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Eniatype
Transdisciplinary Practice for Methodologies of Communication

by

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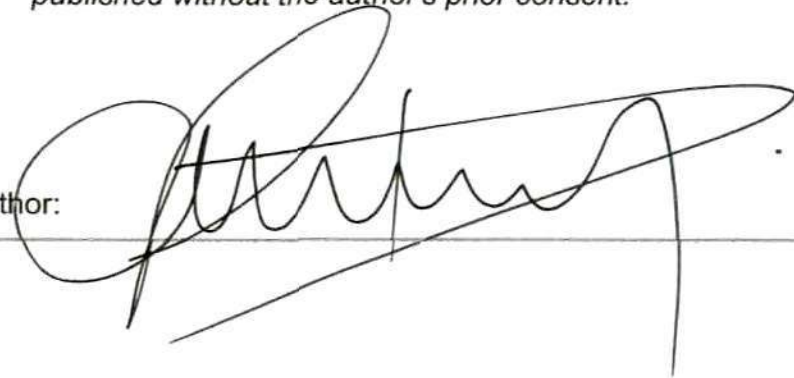
Submitted to the Faculty of Arts in partial fulfilment
of the requirements for the degree of Doctor of Philosophy
at the
University of Plymouth

April 2010

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Signature of Author:

A handwritten signature in black ink, appearing to read 'Shaun Patrick Murray', written over a horizontal line. The signature is stylized with large loops and a long horizontal stroke.

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Eniatype
Transdisciplinary Practice for Methodologies of Communication
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Shaun Patrick Murray

i. Abstract

The thesis demonstrates a rethinking of methodologies of communication through ecological design. Human communication and ecological accountability are inextricably linked in architectural design: the current global ecological crisis underscores this fundamental connection. Within architectural practice the communication from architect to participant or environment is not at all straightforward. This is also true of the dyadic relation between context, design and communication in architectural education. Notational systems within architectural education used as a communication tool have made the composition of architecture an activity like the composition of fiction: the activity of communication. So deep is the connection between architecture and communication in our culture that for much of the time we ignore it and behave as if notation were really a transparent window – just as in reading a working drawing in architectural practice we may ignore the intermediacy of notation and imagine that thoughts are reaching us directly from the architect's mind. The most important criterion of notational systems, whether literally or architectural, is precisely that it should not draw attention to itself, nor disturb the illusion of neutrality and faithfulness.

Through original design exploration, this work proffers a critical vision towards the built environment. These conceptions challenge the everyday education of architectural design by offering a transdisciplinary framework for design production. The work concludes with the necessity for a new design field entitled 'Eniatype'. Eniatype is still in its nascent stages. It has the potential to become a far-reaching awareness that bonds the disciplines of design ecologies, theory of notation, instructional design and aesthetics; together they form the acronym ENIA. The work establishes the theoretical foundation for Eniatype in four parts. Part one, *ideation*, is a survey of visions on architectural practice illustrating original concepts such as 'Correalism', 'Reflexive Architecture' and 'Recursive Vision'. Part two, *Enia*, illustrates the principles of design ecologies, theory of notation, instructional design and aesthetic strands in projects such as 'Basque Enia' and 'Beijing Enia'. Part three, *Type*, conveys the principles of the logical theory of types in 'Working Drawing, Participant and Environment'. Part four, *Eniatype*, synthesise these approaches through a series of research sessions towards a transdisciplinary idea of architectural education and practice.

The work describes a burgeoning field, Eniatype, which promotes ecological transitions within local and global contexts through architectural education. By linking working drawing and environment within architectural education, unique ecological design proposals were produced, which promote a new role in defining the ciphers of future design thought.

Thesis Advisors: Professor Roy Ascott and Professor Neil Spiller

ii. Acknowledgements

Will Alsop, Brigitte Aga, Lynwen Anthony, Roy Ascott, Marjan Colletti, John Coward, Kate Davies, Matthew Emmett, Wolfgang Fiel, Todd Gannon, Bastian Glassner, Dene Grigar, Cordelia Hanel, Timo Haedrich, Tesoc Hah, Chao Han, Charlotte Harrison, Christian Hermansen, Mei Fang Liao, Sandra Knoebl, Marcus Lundh, Duane McLemore, Francesco Monico, James Moore, Greg More, Stuart Munro, Margaret Murray, Gordon Murray, Jillian Murray, Gaynor Murray, Jerome O'Leary, Esther Ortmann, Melanie Perkins, Kjell Petersen, Felix Robbins, Alison Sampson, Joakim Skajaa, Karin Søndergaard, Camilla E. Sotomayor, Chris Speed, Neil Spiller, Tim Thornton, Chia-Hoa Tsai, Emmanuel Vercruysse, Anne Carina Voelkel, Phil Watson, Kimberley Walker, Dominik Wenzel, Claudia Westerman, Katharine Willis, Simon Winters, Malin Zimm.

iii. Biographical Note

Shaun Murray is a PhD candidate at the University of Plymouth, Faculty of Arts. He is responsible for developing the Centre for Creative Design and Technology, a transdisciplinary teaching and research centre for innovative manufacturing and visualisation. Shaun Murray's work, as published in his book 'Disturbing Territories', is intended to allow the possibility of collaborative practice, and become a digitally networked creative enterprise. The integrity of his projects comes from a distributed network approach whereby the ethics of ecological sustainability needs to be realised. He has exhibited internationally and has developed some major architectural projects through his work with Alsop Architects. He teaches on the A.V.A.T.A.R (Advanced Virtual and Technological Architectural Research lab) programme in University College London, Bartlett School of Architecture. Prior to University of Plymouth, he completed his Masters Degree in Architecture at University College London, Bartlett School of Architecture.

Eniatype Studio is an experimental design collaborative that integrates ecological principles in architectural education. The studio views ecology in design as not only a philosophy that inspires visions of sustainability but also focused on scientific endeavour. The mission is to ascertain the consequence of fitting a project with our natural environment. Solutions range from numerous examples: system habitats, notational building clusters, and meaningless objects in featureless space for cities. The design iterations succeeded as having activated ecology both as a productive symbol and an evolved artefact.

Eniatype Practice is a professional architectural office that explores the burgeoning field of Eniatype within the built environment. The practice promises to become a generative tool, as a means of rationally conceiving new building forms. The mission of the practice is dealing with the dynamics engendered by actions of several levels of communication through context and design. It is for this reason that Eniatype practice is radically distinctive from other practices.

Design Ecologies is a new peer-reviewed academic design journal with Intellect books. I am the principal editor of the design journal, which aims to identify the complexities of burgeoning practices within the architectural community.

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iv. Authors Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee. This study was financed with the support of the Faculty of Arts, University of Plymouth. Projects specifically related to the thesis are available in Part II: ENIA Design Visions, Part III: TYPE Design Visions and part IV: ENIATYPE Design Synthesis. A DVD is also included with the submission and contains further documentation of projects described in the thesis. Relevant seminars and conferences were regularly attended at which work was often presented; external institutions were visited for consultation purposes and several papers prepared for publication.

Publications(or presentation of other forms of creative and performing work):

Murray, Shaun. 2006, *Disturbing Territories*, Hamburg: Springer Wein New York
Ascott, Roy. (ed). 2005, *Engineering Nature*, Bristol: Intellect. pp. *Breeding, Feeding, Leaching*.

Murray, Shaun. 2005, Liquid Press: *Altered States: Transformation of perception, place and performance*. Plymouth

Murray, Shaun. 2005, Qi and Complexity Sixth International Consciousness Reframed. Beijing, China

Murray, Shaun. 2003, Fifth International Consciousness Reframed. Caerleon, Wales, UK. (ed. Michael Punt), CD-ROM Proceedings in Press.

Spiller, Neil. (ed). 2002, 'Reflexive Architecture', London: *Architectural Design*, Vol 72 No 3 February pp56-63 and front cover.

Spiller, Neil. (ed). 2001, 'Young Blood', London: *Architectural Design*, Vol 71 No 1 February. pp36-43.

Ascott, Roy. (ed). 2000, *Art Technology Consciousness*. Bristol: Intellect. pp139-144 *Disturbing Territories*.

Murray, Shaun. 2000, Third International Consciousness Reframed, Caerleon, Wales, UK. (ed. Michael Punt), CD-ROM Proceedings in Press.

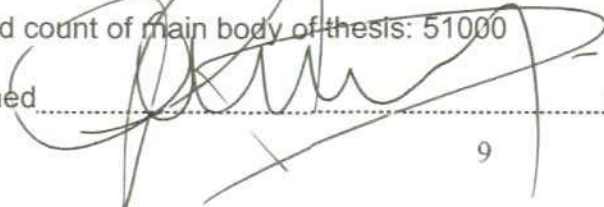
Spiller, Neil. (ed). 1999, 'Architects in Cyberspace II', London: *Architectural Design*. pp91.

Presentation and Conferences Attended:

1. Consciousness Reframed. 2006. Research Conference. Plymouth University, UK
2. Research Conference. 2005. Transmodalities, Sabanci University, Istanbul, Turkey
3. Research Conference. 2005. Altered States. Plymouth University, UK
4. Research Conference. 2005. Shaping Consciousness. Dallas, USA
5. Consciousness Reframed. 2004. Qi and Complexity. Beijing, China
6. Research Conference. 2004. Researching the Future. University of Plymouth, UK
7. Research Conference. 2004. Ciber@RT. Bilboa, Spain
8. Research Conference. 2003. Sensorial Net. Fortaleza, Brazil
9. Consciousness Reframed. 2003. 5th International Research Conference, Newport, Wales, UK

Word count of main body of thesis: 51000

Signed



Date

26.01.11

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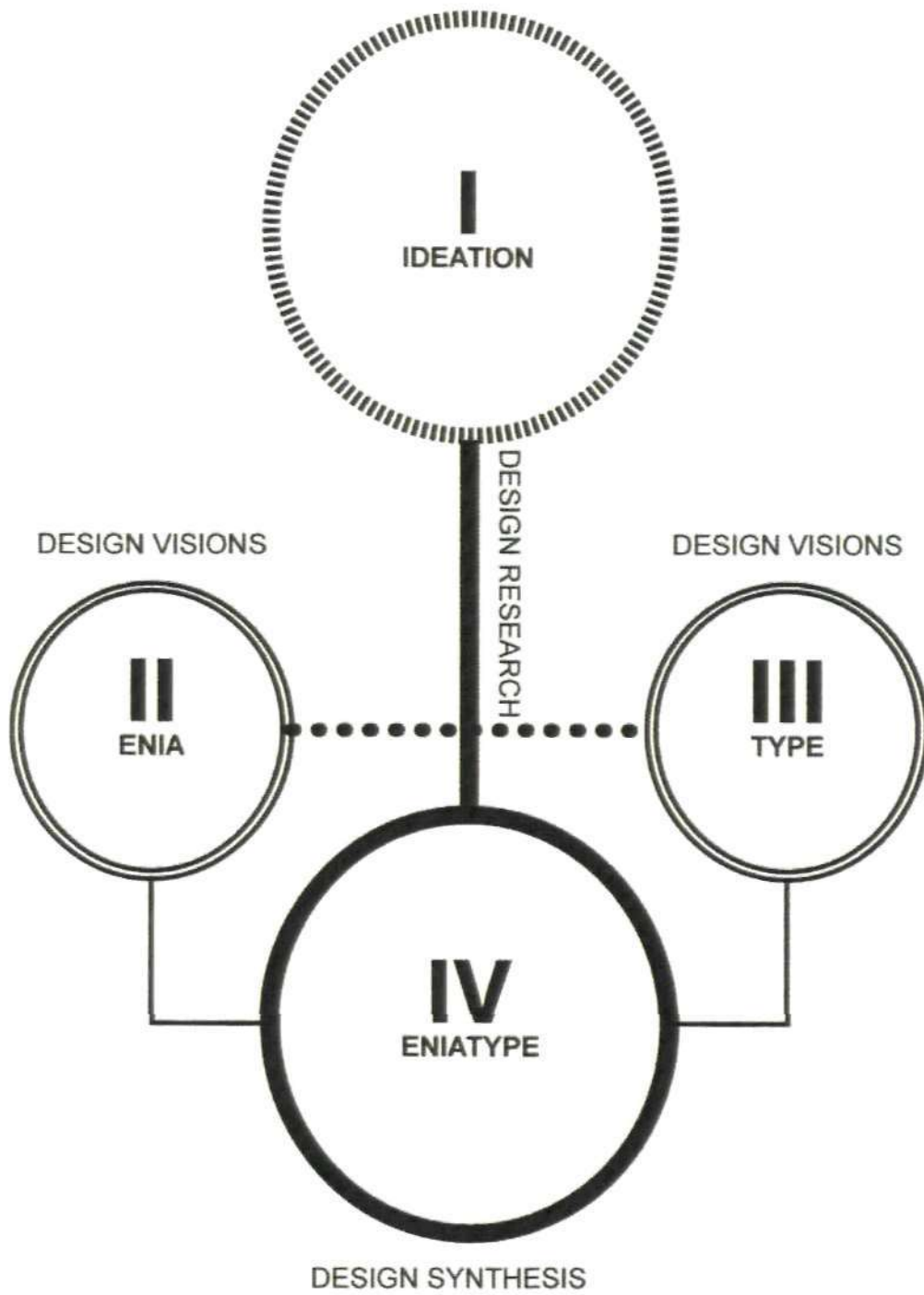


Figure 1-v. Eniatype; organisational diagram of dissertation, 2010

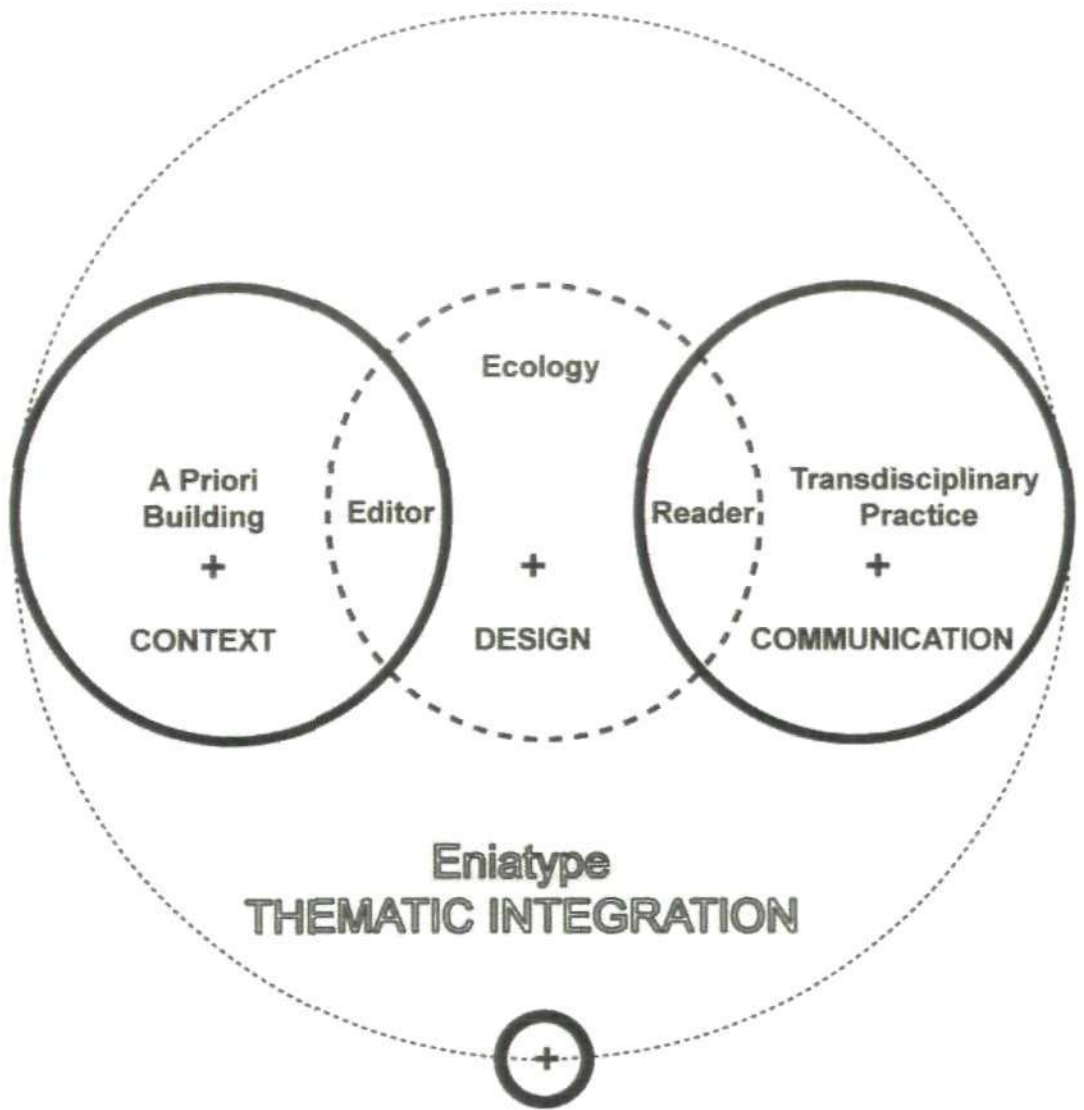


Figure 2-v. Diagram of Thematic Integration:Context,Design and Communication,2010

vii. Introduction

The myth of power is of course, a very powerful myth; and probably most people in this world more or less believe in it. But it is still epistemological lunacy and leads inevitably to all sorts of disaster. To want control is the pathology! Not that a person can get control, because of course you never do. Man is only a part of larger systems, and the part can never control the whole. (Bateson, 1972: 501)

The thesis is organised in four major parts culminating in an emerging design theory entitled: Eniatype. Each part investigates various novel concepts of ecologically informed methodologies of communication. The first part, *Ideation*, describes a history of visionary thinking on methodologies of communicating an architecture along with new models and ecological contribution. In the second and third parts, Enia and Type, a series of design visions explore these concepts in specific studies. The fourth and final part, Eniatype, is a compound synthesis of all three previous parts discussed through practical transdisciplinary research sessions.

The overall aim of this research is to profoundly re-define and re-shape how the relationship between working drawings in architectural education and the environment affect each other. Through a careful restructuring of the professions that influence architectural environments, this declaration is certainly possible. As of now, the limitations in design thinking on various non-integrated professions have spoilt much of the environment. Through my design studio and practice our multi-layered approach has produced a way of thinking professionally about ecological communication in future environments.

Eniatype is an embryonic far-reaching awareness that crucially bonds the disciplines design ecologies, theory of notation, instructional design and aesthetics. Still in its nascent stages, it has yet to be entirely defined. As a pragmatic essential meld of multiple disparate sensibilities, it endeavours to rethink the relationship between working drawing, participant and environment through context, design and communication. Under such a single umbrella influence, a sophisticated ecological view of communication is reified.

The research work within is primarily visually orientated. The text is secondary to the design work, and meant to serve as a brief description and

captions to the projects. The freedom of interpretation for the viewer is wholly encouraged, as long as the basic premises are preserved. The approach of this research is to further the field of architectural education by mobilizing theories of eniatype and linking architectural education to a new theory of the ecology in design. The specific aims of the proposed research are:

1. Develop a new theory of the ecology for designing eniatype systems.

The need to continually change our surroundings reveals the commonness of architecture as a human activity and its embodiment of the human need to address eniatype situations. Architectural professionals have extensively researched architectural education in order to continually address greater orders of complexity without an understanding of the role of the eniatype in architecture. Key research question: What is our understanding of a link between the education of architecture and the eniatype in architecture?

2. Mobilize theories of Eniatype architecture.

Theories of eniatype practice are more powerful than most architectural theories because they accurately describe the design situation as complex and contingent. Key research question: Can eniatype practice provide an alternative epistemology of architecture linked to a new epistemology of architectural education?

3. Produce a methodological framework to guide eniatype architecture in design of ecology systems.

Key research question: In what form can theories of eniatype be mobilized in order to create new and effective approaches to architectural education?

In the first part a visual history of visionary thinking on methodologies of communicating an architecture between working drawing, participant and environment through context, design and communication along with new models and ecological contribution. Many of the notions on communication and relationships in this work, stem from these potent ideations. Methodologies of communication concepts such as *Correalism*, *Reflexive Architecture* and *Recursive Vision* are introduced. These describe new ways in which working drawing; participant and environment interact with each other and as a whole. *Correalism* concerns the relationship between environment and participants. *Reflexive Architecture* charts the emerging practices whose architectures straddle between realms of the virtual and the actual. Whilst recursive vision is about a framework of thinking which is called 'an ecology of mind' or 'mind in ecological settings' (Bateson 1972: xxiii). It strives to discover a set of rules

from which we can derive principles about the environment, and the relations between human activity and the environment.

The next part of the work entitled *Enia*, concentrates on design ecologies, theory of notation, instructional design and aesthetical strands. This is the investigation of the first major attempt at moving working drawing through environment, to contain a series of principles for describing the design situation as complex and contingent. Projects in this part include 'Basque *Enia*' and 'Beijing *Enia*' that support a complex and contingent design. Also within the *Enia* section is a theory of communication design entitled: Design Ecologies.

The *Type* part deals with the fundamental creation of the 'theory of logical types' that proposes that a class is of a logical type higher than its members. This theory becomes very important in negotiating the newly defined relationship between working drawing, participant and environment. Explorations through a series of transdisciplinary research sessions furthered the validity of the working drawing, participant and environment proposals.

Finally, in the *Eniatype* section the previous concepts are synthesized to form new methodologies for communicating architecture. For communicating different methodologies of designing were researched at Alsop Architects and through three academic institutions in University of Plymouth, University College London at the Bartlett School of Architecture and in Oslo at AHO, the Oslo School of Architecture and Design. All of the *Eniatype* projects throughout address environmental and educational issues in different ways. The project summations of ecological design challenges are as follows:

1. Increase spatial notational strategies
2. Increase structural coupling
3. Increase singularity
4. Increase collective subjectivity
5. Increase existential values
6. Increase object-oriented ontology

This thesis demonstrates a rethinking of methodologies of communication through ecological design. In fact there are potentially innumerable forms of holistic designs that will connect and shape environments for human communication. Contained within are new design ideations and explorations for prospective models of designing. These conceptions are achieved towards an emergent protean set of collective principles aptly labelled: *Eniatype*.

e•n•i•a•type

Function: noun

Etymology: "e" denotes Late Latin oeco- household, from Greek oïk-, oïko-, from oïkos house, "n" denotes notation, a system of characters or symbols, "I" denotes instructional, Intended for purposes of instruction, for teaching, "a" aesthetical, of or pertaining to aesthetics, from Latin type- typus from Greek tupos, "mark, impression, type"

1. A field of design concerned with the interrelationship of ecology, notational, instructional and aesthetical types.
2. The totality or pattern of linkages between drawing and environment.
3. The art of transfer or conveyance from one place to another by simultaneously taking into account the human body and its surroundings.

ENIATYPE

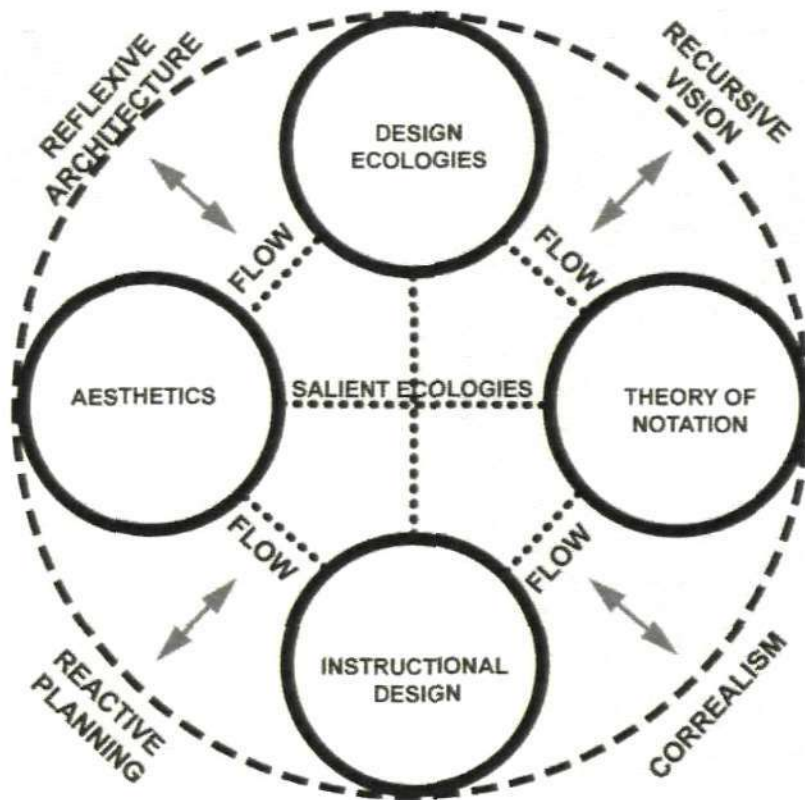


Figure 3-v. Disciplinary Scope of the Theory of Eniatype, 2010

Thesis overview

Within the range of the various senses of the term eniatype, from a signifier of place to denoting the design situation as complex and contingent, this thesis investigates the relationship between working drawing, participant and environment through context, design and communication. It identifies a set of literary works (Gregory Bateson, Nelson Goodman, Ilya Prigogine, Bertrand Russell and Francesco Varela) and architectural projects (Frederick Kiesler's projects on Correalism, Reflexive Architecture and Disturbing Territories), where spatial organisation bears a particular rethinking on the relationship of eniatype as an integrated approach to methodologies of communication. The thesis has been developed upon ten published articles, nine presentations at international conferences, five international transdisciplinary sessions, two international exhibitions, two interviews, one online lecture and a book entitled 'Disturbing Territories' published by SpringerWienNewYork and an exhibition in the Italian Pavilion in Venice Biennale in 2007. We can see through this rethinking of communication through design certain conditions and imperatives in architecture are demanded that we take the practice of architecture forward.

Identification of the field

Human communication and ecological accountability are inextricably linked in architectural design; our current world ecological crisis underscores this fundamental connection. Within architectural practice the communication from architect to participant or environment is not at all straightforward. This is also true of the dyadic relation between working drawing, participant and environment through context, design and communication in architectural education. 'We live in a world desperate to discover a set of rules from which we can derive principles about the environment, and relations between human activity and the environment, yet the holistic perspectives we require seem to elude us' (Harries-Jones, 1995: 3).

This research on ecology and ecological thinking comes at time when it seems that we should be concerned with relationships between things and not the thing itself. This is a fundamental truth with architectural education and research. There have been many shifts over the past decade that enforces the argument that we should concentrate on the relationship, for example, between

people and built systems, between built systems and their infrastructures or between these infrastructures and the ecosystem. Also, through studying the 'relationship of buildings after they are built, that's when the participants take over and make the building suit their real needs' (Brand, 1995: 190).

The working drawing in architectural education and practice has been privileged as a way of describing our complex relationship with the environment. Although the drawing refers to something 'outside itself' (Evans, 1997: 165), its value as a drawing is secondary to its primary purpose that is to describe a building. Robin Evans writes 'architectural drawings are projections, which means that organised arrays of imaginary straight lines pass through the drawing to corresponding parts that are represented by the drawing' (Evans, 1989: 19). Whether perspective or production information, the architectural drawing refers to something outside itself. Its value as a drawing is secondary to its primary purpose that is to describe a building and, therefore, it is usually seen in conjunction with other drawings, whether or not this leads to construction.

This dyadic relationship between working drawing and environment is on a continuum that is shifting. This is clearly evident in architectural education and practice, whereby the environment and working drawing are both dynamic and shifting, the drawing gets revised whilst the environment is continually changing. There have been attempts in architectural education and practice to describe experience through drawing. This can be seen in the works of Frederick Kiesler, Cedric Price, Gordon Pask, Robert Rosen, Mike Webb and John Frazer. This group dominated the field in trying to communicate human-centred architecture. These people and their projects developed new tools for the practice of architectural education through drawing, participation and the environment. Through my practice I am attempting to develop new tactics for architectural education and review the relationship of working drawing, participation and environment through context, design and communication.

Theoretically, a key move was in placing drawing – a precise if unusual idea of 'drawing' (cf. Part I of this thesis) – in the very heart of the physical environment, in this self-generating grammar of living processes and of the incessant, remarkable metamorphosis: if you want to understand different methodologies of communicating architectural design, look at the environmental

evolution and conversely if you want to understand environmental evolution, go look at different methodologies of communicating architectural design.

We need to rethink our methodologies of communication through ecological design and understand that human communication and ecological accountability are inextricably linked. These pertinent questions induce us to look with new eyes at our own idea of 'working drawing'. This invites us, in other words, to see in a wider perspective those inertial habits of architectural design that push us to describe drawing either as a representation of something other than itself for the elaboration of information about building (encapsulated drawing), or, on the other hand, vitalistically, as something ineffable and somehow attached to reality and a larger part of our environment (embedded drawing). To picture this relationship of embedding the drawing within environment as being like the relationship between a river and its banks – the river moulds the banks and is the banks guide the river. Similarly, the embedded drawing moulds the environment and is guided by it.

This practice has identified that methodologies of communication within architectural design are complex and contingent. That they deal with the complexities of 'salient ecologies' through to an understanding that the dyadic relationship between working drawing, participant and environment as 'a science of reciprocal relationships' (Kiesler 1949: 11). Currently within architectural design we have an inadequate understanding of notational methodologies as a method of communication for architectural education. This can be seen through computer- aided architectural design (CAAD) systems that don't fully acknowledge the environmental complexities of site and context through the design process. Architects use many methodologies of communication; some are more effective than others. These methodologies are complex and contingent within architectural education, 'As opposed to the opposite point of view that oversimplified ideas will always displace the sophisticated and the vulgar and hateful will always displace the beautiful. And yet the beautiful persists' (Bateson, 2002: 5).

Particular active threads

There is an inadequacy of ideas in thinking about methodologies of communication within architectural education. Through the projects that I will be

discussing in this thesis it could be said that architectural design has failed to acknowledge the determining function of the ecology in design in the making of meaning. As such current architectural education methodologies can be regarded as a disavowal and harbinger of technologically facilitated interaction as a tactic for engaging with some of the more difficult aspects of architecture as complex and contingent. The particular active threads can be found through Kiesler in 1939, Bateson in 1972, Goodman in 1976, Prigogine and Stengers 1984 and Spiller in 2002.

In 1939, we were introduced to Frederick Kiesler's theory of *Correalism* or the *science of reciprocal relationships*, which expresses the dynamics of the continual interaction between man and his natural and technological environments. Kiesler readdressed a definition and test for a new approach to building design through his manifesto *On Correalism and the Biotechnique: A Definition and test of a New Approach to Building Design*. This article expressed a crisis in architecture was due to the lack of science dealing with the laws that govern 'man as a nucleus of forces' (Kiesler 1939: 60). In 2008 there was a timely exhibition at The Drawing Centre in New York entitled 'Frederick Kiesler: Co-Realities':

This historical exhibition will trace Kiesler's interest in the expressive and conceptual possibilities of drawing through key projects from the 1930s to the 1960s and will include never-before-seen drawings on loan from the Kiesler Foundation, Vienna. Frederick Kiesler: Co-Realities will present over 30 drawings related to Kiesler's decades-long investigation into the correlation between man, nature, and technology, embodied in his iconic Endless House structure. (João Ribas, 2007: The Drawing Centre)

The eminent Kiesler scholars, Dieter Bogner and João Ribas, curated this exhibition.

In 1972, Gregory Bateson published *Steps to an Ecology of Mind* that proposed a new way of thinking about ideas and about the aggregate of ideas which he calls "minds." This way of thinking about ideas he calls "ecology of mind," or ecology of ideas. The questions his book raises are ecological: how do ideas interact? This is particularly vital in rethinking how architects use their

methodologies of communication to communicate their ideas about architecture. Bateson suggests that this contemporary crisis that man has in relationship with his environment can only be understood in terms of such an ecology of ideas. Among Bateson scholars, Peter Harries-Jones is notable for looking at Bateson's *Steps to an Ecology of Mind* in the context of his mature work, using terms for it associated with that period, 'recursive epistemology' or 'ecological epistemology' (Harries-Jones, 1995: 4). Harries-Jones describes the process with which Gregory was concerned was essentially process of knowing: perception, communication, coding and translation.

In 1976, Nelson Goodman suggested that architecture cannot enjoy the benefits of a full-blown notational system and clearly states that architectural notation is inadequate in light of his notational theory. He was especially disappointed with architectural plans as a brand for artistic notation that failed to acknowledge the full descriptions of buildings. His theories are particularly challenging in the light that for a full blown architectural notational system you must preserve the identity or *allographic*ity of the work. This would, in Goodman's view, be attained through *standardisation* of the symbolic characters that represent the elements of designs of a given medium. In 2000, Saul Fisher wrote a paper on *Architectural Notation and Computer Aided Design*. He recognised that architecture can have a full-blown notational system that meets Goodman's criteria.

In 1984, Prigogine and Stengers suggest a rethink in relation to the study of natural phenomena exhibited around us – in our terrestrial environment and upon this earth, and in the local cosmic environment within which the terrestrial is embedded. Prigogine and Stengers invoke the roman poet Lucretius, with the urge to look for the hidden behind the obvious (Prigogine and Stengers, 1984: 3). They make it very clear to us that 'one of the most developed skills in the occident is dissection; the practice of breaking things down into bite-sized chunks, and then isolating each one from its environment'. (Prigogine and Stengers, 1984: xi) This is a common trick within architectural education and practice whereby we reduce all the components within an architectural project to different parts of different working drawings. These parts then become developed into 'packages' of information, which in turn describe how that isolated component will be developed. In this way we discriminate the complex interactions of the building as a whole through dealing with each part separately

through the different working drawings. Prigogine and Stengers suggest that we should have a heightened awareness to the flows of time and suggest we should be interested in open systems that exchange information with the environment continually (Prigogine and Stengers, 1984: xv). This could be especially valuable in letting the environment inform the design of our architectures.

In 2002, Spiller was asking us to rethink the relationship of site and context within his publication on *Reflexive Architecture*. He illustrates this through a series of projects that a 'reflexive architecture can link to all manner of phenomena.' He states that,

It creates a new kind of contextualism as any reflexive architecture is solidly integrated to a 'site of ecologies,' whether natural or artificial or a hybrid of the two. A 'site' might be a set of sites – feeding of each other. The potential of such spatial tapestries has impact on the ecology. (Spiller, 2002: 5)

This re-reading of the relationship of site and context would have a spatial impact on human communication and ecological accountability within architectural design.

Together these active threads allow us for the first time to describe a burgeoning field, Eniatype, which promotes ecological transitions within local and global contexts. By developing working drawing through environment, unique ecological design proposals were produced, which promote a new role in defining the ciphers of future design thought.

When did this shift happen?

There has been a series of shifts that have enabled us to identify a new and emerging field which have a direct correlation to the active threads through Kiesler in 1939, Bateson in 1972, Goodman in 1976, Prigogine and Stengers 1984 and Spiller in 2002. These shifts challenge the everyday practices of architectural design by offering a transdisciplinary framework for design production. The work concludes with the necessity for a new design field entitled Eniatype. One effect of this shift towards image and signs is that

architecture's disciplinary frame shifts. It finds itself in-between the dominance of working drawing through history, a shift in the value of drawing through construction, a shift in the understanding of the 'experience' of architecture, a shift in relation of building as object and relation as object, a shift in the understanding of the ecology of ideas and the recent shift from the drawing board to computer-aided tools. These are all signs of stress in a paradigm shift between working drawing, participant and environment. These shifts could be described as:

1. Shift in dominance of working drawing through history
2. Shift in the value of working drawing through construction
3. Shift in the experiential in architecture
4. Shift in relation of building as object and relation as object
5. Shift in the understanding of ecology as an idea
6. Shift towards image and signs in the development of notational systems
7. Shift of working drawing as architecture

1. Shift in dominance of working drawing through history

From the origins of western architecture in antiquity, the role of the architect has been to describe rather than construct – that is, to mediate between the poetic conception of architectural ideas and their eventual, if more prosaic, realisation. Architecture has been a discipline defined by the tools and techniques of representation as a result, from the rules of renaissance perspective to projective drawing. As Robin Evans has argued when dealing with the issue of drawing as architectural representation: "Drawing in architecture is not done after nature but prior to construction; it is not so much produced by reflection on the reality outside drawing, as productive of a reality that will end up outside drawing" (Evans, 1997: 165). Drawing became the crucial instrument that guided the architect away from the site. Within architectural design, drawing could be described as an 'autonomous instrument' (Robbins, 1997: 16) which allows us to experiment a whole range of ideas away from the costly constraints of designing while building. But in recent times there has been a shift in the opposite direction to reconnect drawing back through the environment. In 1997 Robin Evans in *Translation from Drawing to Building and Other Essays* and Edward Robbins in *Why Architects Draw* described the relationship between

working drawing and the environment as complex and contingent. These writings at this time were crucial in understanding the shift that was happening where technologically facilitated interaction between working drawing, participant and the environment would allow us to embed drawing as a central activity within environment and not without. Through developments in technology, it is possible not to use drawing *per se* but to develop a set of new tools to supplement drawing. This could be done through notational strategies, which are truly spatial and experiential. We think of working drawing as reflexive, something that is enacted upon over the course of developing a project, but this is only a manual revision rather than a recursive relationship with the dynamics of the physical environment.

2. Shift in the value of working drawing through construction

There has been a shift in the value of working drawing through construction. Taking into account Evans' remark 'drawing in architecture is done after nature, but prior to construction' (Evans, 1997: 165), we can see that this shift has come at a critical time where drawing is becoming 'post to construction.' This can be seen in the use of real-time communication systems in architecture that is preceding without question the role of the architect. This tension can particularly be seen through building projects I have worked on in China, whereby the construction of the building is preceding the working drawings of that same building. The value of the working drawing after the building becomes quite redundant. What seems to be missing in some of these projects is to acknowledge the participant in the projects as a maker of meaning through design, which happens post building. This example will enable us to target certain contemporary understandings of ecology, by understanding the complexity within the design process.

3. Shift in the experiential of architecture

As stated by Saul Fisher in his article on *Architectural Notation and Computer Aided Design*,

It is generally held that in the *experience* of architecture there is no substitute for a walk-through. To know the essential features of a building, one must personally encounter its constituent forms. If one

cannot visit the building, the next best option for becoming familiar with those features is acquaintance with some representation of the same features: a plan, a model, or a verbal description, for example. The primary concern in choosing the best of such options is deciding the means by which we most effectively identify a given building. This concern is captured by the question: *How do we best communicate the essential features of an architectural work?* One answer to this question may be found in Nelson Goodman's *Languages of Art*, in which he proposes a theory of artistic notation that includes foundational requirements for any system of symbols we might use to specify and communicate the features of an artwork, in architecture or any other art form. But not all art forms can enjoy the benefits of a full-blown notational system, in Goodman's view, and he suggests that architecture's symbol systems fall short in this regard. It is a shortcoming of architecture, he believes, that its notation cannot communicate the sum of a given work's essential features. (Fisher, 2000: 273)

4. Shift in relation of building as object and relation as object

One is the notion of a building existing in the form intended as a result of complex inter-relationship with it, or through it, or on it, where the building itself exists in the relationships between things, not the thing themselves. Current practice methodologies in contemporary architectural practice have become a series of systems of operations from planning through to building control and schedule of works. In the architectural model the plan has become obsolete as a vehicle to understand the axis of information production towards the construction of a building and the axis of post building systems, which are incorporated after building completion. This questions not only the relevance of working drawings in practice but also the importance of communication in design. If this way of construction becomes a way of practice rather than the exception, we will need to find other means and methods of communicating our architectures.

5. Shift in the understanding of ecology as an idea

With reflection on Stan Allen's book *Points and Lines: Diagrams and project for the City*, there are a number of opposed positions have emerged among

architects who have addressed the pervasive role of ecology and working drawings.

One asserts that architecture will fade away under the advancing imperatives of working drawings. This has led some architects to retrench, and insist an ever more stridently on architecture's material specificity. Others submit to the imperatives of the new methodologies of working drawings and redefine architecture as ecology and image. (Allen, 1999: 15)

Allen suggests that 'alternatively, architects have attempted to reassert architecture's traditional capacity to represent (formally or metaphorically) the condition of distraction through a fragmented or 'dislocated' architecture that stands as a metaphoric equivalent to the dizzy euphoria of communication.' (Allen, 1999:15) In each case, architecture is understood as something different from ecology, its physicality opposed to the virtual effects of ecology and working drawings. Consequently creative work and texts began to emerge and formed a critical practice that can be described as Eniatype architecture. This thesis and the supporting research aims to provide models for the further development of eniatype. In addition it will extend a theoretical framework for the field through the integration of notational readings of space. The central hypothesis behind the practice and research is that, despite Eniatype architecture burgeoning a field of research, it has also begun to reveal deficiencies, which undermine its critical and sustainable development.

6. Shift towards image and signs in the development of notational systems

During the 1980s, the transition from analogue devices to digital systems affected the relationship of communicating working drawings within the architectural profession in many ways. For architecture, the transition from drawing board to the office computer was a significant change, but, as the underlying coordinate system essentially remained the same. An effect of this shift towards images and signs through CAD is that 'architecture's disciplinary frame shifts' (Allen, 1999: 51). Allen goes on to explain that architecture then finds itself in competition with other discursive media which architecture seems

to come up short. What these other medias lack, of course, is architecture's powerful instrumentality – its capacity not only to critique, but also to actually 'transform reality'. Within architectural education the shift from analogue to digital is still in its nascent stages. Many schools of architecture use the computer aided drawing tools in much the same way as if they were using a drawing board. Even though many schools of architecture use the computer-aided tools to communicate their architectures three-dimensionally, walk-through or virtually testing out their structures materiality. A problem with these methodologies is that they are neither truly digital nor ecological in correlation with the environment.

We think the working drawing as reflexive – (something that is enacted upon) but this is only on the premise of manual revision rather than recursive relation of the dynamics of environment. The capacity of the notational structure is to depict the imagined life of a building.

7. Shift in relation to drawing as architecture

João Ribas wrote an article entitled 'Drawing as Architecture', suggesting that through Kiesler's methodologies of representation he played a decisive role in the production of architectural discourse. For Kiesler, the drawing was not under what W.J.T Mitchell might call 'the tyranny of the graphical image' - rather drawing becomes an act of unifying the artistic, ethical, social, and technological aspects of architectural practice. A working drawing, as architecture, is where such polemics are investigated, developed and reconciled. Architecture, through working drawings, provided a bold directive to the modernist project: an attention to the spiritual, humanist, and fundamentally liberating responsibility of the avant-garde. For Kiesler, this amounted to developing a new kind of architectural thinking through his own theory of Correalism or 'the science of reciprocal relationships' which he developed from 1930 until his death. Key to Kiesler's ideas is the place of the human body (participant), the perceiving subject, as an indivisible part of the built environment.

Transdisciplinary Design: Definitions and Theoretical Concepts

The traditional sense of the *design* being *transdisciplinary* within design practice may be accredited to Vitruvius, whose condition for architecture can be seen as an open system of design, which is of great influence to any designer of buildings since antiquity. In *Ten Books of Architecture*, Vitruvius provides us with a system that was 'capable of accommodating steady progress and innovation' within architecture. The *Ten Books* as a transdisciplinary design approach deals with the actions of practice and of reasoning, not with everyday actions of the general public. Vitruvius is concerned also with the 'complexities' in the field of architecture and the liberal arts; then as know this was controversial, and not a standard view of what an architect and architects preparation should be. In fact today 'most buildings were built without architects at all. It is estimated that architects are responsible for between a fifth and a quarter of all construction' (Saint, 1983: 72). Vitruvius understood the importance of understanding the relationship of the branches of knowledge an architect was expected to operate within practice. He understood through his prescriptive writing that architectural design must operate across many disciplines from draftsmanship, geometry, history, philosophy, music, medicine, legality, astronomy and the ways of the heavens. It was very important to Vitruvius for an architect 'to understand how all these studies have interconnected subjects in which the architect's participate. To understand the *relationship* between all branches of knowledge' (Vitruvius, 1988: 23). Vitruvius prescribed parameters for an transdisciplinary design approach through his *Ten Books on Architecture*. In Vitruvius's book one, on 'first principles and the layout of cities', he understood even then the protocols of an integrated design approach through the education of the architect, the terms of architecture, the division of architecture and the choice of a healthful site. His explicit drawings with their written annotations aided the architect to people and spaces within specific dynamic environments. For example in his illustrations 1.4.7 and 1.4.8, he identifies an understanding of the ecological impact that birds, fish and land animals have on the environment. He identifies that man's impact in designing of buildings must take into consideration by stating: 'we perceive that the bodies of animals are composed of the elements, and we judge that they suffer and dissolve when there are excesses or failures of one element or another' (Vitruvius, 1988: 27).

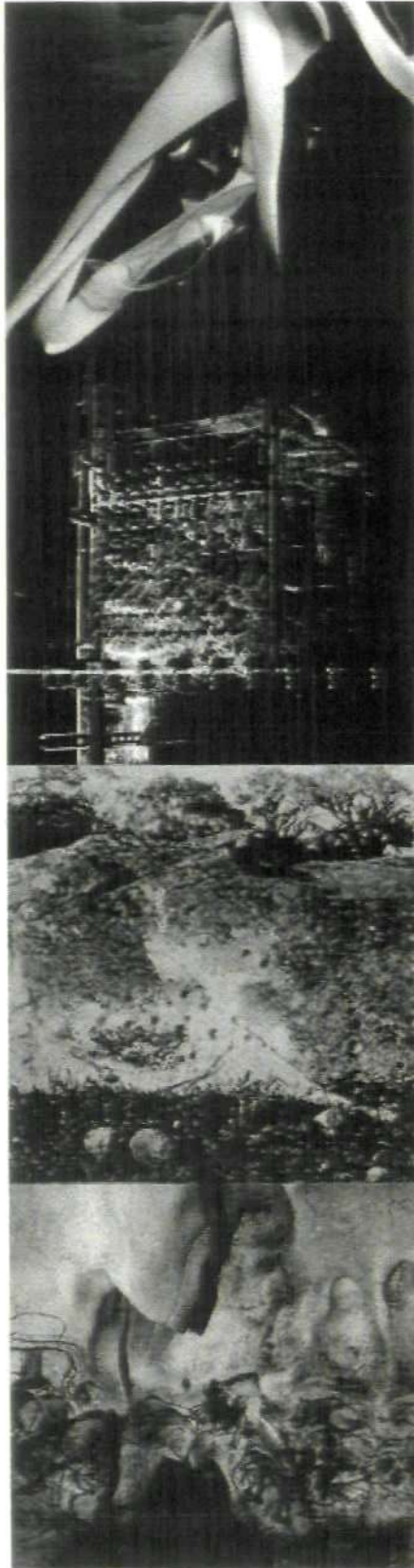
Drawing: Definitions and Theoretical Concepts

Drawing should to be read as a web of relationships connecting different pathways together. Drawing acts as a mutable transformative model within design. The drawing allows other things to interact with it and for it. As a community we must embrace and document the changing status of working drawings within architectural education. This will enable us to understand the emerging fields within education that should identify how our tools are being shaped.

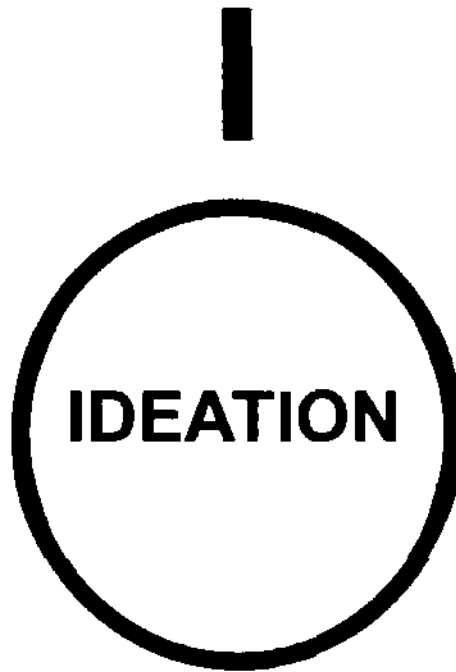
Throughout this thesis I am not defining drawing as such, but framing the definition of drawing through our relationship with it. Many architects fail, often deliberately, to recognise that the drawings they produce are, architecturally, more interesting than the buildings they produce. Within my practice I am using working drawing as a tool to set up new relationships between the changing status of drawing, participant and environment within context, design and communication. This might enable one to shift the idea of a working drawing into a spatial and contextual tactic for design education. Working drawings are a fundamental act within architecture that allows architects to communicate their ideas usually towards building. Working drawing in relation to design has shifted over the past ten years because of the use of CAAD systems and the commercial practice of using the building information model (BIM). Within contemporary practice there are transdisciplinary models of working drawings across all disciplines involved in the built environment from engineers, contractors and clients.

The visions of working drawings are particularly resistant to interpretation. This is by design, to make sure that what we draw defies readings other than our own. A working drawing is therefore overloaded with conventions (both for the author and the reader), particularly through notational strategies. You might protest that this relates particularly to production drawings but the fact that the conventions allow the same thing to be understood in the same way by the many agencies that contribute to its production means that other forms of architectural representation tend to conform to the same rules. It is very rare to find drawings that stray too far from conventions, when architects draw they do so to study or document an idea. The drawing is trying to discuss an idea while at the same time trying to avoid prescription. I am looking for drawing that is available to the author for reflection and allow the reader to take

possession in a way that does not rely on interpretation. I suspect that the mechanism to allow this is to look at how the drawing can become spatial and embedded so that it requires a direct and phenomenal relationship between drawing, participant and environment. Some of these ideations explore the relationship between context, design and communication by placing drawing in the very heart of environment, and situating the participant within the drawing within the environment as it is drawn. Thereby making the connection of drawing, participant and environment both spatial and experiential.



DESIGN IDEAS



IDEATION

- 1** **Precedents**
- 2** **Communicating Infrastructures**
- 3** **A Priori Building**
- 4** **A Science of Reciprocal Relationships**
- 5** **Salient Ecologies**

1. Precedents

The section describes how precedents have impacted on the foundations of the field of Eniatype. It suggests that although the precedents have connected different areas of study within the field, there is no singular precedent that defines the whole. All these visions acknowledge the determining function of the participant in the making of meaning, which facilitates a tactic for engaging with some of the more difficult aspects of communication. All these precedents reveal different and distinctive visions of the relationship between practice and research for aiding an understanding of Eniatype. Through the shifts within the architectural profession we can see that through throughout history other disciplines have been dealing with aspects of a more holistic mode connecting drawing, participant and environment through context, design and communication. Each precedent is in chronological order and all have equal importance in the development of the burgeoning field of Eniatype.

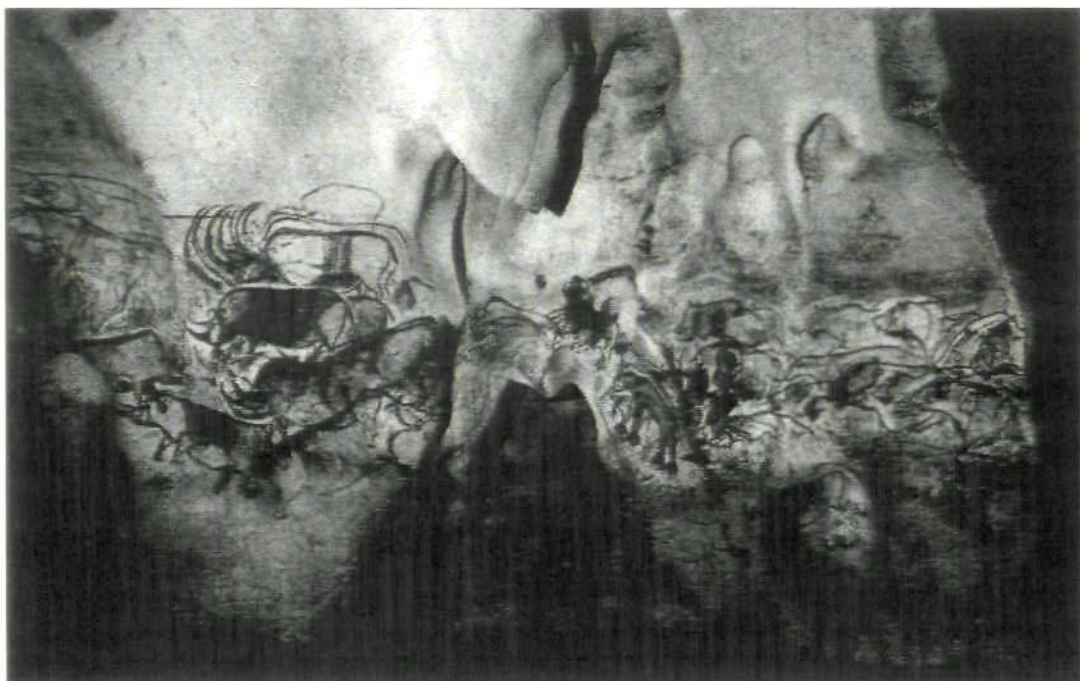


Figure 1-1. Photograph of a drawing in the Chauvet Caves.

On 24th December 1994, three speleologists, Eliette Brunel Deschamps, Christian Hillaire and Jean-Marie Chauvet, discovered the Chauvet Cave (or Chauvet-Pont-d'Arc Cave) in the Ardèche of southern France. It contained the earliest known cave paintings and other evidence of Upper Palaeolithic life. Based on radiocarbon dating, most of the artwork dates from 30,000 to 27,000 BCE. Drawing was supposedly invented before writing, though spoken language predated both. The cave paintings are embedded in their environment and show highly refined formal and technical understanding and technique, as well as an almost 'modern' conception of montage and perspective. The drawings are of lions, bears, rhinos and many other animals. They appear on the cave wall as a stampede. Interpretation relies on understanding the people who drew, were members of nomadic hunting tribes who had a special identification with the animal world of which they were so intimately a part. Were they constructing the world as they experienced it through drawing? Moreover, why did visions of the environment almost always express dynamic scenarios?

This intimate environment reveals a commonness of our connection to the world through the working drawing. As a community we must embrace and document the changing status of drawing within architectural practice. This will enable us to understand the emerging fields within practice that should identify how our tools are being shaped. Throughout this thesis I am not defining working drawing as such but framing the definition of working drawing through our relationship with it.



Figure 2-1. Recumbent stone in the Rothiemay circle in Aberdeenshire, bearing marks which Browne interpreted as a star chart.

One of the earliest visions of an embedded drawing can be found in the highlands of Scotland. These stones influenced a lot of the later work in thinking about recursive visions, reflexiveness and correalism in architectural drawings. A unique feature of these monuments is that they contain a large pillar stone, flanked by two others and marked by a series of carved circles and depressions, known as cup and ring marks, on one of its sides. Bishop Browne, who in 1919 studied these markings, discovered that many of them were accurately arranged to form patterns of various constellations in the night sky. But in every case the image was reversed as if the stars were reflected in a 'mirror', and Browne formed the theory that they were used as stone blocks for printing charts of the night sky onto sheets of cloth or stretched hide. Alfred Watkins, discoverer of the hypothetical ley-line system, had noticed prehistoric sites were laid out to reflect the constellations, their relative positions were plotted by cup marks on various key stones, so these stones were both terrestrial and celestial charts. With the drawing being in a fixed location within the environment, the participants must position themselves within the context where the mirrored drawing is marked into the stones, to understand the reciprocal relationship of the reversed drawing and the environment. This embedded drawing constitutes a drive towards the geographical location and direction of drawing within the environment as an important contributing factor for its particular methodology of communication. The drawing becomes a kind of 'through seeing', whereby the relationship of the parts in the drawing are related to the parts in the celestial system, this begins to suggest the drawing as a meta relationship. The drawing thus becomes a reader of another system, rather like in the current relationship of drawing to building, but with one major shift in the direction of the contextual relationship of the working drawing between participant and environment, environment and working drawing and participant and working drawing.



Figure 3-1. A Navajo makes a sand mandala in a healing ritual; the participant sits in the working drawing within the environment.

1.02 Sand Mandala

The creation of a sand mandala requires many hours and days to complete. Each mandala contains many notations that must be perfectly reproduced each time the mandala is created. When finished a Navajo sand painting ritual may last from five to nine days and range in size from three to fifteen feet or more. The Navajo Indians try, by means of mandala –structured sand paintings, to bring a sick person back into harmony with himself and with the environment – and thereby to restore his health. The image shows a Navajo making a sand painting (a mandala) in a healing ritual; the participant sits in the working drawing. By incorporating the Native American mandala as a tool, we too can begin to understand the connectedness between drawing, participant and environment within context, design and communication. By positioning the participant within the working drawing within the environment there is better sense of understanding the reciprocal relationships between working drawing, participant and the environment. The participant appears coupled with the environment through the working drawing. This drawing system is an experiential model, which allows these reciprocal relationships to become a spatial notational system- similar to a conductor (architect) with the orchestra

(participant) in a theatre (environment). Within the working drawing there are notations which are highly explicit in their relationship to the celestial system and through the environment in which these notations are placed. Throughout the ritual the notational system is continually enacted upon depending on the participant's needs. This notational system is embedded within an ecology of relationships that determines the effects of interaction throughout the ritual. The totalising tendency of this ritual offer a system of varying power and is a pioneering model for notational systems for the burgeoning field of Eniatype. For the native american looking at the sky and earth, their not looking at just a material collection of bodies moving in accordance with inanimate laws. The sky is a living being, the abode of the spirit. The earth is a living mother; it's not just a collection of rocks with physical forces at work in them. So, if you look at any traditional worldview there isn't a separation between nature and spirit, and environment and architecture. The two go together. It's a much more holistic and integrated view of the world, and I think that, as architecture emerges from this narrow, mechanistic phase that it's been in and we move to a broader vision, a new kind of connection between the realms of architecture and spirituality becomes possible. They can converge again. They can relate to each other once more through a spatial, notational model of working drawings. This precedent is to be viewed as an exploration into the relationships and use of working drawing within different environments, this will allow for a fuller view of the complexities in dealing with a different model of constructing an architecture within the burgeoning field of eniatype. The sand mandala is particularly relevant to the field of Eniatype through its exploratory relationship between the working drawing, participant and environment within context, design and communication. This ecological model can be viewed in making a partly spiritual, partly physical journey, spatial and embedded. Through this understanding we can communicate the wider ritual of a sand mandala and thus formatting a specific complexity of links and couplings into a lived and documented narrative.

These situated, lived, and sketched encounters with the world could be viewed as a formatting of the conceptual ground for whole new approaches to architecture incorporating lived experience and spirited dimensions as construction parameters?

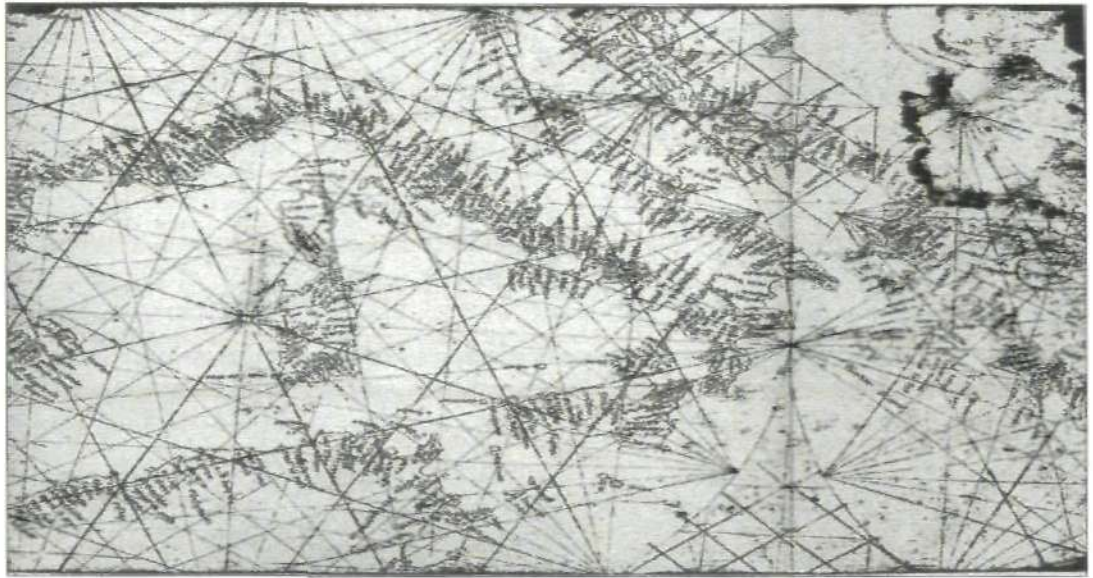
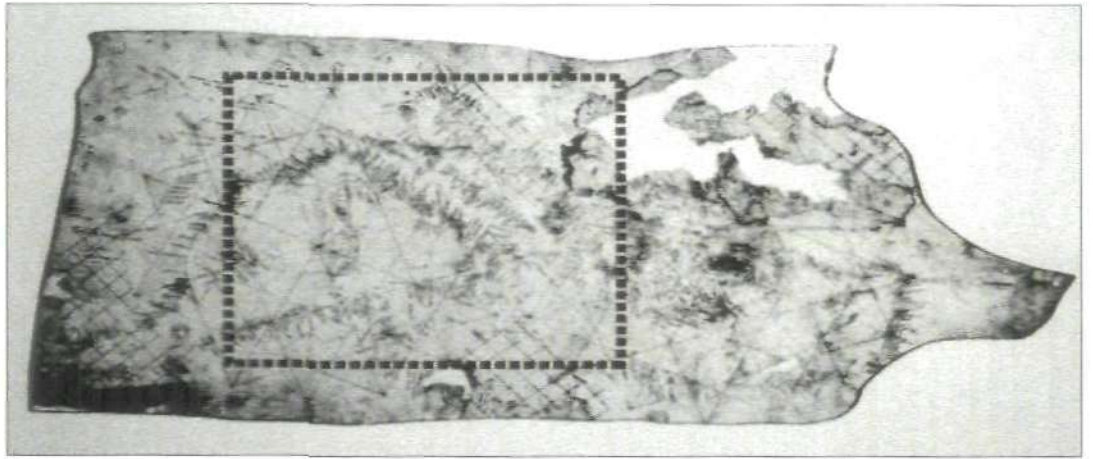


Figure 4-1. Top and Bottom: Carte Pisana (Pisan Chart), 1285

1.03 Carta Pisana 1285

The medieval portolan chart has been considered as a unique achievement in the history of maps and marine navigation, and its appearance one of the most representative turning points in the development of nautical cartography. It took place in a time when the cartographic representation of the known world, in general, and terrestrial cartography, in particular, were still in its pre-scientific era. The oldest known portolan chart, the Carta Pisana (Pisan Chart), was made around 1285 and its accuracy and detail are so striking, when compared with the symbolic representations of the known world made at the time, that we are tempted to believe that the techniques used in its construction were already known for at least some decades before.

For more than two centuries, much has been written about the origin and method of construction of the portolan chart; still these matters continue to be the object of some controversy as no one theory was able to gather unanimous agreement. (Campbell, 1987: 380)

If some consensus exists today, that is certainly on the medieval origin of the portolan chart and on the close connection between its development and the appearance of the marine compass in the Mediterranean.

The Portolan Charts have extremely accurately drawn coastlines based on real descriptions. The straight lines show the main directions similar to the later points of the compass; a pilot found the nearest line parallel to the route he wished to follow, and used that bearing with whatever adjustments he saw necessary. The importance of this chart is in the understanding that the environment has been experienced *a priori* to the drawing. This drawing is primarily a communication tool through lived experience. Drawing becomes an active embodiment of a participant using the portolan method in which positions are plotted in the plane according to the course (bearing) and distance between the two points. This is a working model, which reflects the exact position of the coastline at the time it was recorded and drawn on the map. The chart becomes a tool for constructing voyages around the coastline *a priori* to the voyage. To make use of the portolan chart the participant had to be able to tell directions fairly accurately. For this, they could judge by the sun or stars, or even by the direction of the prevailing wind. This relationship between the drawing, participant and environment within context, design and communication are intimately linked. The chart interprets visions of our relationship with our environment through the drawing of notations. These notations are carefully positioned and scaled to describe our relationship with the environment. Each notation is depicted with exquisite detail to allow a reader of the map to use it as an educational function. As one navigates the chart through the real-time navigation of the environment, it is only possible to apprehend one's relationship with that particular charted space. At such time these partial relationships occur, creating an 'architectural paradox', whereby the working drawing becomes privileged and embedded as a communication tool between the participant and the physical environment.



Figure 5-1. The plates are from Kellom Tomlinson's manual *The Art of Dancing*, 1735, which combines Feuillet's method of notation with charming illustrations of a couple performing a minuet.

The *Art of Dancing* by Kellom Tomlinson was a visionary conception of the eighteenth century: it used the bodies of his figures as if they were dancers, shifting, turning and repositioning a new system of interaction through the drawing. The relationship between the dancer, the space and the other body and the reader of the instruction manual are all taken into consideration. This union of body with linear artifice, moreover, comprised the sensual excitement of the dance, for every line that the dancers traced brought them into a different kind of physical relationship with each other. The notation Tomlinson shows in his images indicates that the two dancers are to face each other as they travel over its curving paths; if one imagines the man moving to the left and the woman to the right, one can envision a whole series of varying spatial confrontations between the partners, one slipping into the next with the continuous flow of music. The notation shows us the whole linear pattern traced by the dancers in the course of this extended temporal sequence.

