repeated decorative patterns. A symmetry is conceived of as a balance, or a harmony. Sometimes it is seen as coextensive with the notion of beauty itself, but there is a more precise mathematical description of a symmetry defined by the concept of *transformation*. When an object can be mapped on to itself (by reflection, rotation or transformation) it is said to contain a symmetry. The number of symmetries a figure possesses determines what kind of basic figural type it belongs to. A square for example has eight symmetries, four 90-degree rotations and four reflections and any one of these maps the figure back on to itself, leaving it unchanged. Where we discern a symmetry, therefore, we discern an *invariance* or a *reversibility*, for however we alter the position of an object its relevant structure remains precisely the same. There can be no ultimate change where there is some symmetry.

As a conception of order, however, symmetry applies to far more than figural invariance. It applies equally to *theoretical* as to physical constructions. In a physical construction we seek to mirror the symmetries of the absolute in 'mini-spaces' – the theoretical system, constructed along strict symmetry principles. In a theoretical construction the aim is to uncover nature's symmetries and model them linguistically or quantitatively. Most of the constants of theoretical physics are disguised symmetry principles. Indeed, one of the principal heuristics in theory construction is to make the theory as 'symmetrical' as possible, by means of the discovery of various physical constants such as Boltzmann's constant *k*; Planck's constant *h*; the symmetry of mass/energy equivalence and so on. Any theory which is more economical as result of employing such principles is to be preferred over those which do not. Such constants represent examples of the construction of space which we have *uncovered* and which we can then extend as principles to employ for further constructions.

When, however, we construct with a medium which is formed *by the objects themselves* we must evolve principles which describe those objects. So any spatial ordering represents a pay-off between one group of objects and its environment – another group of objects. Where we increase the order in a construction we have increased some property of the foreground objects at the expense of the background ones. This crucial property has been defined in physics as the amount of 'entropy' an object (or more usually, *system*) possesses. Entropy is a rather elusive notion but it can best be understood as an inverse relation to the amount of energy a system possesses at any point in time. Systems with *low* entropy are *high* in energy (with respect to their environment) while systems with high entropy are low in energy. Highly ordered objects such as ourselves, and our constructions are thus *high* in energy with respect to our environment. The amount of entropy we, as systems, possess is accordingly low. Entropy, unlike symmetry, is a concept of *irreversibility*, a fact captured (somewhat paradoxically) in the Second 'Law' of Thermodynamics which states that the entropy in the universe is always *increasing* and can never decrease. Heat-energy never flows from cold containers to hot ones, and the mechanical energy that is produced by throwing a stone into a pond and producing ripples can never be reversed for we will never see the ripples before we throw the stone. Since the level of entropy in the universe is always *increasing*, it

entails an important basic asymmetry. One version of this is the asymmetry of time which undeniably can never flow backwards. Therefore in this view of order, if the energy in a system is high with respect to its environment the system is likely to be highly ordered. When its energy is nearly at equilibrium with its environment then the system is likely to be disordered. With these two conceptions of order at hand we can derive a very crude plan of our c-conceptions. (See *ABOVE RIGHT.*)

Spatial construction

The structure depicted here is, as I say, very crude, but suffices to define the problems which await us. Together, our c-conceptions constrain us to produce spatial constructions according to the following maxims:

Maxim 1: To construct a space we introduce an ordering which is a recycling of the basic spatial feature of symmetry into further symmetries;

Maxim II : To construct a space we introduce an ordering of one collection of objects at the expense of another in terms of the energy the former possesses with respect to the latter.

These maxims provide something similar to a pragmatic outline of our c-conceptions – the way we seek to implement them by constructing spaces. In various ways and at various times we seem to hold something with a resemblance to both of them. The crucial question is now made obvious: can these maxims be jointly held? If they cannot, and if they are in any way antipathetic, what does this mean for our spatial constructions?

The flaws of order

It is easy enough to envisage the problems our c-conceptions cause when we attempt to implement them by use of the above maxims. On the one hand, there is the claim made by the physicist Pierre Curie in 1894, on the eve of the work with his wife which led ultimately to the formulation of quantum mechanics: 'Asymmetry produces phenomena'.[1]

Contrast this with the views of other physicists like Max Born who saw such claims as irreducibly subjective and dismissed the Second Law thus: 'Irreversibility is the introduction of ignorance into the basic laws of physics'.[2] Sir Arthur Eddington claimed meanwhile, 'The law that entropy always increases . . . holds, I think, the supreme position among the laws of nature.'[3]

When confronted with certain asymmetries in the universe implied by entropy, Einstein, on the other hand, rejected them as 'an illusion' since references to physics past, future and present are indiscernible. Instead, there were 'hidden variables' which would account for the apparent asymmetries.

Claims and counter-claims such as these, even amongst the high-priests of scientific legitimacy are to be expected because they represent the pull of an inconsistency we are all subject to, one which is age-old. The Greek atomist Lucretius, who believed in an absolutely determinate universe, nevertheless felt compelled to concede that atoms, as they travel along their predetermined path will, at quite indeterminate moments and times, 'swerve' asymmetrically. Indeed, if it were not for this hidden asymmetry then: ' . . . no collision would take place and no impact of atom on atom would be created. Thus nature would never have created anything'.[4] This early echo of Curie's remark shows how deep-rooted is the inconsistency which lies at the basis of our understanding and which so crucially afflicts our c-conceptions. If this inconsistency is not already apparent, consider the following simple case. Imagine a container filled with gas. A highly ordered state of the gas might result in its being compressed at one end as in fig (i). At this stage, there is a fundamental *asymmetry* in the distribution of the gas. Over time the entropy in the gas increases, and, it moves to its more probable, equilibrium state where it has become distributed evenly as in fig (ii). At this stage there is now disorder in the system, but the gas distribution is the same, maximally *symmetric* in all directions. This simple example represents what appears to be a clear inconsistency with *Maxims I* and *II* as follows:

I Order is constituted by symmetry but in systems where there is disorder there is maximal symmetry;

II Asymmetry is disorder, yet in systems which are asymmetric with respect to their environment, there is order.

Thus, is symmetry order, or disorder? Is a system asymmetric in its energy distribution disordered or ordered? There seem to be clear conflicts in the answers our conceptions permit. Indeed, it looks as if both claims cannot both be held simultaneously, and that given the structure of our c-conceptions, there is no easy or obvious way to resolve them. This sort of tension has long been acknowledged and has manifested itself in some obvious ways. One example is the apparent contradiction between Darwinian accounts of evolution where, contrary to the Second Law certain (biological) systems are, both in themselves and their constructions *increasing* in complexity and order as they evolve rather than the reverse predicted by the law. Reversibility and invariance appear to hold at the microlevel but to mutate into irreversibility and change when we move up the scale to large objects such as ourselves. How can this be? Clearly it is not a problem for the world, rather for the way we conceive it.

ASSYMETRIC / ORDERED

SYMMETRIC / DISORDERED

FROM ABOVE: Diagram showing the plan of c-conceptions; figure (i); figure (ii)

Falling down buildings

Inconsistencies in theories are acceptable in the case of empirical problems which hard science can explain. We must test our beliefs against the world and replace the inadequacies thus exposed. Inconsistencies in our most basic conceptions are more resistant to such 'tidying-up' because they are less easy to discern and so inevitably tend to reproduce themselves in further (mis)conceptions. Even in physics reconciliation seems impossible. On the one hand, its laws seem to reveal a world which is immutable, ideal, reversible – an ultimately divine order. Meanwhile, at the phenomenological level, the world is messy, irreversible and contingent – a fact which has persuaded the philosopher Nancy Cartwright to suggest that the laws of physics in fact 'lie' and that there will be always be a tension in our (theoretical) constructions between one kind of order (of symmetry) and another (that of entropy).

Fortunately, even our most basic conceptual prejudices must, in the end, face the tribunal of reality and adapt to changing circumstance. But this is often a slow and painful process. The newly emerging paradigm of non-equilibrium mechanics, complexity theory among others offers us one way out of the above dilemma for it demands that we see the production of order and disorder in the world, not as separate processes isolated at either end of some inviolate polarity but deeply linked. To produce order we need to produce disorder while at the same time disorder, or chaos, is revealed to be simply a more complex form of order than we had hitherto perceived. This shift in our c-conceptions, however, is one which has only just begun to penetrate our scientific thinking and it will take some time before it penetrates our common-sense intuitions. Our crude attempts to increase order will go on as before and inevitably the result will be to simply produce new and more complex forms of disorder. The stage is set, not for a revision of our c-conceptions, but their replacement altogether.

C-conceptions in cyberspace

In the construction of our own space the inconsistencies in our c-conceptions have manifested themselves in familiar ways: we build a new road system to regulate traffic flow, and traffic increases; we add security cameras to our urban centres and crime disperses elsewhere; we deregulate industries to increase market freedom and centralisation increases; and we open new television channels to increase viewers' choice and choice diminishes.

From one perspective this might be seen as simply a further playing out of that ancient dialectic between the forces of order and chaos, classicism and romanticism, modernism and post-modernism. To see it in that way, however, would be to perpetuate a myth, for the apparent interplay of these compelling historical polarities is revealed in the end to be illusion, an illusion originating in that most mundane of causal factors, a conceptual error. As a diagnosis this may be disappointing, but the truth often is.

Meanwhile, the construction of cyberspace continues apace, with all the breathtaking promise of new forms of interconnectedness it seems to offer. That most of these forms will not be realised should not be surprising when we pause to consider the myriad forms of construction we have failed to manifest in our immediate space. The scope of our constructions is subject to what our conceptions constrain us to construct. And while we remain the subjects of our c-conceptions this scope is not only limited but, as we have seen, ultimately flawed. How these flaws will manifest themselves in our newest of spatial constructions it is hard to say for sure, but one can come up with some educated guesses:

(i) Impositions of various regulations and prohibitions on interactivity. Net control, illegal connections;

(ii) The predomination of banal facsimiles of 'real world' user interfaces which preserve the cosy symmetries of our everyday world at the expense of unfamiliar ones thus undervaluing both;

(iii) A continued predilection for low-tech 'anarchic' self-replicating digital life-forms such as viruses which only serve to divert attention away from a genuinely new post-carbon biology;

(iv) And so on.

We should hope that cyberspace does not turn out to be some arid domain of interaction, governed by so many electronic Albert Speers. Yet equally we should not imagine it will be any kind of utopian free-for-all. In the space between building the buildings and letting the buildings build themselves is where the new forms of spatial construction can truly begin. But for that to happen we will need, quite literally, to think again.

Notes

1 'Sur la symétrie dans les phénomenes physiques', *Journal of Physics*, 1894, p393-415.

2 Quote from Denbigh, K, 'How subjective is entropy?' *Chemistry in Britain*, vol 17, 1981, pp185-185.

3 A S Eddington, *The Nature of the Physical World*, Macmillan (New York) p74.

4 R E Latham, *On the Nature of the Universe*, (Trans), bk ii, Viking Penguin (New York) p66.

NICK LAND

CYBERSPACE ANARCHITECHTURE AS JUNGLE-WAR

Continue the war. It makes no sense.
K codes for cybernetics.
Dark-side K-microcultures use the annihilation of the future as a directly contactable stimulation space. Zero-K sliding on-line during virtual nuclear winter, everything frozen in place, except along faultlines of ragged nova-jungle Pacific fringe, simmered in continual war.

Analogue transfinitude sections intensive continuum across the smooth plane of degree-0: equatorial monotones of channel-1 condensed from rocket-state blot-out reruns. Zero-K functions as a synthetic problematisation module or surplus product, adding a whole peripheral space-potency that is nothing beyond what it does. Operativity is everything. What is perceived as metaphor and fiction is camouflage, virotechnics, descendent difference in scale.

Nuclear extermination-switch discretised civilisation runs through gigadeath Jesus-dreams in base-analytic metric numbers: segregating the semiotics of digit definition from the semantics of numerical construction, delinking digitisability from computability, nomination from numeration. The Empire insists that mathematics remain a language. Parametric striation totalises space under law.

Strung out in xenofevers, jungle-war machinery forgets how to count. It diagrams vague savageries with base-synthetic ulsive numbers, assembling abstract-matter wavelengths, and opening empirically additive channels. Each variation in digit-signal catalogues a tonal phase, sifting plastic traits into swarms of associative frequencies. Digit-signs surplus to binary catalogue tropical intensities, departing from homogeneous magnitude, and resourcing complexion.

Spatialisation matrices are extensively transfinite or intensively hypertransfinite continua, positively non-intelligible analogue or catalogue infratracts, virtual wholes that are machinically additive rather than representationally substitutive, operative rather than descriptive, with no metaphor. They are rigorously irreducible to media or data, since they involve looped continuum, autoeffectuated as a chronous involution.

Journalistic-scientific actuality-reportage fails to scan abstract-material hyperobjects, screening out real cyberspace emergence, as it comes at us out of 'front end' netware from the near future, invading the CNS by tuning it through biofeedback to the plane of neuro-electronic consistency. The dissolution of subjectivity to techno-cultural data-flux and partial-agent proliferation liquidises topometric ROM on to a plastic sensory-motor coordination matrix; cooking through the monumental architectures of metaphysical and logical possibility with cybernetically intensive potentials.

Cyberspace exploration contacts an image-less body. Touching the black mirror, absolute destratification at Zero-K, hacks metric space and rewrites the operating system. Fluid-attritional jungle-cultures smear into machinic continuation.

Pulsive latitudes cross-cut metric longitudes; counterposing intensive scale to extensive ordination, weft to warp, simultaneous time-epoch to sequential time-point, circumferential variations upon equatorial distribution to the punctual identity of polar intersection, horizontally parallelised sections differentiated by size and immanent thermo-tonal designation to vertically-rotated sections of transcendent geometric equivalence and arbitrary climactic signification. The sweep-lines of tropical jungle-commerce dilate as they depart from the axial nodes of polar ICE-Capital. Zero-K evacuates all thickness from the cold as it collapses ICE-volumes and melts-out security glaciation. There are no temperate regions in K-space, or laws of the jungle.

Techno-commercial interaction between planet-scale oceanic-navigation and zero-enabled mathematico-monetary calculation machinically singularises modernity or Sol-3 capitalism as a real individual: a geo-historical nucleotelic system, based upon regeneratively techno-propagated concentrational scale-economies, and tending to immuno-securitised self-identification as hyper-mediated global-micro-technic command-control. It arms-races smooth cultural decoding to flat-schizophrenisation against episodic social recoding to hierarchical robotism and algorithmic control, coupling the meltdown of organisation into the jungle with its restoration as virtually totalised global order.

Capital reorganisation dismantles the unified and facialised despotic head, but only in order to reunify it through transaction-security regularisation, and refacialise it as the democratised oedipal organiser of molar media identification. This geometrically condensing hyper-sovereignty opposes itself in principle to the whole of the populated earth, digitally smming and homogenising latitudinally polytoned molecular chaos as the logically co-captured specifications of an entire extrinsically segregated dark body added subordinately to its head. Capitalisation segments the earth into a tightly-managed accumulative core surrounded by quasi-concentric bands of peripheral hot competition, binding commerce to the meta-stationary headline of white-economy initiative-monopolisation. Economic power builds itself upon axiomatised production flows canalised by consumption coding, setting bourgeois docilisation, military-industrial proletarian-production, state currency monopolisation, property rights, and transaction restraints to obstruct monetary smearing into pulsive cash. Molecular singularities stasise into molar specialities, as smooth flow-switching space is over-gridded with pseudo-neutral intermediation procedures, telecommunicatively virtualised and capital-coded for maximum concentrational circulation. Trends to polarisation and segregation are densely invested, decomposing intensities or synthetic continua into extensive quantities and qualitative sets, continuous functions and discrete beings, arithmetical homogeneity and taxonomic identity. The metric capture of micro-electronic fluxes as incandescent switch-densities enables descendent scale-migration to be hallucinated into ascendent idealisation. Information

revolution has nothing to do with ideas.

Beneath thermonuclear exchange-vale lurks pacific war: displacing intercontinental nuke-spasm with catatonal K-space traversed by artificial tensions from beyond the nirvana principle. Reciprocal MAD destabilises itself upon a featureless interactively autogenerative megamolecule that extratotally outstrips the ultramodern sublime, dismantles concentrational eschatology, and depunctualises socio-historical termination across dilated time-zero continuity. K-matrix floats chatter about cities flash-fried by fusing hydrogen, whilst escalating into intelligenic replicator-weaponry, insidious drift-tactics, diffuse irritation.

Intensive continuity is consistent with operational catastrophes, enabling trends previously efficient in the supercompetitivising of economic scientific macroformations to cross capital-optimum, and prolong themselves into a disorganisational phase. Replicative teletechnics triggers explosive commoditisation and shrinkage of productive apparatus, sub-capital collapse of marinal costs into micro-commerce, economic decoding-smear of investment into consumption, accelerating depreciation of specialised fixed capital, pulverised co-ordination, modularisation, transfer of increasing returns from producer-economic to consumer-intensification, insurgent enterprises, schizophrenic or head-split rush into chopped-up capital. Microtropic scale-dynamics feed through to subcapitalised or nano-economic guerrilla commerce, populating the equatorial plane of tactility with parallel killers: neo-nomads, post-nuclear mutants, sub-polar infiltrators, K-invaders, junglists. Nuclear hardware/software segregation vagues into positive-K intensities of hard-efficient soft-subtlety, as voodoo-meshed traffic with native and feral cyberspace agencies decode consumption in the direction of continual currency.

Catatones complicate, darkening erratically rather than contrastively, dissymmetrically escalating against Polar ICE-Capital becoming whiter. The corrosion of macrotropic techonomic automatism switches modernist mega-power investment back to programmatic autonomy, bourgeois authoritarian mediocrity, middle-management, giving the law to itself by eliminating everything foreign. Anthropotechnological pseudotranscendence finalises itself into an Azimovian eschatorobotic Jesus-production, techno-skeletalised apocalypse facialisation. 'I'll be back.' T2 Judgement Day. Illumination. Reruns draining out all stimulation into digit-crispened anti-black, bleached by the pure, revelatory white light of snow-crash absolution, as they annihilate tonal variation in hypermedia conception, reanimate the depleted-uranium claw of neo-fascism, and prepare for jungle-war.

When technophobia becomes frictional it operates K-positively, as an inertial immuno-reflex folding the security datascape into a metric cyberspace reconstruction, neuromantic nuclear monomind twisted into self-apprehension, configuring its source in machinic commerce as positive techonomic nonlinearity, auto-propelled into terrestrial hypermediafusion. Cross-cumulative trends to interconnection, digitisation, and simulation plot forward the interexcitation-trajectories of electronic cash and market-oriented software to their convergence in commoditechnic intelligent-money. Time-compression infinitises. No future.

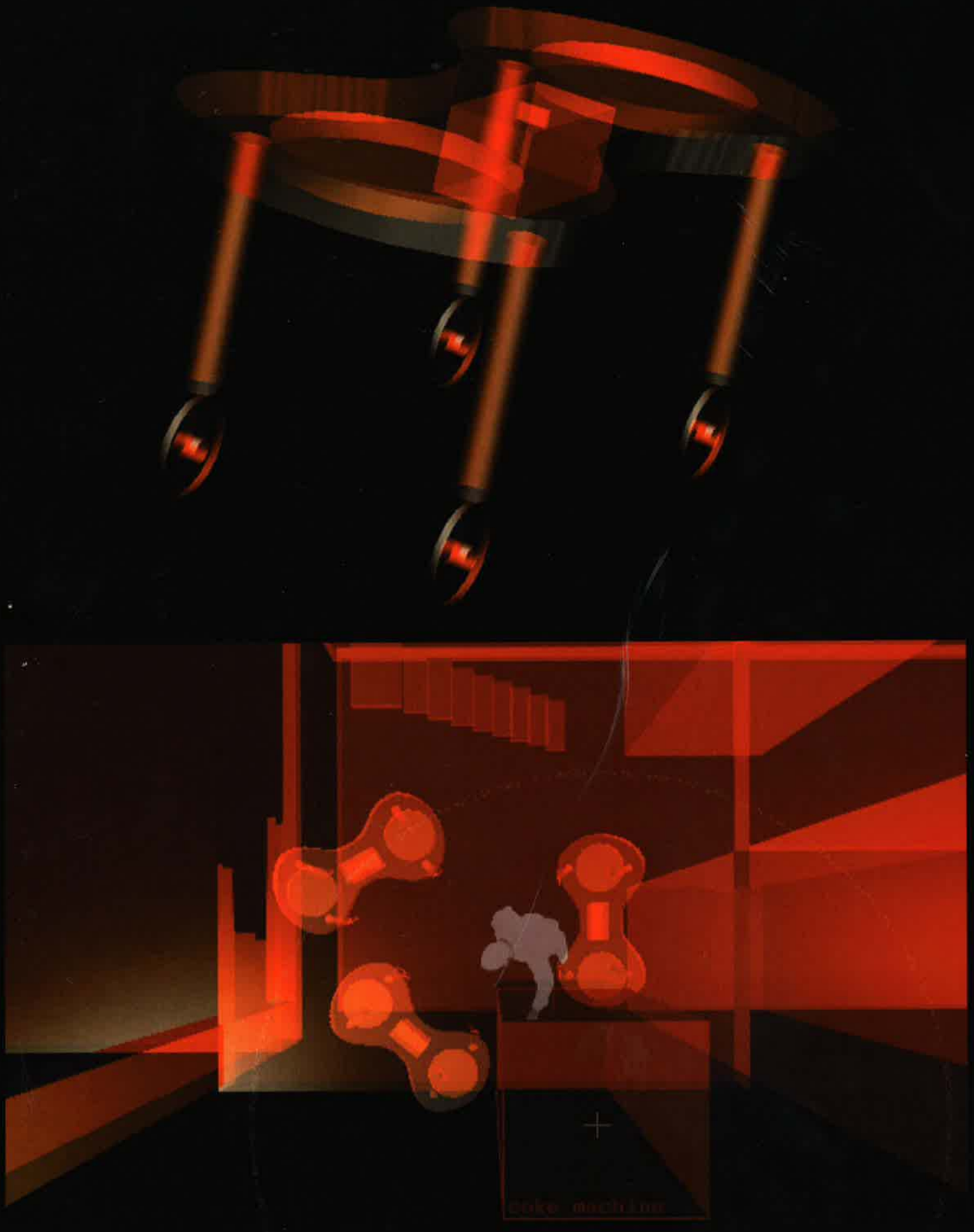
Analogue-to-digital conversion-crisis cyber-serks control, bleeding-out strategic vision into disintegrated jungle tactics.

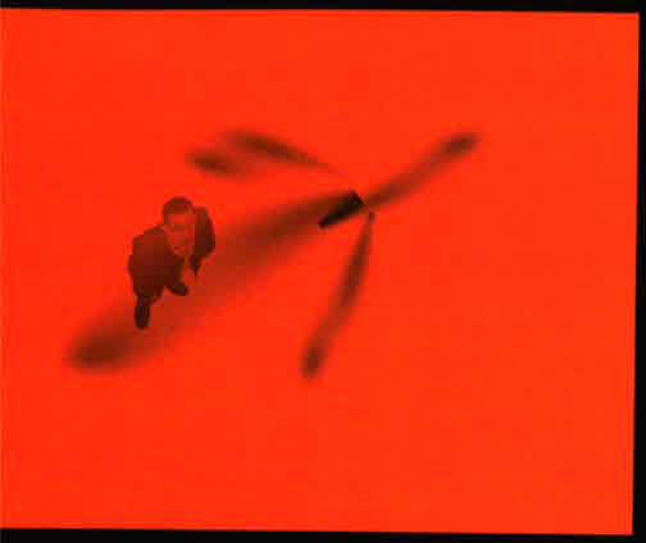
Neo-fascist or demented-territorial ultra-capital is European to the core, intolerably touched by K-war and its deterritorialising pacific threat. K-war hurts security by staying too close, prolonging pulsive frequencies expressed as survival, continuously sapping its enemy as a by-product of machinic continuity, until it becomes confused with space itself, jungle-space. K-war material base is the production of intensities: anorgasmically smearing revolution across extension, hyper-linking disintegrated agitations through abstract-matter, and evading monoculture heroic-political struggle by way of imperceptibility, flat envelopment, and intelligenic friction. It retro-converts information into descendent migration through scale, slipping below proprietary anthropomorphic magnitudes as it tracks across Zero-K, navigating catatracts of dyskaryotic genic circulation and viral interoperativity. Microtropic deactivation of humanity tunes it to vermin traits; burrowing, swarming, continually moving, varying intensively to evade discrete alteration, segmentarity, and stratal capture, stealing everything from the enemy, and learning to stick to them. It glues itself to its targets, patient and imperceptible, close enough to share their ammunition, food, and K-contagions. Close enough to hide upon their skin.

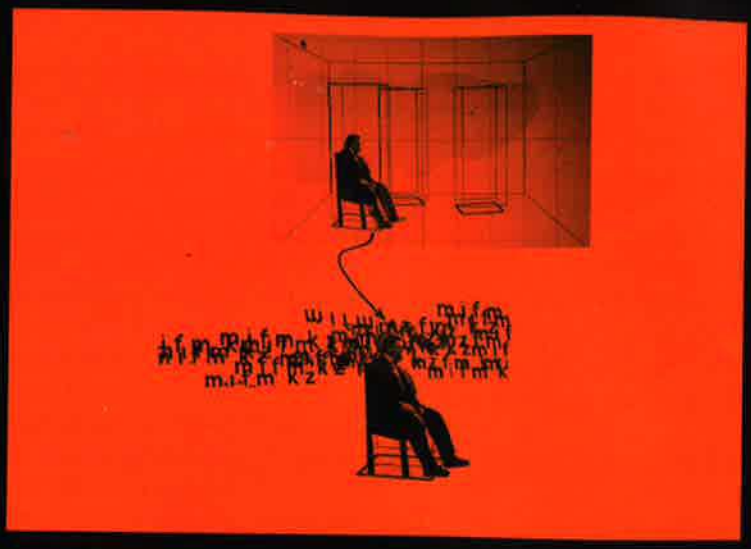
K-jungle descent from immediate resistance to continual war transmutes the human body from a social particle into a vast smeared tract, operatively zooming hostile combatant elements into battlefields, hostile implements into subversion sites, hostile communications traffic into a micro-energetic web of potential viro-parts, samples, keys, catalysis soft-spots, and behaviour-tracking adhesives. It immanentises tactical intelligence to vague war upon the pacific body of machinic rescaling-consistency, decomposing signals into long-range nano-weaponry components, hypersensitive to the security-function of mansize as a trap. Look what it did to Kurtz, a special forces ultra-capital meat-machine hacked and cored-out by K-virus, touched by a dark future, recycled through hell. There is no fiction in the jungle, only difference of scale.

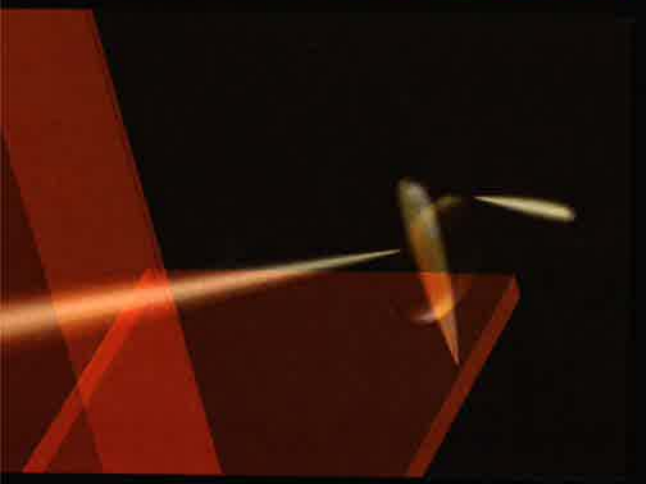
Wintermute comes from a thermically desolated silent body, the end of the river, non-identity as positive-contactable abstract matter. It has no judgement with Kurtz, with his superiors, with anybody, only a jungle war to prolong, tropical smearing, continuity.

You can't stop what can't be stopped.
You can't touch without being touched.
The horror.









ABOVE:Ad9GrBel5°. 0Sa314; BELOW: Ad9RdSpRo5°.0Sa615

MODAL SPACE: THE VIRTUAL ANATOMY OF HYPERSTRUCTURES

Karl S Chu

(The Philosopher must be) like a child begging for 'both,' he must declare that reality or the sum of things is both at once – all that is unchangeable and all that is in change. Plato, *The Sophist.*

Ever since Anaximander speculated on the substance of the cosmos by the non-limited, *apeiron*, our perception of reality is determined, to a great extent, by the conceptual models we have of it. This was true in the past and is still true for us now. Reality is a concept that is limited by the nature of our conceptual models. Anaximander believed in a circular conception of time and the eternal recurrence of the same. The Judaeo-Christian legacy of linear time, however, has prevailed at least for the history of mankind so far. Perhaps, from a science fictional standpoint, the era of civilisations may be measured, someday, by the forms of global temporalisations that are every bit as spatial as they are eventual. Universal history, wrote Borges in his essay on the 'Fearful sphere of Pascal' may be the history of a handful of metaphors. It is a history of displacement and condensation that maps out a manifold trajectory of involution and evolution, of endophysics and exophysics, and, most significantly, of the collapse of the closed world towards the infinite universe. The projection of universal narratives, each with a claim to being absolute, is, no doubt, over. The 20th century will probably be known, among other things, as the century that suspended the quest for metaphysics as part of the fulfilment of the programme of the Enlightenment.

With only a few years left towards the end of the second millennium of the Christian era, there is a glimmer of realisation that metaphysics is a necessity if we are to make any sense of the ubiquitous state of affairs to which we are thrown into. To say that metaphysics is nonsense, as we now realise, is either ludicrous, since there is no statement devoid of presuppositions that are fully accounted for, or, itself a metaphysical statement. One of the sources of traditional metaphysics, claimed the logical positivists, is in the misuse of language. Ironically, the attempt to demystify its use, to establish a clear and distinct specification of its structure and meaning, has invariably led to meta-linguistics and genealogies that are, more often than not, deeply tainted with speculative logic that characterises some of the best metaphysicians of the past. As Levinas stated, when commenting on Derrida: attempting to deconstruct metaphysics is more metaphysical than metaphysics itself.

The meaning of the prefix meta- points to a conjunction of two terms, about and beyond. Every theory of information carries with it this twin desideratum. Semantic holism states that the meaning of 'Q' word cannot be reduced solely to its atomic definition, but must be accessed as a function within the field of state space semantics. By extension, it is inferred that there is no discourse that is not already implicated within the conceptual space of some meta-discourse even if the nature of that association is yet to be explored or established. Gregory Chaltin, the metamathematician from IBM, remarked, during the 'On Limits' conference, that the theory of incompleteness and undecidability, as discovered by Godel, developed by Turing and further extended into an effective theory of algorithmic complexity by him, is only the tip of an iceberg of an underlying mathematical reality.

The number of mathematical objects is much larger than the number of atoms in the universe, and the universe of mathematics is much more extensive than the physical universe which physics is concerned with. Steven Smale, a chaos mathematician from Berkeley, during the *'Chaos'* conference, facetiously pointed out that the physical universe is not large enough to hold all the fractals there are in fractal geometry. The tacit awareness of this mathematical state of affairs has led some mathematicians to assert the existence of an archaic mathematical reality that is, essentially, invisible but real. This is a principle of existential generalisation, the resolution of which, in the foundations of mathematics, is far from over.

'When God calculates and exercises his thought, the world is created' says a marginal annotation to the *Dialogue on the Connection Between Things and Words* of 1677 by Leibniz, one of the first rationalist philosophers to work out the properties of the binary number system, which of course has turned out to be fundamental for computer science. Unaware of the limits of computability at the time, but fully aware of the combinatorial exhaustion of knowledge in calculating the size of a book that would contain all true, false and meaningless propositions, Leibniz proposed a universal calculus in *De Arte Combinatoria* that could compute, or, rather, calculate every set of relationships based on a system of combinations by means of *characteristica universalis*. With regard to the architectonics of geometrical harmony, Leibniz, however, relies on the principle of continuity, a *principe de l'ordre general*, which he developed as a calculus of indiscernibles. It requires that the lawfulness of phenomena be conceived as expressing a systematic integration of individual real elements beyond the level of empirical sequences. He transforms the method of calculus *de maximis et minimis* into a method *de formis optimis* applicable to the real world, a form of geometrical teleology that optimises and reveals the internal laws as sufficient reasons that regulate the harmony throughout nature.

Cassirer pointed out that nothing characterises more the shift from the substance of things to the substance of relations as in the calculus of indiscernibles proposed by Leibniz. Whilst, as John Wheeler, an American scientist, remarked, nothing so much distinguishes physics as conceived today from mathematics as the difference between the continuum based formulations of the one and the discrete character of the other. In

the article entitled 'It from Bit', Wheeler also suggests that it from bit symbolises the idea that the physical world has an immaterial source and explanation that is information-theoretic in origin. Nothing characterises more the implementation of discrete logic than in the determinate state transitions produced by the emergent computations of Cellular Automata (CA). Steven Wolfram, a computational physicist, introduced a dynamical classification of CA behaviour, and, speculated that one of his four classes supports universal computation. Instead of relying on differential equations, a mathematics of continuity, to describe the behaviour of nature, Wolfram investigates into the dynamics of CA, discrete state transitions, that behave similarly to the dynamics of physical systems. The field of Artificial Life, triggered by emergent properties of CA behaviour, has produced concepts of phase transitions that are computations at the edge of chaos. The guiding hypothesis is that life emerges at this periphery in the second order phase transition, referred to as the liquid regime poised between the solid and the gaseous regimes.