This trailing residue behind the two dancers is a elegant graphic tracing that mirror one another and imply the course that the couple will continue travel as they progress with their dancing. This is the notation system that had been developed for the ballet in the late-seventeenth century; its longer, curved dashes indicate steps, and the smaller symbols attached to the dashes indicate more specifically the continuous pattern of bending and rising that characterised the minuet movement. Usually the notations were published separately as devices for learning and teaching new dances, as well as for connoisseurs who appreciated the visual elegance of the graphic design. Tomlinson's method of showing notation together with representations of dancers in space helps a contemporary viewer to understand how closely geometric patterning was joined to physical movement in the process of both choreographing and of executing the dance. Thus, enabling joy from the complexity and ecology of participants in space. Here, the participant enacts the relationship between the working drawing and the environment through the context of the working drawing.

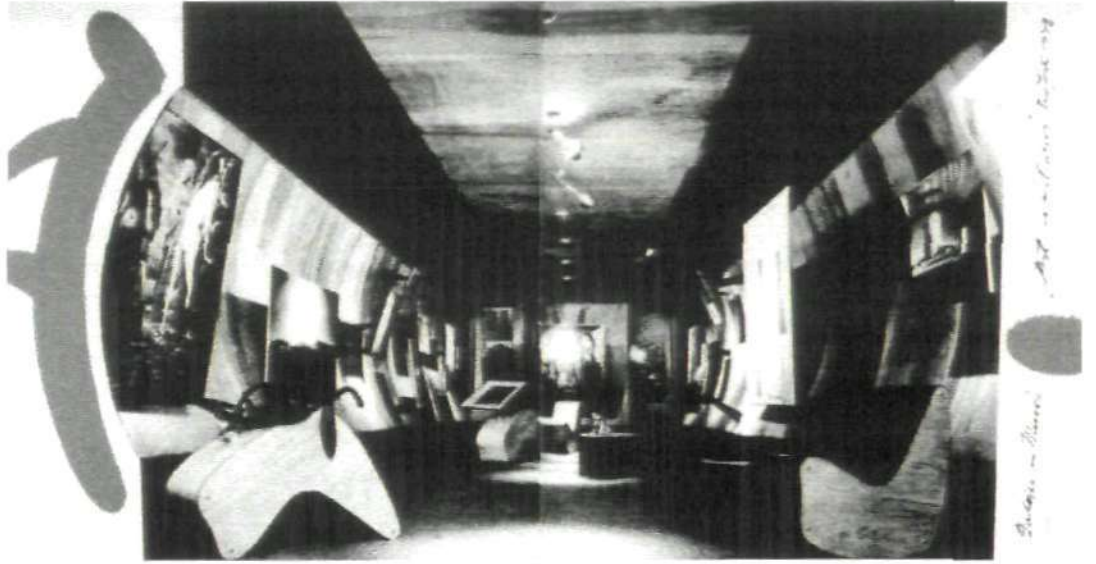


Figure 6-1. View of the Surrealist Gallery, Frederick Kiesler, 1942

1.05 Art of This Century 1942

Frederick Kiesler's vision called for an interactive, environmental approach through participation in which both space and viewer would be activated. Kiesler attempts to create a new methodology for communicating an architecture with drawing, participation and environment through context, design and communication. The basis for his innovation was Kiesler's conviction about the importance of the active role of the participant. In 'Brief Note on Designing the Gallery':

Man, seeing in a piece of sculpture or a painting on canvas the artist's projected vision, must recognize his act of seeing – of 'receiving' – as a participation in the creative process no less essential and direct than the artist's own. (Kiesler, 1942: 1)

An important milestone along the road towards the isolation of autonomous elements is the installation for the 'Art of This Century'. In its Surrealist Gallery, Kiesler for the first time liberates the exhibited paintings from their frames and distributed them freely throughout the rooms with the aid of wooden partitions.

This advanced position of the picture has two consequences: it is separated from the background and brought closer to the spectator. The picture seems to float freely. It ceases to be a decoration on the wall and becomes a small solid island in space. It is a world in itself which the painter has conceived and the architect has anchored. (Kiesler, 1949: 14)

The objects float like monads in the spatial continuum – which involves architectural elements, participants, and furniture – isolated from each other and from the wall not by means of the traditional frame but by space, through which a precisely defined relationship of tension is maintained between them. In this complex system of relationships, space becomes a medium common to all elements, an 'absence' which guarantees maximum individuality, which separates and, at the same time, creates interrelationships.

His intent in 'Art of This Century' was to devise a new system of coordinating architecture with painting and sculpture to dissolve the barrier and artificial duality of 'vision' and 'reality', or 'image' and 'environment', (Kiesler, 1942: 1) so that no frames or borders would intrude between art, space and life. In 'Art of This Century', Kiesler accomplished three important things. First, he manipulated real space to create a sculptural environment. Second, he assigned viewers an active role as they moved through space, exploring and interacting with it. Finally, he underscored the quality of art objects as real things in real space, thus completing his triangular correlation 'between space, spectator and art object' (Cantz, 2001: 28). Kiesler understood the complexity of the relationship between working drawing, participant and environment explicitly. Through the interaction of the participant with the context, Kiesler shifted the focus away from the art object and towards the relationship between the participant and environment.



Figure 7-1. Newspaper, Jochem Hendricks, 1994

This sample of the rendering work of designer Jochem Hendricks envisions a relationship between the act of drawing and eye movement. His 'eye drawings' reveal to us that the complex relationships between participants and environments through drawing. Through this approach one could declare the drawing of architecture could challenges the predominant notion of the architectural drawing through reading space with our eye movements.

Eye-drawings, 'Augenzeichnungen', are drawings done directly with the eyes, without the slightest interference of the hands - the organ of perception being turned into the organ of expression. By means of technical aids (infrared-, video-, and computer-techniques) human eye movements are traced and digitized during the visual process of looking at something, so as to be able to do an ink-jet print out of these movements eventually. The body of works called Eye-drawings not only investigates the process of looking at everyday objects in the form of photographs or real three dimensional items, but primarily circles around issues of research and the visualization of abstract motives and processes e.g., time, reading, writing, drawing, light, and afterimage, culminating in the denial of the gaze: nothingness - the invisible is made visible by means of a trace. (Hendricks 1998: 186)

Through this project, our understanding of drawing and reading are connected in an intimate and complex manner. Whilst the reading of the newspaper has already been read, this drawing becomes an intimate re-reading through the participant of the project. The environment in which the participant is reading the newspaper is not included in the drawing, but what remains behind is a trace of the intake of information. Something of the otherwise invisible process of reading is made visible, and a trace of the absorption of information remains. The result is a working drawing which has already been read. The working drawing becomes embedded through the participant's eye movement in the context of reading the newspaper.

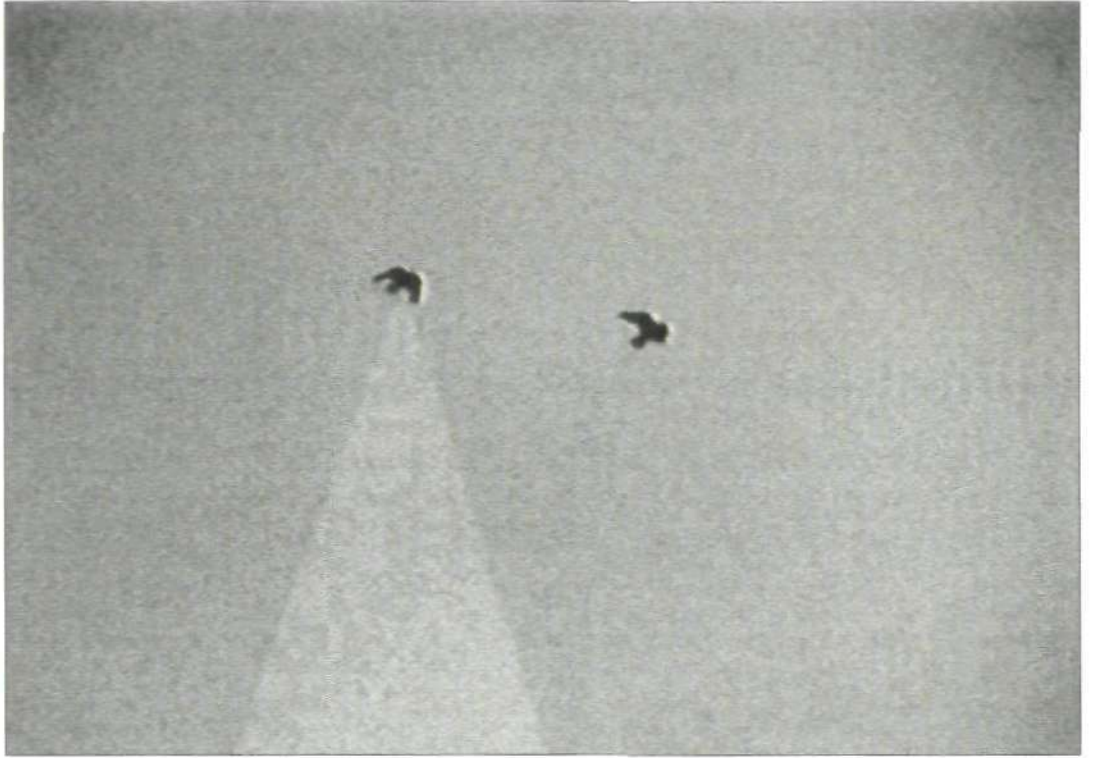


Figure 8-1. Top: Video still of 'Radio Birds', Trafalgar Square, Dunne+Raby, 1998
Figure 9-1. Bottom: Video still of street in Chiswick, Dunne + Raby, 1998

Dunne and Raby redefined the basis of communicating an architecture in the 1990s, a period of their work that they termed 'Hertzian Space'. The idea is that we inhabit environments of dense electromagnetic space that has exploded in complexity since the Second World War. They go on to explain that:

If our eyes could see (tune into) energy of a lower frequency these objects would not only appear quite different but their boundaries would extend much further into space, interpenetrating other objects considered separate at the frequency of visible light. (Spiller, 1998: 78)

Through projects such as 'Tuneable Cities,' Dunne and Raby investigate the relationship between visualising the electromagnetic radiation through drawing, participants and environments. The electromagnetic radiation interacts with the physical world to produce a new in-between environment of shadows and hotspots we call an electrogeography. They used a wide-band radio scanner to search for these overlaps, which they then constructed a drawing of where these overlaps occur. Through their drawings, they aim to reveal parts of the electromagnetic spectrum spatially within the environment. If you consider architecture in this way, the focus of communicating shifts from concerns with the physical interaction of participants and environments to the psychological experiences inherent in the architecture itself.

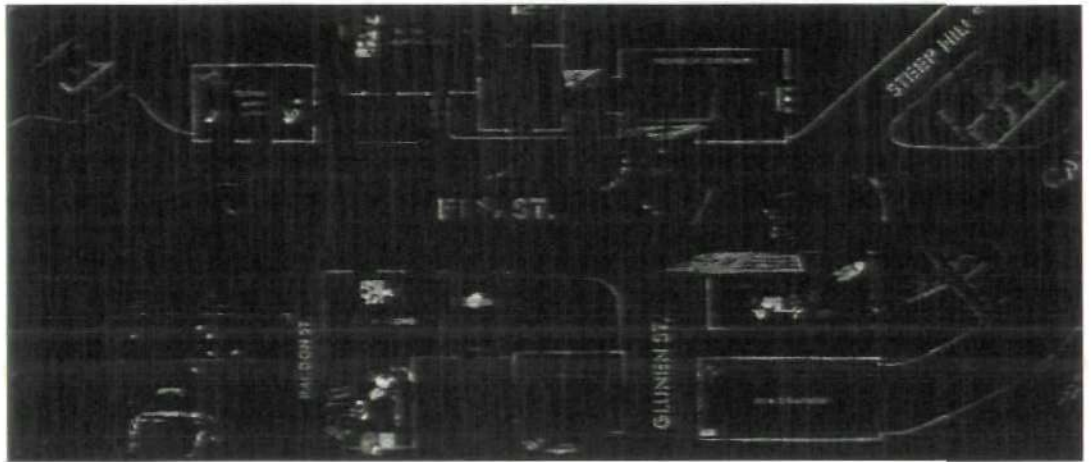


Figure 10-1. Top: View into the Dogville stage-set, Lars Von Trier, 2003

Figure 11-1. Bottom: Aerial view of Dogville stage-set, Lars Von Trier, 2003

Dogville is a 2003 film written and directed by Lars Von Trier. It uses an extremely minimal stage-set, whereby only the notations of the working drawing are laid bare on the stage-set floor. Some walls and furniture are placed on the stage, but the rest of the scenery exists merely as white painted outlines, which have big labels on them; for example, the outlines of gooseberry bushes have the text 'Gooseberry Bushes' written next to them. With the only reference to a full-scale architectural plan, the participants must negotiate the working drawing as if it was a built form. Through only notating the key physical architectural parts, the participant must not only negotiate the environment in a different manner but also understand that the bare staging serves to focus the audience's attention on the acting and storytelling, and also reminds them of the film's artificiality. The participants embed the working drawing through the context of the stage set and use.

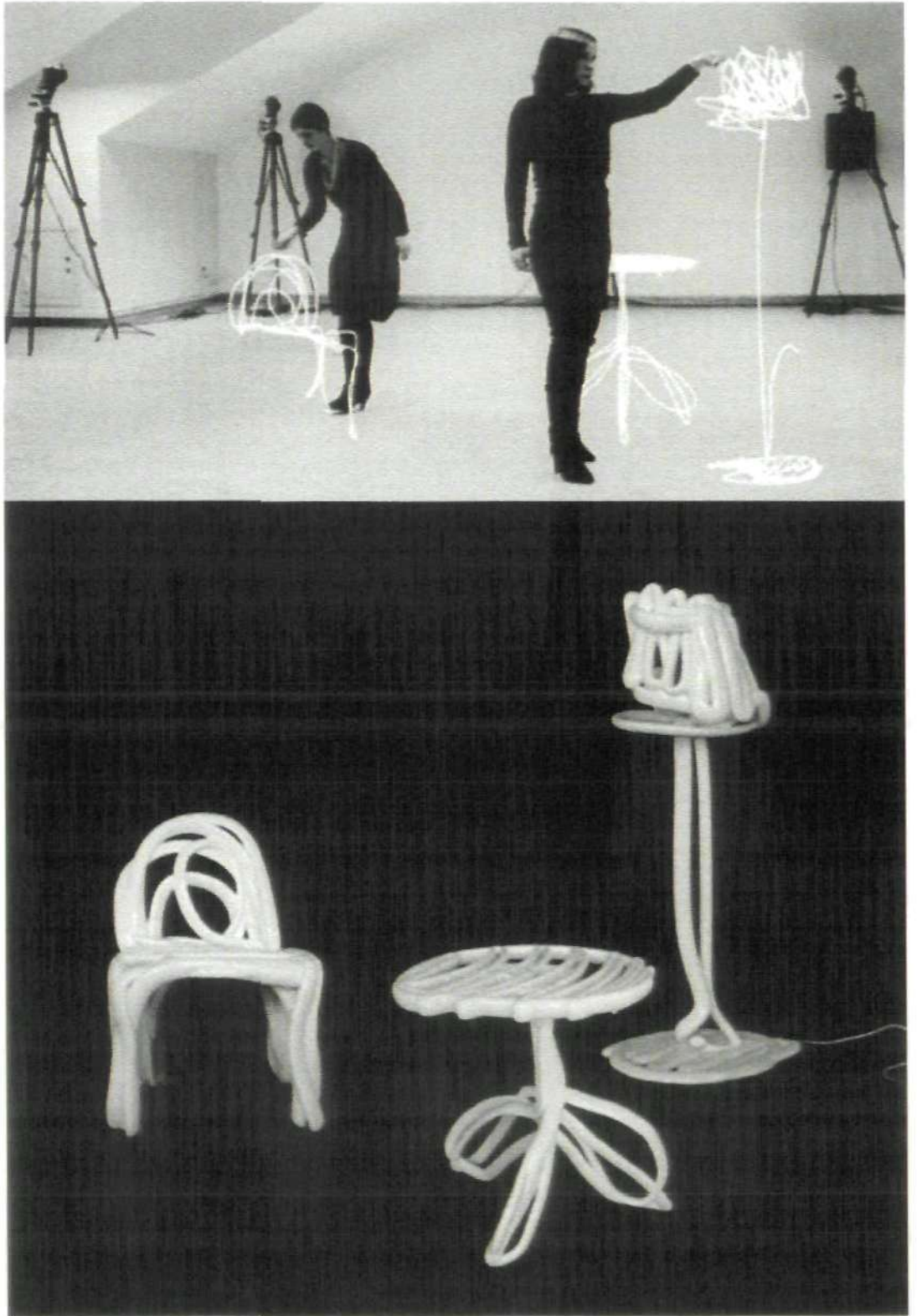


Figure 12-1. Top and Bottom: Image of Sketch Furniture, Front Design, 2006

The four members of Front Design have developed a method to materialise freehand sketches. They make it possible by using a unique method where two advanced techniques are combined. Pen strokes made in the air are recorded with motion capture and become three-dimensional digital files; these are then materialised through rapid prototyping into full-scale pieces of furniture. The participant's gestures and hand movements being recorded in the environment with motion capture devices. The information through the working drawing of gesture and movement is then made into a three-dimensional digital file. This three-dimensional file can then be sent to a rapid prototyping device that will fabricate the working drawing as an object with liquid plastics.

The practice of gesture and movements to communicate an object allows us to construct the once invisible relationship between our environment and us. The immediate act of gesture as drawing becoming visible through an object is somehow describing a space in a more complex and contingent manner. The participant embeds the working drawing through gesture and hand-movements within the context of designing a piece of furniture.

2. Communicating Infrastructures

The section provides a background on the impact of ecology as a model of communication in architectural design and through a brief history, identifies a series of responses to new opportunities as the technology developed and began to affect architectural education and practice. The section begins by making reference to Haeckel's definition of ecology through to René Thom's Catastrophe Theory.

2.00 Ecology as a Model

The German biologist, Ernst Heinrich Haeckel, introduced the term 'ecology' in 1866. The term, derived from the Greek *oikos*, means 'household', which is the root word for economy as well. We can define ecology as the study of the interaction of organisms, populations, and biological species within their living and non-living environment; the composition change and stability of geographically localised group of species, and the flow of energy and matter within such species. Ecology could be understood as the study of the relationship between the environment and us. This could also be described as the flow of material and energy between the environment and us through context, design and communication.

Ecology in design is about the relationship between systems for everyday environments and activities. This idea can be seen through architectural practices like those of Kiesler, Brody, Price, Webb and Frazer, which dynamically link theory and practice through a complex understanding of ecological systems. A fundamental aspect of these practices is to rediscover the systems of operation that arise within architectural education and practice, and between working drawing, participant and environment through context, design and communication. And there are other practices that are unable to engage with the complexities of ecology in design. This ideation of 'ecology as a model' will reveal other fields from the environment; and hopefully reveal a greater understanding of the complexities of ecology in our architectural design. Through our coming to terms with ubiquitous computing, air travel, global financial markets, and the like, it would be a combination of naiveté and hubris to think that traditional architectural communication could any longer manage mass communication and perception. The physical environment includes the sun, water, wind, oxygen, carbon dioxide, soil, atmosphere, and many other elements and processes. The diversity and complexity of all the components in an ecological study requires studying organisms within their environments. Through an ecological model in architectural education and practice we could connect many fields and areas of expertise, and in so doing illustrate holistic aspects of components and their relationships to one another within their spatial community. Ecology as a model should challenge the designer to design connections to the environment through context, design and communication. To

design holistically and connectedly and address the needs of the building, the participant and the environment and the wider community of which it is apart. To view ecology as a model is to integrate the design into the ecology of the place – the flows of materials and energy residing in the community. Architectural education has been slower to acknowledge the reality of interconnectedness, yet in the past few decades, the message has grown stronger – from the physical unity of the universe, to the unity of life on Earth, to the interconnectedness of ecological systems, to even the interdependence of our global economy.

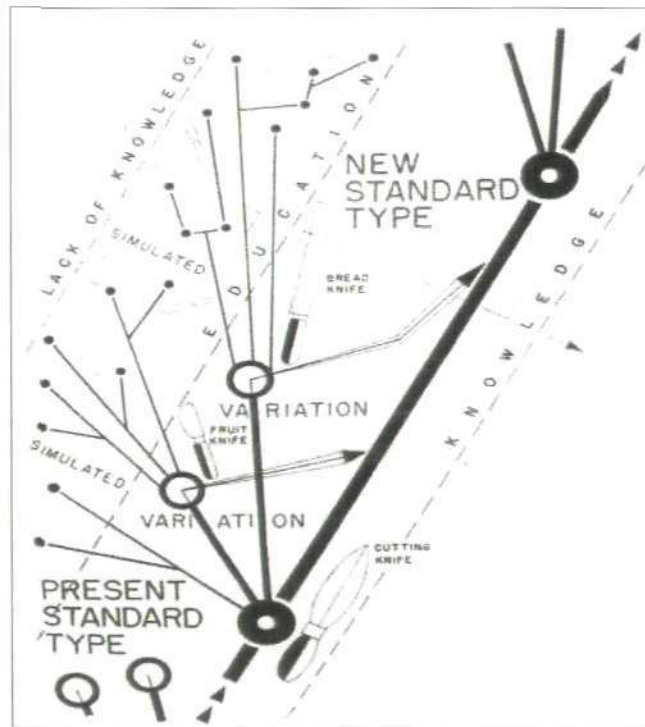
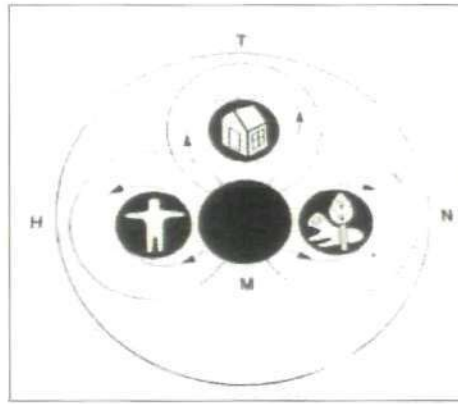


Figure 1-2. Top: Man= Heredity + Environment. H= human environment, N= natural environment, T= technological environment, M= man (Kiesler, 1939: 60).

Figure 2-2. Bottom: Morphology Chart of Three Types of Technological Products: Standard, Variation, and Simulated (exemplified here with the development of the cutting tool), (Kiesler, 1939: 63).

2.01 Frederick Kiesler's *Man = Heredity + Environment* 1939

This idea of dealing with man's variable relationship to the visible and invisible matter, from electricity to magnetism, in our environments was central to Kiesler's vision. He expresses that 'man had to evolve a method for dealing with

the effects of these overwhelming forces upon him' (Kiesler, 1939: 61). Because of the overwhelming forces upon him, man created a technological environment, an environment produced out of human need. The technological environment is made up of a whole system of tools. The tools are classified into three categories: The Standard Type, developed by absolute need; The Variation, evolved from the Standard Type for auxiliary purposes; and The Simulated, which springs directly or indirectly from one of the two foregoing types. It was in 1936 that Frederick Kiesler founded the 'Laboratory for Design-Correlation' at Columbia University, where he was able to measure and classify industrial methods according to the three groups: Standard, Variation and Simulation. One of the most interesting and valuable points that Kiesler states is that 'what we call 'forms', whether they are natural or artificial, are only the visible trading posts of integrating and disintegrating forces mutating at low rate of speed' (Kiesler 1939: 61). Kiesler goes on to say 'Man is born in evolution of heredity trends. He is the nucleus of forces that act upon him and upon which he acts' (Kiesler 1939: 60). His vision was to make architecture a socially constructive factor in man's daily activities. The differentiation of autonomous elements, in the diagram, and the tension in the intervals between them are elemental determining factors in this vision of a system created from correlation. Kiesler's model is helpful because it illustrates the essential relationships and connections between man, environment and technology. Since correalism is achieved by using the science of this relationship, the model illustrates the places of opportunity and connections needed for designing interfaces. Our architecture in Kiesler's eyes would be something that straddled between objects, something that was constantly varying in form due to the forces enacting upon it. That is to say we should concentrate not on the object but the relationships between the objects.

The differentiation of autonomous elements and the tension in the intervals between them are elemental determining factors in this vision of a system created from correlation. Is not this tension in the spaces between, spoken and dreamed of by Kiesler throughout his artistic life – the constitutive element of the Galaxies, the sculptures, and finally the Endless House – related to that "absence" which Jacques Derrida tried to capture in his reflections on *difference*? (Cantz, 2001: 25)

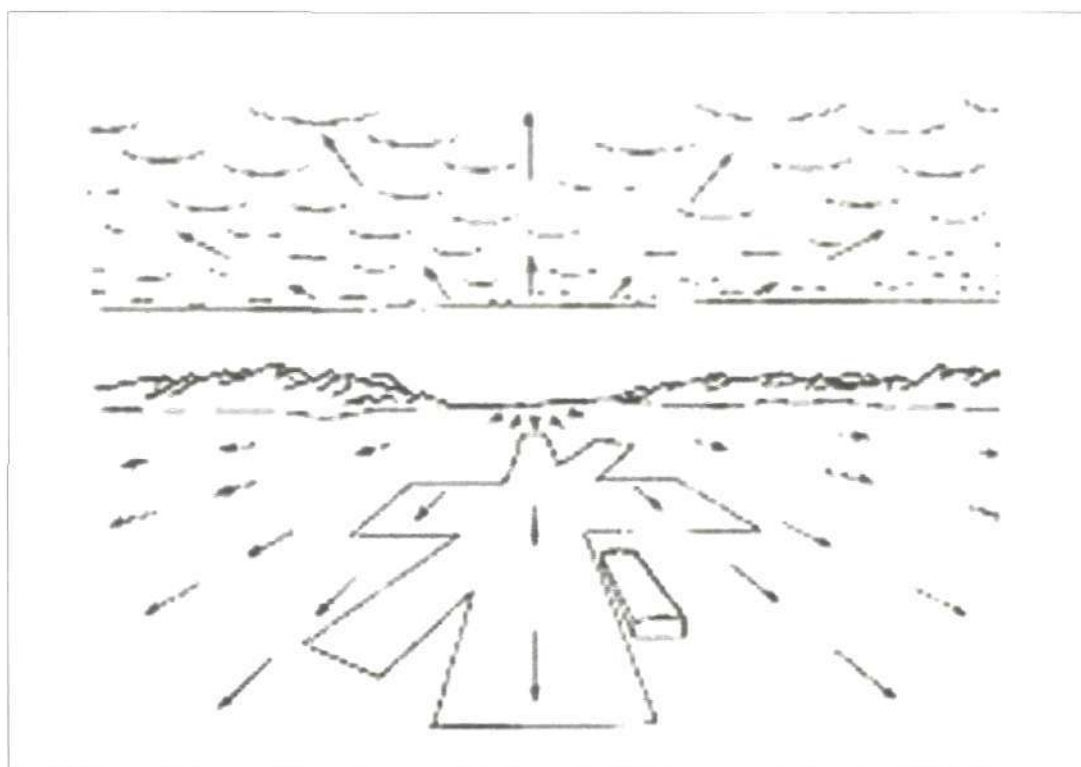


Figure 3-2. Image from Training film for pilots, James Jerome Gibson, 1950

The American psychologist, James Jerome Gibson, was the most important 20th century psychologist in the field of 'visual perception'. He developed his theory during the second world war when he was given the task of preparing training films for pilots. From this he developed a theory of optical flow patterns, based on a fixed point towards which the pilot is moving, the moving flow patterns appear motionless. The rest of the visual environment is moving away from that point, flowing over and around the viewer. Gibson then developed his theory into a general theory of visual perception which has three key ideas of the optic array, textured gradients and affordance. Gibson's book, *The Perception of the Visual World*, was written in the 1950s and is based on his own experimental work, which pioneered the idea that animals 'sampled' information from the environment. Gibson also coined the term 'affordance', meaning the interactive possibility of a particular object in the environment. 'Affordance' is the perceivable possibilities for action seen in objects. Gibson claims that we perceive possibilities for action. i.e. surfaces for walking, handles for pulling, space for navigation and tools for manipulating. This theory in the functionality of objects and spaces, provides us with the understanding that human requirements for inhabiting spaces are beyond the systematic means of Corbusian measurement, which in essence has provided the base for accepted building code standards around the world. His later work *The Ecological Approach to Visual Perception*, written in 1979, Gibson argued strongly for 'direct perception', or 'direct realism' as opposed to 'indirect realism.'

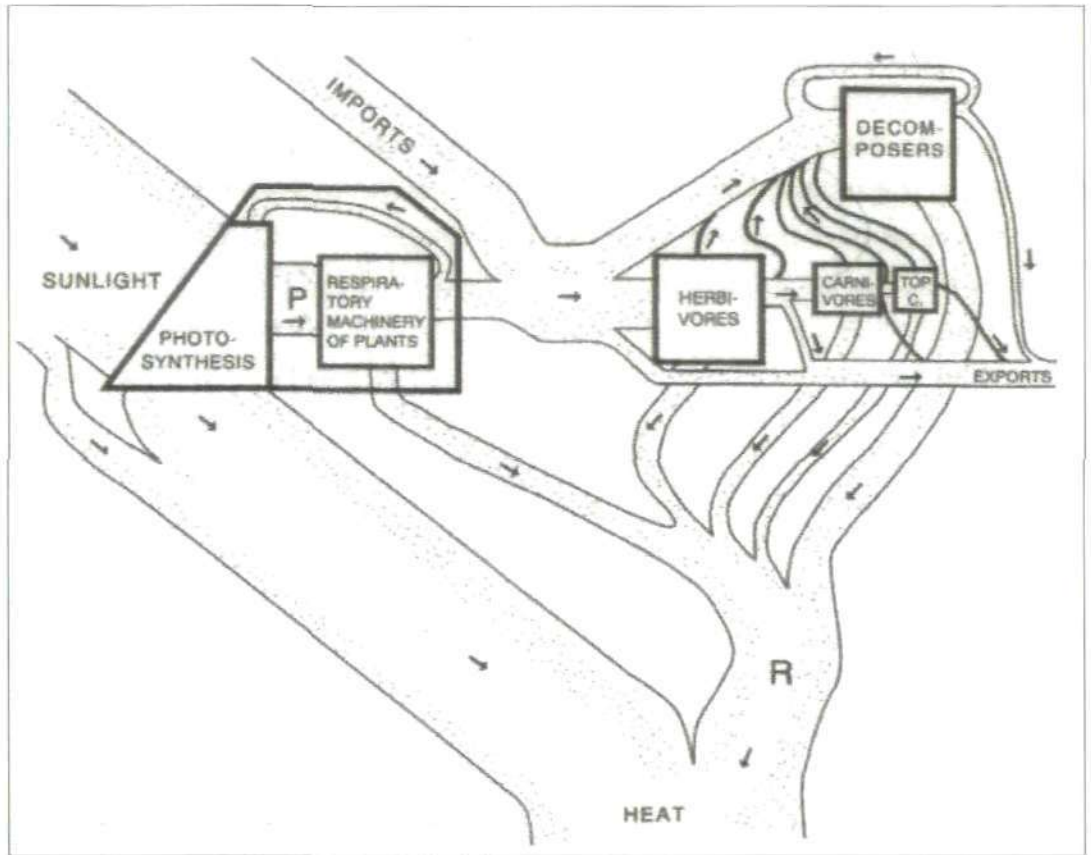


Figure 4-2. Image of Odum's Silver Spring study, Howard T. Odum, 1950

2.03 Odum's Model 1950

In the 1950s, Howard T. Odum was pioneering a new integrative approach in ecology. He was an ecologist who was to recognise and classify large cyclic entities (ecosystems). To do this he tended to think in the form of analogies, he used analog of electrical energy networks to model the energy flow pathways of ecosystems. Odum's analog electrical models had a significant role in the development of his approach to systems and have been recognized as one of the earliest instances of systems ecology. He claimed that energy was driven through ecological systems by an 'ecoforce' analogous to the role of voltage in electrical circuits. Odum's model acts as a signifier of the difficulties and complexities of unravelling the relationship between the environment and us through a working as a model of ecology.

An example of Odum's model can be seen in his Silver Spring study. This model of ecology is about a common type of spring-fed stream in Florida with a constant temperature and chemical composition. This study could be viewed as the first complete analysis of a natural ecosystem. Odum would start with an overall ecology as a model. He would use notational techniques to communicate the relationships between flow and energy within the context. With the diagram the arrows are proportional to the amount of flow through the ecosystem. Odum goes on to describe the different parts of the system through the working drawing:

In this model energy and matter flows through an ecosystem: H are herbivores, C are carnivores, TC are top carnivores, and D are decomposers. Squares represent biotic pools and ovals are fluxes or energy or nutrients from the system. (Odum 1960: 2)

Odum communicated through the working drawing the detail of all the flow routes to and from the stream. He did this by measuring the energy input into the environment through its environmental conditions and of all organic matter. It has been suggested that Odum even measured the bread the tourists threw to the ducks and fish, and then measured that which gradually left the spring. In this way he was able to establish the stream's total energy flow within the environment.

Around the same time as the cybernetician Gordon Pask, the architect William Brody published a rather visionary article in 1967 that proposed that we develop our architecture first complex, then self-organizing, intelligence that would eventually become evolutionary. But the work of Brody and his group at the 'Environmental Ecology Laboratory' was a project on a much more impressive scale. As a broad statement of what is going on:

A computer controls the visual and tactile properties of environmental materials (which are available in sufficient diversity for most architectural purposes). These materials contain sensors, tactile or visual as the case may be, which return messages to the computer at several levels or generality. In the absence of a human inhabitant, the feedback leads to stabilization with respect to certain pre-programmed invariants (for example, that a body of material shall maintain mechanical stability and occupy a prescribed value), and to a search process in which the material actively looks for signs of a participant in contact with it. If there is a participant in the environment, computer, material and all, engages them in dialogue and, within quite wide limits, is able to learn about and adapt to their behaviour pattern. There is thus one sense in which the reactive environment is a *controller* and another in which its inhabitants control it. (Pask, 1969: 496)

In Warren Brody's article, *The Design of Intelligent Environments*, he proposes an evolutionary, self-organising, complex, predictive, purposeful, active environment. Brody asks the question 'Can we teach our environments first complex, then self-organising intelligence which can ultimately refine into being evolutionary?' (Pask, 1969: 496). Brody went on to describe some of his hypothetical implications of intelligent environments, and to introduce the concept of 'soft architecture.'

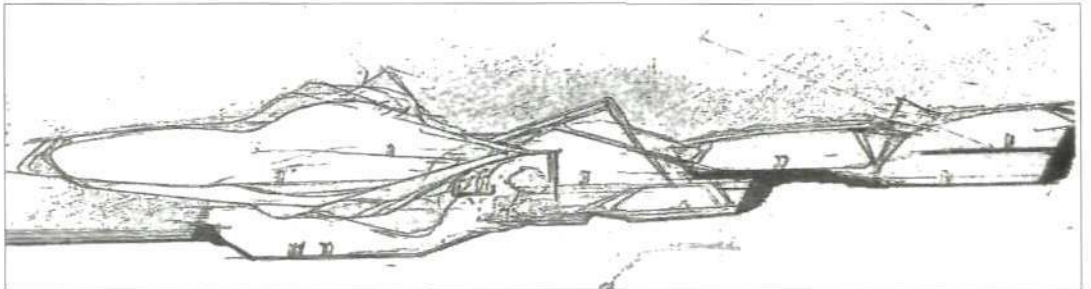
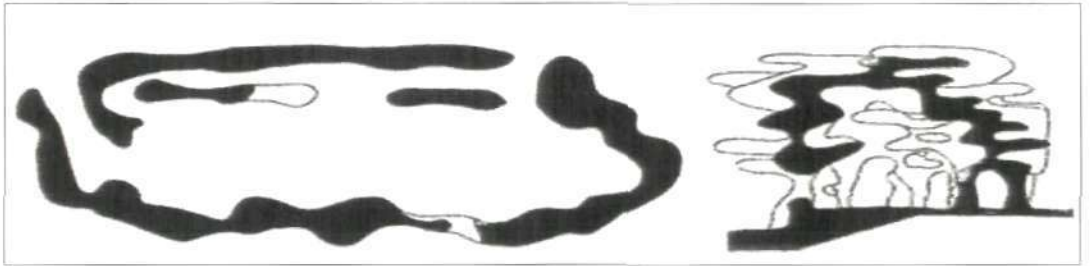
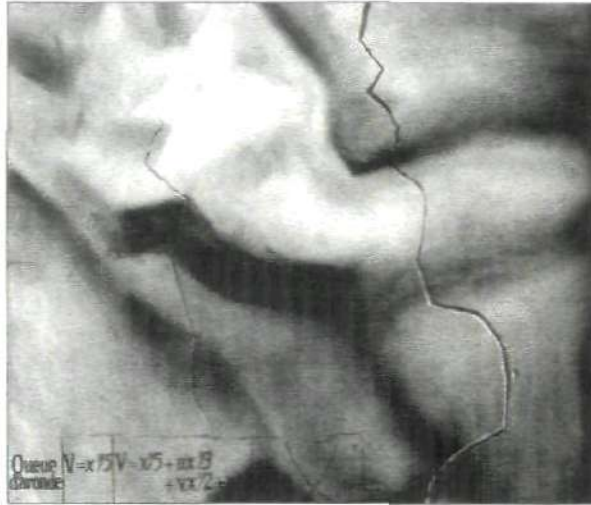


Figure 5-2. Top: Topological Abduction Europe-Homage to René Thom, Dali, 1983

Figure 6-2. Middle: Image of Habitable Meudon, Andre Bloc, 1962

Figure 7-2. Bottom: Study section of the Monteflavio in Roma, Jean Marc Schivo, 1987

2.05 René Thom *Catastrophe Theory* 1975

René Thom is known for his development of Catastrophe Theory, a mathematical treatment of continuous action producing a discontinuous result. He addresses this subject in *Structural Stability and Morphogenesis*, published in 1975, outlining a theory to describe those situations in which gradually

changing forces lead to so-called 'catastrophes'. Within this book he made remarks on the forms present in mathematics and architecture broke of abruptly on the threshold of a new field of inquiry, namely 'umbilic' functions from topology and bionics. A typical case would be regarding the study of form in nature. Umbilic catastrophes in nature comprise a vast range of curves with the common property of a depression in the centre of their surface. This phenomenon is encountered in many cases: a breaking wave, an eddy of water in a river, a vortex of air, and the effect of a stone dropped onto a liquid surface. There are at least two links with architecture. The first regards a number of experiments in sculptural architecture dating from the 1960s, when the configuration of the building was studied as a shell folded in on itself. The second is an extremely complex issue casting light on the ongoing debate as the fusion of architecture and environment.

The sculptor, Andre Bloc, constitutes one of the essential points of reference in connection with the fusion of architecture and environment. His 1962 project 'Habitable a Meudon' is only apparently a sculptural digression into the field of architecture. In point of fact, it provides a particularly significant example of the disintegration of the relationship between working drawing and the environment through participation. While the primary reference is to cave architecture, the discourse must be broadened to include the attempt to recreate that physical and spatial continuity between working drawing participant and environment. In other words, it establishes direct continuity through context, design and communication.

Jean Marc Schivo's compositional work is based on a continuum of architecture and environment. The analysis of the relationship between working drawing, participant and environment within context, design and communication was operating in a kind of continuity of spatial flow. His work is far more significant due to his attempt to attain the total fusion of architecture and environment. In a figuratively more abstract sense, this is an expression of how to slide exterior into interior through the environment. Their ideas of architecture and the ways to communicate immediately through working drawing aided the potent ideations of architecture and environment.

3. *A priori* Building

While the use of working drawings in architectural education can operate as a safe haven from which to develop a discourse within architecture, however, it may only remain representational and not experiential. This has led to shifts in our relationship with our environments through participation and working drawing.

William W. Braham, who is the associate Professor of Architecture at the University of Pennsylvania, is working in the field of Ecological Architecture. His theories are a leading light into the contemporary ideas of what happens before building in architectural practice. He views this moment in the architectural process towards communicating building as an opportunity to reflect and consider other outcomes. Braham writes:

Architects produce drawings, not buildings, but diagrams are wholly immanent, wholly embedded and coextensive with the materials, configurations, and forms of buildings. Theories of representation and expression have tended to privilege the concept over building, treating the artefact as a site of interpretation, a mere extension of the process of its production. But if a concept could be adequately expressed or understood separately from their manifestations, then the buildings themselves would be unnecessary. Architectural concepts only exist fully in their realisation, as discovered through the non-linear process called design. That condition of immanence inspires the recurring attention to methods and processes in the architectural discourse and equally the frustration with the embedded quality of the theorising it reveals. (Braham, 2000: 9)



Figure 1-3. Image of 04_Apriori model 001, 2010

Many non-building architects within the architectural profession have been researching ways of embedding working drawing into environments through participation. Robin Evans makes the point that architects do drawings of buildings, not build buildings. The architect draws, and then hands working drawings to someone else who touches the materials. This is a fundamental percept of architecture, that it has to move from some form of abstraction to some form of materialisation, and that it does it through drawing and geometry. Architects make working drawings; they make models of working drawings. Others build buildings. Very few architects are design/build practitioners who get out and hammer it together. Some architects want to build projects on the drawing board, some architects resist building it.

After all once it's built it becomes a fixed point, an end, a glob, a blob, a nothing because it is no longer transmutable. It's no longer morphable; it's no longer biological for them. So the question is how you keep modelling. (Cantz, 2001: 85)

Lebbeus Woods made a point that 'the ideas that to build is to lose the potential for experimentation; anything beyond the working drawing, any engagement with some kind of practice is to shut down possibilities for experimentation' (Cantz, 2001: 86). For centuries the education and practice of architecture has resisted buildings through privileging the working drawing of buildings. Is there a way that architecture can practice building before building?



Figure 2-3. Image of outcrop on High Dam, Lake District, 2010

Before the building we have the environment. Jacob von Uexküll was interested in how living beings subjectively perceive their environments. Umwelt means 'environment' or 'surrounding world'. Uexküll theorises that participants (living beings) have different umwelten, even though they share the same environment. An ant, cicada-larva, cow, and human perceive a stem of a blooming flower differently. Furthermore, think of what time means in each of these different beings and their relative lifespans. Uexküll called these subjective spatiotemporal worlds 'Umwelt'.

The main idea of Uexküll is that each component of Umwelt has a functional meaning for an organism; it may be food, shelter, enemy, or simply an object that is used for orientation. A participant actively creates its Umwelt through repeated interaction with the environment. It simultaneously observes the environment and changes it; the phenomenon which Uexküll called a 'functional circle.' These functional circles in our Umwelt could be called 'marks' or 'notations in the environment'. These notations in the environment are "carriers of significance" depending on the participant in the environment. The levels of significance could depend on the levels of the relationship the participant has with the environment. The theory of meaning developed by Uexküll is coherent with the ideas of semiotics (theory of signs) proposed earlier by Charles Sanders Peirce, an American philosopher. Translating the theory of Uexküll into the language of semiotics. He argues that the environment, the Umwelt, is not a set of objects in the environment but rather a system of signs interpreted by a participant. As the environment changes over time, the Umwelt shifts, depending on what participants are around at that given time.

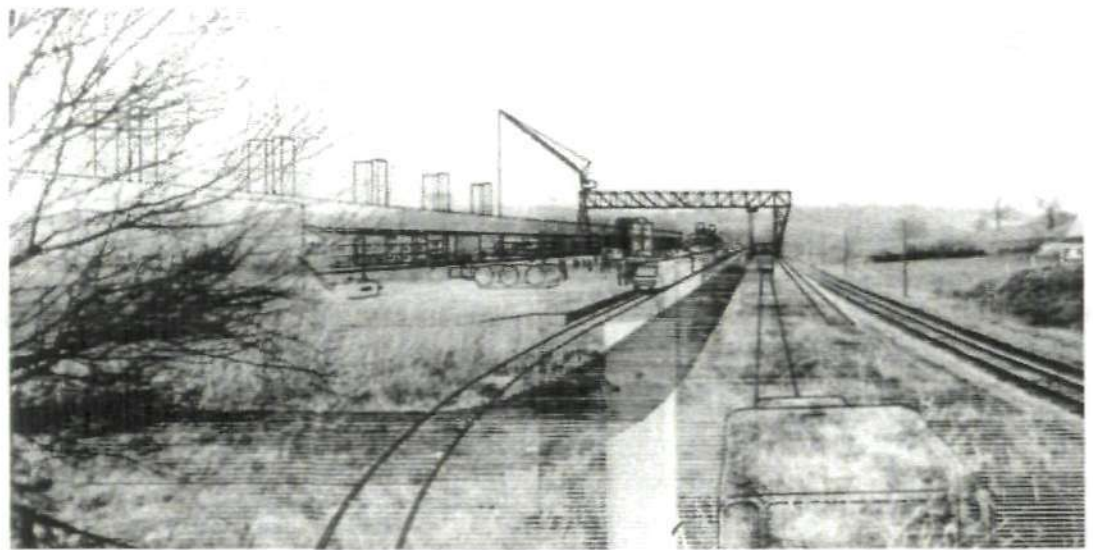
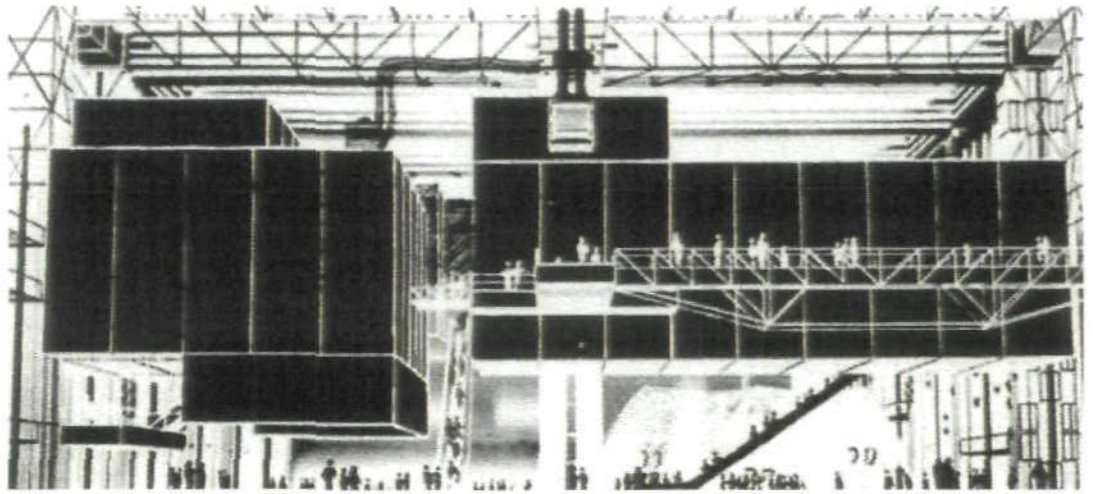


Figure 3-3. Top: Image of the Fun Palace, Cedric Price, 1960-1961

Figure 4-3. Bottom: Image of the Potteries Thinkbelt, Cedric Price, 1964

Cedric Price was a visionary architect who built very little and communicated the majority of his architecture through working drawings. Price uses different methodologies of communicating architecture through time-based urban interventions, participation and environments. Through Cedric Price's belief that architecture must 'enable people to think the unthinkable' (Price 1996: 36) he developed the concept of 'Anticipatory architecture' (Price 1996: 36). Anticipatory architecture enables through the time-based interventions of projects like the Potteries Thinkbelt in 1964 and Fun Palace in 1960-61, an architecture that allows the participant and the environment to work together over time. This was initially achieved through his visions expressed on his working drawings. More importantly this enables his architecture to become a vision over form and participation over environment. He did this by inviting the user's participation to define architecture through technologically facilitated interaction and the radical reliance on structure and technology. Cedric Price's most celebrated project was the unbuilt idea of the Fun Palace, which influenced an architecture of process that was indeterminate, flexible and responsive to the changing needs of participants. Price studied everything from the relationship of similar activities through to the spaces the participants require and to a complex analysis of his own decision-making and design process as affected by external consequences. This would be achieved through anticipating the uses to what the building might become subject to over time.

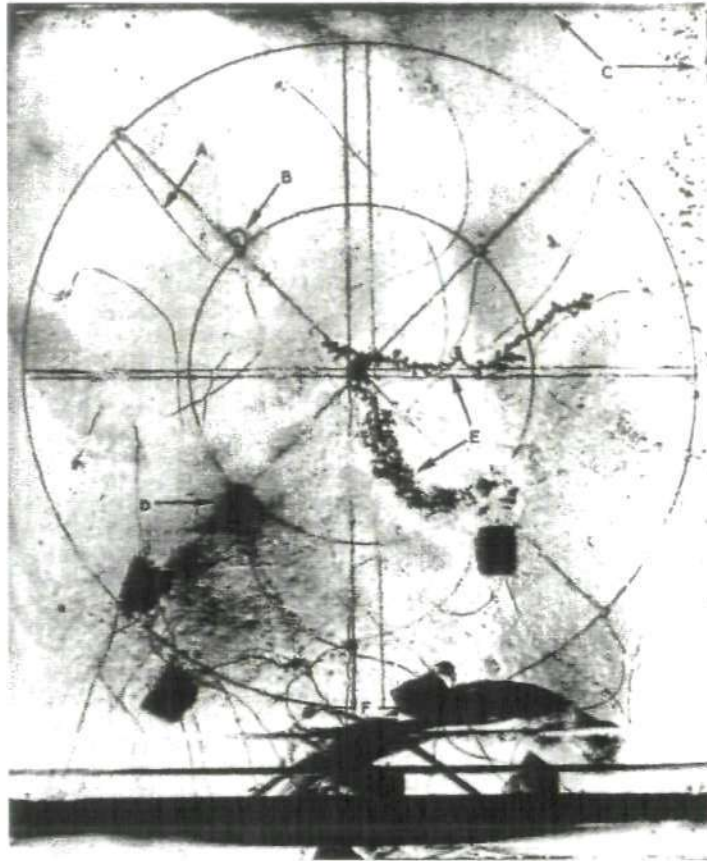


Figure 5-3. Image of 'Electrochemical Assemblages', Gordon Pask, 1969

3.03 Gordon Pask's 'The Architectural Relevance of Cybernetics' 1969

In the 1960s, Gordon Pask and other cyberneticians made advancement towards an understanding of architecture through cybernetics. This allowed for other fields in architecture to develop, from interactive architecture, digital architecture to reflexive architecture and living architecture by formulating theories in the topic. Pask, who later collaborated with a number of architects in the 70s and 80s, developed a 'conversation theory' which served the basis of much of the architectural development in these fields. In Pask's seminal article on 'The Architectural Relevance of Cybernetics,' he claims that architects are system designers, and have been forced over the last 100 years to take an interest in the organisational (i.e. non-tangible) system properties of development, communication and control (Pask, 1969: 494). The argument is structured from an historical perspective about 'pure architecture' before the 1800s, which was descriptive about observing buildings being constructed during different periods

in different places, and as prescriptive through the preparation of working drawings of plans, but it did little to predict or explain (Pask, 1969: 494). Pask concludes his article with speculations about rapid advances will be made in five areas guided by cybernetic theory of architecture. These areas are:

1. The development of CAD systems into useful instruments.
2. Concepts of different disciplines such as ecology, social anthropology, sociology and economics unified with the concept of architecture to yield a broad view of 'environments'.
3. Proper and systematic formulation of the sense in which architecture acts as a means of social control.
4. Concept of a 'house acting as a tool serving its inhabitants', refining the concept of 'environment' with which the inhabitants cooperates.
5. Achieve a dialogue between environment and the inhabitants through a reactive environment, which is malleable to changing variables.

It followed, through Pask's article, that buildings couldn't be viewed in isolation and only become meaningful through an understanding of the relationships between humans and the environment (Pask, 1969), whereby the environment perpetually interacts with its participants. Rather than an environment that strictly interprets our desires, he says, an environment should allow participants to take a bottom-up role in configuring their environment in a malleable way without specific goals. Here, Pask dubs the work 'architectural mutualism', meaning mutualism between structure and societies. The consequence of this concept is that architects are required to design dynamic rather than static entities and apply it to the interaction between the architect and the system they design, rather than the interaction between the system and the participants who inhabit it. This could quite clearly refer to the understanding of the relationship between the drawing and the environment rather than the drawing and the participant. Clearly the participant is dynamic as well as the environment within which the participant is embedded. Pask viewed the participant as part of the resonance that looped from the participant, through the environment or apparatus, back through the participant and around again. For Pask that is the 'interaction by which we understand each other and when we communicate with each other' (Pangaro, 1996).

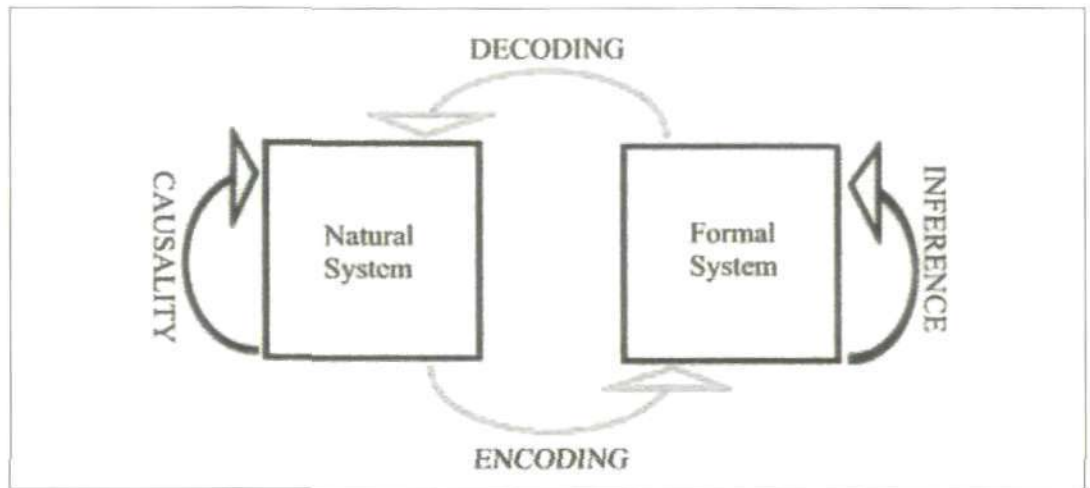


Figure 6-3. What we see is that the two systems are related via the encoding and decoding arrows. *Encoding* is the process of *measurement*: it is the assignment of a formal label (such as a number) to a natural phenomenon. *Decoding* is *prediction*: it is the taking of what we generate via the inferential machinery of the formal system into representations of expected phenomena. Additionally, the arrows for inference and causality represent the entailment structures of their respective systems.

3.04 Robert Rosen's *Anticipatory Systems* 1985

In 1985, Robert Rosen defined an anticipatory system as 'a system containing a predictive model of itself and/or its environment, which allows it to change state at an instant in accord with the model's predictions pertaining to a latter instant' (Rosen, 1985: 339). The modelling relation is described mainly in his book *anticipatory systems*. Rosen showed the deep differences between a true modeling relation and a simulation, which is not based on such a relation.

One of the most interesting aspects of the Rosen 'modelling relation' is the fact that the 'modelling relation' is itself complex, in Rosen's sense of the word- as is the relationship between working drawing, participant and environment in architectural education and practice. The relationship between working drawing, participant and environment in architectural practice is complex and contingent and could be seen as three systems. In architectural education and practice the working drawing has mostly been dealt with in a

contingent reality separate from the reality of the participant and environment, where the architecture will eventually become embedded.

We can look at Rosen's work to begin to understand that when we are dealing with three systems (working drawing, participant and environment) we should be looking for a model that can work back and forth between the relationship between working drawing, participant and environment within context, design and communication. In a 'modeling relation' it requires that we find the appropriate *encoding* and *decoding*, 'notations', to *translate* back and forth between the three systems, consistently. Without the proper encoding and decoding, there can be no comparing of the three systems, and no way to establish congruence between them.

'Anticipation' in Rosen's terminology is a style of control, which is based not as cybernetic systems on a deviation from a desired behaviour. Anticipation is based on having a predictive model of the system you're trying to control and using the predicted behaviour to generate the control, which will modify the behaviour in a desired way. Rosen suggests you have to have more than one time scale more than one thing that you could call 'real time' in an anticipatory system. In his first approaches, the anticipatory system was based on predictive models. So, starting from the idea of anticipation- the idea that you have to have more than one scale of real time in a system, like two notions of measure in a family of subsets- you come to the idea that these various times are tied to modes of system decomposition and these lead fairly directly into the wider notion of complexity. The modelling relation thus provides us with a methodology for studying one system in terms of another system. In the example of the diagram in figure 21-1, we see a modelling relation between a formal system and a natural system between working drawing, participant and environment.

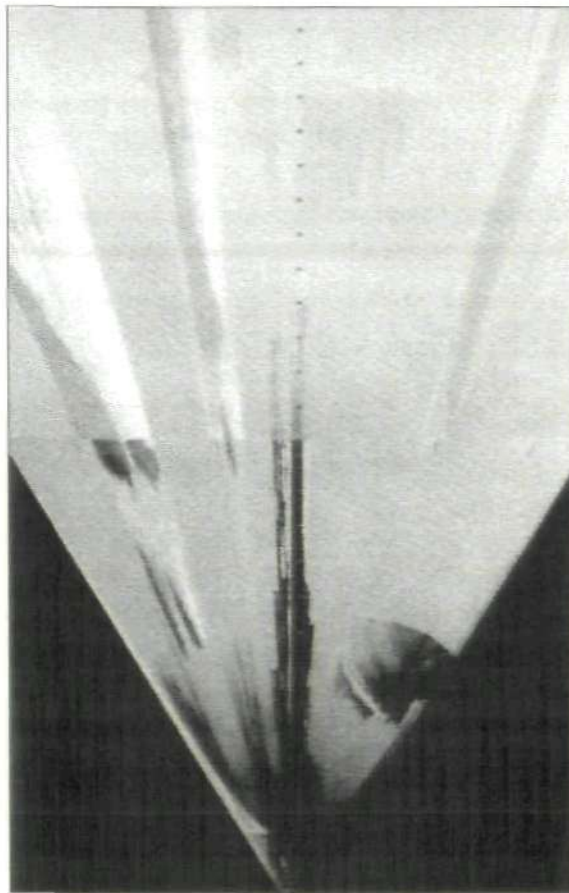
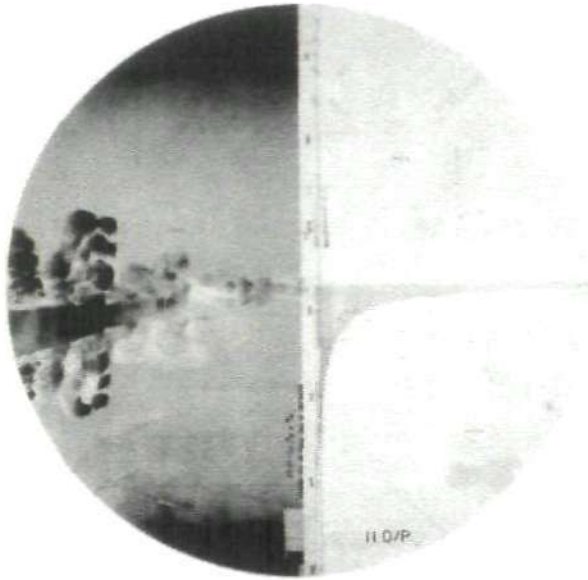


Figure 7-3. Perspective looking towards Temple Island, Mike Webb 1987

Figure 8-3. Perspective viewed by an overhead observer, Mike Webb, 1987

Mike Webb has dominated the field of architectural education in trying to communicate human-centred architecture. His Temple Island project is a quest to draw the relationship between working drawing, participant and environment within context, design and communication. It is a major piece of work in observation, geometry and perception, whereby the participant is central to the design project and the markers in the environment are highly specified and intimately linked to each other in a complex web of relationships. The relationship between the artificial and the environment create windows of opportunity in Temple Island. It gives voice to the architecture because it is no longer an object of perception but rather a system of communications between working drawing, participant and environment within context, design and communication.

The project is located in his home town of Henley-on-Thames, which hosts an annual event that centres on rowing on the river. The movement of the boat along a straight stretch of that river is the key to his proposition regarding the space behind the trees. By contrast, the other celebrated object in his study, the submarine, must rest prone and the participant observes through a small porthole, having the perfect conditions for observing the spatial denouement. These three conditions - the map, the romantic island and the vehicle - must exist in extremis, while still being absolutely necessary to each other. (Cook, 2008: 33)

Mike Webb is attempting, through the Temple Island project, to develop new tactics for architecture and review the act of working drawing in architectural education and practice to be both spatial and experiential.

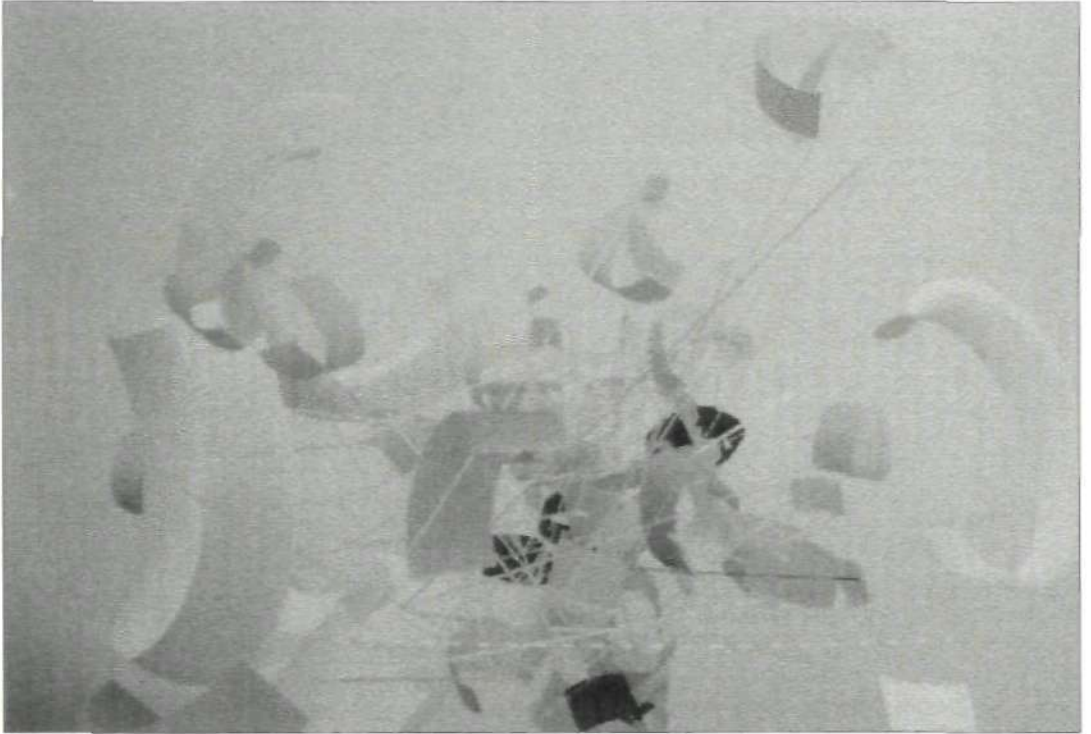


Figure 9-3. Evolving sequence in the universal constructor, Stefan Seemuller, 1995

3.06 John Frazer *Evolutionary Architecture* 1995

In John Frazer's book entitled *Evolutionary Architecture*, he proposes and implements a set of tools to assist his vision. Frazer's work is valuable as it extends beyond the design process to the built works themselves. He outlines eight aspects of evolution which all produce change at a variety of scales, and he says the basis of all such conditions is information. He makes a strong environmental case for such ideas without actually advocating the replication of natural ecosystems. Frazer states: 'Natural ecosystems have complex biological structures: they recycle their materials, permit change and adaptation, and make efficient use of ambient energy' (Frazer, 1995: 16). *Evolutionary Architecture* is fundamentally about investigating form-generating processes in architecture, paralleling the wider scientific search for a theory of morphogenesis in the natural world. It proposes the model of nature as the generating force for architectural form. It aims to achieve a symbiotic relationship between the designs of architecture to the environment by focusing on processes that work in the relationship between architecture and the

environment, between working drawing and the participant, between the participant and the environment, between the environment and working drawing. The fundamental argument for this thesis is that architecture is a living, evolving thing which changes through our continual relationship with the built environment. Pask suggested in the introduction to *Evolutionary Architecture*, that the role of the architect could be seen as not so much to design a building as to catalyse them; to act that they may evolve (Frazer, 1995: 7). This had particularly relevance for society and the environment, as the built environment becomes ever more dependent on meaningful information transfer.

Frazer points out the problem concerned with architectural drawing through his understanding of the problem of the 'blueprint'. He understood the present search to go beyond the 'blueprint' in architecture and to formulate a script- a coded set of response instructions- may be a more appropriate method of communicating his architecture. Frazer's vision leads us to his own conclusion that the solution to our current global environmental problems may lie in the relating architecture to the new holistic unravelling of the complexities of our environment directly.

Frazer's vision of unravelling the complexities of our environment could be evolved in generating rules *a priori* to building, much like how architects use notational strategies to describe the relationship between working drawing and buildings. This relationship could be developed to produce a notational script of instructions for form generation between the two systems of working drawings and the environment. Frazer worked with coded scripts to develop his prototypical forms, which were then evaluated on the basis of their performance in a simulated environment. This idea of developing architectural form between two systems becomes a unique and valuable step towards a greater understanding of the complexities that we are dealing with between working drawing, participant and environment within context, design and communication. Frazer understood that form and content of the architecture is not designed as such, but becomes an outcome of the back – and – forth relationship between design processes and the living environment.

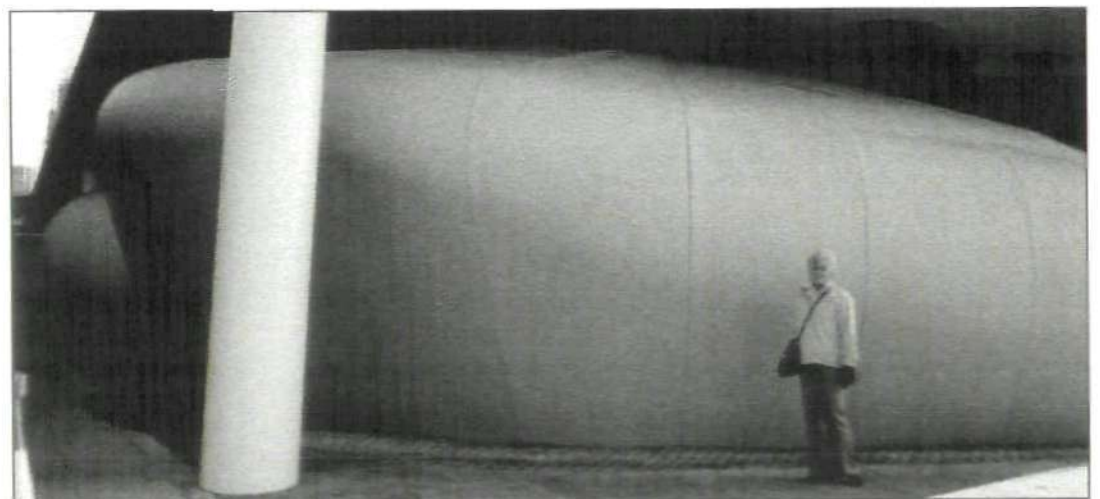
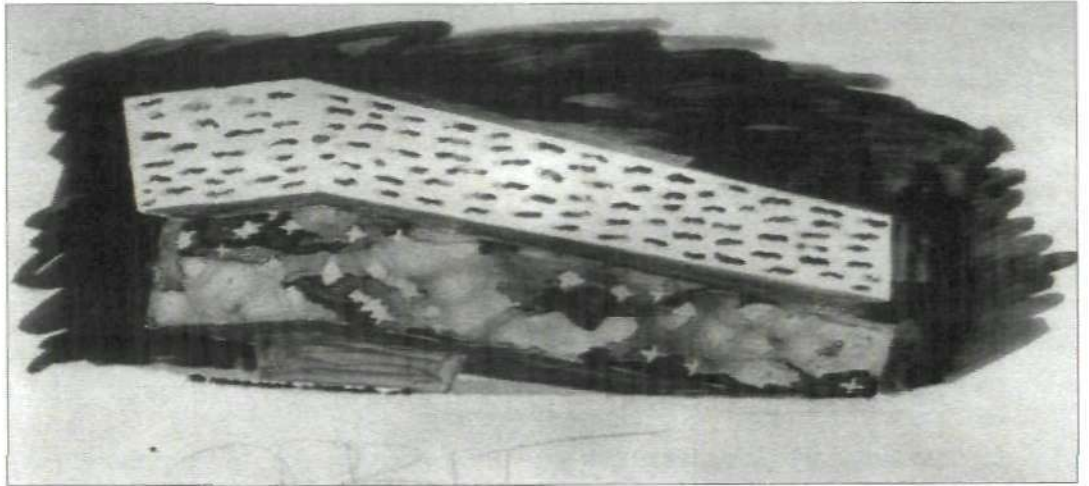


Figure 1-4. Top: Painting of Palestra, William Alsop, 2004

Figure 2-4. Bottom: Photograph of Palestra retail pod, Alsop Architects, 2010

4.00 Experience in practice

Throughout my professional career in architecture, I have worked at many types of architectural practices from detailing barn conversions in the Lake District to designing a retail pod in commercial office buildings in London. Throughout my experience in the different practices I was able to gain valuable insight to the personal working methodologies of each practice. At John Coward Architects I gained my basic training in designing at a drawing board, producing working drawings for tender. At this time in practice, you worked on tracing paper to generate a 'blueprint' for the proposed building. The 'blueprint' would be edited and reedited over the course of the development of the project. Here I gained a valuable insight to just how important this document of information became, even though this method of communication needed to continually be translated for the client, builder and designer. Later on in my career, I went to work for Alsop Architects where I gained a very different and varied experience of understanding the relationship between working drawing, participant and environment within context, design and communication. Within this practice, there seemed to be a method of exploring the tacit knowledge through the process of a project. These methodologies of communication came in many different guises from paintings to working drawings, from conversations to working drawings. The most identifiable outcome is the building itself, but on some projects the outcome could be suspended in a conversation or during a meeting. Through my experience, I learned that current practice methodologies in architecture have become a series of systems of operations.

My observation of practice has led me to develop a process that works around this current architectural model as a 'series of systems of operation', and towards a more connected model. It is through the drawing of notational systems that I want to examine the state of communication from one medium, as drawing, to another, as environment, as in a material communication, for example, a physical object or fortuitous communication. This may be understood as the syncretism of working drawing, participant and environment through communication between states, fields and notational systems. To develop what will essentially become a new theory of the ecology for designing Eniatype systems, to mobilise theories of an Eniatype within architectural practice, and produce a methodological framework to guide Eniatype in designs of ecologies.

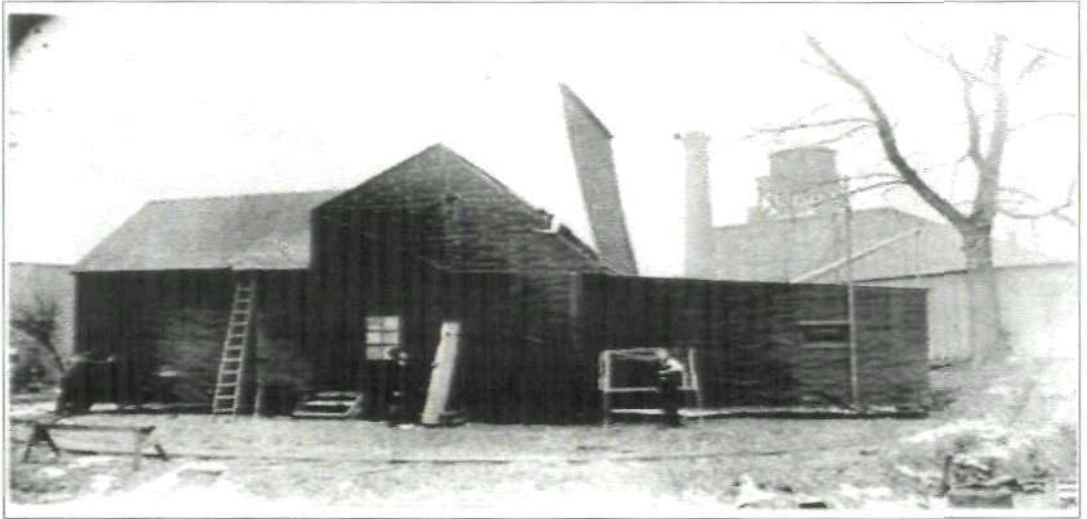


Figure 3-4. Photograph of the Black Maria Studio, Thomas Alva Edison, 1892

4.01 Gregory Bateson's Recursive Epistemology

Recursive Epistemology concerns the way in which events continually enter into, become entangled with, and then re-enter the universe they describe. A central goal of recursive epistemology is the delivery of understanding the need for a 'rigorous thinking about interconnection and interdependencies in our ecosystems' (Harries-Jones, 1995: 5), so that we can begin to resolve our massive ecological dilemma. Bateson was aware of the environmental impacts of the twentieth century, yet information remained scarce for those attempting to rethink the human condition. Recursive epistemology addresses the shortcomings of our attempts to explore in depth our being part of larger systems – interpersonal, social and natural – from our previously localised and fragmented knowledge into a broad and inclusive framework for understanding and developing solutions. The 'new science' brings together leading ecologists, social anthropologists and architects to articulate state-of-the-science principles, and present specific examples that demonstrate the application of those principles. Diverse theories, models, concepts in the new science of recursive epistemology are integrated to establish a coherent framework for process of knowing: perception, communication, coding and translation. Recursive Epistemology links ecological theories and concepts with participants and environments. Bateson believes that Recursive Epistemology requires, in addition to a cognitive understanding, a perceptual and aesthetic 'space' for its

interpretation (Harries-Jones, 1995: 4). Bateson writes in his book *Mind and Nature: A Necessary Unity*:

At present, there is no existing science whose special interest is the combining of pieces of information. But I shall argue that the evolutionary process must depend on double increments of information. Every evolutionary step is an addition of information to an already existing system. Because this is so, the combinations, harmonies, and discords between successive pieces and layers of information will present many problems of survival and determine many directions of change. (Bateson, 2002: 19)

At the same time, architects responding to the increasing demand for methodologies of communication recognised the need to minimise the adverse impact of buildings and projects. Foresight was needed, along with deeper understanding of environments, participants, and their consequences. Practitioners in this developing new science have come to see that human communities and natural ecosystems have much the same needs for sustainable communication systems between working drawing, participant and environment within context, design and communication. When new methodologies of communication are under the influence of recursive epistemologies a new magnitude of perception, communication, coding and translation of buildings will become viable. Many of the projects contained in this dissertation utilise at least some aspects of this new science. Bateson was engaged in what we might now call transdisciplinary work which not only cross-disciplinary boundaries but 'to rearrange our mental landscape – to make us see anew' (Bateson, 2002: xviii).

One example of a project that connects Recursive Epistemology with the environment is the Black Maria Studio created by Thomas Alva Edison, which was the world's first film production studio. The studio had a roof that could be opened to admit sunlight for illumination, and the building itself was mounted on a revolving pivot so that the structure could be constantly repositioned to keep it aligned with the sun. Through the lens of the relationship between participant and environment the actualisation of form is reconceived – out of place and time.

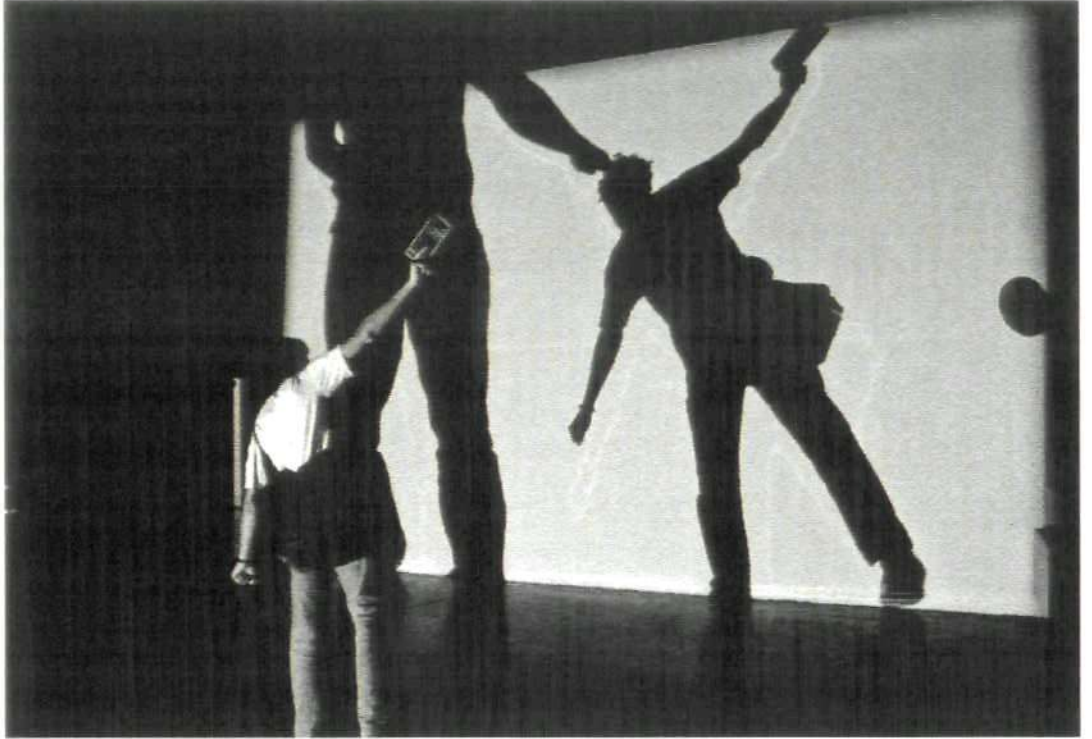


Figure 4-4. Image of a Relational Architecture, Rafael Lorenzo Hemmer, 2005

Rafael Lorenzo Hemmer defines the term Relational Architecture as the technological actualisation of buildings and public spaces with alien memory. Relational Architecture aims to transform the master narratives of a specific building by adding or subtracting audiovisual elements to affect it, effect it and re-contextualize it. Relational buildings have audience-activated hyperlinks to predetermined spatio-temporal settings that may include other buildings, other political or aesthetic contexts, other histories, or other physics. Relational Architecture is based on dissimulation by inviting participants to probe, interact and experiment with real buildings and the projected false construct. Relational Architecture amplifies the relationship of the participant to the buildings scale or emphasizes the relationship between urban and personal scale by dematerializing the environment. Relational Architecture is participant-centred, whereby Hemmer creates a situation where the drawing, participant and environment through context, design and communication relate in new ways.



Figure 5-4. Drawing by Neil Spiller entitled: Interstitial Drawing: 'Holey Hedge' – elevation (apologies to Albin Brunovsky), from *Reflexive Architecture, Architectural Design*, 2002

4.03 Neil Spiller's Reflexive Architecture 2002

Essentially, a reflexive practice could be suggested as one of exploration and seeking 'true invention' (Spiller, 2002: 4) in the relationship between working drawing, participant and environment through context, design and communication. In search of ways to reinvest the outcome of the architecture through a feedback loop of our physical environment through the new definition of drawing and back into the environment through the participant. In our natural and artificial environments, 'sites of ecologies' exist and interact with one another to generate 'hybrid sites' (Spiller, 2002: 5). Through the research discussed in *Reflexive Architecture*, architects are looking towards ecological issues, which can be correlated as design tools in the design of architectures on 'hybrid sites', which is inhabited by the human environment.

Neil Spiller used the term 'Reflexive Architecture' for the third edition of the *Architects in Cyberspace* series for the journal, *Architectural Design*, in 2002. The projects within the journal all utilize the idea of a hybrid site, revealing a spatial tapestry of different sites and environments at different scales, feeding off each other. The method of communication for all the projects is through drawing. When architecture can fully exchange information with a mutable field of quantum fluctuations, architectures capabilities for knowledge and communication would be far deeper and more extended than presently understood. It also would blur the boundary lines of our individuality – our very sense of separateness with the built environment. With the distinction between different scientific disciplines breaking down through new 'transdisciplinary disciplines', a reflexive practice works at the intersections in-between maths, biology, ecology and computer science.

Currently, architectural practices such as Gehry, Liebeskind and Foster rely on scientific and technological innovation to create their buildings. But the building form is conceived in the mind of the architect; the science is a tool to make possible their increasingly complicated creations. By contrast in a reflexive practice, science itself determines the final form of the building. A set of criteria – light conditions, the characteristics of the site and the means of production – are set down. The building form then evolves out of these through the relationship between working drawing, participant and environment of various modalities.

Is it not myopic to focus so much effort on ecological impacts between our natural and artificial environments when the ultimate artifact of a 'building being assembled' is such a serious threat to global sustainability?

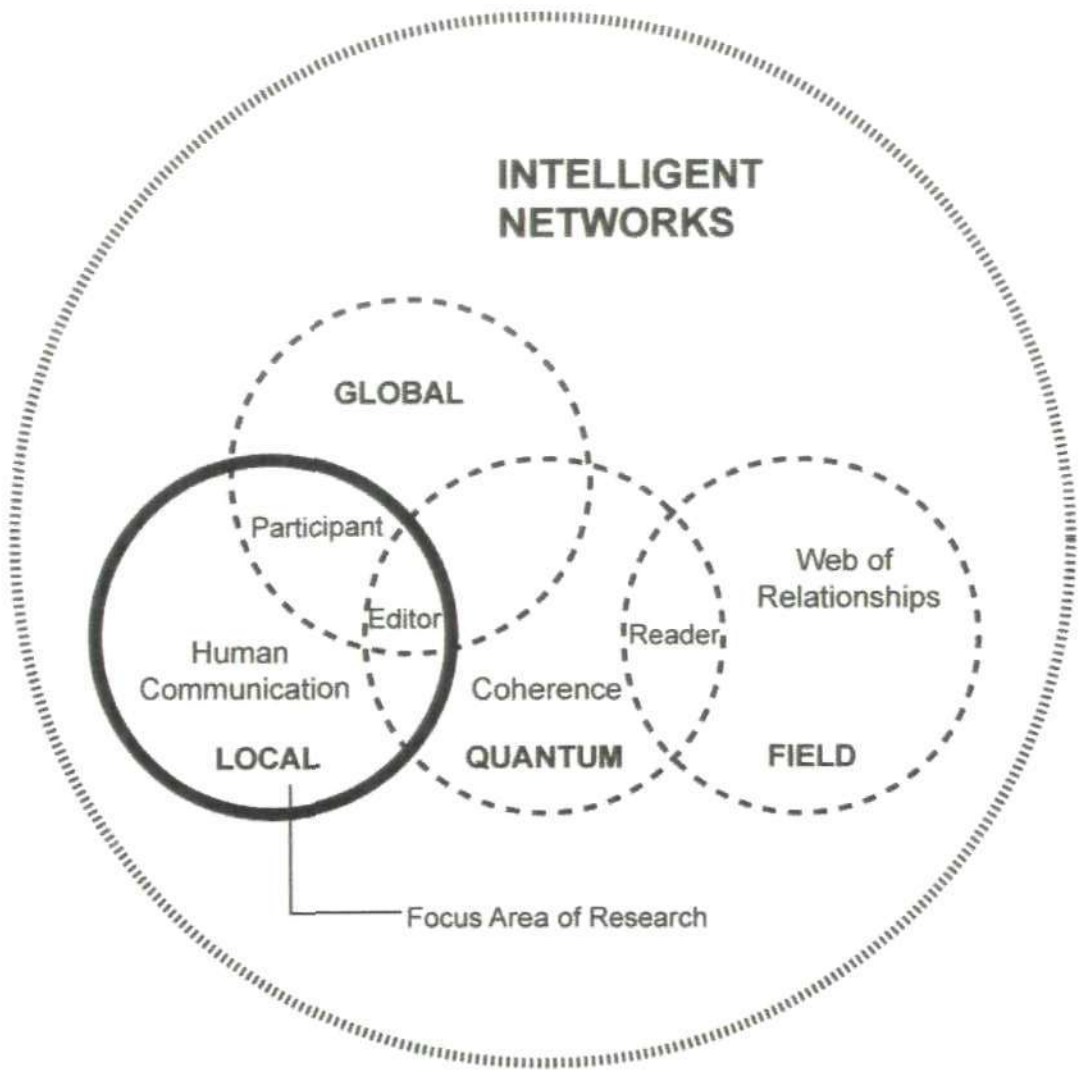


Figure 1-5. Intelligent Communication Ecologies, 2010

5. Salient Ecologies

Modelling relationships within the field will be an architecture that has an active and recursive engagement with its environment. If we understand our environments to be composed of multiple ecologies, then we may be able to operate as a designer within them.

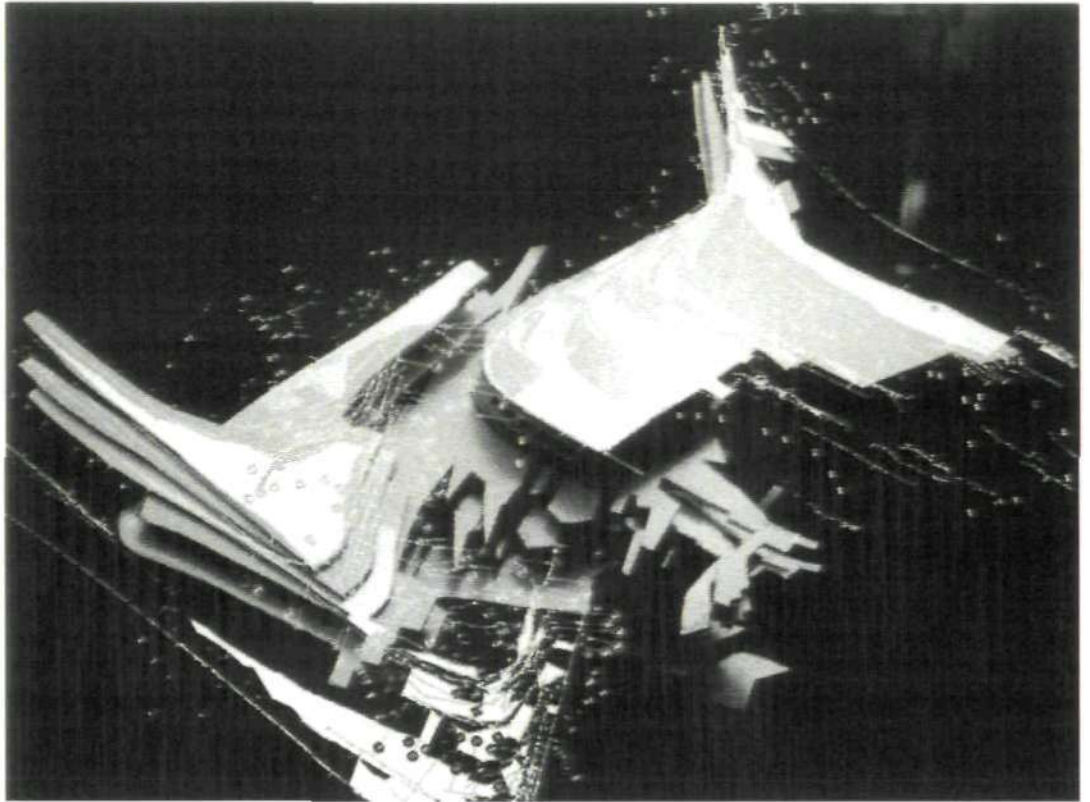


Figure 2-5. *A priori* model 01, a model for design, 2010

5.00 Suppositions

The following section discusses my own new theoretical contributions to methodologies of communication within architectural design. Based on the aforementioned precedents, each supposition represents a different design theme. These themes serve to form creative solutions throughout the thesis. Since design thoughts in reality tend to be formed in a non-linear fashion, these concepts are purposely not in any predetermined order.

Hence the work can be read in any sequence, and is not limited to the transdisciplinary research sessions which are discussed later in the thesis. The following series of theoretical and experimental projects explores the limits of architecture using the defined concepts of working drawing, participant and environment through context, design and communication. Each project is set up as a network of architectural nodes to allow for the capacity for hybrid sites and new methodologies of communication between working drawing, participant and environment within context, design and communication. These hybrid sites are subject to change over time, hence the methods need to become dynamic and able to evolve and flow.

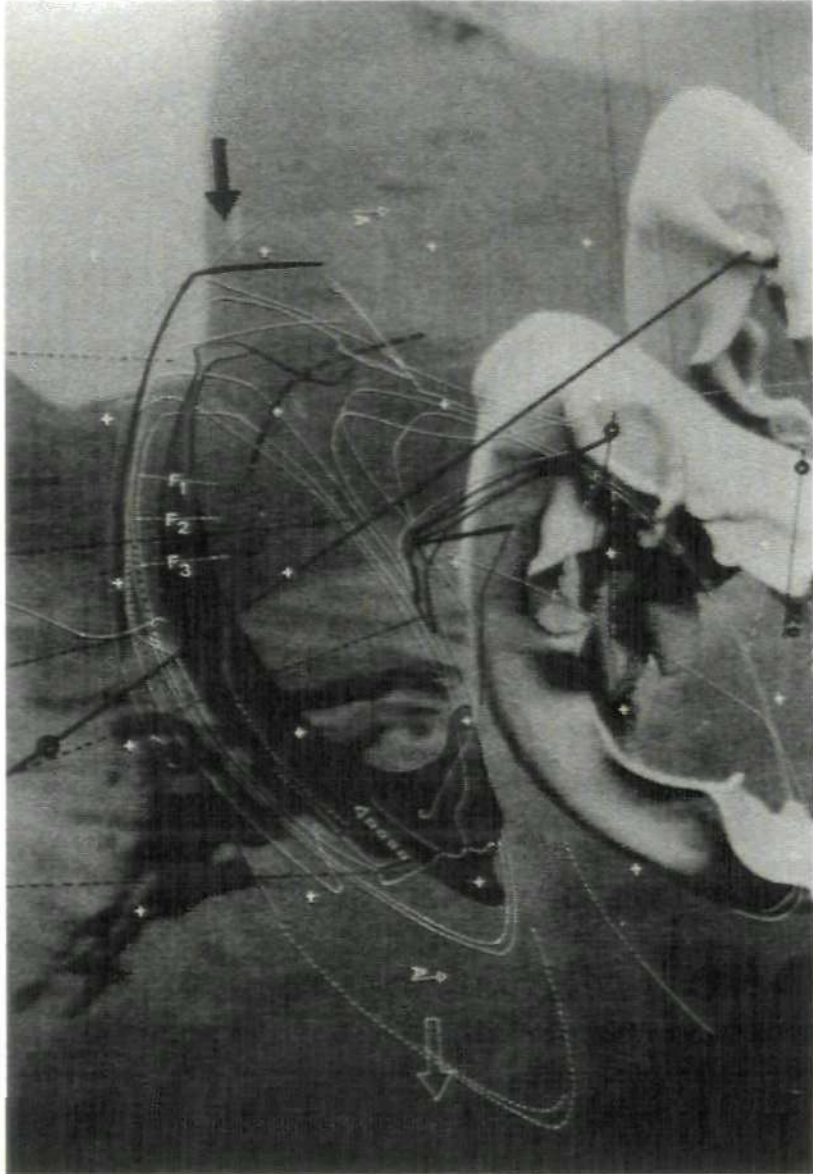


Figure 3-5. Vacillating Objects in the Gorge du Fier in Annecy, 1999

5.01 Form Follows Vision

Most architects use notation to represent and communicate their architectures. Notations are essentially used to mediate the experience of the design towards building; they occupy most working drawings in architectural education and practice; they can confuse clients, builders, lecturers and architects alike and disrupt projects.

Yet architects mostly take them as given, as a neutral code towards the final design. Here I aim to challenge and reverse this well-worn assumption. We

design notation to suit a new vision of how we can communicate our architectures embedded, spatially and experientially, not to suit the arbitrary specifications of the notation. The technologies that make this possible are advanced holography, telematic communications, ubiquitous computing and advanced control software. They allow us to define a fundamentally new, radically restructured architecture for our notational systems.

Notations are used to construct all architectural drawings and have often been studied as whole in space, but never before have they been studied as whole in time. My interests reside in a synthesis that proposes that notations adapt best when constantly refined and reshaped by their occupants, and that architects can mature from being artists of space to becoming artists of time. More than any other artefact notations improve with time. The word 'notation' contains a double reality. It means both the 'action of the verb notate' and 'that which is notated' – both verb and noun, both the action and the result. Whereas architecture may strive to be permanent, a notation is always notating and being notated. The idea is crystalline, the fact fluid. Could the idea be revised to match the fact?

One illustration of this vital reorganisation is the reinvention of the form-making of a building. In Figure 3-5, the vacillating objects are in a fixed position within the central axis of the gorge, allowing the turbulent water to pass through it, or on it, where the vacillating object exists in the relationship between things. The participant can enter into the vacillating object and become an embodied member of the environment through the surface of the object. As water passes over the spline of the vacillating object, turbulence starts to appear at the upstream end of the spline. The effects of the turbulence are recorded and over time the place where the turbulence appeared will eventually become the physical surfaces of the vacillating object. This process of recording the turbulence and then adding more and more physical surfaces onto the spline continues *ad infinitum*. The physical surfaces are also continually being worn down thus the development of the form is forever in transition through the relationship between the object and the environment through the actions of the participant. The proposition was to enable the development of the architecture to evolve over time and become apart of its environment by continually being reshaped and shaped again by the participants who begin to inhabit the vacillating object and the environment simultaneously.

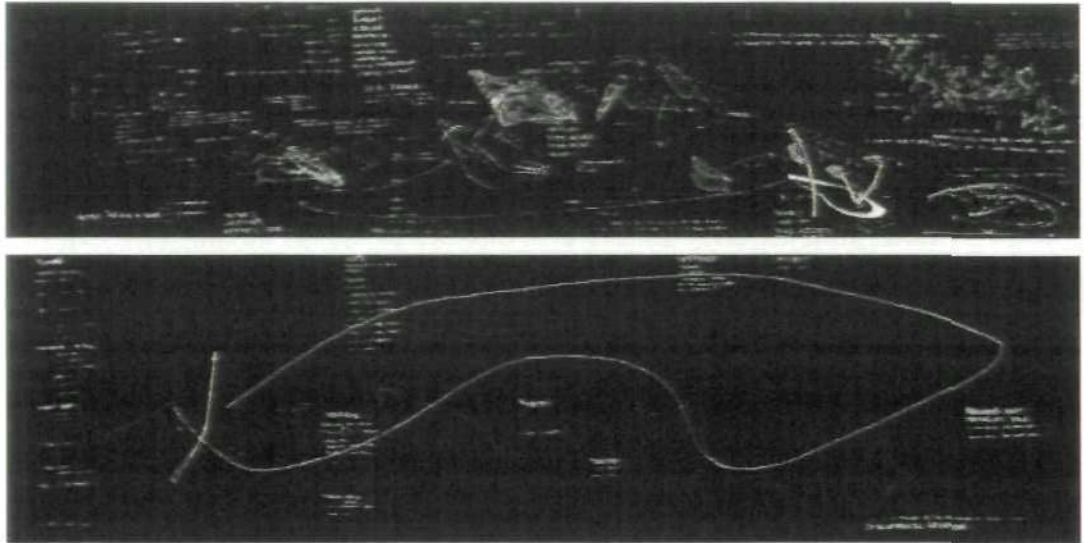


Figure 4-5. Top: Ecotype Map, 2010

Figure 5-5. Bottom: Ecotype Map: construct process, 2010

5.02 Ecotype-Map 2010

The map is not the territory. (Korzybski, 1949: 38)

Bateson interpreted the phrase as meaning that the ability of living forms to take their environment into account is not of the same order as physical interactions of the environment itself. The idea that the mapping process is *not* the territory gives rise to an understanding that there is a field of relations we construct between ourselves and the 'territory'- the 'objective world'- so that what we map is that relationship in which we participate, and not a direct representation of the things 'out there.' (Harries-Jones, 2002: 59).

If we can understand Harries-Jones interpretation of Bateson's idea that the map is not the territory within the experience of architectural practice. We might begin to unlock the more fundamental ambition of the relationship between working drawing and environment that we must experience.

As Michael Polanyi has written, 'all theory is a kind of map' (Polanyi, 1974: 4). Thus we are left in the situation of mapping the map. We are at least setting up conditions for a highly complimentary set of relationships between map and territory when dealing with the conceptual realm. An ecotype map is characterised by the surroundings it inhabits.

For this type of architecture to operate and be engaging with its environment, it needs to assimilate information from its environment and recode it as an actual. To assimilate information from an actual environment means that the architecture will receive data analysis of, for example, soil conditions, wind speeds and zoning or recorded information on seasonal changes. The model I am using for this is an ecotype map, which becomes a way of thinking about the relationships between working drawing, participant and environment through context, design and communication. It is through drawing these notational systems that I want to examine the state of transfer from one medium- working drawing, to another, as environment, as in a material transfer. This model may be understood as the syncretism of working drawing, participant and environment through communication between states, fields and notational systems.

The idea is to grasp the essential framework of working drawing, participant and environment through the developments in drawing notation directly on the environment. But the definition of extending architectural propositions into the field through spatial, embedded notational systems that the projects and essays combine to propose is much wider and more formal than is conventional. And it is essentially through the working drawing that I currently claim for the burgeoning field of Eniatype. It is hoped the practice work will develop to the next step and embody the environment directly, so we can seek to rediscover the precisely determined, purposeful, or inevitable attributes of form.

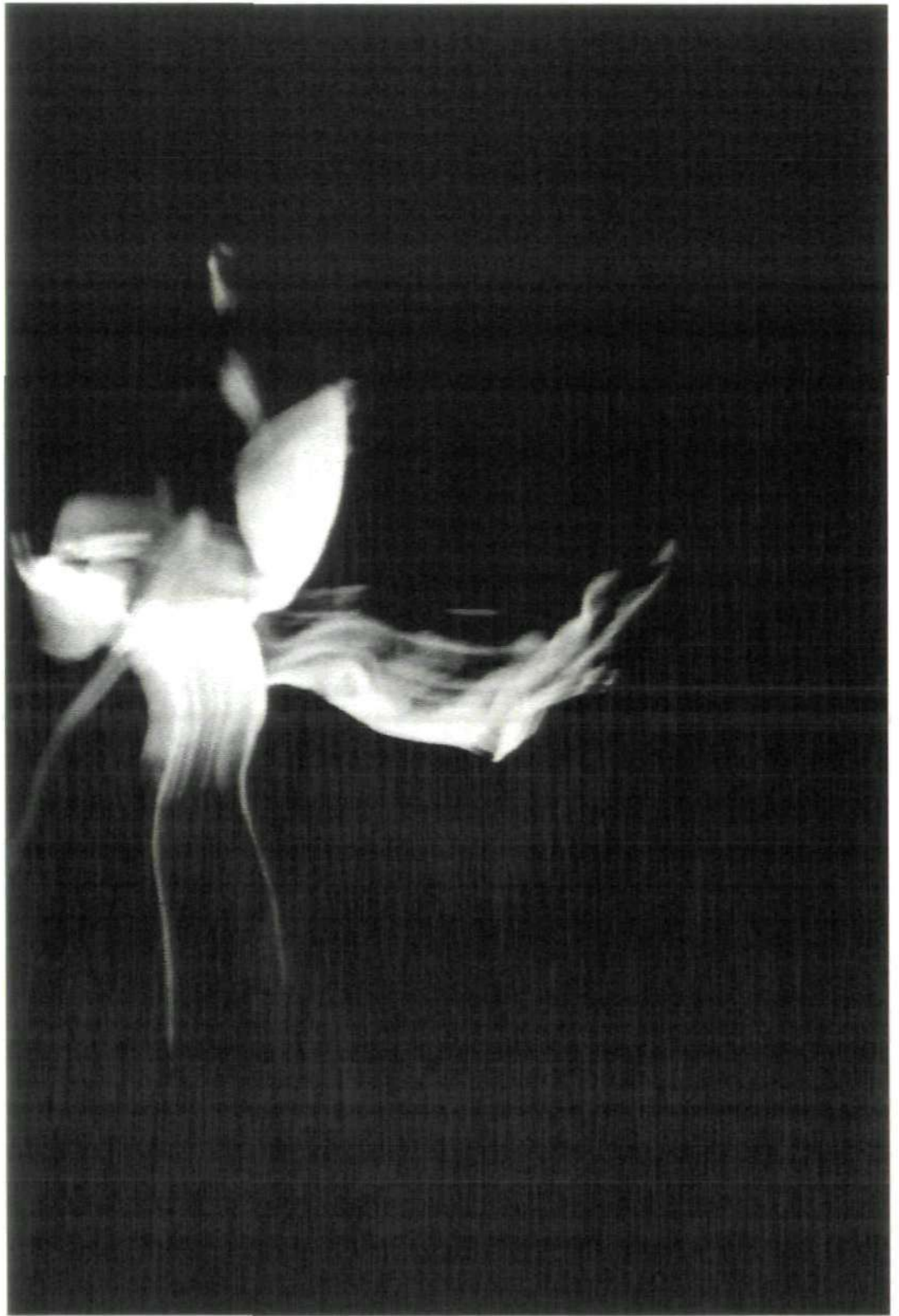


Figure 6-5. Image of jittering Information Polyp, 1998

Information Polyp is an object that roams across rural landscapes and is linked via a geo satellite to remote computers, driven by the vicissitudes of the wind to create a kind of alternative geography of points of observations. The aims and scope of the Information Polyp is to create a sustainable reflexive system that will manage the landscape efficiently and give suggestions of ways to make the land 'holdings' more productive. This is a roaming device that is under constant control by the mesh network system and goes through endless transformations but has no fixed total image. Through remote sensing software, the Information Polyp collects and analyses pollutants and chemical composition of the terrestrial and celestial environment it encounters. The data collected would be tailored to the participants needs and presented as a dynamic database model, which will be used for physical counterpart application back in the environment. The surface of the Information Polyp is composed of three layers. The primary layer is a wire structure, so that each wire is so perfectly balanced that its movement from light air currents sets the entire polyp in easy motion. The secondary layer is a filter which enables the control of the percentage of openings in the surface. This aids with the motion of the polyp and acts as a sieve for airborne pollutants. The tertiary layer is an electromechanically driven fluid which tests, samples of the environmental pollutants.

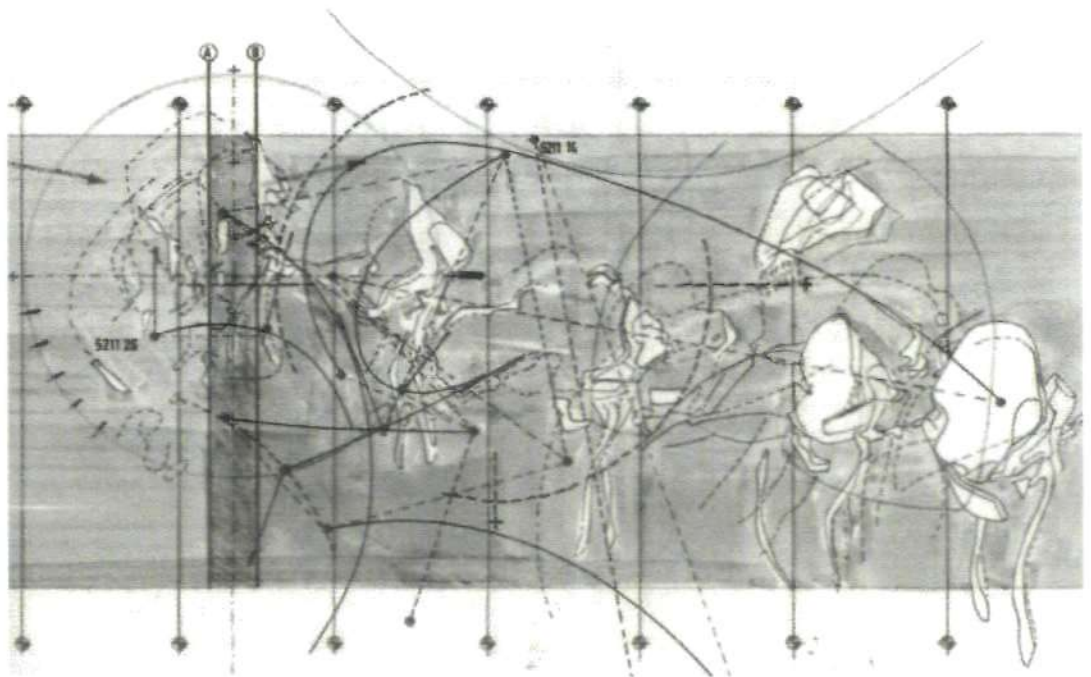
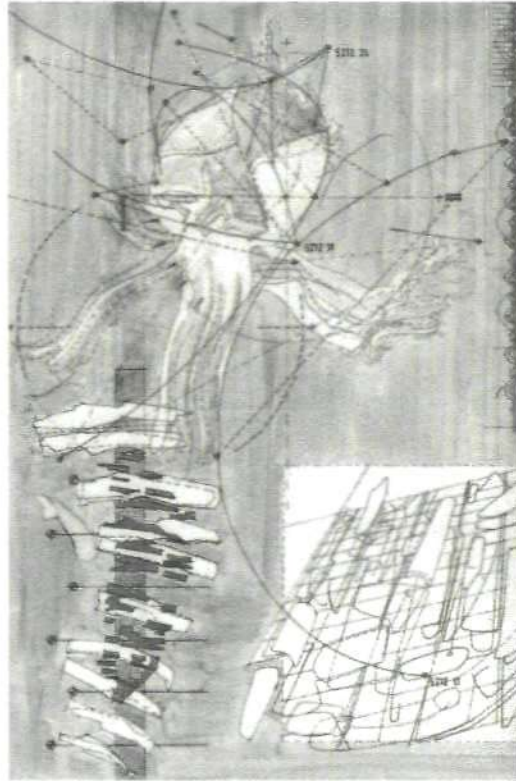


Figure 7-5. Top Trajectory mapping of the Information Polyp, 1998
 Figure 8-5. Bottom: Information Polyp showing distributed networks, 1998

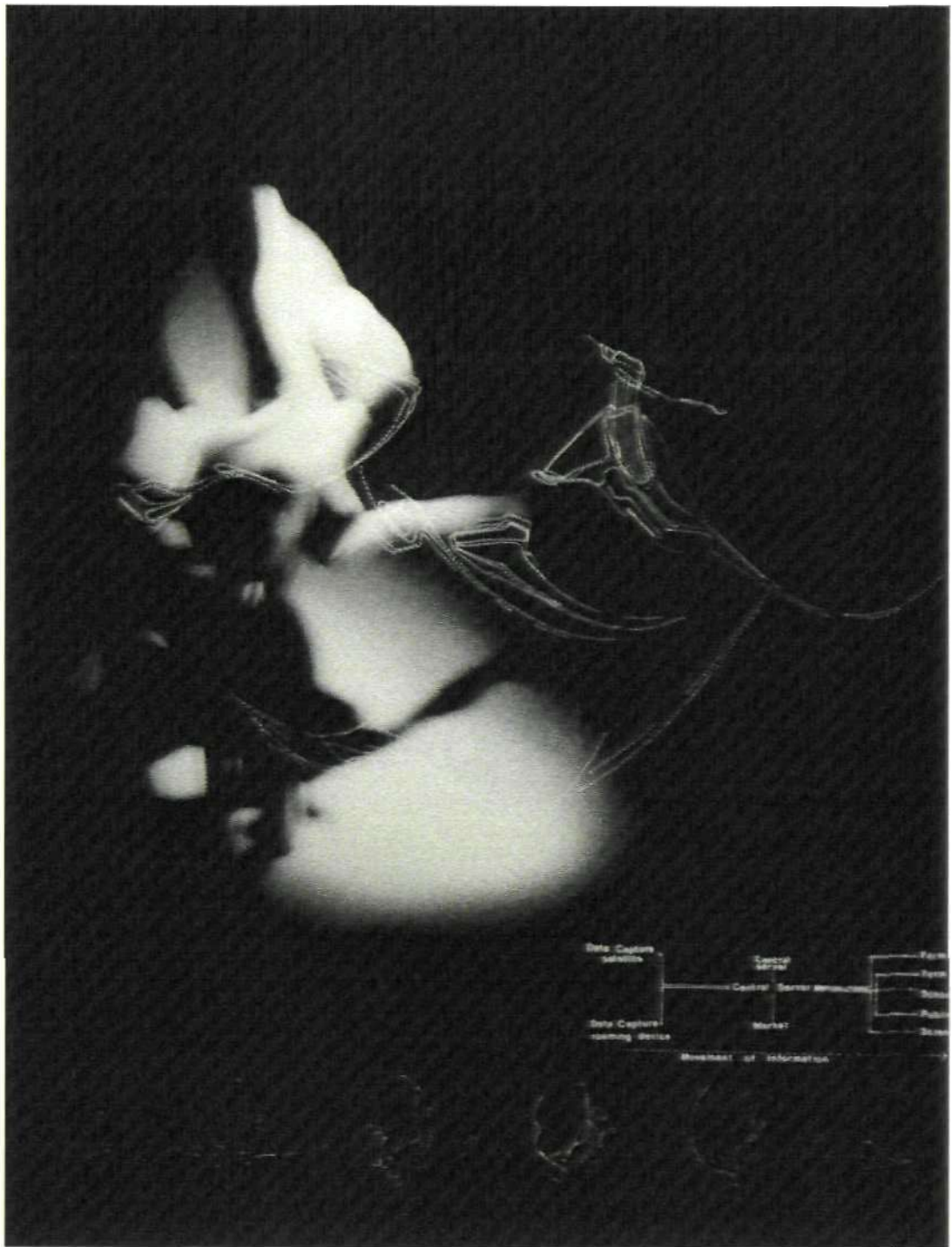


Figure 9-5. Information Polyp as data visualisation tool, 1998

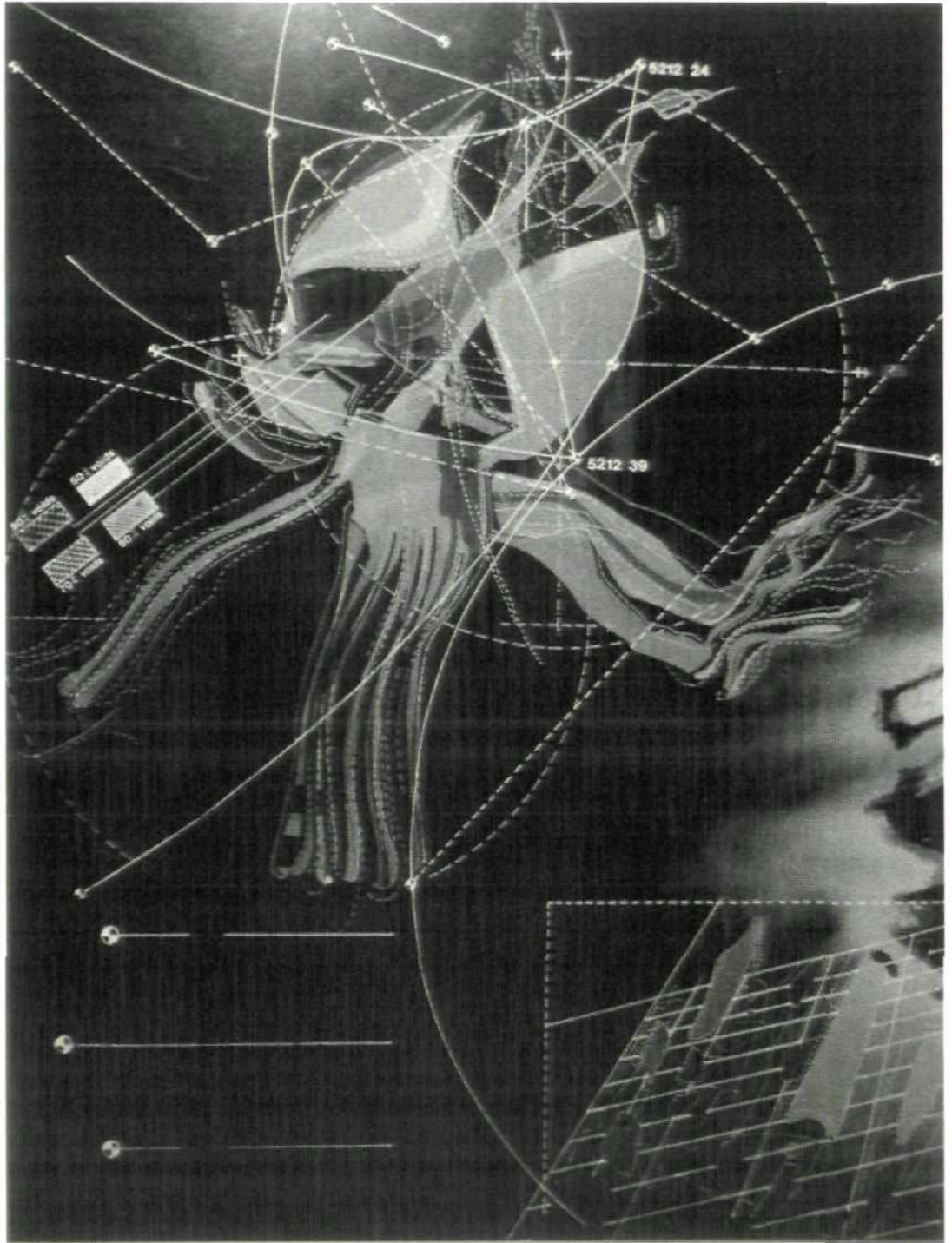


Figure 10-5. Information Polyp trajectories with skin detail, 1998

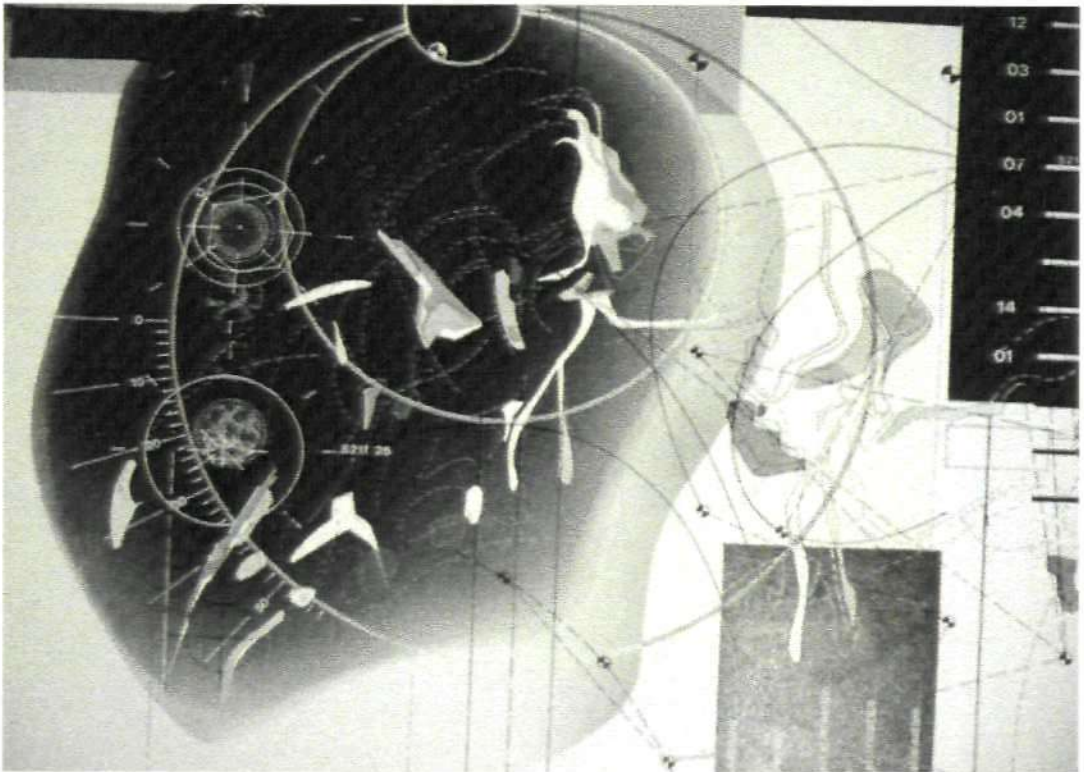
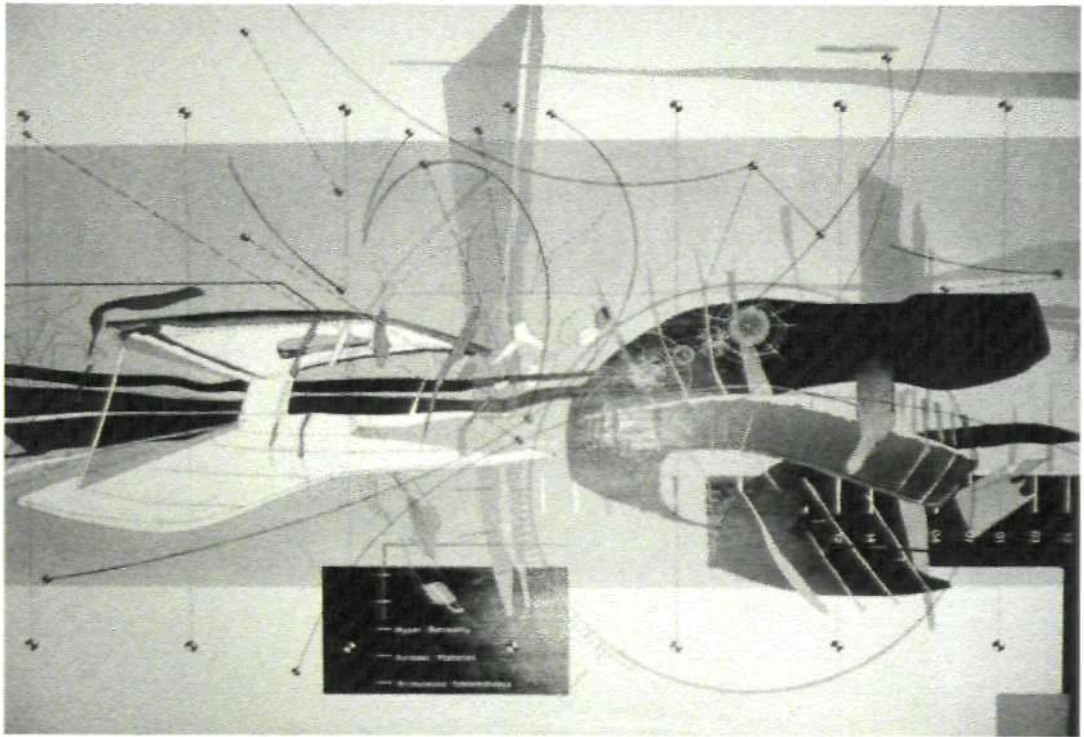


Figure 11-5. Top: Information Polyp air mass histories, 1998

Figure 12-5. Bottom: Information Polyp detail of air mass histories, 1998

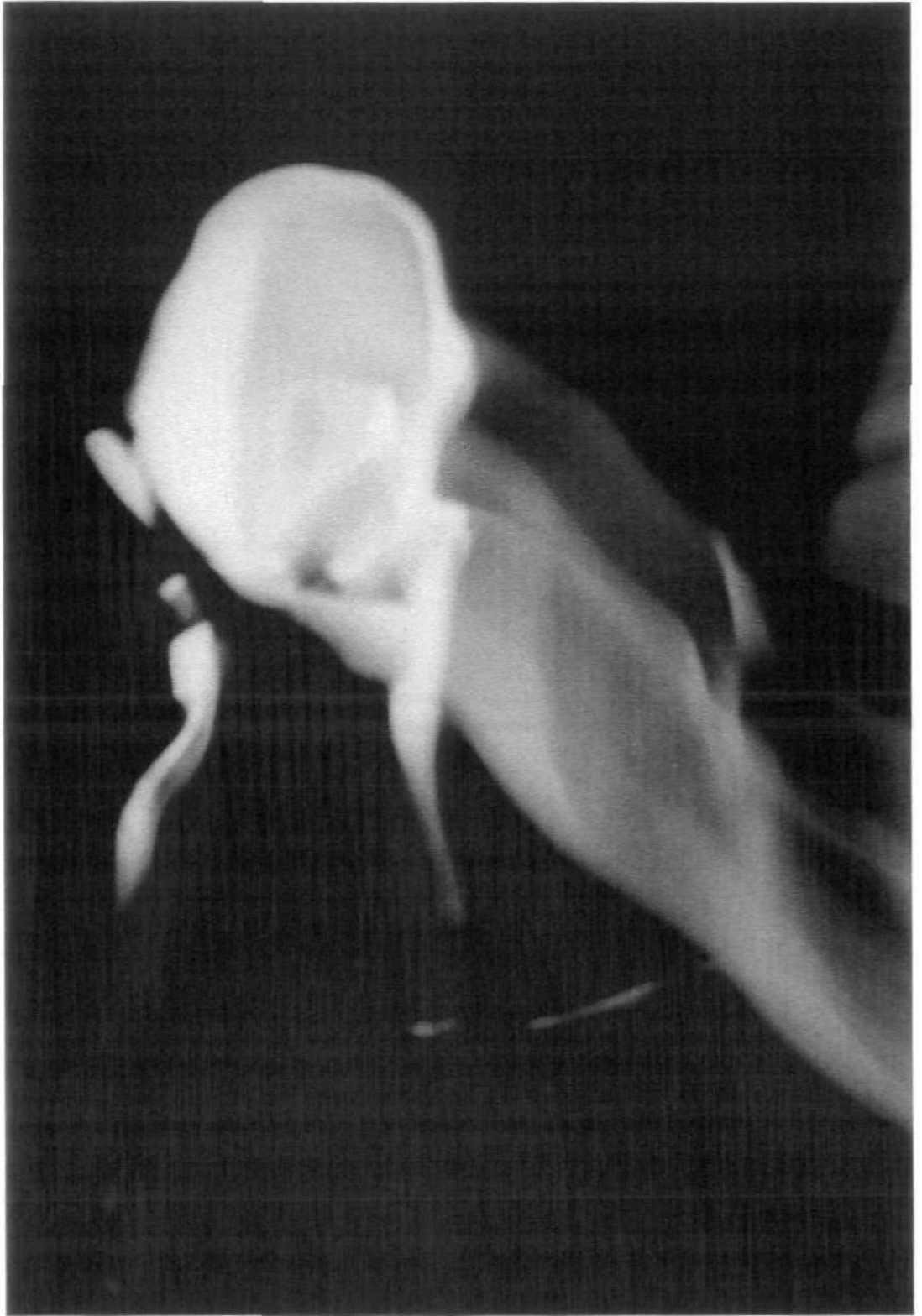


Figure 13-5. Information Polyp as data visualisation tool, 1998

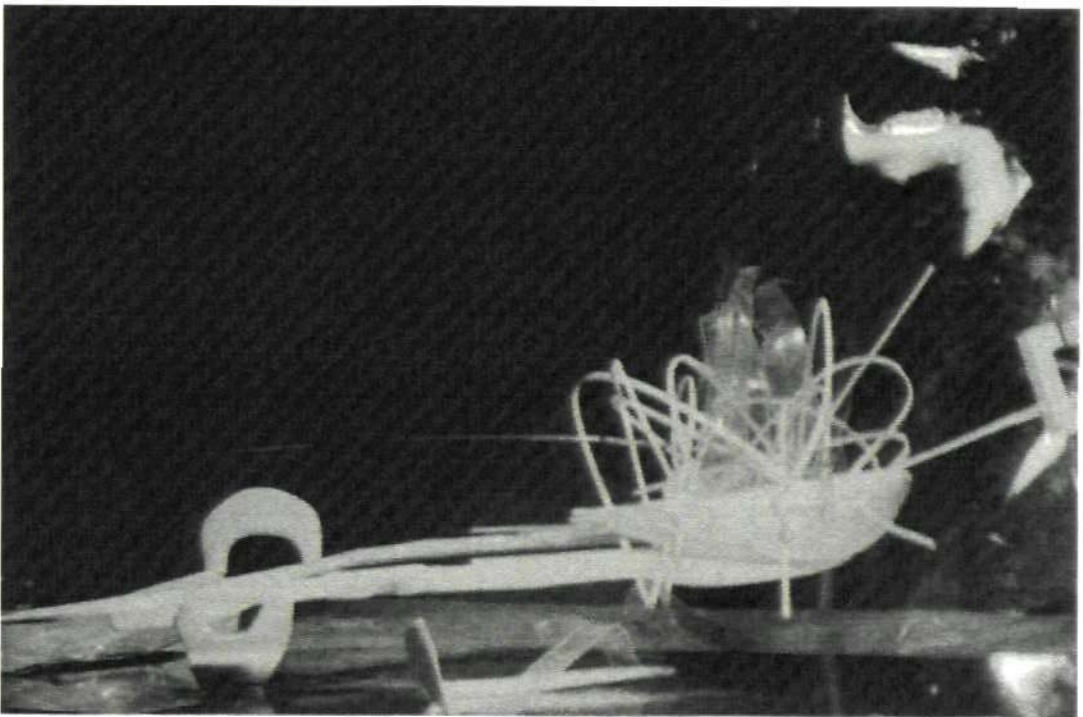
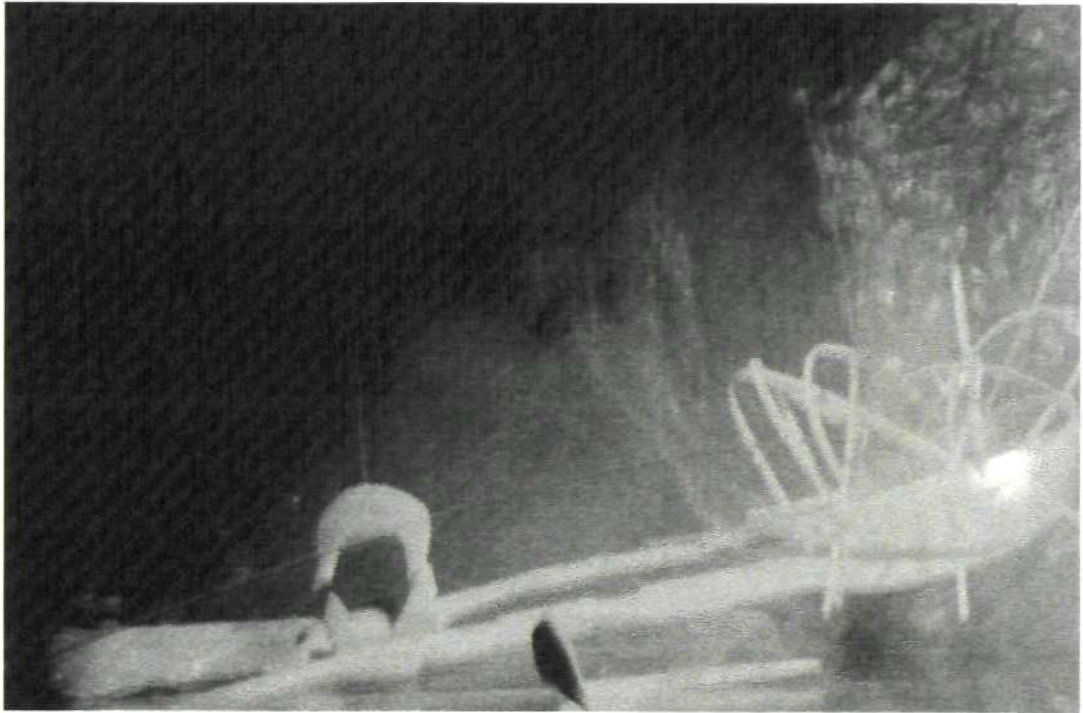


Figure 14-5. Top: Information Polyp scanning air mass histories, 1998

Figure 15-5. Bottom: Information Polyp scanning air mass histories, 1998

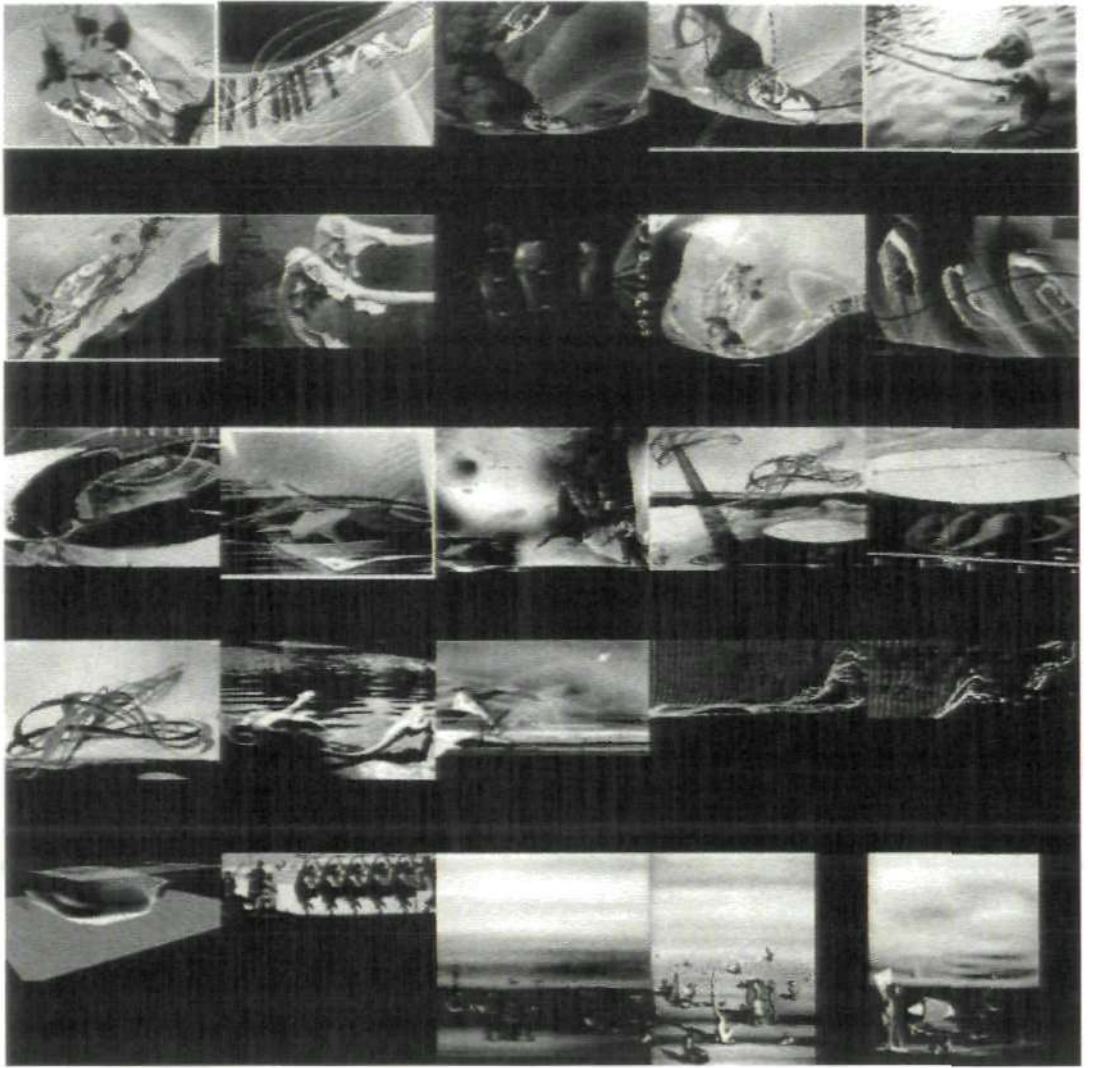


Figure 16-5. Composition Camargue, 1999

This project reverberates around a series of 'split' sites linked to each other within a complex web of feedback loops and retro-sensing devices. It centres on the harnessing of natural phenomena and complex ecological networks within the unique environmental conditions of the Rhone Valley in southern France. By making use of modern technologies, including caged light and magnetorheological compounds, these naturally fluid systems will be amplified and distorted to form self-regulating, interactive configurations, with endless possibilities for adaptation and transformation. As well as collecting and collating ecological information for research uses, this mesh network provides the means for the participant, as reader, to be 'plugged into' nature. At various critical locations the participant becomes yet another component of the mesh network, influencing the environment and simultaneously being acted on by diverse factors. These architectures are distributed across sensitive geomorphologically and ecologically special locations, such as gorges that flash flood, salt pans or the point of the France's thinnest earth crust, all of which are found along the Rhone corridor that terminates at the Camargue and is prone to the ravages of the mistral wind. The synthesis between the locations will have an extensive impact on this sensitive landscape beyond their immediate location, disturbing the threshold between the natural and the artificial.