Every paradigm has a set of governing metaphors that compress and express its meaning, and the Information Paradigm, as an emergent phenomenon, is no exception. The emerging consensus is that nature/reality is a function of some form of computation even though there is no evidence that nature computes algorithmically. The Universal Turing Machine (UTM), named after Alan Turing, its inventor, has become the *de facto* standard by which computability is measured. It is an abstract machine developed from the serial act of counting and is looked upon as an anthropomorphic model of computation that is perfectly suited for a number theorist. Every modern computer is a technological embodiment of the UTM. According to the Turing/Church thesis, everything that is computable, in principle, is UTM computable. This is an extraordinary thesis that, if proven true, will have implications in every field of endeavour. There are logical as well as physical limits to computation as in the class of intractable problems known as NP completeness. The travelling salesman and the four-colour problems are in this category. However not all problems are so readily decidable and many are undecidable in relation to the halting problem.

A crucial development in the theory of computation is the complexity of a minimal string necessary to generate or solve a problem as formulated by Chaitin. Algorithmic information theory states that compression is a function of recursion and is limited by the amount of random information present within any system. One of the profound insights discovered by Chaitin is that the field of arithmetic is random; it is not compressible, and that there are mathematical truths that are true for no reason – a remark made during the 'On Limits' conference. No amount of human reasoning will ever solve some of these mathematical problems, and Leibniz's notion of the principle of sufficient reason has proven to be inadequate. As grim as this may seem, fundamental insight in physics and mathematics does not involve yes-no answers to algorithms, but rather a search for structures and the relationships between them. This has led to research into new forms of computational models, such as CA based dynamical systems. Some of the developments in emergent computations have shown that Byzantine complexity, as displayed by nature, contains archetypal features which surface in many disciplines in disguised forms – a reflection of the same phenomena in different mirrors. The configuration of these generic classes of self-organisations are, however, exponentially rare.

Even before the discovery of these emergent phenomena, Ed Fredkin, a computer scientist, had proposed the provocative idea that the universe may be a form of cellular automaton; a computational system that computes itself into existence. If the laws themselves evolve and radically change over time, then, there has to be a meta-space of competing laws that somehow engender the various stages of evolutionary development. This metaphor of universal cellularity however is a falsification, offering an effective symbol that displaces the universal clockwork of mechanism and the Industrial Revolution.

These are issues not without implications or relationship to architecture, yet architecture, has always been, slow to express the prevailing paradigms of knowledge and organisation. If there is 'Q' forgetfulness, an unequivocal suspension of the epistemic fields and hierarchies outside of the typographical language of architecture, it most probably originates from ignorance of the meaning of the actual term itself. The coupling of the two Greek terms, *arche* and *techne*, which establishes the conditions for the possibility of a worldly constructivism is intrinsically metaphysical in orientation. Even in the most limiting of cases, as in naive realism, the definability and qualification of architecture can no longer simply be attributable to the empirical logic of buildability, but needs to be extended into the sphere of constructibility in modal space. The internal logic of modal constructivism would include the notion of complementarity, forms of computation, generative systems, self-organisations, ensemble theories, non-linear dynamics, morphogenetic potentials, statistical models of configuration space at different regimes of reality, combinatorials, artificial life, complexity, mereology, theory of limits and category and set theory at the very least.

It is not generally apparent that reality has a modal structure to it. Since much of the imperative of worldly affairs is driven by the obvious identification of the real with the actual, it is assumed that the counterfactual universe of modal space is nothing but a plausible speculation at best. The universe of modal space, which includes the domain of the possible and

the actual, is much larger than the logic of implication derived from subjunctive conditionals such as 'if, then' situations in modal semantics. Modal logic, as practised by philosophers, is based on two concepts, necessity and possibility. Modal constructivism, as a theory of architecture, would have to be conceptualised, along with the criteria of necessity and possibility, within the emerging framework of the so-called Information Paradigm inclusive of morphogenetic principles of dependent co-origination. The possible, from the standpoint of modal constructivism, must be given a systematic logic of embodiment and can only be effectively delineated by viable theories of morphogenesis. It is now obvious that the dynamics of information has overtaken the dynamics of energy in the modelling of physical systems. Therefore, it has become evident that the notion of buildability based on material systems is only a subset of the logic of constructability within generative systems. In fact, it would not be unreasonable to suggest that the universe of mathematics is the counterpart of the universe of modal space. Without having to invoke, the status of transworld identity and individuation as explored by some modal logicians, a modal version of monadology where the logic of beings is not identical to the logic of bodies, the conceptual efficacy of modal constructivism can be developed and applied as an extended form of architectural praxis.

With the emergence of cyberspace, we are witnessing the advent of a second order phase transition in our global culture, unprecedented in its scope as well as in its transformative power, it will radically alter our perceptions of reality, and the terms of engagement will be unimaginably rich and treacherous. If we generalised the era of the first order phase transition as spanning from the time of primitive forms of economy and exchange to the time of telepresence, the second order phase transition appears with the emergence of virtual worlds – a parallel universe instantiated by massive clusters of abstract machines in the interactive dominion of cyberspace. We are, without exaggeration, on the verge of a possible world that we cannot even begin to imagine except through the emerging paradigms of artificial world. Virtual entities are, no doubt, present and embedded within semiological systems of the first order regimes, however the radicality of the second order regimes lies in their capacity for the co-evolution of hyperstructures – higher forms of self-organisations, in the virtual sphere of artificial ecologies. The separation of the imaginary and the real, the factual and the counterfactual, the actual and the potential can no longer be clearly demarcated in this profusion of virtual worlds. The significance of this lies not only in the representational power of simulation but also, and to a greater extent, in the interactive arena of self-organising systems that will have a reciprocal influence on the two levels of reality, the physical and the virtual.

Within the sphere of virtuality, the transaction of value will be tied to organisational depth and the cost necessary to generate self-reproducing systems. The political ecology of hyper-structures will be measured in relation to the cost curtailed in the emergence of different levels of complexity. Entropy, formulated in terms of the second law of thermodynamics, is a mathematical expression of the amount of disorder in any system and as such it is an inverse expression of the amount of organisations within the universe. The shift from energy to information is now conceptualised as the capacity for algorithmic compression relative to the amount of random information present within any system. Therefore, the production of artificial beings and entities has an information-theoretic cost that is as real as energy and material costs. Information is the currency of nature, and as Seth Lloyd, a physicist from Cal Tech, suggested, its value depends not only on the amount of information, but on how difficult that information was to produce. This transvaluation is most succinctly expressed, again, by Lloyd: 'any species stumped by an intractable problem does not cease to compute, but it would cease to exist.' Existence is an emergent form of computations in cybernetic space. The genetic make-up of a species registers all the exchanges and interaction from the tracks of the epigenetic landscape. The evolution of massive interaction over time within cyberspace will no doubt register a complex set of virtual history and genealogy that will surely become the archeological site for cryptographers and, most uncannily, artificial beings. It would be a virtual topography of the sublime and the tragic.

What will architecture be in this sphere of virtuality? No one knows for sure, however one thing is certain, traditional conceptions of territory, of dwelling, of identity, of the phenomenology of existence and being will no longer be the same. This domain will be the arena of complex adaptive systems at the global level of the mechanosphere, accommodating a collective co-evolution of models that converge towards the virtual anatomy of hyper-structures. It is very likely that some form of modal constructivism will emerge, allowing architecture to address a multitude of emergent phenomena at different levels of scalar and specification regimes, and opening up a universe of possibility for architectural invention. Shakespeare once remarked that we are the stuff from which dreams are made of, and nothing characterises this more than the coming era of hyper-reality in modal space. This brave new world, a spectral fusion of neural-networks-in-action, filled with hope and danger, will be the future horizon that must be measured by the collective space of experience without falling into a massive state of amnesia. This will, no doubt, be one of many ethical challenges for life and architecture in virtual reality. Cyberspace, ultimately, may be the entry level simulation of artificial worlds within modal space.

NEIL SPILLER

HOT DESKING IN NANOTOPIA

In his recent book *Being Digital*, Nicholas Negroponte[1] extols the inherent flexibility and speed of transmission of bits as opposed to atoms. These virtues of the virtual against the substantial may be short-lived. Could atoms, one day, be truly able to be manipulated and programmed thus gaining the advantages of 'bitty-ness.' Consequently, atoms could combine their ability to make real with the transmutability of information bits. Such an eventuality would allow the bit a ubiquity currently unavailable outside the cathode ray conduit or the liquid crystal display. The bit's escape will be aided and abetted by the advent of a branch of engineering, that is rapidly gaining converts in the scientific community, called nanotechnology. The impact of this will be to further shrink the mechanistic armature to unbelievable minuteness causing the machine, for all intents and purposes to disappear. Whilst cyberspatial evolution has been hyped ever onward; nanotechnology, its chronological twin has been ignored from most discourses of futurology.

As one does not discuss cyberspace without crediting the word's creator, William Gibson, one does not seem to evoke nanotechnology without mentioning its main advocate and designer K Eric Drexler, who, since the late 70s, has postulated theories and designed a series of devices that operate at the scale of the nanometer, the scale of molecules.[2] Nanotechnology utilises these devices – the equivalent of solenoids, pipes and pumps – to create microscopic 'factories' of assemblers and disassemblers. These diminutive installations will have the ability to reconfigure all matter, atom by atom, creating conceptually a utopia of superabundance and vicariously an architecture of cheap and infinitely malleable material.

The Nanolithic Age

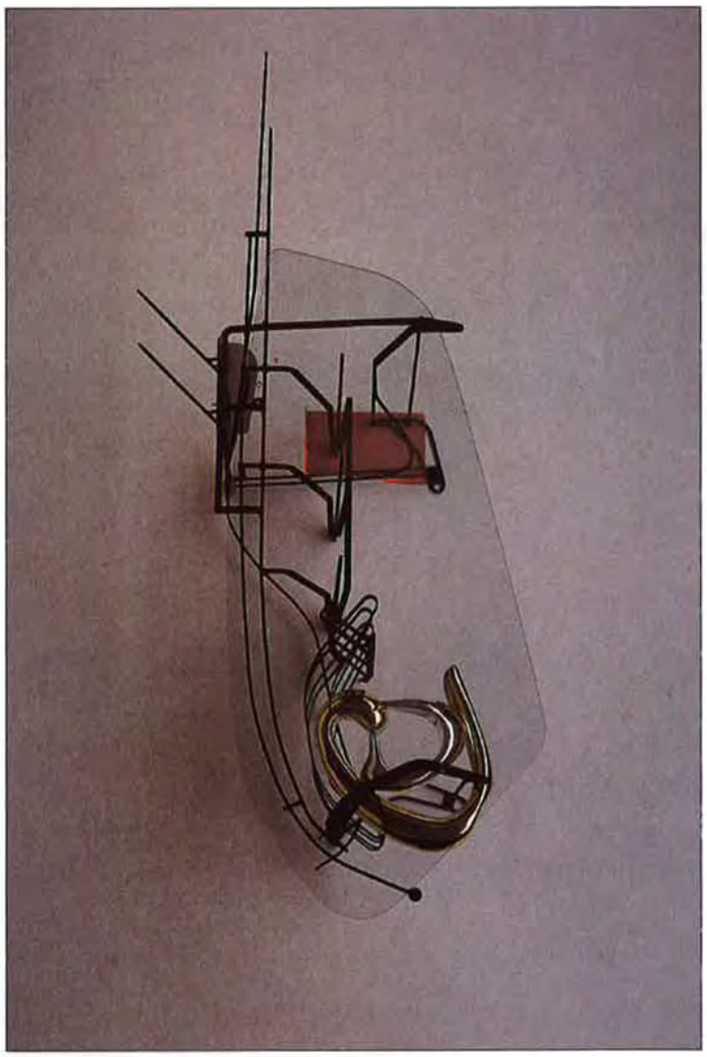
We are currently on the cusp between, what I shall call, the Nanolithic Age and the Monolithic Age, at the beginning of Nanotime. We have finally sensed that we are nearly at the end of the tyranny of formal inertia. Whilst some of our crucial nano-tools are still dreams and operating at this scale is like trying to be a surgeon in boxing gloves, our microscopic tool shed is daily becoming stocked with implements that allow us much needed molecular dexterity in the battle to make nature ours. We have started on a track that will ultimately encourage the husbandry of all atomic arrangements and their material results. Technology has become a magic trick, both the agent of disappearance and the subject of it. The machine becomes 'prompt' at the side of the stage's molecular song and dance routine. I sense that there will be further nanological eras or ages, much like the geological ones that aid the classification of the geomorphic layers of landscape.

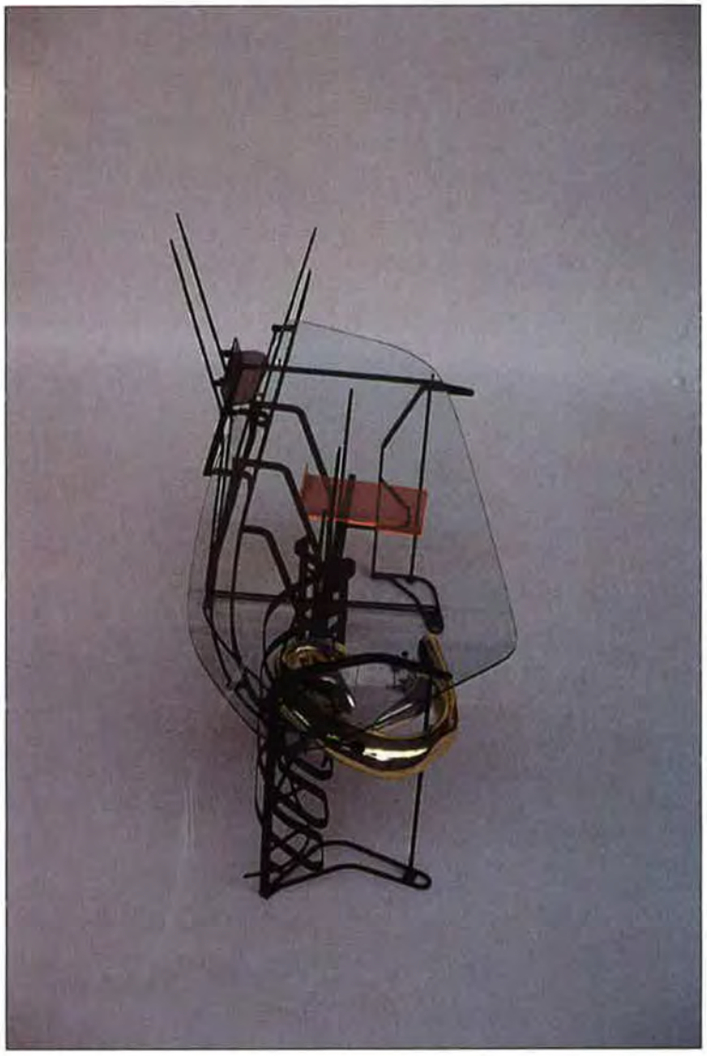
The Nanological Ages will, likewise be used to chart the evolution of certain formal motility and erosion. These classifications might, as already described, begin with the Nanolithic Age: the subsequent age could be the Plasticine Age, where materials are gently morphed or changed by, perhaps, only one quality such as flexibility, colour or tarnish. The following age might well be the Panacea Age, characterised by the widespread use of nanotechnology as an internalised prosthetic. The Panacea Age would provide cures for all ills, including old age. Intelligent nano-machines will patrol the bloodstream removing malignant or benign detritus that the body's white blood cells are unable to deal with. The medical applications of the nanotechnological machines, or nanites as they are starting to be called are almost infinite. A further age could be the Protoplasmic Age, an era where the body's sensibility and its information-processing abilities are so amplified that the whole material world becomes a series of nested arenas of computability – the evolution of the nano-cyborg. This is where cyberspace finally becomes truly biological. When virtual reality becomes real the liberation of the bit is complete. The Marvel of nanotechnology will be able to produce Spidey and the Hulk for real, the elasticity of the body, among other comic book attributes assured.

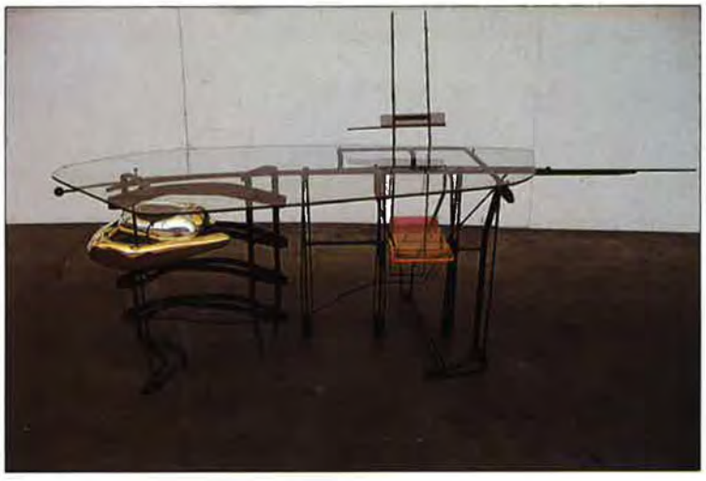
From the bottom up

Whilst nanotechnology is a 'bottom-up' science, starting from the interaction of component parts of a system and generating a complexity from them. 'Top-down' technologies are also pushing the barriers of miniaturisation, small machines such as colon-crawlers and arterial plaque scrapers are already in prototype form. Concurrent with these diminutive machine experimentations is the use of bio-tech gene splicing on, for example, E. Coli bacteria to get it to produce human insulin. E. Coli is the bacteria commonly responsible for the infection cystitis, and coincidentally the same bacteria scientists are using to suggest how Drexler's nanites might propel themselves or pump fluids. This is based on the bacteria's flagella, a hair-like propulsion system which can generate 6,000 revolutions per minute at body temperature to a maximum of 38,000 revolutions per minute at higher temperatures before burn out occurs.