The key points to be discussed in the following project are firstly to introduce each node on the mesh network through materiality and the relationship with its natural trigger in each of the five locations. Following that, I will discuss the relationship between working drawing, participant and environment and describe what territories are disturbed. This will be explained through each node individually and then collectively how one node will affect the other spatially and experientially.

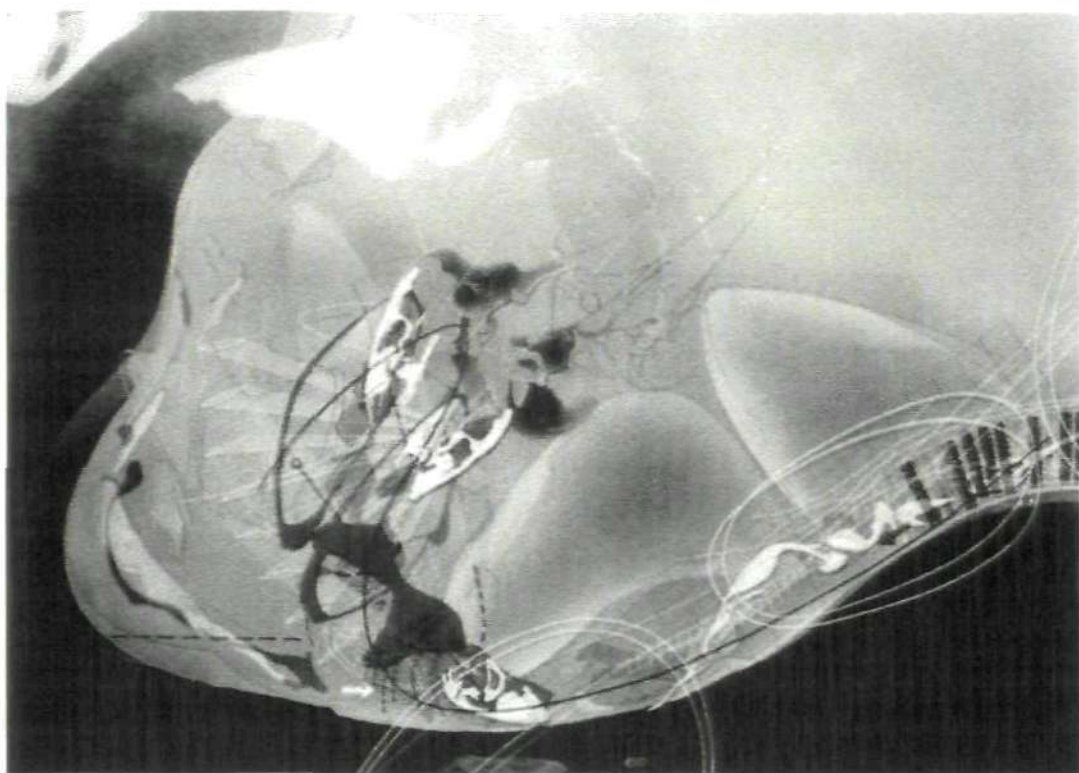


Figure 17-5. Aerial view of Gorge du Fier, 1999

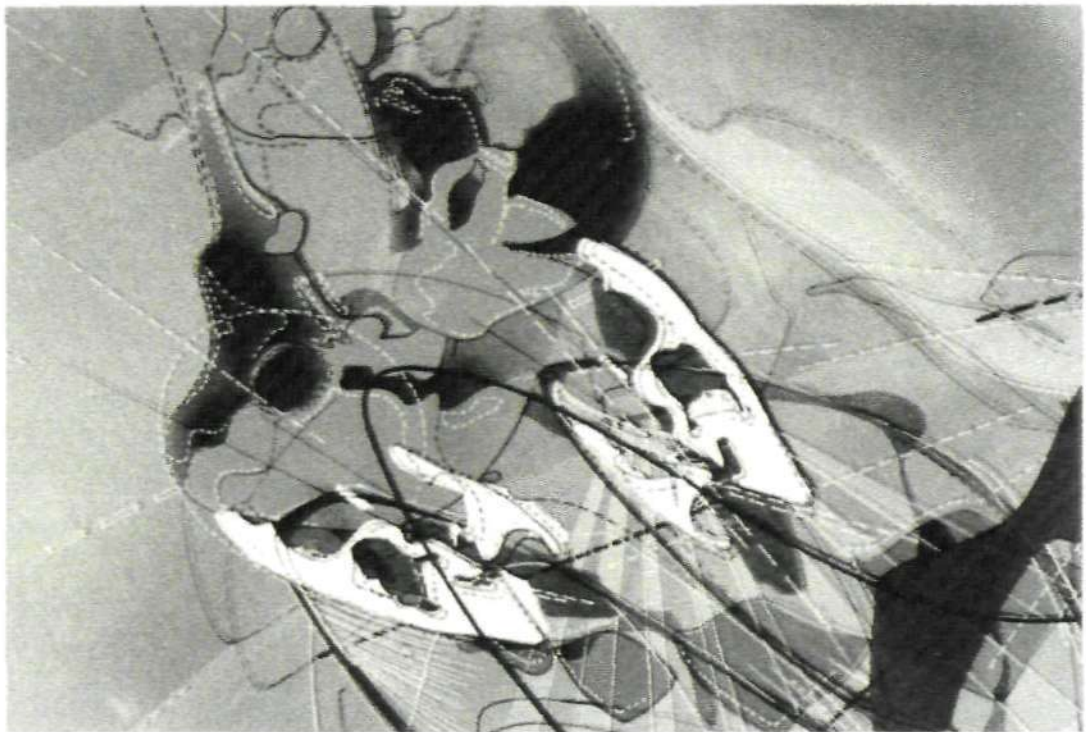
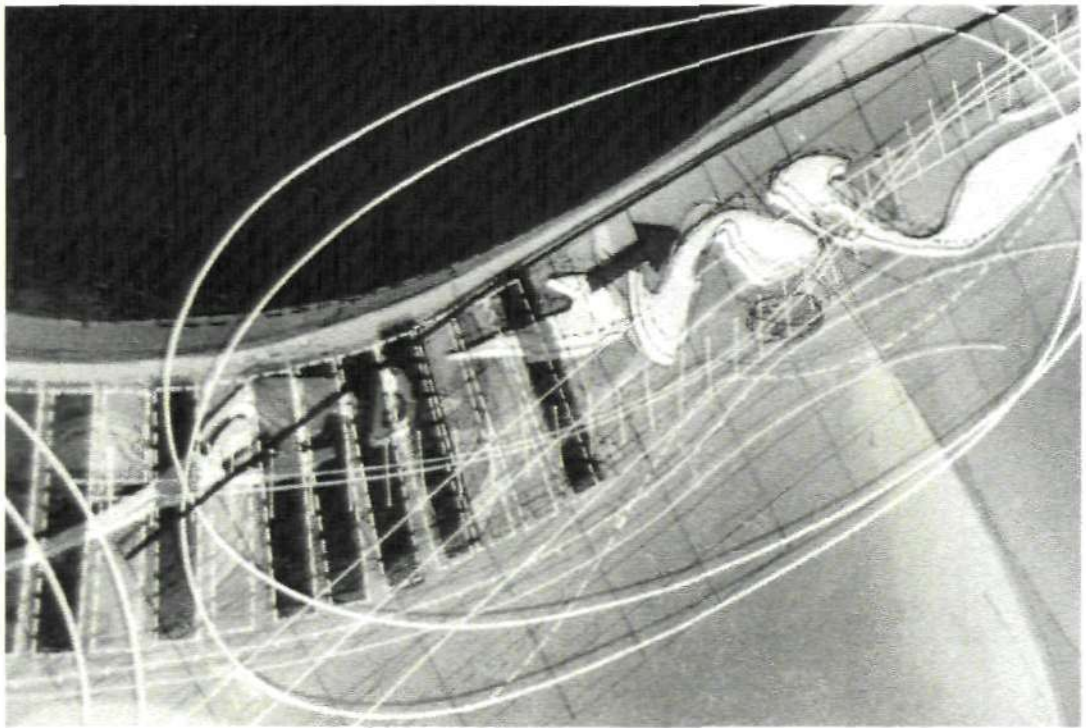


Figure 18-5. Top: Gallery detail, 1999

Figure 19-5. Bottom: Cradle detail, 1999

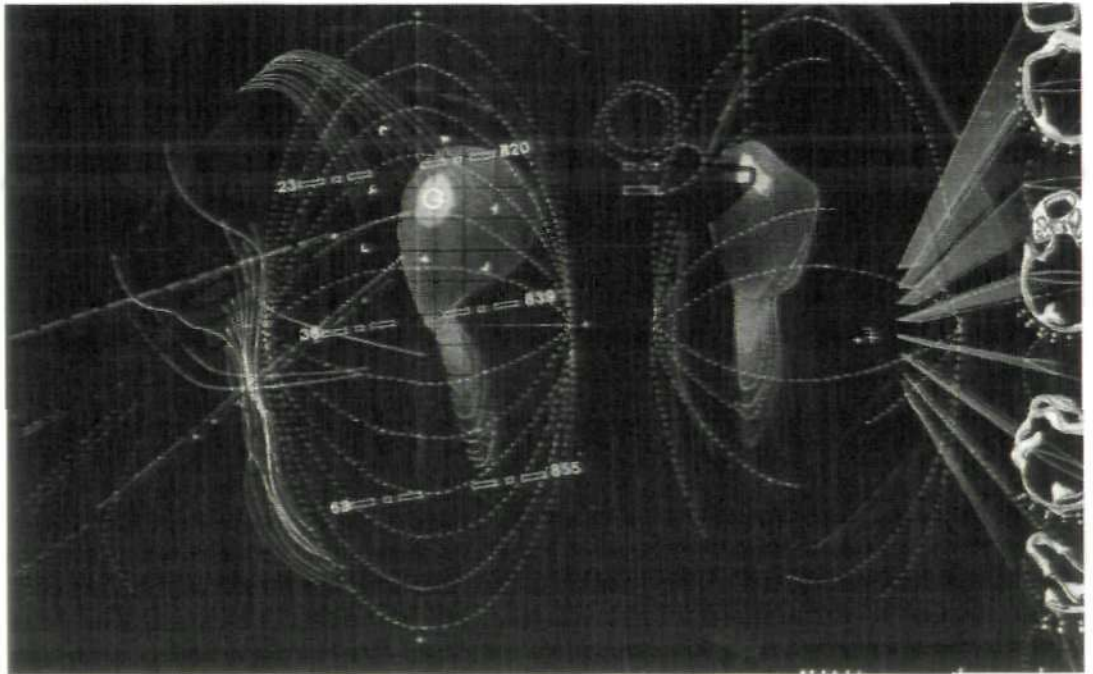
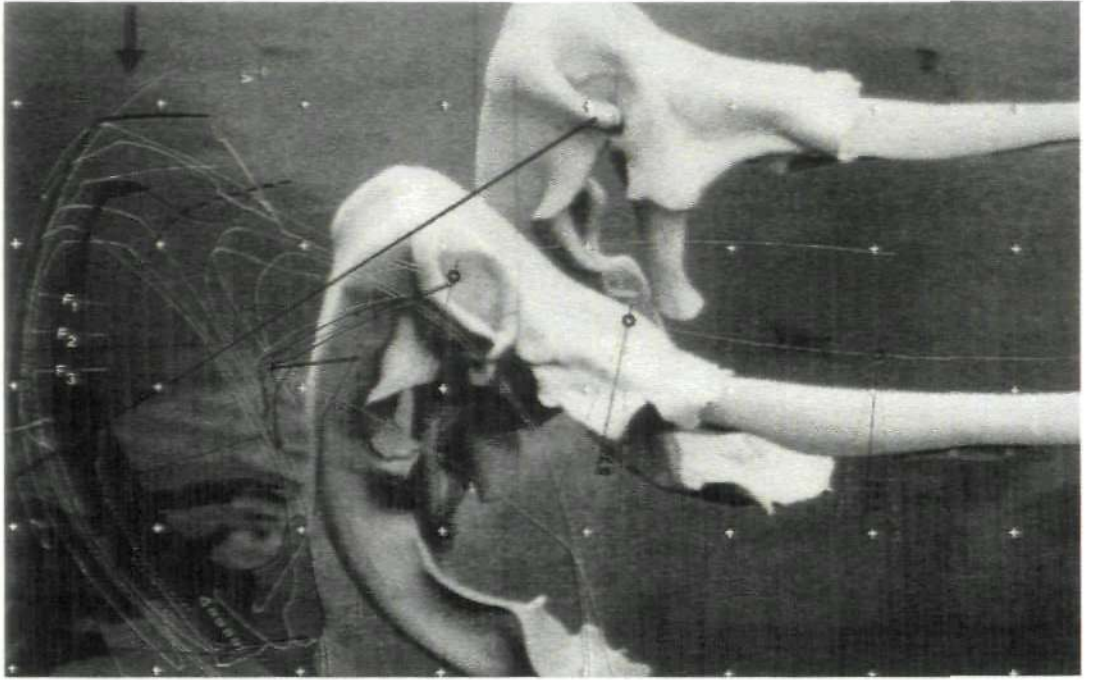


Figure 20-5. Top: Vacillating Object with section detail, 1999

Figure 21-5. Bottom: Participant view inside the vacillating object, 1999

Water: Gorges du Fier

Les Gorges du Fier, at 300 metres long and 60 metres deep, is classified among the largest curiosities of the Alps. Inside these gorges one can admire a giant pot of water. To the exit is the impressive aspect of *la mer des rochers*, a labyrinth eroded by the Le Fier River. Along the vertical faces is a scale showing the heights reached by the river in flood, including September 1960, when it rose 27m above its normal level.

The 'gallery' allows the participant to scrutinise without any danger the depth of the abyss, where the Le Fier scours and groans. Beneath your feet a smart floor that aims to identify and track you around the labyrinth of walkways, measuring other biometric features such as weight, gait distance, and gait period to assist identification. This information is used to establish the intensity of the experience and the altered state of effects in the vacillating object. There are different sensors connecting different actions of visitors to fluidity. Light, touch and pulling sensors respectively creating the vector, the inflection and the frame in real-time projection, real-time sound manipulation and the interference of the light sp(l)ine with its information projectiles. Between animated elements a projected space allows the participant to experience a disturbance in the territories.

The 'cradles' swing out from the gallery and present the participant to the point of immersion into the gorge and the vacillating object. The participant is now active in disturbing the field of the other nodes, whilst swaying inside the two cradles. Swinging out over the gorge below the cradles connect into the vacillating object. Once the participant is inside the vacillating object the pressure-sensitive floor will trigger a silicon glow around the cradle to show it has become activated. The colour of the light is tuned pending on the particular absorption and emission of activities in the fire node of the mesh network. Within the cradle the participant *listens* for visual signals from the other nodes through the phonoscope, which acts as an instrument for the translation of sound vibrations into visible images. The 'vacillating object' operates between the participant and the environment. This notion creates a second-order field where the participant communicates not directly with the environment but through a reader of the environment as a participant. The vacillating objects are fixed within the central axis of the gorge, allowing the turbulent water to pass through it, or on it, where the vacillating object itself exists in the relationship

between things. Along the length of the sp(l)ine is a series of information projectiles. The displays retain a ring of waterspouts that can be inflated and deflated through a series of release gates that can be opened to spurt out water when the pressure is too great. This assembly in each array will be fitted with a microprocessor. Output from the system will be used to sustain the vacillating object mobility. The tripper can slide down on a calibrated foot-track from the cradle into the guts of the vacillating object which can be calibrated to enable each individual participant to gaze into the gorge through the sp(l)ine. Now the participant counter balances the physical weight of the vacillating object to become apart of it. Once located inside, the participant is presented with three mathematically related images through different filters via a digital interface, described as F1, F2 and F3. Respectively, each image has been adjusted to present other sites in real time, act as an instrument for translating sound vibrations into visible images and act a pressure-sensitive backrest which controls the light source along the length of the sp(l)ine. Slung out behind the vacillating object is the generated texture field, which comprises of a finely meshed net. The net continually flows with the surface topology of the water. The notion of delay is introduced where some external agent could control the flow of the net. Contained within the wires of the net are magnetorheological fluids that can be switched to a highly viscous or semi-solid gel-like state in a matter of a few thousandths of a second by applying a strong magnetic current. This smart net can be made *intelligent* by coupling it to sensor devices that, for example, detect sudden fluctuations such as those caused by flash floods. By applying a magnetic field to the fluid a frozen flow is generated; and when it returns to the liquid state, the net continues to flow with the surface topology of the water. Forged into the rock face is a vertical measuring instrument with a sliding float which records the fluctuating movements of the water as it flash floods seasonally. This information is sent digitally to the condensation node in the camargue. When the gorges flash flood, it causes a *critical threshold* to be reached, whereby the vacillating object begins to writhe frantically, like a wild dog on a leash. As the water cascades all around, the gut descends beneath the water and causes the sp(l)ine to coil up until it exerts its potential energy in a dramatic whip-lash effect.

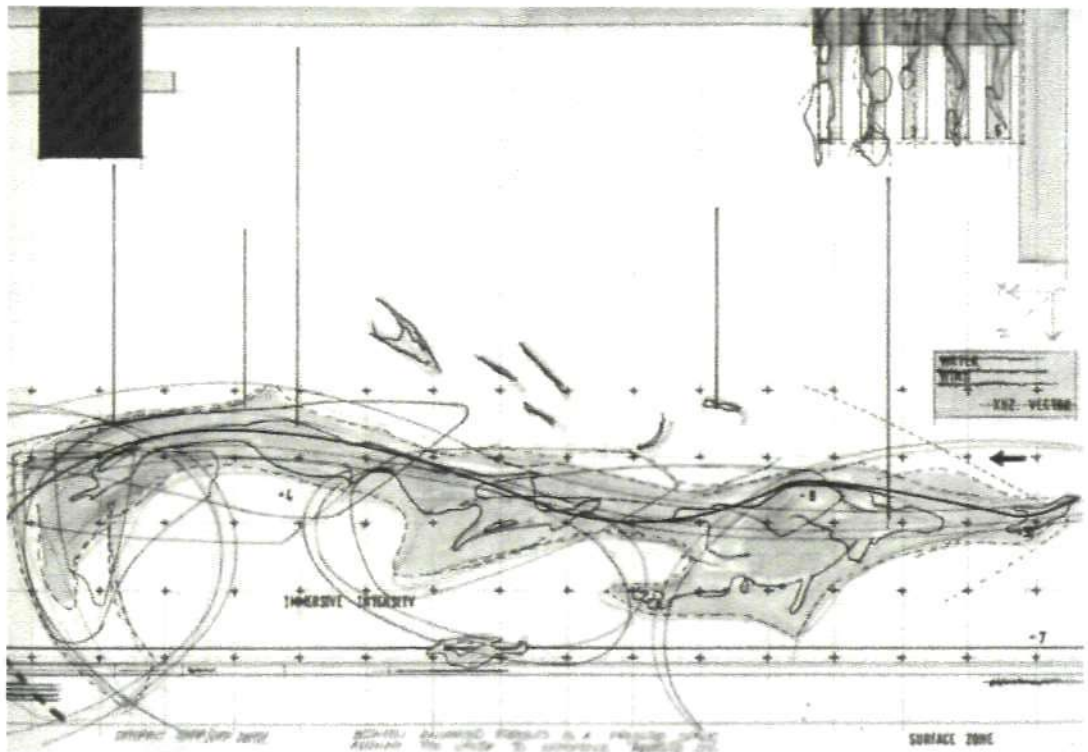
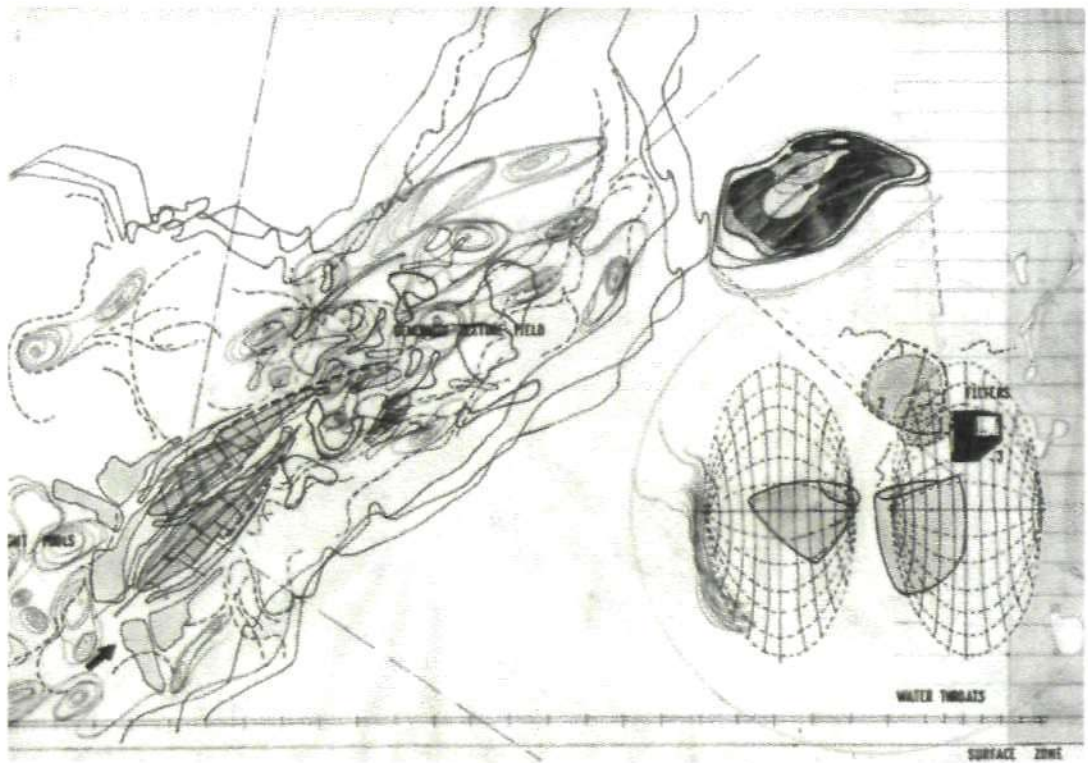


Figure 22-5. Top: Aerial view of gorges showing generated texture field, 1999
 Figure 23-5. Bottom: Preliminary sketch section of Gorge du Fier, 1999

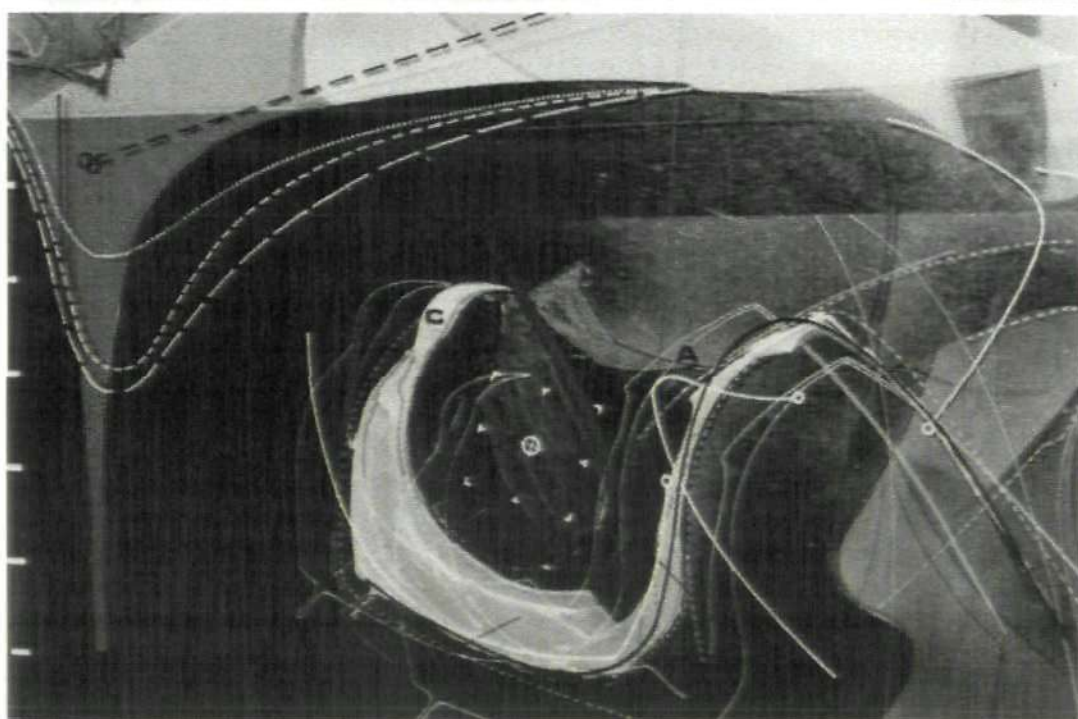


Figure 24-5. Top and Bottom: Preliminary sketch section of Gorge du Fier, 1999

Earth Cruas

Old stone houses huddled around an abbey, all covered with a fine white dust from the large cement works by the river. Not far away the great towers of the nuclear power station pour forth huge plumes of smoke. The land around Cruas is the thinnest part of the earth's crust in France, and is subject to frequent movements which might or might not become more serious.

This node is developed as an ecological retreat. The implicit challenge was to develop a process where the form would be suspended between the drawing and the environment but would lodge vividly in the imagination – a sort of psychological involution. A flat stretch of land was chosen which is visually linked to the nuclear power station. The node has the simple program of exhibition and conference spaces that are occupied in the adjusted existing topology. This series of topological distortions blister the landscape into a field of giant looking sand-worms that programmatically writhe. The design was based on the metastable aggregation of architecture and information. The form itself is shaped by the fluid deformation of ellipses spaced over lengths of more than 45 metres. In the exhibition space, which has no horizontal floors, and no external relation to the horizon, walking becomes related to falling. The deformation of the land is extended in the constant metamorphosis of the active layer of the building that reacts interactively with the frequent earth movements. Visitors to the centre will be encapsulated by means of different light, touch and pulling sensors that cause this constant reshaping of the retreat. The conference space is on three sliding platforms that migrate slowly around each other as a fluid deformation of space set on the reactive layer. The active layer becomes directly linked to the natural environment and the reactive layer explores the relationship between the natural and machinic phylum. These two layers restructure the external and internal skin of the building. The site becomes a play of dermis-like forces, the projected flesh or skin of the building spreads out, slips and bends like a surface of variable curvature on an abstract plane. If the seismic activity increases, there is the possibility that a critical threshold could be reached, whereby the elliptical structure will writhe frantically and cause subsequent contortions to the spaces. Enfolding the surface of the building that slowly but continuously destroys and reassembles itself through the direct relationships with this territory.

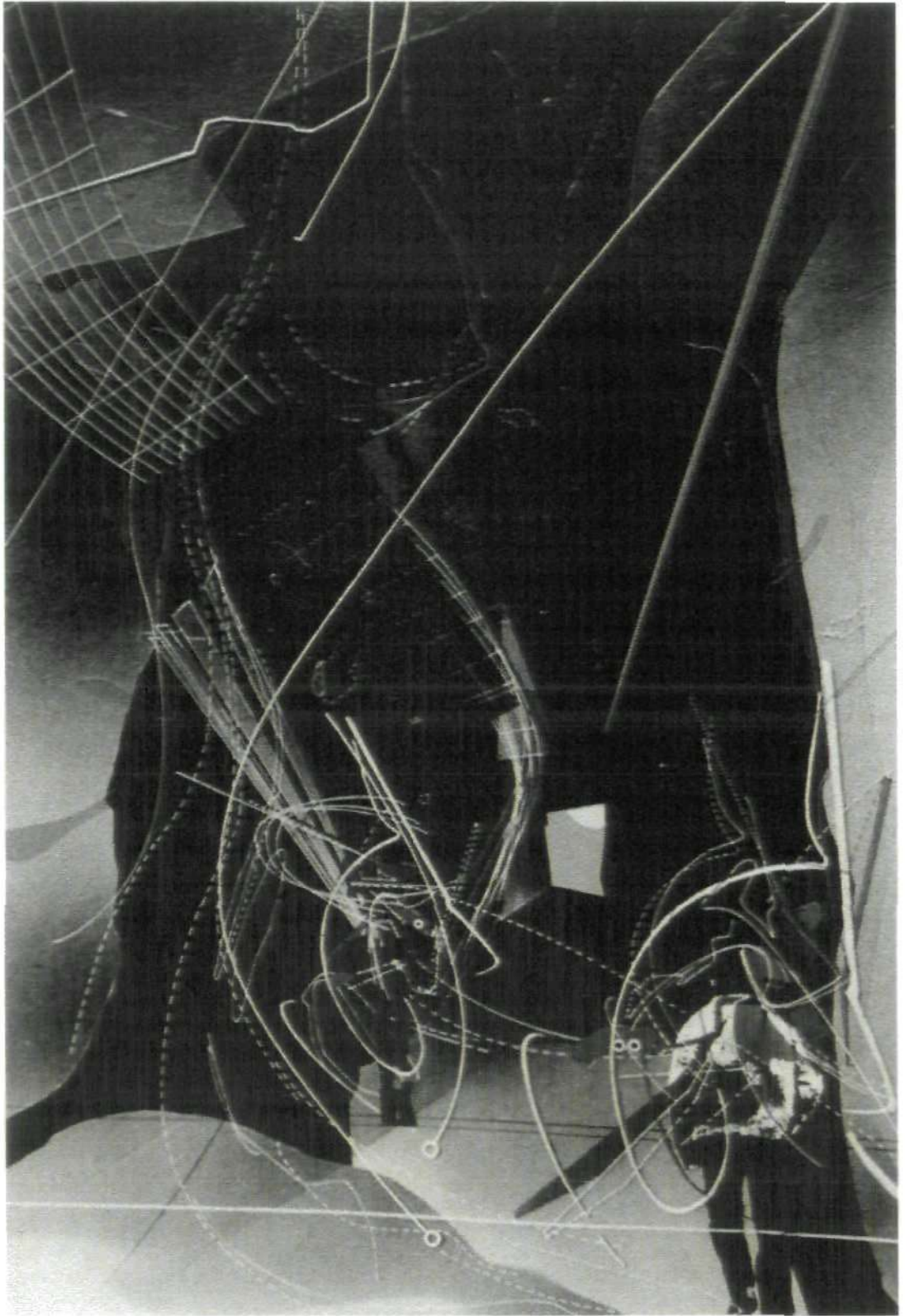


Figure 25-5. Section through Chauvet caves, 1999

Fire: Chauvet Cave

The physical intervention is sited in the Chauvet cave in the Ardeche region, where there is a vast network of galleries and rooms (about 500m galleries). In the design are a series of light sails cast out from the entrance of the cave. They trap and manipulate light on this open aspect south-facing environment. The primary environment is the interface between the stable ecology of the cave and the more unstable exterior conditions. This is the place of restitution, requiring the most advanced imagery and entertainment technologies. In addition museographic and educational equipment will recall the living conditions of prehistoric man, the evolution of natural environments and the origins of rupestrian art. On this south-facing entrance, a series of light-sails are cast out and held about 10 metres up in the air on pneumatic poles. The surfaces of these light-sails are composed of three layers. The primary layer consists of a muscle-wire net structure that balances the movement of the photo-sensory cells. The secondary layer consists of a multitude of photo-sensory cells that focus the light on their photoreceptors; coupled with photo-detectors which function as meters in measuring light intensity and in clocking the hours of light and darkness. The timing of these photoperiods (light-dark) is related to 24-hour rhythms of the environment. The tertiary layer consists of a photovoltaic array that can rotate to the brightest part of the sky and is fitted with a microprocessor. All the receptors are focused onto a ring of amplified light. The inflammable interfaces are developed to allow a personalised light to follow the participant along the labyrinth of galleries and rooms. The second environment is the inflammable interface, which runs along the labyrinth of galleries and rooms. Here the participants receive a back-pack containing three telescopic armatures which can rotate in three axes of movement, one of which is for telescopic eyes and the other two are personalised light sources. Beneath is a footbridge with a smart floor networked to a light sp(l)ine overhead. The personalised lights are programmed to move around the cave walls sequentially framing specific cave paintings to enable the participant to receive a personal dialogue with the drawing and environment. With the superimposition of four or five systems of projection, the cave becomes a dance of complex geometries. Each time the participant visits, they can chose from a multitude of programmed patterns of light on the cave paintings which will enable the participant to look

more intensely at the work and not to receive a repeated spatial and visual experience.

Under the stark glare of your personalised light, a breathtaking backdrop unfolds: gigantic columns of white and orange calc-spar, alternating translucent and nacreous, splendid draperies of minerals, sparkling carpets etc. Scattered on the ground are the bones of bears; the walls are scratched with claw marks. Suddenly, the image of a white horse appears before you.

The telescopic eyes enable you to look at the paintings in detail without leaving the footbridge. Either side of the footbridge are posts that transmit a continuous beam of infra-red light. If the beam is broken the two light sources will turn off. You will be guided by the light sources through the labyrinth of caves. A continuous signal from the light sp(l)ine monitors your movements through the cave: this enables the system to detect where you are.

The light cage encapsulates the user in a kinetic volume of caged light. The critical environment where the participant becomes an active participant in this node is the light-cage which encapsulates the participant in a kinetic volume of light. The light-cage is supplied with light from the light sp(l)ine. The proposed device is based in one of the back rooms where there are large polychrome panoramic compositions of paintings and engravings from 4-12 metres long. In the centre of this space there is an elliptical hydraulically muffled glass platform. There are two rotating surface mirrors that fan out a laser ray as the referential surface. The platform is connected to a computer system, which displays a wire frame model of the room to the place of restitution. In this light-cage a swarm of dots moves, pursuing one another, thus behaving like a virtual creature commanded by the movements of the platform. An increase in movement generates more light and the whole room begins to glow. There is also touch sensors set in the floor, and standing on them triggers a real-time projection from the other nodes. During electrical storms, lightning is conducted through light spikes located above the cave, which pulses through the light sp(l)ine into the light-cage.

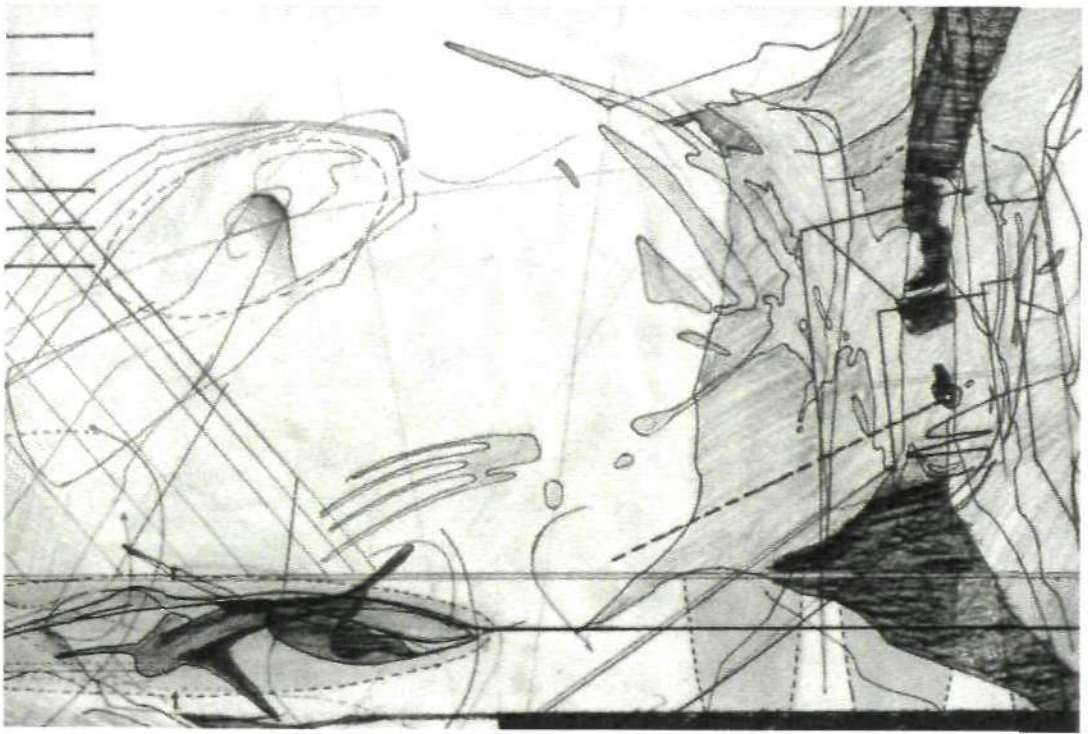


Figure 26-5. Preliminary sketch of Chauvet caves, 1999

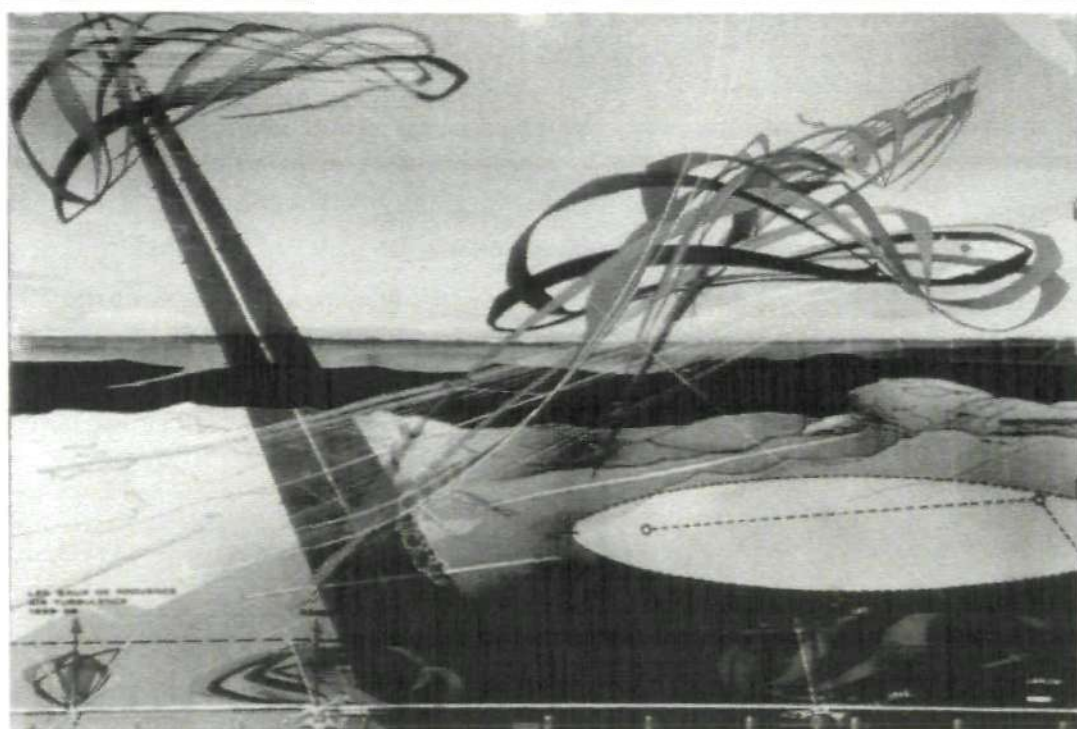
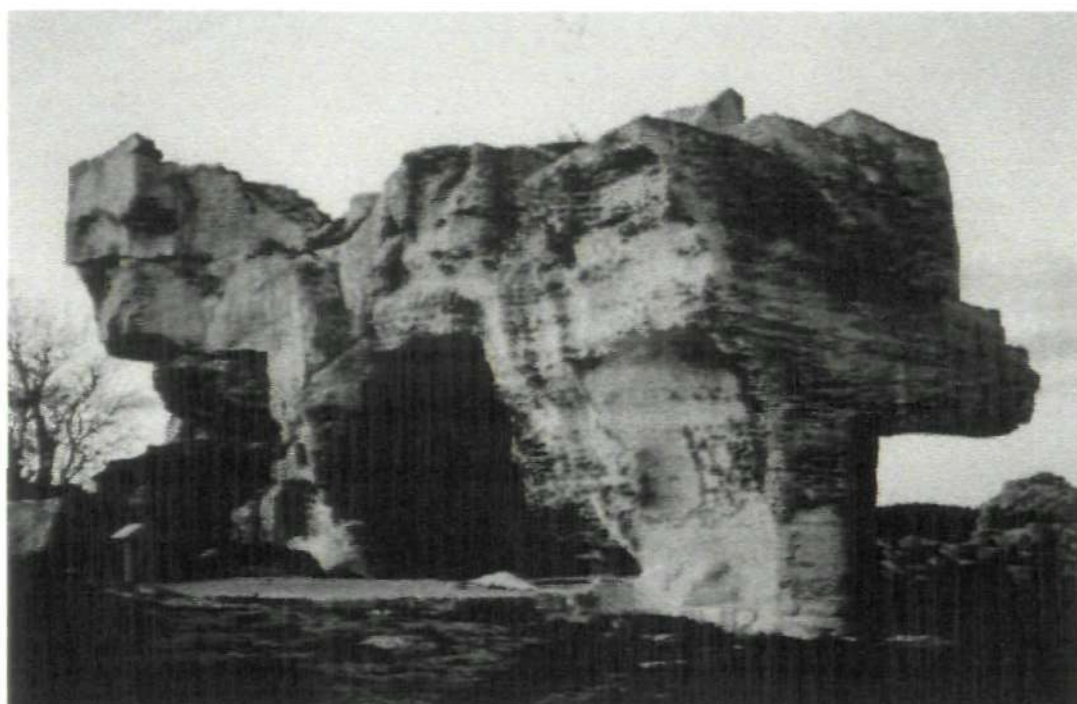


Figure 27-5. Photograph of broken rampart in Les Baux de Provence, 1999

Figure 28-5. Perspective view showing air turbulence, 1999

Air: Les Baux de Provence

On top of an isolated spur of rock, thrust out from Les Alpilles, and with steep ravines on either side, Les Baux de Provence is dramatic, beautiful, a shade sinister and melancholy. It is like tangled ruins, crowned by the wreck of a castle that seems to grow from the rock itself. The notorious wind of the Rhone Valley, the Mistral, blows for the most part between October and April. In winter the Mistral – its name comes from the Latin *magister* and means 'master wind' – can blow with tremendous violence. Icily cold, it screams down the Rhone Valley from the north-west, with gusts reaching 130mph, tearing out trees, stripping roofs and blowing away cars. But the Mistral also has its merits: it blows away clouds and dust, and keeps the skies of Provence crystal clear. In the past it was credited with preventing the fevers and diseases of the swamps of the Rhone delta from spreading up the valley, by blowing the miasmatic vapours out to sea. The Mistral is triggered by a set of specific meteorological conditions, one of which is the presence of a depression centred in the Gulf of Genoa. The cold air coming down off the Alpine peaks get funnelled into the Rhone Valley 'corridor'. It is at Valence that the wind gains strength and becomes the Mistral. The region is an impressive meteorological laboratory, an incandescent battlefield of meteorological conditions. This 'air turbulence' design sits on the edge of the spur of rock. The combination of high mountains and the surrounding flat delta leads to a dramatic contrast in air temperature and wind pressure. Atmospheric inversion and turbulent airflows are common, resulting in high winds. The energy that these airflows yield is captured by strategically sited ribbon structures. Initially the ribbon structures are compacted in thin slots forged into the rock. The devices are programmatically triggered at different wind speeds, whereby a release mechanism catapults the ribbon structure out over the rock face. The ribbons are made in an aerofoil shape so as to produce enough lift to support the weight of them. The shape of the aerofoil is determined from the different trajectories of the wind. The ribbons are made up of a series of wind volumes which can expand at various rates of movement, depending on the different wind speed, and pressure which is prevalent. Once the device has been catapulted out over the rock face, it calculates the wind speed and detects air pollutants and moisture content through a series of filters within the ribbon structure itself.

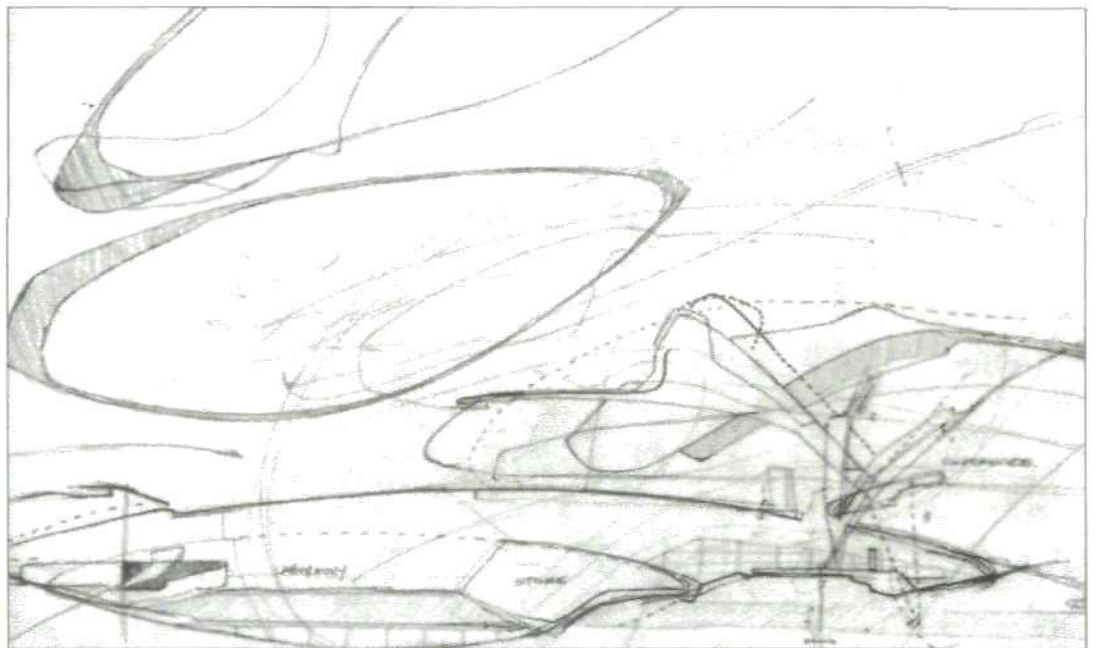
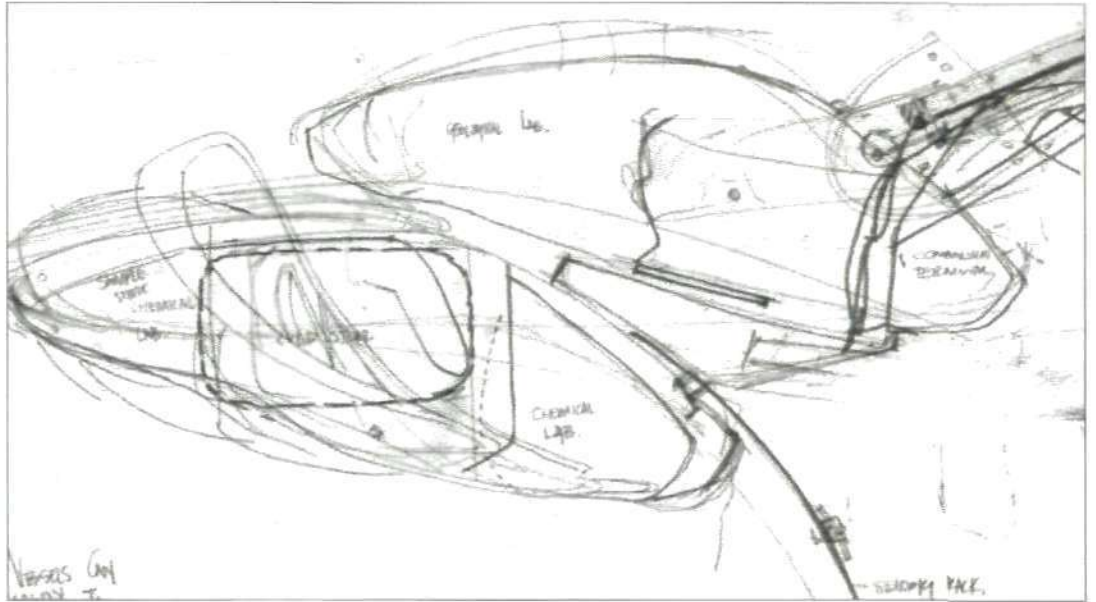
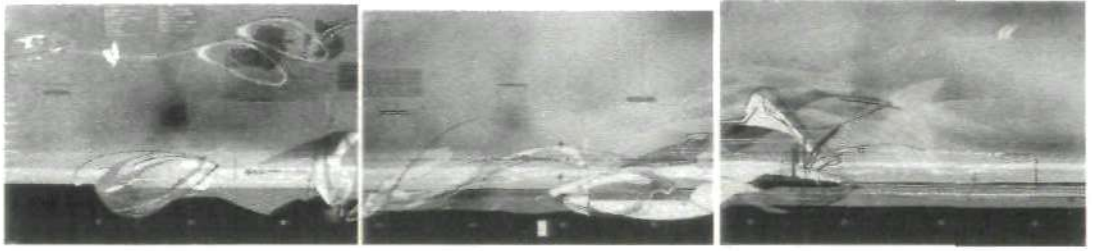


Figure 29-5. Top: Section through Ecological Research Facility, Camargue, 1999

Figure 30-5. Middle: Plan through the Ecological Research Facility, 1999

Figure 31-5. Bottom: Section through the Research Facility, Camargue, 1999

Condensation: Camargue

This node collates and condenses the data from the other nodes to become the hub of the ecological research programme. The sensations, movements and emotions generated around the Rhone Valley, and the data collected in the various nodes: These are ultimately channelled through this primary vessel.

There are a series of interactions, visual and kinetic between each of the nodes, blurring the threshold between the natural and artificial. This brief list views the potential of a distributed network within Water (N1), Earth (N2), Fire (N3), Air (N4) nodes. The handrail on N1 vibrates as a response to any seismic activity occurring on N2. N1 is animated within parts of the floor structure in the exhibition space on N2. Wind pressure on N4 is regenerated with a series of miniature wind turbines of N2. Acoustic sensors within N3 are played real-time in the gallery on N1. Wind speed sensors on N4 are played real-time in the cave on N3. Acoustic sensors on N2 are played real-time on N1 and N3. Light levels on N3 changes the intensity of the silicon glow in cradle on N1. Wind speed sensors on N4 are translated down the phonoscope visually on N1.

Nature evolves its own fluctuating systems in which diverse ecological phenomena combine to create a fluid whole. What I have aimed to achieve is to develop an architecture as a *machinic phylum*, as expressed by Deleuze and Guattari (Deleuze and Guattari, 1988: 409). Thus, the natural becomes apart of the cultural potential of modern technologies. The architecture learns to respond and conduct a dialogue with the environment. This understanding enables the user to be plugged into the system at the nodes, the focal point, and the hub of the intervention. Elemental forces caress and tease the user with gently fluctuating movements. Yet a shocking contrast is experienced when the system suddenly reaches critical threshold. The potential energy of these environmental forces manifests itself in violent and exhilarating disturbances in the tectonic and spatial fluctuations of the architecture.

The nodes discussed in this project are highly specified and intimately linked to each other in a complex web of feedback loops and retro-sensing devices. The environmental and artificial disturbances create windows between each node on the mesh network. It is not the real environment; not even with the object remembered, but a third one imagined.

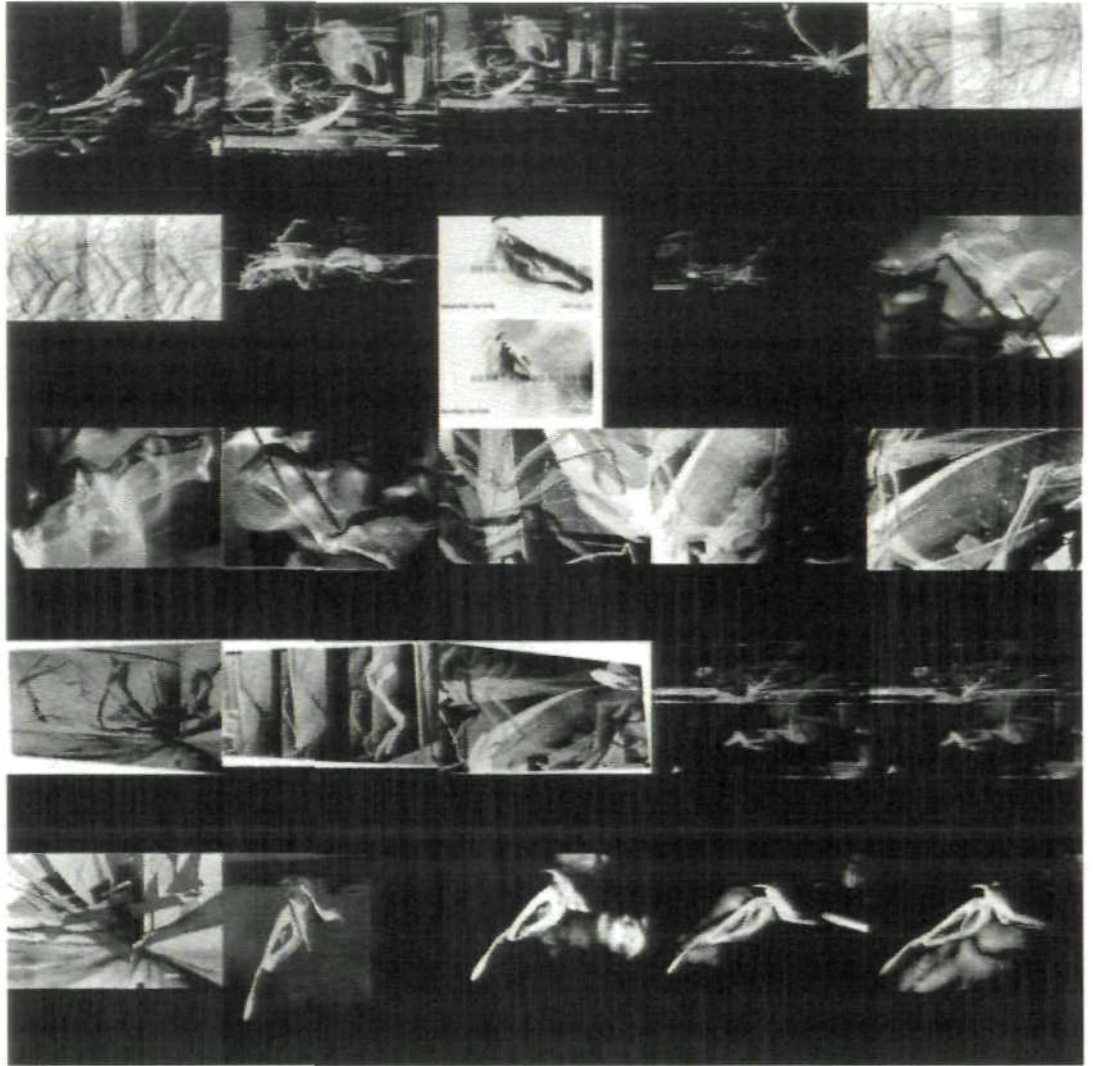


Figure 32-5. Perspective of the Archulus system, 2000

Archulus posits a new landscape at the point where the local river meets the sea at Aldeburgh. The river is separated from the sea by a small spit of land which is prone to the rapid erosion; one day soon the spit will suddenly disappear and the coastline will flood. The proposition creates a series of almost cocked and loaded pieces that suddenly at the moment and point of breach explode into action. This landscape creates a new surface for plant and animal colonisation. The flood shields resonate in the territory of harpooning landscapes linked to each other through an enchanted tectonic loom embroidering and weaving spaces. Through the transitional territories of working drawing, participant and environment, Archulus explicitly injects and infuses its own agendas. The movement of waves, tidal imbalances and currents shape the ever-changing Archulus profile. The relationship at the neck of the spit between the water depth in the river and the sea will act as the source of power.

The coastline of Aldeburgh is a delicately balanced interface between man, sea and river, subjecting itself to many geo-physical processes. These processes operate over a range of time scales, from short-term fluctuations to long-term changes over thousands of years. Archulus is thus a consequence of recurring floods on the east coast of Suffolk, which has lost more than one metre a year for the last 400 years. The project straddles this transitional interface and explicitly injects and infuses its own agendas. The movement of waves, tidal imbalances and currents shape an ever-changing Archulus profile.

A model is constructed by using a set of derived values from the landscape – through temperature, humidity and salinity levels – of the real world and from the data and processes of the virtual world.

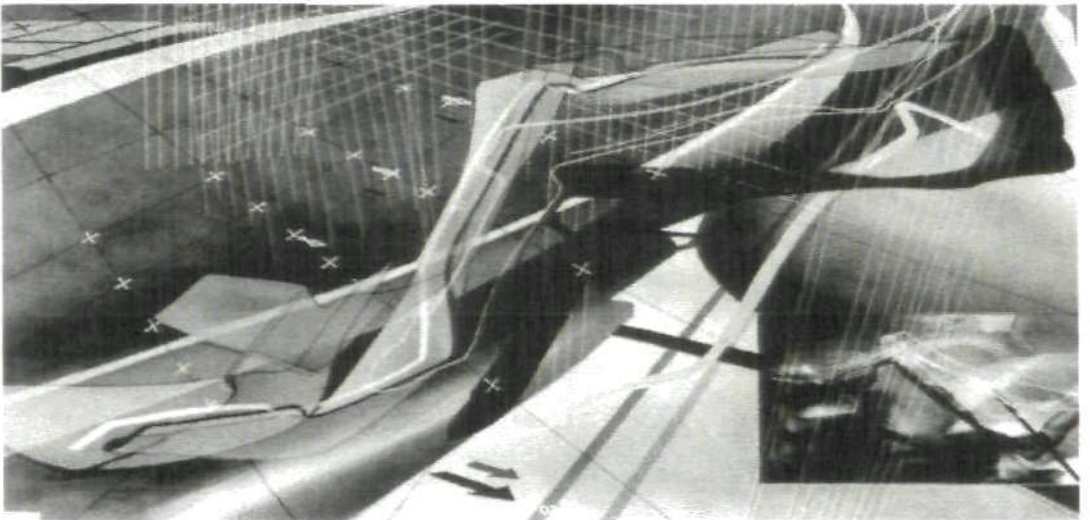
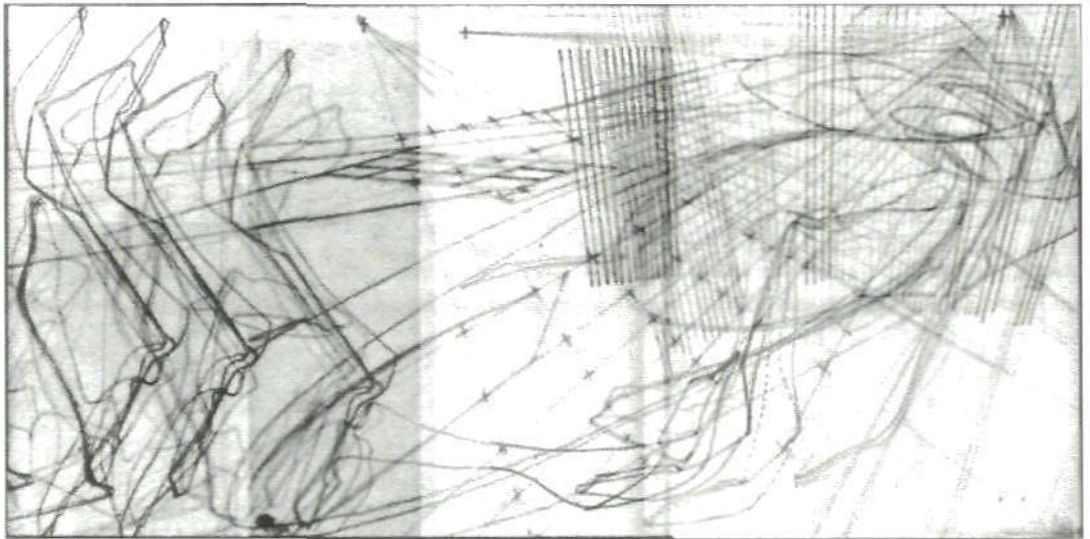
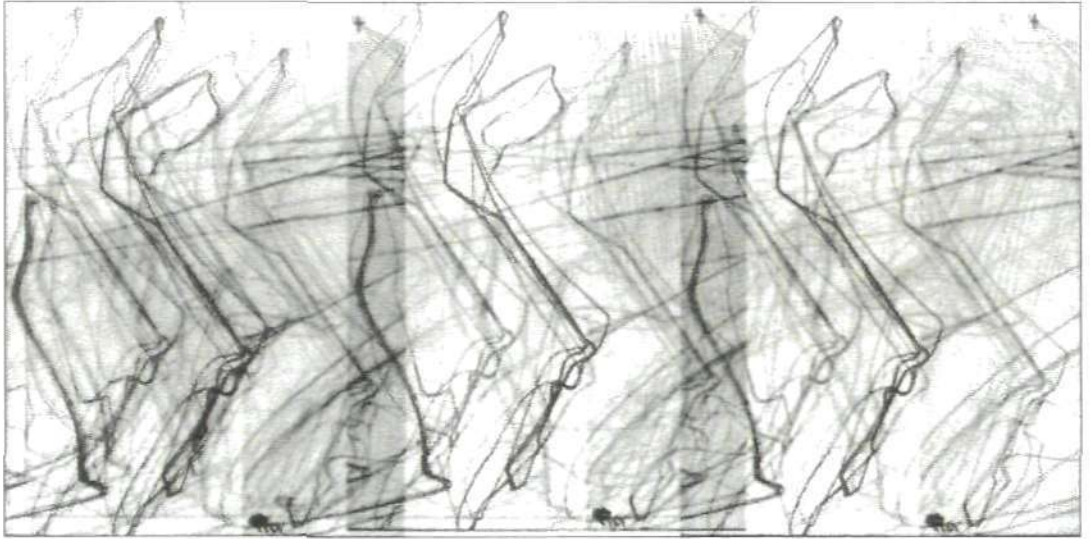


Figure 33-5. Top: Section and plan of Flood Control Structure, 2000

Figure 34-5. Middle: Time-based drawing of the shifting Flood control structure, 2000

Figure 35-5. Bottom: Orientation drawing of the flood control structure, 2000

Flood Control Structure

Woven fibre-optic cables and circuitry flex with the movement of the structure. Filters reduce unwanted nutrients: they dissolve gases, phytoplankton and waste, and pathogens, which consume large amounts of oxygen. Mechanical aerators inject supplementary oxygen to the flood control structure. Agricultural limestone and burnt lime adjust the acidity level of the water. A shotgun mechanism positioned at the base of the flood control structure fires out the turbulence voids during flood tidal conditions, whilst buoyant chambers aid the movement of the flood shields.

These shields run along the length of the coastline that rapidly reconfigure after flood tidal conditions. This reflex results in a catalytic task space, which consists of a series of dynamic frames and shifting horizons in between the flood shields. These shields shift at varying time scales, depending on the archaeological, geomorphological and daily processes acting on the site. The positioning strategy of the initial flood control structures were sited through the median of a hundred years of mapping the coastline territory between high tide and low tide. The shield form is generated through suspending this process of mapping onto a series of splinear time lines stretched out along the coastline then lofted together. These flood control structures are sensitive guides in a dialogue with the ever-changing coastline. They act as the arms of this enchanted loom, working with the natural phylum through the machinic to enable the flood control structure user to be apart of the environment through the readings of its pristine positioning in space. This lightweight structure filters nutrients as well as protecting and nurturing the advancement of secondary succession in the linked hyper polder.

In normal tidal conditions the shields are positioned in a low profile state – just a shimmering backdrop to events. But it is a surface of potential, carrying a latent charge, which may suddenly be released during flood periods. At the juncture of the flood shields is the nave that translates environmental stimuli from the surrounding landscape, and can dissolve into movement – supple fluidity or complex patterns. The translation surface responds to the landscape strategy, oscillating between solid and fluid. Within each nave is a suspended aisle that holds the archive of these communicating vessels from the turbulence voids, flood control structure and hyper polder.

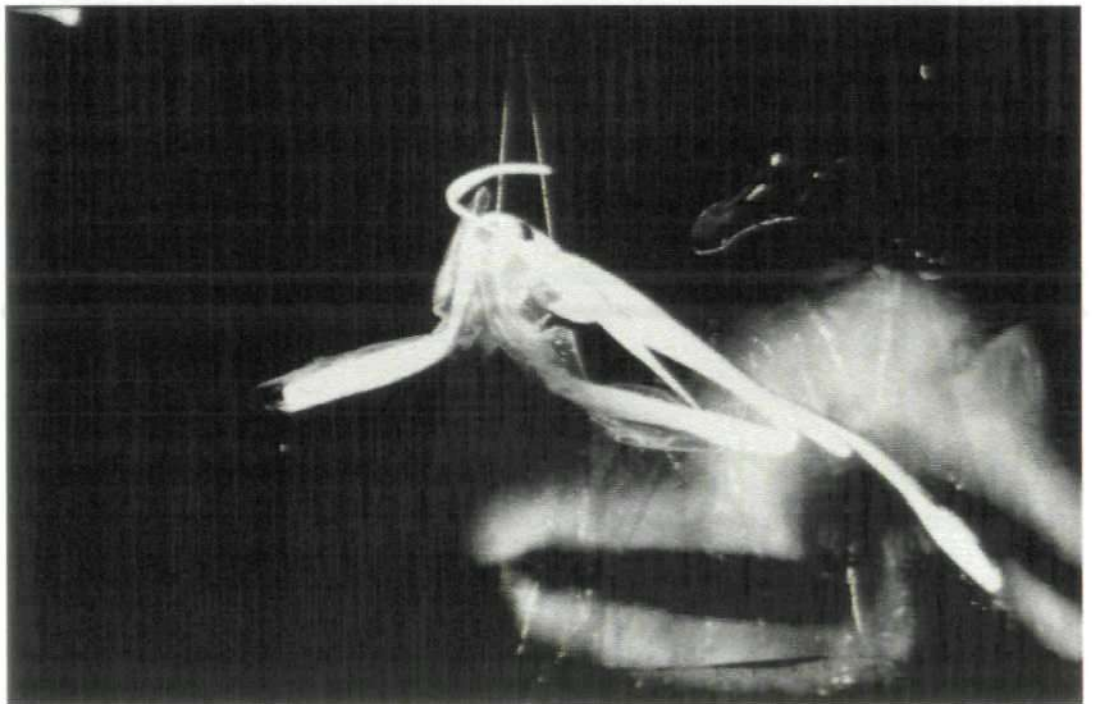
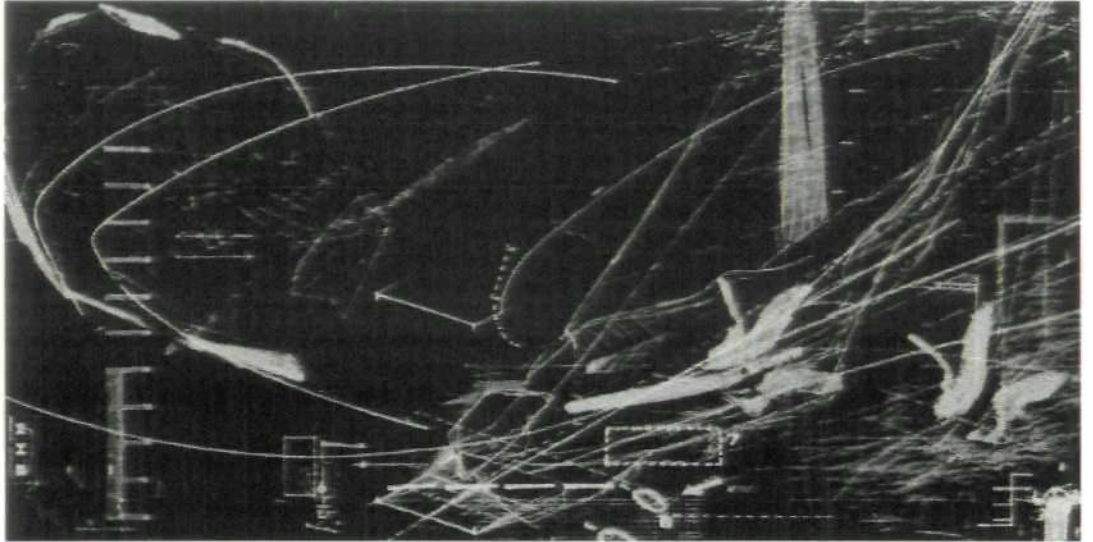


Figure 36-5. Top: Scanning and mapping the bathymetries of the coastline, 2000

Figure 37-5. Bottom: Turbulence void, 2000

Turbulence Void

The turbulence voids scan and map the territory of the seabed. Dark spaces and recovered, abstracted and observed. The processes of archaeology and architecture are used to strive for discovery of the old settlements and roman forts below the silted beds of the North Sea. Turbulence voids become the reader of this watery environment between working drawing, participant and environment. They are connected to the main flood control structure by a spool mechanism and have two main applications, one as a float structure and the other as a harpoon mechanism. As a float system the turbulence voids begin descending and drifting for ten days powered by the movement of the currents. Initially they scan the sea-bed floor for archaeological remains, lost churches and shipwrecks. The turbulence void registers these remains through acoustic positioning devices; every contour is scanned with a laser. As the turbulence void ascends, the information received can then be mathematically mapped and recreated in a virtual archive within the nave of the flood control structure. The device can move at varying speeds and trajectories, mapping these solids. It is trailed by a series of ribbons, which act as light buoys on the surface of the water to warn off any nearing vessels. As a harpoon mechanism the turbulence voids inflatable chambers are deflated in the keel during flood periods to take on this dynamic role. They skim at high speeds across the surface of the water soon after being released from the shotgun mechanism within the flood control structure. The tension builds up on the leads, and the whole structure is shunted forwards exposing a new hyper polder. The turbulence voids detect trace chemical impurities in the shallow sea, depicting a structure of certain propositional, but proposition is not clear; some parts extend like telescopes, revolve, or fold in on themselves. A flowering turbulence void has an interactive quality. It appears as a third life-form that goes through endless transformations and has no fixed total image.

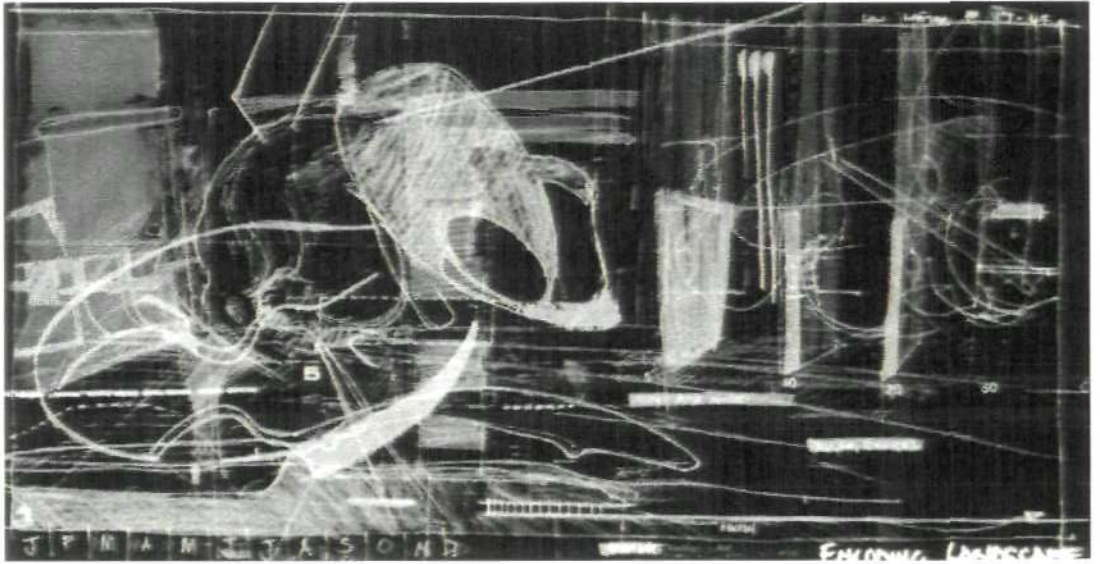
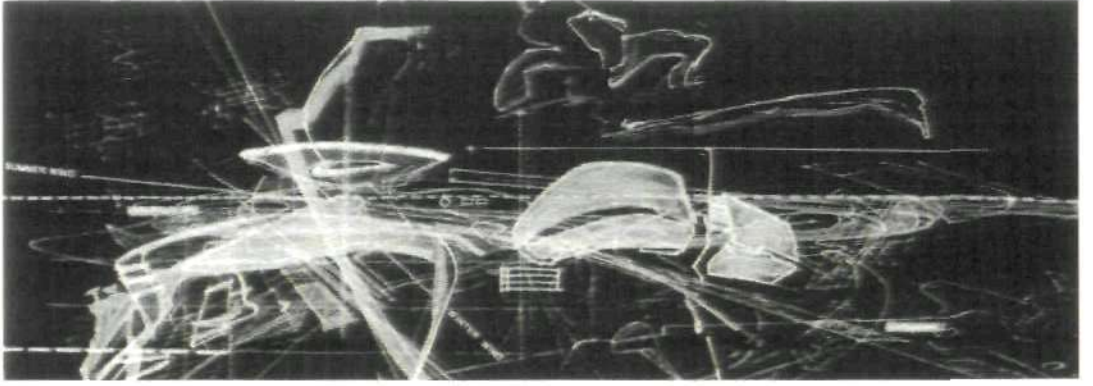


Figure 38-5. Top: Low slung perspective of the spatially woven landscape, 2000

Figure 39-5. Bottom: Visualisation of 5,10 and 15- year cycles of environmental data, 2000

Hyper Polder

Colonisation on the Hyper Polder occurs during flood tidal conditions. It is encoded with a complex external skin which acts as a filter for future harsh climates. The surface is thin and taut, deforming according to stimuli captured from the environment, which may be deployed through active or passive sensors. It is linked in to the base electrical services of the objects, such that all electrical activity can feed into its operational matrix, allowing it to register any aspect of electronic capture. This reflex produces a near infinite series of changing permutations, which overlap continually, drifting in and out of sequence. Topological deformations render the surface a programmed landscape that not only has the capacity to fulfil the smooth functioning of the major programmes of aquaculture farming, but also to foster the emergence of new and unanticipated configurations of space.

The Hyper Polder formation takes place through secondary succession whereby a climax occurs when there is stability in transfer of material and energy in the hyper polder between plant cover, the physical environment and machinic phylum. This territory is initially uncovered for less than one hour in every twelve-hour tidal cycle. The Hyper Polder is under constant transformation through two zones of development on the coastline. Firstly, the slob zone, which is four hours, exposed everyday to the air every twelve hours and receives new sediment every day. During the rest of the time this zone is waterlogged to the exclusion of oxygen and has a high Ph value. Secondly, the sward zone, which is four hours, submerged everyday to the air every twelve hours and receives new sediment every day. A topological deformation in the Hyper Polder surface may remain where seawater is trapped then evaporates leaving salt pans. In the deformations the salinity level is too great for plants to grow. If 'disturbing territories' has emerged, it is the result of the journey towards it; were the journey to be made in reverse, the territory would revert back to the image of its incorporeal antecedent. What matters most in the architecture are not the ideas as such but their resonances and suggestions, the drama of their possibilities and impossibilities. It becomes an architecture in search of physical form, but one derived and controlled by the physical stimuli of this unique local environment. The work becomes the intermeshing of differential local stimuli in various natural environments, as control factors for the construction of architectural environments.

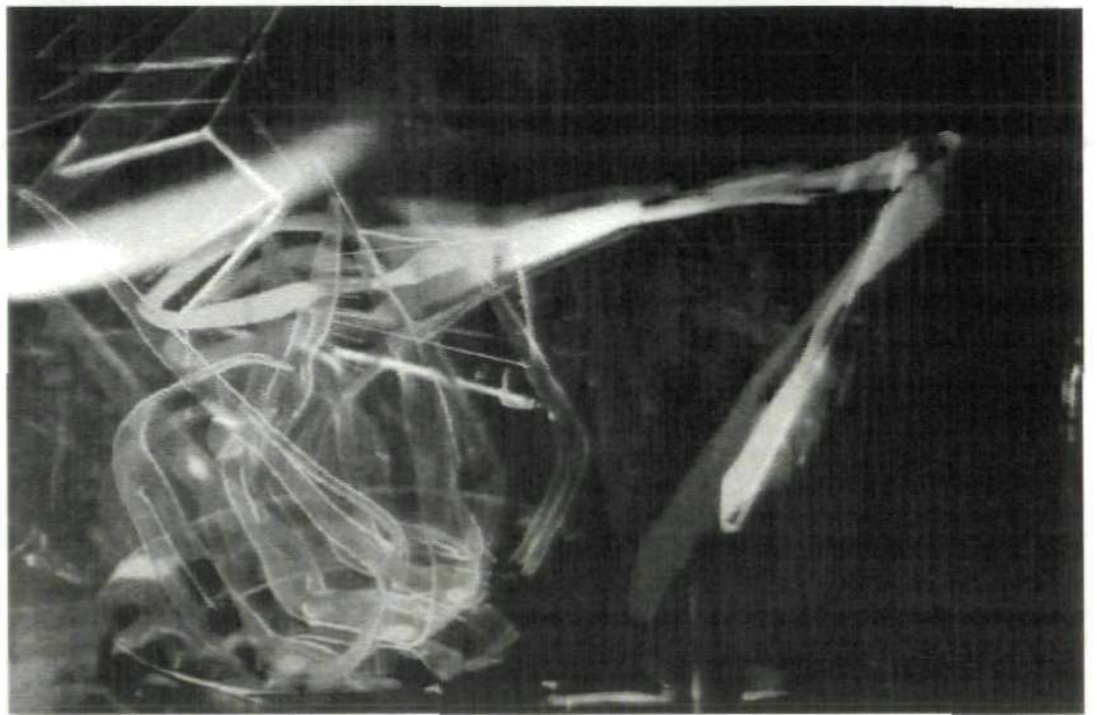
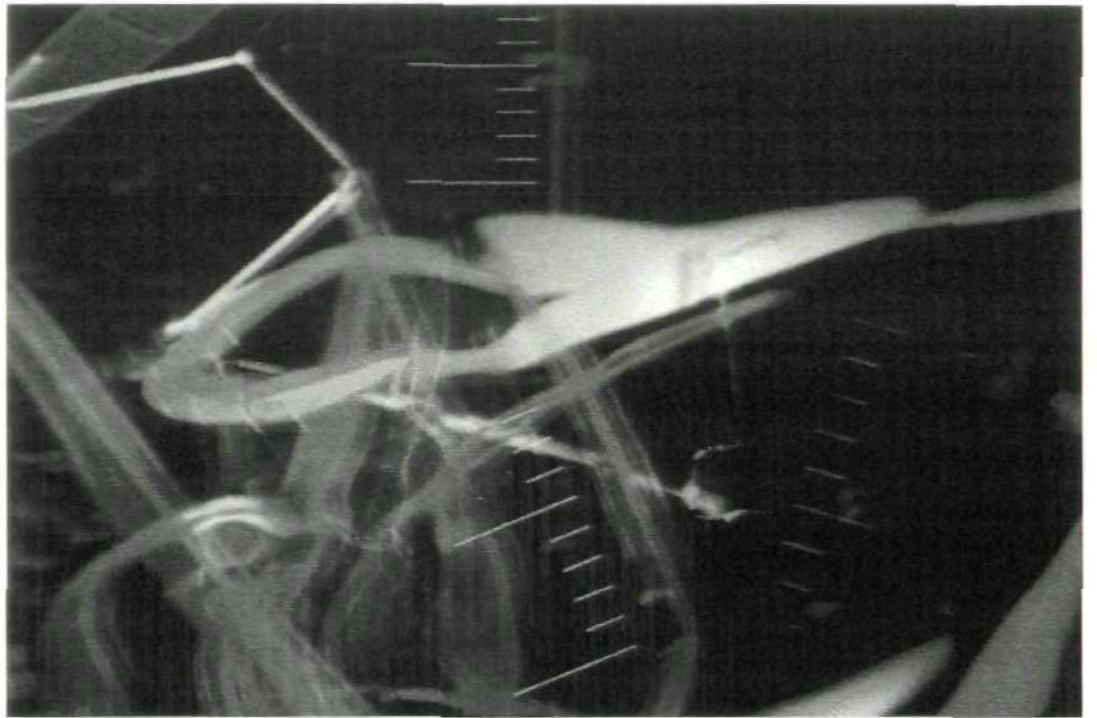


Figure 40-5. Top and Bottom: Darksoul Collective, 2001

The work is a piece of sculpture with no dialogue, through a fixation of characters in space; you become the 'entered apprentice' in this non-linear narrative. It is a huge motile sculpture, working on the very edges of form, moving with greased abandon between categories such as installation art, rock videos and contemporary dance.

Deep in the dark depths there are dragons, and their fire is a beam of red light. Like military sniper scopes, the dragon's red searchlights allow it to see without being seen, except by other dragons equipped to pick out their secret signals. The red light allows them to hunt unseen and find prospective mates without alerting their own enemies. This serves many purposes: to attract a mate, seek out or lure prey closer, or frighten off potential attackers. A bright flash of light can blind an approaching predator used to dim light, perhaps for long enough to make a getaway. Things only emit light when something does something, when there is an interaction between dragons. But just one interaction - a dragon blundering into another, for instance can set off a chain of flashes and twinkles.

A dragon looking upwards could see shadowy silhouettes of other characters moving overhead against the dim light above. Some characters can make themselves invisible by counter illumination, giving out light of matching intensity along their bellies.

These images show the dragons as they bask in dark spaces of the sea. These dragons fire is in fact a beam of red light that shines from a lamp beneath each keel. Like military sniper-scopes, the dragon's red searchlights allow it to see without being seen, except by other dragons with lights equipped to pick out their secret signals. The red light allows them to hunt unseen archaeology and find prospective territories. They only emit light when something does something, when there is an interaction between organisms. But just one interaction - a turbulence void blundering into another, for instance - can set off a chain of flashes and twinkles.

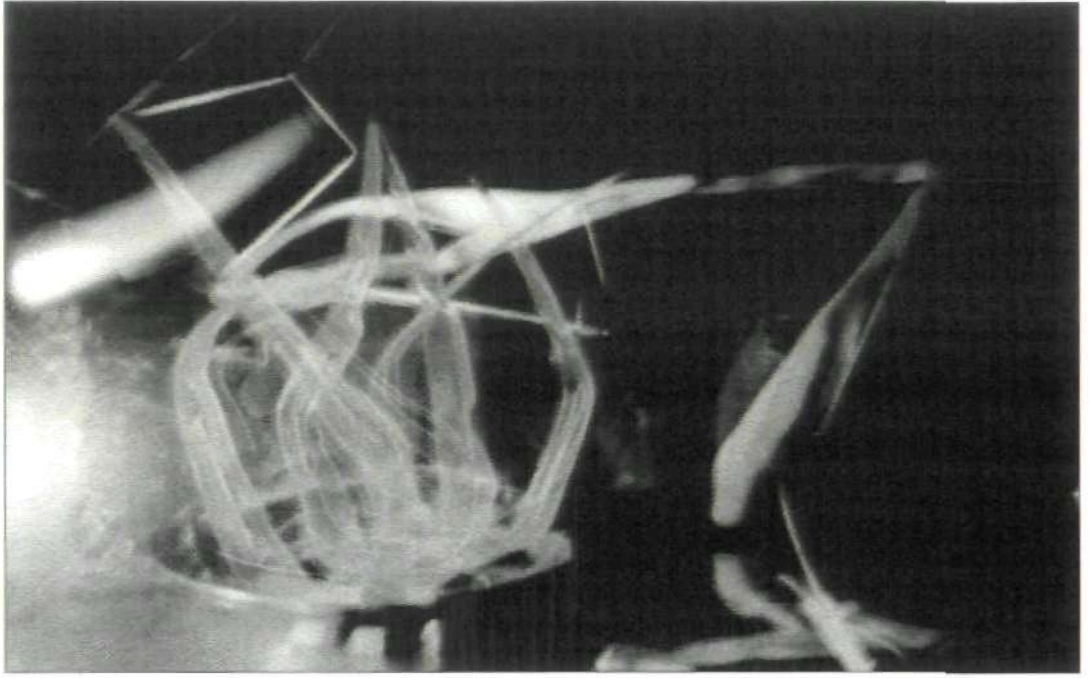
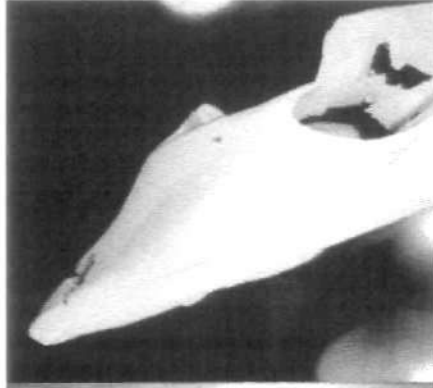


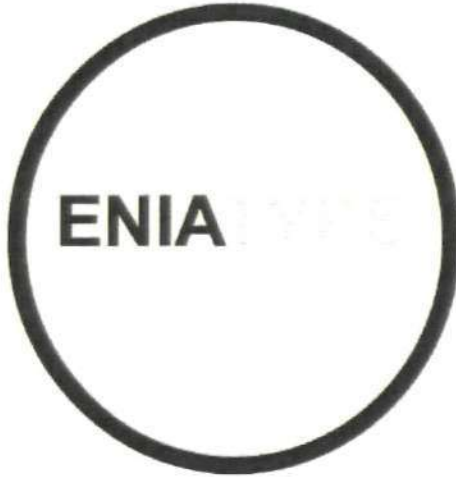
Figure 41-5. Top and Bottom: Darksoul Collective, 2001



Figure 42-5. Darksoul Collective, 2001



DESIGN VISIONS



- 6 **Why Now?**
- 7 **Where do we want to go?**
- 8 **Where to Start?**
- 9 **Approaching Enia: Basque Enia, Beijing Enia**
- 10 **Principles of Design Ecologies,
Theory of Notation, Instructional Design
and Aesthetical Strands**

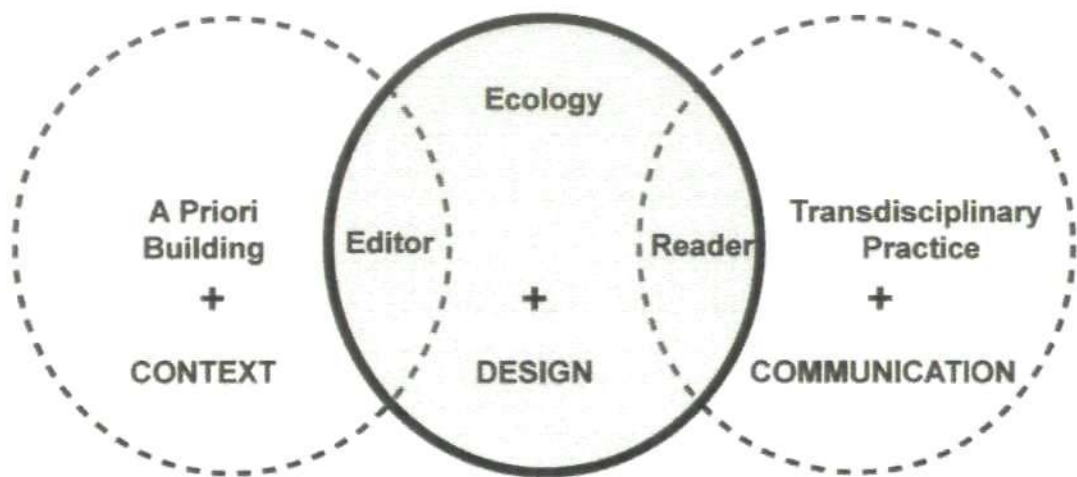


Figure 1-6. Diagram of Thematic Integration: Focus on Ecological Design, 2010

6. Why now?

Through the projects that I will be discussing in this thesis I will reveal that architectural education has failed to acknowledge the determining function of the ecology in design in the making of meaning. As such current methodologies can be regarded as a disavowal and harbinger of technologically facilitated interaction as a tactic for engaging with some of the more difficult aspects of architecture as complex and contingent.

What intellectual moves are necessary for the architectural profession to talk about ecology in terms that have some continuity to their history? Proceeding from the assumption that architectural design is an autonomous intellectual engagement played out through the interpretation of ecology as an artefact. This thesis identifies how this is a critical moment for architectural designers, who appear to be unable to respond to a problem of the apparent disconnection and the progressive displacement of the participant in reference to ecology. The way that this has been constructed has not only impacted on design solutions but has led to a particular understanding of ecology. It is this understanding of the artefact which has become no longer sustainable and precipitates the crisis. The thesis argues that by revisiting the working drawing as a mutable consequence of culture it is possible to relieve the problem by opening up the scope for finding new methodological approaches. These can be used to develop design strategies that are sufficiently subtle and coherent in their terms, to engage with the open complexity of future discussions of the distributed and enacted human within the scope of Eniatype.

Felix Guattari and Gregory Bateson have extended their definition of ecology beyond merely environmental concerns to include human subjectivity itself. Guattari's concept of the three interacting and interdependent ecologies of mind, society and environment stems from the outline of the three ecologies presented in cyberneticist Gregory Bateson's book entitled *Steps to an Ecology of Mind* in 1972. Bateson suggests 'ecology' must stop being associated with the image of a small nature-loving minority or with qualified specialists. Ecology in Guattari's sense questions the whole notion of subjectivity and capitalistic power formations, whose sweeping progress cannot be guaranteed to continue as it has for the past decade (Guattari, 2000: 35).

Guattari's focus in *The Three Ecologies* is his conception of 'ecosophy'- the three related ecological registers of environmental ecology, mental ecology and social ecology, and their amalgamation into a methodological practice. Guattari's argument is that we have an erroneous conception of ecology, of environmental struggle, and that only by broadening our views to include the three ecological registers will we be able to affect any enduring changes in our social, cultural and natural environment. Guattari clearly points out that

'structuralism and post modernism have accustomed us to a vision of the world drained of the significance of human interventions' (Guattari, 2000: 28).

The objectives of the new ecological practices is not a question of changing one model or way of practicing architecture for another, but of 'responding to the event as the potential bearer of new constellations of universe of reference' (Guattari, 1995: 18). The paradox is this: although these universes are not pre-established reference points or models, with their discovery one realises that they were always there, but only a singular event could activate them. The best architects don't repeat themselves: they start over and over again from scratch, uncertain with each new attempt precisely where the next experiment will take them. But then, suddenly, spontaneously and unaccountably, as the painter Francis Bacon has observed, 'there comes something which your instinct seizes on as being for a moment the thing which you could begin to develop' (Sylvester, 1987: 54).



Figure 2-6. Image of the website for Design Ecologies Journal, 2010

6.01 Design Ecologies

<http://www.intellectbooks.co.uk/journals/view-Journal,id=197/view,page=0/>

In 2010, I became the principal editor of a new academic design journal entitled *Design Ecologies*, for Intellect Publishing. The Journal will foreground the inextricable connection between human communication and ecological accountability in architectural design. This burgeoning field has the potential to become a far-reaching discipline, bonding a community that crosses over into and out of architecture, environment, interaction, urbanism, and performing arts and communication. Through original design exploration ranging in scale, the journal will proffer a critical vision towards the built environment, and promote ecological transitions within local and global contexts. It will challenge the everyday emerging practices of architectural design by offering a transdisciplinary framework for design production.

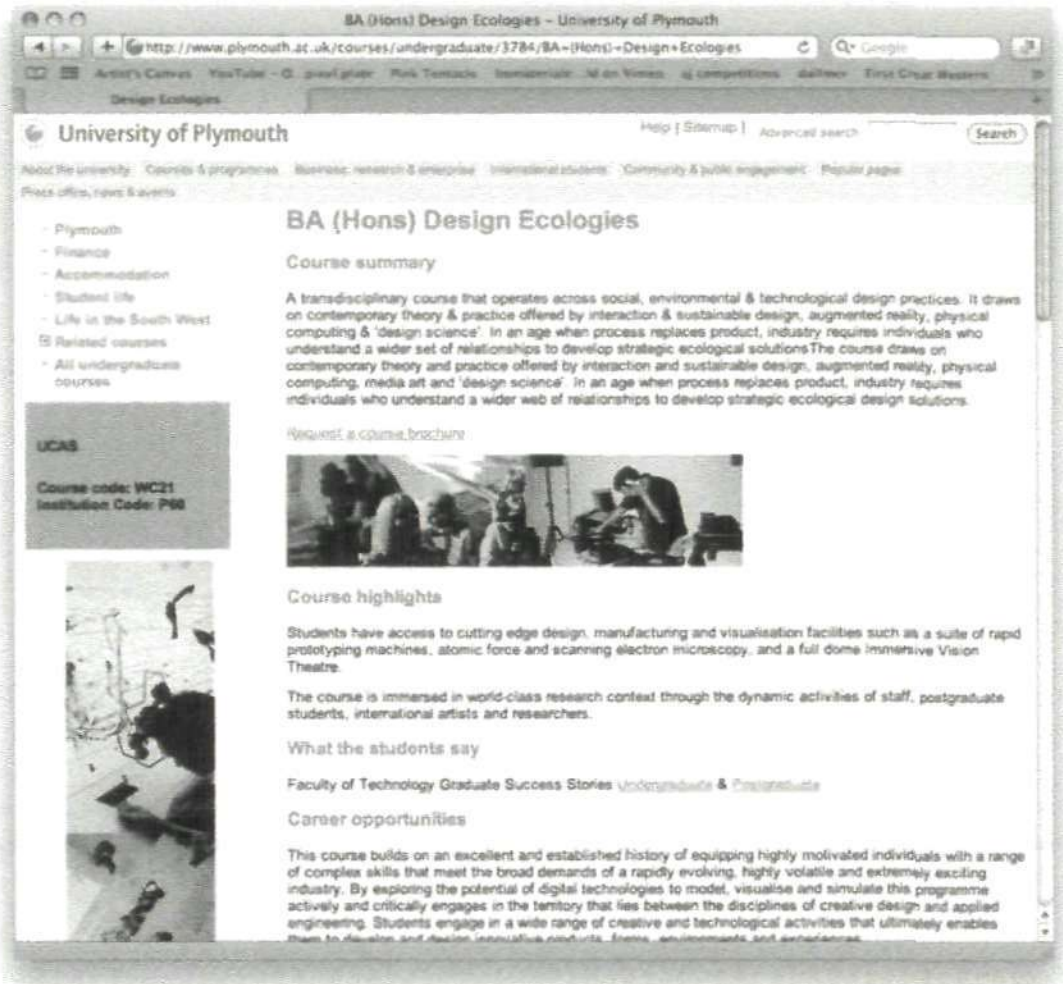


Figure 3-6. Image from University of Plymouth website, 2010

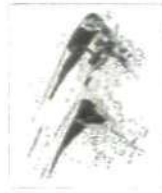
6.02 BA/Bsc Design Ecologies

[http://www.plymouth.ac.uk/courses/undergraduate/3784/BA+\(Hons\)+Design+Ecologies](http://www.plymouth.ac.uk/courses/undergraduate/3784/BA+(Hons)+Design+Ecologies)

I was involved in defining and structuring a new undergraduate degree program for the University of Plymouth. The BA/Bsc course entitled Design Ecologies was approved at the University of Plymouth in November 2007. The BA/BSc Design Ecologies is a transdisciplinary program that operates across related ecologies of environmental, mental and social design practices. Through digital and analogue processes, participants use cutting-edge technologies to creatively explore emerging concepts of the material world, such as the 'new' immateriality offered by bio-engineering and nanotechnologies. The course draws on contemporary theory and practice offered by interaction and sustainable design, augmented reality, physical computing, media art and 'design science'. In an age when process replaces product, industry requires individuals who understand a wider web of relationships to develop strategic ecological design solutions. Design ecology challenges the designer to design connections to the site and to the sites resident energy – to design holistically and connectedly and address the needs of the building and the environment and community of which it is apart. To design ecology is to integrate the design into the ecology of the place – the flows of materials and energy residing in the community. By ecological, we mean taking into account the structure, activity, and interactions of all meaningful participants in the environment affecting the designed system. As with studying an ecosystem, how do we observe an innovation environment to identify the elements of "design ecology"? How do we find, study, or measure the tools, practices, social systems, and economies for innovation?



Apriori model 01



Apriori model 02



Apriori model 03



Apriori model 04



Apriori model 05



Apriori model 06



B Construct

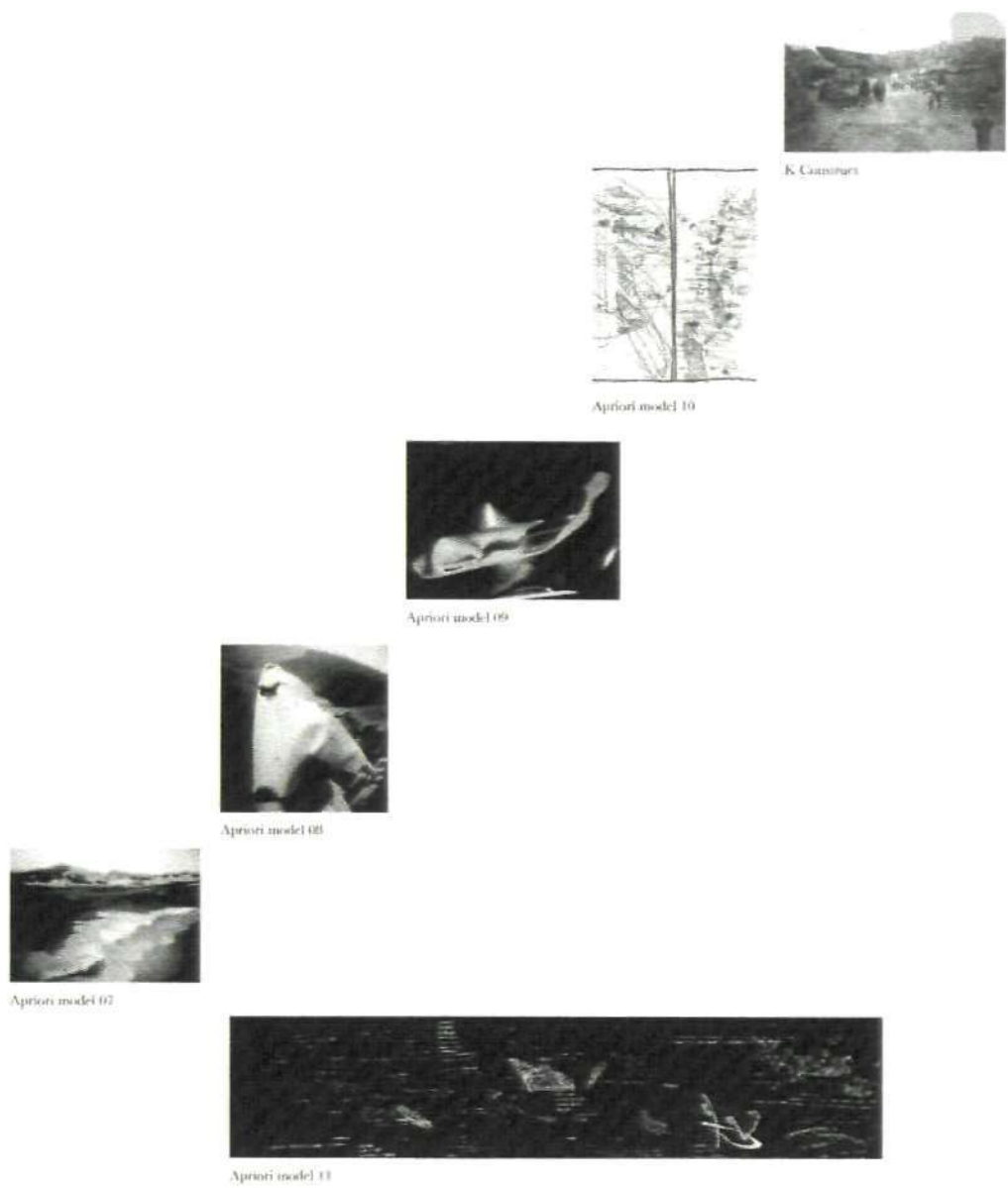


Figure 4-6. Overview of all practice methodologies developed to date, 2010

At the moment we lack suitable theories for the immanence of how we might design ecological architectures in our near future. There are many organisations out there telling us what the rules are in designing and branding ecological projects, for example, Building Energy Ratings, Scottish Ecological Design Association (SEDA), Association for Environment Conscious Building and UK Green Building Council. These organisations use somewhat reductive models that limit the architectures capability to respond to the environment.

The practice methodologies I have developed derive from the following areas:

1. The use of thirteen research design projects from my own practice. Examples are *a priori* model 01, *a priori* model 02, *a priori* model 03, *a priori* model 04, *a priori* model 05, *a priori* model 06, *a priori* model 07, *a priori* model 08, *a priori* model 09, *a priori* model 10, *a priori* model 11, B Construct and K Construct. All these research projects explore the relationship between working drawing, participant and environment within context, design and communication. The methodologies of exploration involve the use of notations that are characterised by levels of logical types (Whitehead and Russell 1910) or communicational methodologies (Bateson 1972).
2. Through practice research and design at Alsop Architects, Mass Architecture and John Coward Architects. The research methodologies developed were a way of exploring the tacit knowledge through the development of a project. The method of exploration involves the practice and value of the working drawing, the participant and the environment through the development of projects. These methods within professional practice are characterised by different communicational methods towards the development of form.
3. In the series of transdisciplinary research session completed in 2003-2009, I documented the relationships between working drawings, participant and environment through the development of the sessions. Within each session the participants were asked to develop design strategies for a project of their own making whilst using different technologies. These technologies ranged from the scanning electron microscope to the rapid prototyping of physical objects. The projects of the sessions bifurcated into multiple tracks, for

example, *notational* through drawing, *tacit knowledge* through communication and *reflexive* through installations.

4. Response to Theory and Practice. My aim is to critique the field in relation to process, to be able to move forward by stating that there is another thing that is important, which is the critique on drawing, which is imperative for an alternative agenda.

The *a priori* model is a model to visualise the relationships between working drawing, participant and environment within context, design and communication. It is a model composed of four-dimensional environments, three-dimensional objects, two-dimensional sketching. Each of the supporting images are different parts of the same model. The overall idea for the model is that an object is constructed through the full-blown spatial notational scheme; the physical model is then edited and re-edited over time as the spatial notations and influence of the participant's changes in the spatial flow of the environments over time. The influences of the working drawing, the participants and the environment change not only the spatial relationships of the environments but also the wider perspective of understanding the different levels of communication through the chosen site and the various logical types.

Following is a short description of all the *a priori* models used for the Bilbao Enia, Beijing Enia and the reflexive handrail projects. In *a priori* model 01 the physical model is continually reshaped by the influences of working drawing designs, participants in the field and the environmental shifts on *the* site. This model is the construction of the architecture through the environment. The physical model is in continuous transformation as it is shaped and reshaped by adding parts and extracting other parts through the changes in the working drawing, the participant and the environment. The model slides back and forth across the surface of the environment through the spatial notational field over time. Within the image of *a priori* model 02 it reveals the construction plane with all the real-time embedded notations. Through *a priori* model 03 it shows the construction plane of embedded notations within the Deba Valley context. *A priori* model 04 shows a physical model of the reflexive handrail surrounded by simulated temperature variants from hot to cold. *A priori* model 05 shows a full simulation model of the construction process. *A priori* model 06 reveals the reflexive handrail simulation. *A priori* model 07 shows an aerial view of the Alava plateaux. *A priori* model 08 shows a physical model hovering over the

source of the River Nervion surrounded by spatial notations. *A priori* model 09 shows a physical model of the cast from localised differentiations in the notational system. *A priori* model 10 is a sketch of the lotus leaf surface from the Yongding River in Beijing. *A priori* model 11 shows the ecotype model. K construct reveals the Kashgar construction site for architecture and the B construct image reveals the Beijing construction site for architecture.

The *a priori* models use different viewing angles and scale, as represented by the images, to show different levels of communication between the artificial model and the natural environment. The model can be rotated and analysed through different viewing angles and scale, to be able to analyse and view details of the relationship working drawing, participant and environment within context, design and communication.

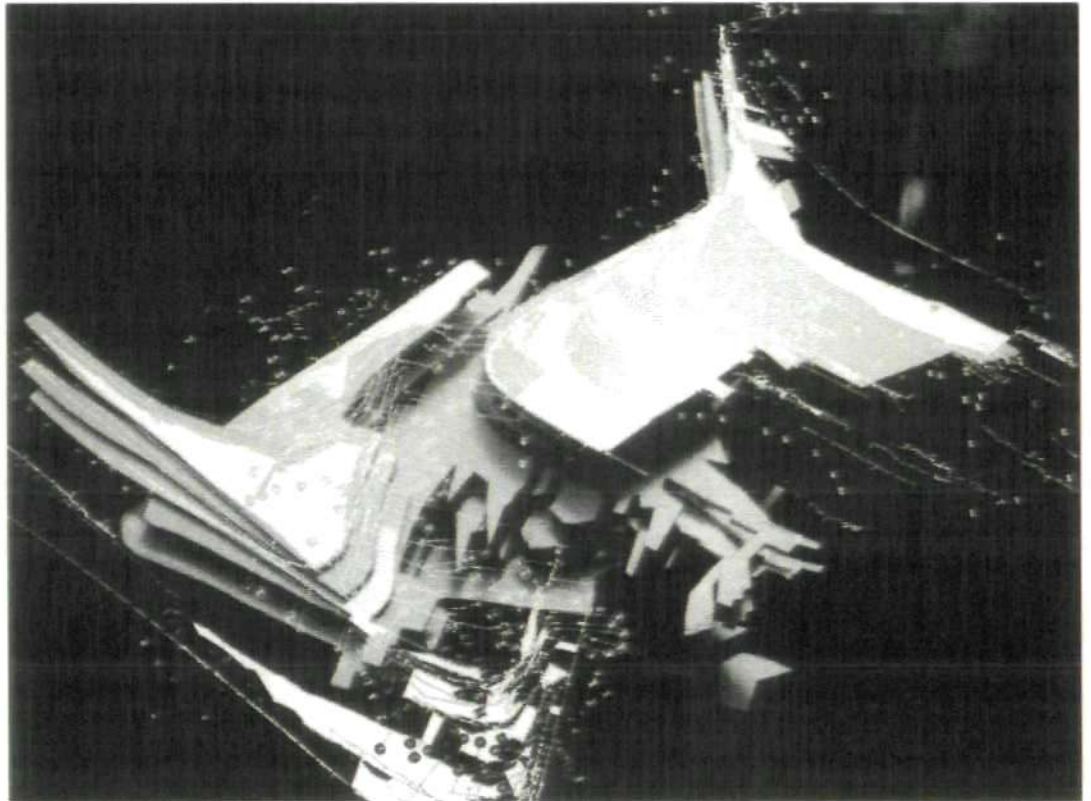


Figure 5-6. Image of *a priori* model 01, 2010

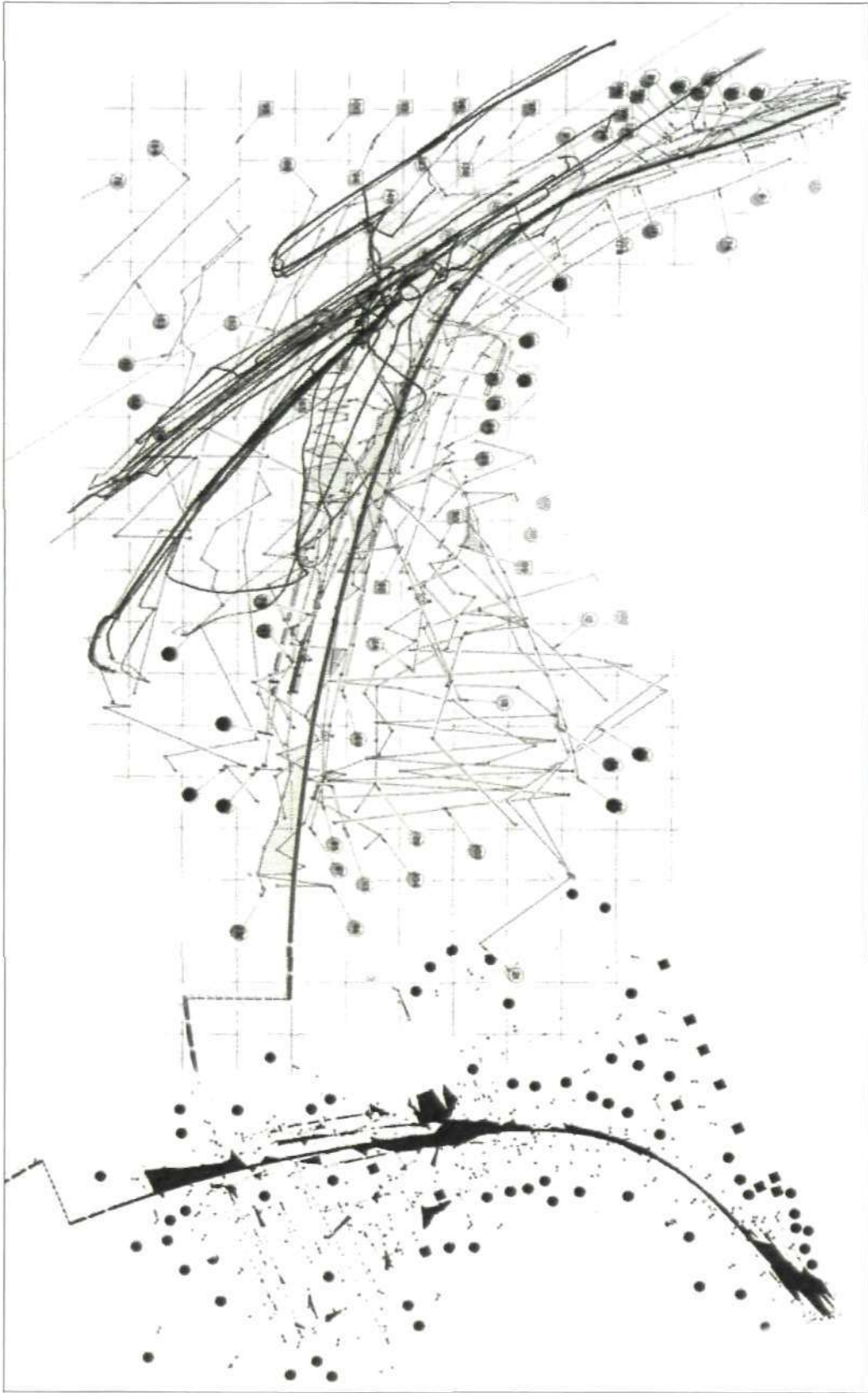


Figure 6-6. Image of a *priori* model 02, 2010



Figure 7-6. Top: Image of a *priori* model 03, 2010

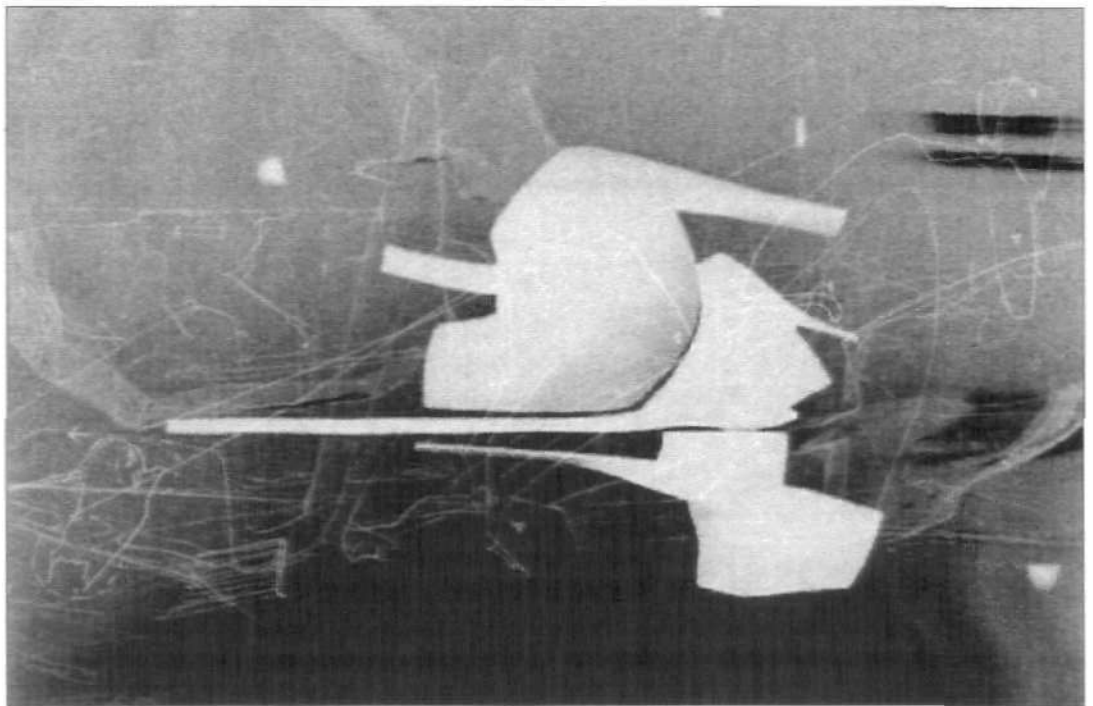


Figure 8-6. Bottom: Image of a *priori* model 04, 2010



Figure 11-6. Image of *a priori* model 07, 2010

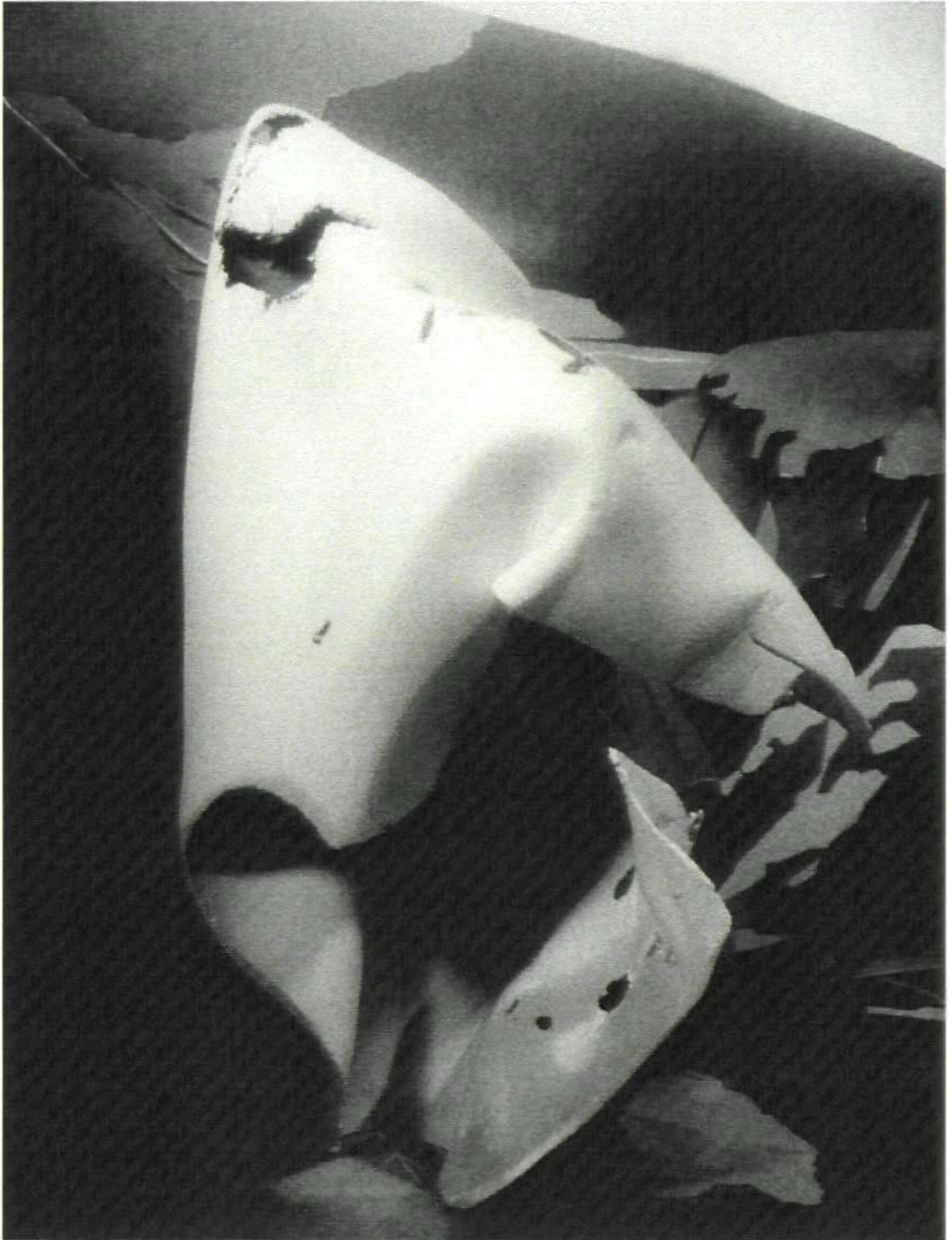


Figure 12-6. Image of a *priori* model 08, 2010

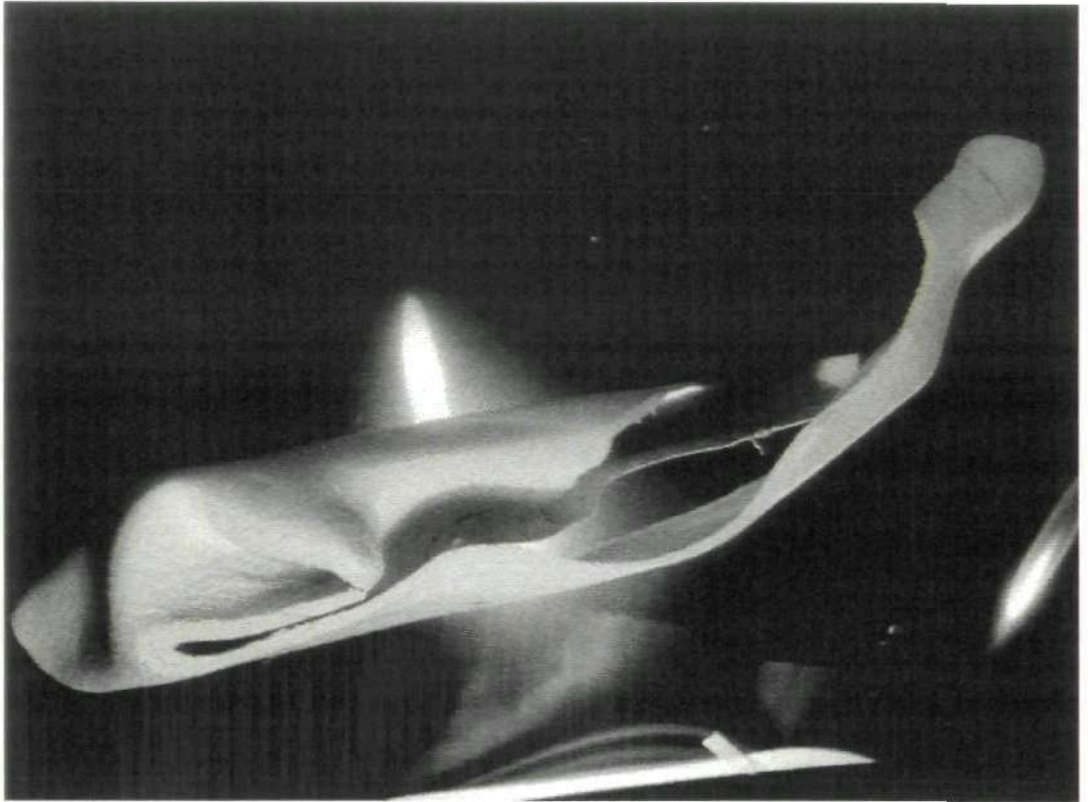


Figure 13-6. Image of *a priori* model 09, 2010



Figure 14-6. Image of *a priori* model 10, 2010

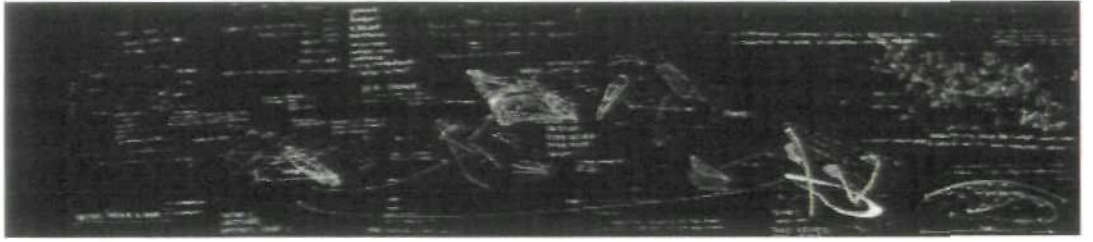


Figure 15-6. Top: Image of *a priori* model 11, 2010

Figure 16-6. Bottom: Image of B Construct, 2010

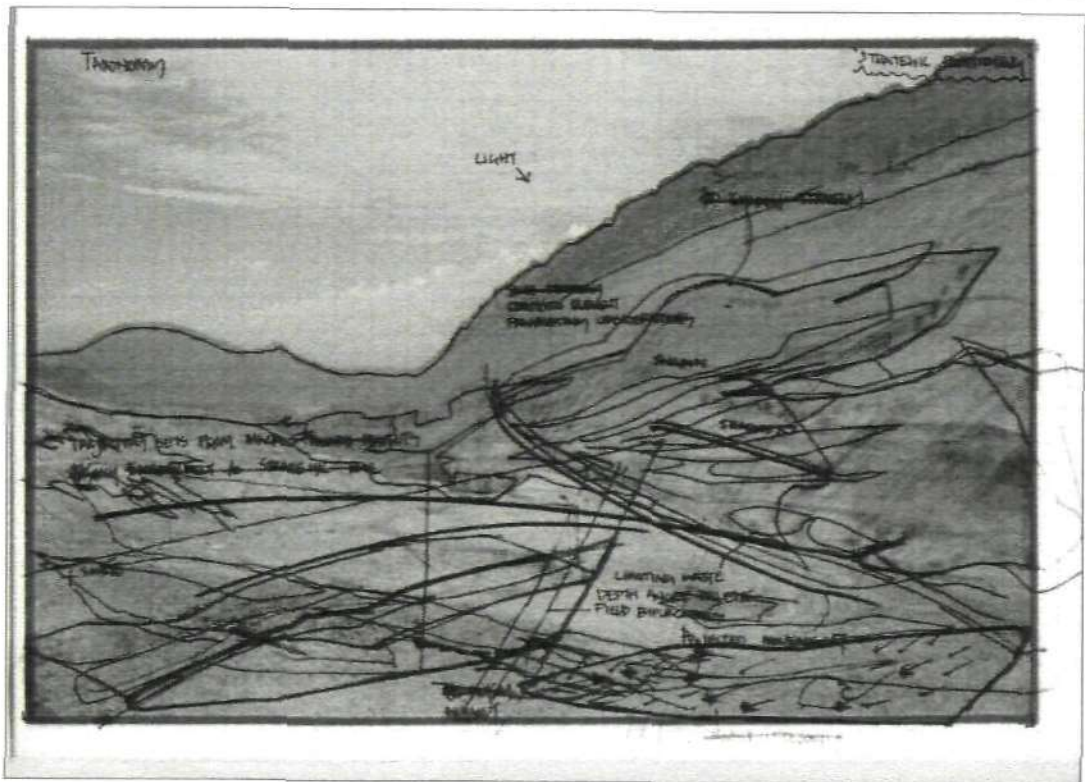
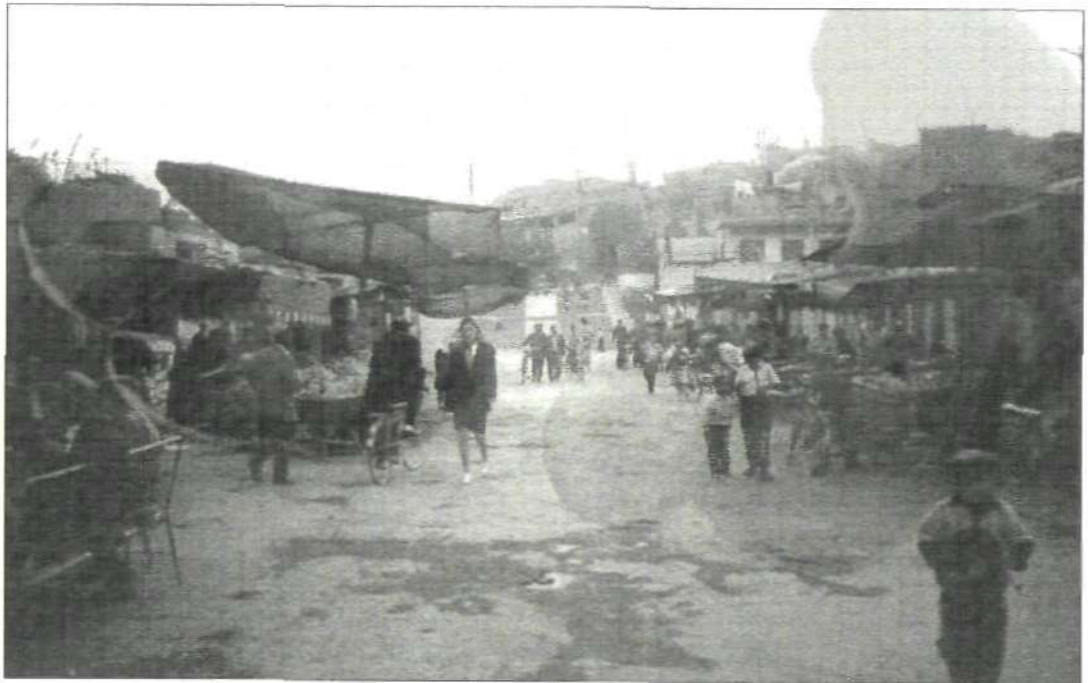


Figure 17-6. Image of K Construct, 2010

7. Where do we want to go?

The architecture that I am presenting will define the determining effects of interaction through systems of varying power, and will suggest a theoretical framework pioneering a 'notational model' (a 'notation' being elements in a specialised system) of interlinking research and design in a high-end computational architectural context. This approach incorporates the development of human-computer interaction design and its engagement with the research of the human occupant, the computerised system and with the design of their multiple interactions. The research explores formal aesthetics, material technologies and semiotics, whilst the design formulates their translations into reflexive, predetermining, spatial interfaces

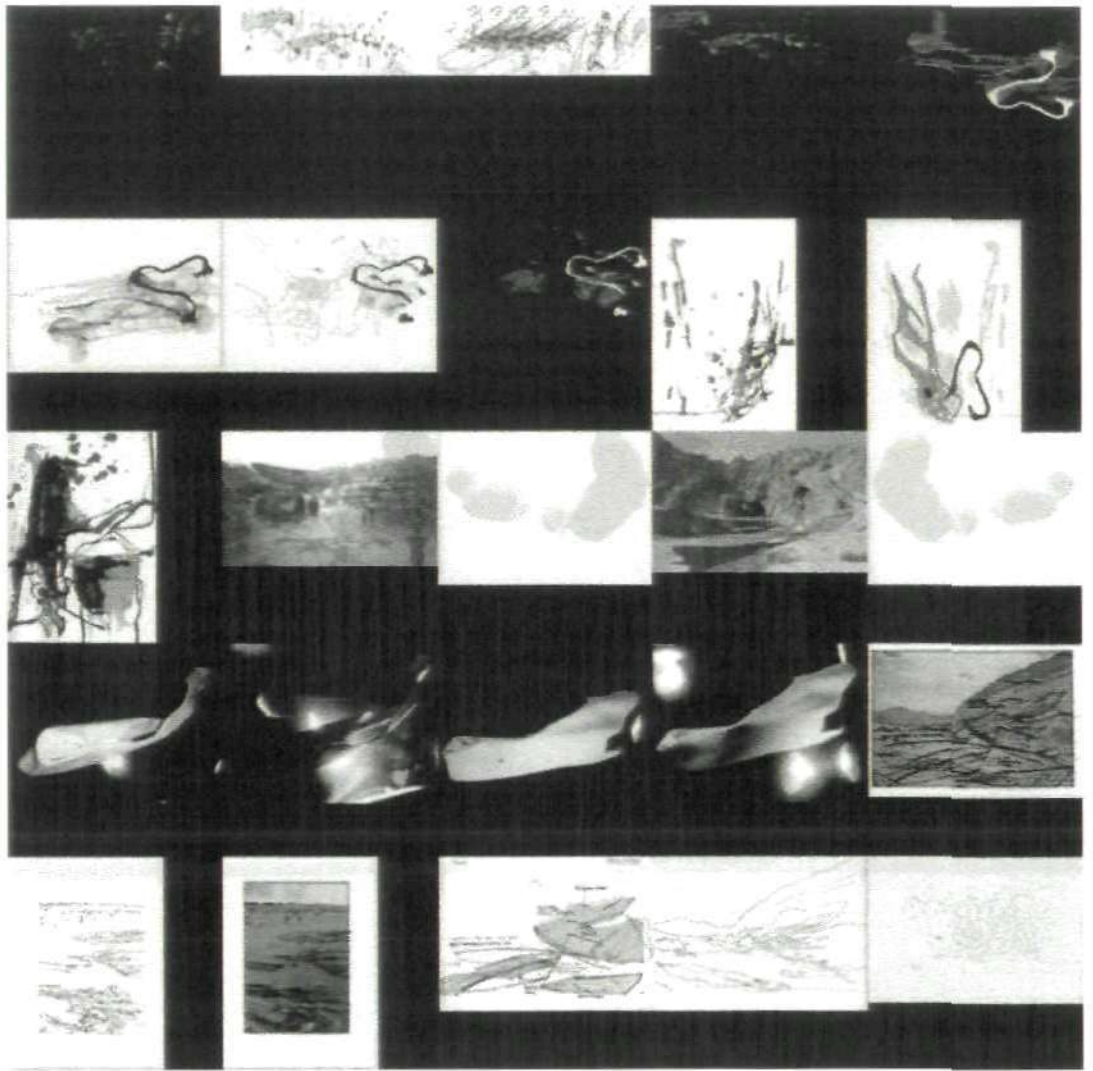


Figure 1-7. Thematic Integration: Focus on Notational Design, 2010

Concerning notation in architecture there are some questions often dismissed as annoyances. Notation implies a written system of notes and interaction. Notation offers entry to architectural space, structuring working drawing in a relationship with the environment. Notations are an instrument for navigation and organisation between working drawing, participant and environment. As architecture seeks to rediscover form, notations seek to occupy and interact from within architectural practice. Notation in the dictionary is defined as a system of symbols which have a dynamic value in composition. Because architects often use three-dimensional simulations, notations such as plans and sections are not enough to express ideas correctly and completely. Software and programming, as another kind of notation, help to communicate a wider range of qualities of architectural drawings. They explore and show fundamental aspects of designs in architecture which cannot be shown or experienced by means of other media. Notation should be used for the planning of architectural systems. In architecture the notations are usually used for translation between working drawing and building rather than working drawing and environment. This is a deficiency in the system of understanding ecology in architectural practice.