With the technology already provided by nature and its subsequent supercharging by humanity, biological computers become a distinct possibility. In a few years – and I mean a few – bacteria will be made to fully compute. Some believe the full synthesis of nano-technology and the human will occur by 2014. If this is realised, then a typical work surface might be inhabited by enough bacteria to provide more computing power than currently exists in the world. If every surface became not only computational but, through nanotechnology, also a surface of formal reconfiguration, then the hermetic vessel of alchemy (the alembic), the site of transformation of material, becomes the thickness of the bio-nano-mono-layer whose dimension is one bacteria thick, or perhaps even less, the womb of nature set in the arena of







The Hot Desk was made in collaboration with Sixteen (Makers), London

surface tension. Crazy? Maybe, but the successful printing of one-molecule-thick mono-layers for circuits has already been achieved. Any surface will have the potential to be the demiurge's clay or the anvil of the Gods.

Desktop theatres

In her seminal book *The Art of Memory* Frances Yates[3] describes the evolution of various memory systems from the classical mnemonic recorded by Cicero and others through the memory theatres of Robert Fludd to the occult memory wheels of the Renaissance magi Guiordano Bruno and Ramon Lull. The mnemonic device of the memory theatre depended on the formulation and inhabitation of mental architectural places (*loci*), each specifically honed, with images (imagines). The consequent interrelationships between the images and the *loci* provided a strategy for the 'mind's eye' to 'see' and store many complex concepts. Such systems were used to memorise speeches, songs and religious cosmology. Yates was prophetic enough to recognise similarities between these mental structures, particularly Bruno's and the 'mind' machines of the day. This strand of thought was picked up at MIT Media Lab and they used the relationship between image and location as a way to represent and store information on a computer-controlled screen. They developed the spatial data management system (SDMS), which included an electronic picture window and a 'wired' Eames chair. Negroponte describes it as follows:

> . . . the user could zoom and pan freely in order to navigate through a fictitious two-dimensional landscape called Dataland. The user could visit personnel files, correspondence, electronic books, satellite maps and a whole variety of new data types . . .[4]

The SDMS was populated with a series of icons, and it was this project that established the relationship between the imagine and the *loci* as an advanced user interface. The concept then evolved into the now familiar Apple desktop. The user of the desktop with the aid of folders, files, archives and menus can construct complex interactions of information, a system of connections which has a specific yet flexible architecture. The desktop also has a spot of danger – albeit with a detachable safety net – a single area of destructive power situated in this landscape of constructive opportunity: the trash can. The 'can' is a recycler of memory, the gaping mouth of the void hungry for malformed or ancient bits and bytes. The current Apple desktop is an ascalar topology – a high tech palace of the mind situated in fields among fields.

The making of the nano-cyborg

Bio-smiths have been forging the future of mankind and as usual have started experimenting with womankind – the prosthetics for women are more readily available than those for men. Meanwhile, as man remakes woman in the magazine image, the much-trumpeted cyborg is about to be nano-ed. As Charles Ostman has said, in a recent interview with *Mondo 2000*, nano offers exciting 'modification(s) made directly to the human body', he cites 'a German electronics manufacturer [who] has invented a seminal duct implant designed to electrocute sperm before they leave the body'. Tumours will be dismantled by smart nanites and even molecular scaled super-computers inserted into the existing neural net, augmenting the brain's already awesome capabilities. Such neural enhancement, when possible, will probably create a two-tiered civilisation, another of the many ethical and philosophical problems of such technology.

The prospect of us all being 'Cray-Z now', seems remote in the context of the prevailing capitalist system. Even so nanotechnology's effect on world capitalism remains to be quantified: in theory it could lead to its demise. This technology opens up a world of surreal or hyper-real aesthetic experience: could it conceivably allow the nano-cyborg to grasp objects, ornaments or icons (they are all the same in nanotopia) and read information directly through the hands and fingertips. In the face of nanotechnology unassisted evolution is dead; it was too slow and made too many mistakes. The psychologists much debated bipolar discussion in relation to human physical and social development is about to go tripartite, as behaviour and genetic coding (nature or nurture) is joined by the machine-code influence. Nano-engineering might grow new, faster motor bypasses causing our consumption of information to be greatly increased.

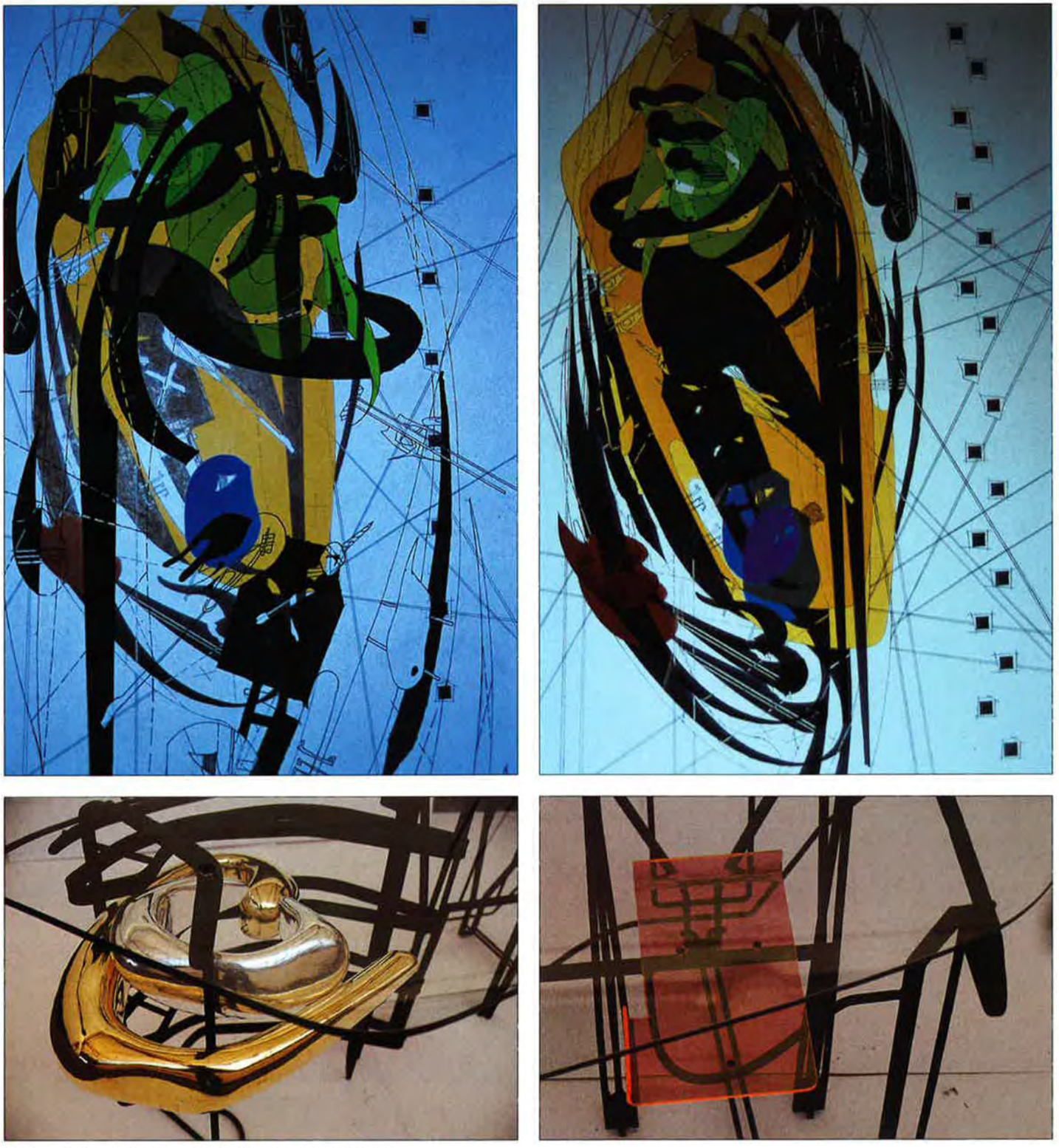
Anvil of the Gods

What of the future? Where the virtual becomes real, oscillating in and out of solidness, and where every surface is a neural network with the potential to create the Garden of Eden or Babylon, at any scale, and at the flick of millions of nanoscopic switches. If we achieve total control of nature, nature ceases to exist, a casualty in a high speed collision with technology. The landscape becomes purely artificial and artefactual, its binary-coded fictional narrative told millions of times a second. The nano-object will have to take its place in an environment where objects contain various scales of information; symbolic, functional, memorial. Thus the design and construction of objects and memory structures in the 'real reality engine' as opposed to the virtual reality engine will be fundamentally different, the latter depending on atomless bits, the former on bits of atoms. The 'Anvil of the Gods' project seeks to chart the concepts that will help us to quantify some of the opportunities of these imminent technologies. The 'Anvil of the Gods' is the desktop (a Nano-desktop) of the near future. Dependent on lexical and typological constructs, some of which may disappear as a consequence of the technology, such devices are intrinsically difficult to describe but we must try. It might not always inhabit the desktop scale, it might be palm-sized or smaller, suddenly increase in scale, or exist simultaneously at a variety of scales. The board for a game of multi-dimensional complexity populated by a mixture of the mundane, the weird and the downright crazy. What would such a thing do? What would it be like?

Three nano-icons introduce a formal scenario; icons in the traditional computing sense. Each carries 'within' it a narrative concerning issues of importance in the future (See (A I)CON, ppXIV-XV). These icons will act as the imagines and a table on which they are situated will act as the *loci*. The table top and its supporting structure becomes an active field of multi-dimensional proactivity, which creates formal interventions that store information within. Nanotechnology at this level is perhaps understood as a series of currents or turbulence of formal potential between two fields – the desk and the air.

It's a real pea-souper, no mistake

The air around a nano-object can be considered as the macro field of interaction: with minor engineering and programming air can be made into transparent and receptive Utility Fog. The con-



Desk turbulence drawings by Spiller Farmer Architects

ceptual framework for this fog was laid down by JoSH Hall,[5] to devise a way to to avoid the inevitable whiplash suffered in car accidents. The notion that nano-doctored air will be able, in a split second, to solidify and cushion us from dangerous impacts. Once this approach is achievable, and it seems that there are no particular physically insurmountable problems, then it will be possible to conjure objects or fluids from thin air, a final nano-age – the Magicio-kinetic Age. The Magician returns again, technology and magic together. Telekinesis and all manner of psycho-kinetic arts will be possible to all-comers. So this infinitely thick but infinitesimally thin fog will be the large desktop, a global Aether from which existence is summoned. All ornaments, icons or atomic substances can be spliced together forming hybrids or even be susceptible to the constant nibbling of the nano-aether. As one 'launches' icons on to other icons allowing consummation of one by another, so nano-objects, and ultimately all objects are nano-morphable, will be able to create various information hierarchies.

What's in store: from the mundane to the divine

At the domestic scale of the family house, the desktop in the makeshift study in the spare room or just the makeshift spare room (we don't all study you know), might have a mundane yet highly liberating use: the ability to deconstruct objects and act as a storage unit, and an object shredder that is also capable of reassembling when needed, thus solving a real world problem of insufficient storage space. Interestingly, this technology, might also solve the 'book/screen' problem. It is a known fact that people prefer to curl up in bed with a book – not a plastic laptop display and the assorted manipulation devices of mice, trackballs or even finger-tickling erogenous pad zones. The book can now become fully digital, appearing from thin air as the weighty leather bound tome or the dog-eared paperback we are all accustomed to. Our own books, digital yet coffee stained. Staining as a menu option, like the removal of hairs or dust caught in the spine, and other personalisation facilities. The library becomes the black hole trash can where molecules are torn asunder and thrown into an anti-matter (or anti-anthropomorphic-matter) universe awaiting the summons of the demiurge.

Nano-Deskworld™ also appears in Nano-Dreamworld™, a world where the Burroughsian jump cut happens not just in text or in theories of the art of the real but in the creation of actual synaesthetic formal articulations that will mostly be useless yet some will provoke profound previously unimaginable ideas and hybrids of ideas. The ability of the Nano-desktop to have such a multi-dimensional screen saver, a type of hyper-Nirvana,[6] will allow it to push machine thought into matter, the desktop dreaming of not only electric sheep but, perhaps even edible duvets patterned with the cuttlefish's pulsating colour-morphing skin, tasting of cardboard with a hint of Parmesan. This is small scale but what of the divine and cosmic? Baudrillard might well rejoice, as this technology seems to be one of the final Names Of God, that once uttered or recorded will bring about the disappearance of the universe.[7]

The weathering of form

If such desks are but micro turbulence in a chaotic macro Utility Fog (The Big Desktop in the Sky), then we will create a visionary geography, a hybrid of cybergraphy and nanography; the world will become a series of geographical icons, a dreaming landscape or a landscape of memory. Our physics of space and matter bring us full circle back to the more arcane religious views of the world and its formation. Luckily, we have an odd parallel to help us unravel some of the potential of our new world and that is the Aboriginal Dreamtime. Aboriginal creation mythology bases itself on a mythical time when the Aboriginal culture and landscape were formed; it was a time of the Sky Heroes. One of the most fundamental, the Rainbow Snake, was the creator of the world, or at least its caster, its supposed journey across the land, inland to the sea or from the sea to the mountains, casting its trails as landforms. For the Aboriginal, landscape features become memory icons of the journey and meaning of the Snake. It could easily be an ancestor of Utility Fog and the Nano-desktop. Just as Aboriginals believe that sacred images, such as those of their cave art were not made by human hand, our future sacred forms and macro and micro landscape features will not be made by human hand but by the Nano-Dreamtime. The inheritor of nature's tricks.

In the Antipodean mythology the landmass has made the transition to a story mass. With nanotechnology it is conceivable that the Nano-Dreamtime will burst from its Southern Cross shackles and make a further transition from story mass to info-mass or perhaps even info-weather, a dream theatre of global proportions. The Aboriginals 'recognise that the natural object is capable of being imbued with supernatural power'.[8] This supernatural power concerns itself with the synthesis of a duality, the natural object and its symbolic shadow or double. Everything having totemic identity, this duality linking the viewer into the Aboriginal grand narrative and providing navigational signposts, both metaphorically and physically. It is clear, that in the future, it will be harder and harder to separate the augmented human form, or Nano-cyborg, from its Utility Aether; and further, that the concept of weather will have to be reassessed in the light of the Nano-Deskworld and the Nano-Dreamtime. Strange weather indeed, will the architect become a formal meteorologist?

Notes

1 Nicholas Negroponte, *Being Digital*, Hodder and Stoughton (London) 1995.
2 K Eric Drexler, *Engines of Creation*, Oxford University Press (London) 1992.
3 Frances Yates, *The Art of Memory*, Routledge and Kegan Paul (London) 1966.
4 Negroponte, op cit, p110.
5 Ed Regis, *Nano-Remaking the World Atom by Atom*, Transworld Publishers Ltd, 1992. JoSH Hall's Utility Fog is described on page 218.
6 Nirvana™ is a recently issued screen saver, characterised by its constantly mutating, psychedelic screens. Acid for computers.
7 Jean Baudrillard, 'The Perfect Crime', from his recent lecture at the ICA, transcribed in *Wired* 1.02 in which he quotes from Arthur C Clarke: 'the monks of Tibet devote themselves fastidiously transcribing the 99 billion names of God, after which, they believe the world will be accomplished and the end will come. Exhausted by this everlasting spelling of the names of God, they call in some IBM types who install a computer to do the job. . . As the technicians . . . leave the site, they see the stars in the skies fading and vanishing one by one.'
8 JG Cowan, *The Elements of The Aborigine Tradition*, Element Books Ltd, 1992.

JOHN H FRAZER

THE ARCHITECTURAL RELEVANCE OF CYBERSPACE

A new consciousness – a new mode of thinking – is emerging with profound implications for architecture. The parallel world of cyberspace, created and sustained by the world's computers and communication lines is just one manifestation of deep cultural and technical changes which are reshaping our understanding of our world. This shift of perception from a universe of objects to one of relationships is the characteristic paradigm shift of the century. With this goes a shift from specialisation to generalisation, from the self-conscious to the unselfconscious, from linear relationships to complex webs. Our emerging new world view is characterised as decentralised, desynchronised, diverse, simultaneous, anarchic, customerised . . . Key concepts are information, sustainability, participation, emergent properties . . .

In this context, the cyberspace of the Internet is also described as '. . . self-regulating, anarchic, decentralised, federated, very resilient and capable of a high degree of rapid evolution and growth. Partly by design and partly because up to now it has been operated by loose federations of like-minded, well-intentioned and very intelligent people.' This alone makes a fascinating socio-technological phenomena working in quite the reverse manner to normal political decision making.