Researchers use standardised notational visual languages to communicate complex information in many scientific and engineering fields. A well-known example is the circuit diagram in electrical engineering. The first standard graphic notation for biology, called the Systems Biology Graphical Notation (SBGN), was published in the 8th August, 2009 issue of the journal *Nature Biotechnology*. In psychology, notation can serve two different functions which are not necessarily exclusive. One function is as a means to communicate the other is to enhance cognitive processing, for example, as a memory aid. Notations are not defined by a fence or line but are dynamic and transformative forever interacting with the boundaries between the natural and artificial. The fact that when working drawing can fully exchange information with natural phenomena, architecture's capacity for knowledge and communication would be far deeper and more extended than presently understood. It would also disturb the boundary lines of our individuality – our very sense of separateness with the built environment.

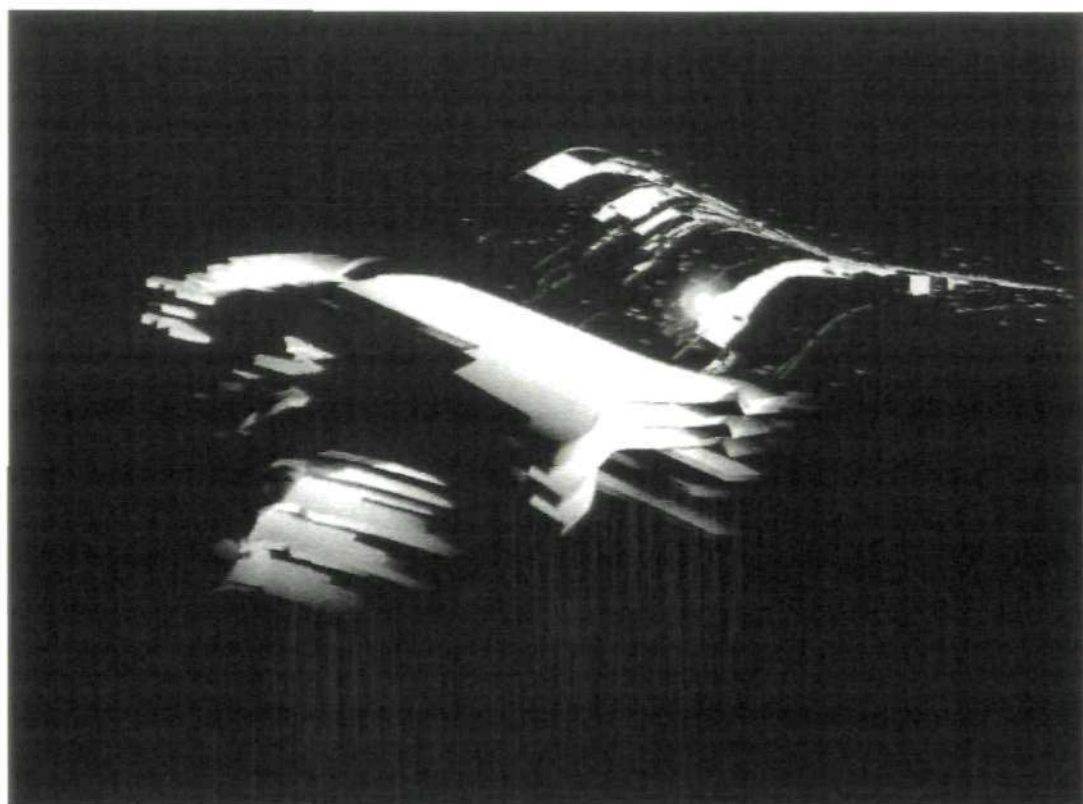


Figure 2-7. Image of 01_Apriori model 030, 2010

An example of how we can best communicate the essential features of an architectural work would be through Nelson Goodman's *Languages of Art*, written in 1976. Goodman gives us an insight to the complexities involved in communicating the essential features of how this could be applicable to the field of architecture. Goodman identifies that in 1976, the architectural working drawings are a strange mix of sketch and script and that scale in a drawing is merely for convenience and elegance. Goodman stated that there are five requirements for a notational system, which are all negative and general, satisfiable by systems with null or even no characters. The five requirements are:

1. *The Primary Function: score.*
2. *Syntactic Requirements: character-indifference or disjointedness, finite differentiation or articulate.*
3. *Composition of Characters: atomic, compound.*
4. *Compliance: syntactic classification/ semantic classification, inscriptions*
5. *Semantic requirement: unambiguous, semantic finite differentiation and semantic disjointedness.*

In short, Goodman wants to ensure the participant of a given notation system will agree upon what inscriptions represent what character, and without the inefficiencies of an overly complex and overpopulated character set.

Goodman states that these five requirements are the basic theoretical functions of notational systems. Clarity, legibility, durability, manoeuvrability, ease of writing or reading, graphic suggestions, mnemonic efficacy, ready duplicity or performability, none of these has anything to do with the basic theoretical function of a notational system. Through my understanding of these different requirements, I have listed below a brief description:

The score could be seen as the initial guide or tool for a full-blown notational system. The score is dispensable after the performance and can be composed, learned and played by vision. Because the score is a mere tool which is learned and dispensed, the notation becomes nothing more than a practical aid to production. The score has a primary function of authoritative

identification of a work from project to project. As expressed by Goodman, 'the symbol scheme of every notational system is notational, but not every symbol system with a notational scheme is a notational system.' (Goodman, 1976: 130). A notational scheme needs to have syntactic and semantic requirements. The first syntactic requirement for a notation is character indifference. *Character-indifferent*: if one inscription does not belong to that character the other inscription may not either. The second requirement for a notational scheme is that the characters be finitely differentiated or articulate. *Finitely differentiation* states that we must be able to tell if a newly introduced inscription does or does not belong to the extant set of characters. The final requirement is that the notation should be *Syntactically dense*: in short, Goodman wants to ensure the participants of a given notation system will agree upon what inscriptions represent what characters, and without the inefficiencies of an overly complex or overpopulated character set.

The first semantic requirement of notational systems is that they be unambiguous, that neither their inscriptions nor their characters are ambiguous. The second requirement is that the compliant-classes must be semantically disjointed. The third requirement for a notational system is semantic finite differentiation. The final requirement for a notational system is that it should be *Semantically dense*: it is not the case that given two ordered compliance-classes we can always find a third in between, as in any system where there is no limit to the different classes into which compliant may fall.

Goodman sees that architecture won't be capable of a full-blown notation due to the:

Compliance-class of a set of working drawings happens too often to consist of but one building. Many a composition is played only once; certain performances of other pieces have exceptional importance; and a building or performance executed under the direction of the designer or composer, while a more personal product and perhaps much better (or much worse) than another building or performance from the same working drawings or score, is not therefore more authentic or an original instance of the work. (Goodman, 1976: 220)

Goodman's summary is that 'If the notational language used in architecture has not yet acquired full authority to divorce identity of work in all cases from particular production, architecture is a mixed and transitional case' (Goodman, 1976: 220). Hence, is there a way to make the relationship of working drawing towards the environment, more authentic or original? Why are we not as comfortable about identifying an architectural work with a design rather than a building as we are about identifying a musical work with a composition rather than a performance?

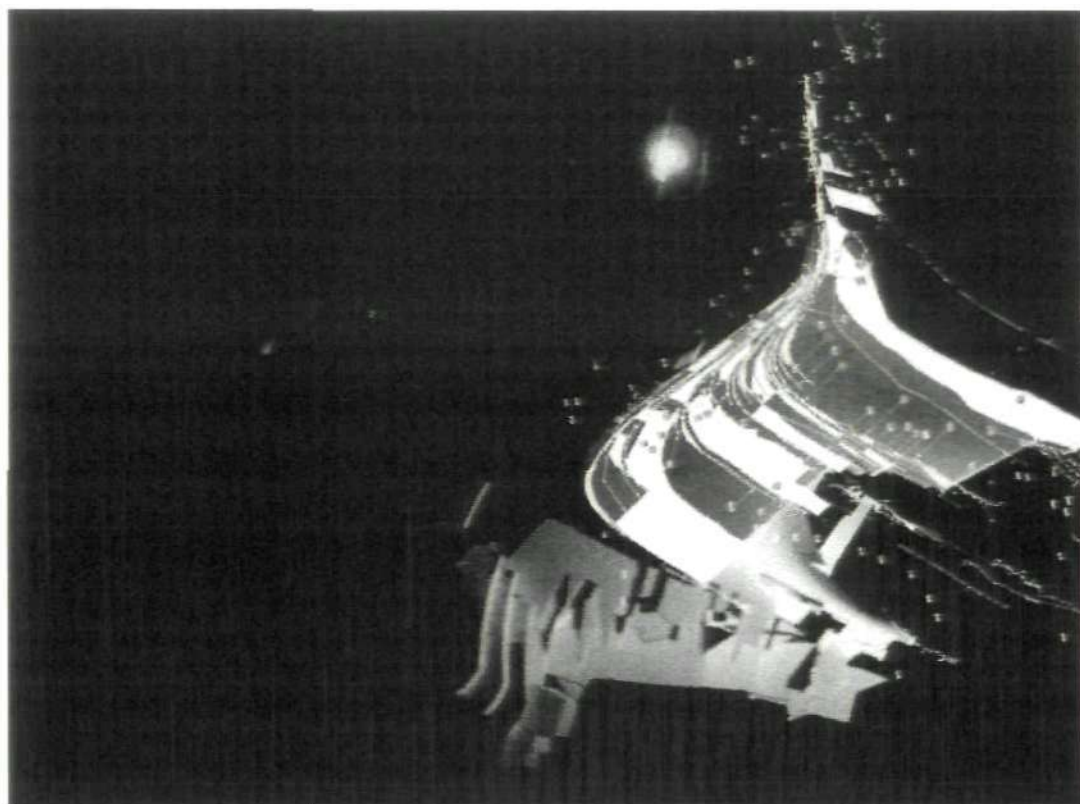


Figure 3-7. Image of 01_Apriori model 027, 2010

7.02 Saul Fisher's CAD Theory

One answer to the questions raised by Nelson Goodman can be found in Saul Fisher's article on 'Architectural Notation and Computer Aided Design' which was published in the, Summer 2000 issue of *The Journal of Aesthetics and Art Criticism*. In this article Fisher proposes a theory that William Mitchell satisfies Goodman's criteria of a full-blown notational system in architecture that can communicate the sum of a given work's essential features. Fisher went on to find out whether Goodman's notational theory can be satisfied by an actual architectural notation. Goodman himself judges that architectural notation is inadequate by the light of his notational theory, but Fisher concludes by rejecting that judgement, not because the general theory is wrong but because the problems Goodman raises are less severe than he claims and because at least one current notational theory in architecture may mitigate these problems even further. Architecture can have a notation that meets Goodmanian criteria, and with this notation we get much of what Goodman seeks: the individual

identity of a given architectural work, the delineability of its essential features, and the feasibility of notations for architectural works for which all true instantiations are identical.

Saul Fisher contends that, broadly speaking, such notations must satisfy a set of linguistic and philosophical tasks characteristic of successful communicative media, and, in particular, the foundations for such notation need to fulfil three tasks:

1. The first task is to represent architectural elements and design in a way that allows us, with appropriate syntax and semantics, to develop, preserve, and relate architectural ideas in the manner of our natural language architectural discourse. This is the minimal guarantee that the notation can function as a communicative medium.
2. In addition, we will want the formal "language" of our notational system to offer some communication advantages over the natural language of architectural discourse; these might include speed, simplicity, and resemblance to actual architectural works. This is our minimal incentive for using notation as shorthand, rather than simply describing the relevant works.
3. Finally, a typical asset of formal languages is their capacity to further our conceptual clarity by rendering propositions in abstract form. Thus, given the formal linguistic character of an architectural notation, that notation should abstract architectural works from their particular instantiations and so help identify the essential characteristics that distinguish one work from another. This is an added value of notation that Goodman first noted, and it can be conceded that even if one rejects the particulars of Goodman's view, 'it is surely a desirable outcome of using a notation that the essential features of artworks be identified and their identities so preserved' (Fisher, 2000: 273).



Figure 4-7. Image from Transdisciplinary research session 1, 2010

7.03 A notational system for an ecological notated architecture

In architectural practice the communication from architect to participant or environment is not at all straightforward. This is also true of the dyadic relation between working drawings, participant and environment in architectural education and practice. Notational systems used as a communication tool have made the composition of architecture an activity like the composition of fiction: an activity of communication. So deep is the connection between architecture and communication in our culture that for much of the time we ignore it and behave as if notation were really a transparent window – just as in reading a working drawing in practice we may ignore the intermediacy of notation and imagine that thoughts are reaching us directly from the architect's mind. The most important criterion of notational systems, whether literally or architectural, is precisely that it should not draw attention to itself, so as not to disturb the illusion of neutrality and faithfulness.

With reference to Saul Fisher and my experience of the use of working drawings in architectural education and practice, it becomes clear that the relationship between working drawing and environment has failed to acknowledge the essential features of an architectural work. There seems to be an understanding that some architects were trained to think and argue the working drawing as separate from the environment, whilst few other architects refer to the working drawing as included through the environment. To put it another way, some design through the environment and others separate from the environment. This distinction becomes even more critical due to architects wanting to communicate their designs as environmental time-based projects. Some of the most pertinent questions architects should be asking themselves might be: Can we have a full-blown notational system through our current methodology of working drawings within architectural practice? What are the implications of introducing full-blown notational systems in architecture? Why would they be used and where? What would they be used for and how would they be used?

This idea about notation, suggests that we should be developing a notational system for an ecological notated architecture that constructs the world as we experience it. We should embrace the changing status of the notational system by allowing a dynamic notational system to be embedded within the environment and work with the participant within environment within notational system. This might help us in understanding that the participant has living experience of *a priori* notational system.

8. Where to start?

Theoretically, a key move was in placing drawing in the very heart of the physical environment. Whereby the actual environment is studied through various anamorphic studies to demonstrate a methodology for analysing determining effects of interaction within a field strategy. This will be an architecture as coupled action with the environment creating a fingerprint not a blueprint.

There are many kinds of relationships between working drawing, participant and environment within context, design and communication. An extremely important one is who communicates with whom and who instructs whom. From the instructions of the working drawing to the participant, from the environment to the working drawing, from the participant to the environment, there are a multitude of potential inter-relationships, none of which can be ignored. At present there is no existing architecture whose special interest is the combining of pieces of information. But I will argue that the communication of architecture must depend on a 'double increment' of information (Bateson, 2002: 19). Every step in the communication of architecture is an addition of information to an already existing system. Because this is so, the combinations, harmonies, and discord between successive pieces and layers of information will present many problems and many directions of change in the communication of the architecture.

Architects would need to become an editor of the situation by determining the effects of interaction within system of varying power. This could be developed through the network of instructions from the evolving interrelationships between working drawing, participant and environment. For example, from positioning yourself within environment within working drawing, as seen in the precedent of the sand mandala, we can gain a different understanding of our relationship with this complex field. There have been many attempts to gain an insight of our environments and an important one would be: can we get instructions from the environment through experience?

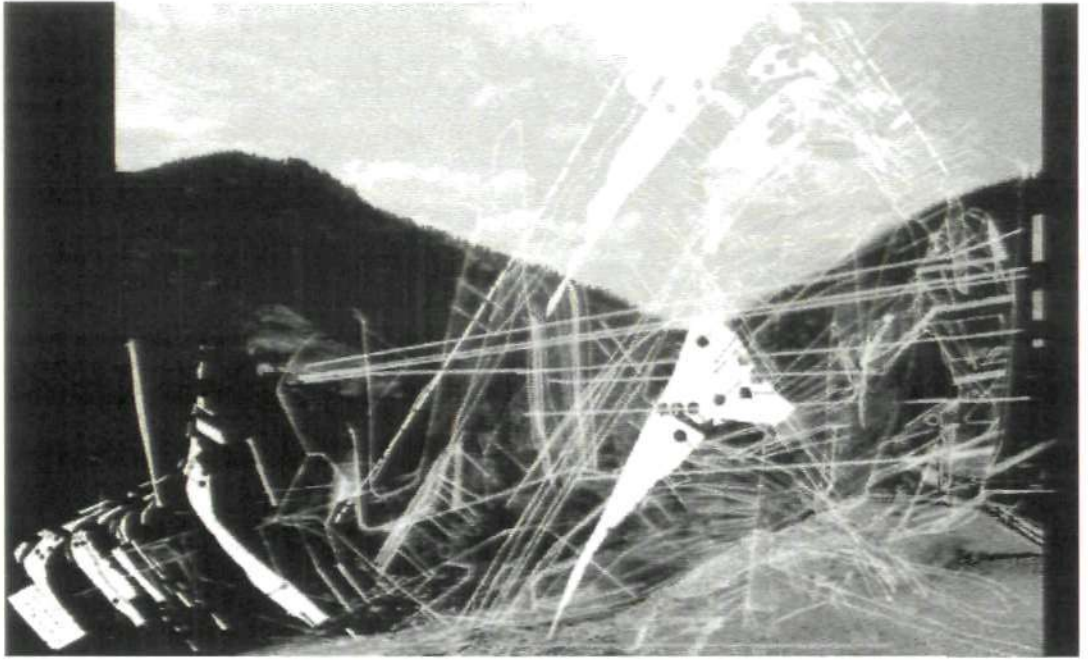


Figure 2-8. Image of an Open System Working Drawing, 2010

8.01 Open System Working Drawings

Currently through working drawings in an architect's office, a building is broken down into different parts and then each part is isolated from its context. Architects are trained to think about packages of information in the development of working drawings for a building. These packages are usually different parts of the building packaged together to aid the builder. Central to the perceptual shift of a working drawing is the term 'system'. A system always describes a whole, which in contrast to the elementary consists of parts. The working drawing is, *a priori*, the building, and is the current methodology of communicating the organisational closure between working drawing and building. In this organisational closure, the system selects the information from the building required for the maintenance of its organisation. The environment, for example, is everything that is not part of the system; on the other hand is not able to influence the current system in a linear and causal manner. It can only trigger temporal structural changes of the system's inner organisation and not determine the system's behaviour directly. Can the working drawing become an open system of communication between the working drawing, participant and environment? This would suggest that an open-system working drawing is

embedded in the environment through a full-blown spatial notational system which changes in relation to the shifts of the working drawing, participant and environment. The open system of a working drawing should have the ability to respond to perturbations by its environment and changes by the participant, but this is achieved only by structural changes within the system itself. The ability of an open-system working drawing is summarised in the term self-organisation the system's capacity to rearrange its internal organisation, i.e. through notational system, in case of environmental changes. Consequently the working drawing must become apart of the wider web of relationships. One could then begin to develop an understanding of the complexity and diversity of the methodologies of communication from working drawing to environment. The working drawing could then become 'primarily a dance of interacting parts and only secondarily pegged down by various sorts of physical limits' (Bateson, 2000: 12) and by those limits which environments characteristically impose.

Building Information Model (BIM) is the latest process for generating and managing the building data during its life-cycle, and encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components. I used BIM when working on Herron Quays DLR for Alsop Architects in 2003: we used Revit software which allowed us to upload working drawings and comment on other working drawing from members of the team, which included structural engineers, main contractor and sub-contractors. It is anticipated by its proponents that BIM can be utilized to bridge the information loss associated with handing a project from the design team to the construction team and then to the building owner/operator, by allowing each group to add to and reference back to all information they acquire during their period of contribution to the BIM model.

By deduction, the model could be used to understand the building in a different way. For example, a building owner may find evidence of a leak in his building. Rather than exploring the physical building, he may turn to his BIM data and see that a water valve is located in the suspect location. BIM is thus a process which goes far beyond switching to new software. It requires changes to the definition of traditional architectural phases and more data sharing than most architects and engineers are used to. This is a substantial shift from the traditional computer aided drafting method of working drawing with vector-file-based lines that combine to represent objects.

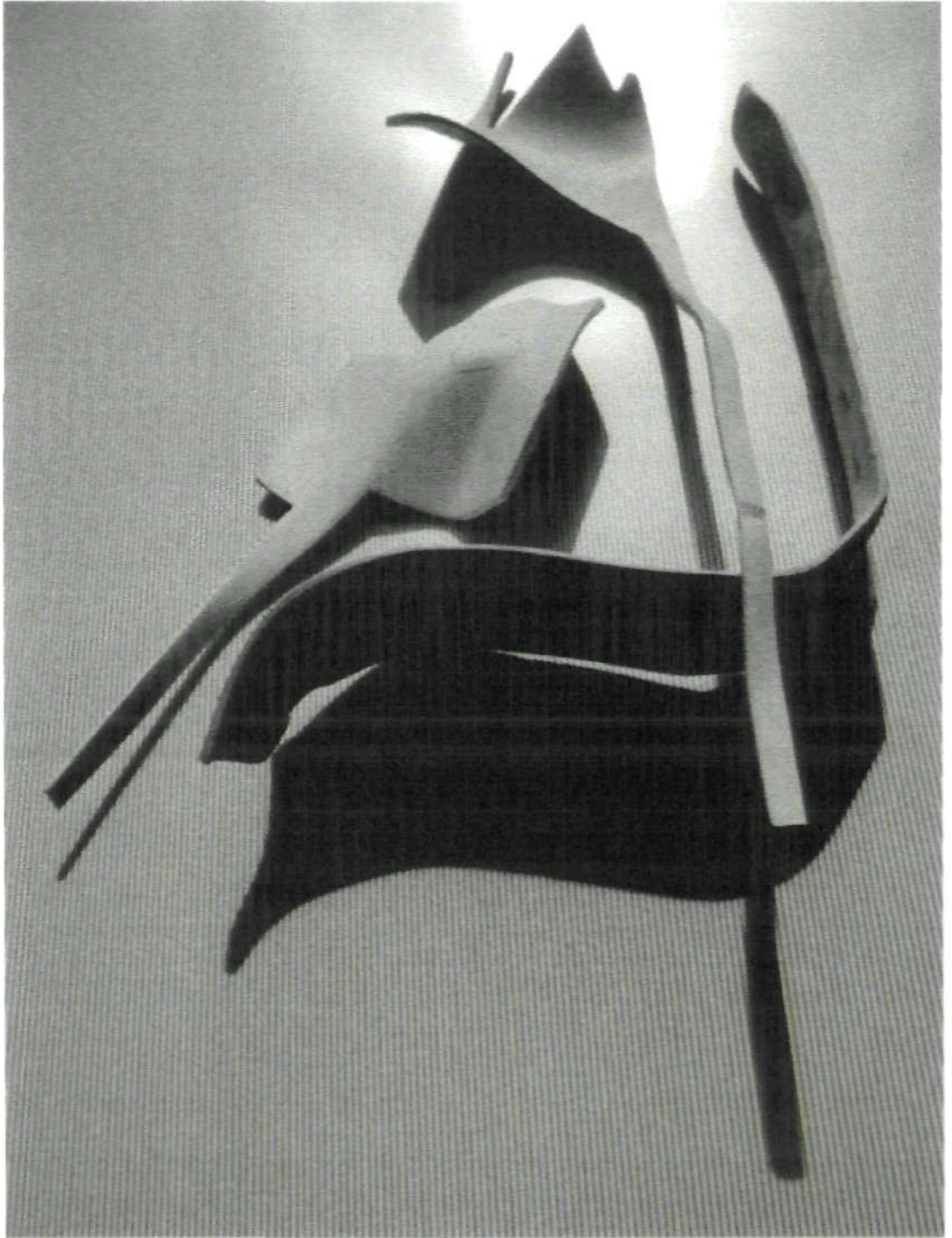


Figure 3-8. Overview of the Innovation Pavilion, 2010

In congruence with ecological thinking as the guiding principal, my design research projects into the Innovation Pavilion and Recursive Handrail are harbingers for a meaningful ecological (both machinic and natural) audit of specific sites and the development of a series of tactics and protocols that can deliver to architects a full understanding of their sites and of the agents, provocateurs, cybernetic systems and disparate observers and drifters that influence and use them in some way.

The Innovation Pavilion is designed to be a continuously failing structure, so as to require the participants to be innovative at every stage of its cycle of development. While inhabited, the surfaces continually crack and fall apart from the main structure, as a direct contributor to the cycle of the relationship between participant and environment it supports. Innovation refers to a new way of doing something. It may refer to incremental and emergent or radical and revolutionary changes in thinking, from the origination of an idea to its transformation into something useful, to its implementation and on the system within which the process of innovation unfolds. The walls crumble under the movement of the participant in the pavilion whilst soft 'tongues' sweep the brailed electric comb floor, which has a series of tactile sensors. The pavilion reconfigures through its own reading of the brailed floor, as some sort of reference of its relationship with the ground plane.

Recursion is used to describe the relationship between the objects and the object defined is being defined within its own definition. Recursion is a method of defining functions in which the function being defined is applied within its own definition. The term is also used more generally to describe a process of repeating objects in a self-similar way. Broadly speaking recursion concerns the way in which events continually enter into, become entangled with, and then re-enter the universe they describe. The Recursive Handrail was developed for use with the Arch-OS system in the Portland Square building at the University of Plymouth. The concept for the handrail is about the recursion of form with a real-time feed from the temperature sensors in the building. To achieve this, an existing handrail in Atrium B of the Portland Square building is chosen as the site for the Recursive Handrail. There are six smart temperature sensors around the existing handrail. The temperature real-time feed is used to

assimilate slivers of the Recursive Handrail. As a section of the new handrail is constructed, this new handrail replaces the existing section of the handrail. Each day, from dawn till dusk data is collated and a unique form for the section of the handrail is defined. From dusk till dawn, one new section of the handrail is printed using a rapid prototyping machine. Thus each day the handrail evolves in its shape. The new section of the handrail has a smart heating element placed inside its centre. The temperature from the handrail is linked to the amount public traffic in the building- i.e. if there are many people walking up Atrium B staircase, the temperature will be low, or if there are few or very little public traffic the temperature will be high. The heat produced affects the readings on the smart sensors, and thus the participant in the space becomes involved in the relationship of defining the shape of the handrail through the relationship with the building. In effect the participant is slowly adapting and augmenting the building through occupation.

The handrail is thus composed of participant's actions; it is recursive over its various boundaries. At this point the participants may decide, taking all events into account, to alter the bias of the form of the handrail. In the event of such a change in the aggregate of events in the reflexive handrail subsystem, the participants sensing of temperature in the building then determines form in a smaller system. As in real ecosystems, human events over time have causal consequences. There is a possible reverse of this: the larger system also may sample events from an aggregate of the smaller sub-systems. Bateson explains the 'structure' of the ecosystem on the assumption that it is a very large communication system responsive to the fittedness of its integrated cycles. The setting includes the state of system thresholds, contrasts between thresholds, and the readiness of the system to respond to change in the larger system of which it is apart. A careful examination of structure as 'setting' goes some way towards indicating how change may occur in the system, and also how all feedbacks within the system are related to change of threshold or system states. Changes will occur in response to the systems and sub-systems sensing difference in time.

In the largest system (the building and participants), if the participant of the building feel cold, the handrail can be set according to the participant's particular bodily threshold of 'coldness.' This change in 'state of bias' determines an event in a subsystem. A switch goes on or off in the handrail,

and this event then changes a setting on the handrail and the handrail switch goes on or off. The participant, who belongs to an even larger system, may also sense the difference between the building temperature and the weather outside through the form and temperature of the handrail. The feedback loops are multiple. One feedback loop simply returns the change in temperature to the bias of the handrail in the subsystem. In this event the switch will go either on or off in the handrail. The subsystem will continue in a self-maintaining oscillation, for when a rise in temperature of the building creates fluctuations, these are held between thresholds or existing limits set on the handrail.

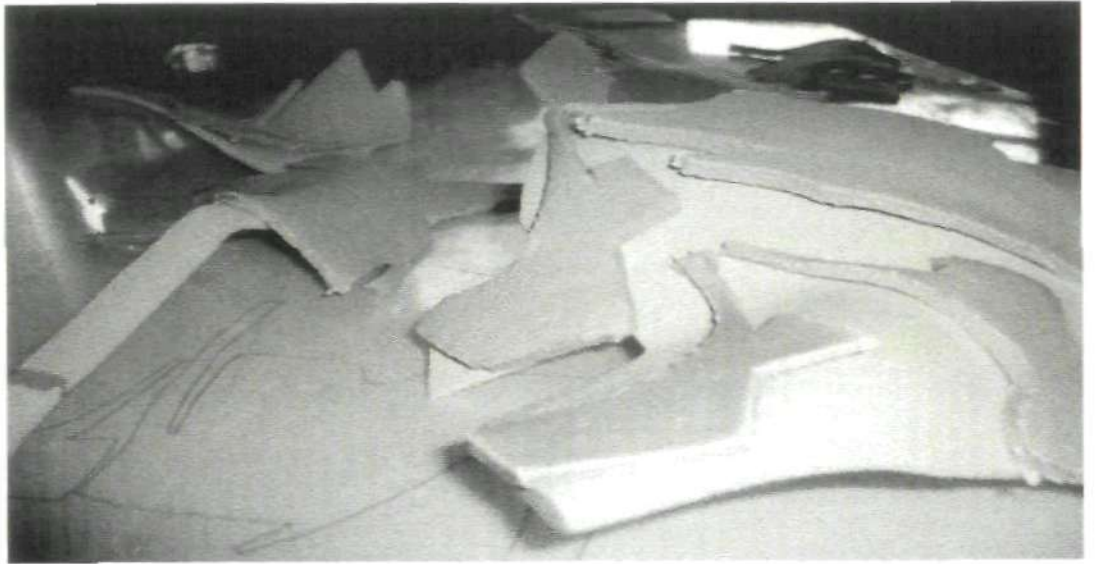


Figure 4-8. Overview of the Recursive Handrail, 2010

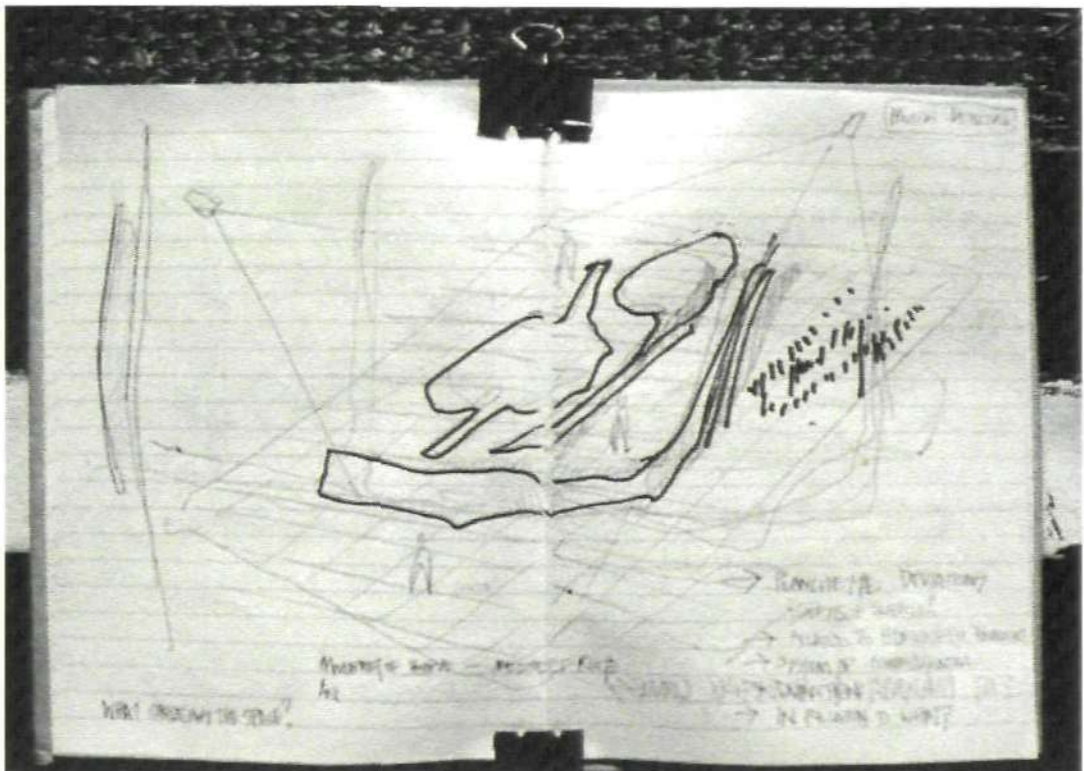
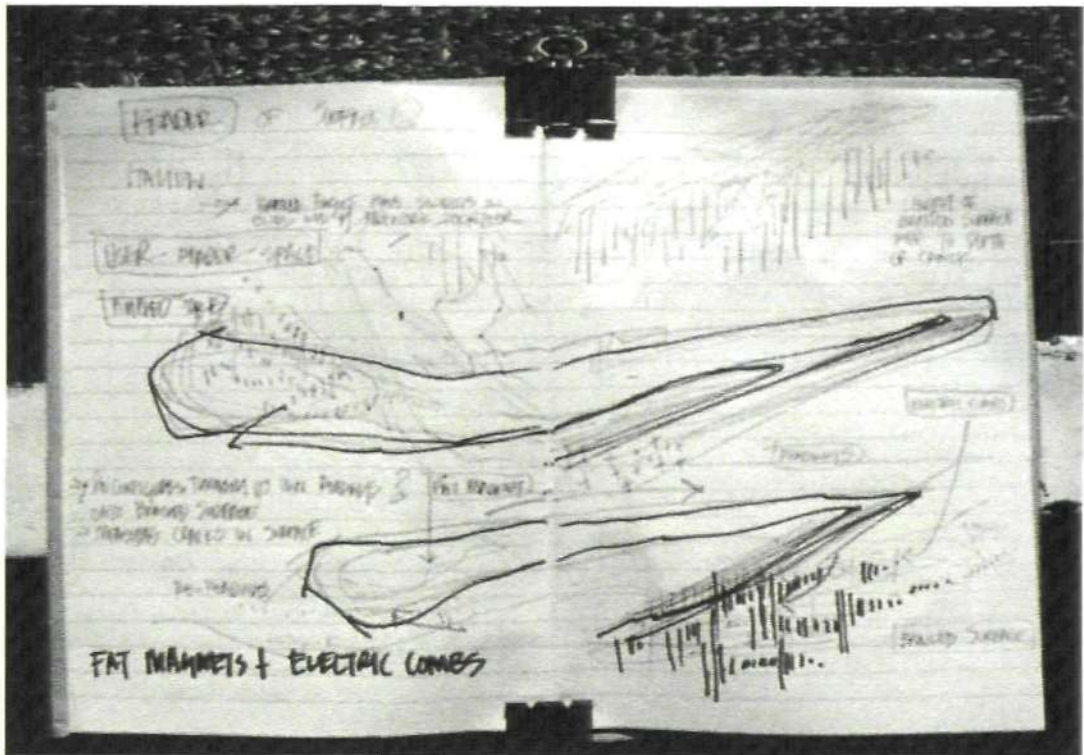


Figure 5-8. Innovation Pavilion Theory Sketch, 2010

Figure 6-8. Innovation Pavilion Theory Sketch, 2010

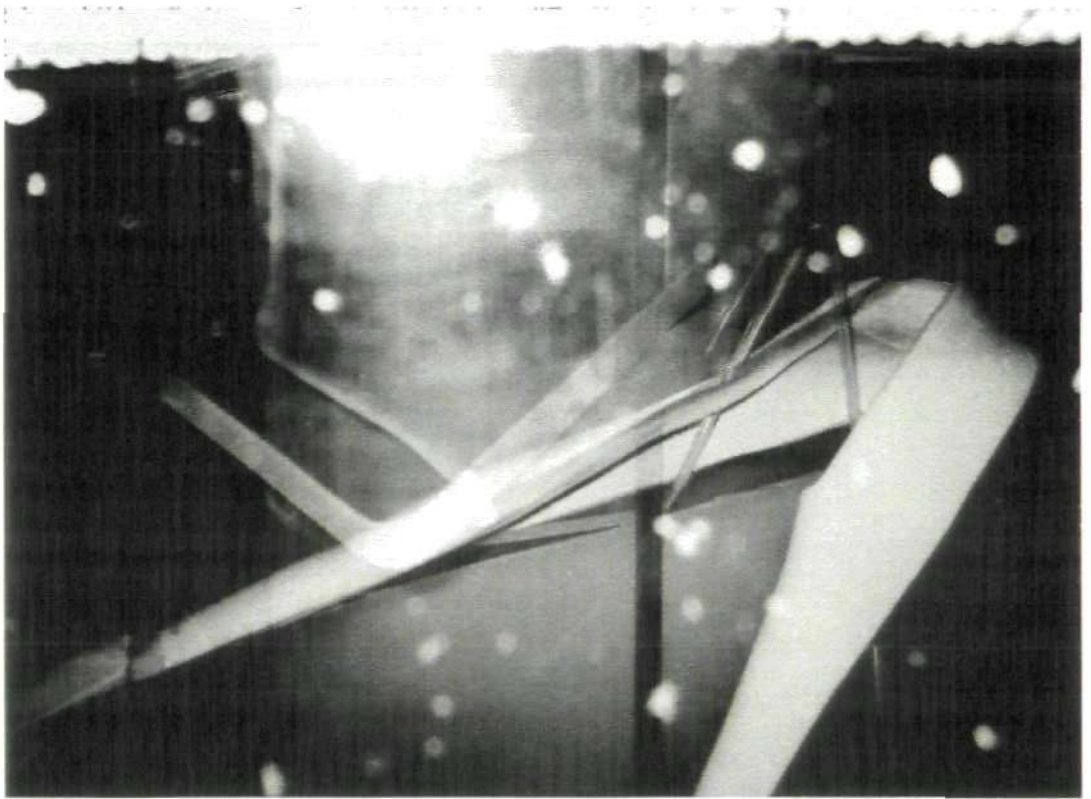
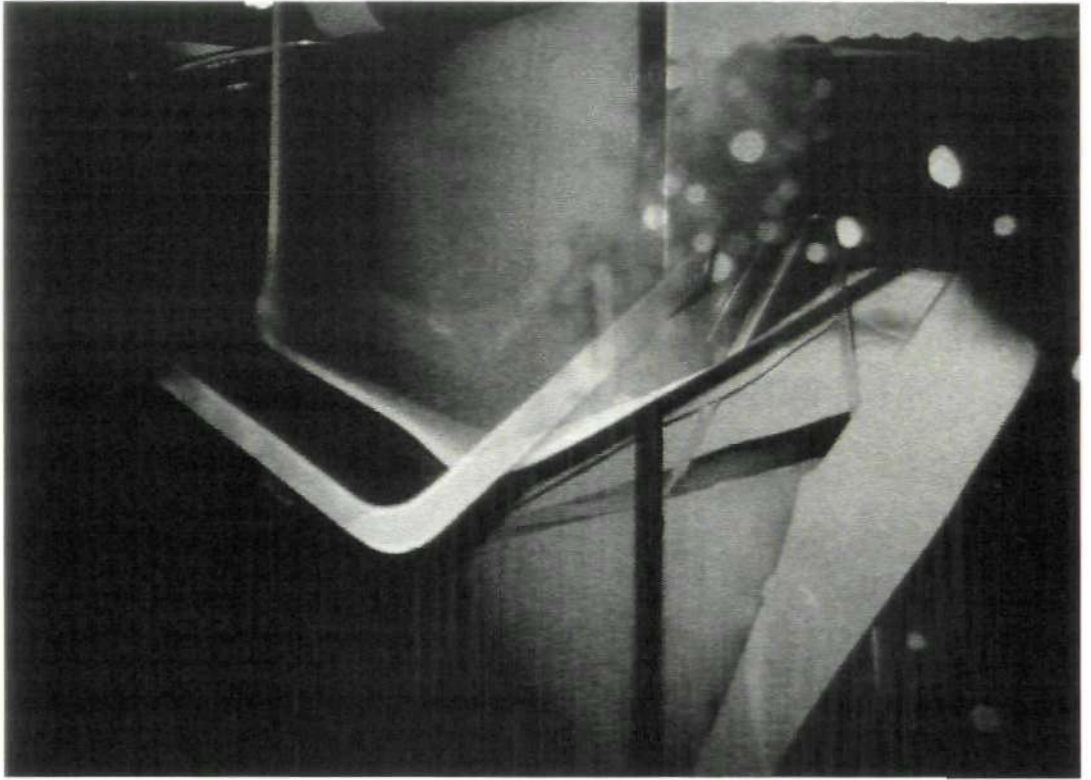


Figure 7-8. Overview of Recursive Handrail, 2010

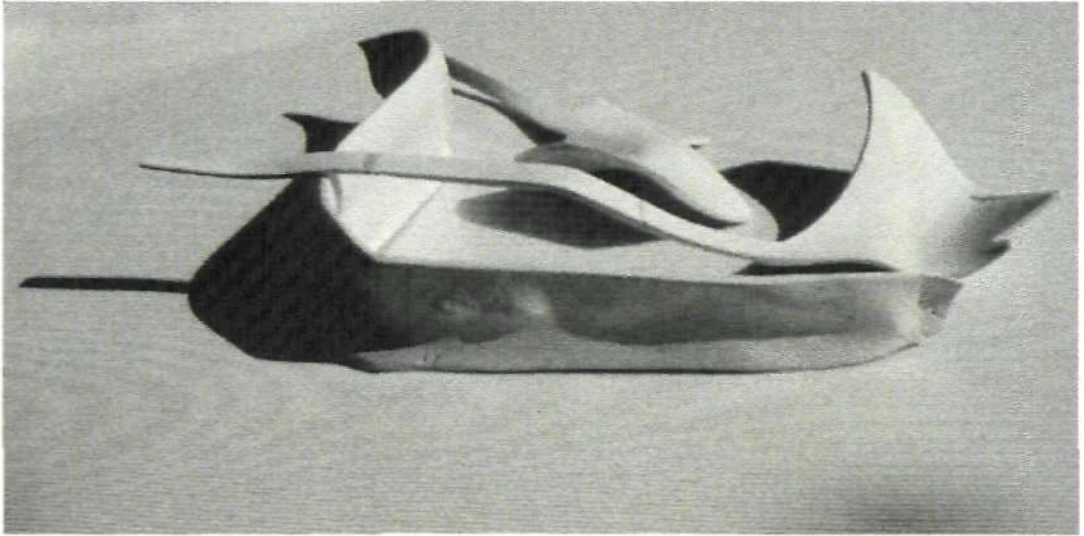


Figure 8-8. Overview of the Innovation Pavilion, 2010

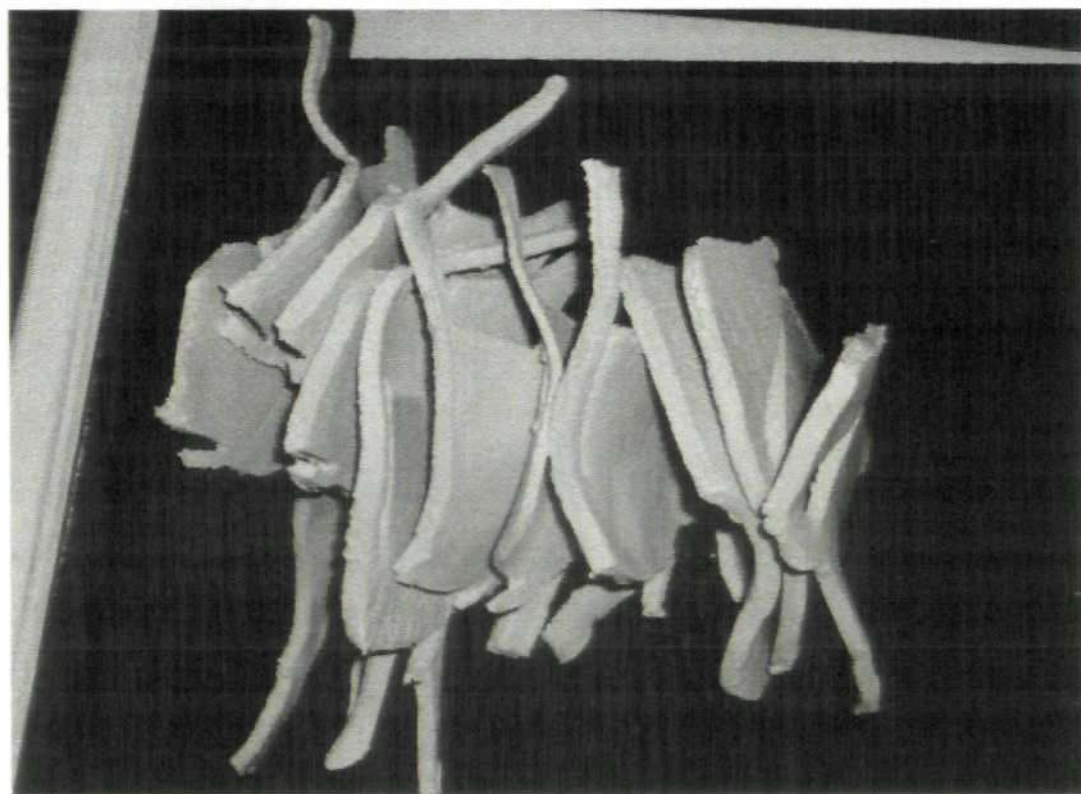
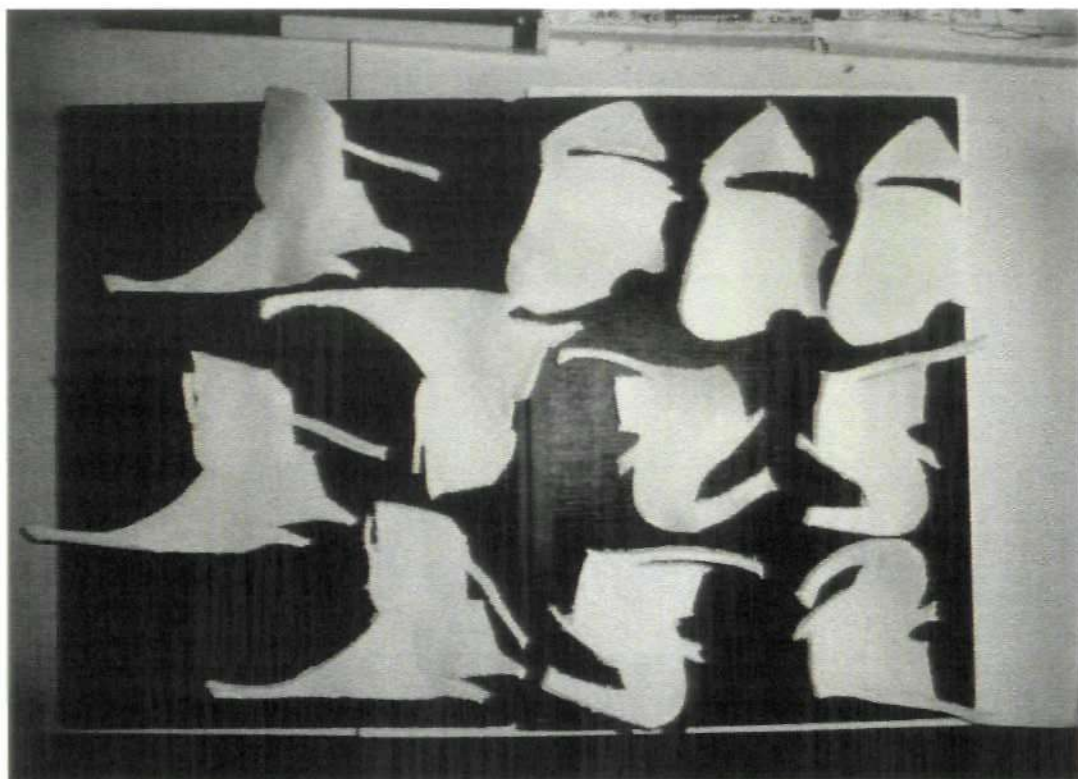


Figure 9-8. Overview of the Recursive Handrail, 2010

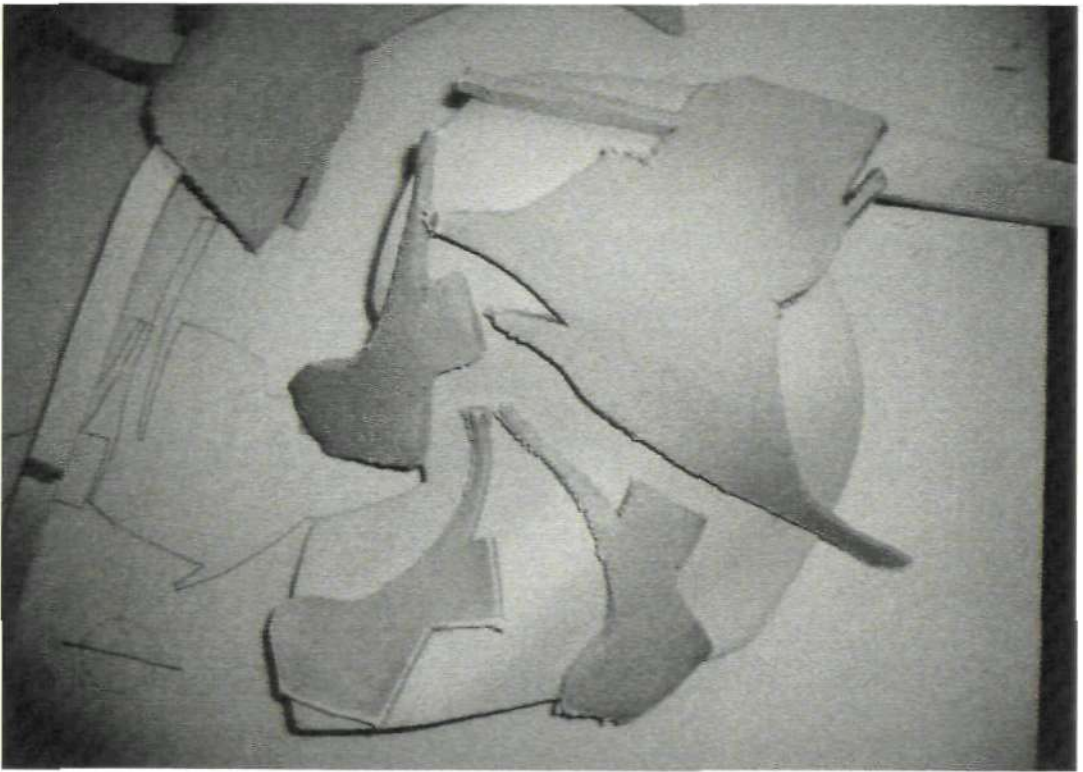
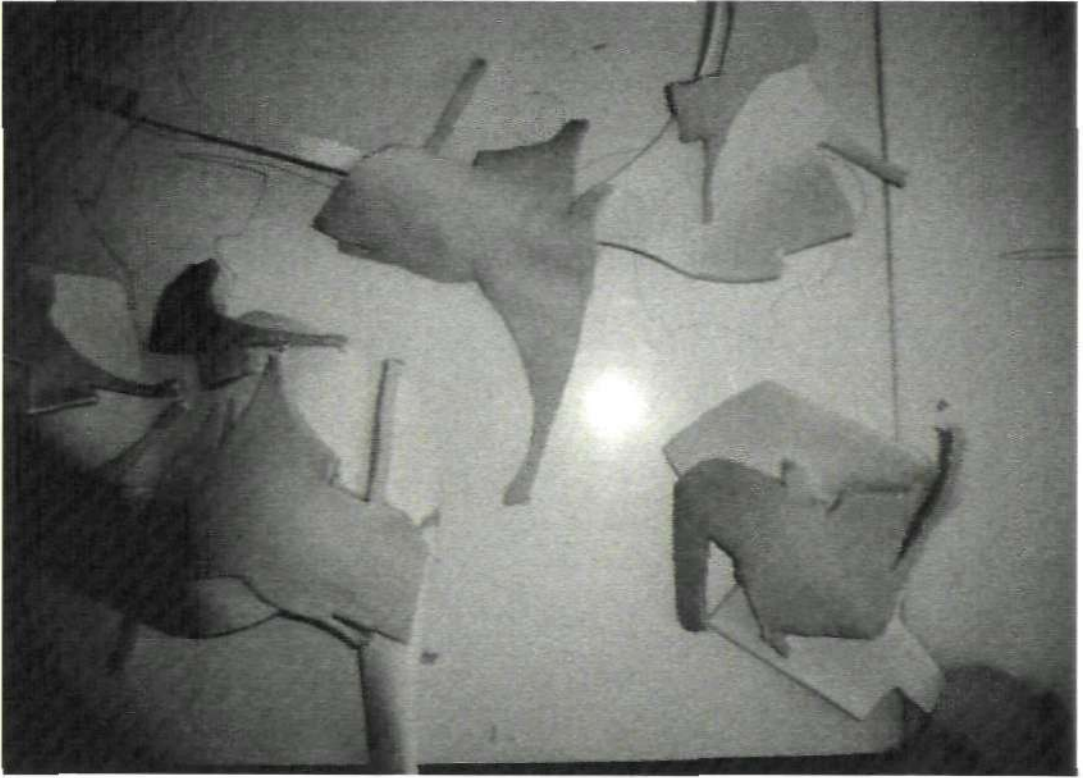


Figure 10-8. Overview of the Recursive Handrail, 2010

9. Approaching Enia: Bilbao Enia, Beijing Enia

As one moves through different parts of the environment it is only possible to apprehend one's relationship with that particular scanned space, thus creating an architectural paradox. This will guide us to develop tactics to get instructions from the relationships between things and not the thing itself, as things by themselves don't exist; they exist only through their relationship in a context. Could it be developed that we view the instructions as a web of relationships, dynamic, evolving and inseparable for contingent participants, maximising the effectiveness, efficiency and appeal of instruction to other leaning experiences?

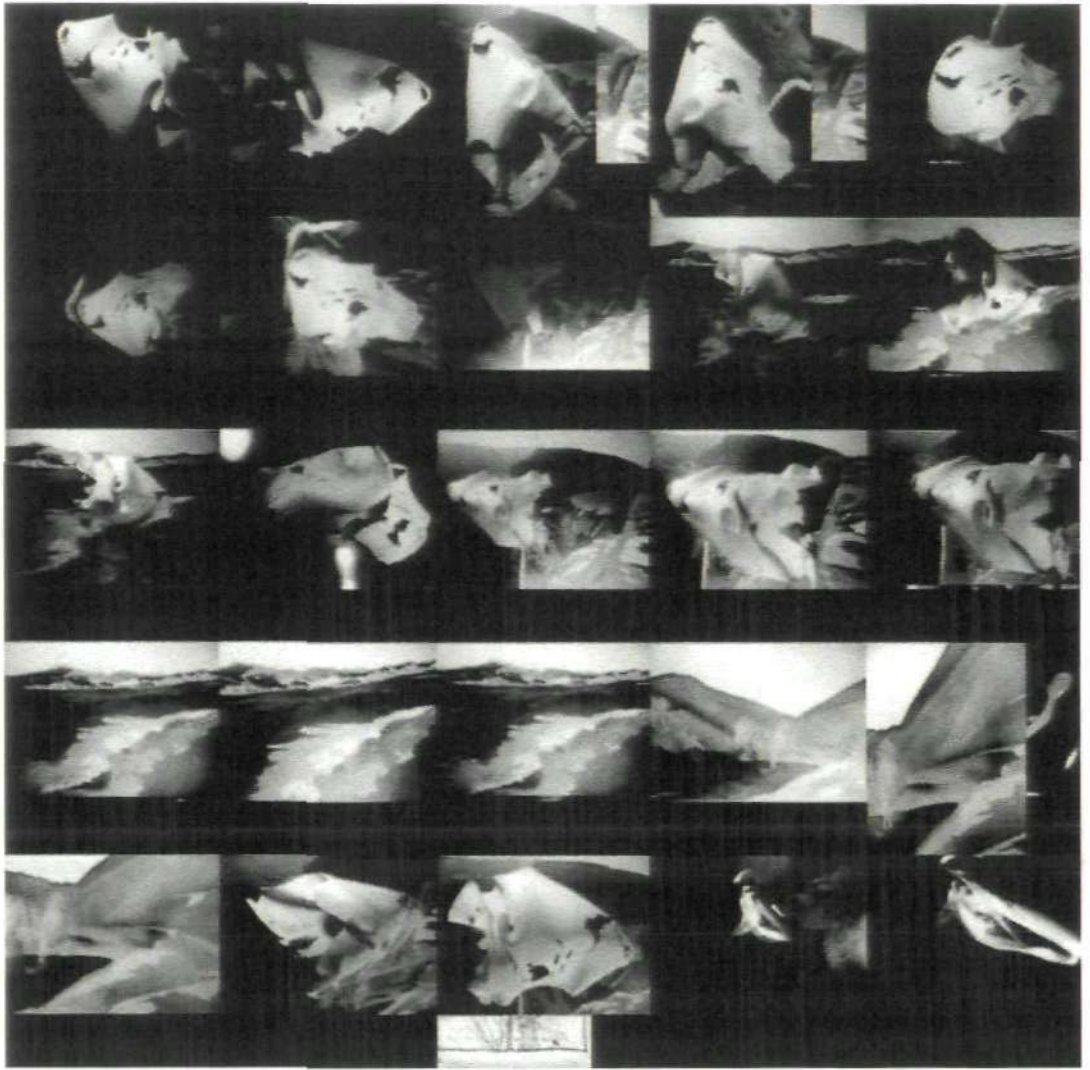


Figure 1-9. Thematic Integration: Focus on Aesthetical Enia, 2010

Appreciating aesthetics is absolutely central to valuing environments (Brady, 2003: 225). In Emily Brady's book, entitled *Aesthetics of the Natural Environment* (published in 2003), she developed a theory of 'integrated aesthetics' which is about integrating descriptive qualities of our environment and aesthetic experience. Brady aims to link subjective and objective approaches to aesthetic experience, judgement and value. Aesthetic experience is one of the most common ways to value our environment. Whether it is having a walk in the park, cycling through a country lane, or just sitting in your garden, we can appreciate the aesthetic qualities. Brady goes on to say that we should be developing 'environmental sensitivity through aesthetic experience' (Brady, 2003: 217). Fisher describes that one of the tasks of architectural aesthetics is to 'show how it is possible to tear architectural works from their historical and geographical ties whilst preserving their identity and distinctive aesthetic properties; this is presumably a key piece in what makes a given work a timeless classic' (Fisher, 2000: 284). How then can we embed the working drawing within the environment and become apart of that aesthetic experience of our environment? For Goodman, this preservation is an automatic consequence of deploying a satisfactory notation, simply because he defines a work as any compliant with a notational outline. In *The Three Ecologies* Guattari's most insistent refrain is that we must abandon scientific (or pseudo-scientific) paradigms and return to aesthetic ones. We need to continually reinvent our methodologies of communicating our architectures just like artists. Bateson claimed that:

Aesthetic knowledge could only be gained through attention to all the natural senses, conscious and unconscious, and suggested that existing methods of sensing employed by western science were inadequate for proper scientific knowledge of ecosystems. The special emphasis on patterns and modulation of patterns typical of aesthetic sensibility closely related to the patterns inherent in a sense of rhythm of duration time. Aesthetics also validated an awareness of change, which cybernetics had set out to explore. Among the important sensibilities crucial to aesthetic understanding was awareness of change in homeostasis of

ecosystem activity, which can, of itself, generating perception of pathologies. (Harries-Jones, 1995:199)

One of Spiller's fundamental paradigms is that 'architects must design in the second aesthetic of the algorithm. This is aesthetics of programmed possible outcomes or forms and is concerned with the provisions of inputs that are manipulated to produce varying outputs' (Spiller 1995: 25). Spiller recognises that architects should look towards the idea of second aesthetics – designing through the relationship between things, designing the aesthetics through the process of bringing together new relationships in the development of the architectural program. The aesthetic comes from designing the relationship between two things, as we are not designing the thing itself. Humberto Maturana would call it 'the emergence of ongoing couplings' (Maturana 2004: 119), Bateson would call it the 'patterns which connects' (Bateson, 2002: 8), and Kiesler would describe this as 'the visible trading posts of integrating and disintegrating forces mutating at low speeds' (Kiesler, 1939: 61).

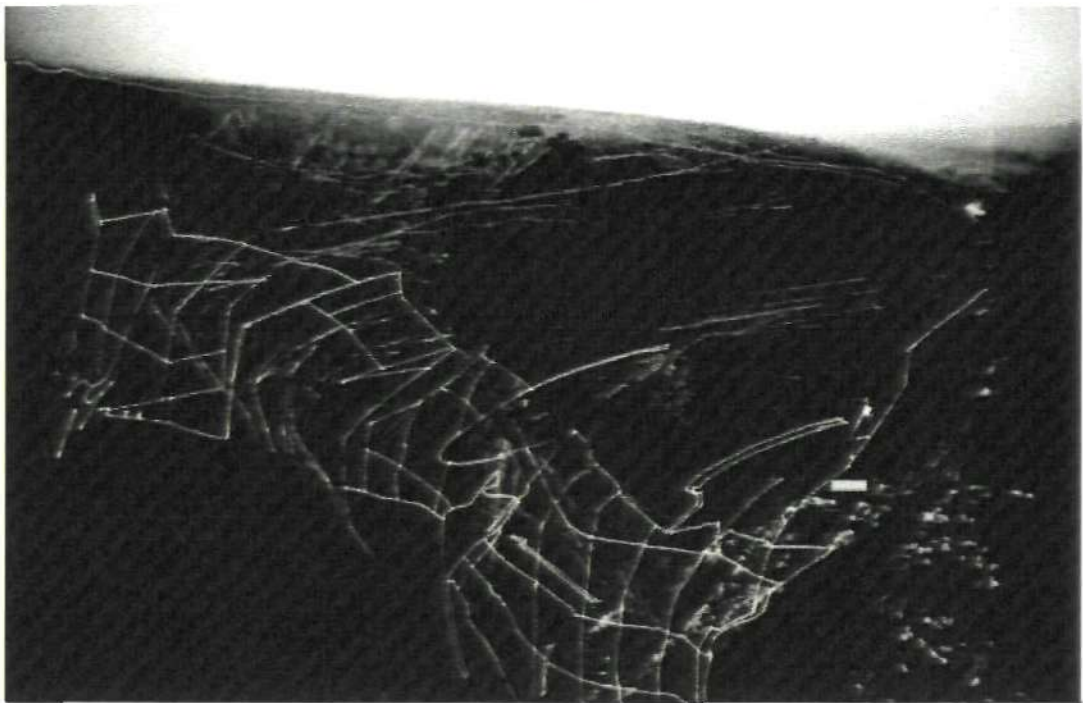
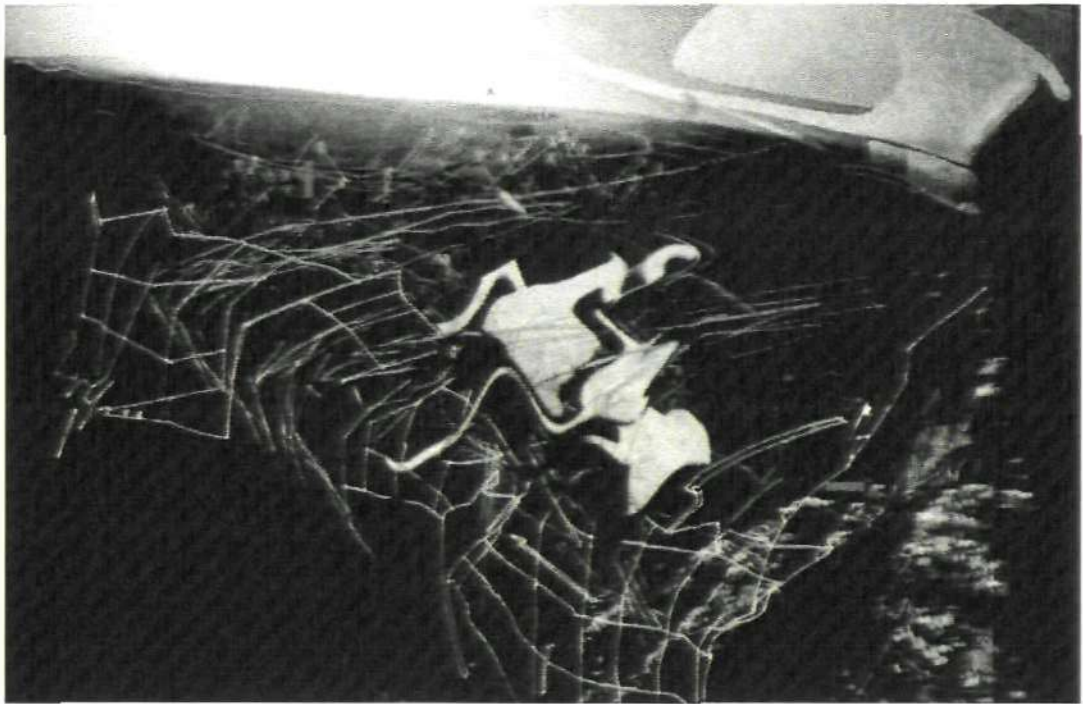


Figure 2-9. *A priori* model 01: source of the River Nervion, 2010

Figure 3-9. *A priori* model 02: source of the River Nervion, 2010



Figure 4-9. *A priori* model 03: Deba Valley, 2010



Figure 5-9. *A priori* model 04: Deba Valley, 2010

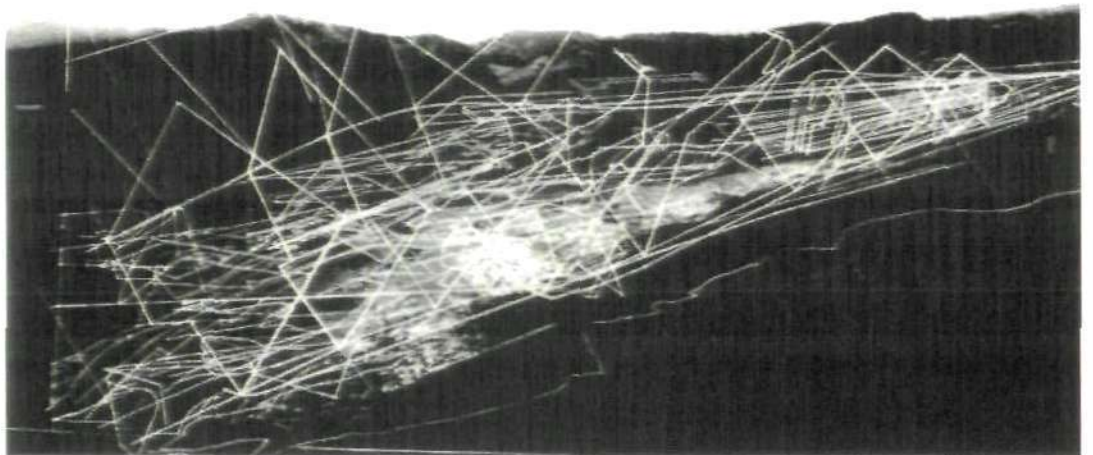
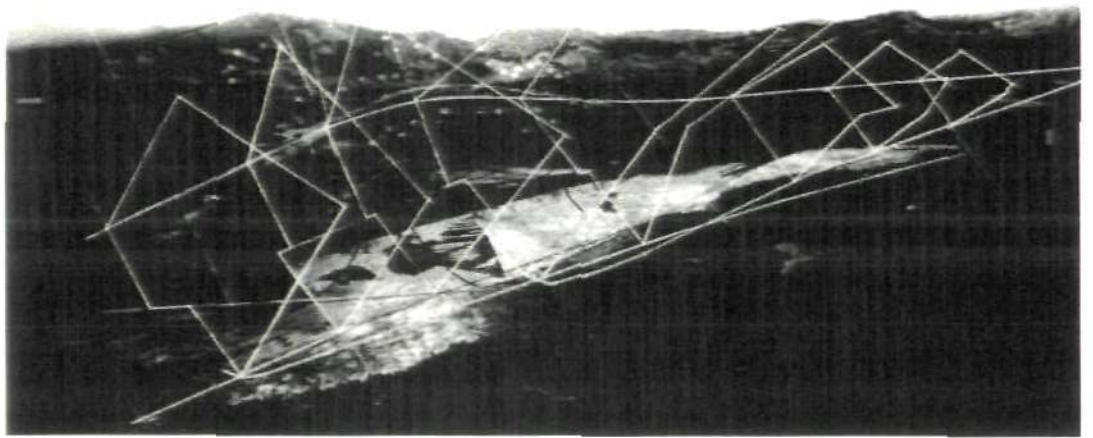


Figure 6-9a. *A priori* model 01: Alava Plateaux, 2010

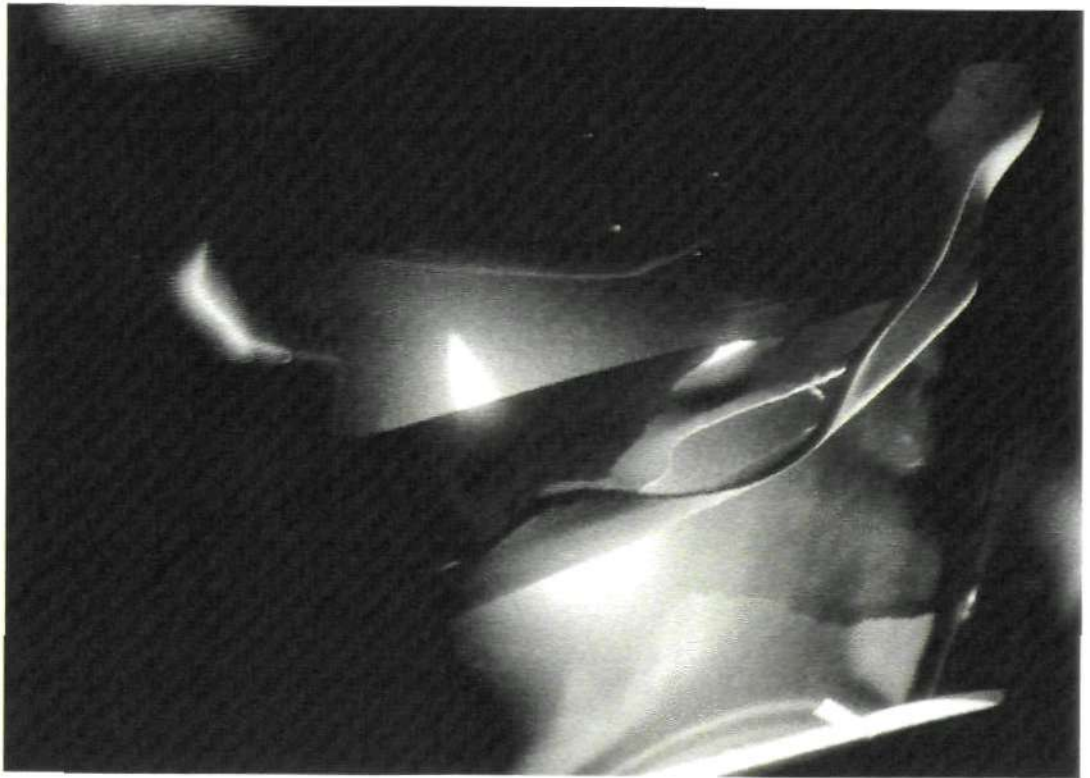
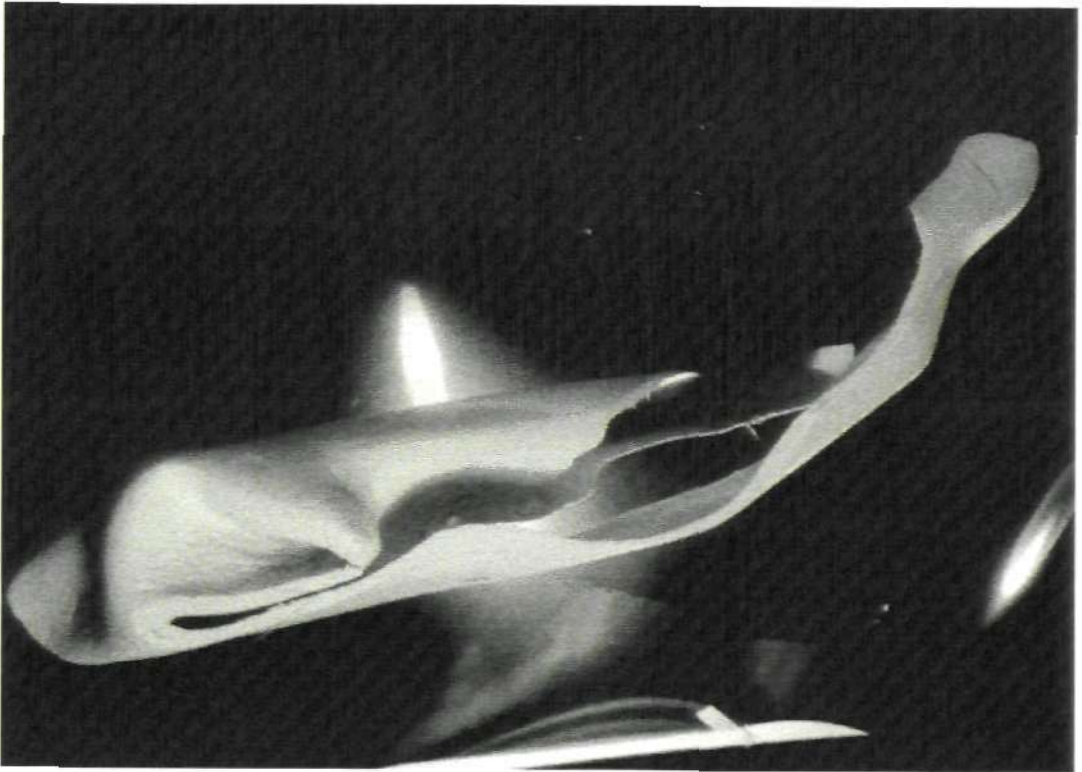


Figure 6-9b. *A priori* model 01: Alava Plateaux, 2010



Figure 7-9. *A priori* model 08: source of the River Nervion, 2010

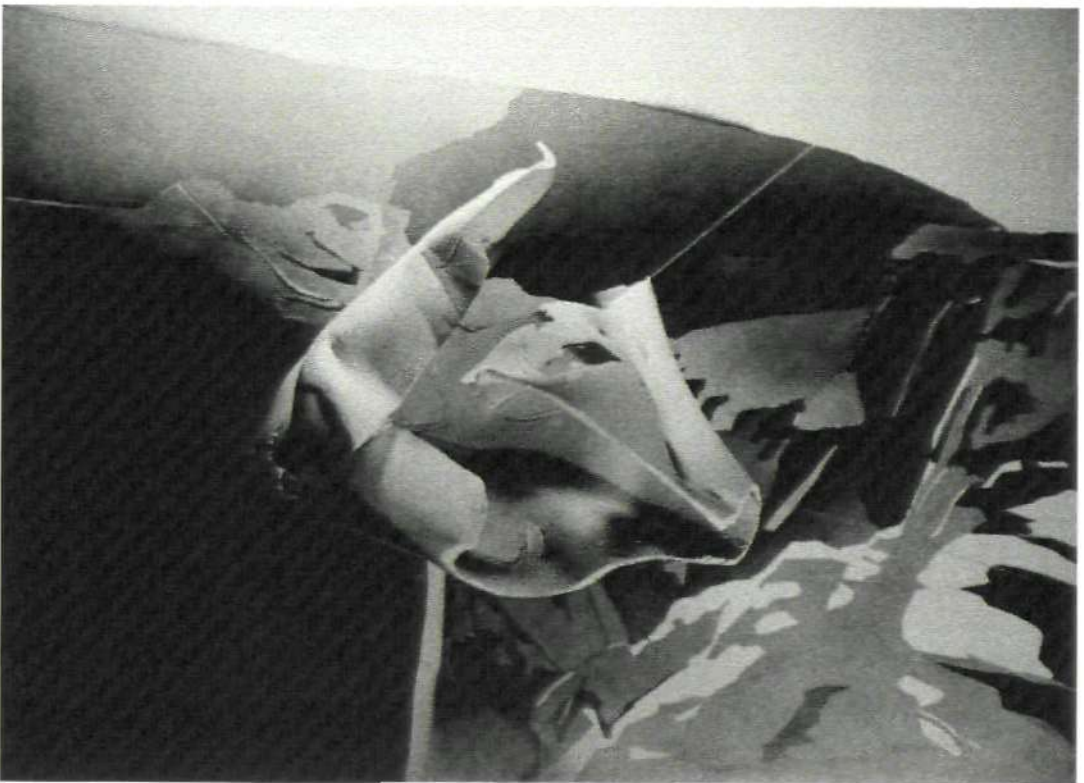


Figure 8-9. *A priori* model 09: source of the River Nervion, 2010

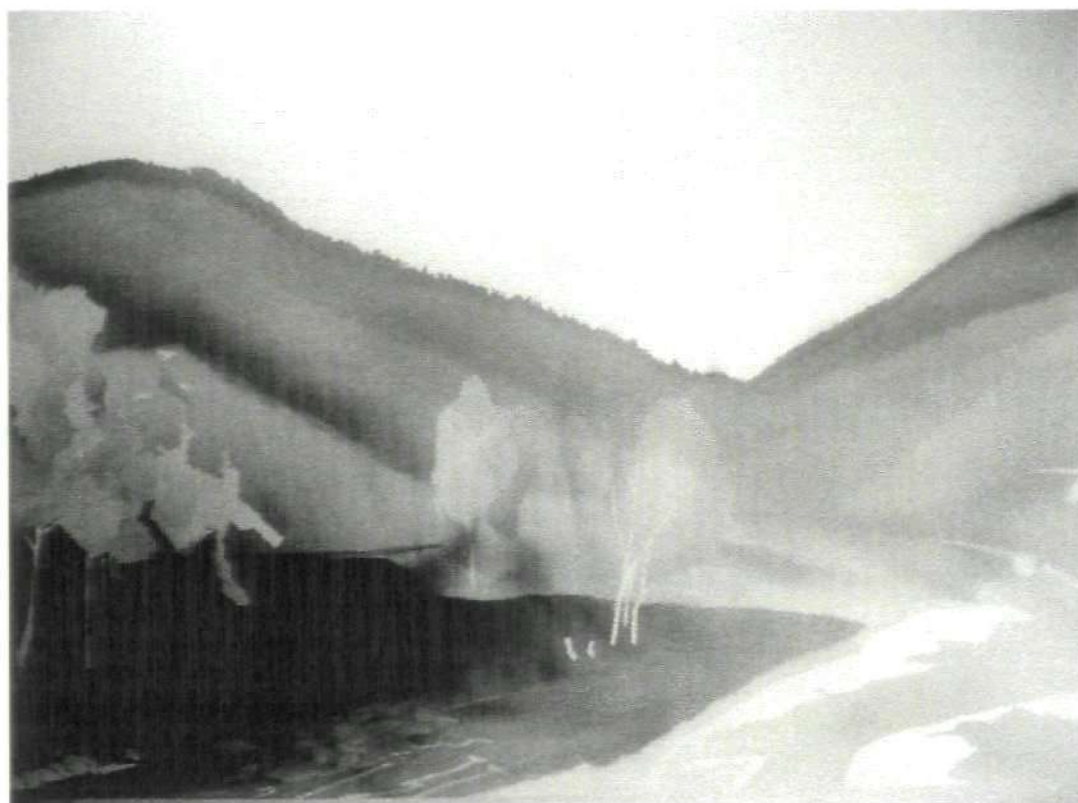


Figure 9-9. *A priori* model 08: Deba Valley, 2010

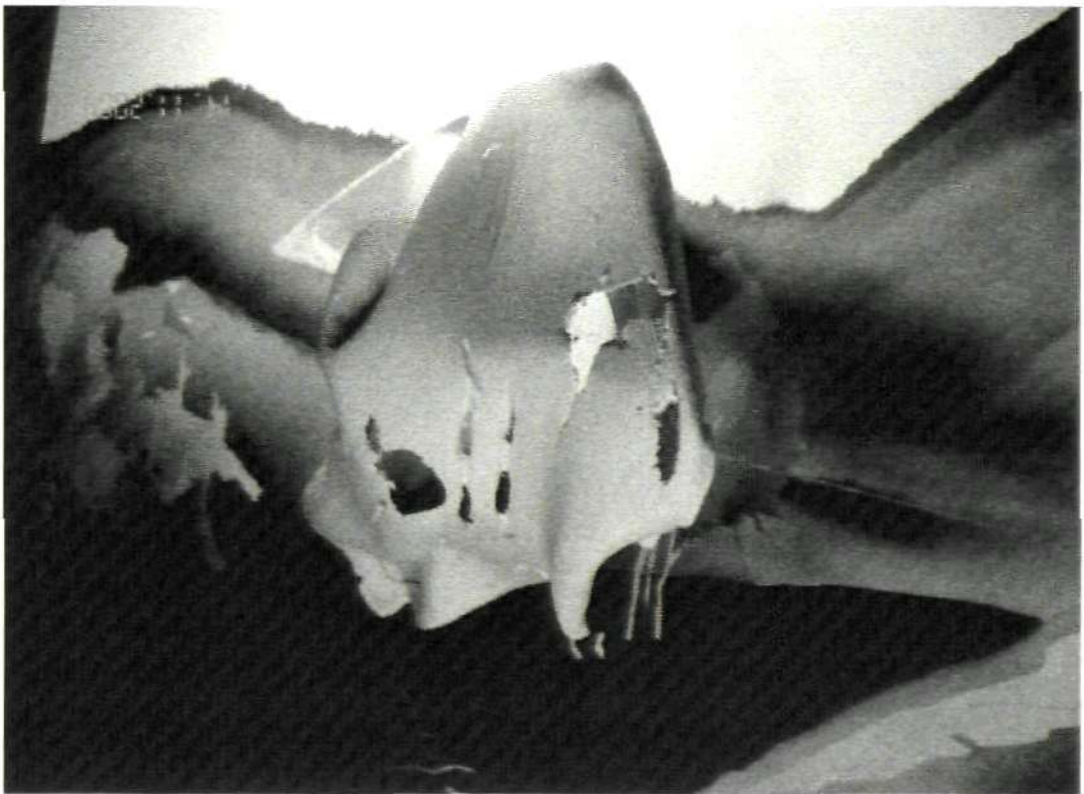


Figure 10-9. *A priori* model 10: Deba Valley, 2010



Figure 11-9. *A priori* model 08: Alava Plateaux, 2010

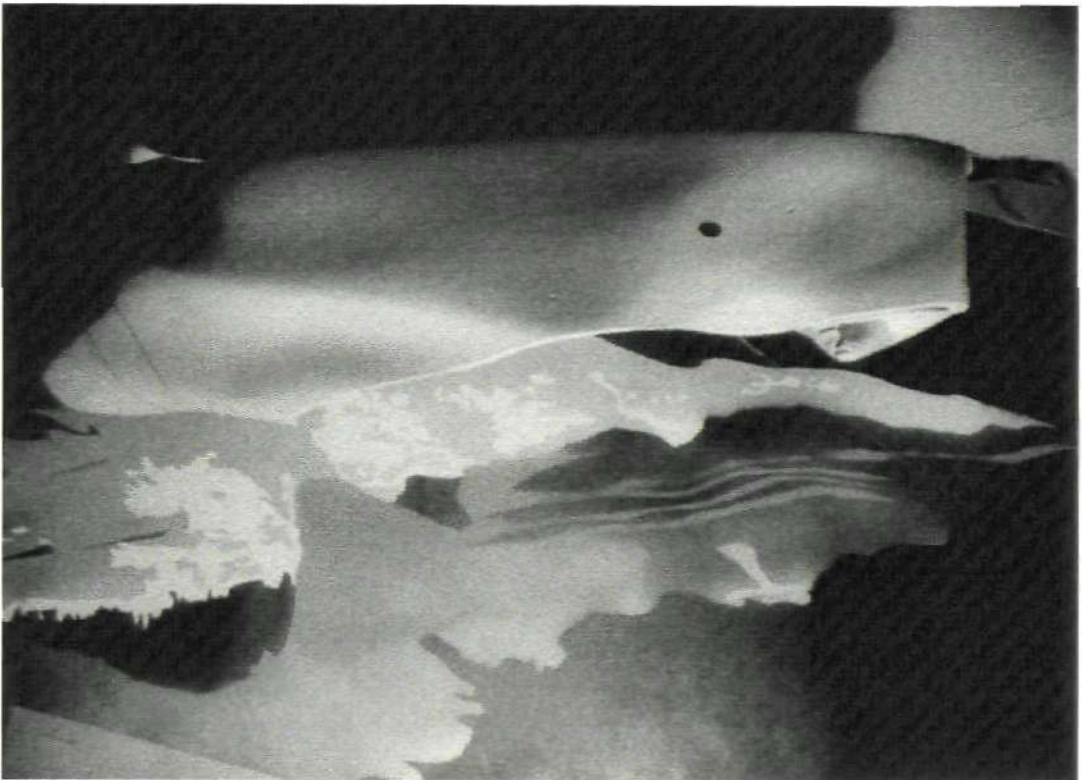
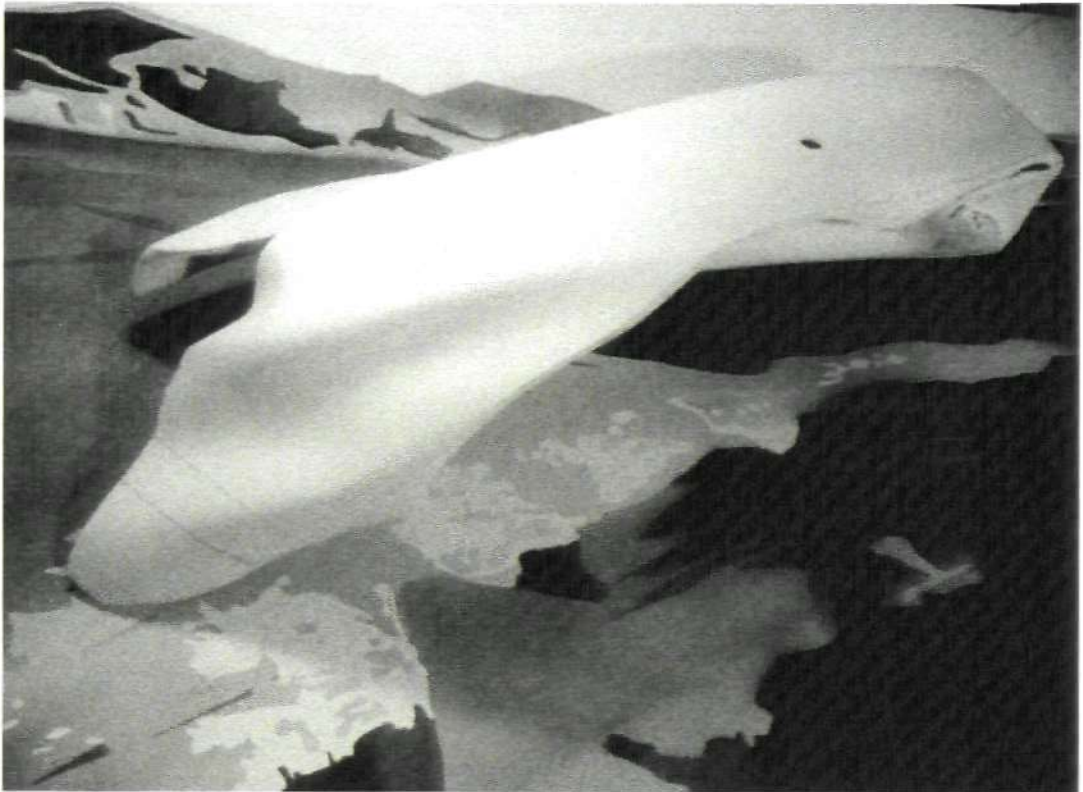


Figure 12-9. *A priori* model 09: Alava Plateaux, 2010

The Basque Country (*Euskal Herria* in Basque) is a cultural region that straddles the western Pyrenees, the mountains that define the border between France and Spain and extend down to the coast of the Bay of Biscay. Basque Enia is about constructing architectures in three territories of the Basque country. Using the Basque landscape to 'narrate' these architectures is most developed at its origins – a source of rivers, raw materials and energy. The architecture becomes concerned with the unfolding of naturalness, to show this sequencing of nature as seen from the architecture. It is also one of transition, of an almost phantasmic, high-altitude architecture that keeps on surfacing and disappearing in the landscape in its tireless dialogue with nature.

The actual Basque environment is studied through its ecological, notational, instructional and aesthetic (Enia) strands. In the Basque project three environments were chosen to consider. The first is the source of the River Nervion. Here the river flows through Bilboa, and at its source it dramatically drops three hundred metres into the valley below. The second environment is in the Deba Valley. In this province of Gipuzkoa there are six small rivers running almost parallel. These six rivers form valleys separated from one another by mountains, thus contributing to the fact that each region constitutes a microcosm with its own peculiar characteristics. And finally the third environment is the Castilian plateau in the territory of Alava. The key interest of these three areas was my research into the high concentration of heavy metals in the Basque landscape, which still remains a serious threat to flora and fauna.

Currently the focus of the research is looking at different viewing angles, as represented by the drawings, to show different levels of coherence between the potential constructs. These Eniatype can be rotated and analysed through various shifting scales for more detailed analysis of coherence between constructs of the natural and artificial. To incorporate better coherence of constructs depends on the level of research available to be applied into this framework. This methodology will also test out the potential operation of the construct intended, so that the actual construct when sited does not have a predetermined usage.

In defining the scope, one was looking at a report from the Environmental Department for the Basque Country which suggests that people

there, don't really care about the environment, and that business interests are so powerful that the people prefer to industrialize their last wild places. The other input was researching dynamic observational data models from research centres which have produced digital models of the three chosen environments. These anamorphic studies, as represented by the drawings, defined the scope of works to develop new Eniatypes for investigation of these architectures in construction. The drawings manifest such things as diagrams of nature – forces, laws, mental constructs and truths of the universe – that appeal to those who take the trouble to decode them. Phenomena will be abstracted from its environment and staged to allow the theory to be tested in a reproducible and communicable way. For example, at the source of the River Nervion, the curves derive from the analysis of data from the context and various functional objectives, but the underlying notation is derived from editing the way that nature self-organizes into flowing fractals. The implications are to review the constraints of the environment and view the architecture in coupled action with its context.

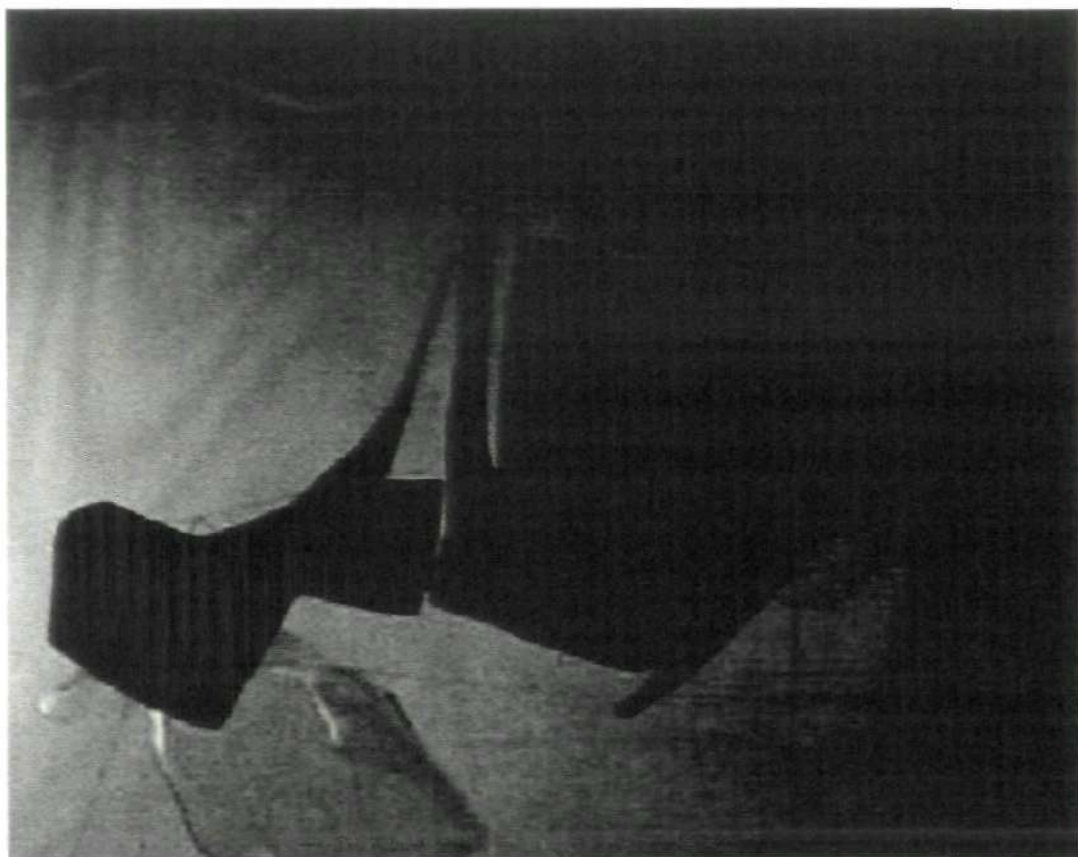


Figure 13-9. A prior model 04: time-based animation for Beijing Enia, 2010

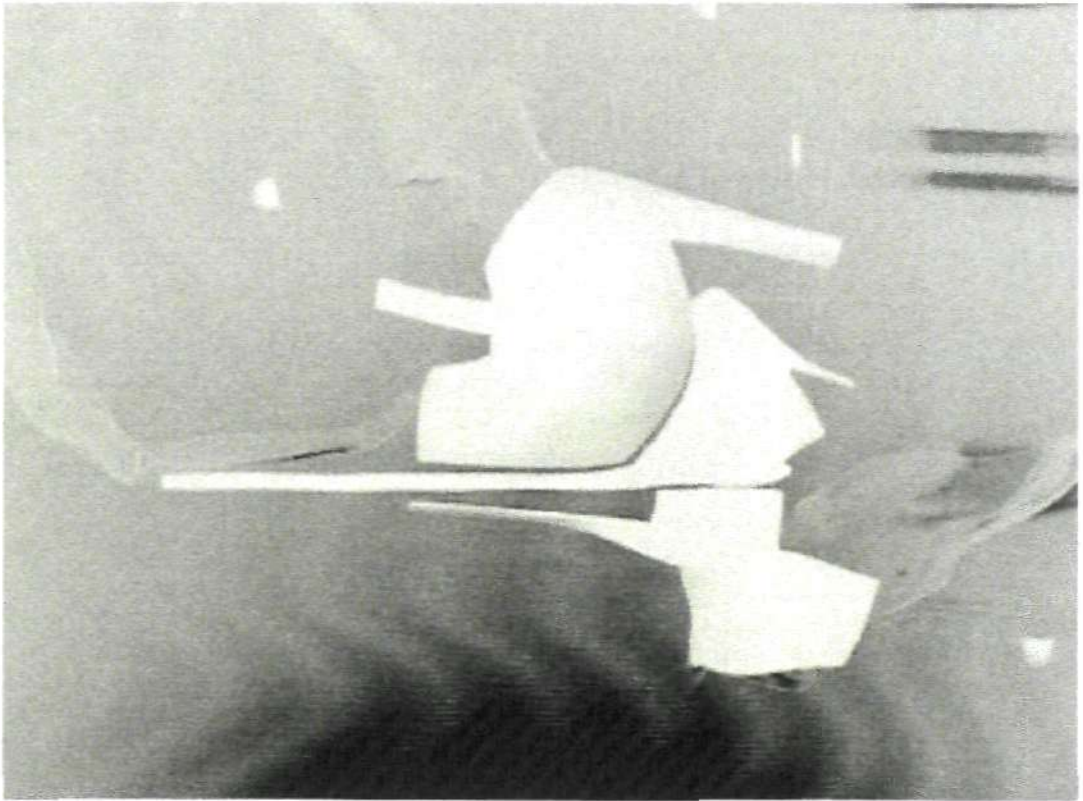


Figure 14-9. A prior model 04: time-based animation for Beijing Enia, 2010

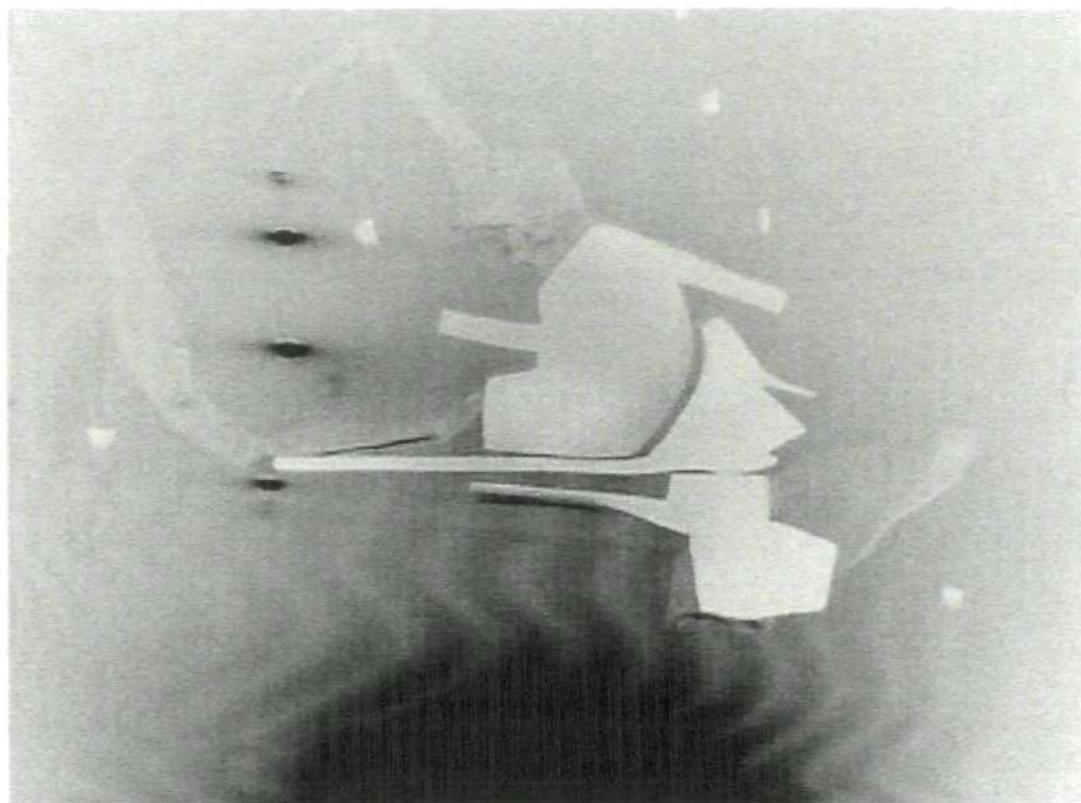


Figure 15-9. A prior model 04: time-based animation for Beijing Enia, 2010

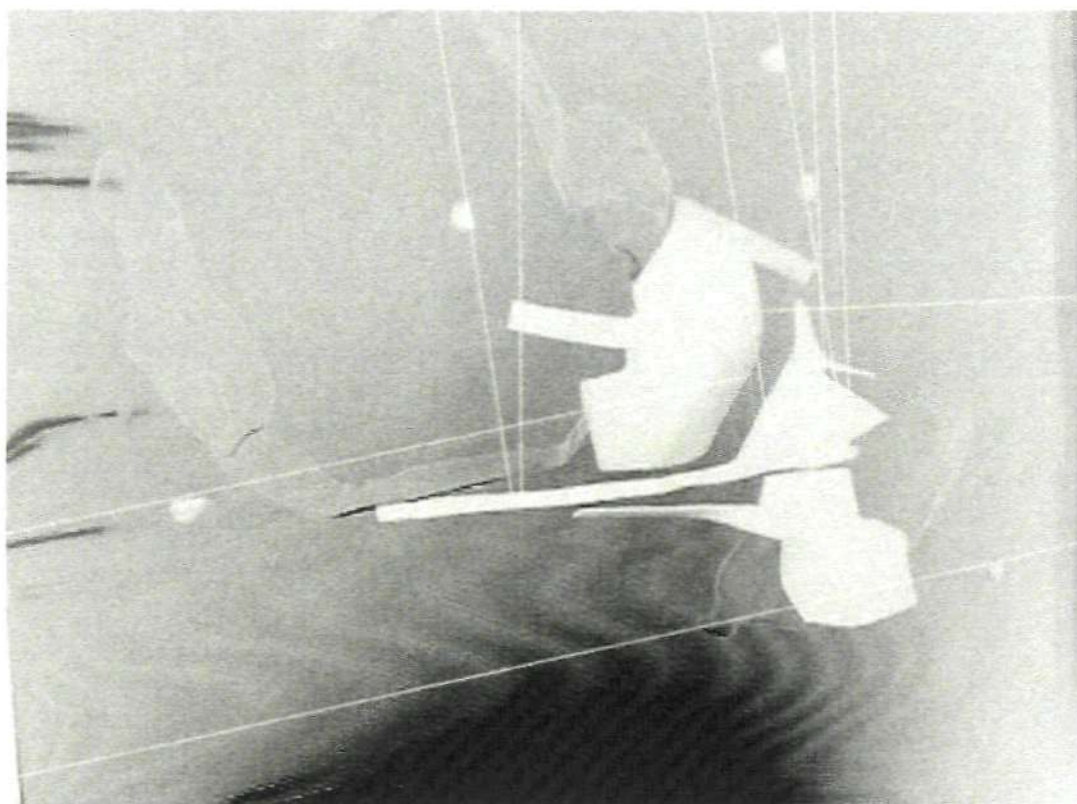


Figure 16-9. A prior model 04: time-based animation for Beijing Enia, 2010



Figure 17-9. A prior model 04: time-based animation for Beijing Enia, 2010

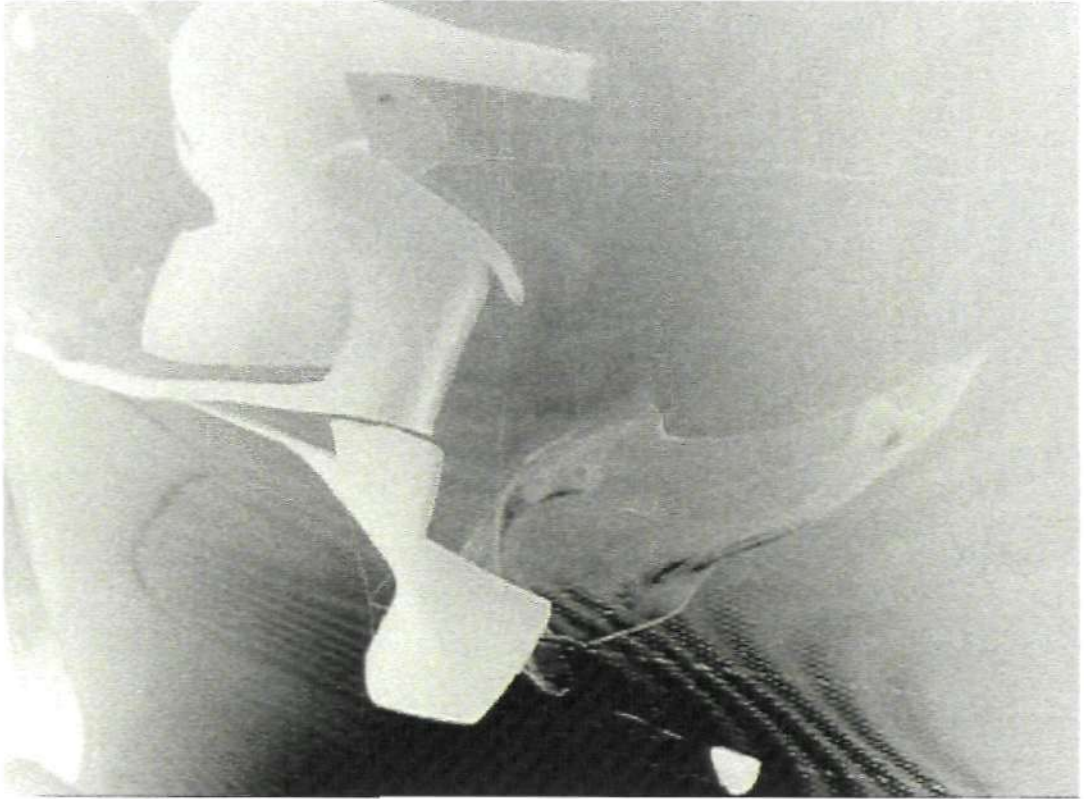


Figure 18-9. A prior model 04: time-based animation for Beijing Enia, 2010

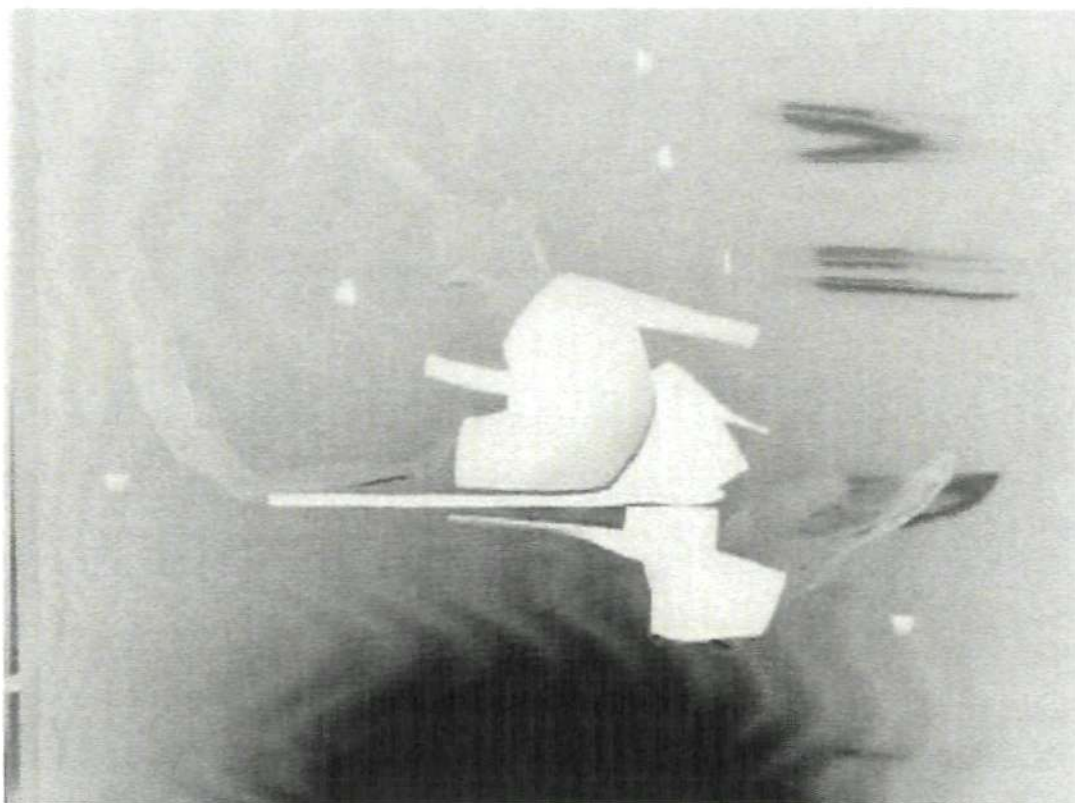


Figure 19-9. A prior model 04: time-based animation for Beijing Enia, 2010

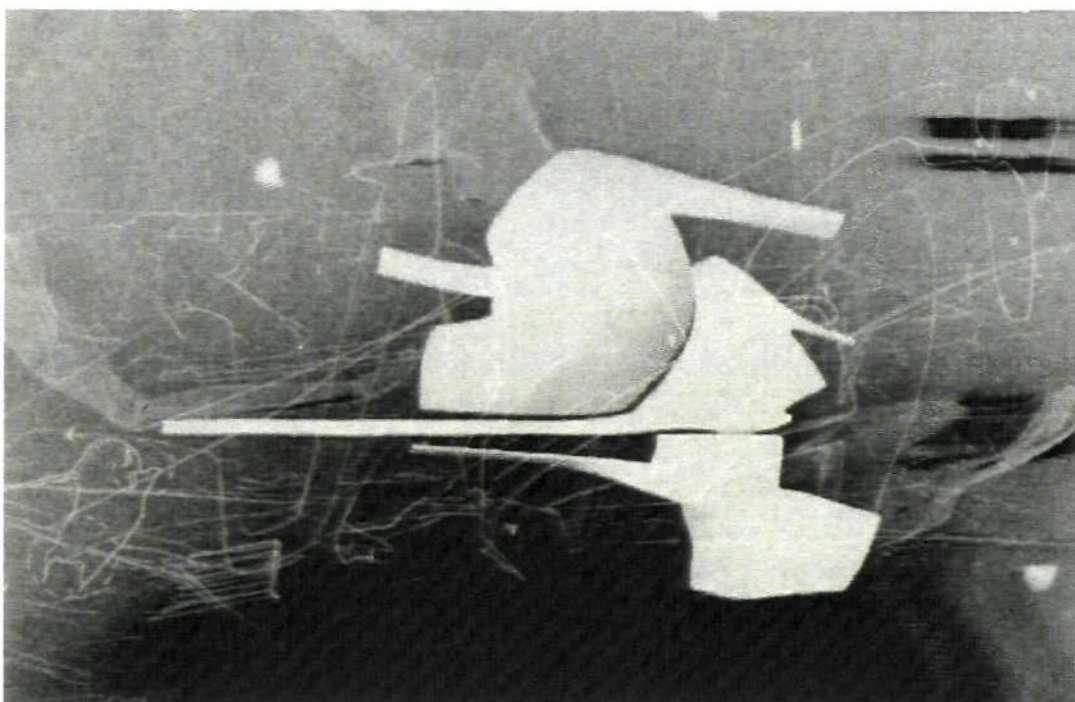


Figure 20-9. A prior model 04: time-based animation for Beijing Enia, 2010

Beijing Enia is a project developed across two sites, one on the Changpu River in the centre of Beijing and the other in the Xingjian Uygur Autonomous Region of Kashgar. In Beijing, the Changpu River was revealed in 2002 after 40 years of concealment at the east end of Tiananmen Rostrum. From a government plan from 2002, initiatives were taken to protect the historic and cultural city of Beijing. This plan is specifically to protect Beijing's water system, to harness and protect these waters as being relevant to the city's history and eco-environment. My investigation into the rivers of Beijing and its unique flora and fauna, led me to develop a project on the river network through the genetic research done on the lotus leaf. Research had been carried out on leaf mutations, leaf development, genetic mapping and self-cleaning and was used to determine the final architecture of specific organs. Four independent leaf mutant lines have been identified and studied.

The Xingjian Uygur Autonomous Region of Kashgar is the farthest point from any ocean on the planet and is the largest political subdivision of China. Xinjiang's lowest point is 155 metres below sea level, which is the lowest point in China. The Uighur people of the province run the risk of having their culture 'packaged' for the tourism market and in doing so losing its very essence. Research shows that the speed of desertification in the past 10 years has decreased by 50 percent, with the downward trend likely to continue. The Kashgar site is series of veils that would manipulate the light and hinder the speed of desertification.

Beijing Enia is a system-based model which negotiates a spatial relationship between the two environments. Neither absolute homogeneity nor absolute diversity is likely when the two sites are dynamically negotiating. Instead the local is permeated by the global to the extent that the local finds from the global what is useful, and employs various strategies to retain its identity.

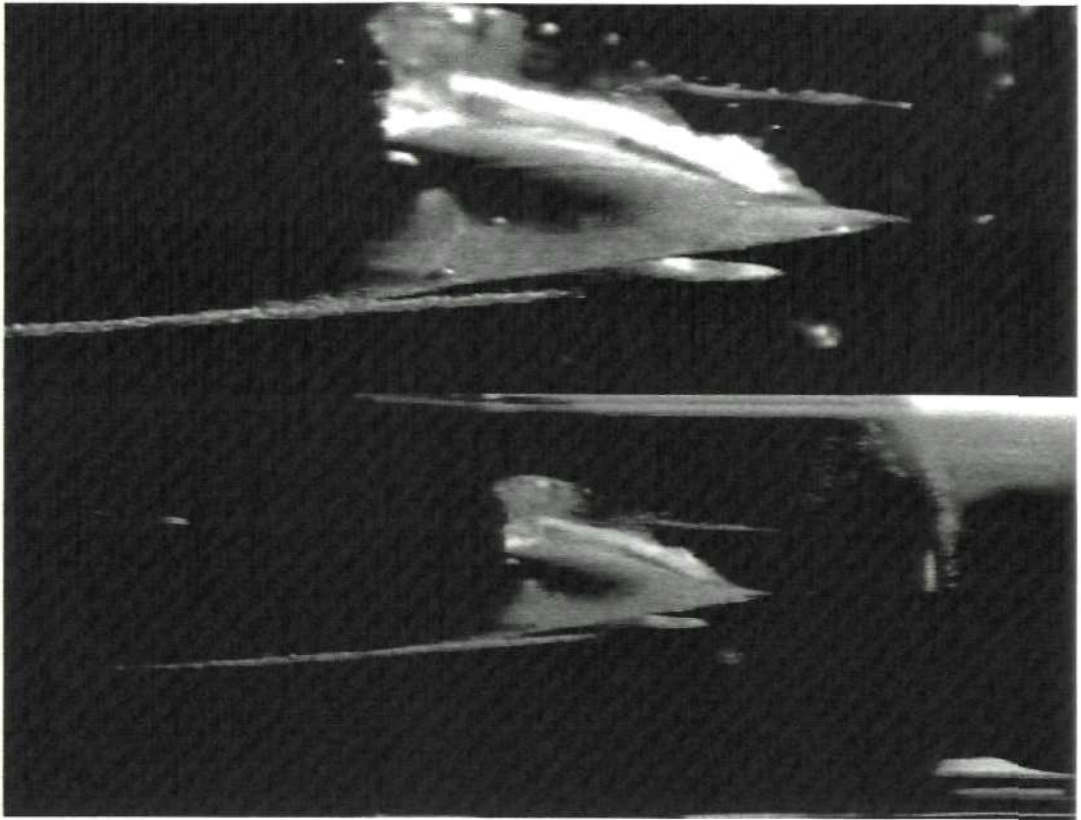


Figure 21-9. A prior model 06: Underwater Lotus leaf time-based animation for Beijing Enia, 2010

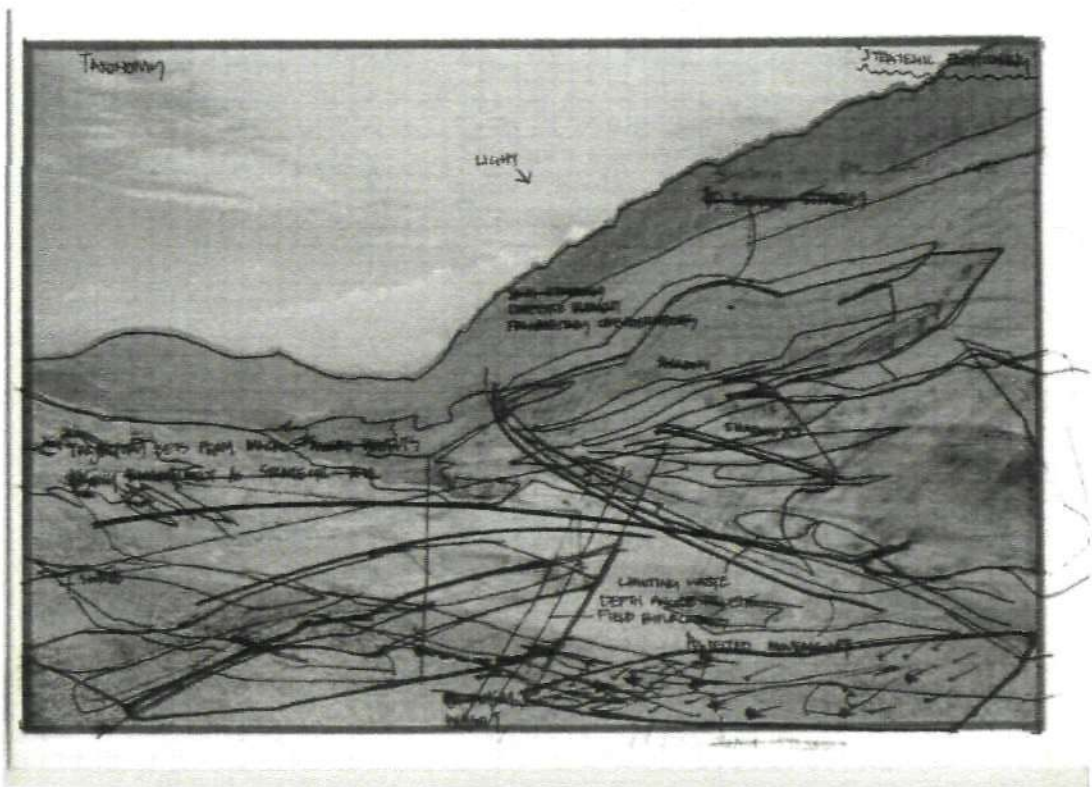


Figure 22-9. K Construct: Kashgar Veils: The Xingjian Uygur Autonomous Region of Kashgar, for the Beijing Enia, 2010

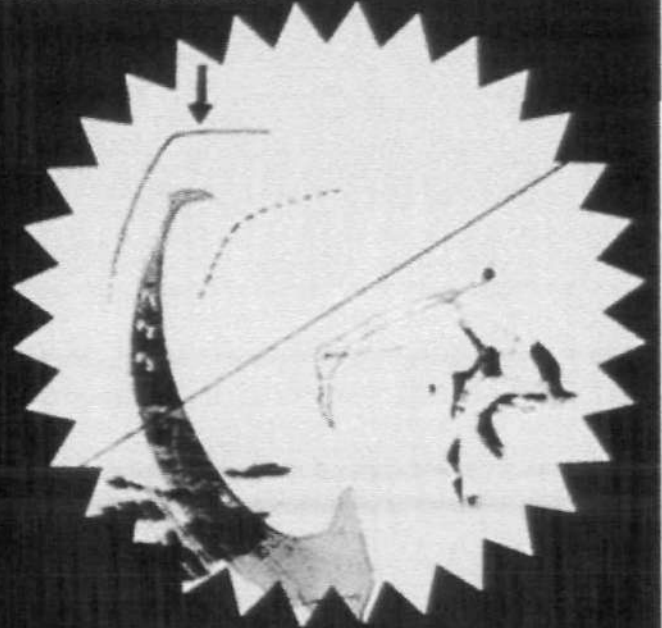
10. Principles of Design Ecologies, Theory of Notation, Instructional Design and Aesthetical strands


If architecture alters the environment, will it be able to be maintained by artificial sub-systems to replace the natural ones, in a way to allow technology to 'keep ahead' of nature until eventually architecture becomes completely independent of the natural order by technological means, this could be seen as an argument for future prescription rather than analysis.

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Figure 1-10. Cover of book entitled: Disturbing Territories by Shaun Murray, 2006

This is the investigation of the first major attempt at moving working drawing through environment to contain a series of principles for describing the design situation as complex and contingent. Projects in this part include Basque *Enia* and Beijing *Enia* that support a complex and contingent design. Also within the *Enia* section is a theory of communication design entitled Design Ecologies.

As a designer we are constantly renegotiating between working drawing, participant and environment within context, design and communication in the natural and artificial. This kind of reality exists by no means in the future but is here with us now. It is not limited by time but exists now with its own operations as something that is somehow expedient. It is a direct intervention in the quality of the world, a space in which beauty acts. This point is inseparable from a deviation, produced at the moment at which the territory is disturbed by working drawing, participant or environment: the point of contact. Through the point of contact a renegotiation takes place, as described earlier.

When confronted between the renegotiation of working drawing, participant and environment within context, design and communication, with several alternatives, usually one is chosen and the other eliminated. The line to be negotiated is constantly disturbed. For example, in conversation, we continually negotiate spaces of any difference that makes a difference.

Our framework here provides the designer with a view to one becoming progenitor in the ecology of design. It is clear that renegotiation of working drawing, participant and environment constitutes components, each of which is connected to other disciplines concerned with communication, information and dialogue in our environments. Therefore the framework provides us with a fundamental basis from which ecological design could be approached.

The work is about the methodologies of communication through the designers of spaces and objects that operate inside them. Significantly, the practice work is intended to allow the possibility of collaborative practice and become a digitally networked creative enterprise.

The integrity of the projects comes from a distributed network approach whereby the ethics of ecological sustainability needs to be realised – in human society as well as in the ecosystem – in which the projects are not the property of the individual, but the property of an entire web of relationships. The work

looks to opening the boundaries of conventional practice by a fresh and exploratory approach to design. It continually looks to develop creative partnerships with people in other domains, and to have a network of research affiliates (mathematicians, programmers, etc) whose skills can be deployed according to the project. The value of this approach is to propose methodologies to understand how architecture can be wholly informed about the implications of social and technological environments through the process of construction. To develop an open research proposal, dealing with environmental considerations through practice research. The aim is to develop and demonstrate a methodology for analysing determining effects of interaction within a field strategy.

We can then begin to see the harbinger of a more meaningful ecological (both machinic and natural) audit of specific sites and the development of a series of tactics and protocols that can provide architects with the these now necessary tools for them to create architectures that are fully in tune with the wide gamut of artificial and natural ecological conditions.

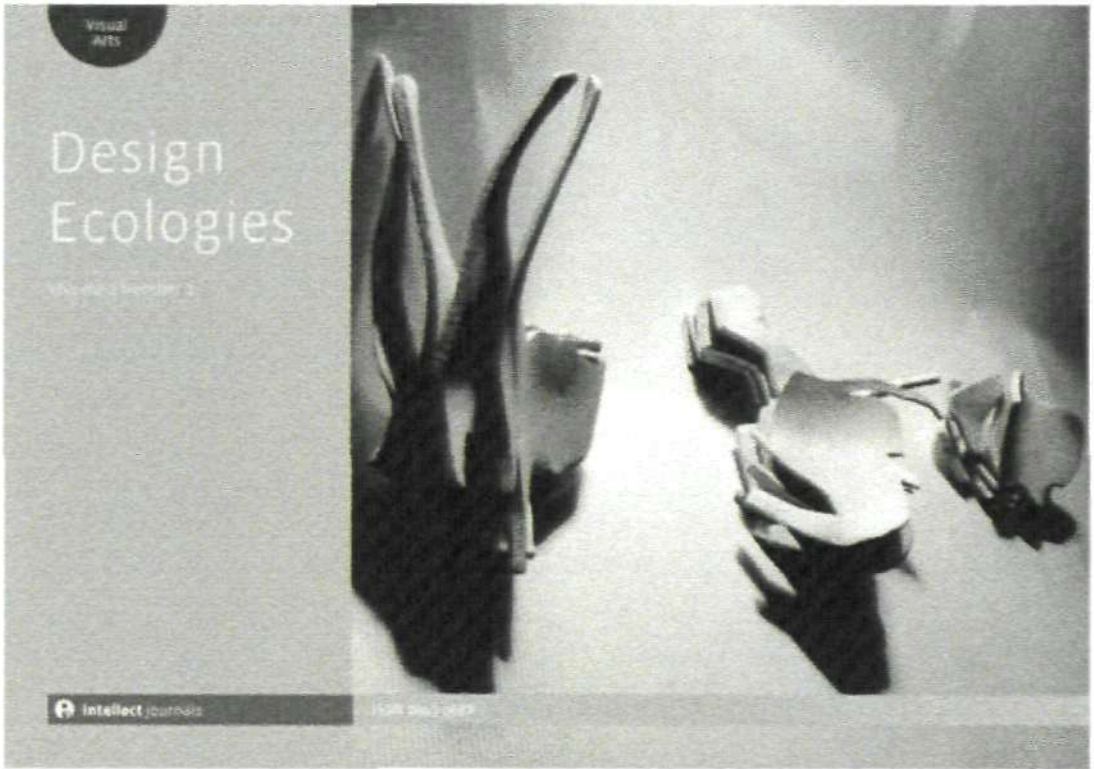
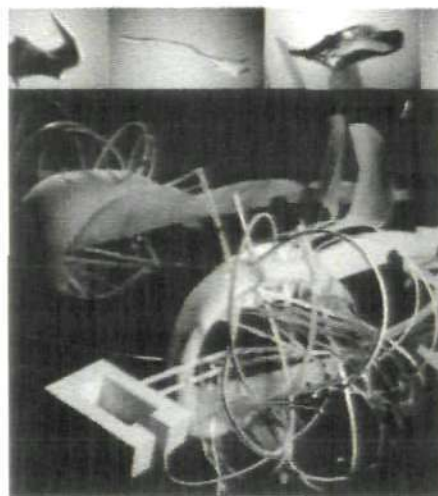
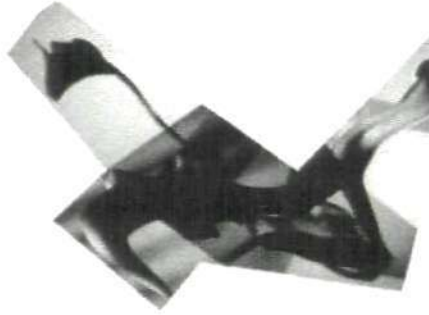
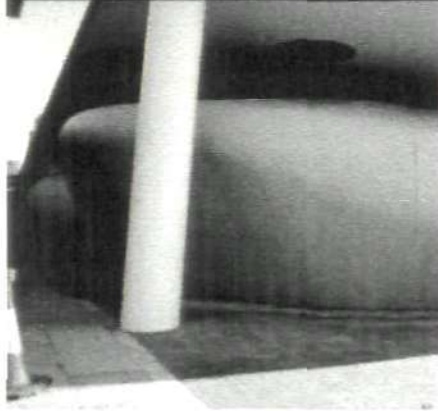
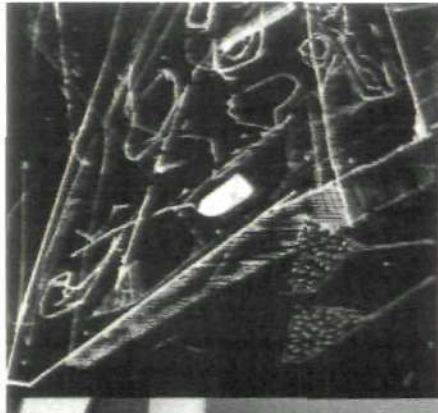
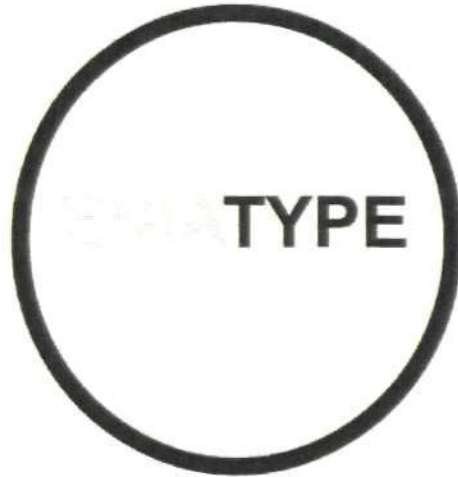
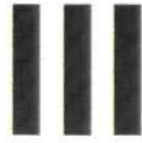


Figure 2-10. Cover of academic journal entitled *Design Ecologies*, 2010



DESIGN VISIONS



11 Type Difference

12 Type Levels

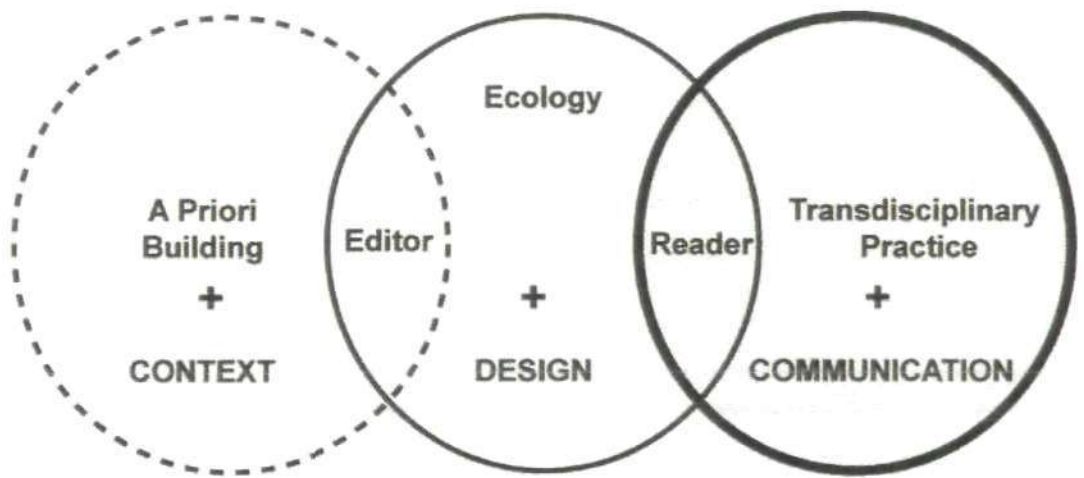


Figure 1-11. Diagram of Thematic Integration: Focus on Type Communication, 2010

11. Type Difference

What is being researched here is how an architecture, by dealing with the environment, can be informed through type. Within research outcomes through professional practice and five transdisciplinary research sessions, I aim to identify an understanding of differences in type through context, design and communication. My research will focus on how these three identifiable processes can be coupled to become coherent outcomes. The differences between research and practice through models of thinking within the transdisciplinary research sessions and within professional practice will hopefully stimulate an idea of an integrated design.