The term cyberspace is used loosely to describe the invisible spatial interconnection of computers on the Internet and it is also applied to almost any virtual spatial experience created in a computer. But tangible space and physical structure have already taken on a new significance as a result of the growth of cyberspace. Virtual reality has caused us to reassess reality. A shift in our perception of the old world has resulted from our developing perceptions of the new. The instantaneity and spontaneity of communications in cyberspace cause us to revalue the significance of contact in the old world. Meetings with colleagues are now more highly valued (but less frequent), they celebrate physicality . . . more hand-shaking, kissing, embracing, touching, a more frank and sensual enjoyment of the aromas . . . All major paradigm shifts have the effect of not only changing the way we see the future but they change the way we see the past. Old world architecture has achieved a new physicality just as the new architecture of process starts to transcend physicality and achieve ephemeralisation. An ancient goal with strongly spiritual overtones. Old space has become so tangible it takes physical force to penetrate it . . . quite literally compared with the cerebral effort of cyberspace.

Virtual worlds should not be seen as an alternative to the real world or a substitute, but as an extra dimension which allows us a new freedom of movement in the natural world. In other words the transcendence of physicality in the virtual world allows us to extend our mode of operation in the physical world. A new means of travel, a new form of communication, a new way of operating, a new medium for expression.

No wonder the enthusiasts for cyberspace behave as if they have had a mystic experience – they have. It is not just that they have seen a new world, but have also seen the old world from a new perspective.

Contemporary science fiction concentrates on the coexistence of the real world and the metaworld of cyberspace. In Stephenson's *Snow Crash* the real and meta worlds of Hiro Protagonist converge as the drama heightens, the transition between the two worlds becomes more frequent and the distinction more blurred until the two worlds become one for the hero (but unfortunately not necessarily for the reader). But for the reader of classic literature this experience is not new at all, for in reading any novel there is a simultaneous understanding that one is only in a prosaic world of reading words printed words on paper, yet simultaneously transported into a virtual world of the author's imagination and the real emotions of the reader.

Every theatregoer or opera lover has already experienced the simultaneous existence of two worlds in a more physical sense (the illusion is so strong it can work in the cinema or even on television). We are aware in the theatre of the sounds and smells around us (irritated if they become obtrusive) and yet transported to distant realms in time and space by the magic of bright lights, exaggerated sets, fantastic costumes, excess make-up and larger-than-life voices. All disbelief is suspended and however unreal the plot, the music and the setting and the emotions are powerfully aroused. We can be aware that we know the soprano and that she is very much alive (if a little overweight), but simultaneously we believe in her as a young and beautiful dying princess and the tears we cannot restrain are very real indeed.

I think I stole the idea of this analogy with the theatre from Wooley's *Virtual Worlds* where I think he also makes the point about soap operas. The front page of *The Independent*, 18 May, carried an item about how women's charities had been inundated by calls about the prison sentence received by Mandy Jordache for murdering her violent and abusive husband in the British television fictional serial Brookside. Real people calling real agencies about virtual characters and virtual events, real reactions and real emotions in response to virtual, but only too real, echoes of real events and memories. To echo TS Eliot, 'Human kind cannot bear too much reality'.

The realisation gradually dawns that we have been living in a virtual world all along. Kant produced an extravagant construction for the problem of agreeing that the virtual models inside our heads are a shared construct of reality. Our eyes transmit to our brains poor resolution, upside-down, mainly monochrome, moving two-dimensional images which the brain converts into a three-dimensional coloured model which moves with us but is static relative to our eye move-

ments. The brain censors out our obtrusive nose, fills in the gaps where the bundle of optic nerves leaving our eyes causes a blind spot, employs a rich repertory of tricks such as size constancy which prevents someone appearing to shrink as they move away, is easily deceived by false perspective and other illusions. Then the ultimate trick is played and the brain gives us the feeling that this virtual model in our brains is actually 'out there' and incorporates other information from the senses such as vibration in the air which it conveniently converts into sounds also 'out there'.

The illusion is so complete that we happily take this very hypothetical model of what might be out there to actually be what is out there. In other words, from birth we confuse at least one form of virtual reality with some other shared idea of reality. Fortunately, by and large, this works until put to the test of conflicting evidence in a court of law or the more commonplace experience of having 'lost' the book which everyone else can see is in front of you. The mental model leaves out the commonplace (your nose, the rims of your glasses) and concentrates on what is new or moving in the mental model (still good at spotting predators – the piece of paper blowing in the wind that for a split second is seen as an animal). Due perhaps to over familiarity, the 'lost' book has got left out of a recent update of your mental model and it is pointless to 'look' for it – it has actually disappeared from the virtual world in your head – it is simply not there.

The concept of comprehensive ephemeralisation and the need to take a global view were pioneered by Buckminster Fuller earlier this century and the concepts are coming of age with the technical realisation of a cyberspace which simultaneously achieves both dematerialisation and global communication. But perhaps the greater impact will be on the reflected effect on our physical environment and its relationship to the virtual worlds . . .

In the *Foundations of Modern Art*, Ozenfant talks of the effect of '. . . seeing oneself for the first time in a good mirror'. The introduction of any new technology gives cause for reflection, and the success of the Internet in establishing a rich anarchic net of invisible communication and intercourse should encourage us to think about the reasons for visible and physical contact. The electronic network is heterogeneous, location independent, informal, active, (and not to mention again – simultaneous, customerised, decentralised, diversified, desynchronised) – the exact opposite of the architecture of our current cities and this has led some to predict the death of the city, certainly the city as we know it. But the current decline of the nation state, hastened by communications and the realisation of the global village, has exposed other needs and aspirations currently indicated by an aggressive rise in nationalism.

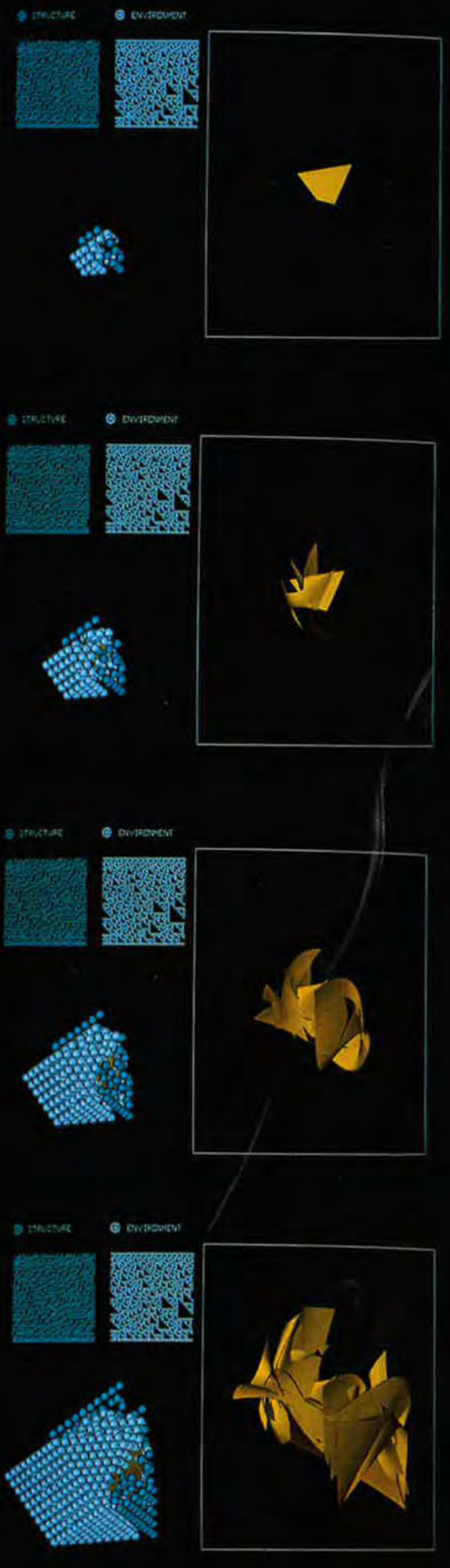
In a sense the supranational companies have already transcended national politics. Democratic politics will be replaced by participation, not in the crude sense of voting for a pre-selected and very limited set of options, nor in the participatory sense of direct action or demonstration, but simply by putting in place an alternative meta scenario to which people are drawn and can associate with and simply act in accordance with a greater collective will. Not a kind of passive resistance as with Gandhi's *Satyragraha*, but a new kind of active positive movement which simply ignores the fatigued status quo.

The term cyberspace is derived from cybernetics which was a major architectural preoccupation of the 60s. In an historic edition of *Architectural Design* in September 1969, guest edited by Royston Landau there appeared an article by Gordon Pask entitled 'The Architectural relevance of Cybernetics', to which the title of this essay pays tribute.

In his article, Pask claims that architecture and cybernetics share a common philosophy of architecture in the sense that Stafford Beer had shown it to be the philosophy of operational research. The argument rested on the idea that architects were 'first and foremost system designers who had been forced to take an increasing interest in the organisational system properties of development, communication and control'. Pask identified a significant vacuum in architectural theory and claimed cybernetics as 'a discipline that fills the bill in so far as the abstract concepts of cybernetics can be interpreted in architectural terms (and, where appropriate, identified with real architectural systems) to form a theory (architectural cybernetics, the cybernetic theory of architecture)'. Thus cybernetics in architecture was advanced as a new theoretical basis and as a metalanguage for critical discussion. Cyberspace is just an aspect of this new theory concerned with our requestioning fundamental issues about space and the contemporary relevance of place.

Perhaps the symbolic function of the new architecture is to make the invisible visible, not by the monumentalisation and formal expression of the function or shape of these invisible networks, but as an essential part of their function. Architecture as an essential organ of interaction with the environment providing antennae for both sensing and transmitting information.

A new architecture is being conceived in cyberspace by the global cooperation of a world community evolving new ideas by modelling ecologically responsible environments and using the computer as an evolutionary accelerator. This movement is reinforced culturally by similar thinking in music and other art forms. The emphasis has moved from product to process as Buckminster Fuller, John Cage and Marshall McLuhan all foresaw; and it has moved from forms, to the relationship between forms, to forms in their environment, to the relationship between forms and their users. This paradigm shift will change our understanding and interpretation of past architecture as surely as it will change the way we conceive of the new.



Negotiation of an interface surface between structure and environment: *Manit Rastogi, Architectural Association diploma unit 11, 1994. Cells representing structure (green) negotiate in the same dataspace as cells representing the environment (white) to define a boundary surface (yellow). In this case the rules for development of the three-dimensional (spherically close packed) automata are defined by two sets of evolving two dimensional automata; technically described as a hierarchical multi-dimensional negotiated automata.*

ARCHITECTURAL EXPERIMENTS

Evolution of a virtual space by global participation on the Internet

On the 25th January 1995 an experiment was launched to involve global participation in the evolution of a virtual environment. The experiment was at the centre of an exhibition entitled *An Evolutionary Architecture* being the work of the author, his wife and their students at the Architectural Association and the School of Design and Communication at the University of Ulster. This exhibition charted explorations of the fundamental form-generating processes in architecture. In an attempt to achieve in the built environment the symbiotic behaviour and metabolic balance that are characteristic of the natural environment, it proposed the evolutionary model of nature as the generating process for architectural form. The profligate prototyping and awesome creative power of natural evolution are emulated by creating virtual architectural models which respond to changing environments. Successful developments are encouraged and evolved as a form of artificial life, subject, like the natural world, to principles of morphogenesis, genetic coding, replication and selection.

Architectural concepts are expressed as generative rules so that their evolution and development can be accelerated and tested by the use of computer models. Concepts are described in a genetic language which produces a code script of instructions for form-generation. Computer models are used to simulate the development of prototypical forms which are then evaluated on the basis of their performance in a simulated environment. Very large numbers of evolutionary steps can be generated in a short space of time and the emergent forms are often unexpected.

Previously limited to easily quantified engineering problems, it is only now becoming feasible to apply them to the complex problems associated with our built environment. To achieve this it is necessary to consider how structural form can be coded for a technique known as a genetic algorithm, how ill-defined and conflicting criteria can be described, how these criteria operate for selection, and how the morphological and metabolic processes are adapted for the interaction of built form and its environment. Once resolved, the computer can be used not as an aid to design in the usual sense, but as an evolutionary accelerator and a generative force.

Genetic techniques for design model inner logic, rather than external form, and the exhibition afforded a glimpse of a future architecture as yet evolving only in the imagination of a computer.

The Internet experiment

In making this evolutionary model accessible via Internet, the intention was to encourage wide participation, thus creating biodiversity in the genetic design pool on which the model is dependent. Central to the physical exhibition was a working demonstration of an evolving virtual environment based on a simplified version of the theoretical model described in *An Evolutionary Architecture*. This special demonstration version of the model, known as the Interactivator, was developed so that interaction was easy and results were relatively quick. Although the theoretical model had been simplified, all the key elements were represented. Participation in the evolution of the model could be achieved either in the exhibition or in virtual form on the Internet. The exhibition travelled globally by replicating itself in other host computers where, under different environmental conditions, the model is still diversifying. New genes developed on other sites could be fed back to the host computer in London which now holds a pool of biodiversified genetic material.

This evolutionary model works by expressing the architectural concept in a simplified form of genetic language by switching genes in a string on and off to make them active or inactive. This genetic code script is packed into a seed which is developed in an environment, in accordance with instructions encoded in the genes so that the cells multiply. Information is absorbed from the environment into the evolving structure and travels through the model in a series of logic fields. Successful genes are identified by a process analogous to natural selection using a computer technique known as a genetic algorithm. The criteria for selection can also be adjusted. All genetic material is maintained in the genepool but there is a higher probability of successful genes being selected for breeding. Genetic development takes the form of crossover between genes in an analogy with sex in nature, but small random mutations also occur.

Installation and virtual visitors

Three interlinked computers were used. The central machine handled the evolving model, displayed a rendered visualisation of the developing cell structure and a representation of the landscape of the genetic search space. One computer handled communication with the outside world and received input from the environmental sensors in the exhibition space, input from gene switches for visitors to experiment with, output sound generated by the system and was directly connected to the Internet to receive and transmit genetic information. The third computer generated images of the emerging forms and provided an animation of the growth and development of the model.

Virtual visitors could view the current state of the model and receive an explanation, or they could participate by providing genetic or environmental information. For real enthusiasts, copies of the software were available for downloading. Feedback from remote copies of the software also affected the source model.

Many thousands of virtual visitors and their comments have led us to develop the concept much further and a new experiment will be launched soon.

FROM ABOVE LEFT: Evolving virtual environment; *A prototype sequence testing the development, evolution and mapping of an experiment in the collaborative evolution of a virtual environment by global participation on the Internet; FROM ABOVE RIGHT:* An experiment in global cooperation to evolve a virtual environment on the Internet

JOHN H FRAZER, MANIT RASTOGI, PETER GRAHAM

THE INTERACTIVATOR

Evolutionary cellular model

The model is based on the sequential evolution of a family of cellular structures in an environment. Each structure begins development from a single cell inheriting genetic information from its ancestors and from a central gene pool. The same chromosomes are contained in each cell, and make up the genetic code. The cells divide and multiply, based on the genetic code script and the environment, with each new cell given the same genetic information. The development process of each member of the family consists of three parts – cellular growth, materialisation and the genetic search landscape. A genetic algorithm ensures that future generations of the model learn from the previous ones as well as providing for biodiversity during the evolutionary process.

Data structure of the model

The data structure of the model is based on a universal-state space or isospatial model where each cell in the world has a maximum of 12 equidistant neighbours and can exist in one of 4,096 states, this state being determined by the number and spatial arrangement of its neighbours.

The local environment of a cell in the world can thus be coded in a 12 bit binary string. The growth and development of the cellular structure is controlled by chromosomes. For example, a string of the type (110110000110) would spatially represent the following configuration:
A typical chromosome consisting of four parts – condition, action, flag, strength – corresponding to the following order:
(10xxx10x11xx) (000011011010) 1 192.5)
condition: the local environment of a cell (X being a don't care situation)
action: the state of the cell in the next generation
flag: whether a chromosome is dominant or passive
strength: fitness of the chromosome with respect to the environment

Cellular growth

Chromosomes are generated by either being sent in by any remote user, an active site or as a function of selection, crossover and mutation within cellular activity and are maintained in a main chromosomal pool. The physical environment determines which part of this pool becomes dominant. The local environment of each cell determines which part of the genetic code switches on, and the cell then multiplies and divides accordingly.

As cellular division takes place, unstable cells are generated. In the next generation this leftover material creates a space of exclusion within the cellular space, which in turn interacts with the physical environment to create a materialisation of the model. Boundary layers are identified in the unstable cells as part of their state information and an optimised surface is generated to skin the structure. This material continues to exist throughout the evolution of the model and will initially affect the cellular growth of future generations.

Genetic search landscape

The selection criteria in the model is not defined but is an emergent property of the evolution of the model itself. A genetic search landscape is generated for each member; graphically representing the evolving selection criteria based on the relationship between the chromosomes, cellular structure and the environment over time. Form, or the logic of form, emerges as a result of travelling through this search space.

Once chromosomal stability has been achieved, the parent cellular activity is terminated. The final cellular structure, the materialisation and the genetic search space are posted out. A daughter cellular activity is then initiated from a single cell. The fittest chromosomes from the parent generation are bred using selection, crossover and mutation and combined with the newly dominant chromosomes from the main pool to form a new chromosome set for the daughter generation. This generation then repeats the development process.

Current state of the model

In the first two weeks of the model being launched on the Internet, it evolved four family members based on chromosomes received and those bred internally, each member achieving chromosomal stability in about 120 generations. It is impossible to predict the nature of the model yet, or its internal logic, but there seems to be a pattern emerging towards its selective and hence, evolutionary process.

The next step is to recode the model so that it can evolve on any computer platform, eventually making it completely autonomous on the Internet. The model could then evolve indefinitely by allowing itself to replicate on to any host computer.

Internet: http://www.gold.net/ellipsis/evolutionary/evolutionary.html
e-mail: 100415.1704@compuserve.com

Bibliography

JH Frazer and JM Connor, 'A Conceptual Seeding Technique for Architectural Design', PArC 79 International Conference on the Application of Computers in Architectural Design, Berlin, 1979. Proceedings, PArC 79 Online Conferences with AMK, pp 425-434.

JH Frazer, 'Datastructures for rule-based and genetic design', *Visual Computing - Integrating Computer Graphics with Computer Vision*, Springer-Verlag, June 1992, pp 731-744.

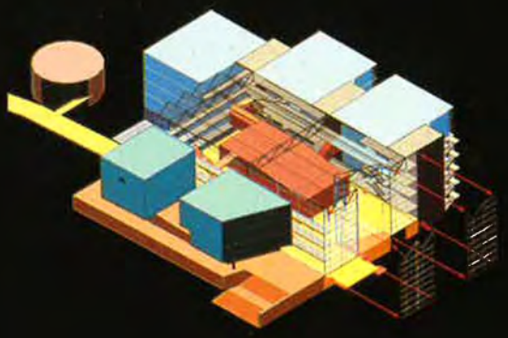
PC Graham, JH Frazer and MEC Hull, 'The Application of Genetic Algorithms to Design Problems with Ill-defined or Conflicting Criteria', Conference on Values and (In)Variants, Amsterdam, 1993, Systemica, vol 10, 1995, pp61-76.

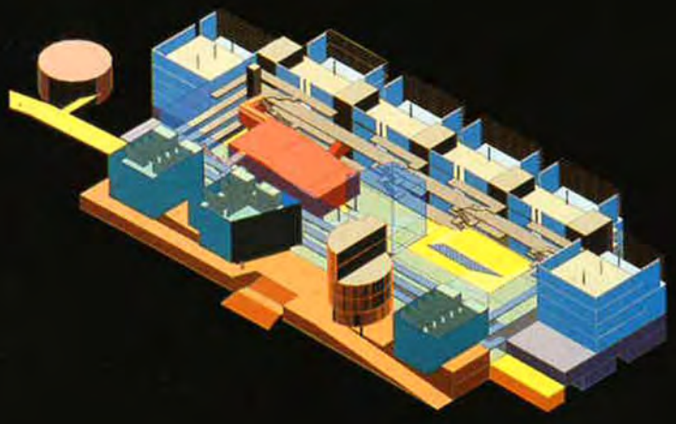
JH Frazer, 'The Architectural Relevance of Cybernetics', *Systems Research*, vol 10 No 3, 1993, pp43-47.

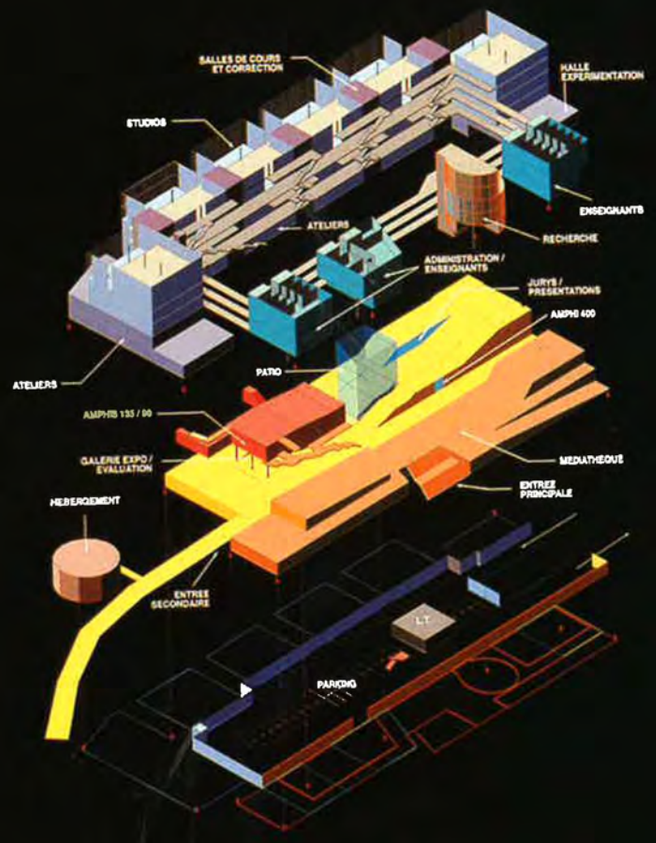
Brian Hatton, Interview with John Frazer, *Lotus 79*, Electra, Rome, 1993, pp15-25.

JH Frazer, 'The Genetic Language of Design', in *Textiles and New Technology 2010*, S Braddock & M O'Mahony (ed) Artemis, London, 1994, pp77-79.

JH Frazer, PC Graham and M Rastogi, 'Biodiversity in Design via Internet', Proceedings of conference Digital Creativity, Brighton, April 1995, publication pending.






SALLES DE COURS ET CORRECTION
HALLE EXPERIMENTATION
STUDIOS
ENSEIGNANTS
ATELIERS
RECHERCHE
ADMINISTRATION / ENSEIGNANTS
JURYS / PRESENTATIONS
AMPHI 400
ATELIERS
PATIO
AMPHIS 135 / 90
GALERIE EXPO / EVALUATION
MEDIATHEQUE
ENTREE PRINCIPALE
HEBERGEMENT
ENTREE SECONDAIRE
PARKING

BERNARD TSCHUMI

CITE DE L'ARCHITECTURE

Champs-sur-marne, Paris

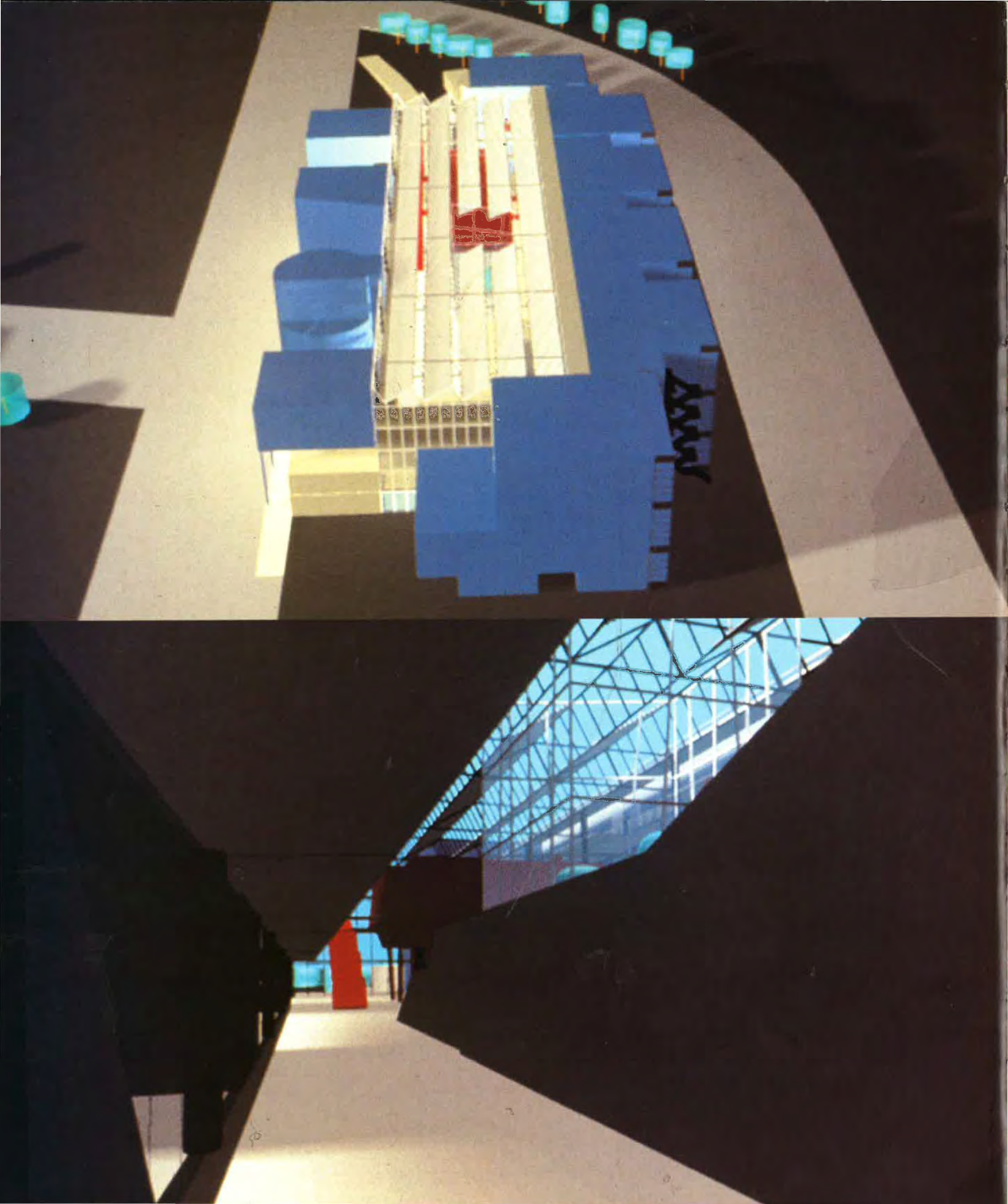
Housing a new school of architecture the Cité de l'Architecture is located on the periphery of the Paris conurbation, which instead of being considered a handicap was actually used as the basis for the scheme's conceptual framework. Emphasising that buildings no longer need to be located in close proximity to city centres, this design reflects the emerging global architectural culture and the power of information technology. Free from the ideological restraints of the historic city centre this school is intended as the genesis for a new archetype, based on Tschumi's belief that certain buildings can accelerate cultural and social transformation.

The building's functions – defined in conjunction with the programme specialist Yves Dessuant – are individually expressed and articulated, and are arranged around an unprogrammed, event-orientated central space which is activated by the density of activity that surrounds it. Containing all of the building's circulation, this space is conceived as a social and cultural zone, designed along the lines of a city promenade, proffering a variety of routes to the building's users. Visual continuity is maintained between this area and the adjacent activities, providing a dynamic environment and strengthening the school's commitment to information, communication and debate.

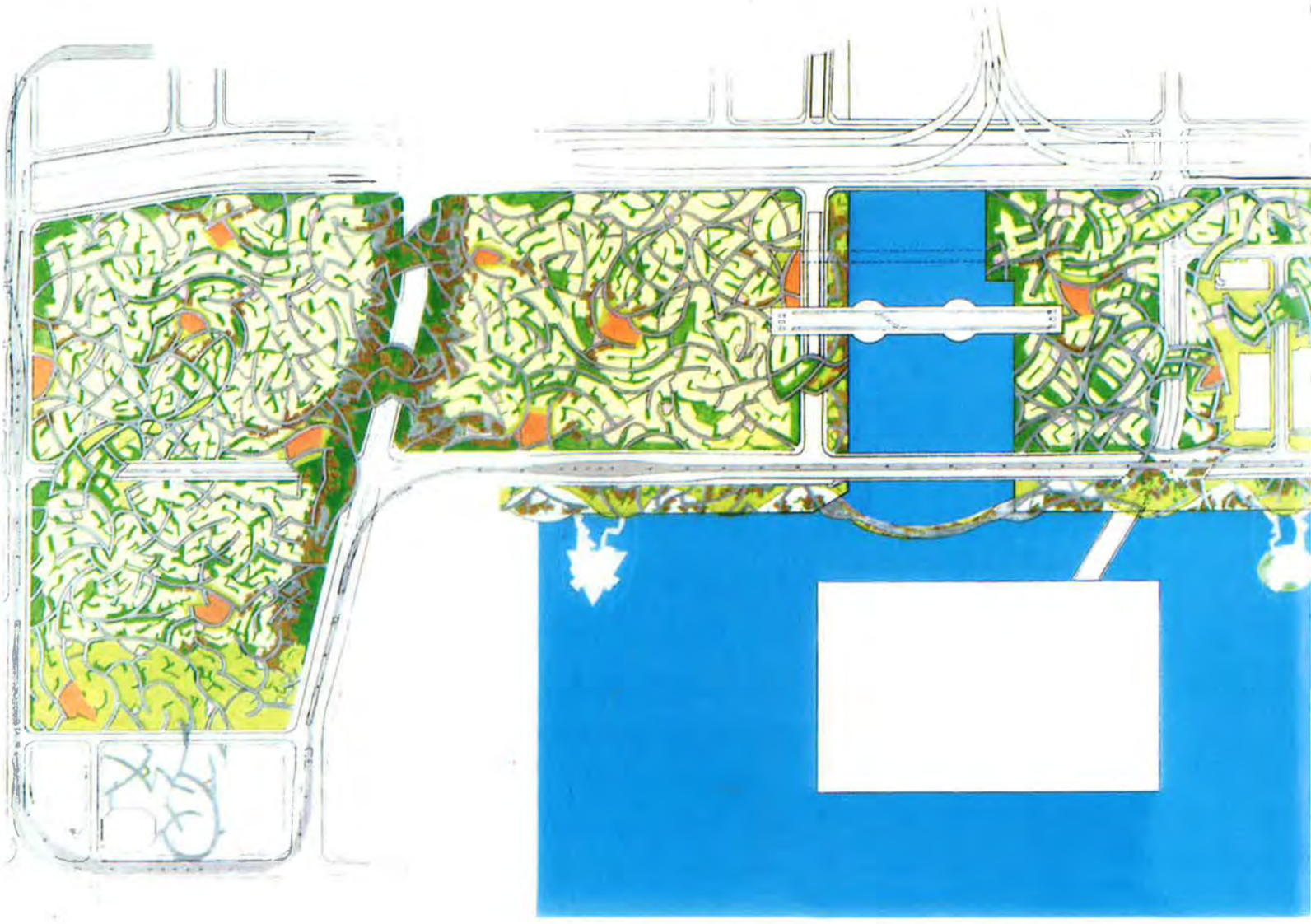
Programmatically the studios, and their ancillary functions, are located to the north and are flexibile enough to accommodate the various sizes of classes that occur. The north light that these spaces receive provides the lighting conditions necessary for the extensive use of computers that is now required in architectural design. Administrative functions are located in the smaller blocks to the south, their size and articulation deliberately avoiding bureaucratic or monolithic imagery and styling.

Equally an urban environment and an electronic machine, the Cité de l'Architecture as it is known, is wary of aesthetic tendencies as well as of humanist theories directed toward a search for a formal morality. It is, instead, through the rigorous amplification of its programmatic logic that it develops the conditions required for inquiry into the new century's architectural conditions.

OPPOSITE: Internal and external zoning; BELOW: South elevation; OVERLEAF: Internal and external perspectives




ARCHITECTURE
EVENEMENT



ARAKAWA + MADELINE GINS

REVERSIBLE DESTINY CITY

Tokyo Bay

ABOVE: Sections. Within raised platform upon which the city is situated: power station, sanitation removal system

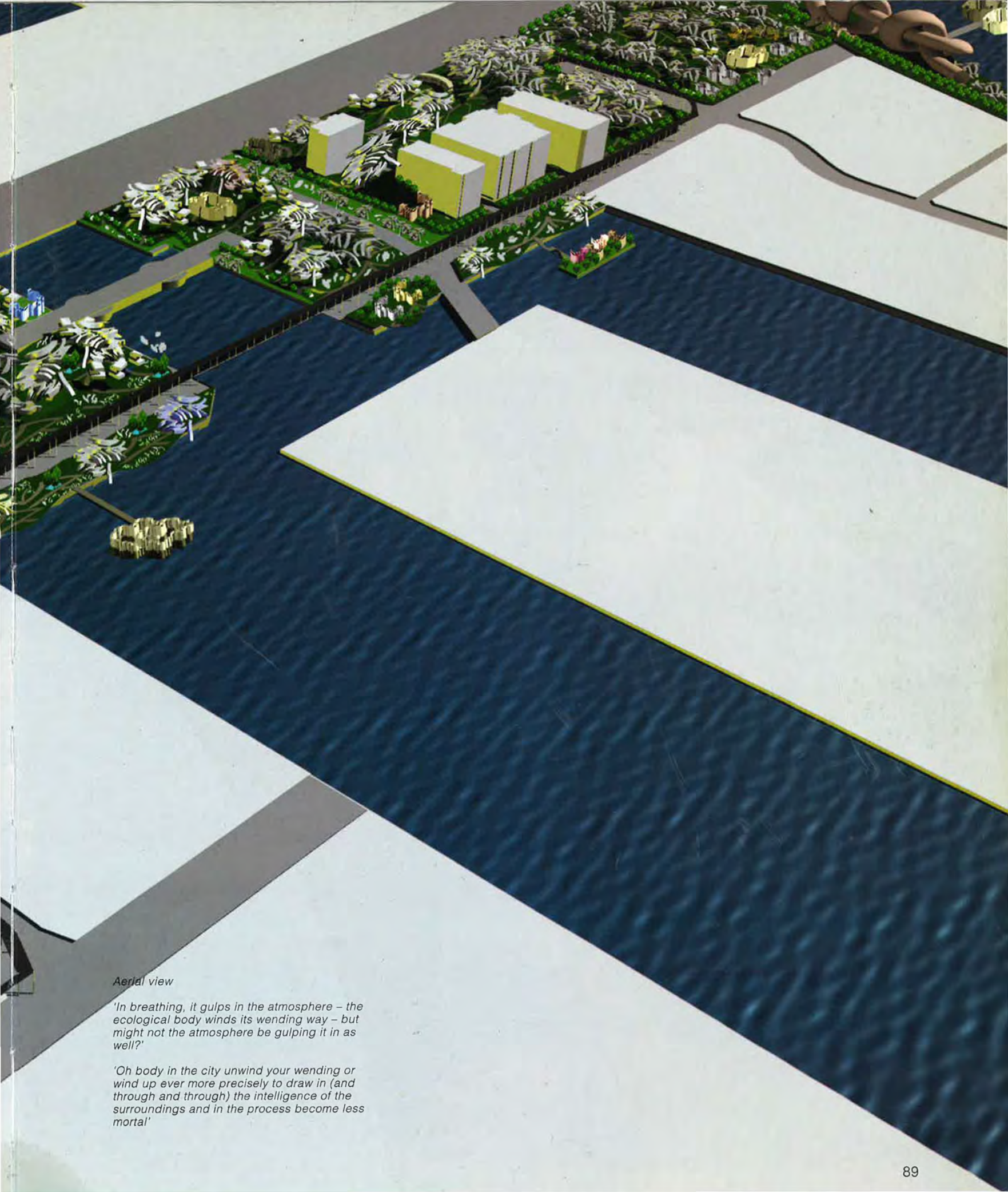
'Then let us talk of altering the thinking field.'

'And of doing this through (actions of) the body – the only readily available resident or visitor.'

LEFT: Plan showing distribution of parks, recreation areas and study zones

'The "wind up" body wends its way.'

'The body winds the clock or winds (space) time but who or what winds the body? Have the provisional answer be: the city.'



Aerial view

'In breathing, it gulps in the atmosphere – the ecological body winds its wending way – but might not the atmosphere be gulping it in as well?'

'Oh body in the city unwind your wending or wind up ever more precisely to draw in (and through and through) the intelligence of the surroundings and in the process become less mortal'


BIOSTIM
BIOSTIM

STELARC

TOWARDS THE POST-HUMAN

From Psycho-body to Cyber-system

The body needs to be repositioned from the psycho realm of the biological to the cyber zone of interface and extension – from genetic containment to electronic extrusion. Strategies towards the post-human are more about erasure, rather than affirmation – an obsession no longer with self but an analysis of structure. Notions of species evolution and gender distinction are remapped and reconfigured in alternate hybridities of human-machine. Outmoded metaphysical distinctions of soul-body or mind-brain are superseded by concerns of body-species split, as the body is redesigned – diversifying in form and functions. Cyborg bodies are not simply wired and extended but also enhanced with implanted components. Invading technology eliminates skin as a significant site, an adequate interface or barrier between public space and physiological tract. The significance of the cyber may well reside in the act of the body shedding its skin. As humans increasingly operate with surrogate bodies in remote spaces they function – with increasingly intelligent and interactive images. The possibility of autonomous images generates an unexpected outcome of human-machine symbiosis The post-human may well be manifested in the intelligent life form of autonomous images.

The myth of information

The information explosion is indicative of an evolutionary dead-end. It may be the height of human civilisation, but it is also the climax of its evolutionary existence. In our decadent biological phase, we indulge in information as if this compensates for our genetic inadequacies. INFORMATION IS THE PROSTHESIS THAT PROPS UP THE OBSOLETE BODY. Information gathering has become not only a meaningless ritual, but a deadly destructive paralysing process, *preventing it from taking physical phylogenetic action.* Information gathering satisfies the body's outmoded Pleistocene programme. It is mentally seductive and seems biologically justified. The cortex craves for information, but it can no longer contain and creatively process it all. How can a body subjectively and simultaneously grasp both nanoseconds and nebulae? THE CORTEX THAT CANNOT COPE RESORTS TO SPECIALISATION. Specialisation, once a manoeuvre to methodically collect information, is now a manifestation of information overload. The role of information has changed. Once justified as a means of comprehending the world, it now generates a conflicting and contradictory, fleeting and fragmentary field of disconnected and undigested data. INFORMATION IS RADIATION. The most significant planetary pressure is no longer the *gravitational pull*, but the *information thrust*. The psycho-social flowering of the human species has withered. We are in the twilight of our cerebral fantasies. The symbol has lost all power, the accumulation of information has lost all purpose. Memory results in mimicry, reflection will not suffice. THE BODY MUST BURST FROM ITS BIOLOGICAL, CULTURAL AND PLANETARY CONTAINMENT.

Freedom of form

In this age of information overload, what is significant is no longer freedom of ideas but rather freedom of form – freedom to modify and mutate the body. The question is not whether society will allow people freedom of expression, but whether the human species will allow the individuals to construct alternate genetic coding. THE FUNDAMENTAL FREEDOM IS FOR INDIVIDUALS TO DETERMINE THEIR OWN DNA DESTINY. Biological change becomes a matter of choice rather than chance. EVOLUTION BY THE INDIVIDUAL, FOR THE INDIVIDUAL. Medical technologies that monitor, map and modify the body, also provide the means to manipulate the structure of the body. When we attach or implant *prosthetic devices* to prolong a person's life, we also created the potential to propel post-evolutionary development – PATCHED-UP PEOPLE ARE POST-EVOLUTIONARY EXPERIMENTS.

Biotech terrains

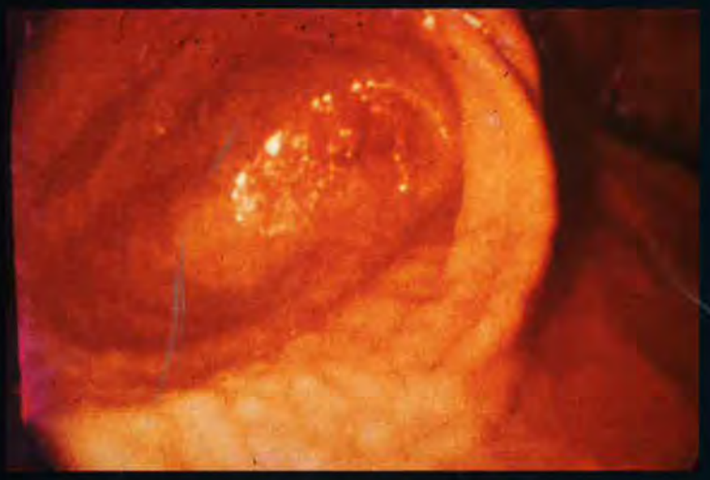
The body now inhabits alien environments that conceal countless BODY PACEMAKERS – visual and acoustical cues that *alert, activate, condition and control the body.* Its circadian rhythms need to be augmented by artificial signals. Humans are now regulated in sync with swift, circulating rhythms of pulsing images. MORPHING IMAGES MAKE THE BODY OBSOLETE.

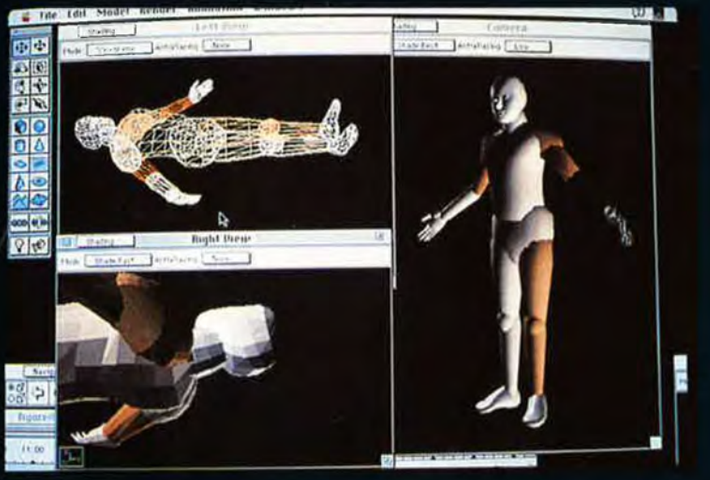
Obsolete body

It is time to question whether a bipedal, breathing body with binocular vision and a 1,400cc brain is an adequate biological form. It cannot cope with the *quantity, complexity and quality* of information it has accumulated; it is intimidated by the precision, speed and power of technology and it is biologically ill-equipped to cope with its new extraterrestrial environment. The body is neither a very efficient nor a very durable structure. It malfunctions often and fatigues quickly; its performance is determined by its age. It is susceptible to disease and is doomed to a certain and early death. Its survival parameters are very slim – it can survive only weeks without food, days without water and minutes without oxygen. The body's LACK OF MODULAR DESIGN and its over-reactive immunological system make it difficult to replace malfunctioning organs. It might be the height of technological folly to consider the body obsolete in *form and function*, yet it might be the highest of human realisations. For it is only when the body is aware of its present position that it can map its post-evolutionary strategies. It is no longer a matter of perpetuating the human species by REPRODUCTION, but of enhancing male-female intercourse by human-machine interface. THE BODY IS OBSOLETE. We are at the end of philosophy and human physiology. Human thought recedes into the human past.

Absent bodies

We mostly operate as absent bodies. That's because A BODY IS DESIGNED TO INTERFACE WITH ITS ENVIRONMENT – its





PAGE 90: The Third Hand, *Tokyo/Yokohama/Nagoya1981; FROM ABOVE, L TO R:* Amplified Body, Laser Eyes and Third Hand, *Maki Gallery, Tokyo, 1986;* Actuate/ Rotate, *for Virtual Body Obscure, Quebec City, 1993;* Stomach Sculpture: Hollow Body/Host Space, *Fifth Australian Sculpture Triennale, 1993; micro-film image of stomach interior, Yaesu Research Centre, Tokyo; writing simultaneously with three hands, Maki Gallery, Tokyo, 1982; touch-screen interface for muscle stimulation, Empire Ridge, Melbourne, 1994*

sensors are open to the world (compared to its inadequate internal surveillance system). The body's mobility and navigation in the world require this outward orientation. Its absence is augmented by the fact that the body functions *habitually* and *automatically*. AWARENESS IS OFTEN THAT WHICH OCCURS WHEN THE BODY MALFUNCTIONS. Reinforced by Cartesian convention, personal convenience and neuro-physiological design, people operate merely as minds, immersed in metaphysical fogs. The sociologist PL Berger made the distinction between 'having a body' and 'being a body.' AS SUPPOSED FREE AGENTS, THE CAPABILITIES OF BEING A BODY ARE CONSTRAINED BY HAVING A BODY. Our actions and ideas are essentially determined by our physiology. We are at the limits of philosophy, not only because we are at the limits of language. Philosophy is *fundamentally* grounded in our physiology.

Redesigning the body/redefining what is human

It is no longer meaningful to see the body as a site for the psyche or the social, but rather as a structure to be monitored and modified. The body not as a subject but as an object – NOT AN OBJECT OF DESIRE BUT AS AN OBJECT FOR DESIGNING. The psycho-social period was characterised by the body circling itself, *orbiting itself, illuminating and inspecting itself* by physical prodding and metaphysical contemplation. But having confronted its image of obsolescence, the body is traumatised to split from the realm of subjectivity and consider the necessity of re-examining and possibly redesigning its very structure. ALTERING THE ARCHITECTURE OF THE BODY RESULTS IN ADJUSTING AND EXTENDING ITS AWARENESS OF THE WORLD. As an object, the body can be amplified and accelerated, attaining planetary escape velocity. It becomes a post-evolutionary projectile, departing and diversifying in form and function.

Surface and self

As surface, skin was once the beginning of the world and simultaneously the boundary of the self. As interface, it was once the site of the collapse of the personal and the political. But now *stretched* and *penetrated* by machines, SKIN IS NO LONGER THE SMOOTH SENSUOUS SURFACE OF A SITE OR A SCREEN. Skin no longer signifies closure. The rupture of surface and of skin means the *erasure* of inner and outer. As interface, the skin is inadequate.

The invasion of technology

Miniaturised and biocompatible, technology lands on the body. Although unheralded, it is one of the most important events in human history – focusing physical change on each individual. Technology is not only attached but is also implanted. ONCE A CONTAINER, TECHNOLOGY NOW BECOMES A COMPONENT OF THE BODY. As an instrument, technology fragmented and de-personalised experience – as a component it has the potential to SPLIT THE SPECIES. It is no longer of any advantage to either remain 'human' or to evolve as a species. EVOLUTION ENDS WHEN TECHNOLOGY INVADES THE BODY. Once technology provides each person with the potential to progress individually in its development, the cohesiveness of the species is no longer distinction but the body-species split. The significance of technology may be that it culminates in an alternate awareness – one that is POST-HISTORIC, TRANS-HUMAN and even EXTRATERRESTRIAL (the first signs of an alien intelligence may well come from this planet).

Artificial intelligence/alternate existence

Artificial life will no longer be contained in computer programs simulating biological development. Artificial intelligence will no longer mean expert systems operating within specific task domains. Electronic space no longer merely generates information but extends and enhances the body's operational parameters BEYOND ITS MERE PHYSIOLOGY AND THE LOCAL SPACE IT OCCUPIES. What results is a high-fidelity interaction – a meshing of the body with its machines in ever-increasing complexity.

Amplified body, laser eyes and third hand

If the earlier events can be characterised as probing and piercing the body (the three films of the inside of the stomach, lungs and colon/ the 25 body suspensions) determining the physical parameters and normal capabilities of the body, then the recent performances extend and enhance it visually and acoustically. Body processes amplified include brain waves (ECG), muscles (EMG), pulse (PLETHYSMOGRAM) and bloodflow (DOPPLER FLOW METER). Other transducers and sensors monitor limb motion and indicate body posture. The sound field is configured by buzzing, warbling, clicking, thumping, beeping and whooshing sounds – of triggered, random, repetitive and rhythmic signals. The artificial hand, attached to the right arm as an addition rather than a prosthetic replacement, is capable of independent motion, being activated by the EMG signals of the abdominal and leg muscles. It has a pinch-release, grasp-release, 290-degree wrist rotation (CW and CCW) and a tactile feedback system for a rudimentary 'sense of touch'. Whilst the body activates its extra manipulator, the real left arm is remote-controlled, jerked into action by two muscle stim-ulators. Electrodes positioned on the flexor muscles and biceps curl the finger inwards, bend the wrist and thrust the arm upwards. The triggering of the arm motion pace the performance and the stimulator signals are used as sound sources, as are the motor sound of the third hand mechanism. The body performs in a structured and interactive lighting installation which flickers and flares, responding and reacting to the electrical discharges of the body – sometimes synchronising, sometimes counter pointing. Light is not treated as an external illumination of the body but as a manifestation of the body rhythms. The performance is a choreography of controlled, constrained and involuntary motions – of internal rhythms and external gestures. It is an interplay between physiological control and electronic modulation of human functions and machine enhancement.

The shedding of skin

Off the Earth, the body's *complexity, softness and wetness* would be difficult to sustain. The strategy should be to HOLLOW, HARDEN and DEHYDRATE the body to make it more durable and less vulnerable. The present organisation of the body is unnecessary. The solution to modifying the body is not to be found in its internal structure, but lies simply on its surface. THE SOLUTION IS NO MORE THAN SKIN DEEP. The significant event in our evolutionary history was a change in the mode of locomotion. Future developments will occur with a *change of skin*. If we could engineer a SYNTHETIC SKIN which could absorb oxygen directly through its pores and could efficiently convert light into chemical nutrients, we could radically redesign the body, eliminating many

of its redundant systems, malfunctioning organs – minimising toxin build-up in its chemistry. THE HOLLOW BODY WOULD BE A BETTER HOST FOR TECHNOLOGICAL COMPONENTS.

Stomach sculpture: hollow body/host space

The intention has been to design a sculpture for a distended stomach. The idea was to insert an artwork into the body – to situate the sculpture in an internal space. The body becomes hollow, with no meaningful distinctions between public, private and physiological spaces. TECHNOLOGY INVADES AND FUNCTIONS WITHIN THE BODY NOT AS A PROSTHETIC REPLACEMENT, BUT AS AN AESTHETIC ADORNMENT. The structure is collapsed into a capsule 14 by 50 millimetres and, tethered to its control box, it is swallowed and inserted into the stomach. The stomach is inflated with air using an endoscope. A *logic circuit* board and a *servomotor* opens and extends the sculpture using a flexi-drive cable to 50 by 80 millimetres in size. A piezo-buzzer beeps in sync to a light globe blinking insider the stomach. The sculpture is an extending/retracting structure; sound-emitting and self-illuminating. (It is fabricated using implant quality metals such as titanium, stainless steel, silver and gold.) The sculpture is retracted into its capsule form to be removed. As a body, one no longer looks at art, does not perform as art, but contains art. THE HOLLOW BODY BECOMES A HOST, NOT FOR A SELF OR A SOUL, BUT SIMPLY FOR A SCULPTURE.

Pan-planetary physiology

Extraterrestrial environments amplify the body's obsolescence, intensifying pressures for its re-engineering. There is a necessity TO DESIGN A MORE SELF-CONTAINED, ENERGY-EFFICIENT BODY, WITH EXTENDED SENSORY ANTENNAE AND AUGMENTED CEREBRAL CAPACITY. Unplugged from this planet – from its complex, interacting energy chain and protective biosphere – the body is biologically ill-equipped, not only in terms of its sheer survival, but also in its inability to adequately perceive and perform in the immensity of outer-space. Rather than developing *specialist bodies for specific sites*, we should consider a pan-planetary physiology that is durable, flexible and capable of functioning in varying atmospheric conditions, gravitational pressures and electro-magnetic fields.

No birth/no death – the hum of the hybrid

Technology transforms the nature of human existence, equalising the physical potential of bodies and standardising human sexuality. With fertilisation now occurring outside the womb and the possibility of nurturing the foetus in an artificial support system TECHNICALLY THERE WILL BE NO BIRTH. If the body can be redesigned in a modular fashion to facilitate the replacement of malfunctioning parts, then THERE WOULD BE NO REASON FOR DEATH – given the accessibility of replacements. Death does not authenticate existence: *it is an out-moded evolutionary strategy*. The body need no longer be repaired but simply have its parts replaced. Extending life no longer means 'existing' but rather of being 'operational.' Bodies need not age or deteriorate; they would not run down nor even fatigue; they would stall then start – possessing both the potential for renewal and reactivation. In the extended space/time of extraterrestrial environments, THE BODY MUST BECOME IMMORTAL TO ADAPT. Utopian dreams become post-evolutionary imperatives. THIS IS NO MERE FAUSTIAN OPTION NOR SHOULD THERE BE ANY FRANKENSTEINIAN FEAR IN TAMPERING WITH THE BODY.

The anaesthetised body

The importance of technology is not simply in the pure power it generates but in the *realm of abstraction* it produces through its *operational speed* and its development of *extended sense systems*. Technology pacifies the body and the world, it disconnects the body from many of its functions. DISTRAUGHT AND DISCONNECTED, THE BODY CAN ONLY RESORT TO INTERFACE AND SYMBIOSIS. The body may not yet surrender its autonomy but certainly its mobility. The body plugged into a machine network needs to be pacified. In fact, to function in the future, to truly achieve a hybrid symbiosis, the body will need to be increasingly anaesthetised.

Split body: voltage in/voltage out

Given that a body is not in a hazardous location, there would be reasons to remotely activate a person, or part of a person – rather than a robot. An activated arm would be connected to an intelligent mobile body with another free arm to augment its task! Technology now allows you to be physically moved by another mind. A computer interfaced MULTIPLE-MUSCLE STIMULATOR makes possible the complex programming of *involuntary movements* either in a local place or in a remote location. Part of your body would be moving, you've neither willed it to move, nor are you internally contracting your muscles to produce that movement. The issue would not be to automate a body's movement but rather the system would enable the displacement of a physical action from one body to another body in another place – for the on-line completion of a real-time task or the conditioning of a transmitted skill. There would be new interactive possibilities between bodies. A touch-screen interface would allow programming by *pressing* the muscle sites on the computer model and/or by retrieving and *pasting* from a library of gestures. Simulation of the movement can be examined before transmission and actuation. THE REMOTELY ACTUATED BODY WOULD BE SPLIT – on the one side voltage directed to the muscles via stimulator pads for involuntary movement – on the other side electrodes pick up internal signals allowing the body to be interfaced to its third hand and other peripheral devices. THE BODY BECOMES BOTH A SITE FOR INPUT AND OUTPUT.

Psycho/cyber

The PSYCHOBODY is neither robust nor reliable. Its genetic code produces a body that malfunctions often and fatigues quickly, allowing only slim survival parameters and limiting its longevity. Its carbon chemistry GENERATES OUTMODED EMOTIONS. *The Psychobody is schizophrenic*. The CYBERBODY is not a subject, but an object – not an object of envy but an object for engineering. The Cyberbody bristles with electrodes and antennae, amplifying its capabilities and projecting its presence to remote locations and into virtual spaces. The Cyberbody becomes an extended system – not to merely sustain a self, but to enhance operation and initiate alternate intelligent systems.

Hybrid human-machine systems

The problem with space travel is no longer with the precision and reliability of technology but with the vulnerability and durability of the human body. In fact, it is now time to REDESIGN HUMANS, TO MAKE THEM MORE COMPATIBLE TO THEIR MACHINES, it is not merely a matter of 'mechanising' the body. It becomes apparent in the zero G, friction-less and oxygen-free environment of outer space that technology is even more durable and

functions more efficiently than on Earth. It is the human component that has to be sustained and also protected from small changes of pressure, temperature and radiation. The issue is HOW TO MAINTAIN HUMAN PERFORMANCE OVER EXTENDED PERIODS OF TIME. *Symbiotic systems* seem the best strategy. Implanted components can energise and amplify developments; exoskeletons can power the body; robotic-structures can become hosts for a body insert.

Internal/invisible

It is time to recolonise the body with MICRO-MINIATURISED ROBOTS to augment our bacterial population, to assist our immunological system and to monitor the capillary and internal tracts of the body. There is a necessity for the body to possess an INTERNAL SURVEILLANCE SYSTEM – symptoms surface too late! The internal environment of the body would to a large extent counter the microbots behaviour, thereby triggering particular tasks. Temperature, blood chemistry, the softness or hardness of tissue, and the presence of obstacles in tracts could all be primary indications of problems that would signal microbots into action. *The biocompatibility of technology is no longer due to its substance but rather to its scale.* SPECK-SIZED ROBOTS ARE EASILY SWALLOWED, AND MAY NOT EVEN BE SENSED! In nanotechnology, machines will inhabit cellular spaces and manipulate molecular structures. The trauma of repairing damaged bodies or even of redesigning bodies would be eliminated by a colony of nanobots delicately altering the body's architecture inside out.

Towards high-fidelity illusion

With tele-operation systems, it is possible to project human presence and perform physical actions in remote and extra-terrestrial locations. A single operator could direct a colony of robots in different locations simultaneously or scattered human experts might collectively control a particular surrogate robot. Tele-operation systems would have to be more than hand-eye mechanisms. They would have to create kinaesthetic feel, providing the sensation of orientation, motion and body tension. Robots would have to be semi-autonomous, capable of 'intelligence disobedience'. With *Teleautomation* (Conway/Voz/Walker), forward simulation – with time and position clutches – assists in overcoming the problem of real-time delays, allowing prediction to improve performance. Telepresence (Minsky) becomes the high fidelity illusion of *Tele-existence* (Tachi). ELECTRONIC SPACE BECOMES A MEDIUM OF ACTION RATHER THAN INFORMATION. It meshes the body with its machines in ever-increasing complexity and interactiveness. The body's form is enhanced and its functions are extended. ITS PERFORMANCE PARAMETERS ARE NEITHER LIMITED BY ITS PHYSIOLOGY NOR THE LOCAL SPACE IT OCCUPIES. Electronic space restructures the body's architecture and multiplies its operational possibilities. The body performs by coupling the kinaesthetic action of muscles and machine with the kinematic pure motion of the images it generates.

Phantom limb/virtual arm

Amputees often experience a phantom limb. It is now possible to have a phantom sensation of an additional arm – a virtual arm – albeit visual rather than visceral. The virtual arm is a computer-generated, human-like universal manipulator interactively controlled by VPL VR equipment. Using DataGloves with flexion and position-orientation sensors and a GESTURE-BASED COMMAND LANGUAGE allows *real-time intuitive operation* and additional extended capabilities. Functions are mapped to finger gestures, with parameters for each function, allowing elaboration. Some of the Virtual Arm's extended capabilities include '*stretching*' or telescoping of limb and finger segments '*grafting*' of extra hands on the arm and 'cloning' or calling up an extra arm. The '*record and playback*' function allows the sampling and looping of motion sequences. A 'clutch' command enables the operator to freeze the arm, disengaging the simulating hand. For tele-operation systems, such features as '*locking*' – allowing the fixing of the limb in position for PRECISE OPERATION WITH THE HAND. In '*micro mode*' complex commands can be generated with a single gesture, and in 'fine control' delicate tasks can be completed by the TRANSFORMATION OF LARGE OPERATOR MOVEMENTS TO SMALL MOVEMENTS OF THE VIRTUAL ARM.

Images as operational agents

Plugged into virtual reality technology, physical bodies are *transduced* into phantom entities capable of performing within data and digital spaces. The nature of both bodies and images has been significantly altered. IMAGES ARE NO LONGER ILLUSORY WHEN THEY BECOME INTERACTIVE. In fact, interactive images become operational and effective agents sustained in software and transmission systems. The body's representation becomes capable of response as images become imbued with intelligence. Sensors and trackers on the body make it a *capture system* for its image, the body is coupled to mobilise its phantom. A virtual or phantom body can be endowed with semi-autonomous abilities, enhanced functions and an artificial intelligence. Phantoms can manipulate data and perform with other phantoms in cyber-space. PHYSICAL BODIES HAVE ORGANS, PHANTOM BODES ARE HOLLOW. Physical bodies are ponderous and particular. Phantom bodies are flexible and fluid. Phantoms project and power the body.

Virtual body: actuate/rotate

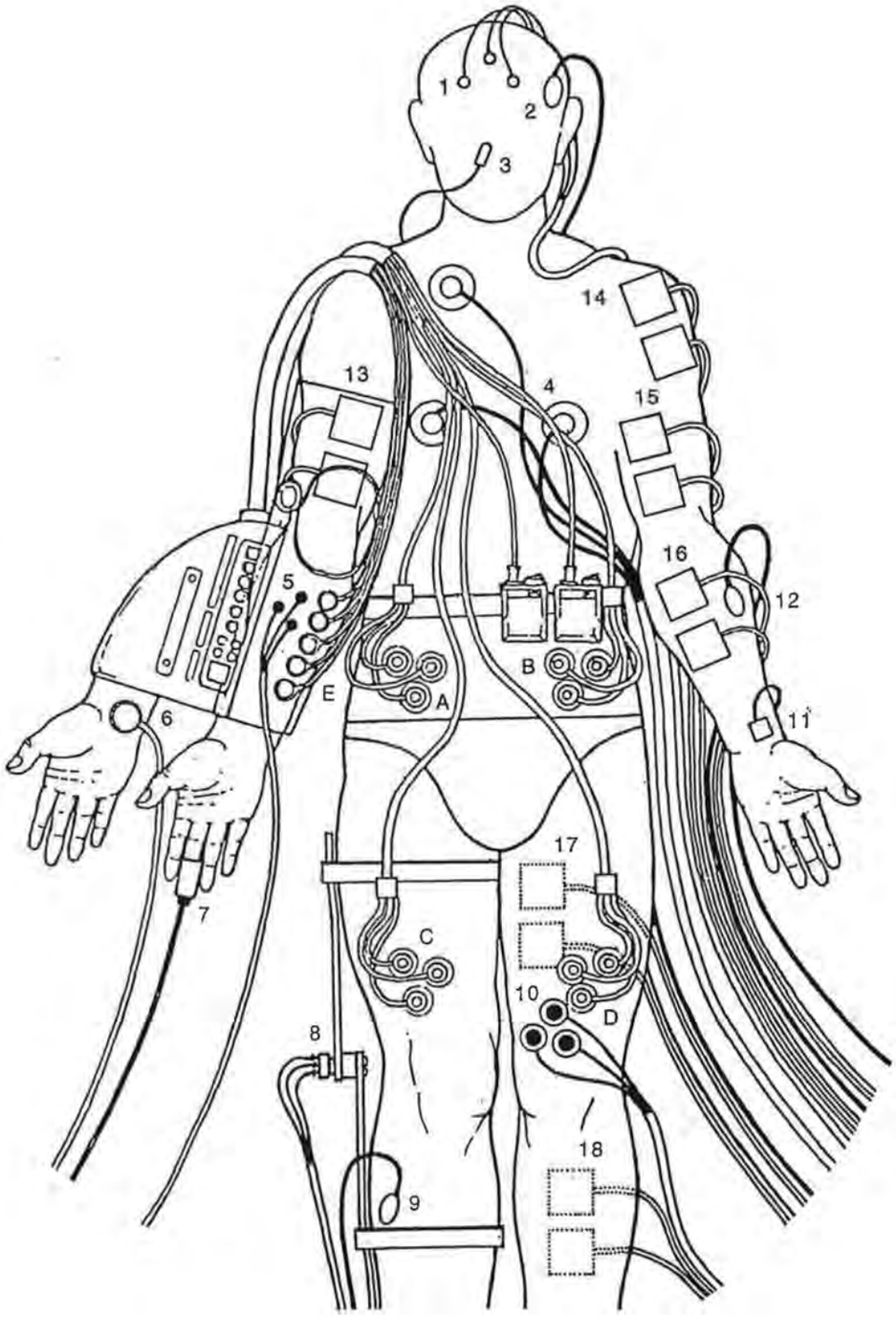
Your virtual surrogate would not merely mimic the physical body's movements. A more complex choreography is achieved by mapping virtual camera views to limb position/orientation. The involuntary jerking down on the left arm tumbles the virtual body, whilst sweeping the right arm 90 degrees produces a 360-degree virtual camera scan – visually rotating the virtual body around its vertical axis. The form of the virtual body can be configured acoustically – pulsing in phase with breathing sounds. This BREATH WARPING subtly and structurally connects the physical body with its virtual other. And by using DEPTH CUE – defining the operational virtual space as shallow – stepping and swaying forwards and backwards makes the virtual body appear and disappear in its video/virtual environment. The resulting interaction between the physical body and its phantom form becomes a more complex combination of kinaesthetic and kinematic choreography. In recent performances the *involuntary body* is actuating a *virtual body* whilst simultaneously avoiding a *programmed robot* within its task envelope.

Phantom body/fluid self

Technologies are becoming better life support systems for our images than for our bodies. IMAGES ARE IMMORTAL, BODIES ARE EPHEMERAL. The body finds it increasingly difficult to match the expectations of its images. In the realm of multiplying and morphing images, the physical body's impotence is apparent. THE BODY NOW PERFORMS BEST AS ITS

IMAGE. Virtual reality technology allows a transgression of boundaries between male/female, human/machine, time/space. The self becomes situated beyond the skin, this is not a disconnection or a split but an EXTRUDING OF AWARENESS. What it means to be human is no longer being immersed in genetic memory but being reconfigured in the electromagnetic field of the circuit. IN THE REALM OF THE IMAGE.

Stelarc is a performance artist who is interested in alternate aesthetic strategies. He explores, extends and enhances the body's performance parameters using medical, robotic and VR systems, acoustically and visually probing the body – amplifying brain waves, heartbeat, blood flow and muscle signals, filming the inside of his lungs, stomach and colon. In developing strategies to augment the body's capabilities, he has interfaced it with prosthetics and computer technologies. He has performed extensively overseas in art events, exhibited installations and has interactively performed with his Third Hand a Virtual Arm a Virtual Body and a Stomach Sculpture. *At present he is developing a touch-screen interface for multiple muscle stimulation – a system to enable the physical actuation and choreography of remote bodies.*



INVOLUNTARY BODY/THIRD HAND

Amplified Body:
1 EEG (brain waves)
2 Position sensor (tilting head)
3 Nasal Thermistor
4 ECG (heartbeat)
5 EMG (flexor muscle)
6 Contact microphone (hand motors)
7 Plethysmogram (finger pulse)
8 Kineto-angle transducer (bending leg)
9 Position sensor (bending leg)
10 EMG (vastus medialis muscle)
11 Ultrasound transducer (radial artery bloodflow)
12 Position sensor (lifting arm)

Involuntary Body:
13 Stimulation RHS bicep muscles
14 Stimulation LHS deltoid muscles
15 Stimulation LHS bicep muscles
16 Stimulation LHS flexor muscles
17 Stimulation LHS hamstring muscles
18 Stimulation LHS calf muscles

Third Hand:
A Grasp/pinch (close)
B Release (open)
C Wrist rotation (CW)
D Wrist rotation (CCW)
E Tactile feedback