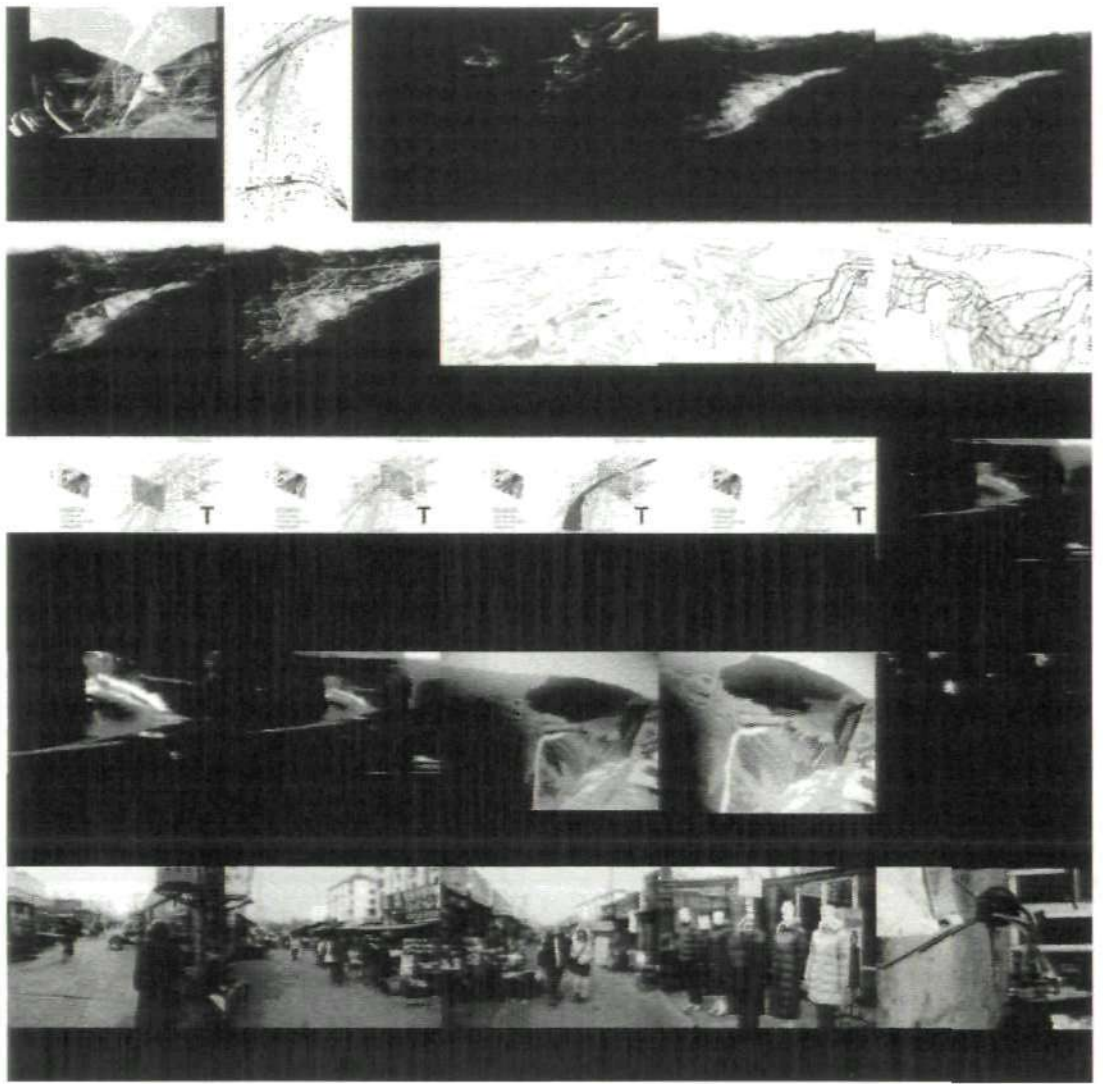


Figure 2-11. Image of working drawing, participant and environment communication strategies, 2010

Difference – constituted of individuality and the interrelationships between heterogeneous elements – is the basic concept of Eniatype theory as applied to architecture and social structures.

I have identified some differences between the methodologies of communication between professional architectural practice and research sessions. These differences are through methods of communication, recursive qualities, authorship of the work and transparency of information. The guiding principle of the Eniatype association of different elements is espoused on the theoretical understanding of methodologies of communicating through five transdisciplinary research sessions and professional practice outcomes. One question would be: Can these two identifiable processes be coupled to work towards an integrated design practice?

The different methodologies of communicating an outcome between practice and research are that within practice essentially the communication of an outcome is carried out through, working drawings, whilst through the research sessions the communication of the outcome is through verbal discussion. The different recursive qualities between practice and research are through the editing and re-editing of the projects on which the participants are working. In practice, the participants editing and reediting of a project becomes evident through the working drawings, whilst in the research sessions the outcomes of the projects with the participants became evident through discussion. Authorship of the work is different between working drawing and session development. The draughtsman in professional practice usually signs off each update in the development of a working drawing; whilst in the sessions there were different participants updating the progress of the project. Transparency of information was thus different between practice and research. In working drawings there was a lack of evidence of where the information had been acquired. It was also evident that a working drawing cannot handle all the information necessary to communicate the outcome; whilst in the research sessions the transparency of information within each outcome became evident through doing.

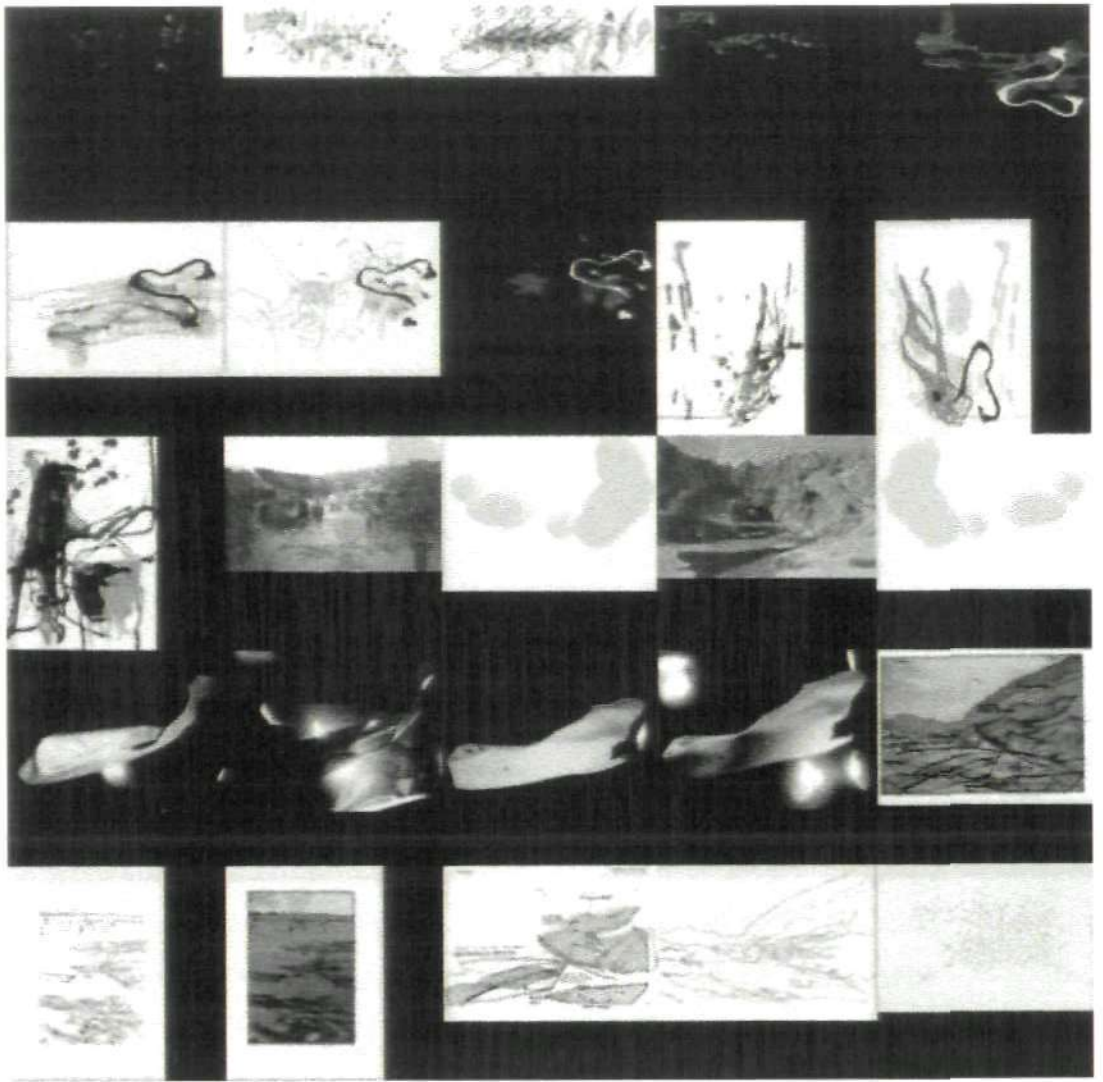


Figure 3-11. Diagram of Thematic Integration: Focus on Type Environments, 2010

The transdisciplinary research sessions were particularly important in studying integrated design because the outcome frequently led to counter-intuitive responses to the relationship between the working drawing, participant and environment within context, design and communication. For example, when I set up a session with participants specialised in programming and architecture, I asked the participants to develop tactics to identify the relationships between the data from the Arch-OS system (which is open sources data from the building energy management system of the building) and the participants that use the building. The participants were asked to present their findings on a large-scale LED-screen or in the immersive vision theatre. The feedback loop of the Arch-OS system from participant to data to participant may operate either to keep the organisation in check or unbalance it. By taking a systems approach, we can see the whole complex of bi-directional interrelationships. Instead of analysing a problem in terms of an input and an output, for example, the participants can look at the whole system of inputs, processes, outputs, feedback, and controls. The participants usual methodologies of communicating their designs were challenged by trying to communicate the complexity of the whole output of the building, and not just one part. The use of a live-feed of data from the building brought unsuspected visual results through the large led screen and the immersive dome screen. Because the architectural participants could not control the outcome, they started to realise that it wasn't about form-making, but about structures – and structures quite different to what they thought. Through an understanding and thinking about the reciprocal relationship between the Arch-OS system and the participants, the session's participants developed strategies about how we can communicate, inhabit and involve themselves through the experience of architecture over time.

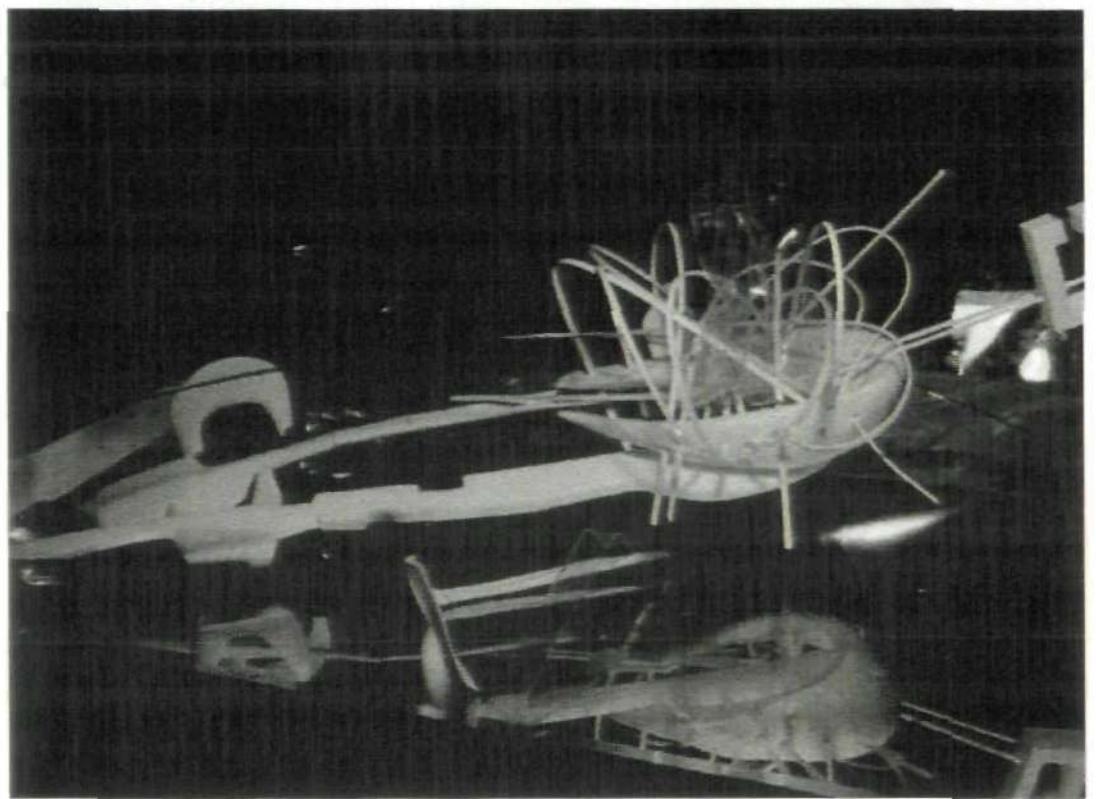
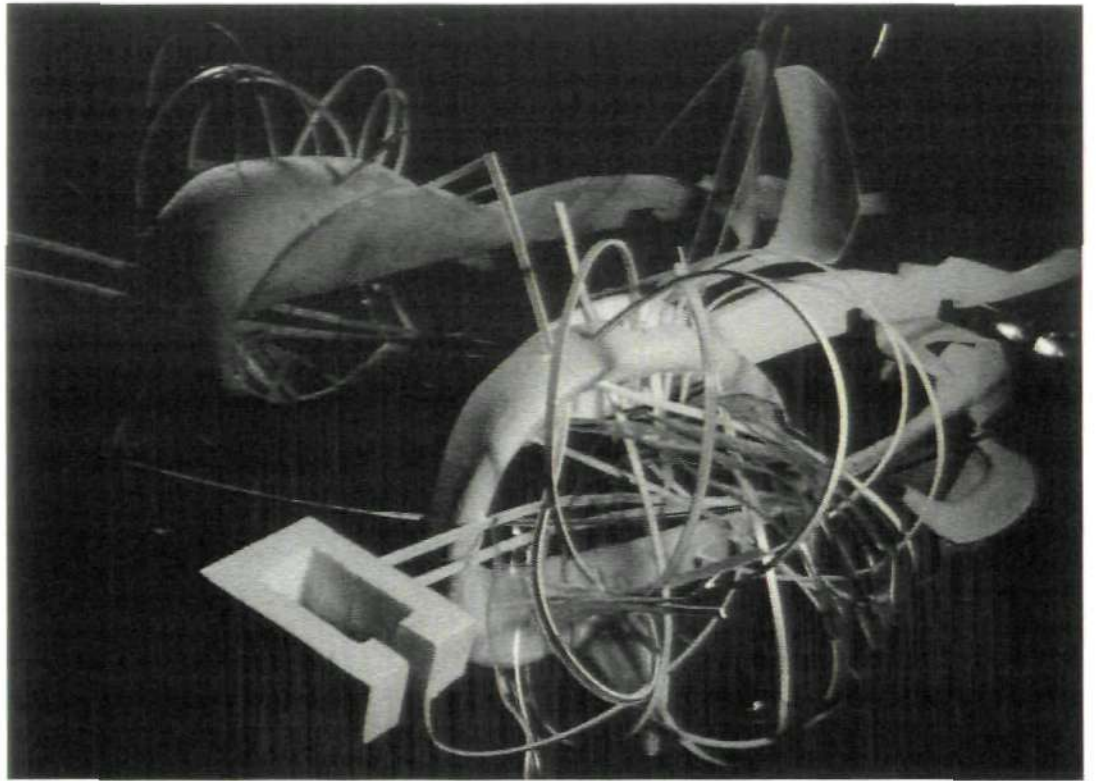


Figure 4-11. Image of Nested Ecologies prototypes for Osaka Development, 2010



Figure 5-11. Aerial view of Nested Ecologies project for Osaka Development, 2010

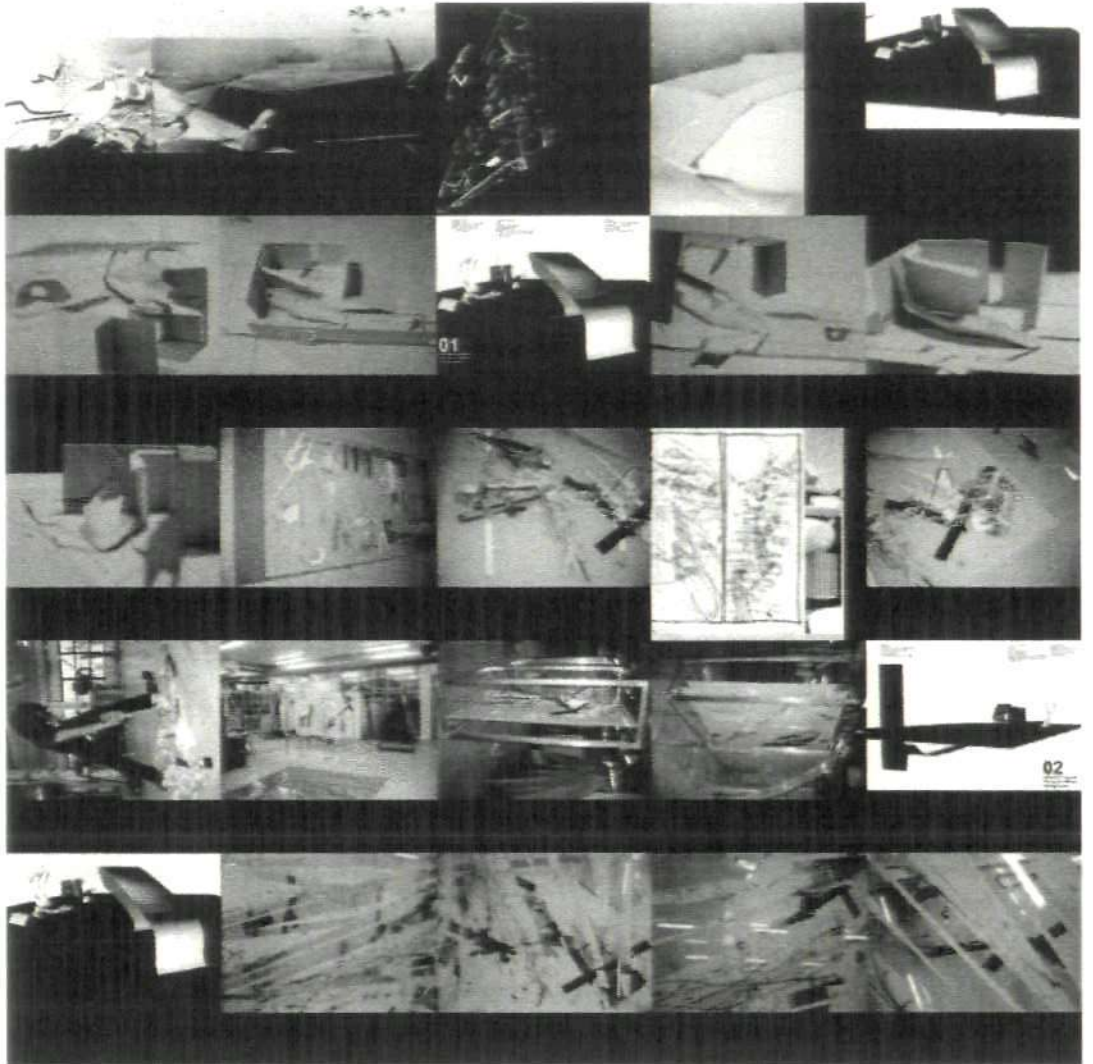


Figure 6-11. Image of working drawing, participant and environment communication strategies, 2010

In the past, architecture wasn't a taught subject but was learnt through practice, by inherently linking architectures to the natural environment through orientation, placement and scale. They developed a particular sense of place and time, and knew the vital importance of honouring the primeval forces and fields. Today, the study and practice of architecture has been restricted from evolving new modalities to link our architectures to the natural environment. Fresh approaches need to emerge that can purposefully 'couple' the relationships between the natural and artificial – an architecture that somehow can be synchronised with the natural forces and fields within our environment, an architecture that can couple with environments at various scales. As practices of architecture evolve, so do the development processes of constructing buildings. Although new techniques in computer-aided architectural design (CAAD), allow architects to enjoy complete freedom in form-making, this arbitrariness and lack of restraint characterises a new era of formal freedom which raises questions about other paradigms that seek to rediscover the precisely determined, purposeful, or inevitable attributes of form. For example, it is through lived experiences on actual building projects that you learn about practice. One of the key ways of gaining experience about the relationships between working drawing, participant and environment is through the act of doing. Each different project brings along its own nuances and challenges that we can learn from. As one works on a project, it becomes possible to apprehend one's relationship with that particular experience. Although currently the fundamental thing we use to communicate the building is through the working drawing, the drawing has a limited opportunity of being able to experience it *a priori* as a building.

12. Type Levels

The fundamental postulate of the theory of logical types, a postulate which in itself alone sums up the prohibition applying to self-referentiality in the logical-mathematical world, is the following: 'A class cannot be a member of itself.' This postulate implies the existence of an infinite hierarchy of logical levels or types. At the lowest level of this hierarchy come the members. At the next level up, we have classes of members or sets. At the next level, we find 'metaclasses', i.e. the class whose members are themselves sets. And so on.

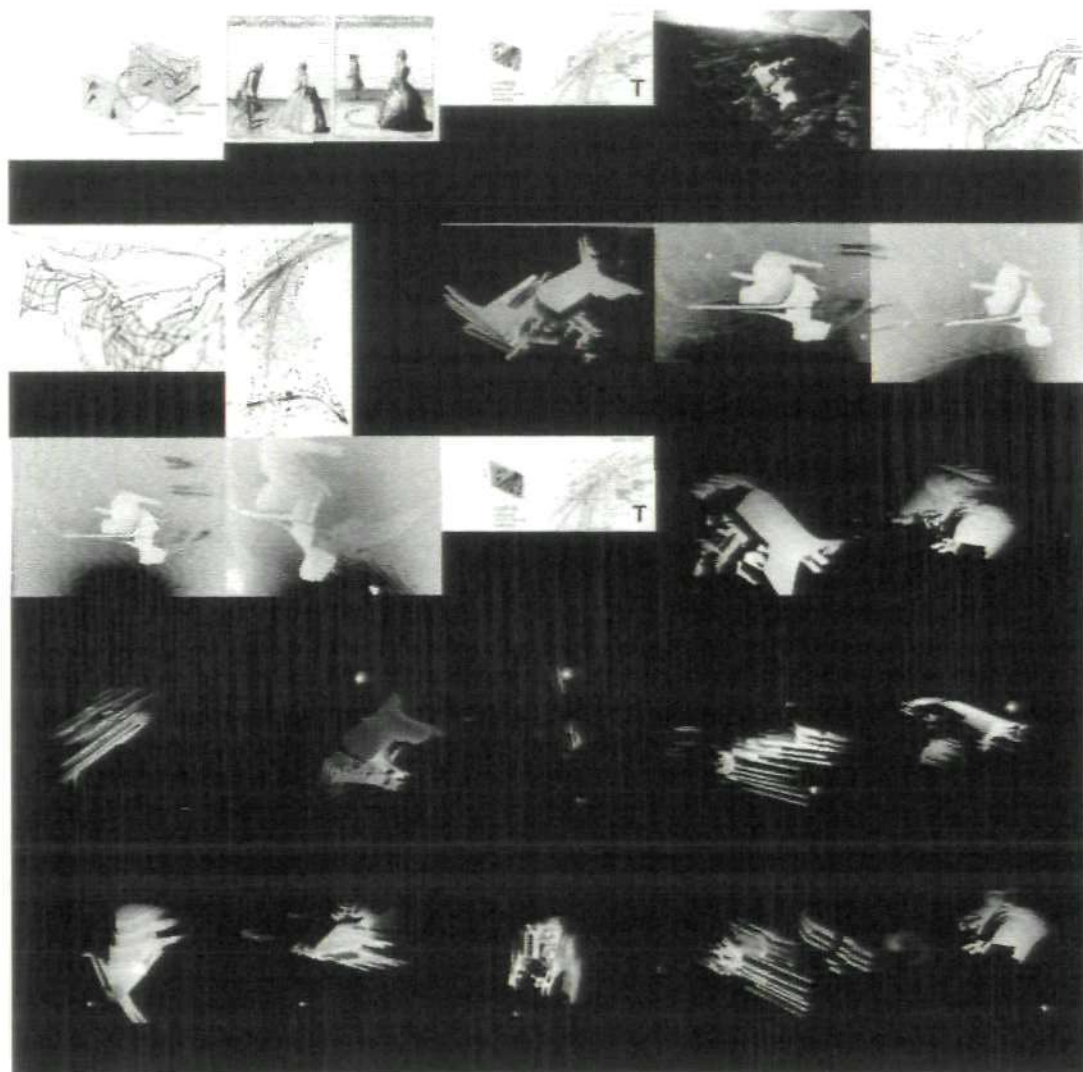


Figure 1-12. Image of working drawing, participant and environmental communication strategies, 2010

Bateson describes levels of communication as 'the combination of the message' (Bateson, 2000:133). Levels of communication have been used in the practice of psychology, sociology, linguistics and anthropology for some time. It has been suggested that the 'levels' of communication provide a way of grouping communication theories, but they inevitably leak from one to the other, or fail to find a group at all. Robert Craig has suggested that there are seven traditions of communication theory including rhetoric, semiotic, phenomenological, cybernetic, socio-psychological and socio-cultural and critical. The interlacing of these levels of communication through working drawing, participant and environment, between people and built systems, between built systems and their infrastructures or between these infrastructures and the ecosystem is evident in practice. A related problem in the evolution of communication between working drawing, participant and environment could be understood through Korzybski's phrase 'the map is not the territory'. For example, the working drawing is not the architecture, the environment is not the architecture, the participant is not the architecture and vice versa. Somehow the architecture evolves through the relationship between the levels of communicating the architecture, and hence architecture seems to mediate between all these levels.

Bateson could be deemed a pioneer in distinguishing the levels of communicating architecture, which are somehow indeterminate through his realization far ahead of his contemporaries that the primary source of error in ecological design lay in the false presumption of an ability to 'control' and 'manage' ecosystems through quantitative measurement' (Harries-Jones, 1995:8).

We measure architecture on many levels and the current quantitative measurement within working drawings is not the architecture.

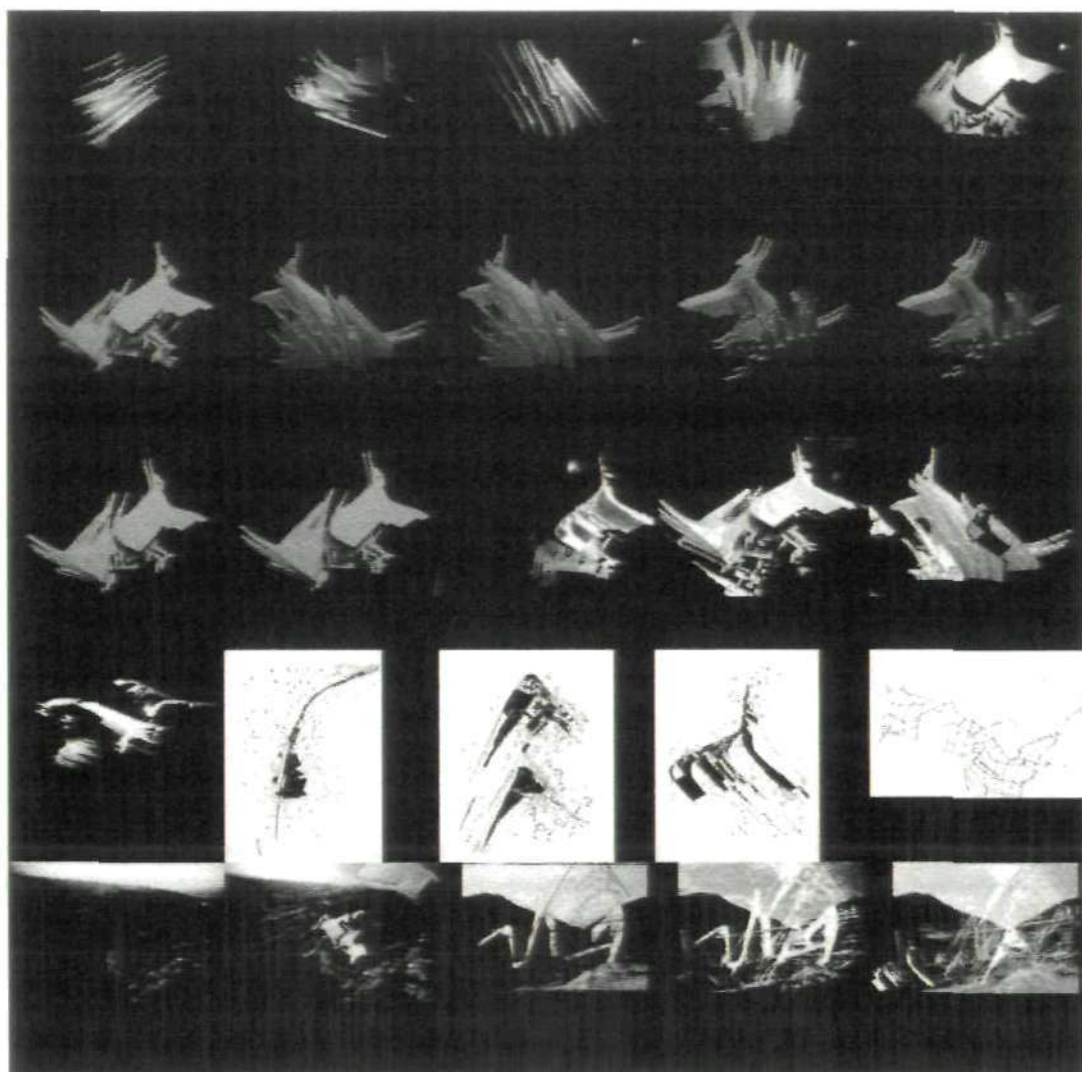


Figure 2-12. Image of working drawing, participant and environment communication strategies, 2010

12.01 Bertrand Russell's Theory of Logical Types

Russell called communications theory the Theory of 'Logical Types' (Whitehead and Russell, 1910). His central thesis is that there is a discontinuity between a class and its members. The class cannot be a member of itself nor can one of the members be the class, since the term used for the class is of a different level of abstraction – a different logical type – from the terms used for its members. In architecture we can avoid Russell's paradox by first creating a hierarchy of types within the elements of a project, then assigning each entity to a type. Objects of a given type are built exclusively from objects of preceding types, thus preventing loops (Whitehead and Russell 1910). Within the practice of architecture this continuity is continually breached in the relationship between working drawing, participant and environment. Characteristics of the architecture itself in the system however become meaningless if this is breached continuously, for example, between structure and materiality.

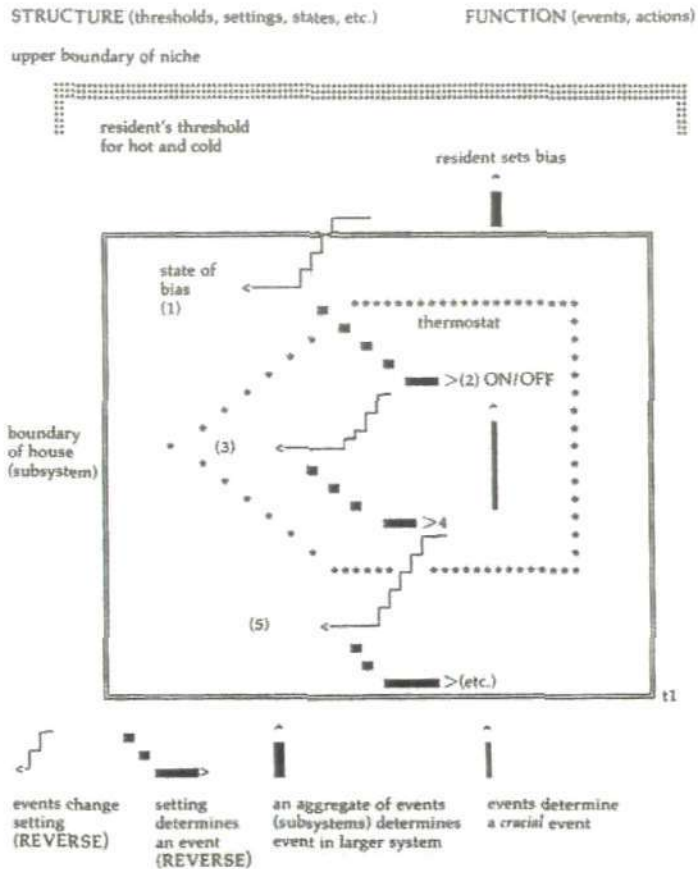


Figure 3-12. Image of Bateson's Model of a House Thermostat as 'Structure' by Gregory Bateson, 1979

12.02 Gregory Bateson's Levels of Communication

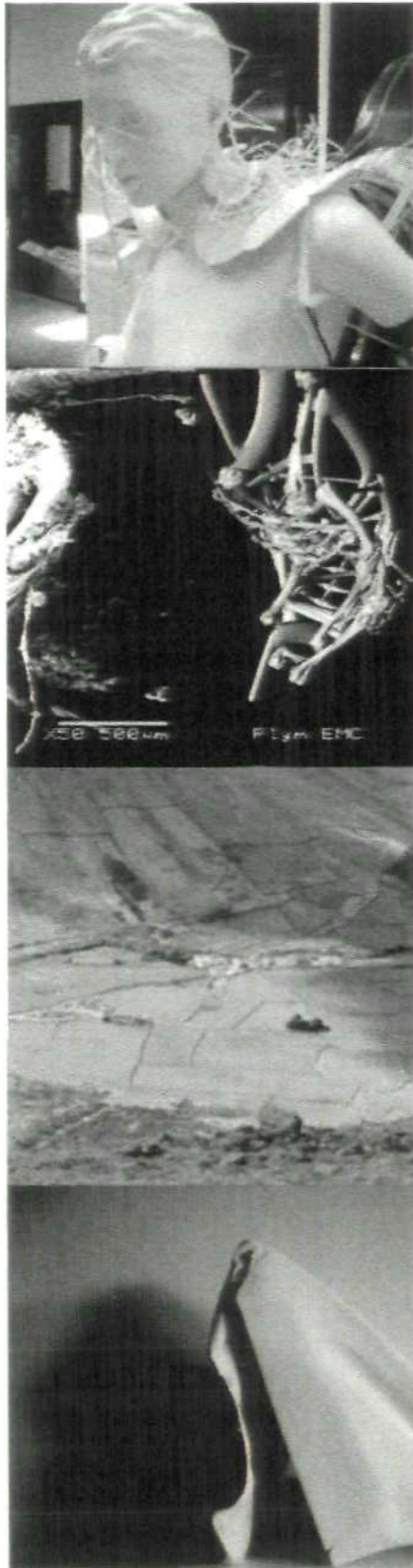
From Uexküll's Umvelts to Rene's Catastrophe Theory, we can distinguish that participants in the built environment have different umwelten, even though they share the same environment, for example, every individual has separate needs of the lighting and heating in a building. This is the same for our working drawings that continuous action on the working drawing can produce a discontinuous result when articulated for the building in the environment. An example of this can be identified through Bateson's project on the reflexive thermostat. In the model sketched by Bateson, an ecosystem is a common set of communication events. It is built upon a prototype that Bateson called a house thermostat, but was, more properly, a 'reflexive thermostat.' The ecologist, John Todd, in 1978 asked Bateson whether there are possibilities of treating an ecological climax as a set of communication events. Bateson's replied that there are obvious contrasts between the type of events one can call

'communication' in a natural ecosystem and the sort of events that human beings usually refer to when speaking of 'communication'. Bateson suggests that communication needs to be defined exclusively in terms of 'reported' conversations or events. Communication between coupled sub-systems can be said to exist in the more limited sense of 'linkage' in a network of events – as in a network of signals having the values of 'commands'.

Bateson proposed to contrast Howard T. Odum's brother, Eugene Odum's energy-driven model of an ecosystem with an 'entropic model' of an ecosystem. Energy driven models of ecology presume that the planet is some sort of biomachine. The release of energy from biomass drives the cycling of materials in the biosystem. Bateson's model proposes that organisation of information is fundamental to ecosystem survival. He called this the 'entropy economics' of biological forms. (Harries-Jones, 2002:235)

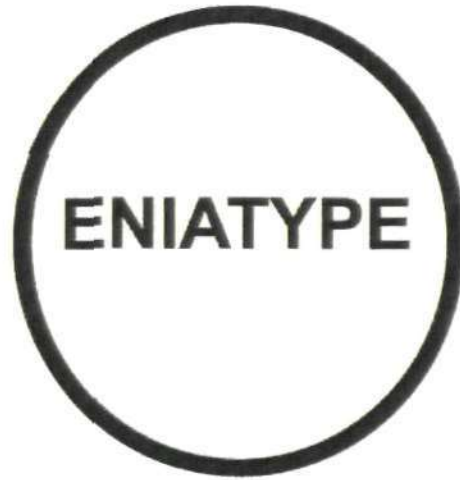
A feature of the Bateson model is a 'multi-level system' with boundaries or thresholds registering several different types of sub-systems. The types of sub-systems include participants, a physical structure, an energy flux within the house sub-system and a feedback device, which connects to various levels of the system. 'As in real ecosystems, the whole system is linked by feedback loops which rise and fall depending on the succession of events' (Harries-Jones, 2002:238-240). The different levels are between the house and system, participant and system, system and system. The thermostat is composed of participants; it is reflexive over its various boundaries. The larger system includes its house and residents.

The Bateson model highlights the nature of systemic interaction in ecological organisation and the importance of feedback to the multi-level structure of a holistic system. It also poses interesting questions about feedback as linkages within the system. Finally, ecological stability is affected by our own understanding of the organisation of stable ecological processes. Only a change in understanding the fittedness of ecological stability will alter a highly organised non-linear ecosystem. It is these communication regularities that we must discover, for it is they, which constitute its structure and form a unity in which we make our home.



DESIGN SYNTHESIS

IV



- 13 Insights
- 14 Elements
- 15 *A priori* Planning
- 16 Recursive Infrastructure
- 17 Synthesis

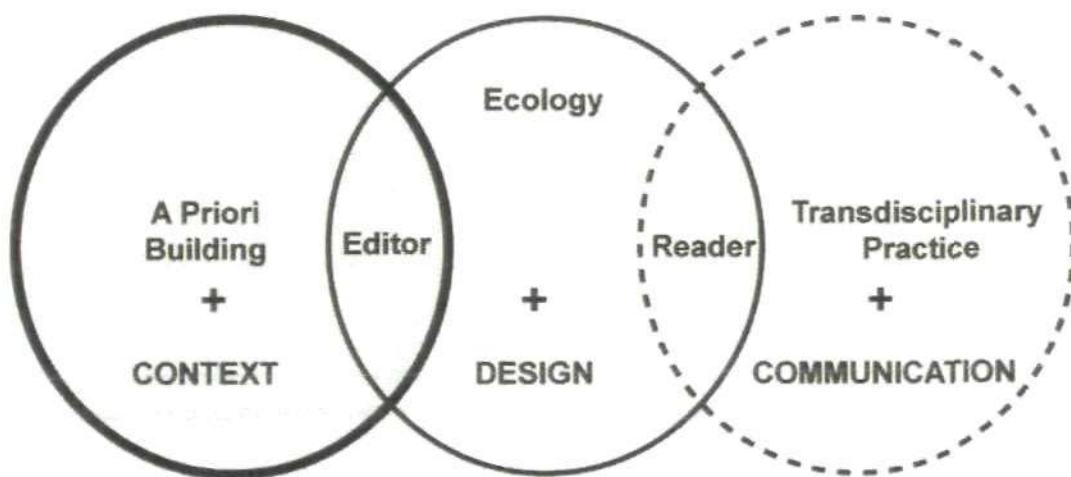


Figure 1-13. Diagram of Thematic Integration: Focus on Context *a priori* to Planning, 2010

13. Insights

This section provides a way of understanding the activities of and the links between research and design through five transdisciplinary research sessions. It reviews existing definitions of research-and-design and discusses three possible models drawing on historic references but also on Umwelt (meaning environment) analysis. The research aims at the comprehension of different spaces related to Umwelt and the 'in', 'off' and 'by' spaces.

The transdisciplinary research sessions we set up are to further develop the ideas of Eniatype. The sessions are a reflection on practice through the experience of participating in the session over three days. The idea of using transdisciplinary research sessions was to enable a principle of unity of knowledge beyond disciplines (Nicolescu, 2002) of design between research and practice. The sessions were organised so that every participant would address the relationship between participant and environment through experience. Each participant was asked to develop strategies of communicating their practice through the experience of the sessions by using, for example, a scanning electron microscope (SEM), ultrasound, Geographical Positioning Systems (GPS), rapid prototype (Rp), three dimensional scanning, Radio Frequency Identification Devices (RFID) within the environment.

Bateson writes in his book on *Mind and Nature: A Necessary Unity* that the architecture, the buildings, the walls separating and organising departments in universities are transforms of the disciplines, of the minds and ways of thinking, that inhabit them: compartmentalised, with subjects isolated from their context, from other ideas, from nature and from the social, political, cultural, and economic world around them. Bateson was engaged in what we now might call transdisciplinary work, 'whose nature is not merely to cross disciplinary boundaries, but to rearrange our mental landscapes – to make us see the ecology of ideas and the ecology of mind – to make us see anew' (Bateson, 2002:xvii-xviii). Also within *Steps to an Ecology of the Mind*, Bateson realised that students were trained to think and argue inductively from data and hypothesis but never to test hypothesis, against knowledge derived by deduction from the fundamentals of science and philosophy. Through diagrams, Bateson stressed that 'data' are not events or objects as they are always in transformation or recording of the raw event, which intervenes between the scientist and the object.

Insights to five of the transdisciplinary research sessions will be discussed individually. The first session is entitled Architectural Ecologies, and involved a transdisciplinary research session in Arch-OS (www.arch-os.com) and the environment through the experience of the participant. The second session is entitled outside/inside, a transdisciplinary research session in GPS

and Ultrasound – this being a session exploring the space between GPS satellites that locate our bodies on the earth's surface and ultrasound that allows us to see beneath our skin. The third session was entitled Digital Design Processes, and explored a transdisciplinary research session in haptic devices and nurb modelling for physical environments. The fourth session, entitled Sliding Scales, was a transdisciplinary research session in SEM and rapid prototyping. The fifth session is another transdisciplinary research session on working drawing, participant and environment through the experience of participating in the Arch-OS system. Central to these transdisciplinary research sessions is the inclusion of the participants through their methods of communicating their practice through experience. Although the transdisciplinary research sessions incorporated research participants drawn from across the fields of architecture, 3D design, communications design, performance, digital art and technology, multimedia production, programming and engineering, they also brought in participants from different Higher Education Institutions from the UK and Norway. The focus was to seek a principle of unity of knowledge beyond disciplines.

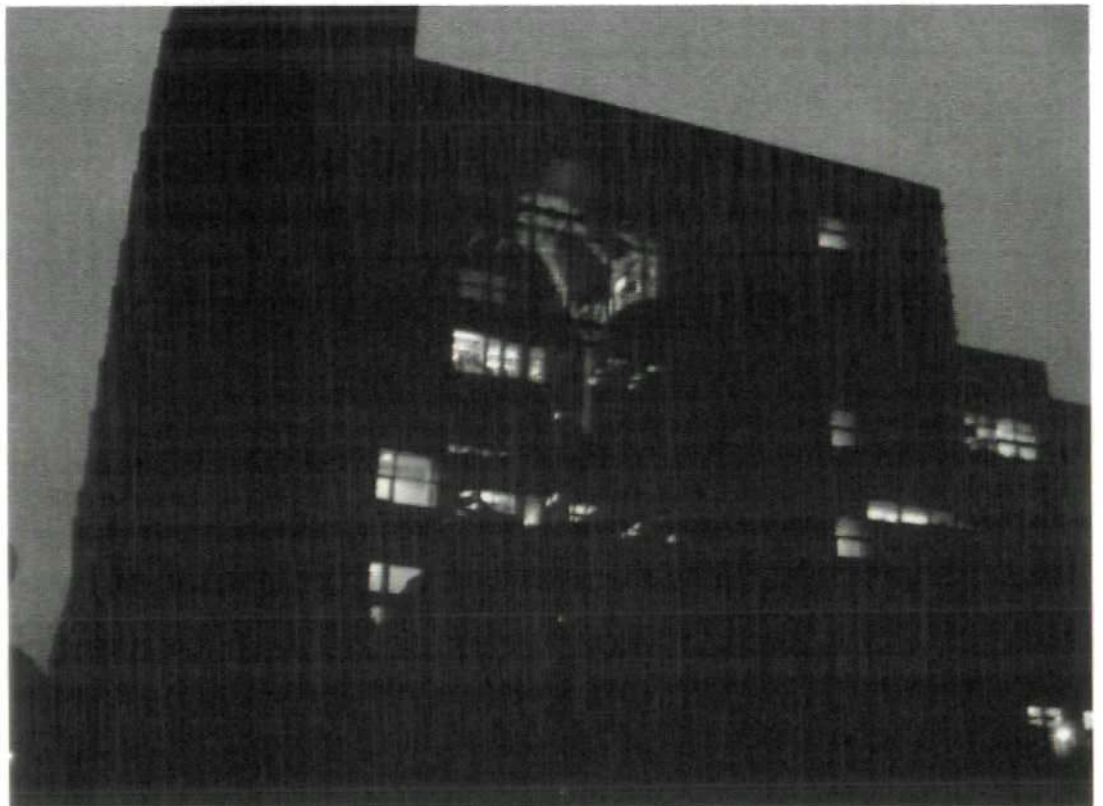


Figure 2-13. Image from participant in Transdisciplinary research session 1, 2010

Architectural ecologies research session worked in different fields, from aesthetics to behaviour, an interdisciplinary approach to affecting the relationships and interactions between inhabitants and their architectural environment. This research session experimented with and forecast potential future use, impact and value of using data generated by a building and its inhabitants, to recursively influence behaviour, creating a symbiotic ecology with a potential greater environmental awareness. Through the session we will encourage the development of an organic list of solutions or potential methodologies for building design. These methodologies were based on the study of the main factors: behaviour, data and interaction of participants in the building. The results of the participants were a hybrid of potential methodologies to expand and evolve our physical and conceptual space, and our behaviours and interactions within these. In such a state, the boundaries and thresholds of spaces maintain a dynamic pluralism between contemporary tectonic architecture and abstract environmentally generated data.

The session used the Arch-OS system as a starting point for this investigation. Current literature on Intelligent Buildings suggests an ideal of a building as an autonomous system that controls its internal and external environments. The model, whose origin lies with early models of artificial intelligence, effectively treats the building as a slave to human needs, and appears to vest more intelligence in the building than its occupants. Arch-OS exemplifies an approach of reviewing the methodologies of communicating practice through participation and experience of the system architecture, seeing environments as extensions of participant's senses, by increasing the participant's consciousness of their built environment. With this ecological model of Intelligent Building we can now question the autonomy of the building from its participants. Sensors within the building yielded data for processing by the system, which in turn actuated equipment that affected the environment. The

Arch-OS project was created to enable a greater transparency and understanding of the complexity of modern buildings and the relationship between its inhabitants and their behaviour. The system enables building occupants to reflect on the environmental impact of their interactions, both

physically and through the extended social interactions enabled by communications technologies. Through the acoustic and visual representation of their social activity, combined with live representations of data generated by the electro-mechanical and environmental activities of the building, the participants are able to better understand the complex relationships that exist between each other and their environment.

Throughout the session, the dynamics of the relationships between the participants shifted at different stages of the development of the project they were developing. For example, at an early stage in the transdisciplinary research sessions, the dynamics of the participants seemed to mostly focus on the programmer participant. The programming within the project was being privileged over the ideas expressed in conversation, sketch or 3D model. The relationship within the group focused on trying to understand what the programmer participant could do. Each participant reflected on the outcome of the session within his or her own practices. All sessions were based within the environment they were designing 'through'. Developing the outcomes within the environment was a key strategy to understanding the correlations with the environment and the participants on the sessions.

Particular parts of the session's outcome formed inputs to later outcomes within the participant's own practices. Some participants began to develop their own toolsets, which included part-drawing, part-participant and part-environment. The constancy in the relationship between the various parts enabled more rigorous outcomes that were developed at a later date. For example, one outcome was focused on the social ecology of the environment. Propositions became architectural as framing of experience through this unity of knowledge developed in the session. This unity of knowledge came from the technological facilitated interaction in the session as a tacit means to engage with the more difficult aspects of our relationship with the environment.

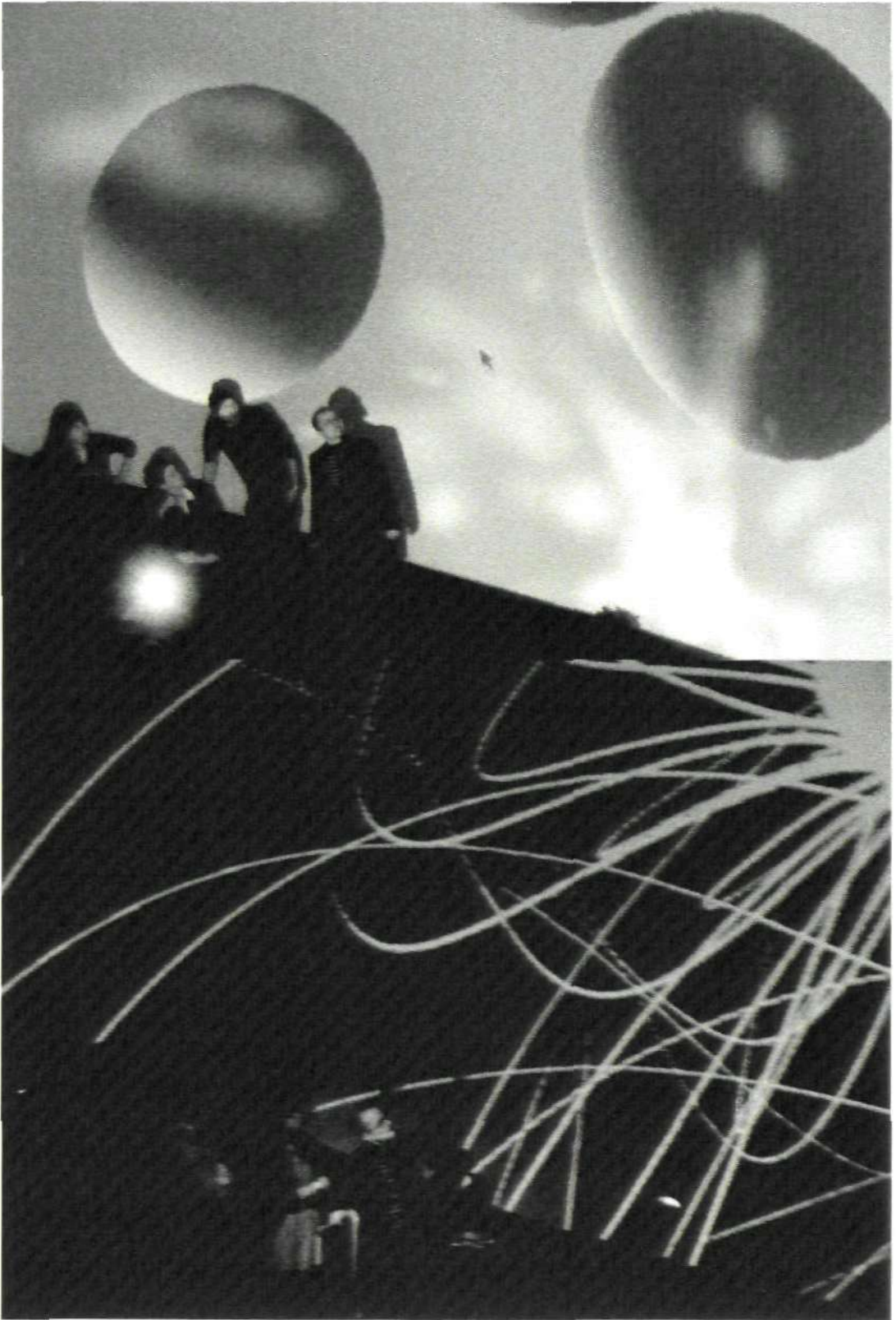


Figure 3-13. Image from participant in Transdisciplinary research session 1, 2010

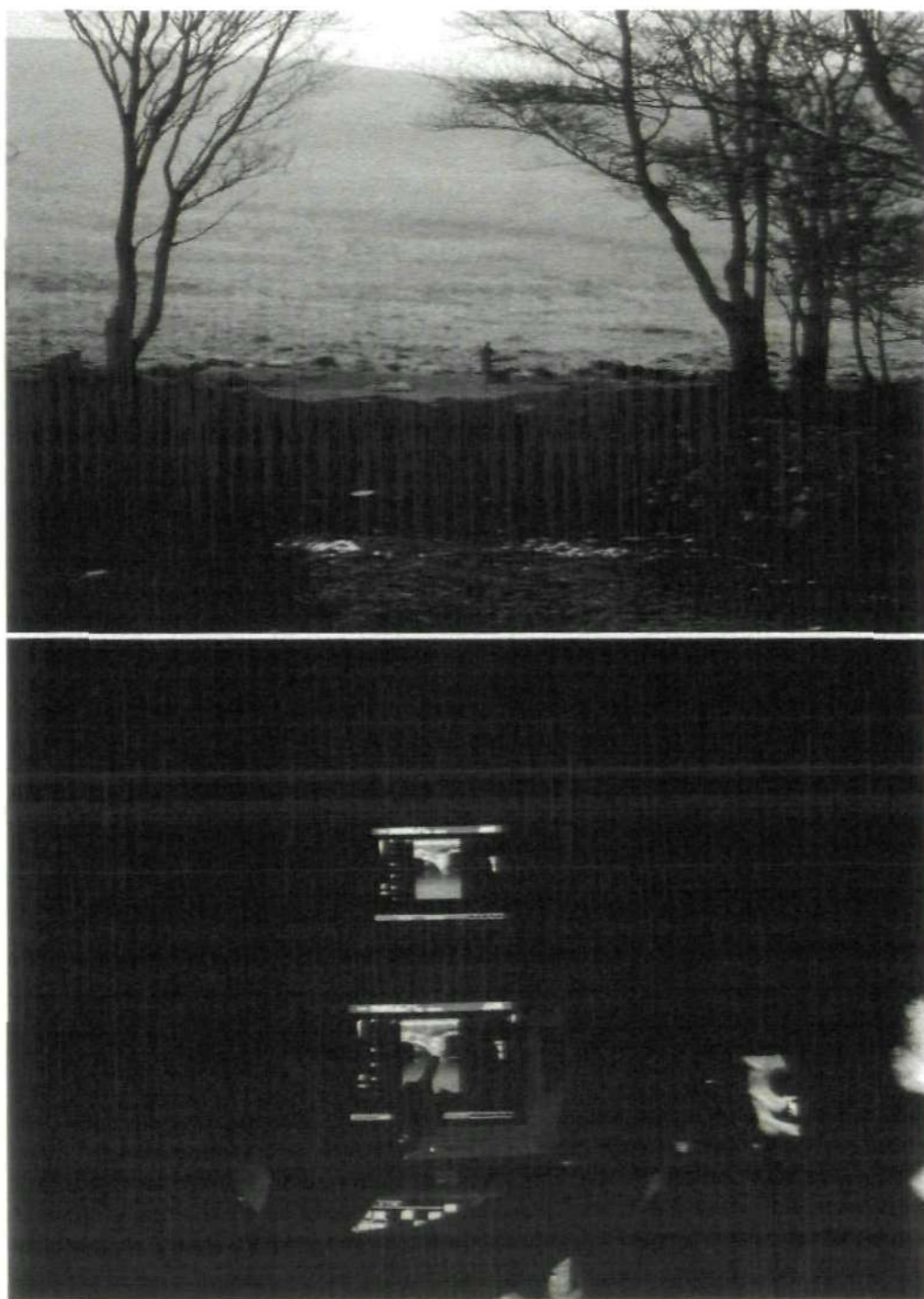


Figure 4-13. Image from participant in Transdisciplinary research session 2, 2010

13.02 Session 2: Outside/ Inside

Through this research session we developed projects where touch is our bridge with architecture and the world. All of our senses are extensions of touch, since our ears, nose, mouth and eyes are all specializations of the skin,

the most sensitive of our organs. As Pallasmaa puts it, 'touch is the unconscious of vision, and this hidden tactile experience determines the sensuous quality of the perceived object, and mediates messages of invitation or rejection, courtesy, or hostility.' (Pallasmaa 2000: 79). Digital technologies now allow us to 'touch' different spaces that are both inside us and outside us, and close to us and far away from us. This three-day session encouraged participants to consider the design space that is found between the GPS satellites that orbit the Earth at a height of 12,600 miles, and the 20cm sensing depth of ultrasound scanners that can reveal the organs beneath our skin. The first day involved, a day trip into the wide-open spaces of Dartmoor National Park to explore the idiosyncrasies of recording movement, form and location through the correlation of data gathered from the satellites and space vehicles that are circling the Earth. In contrast the second day involves a short session at the Peninsula Radiology Academy, where participants had the opportunity to use ultrasound technology to scan the insides of a live human body. The sense of touch obviously plays a unique and important role in human interaction. Touching is not only closely linked to sexual activity and to notions of closeness and intimacy, but as evidenced is central to our language. Furthermore, as evidenced in the research on social touch, touching plays a role – albeit sometimes subliminal – in a much wider variety of social transactions than is ordinarily appreciated. In general, it seems clear that the inclusion of touching in shared virtual environments will strongly increase the sense of togetherness. When technologies facilitate communication, they are in a sense amplifying our natural senses and perception. It is as if our eyes, ears, and mouths were extended beyond their normal reach and capability. But technologies also extend our perceptions asymmetrically. Phones improve our hearing but do little for our vision. Email is used for conversation, but of a kind that lacks the tone and expressiveness of the voice. Thus it makes sense to ask how a technology extends or amplifies the senses, and in what mode and with what kind of results. Materiality and amplification: design, functions, features, and the interface to the human face. Even visual perceptions are fused and integrated into the haptic continuum of the self; my body remembers who I am and where I am located in the world. My body is truly the navel of my world, not in the sense of the viewing point of the central perspective, but as the very locus of reference, memory, imagination and integration.

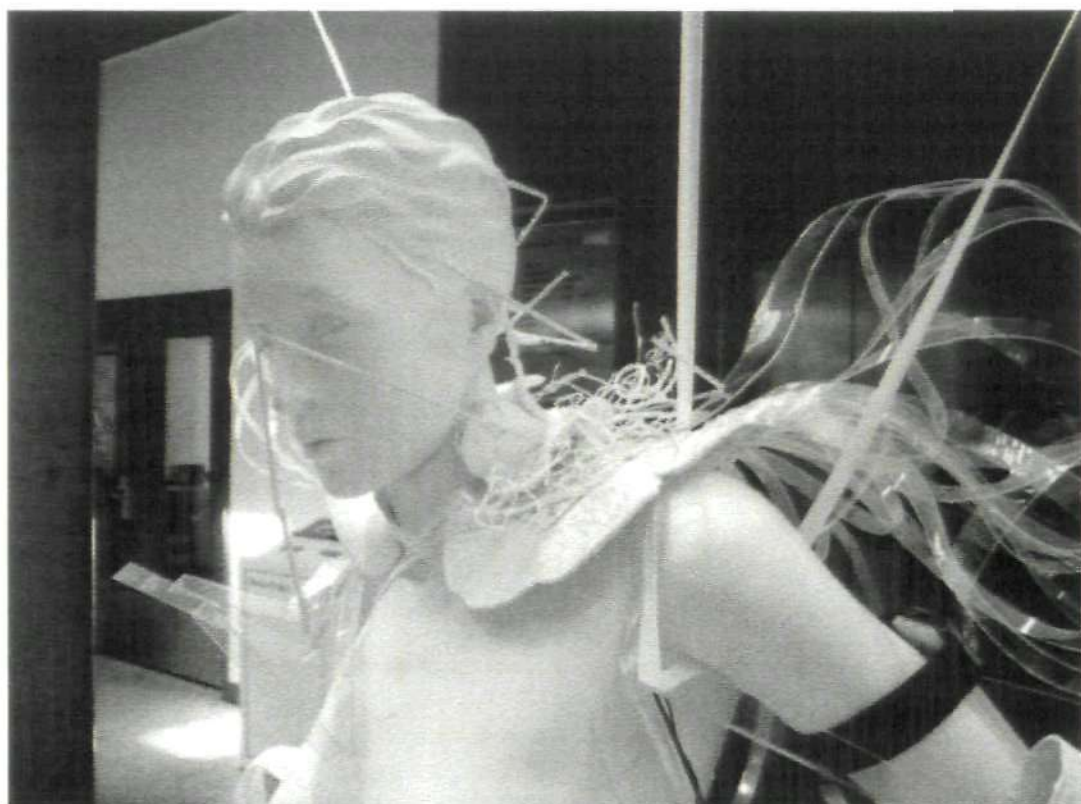


Figure 5-13. Photograph of mannequin from Transdisciplinary research session 3, 2010

The aims here were to introduce participants to contemporary forms of digital design processes, and allow them to explore the relationship of digital design processes to emergent spatial design projects. The participants used various techniques and modeling programs to develop a measuring device for the body. Through developing a rapid prototyped model and exploring scale in the immersive vision theatre, participants created a particular interest in exploratory devices for the body.

It was through an idea of how objects learn to adapt through use by the participant was the most fundamental concept. Each participant developed tactics to develop and communicate a tool for the body through use and experience. The session offered an introduction to contemporary digital processes as a form of calibrating the body in space. Each participant developed a methodology of communicating the ergonomics of their own body and the study of their own routines and gestures to generate experimental furniture. By combining digital and analogue techniques, each participant developed a process of generating an analytical design project. Each participant developed working drawings of the experimental furniture for their bodies with the engagement with appropriate technologies in an analytical way. A unity of knowledge came through with the understanding of body measurement and calibration forming a design philosophy.

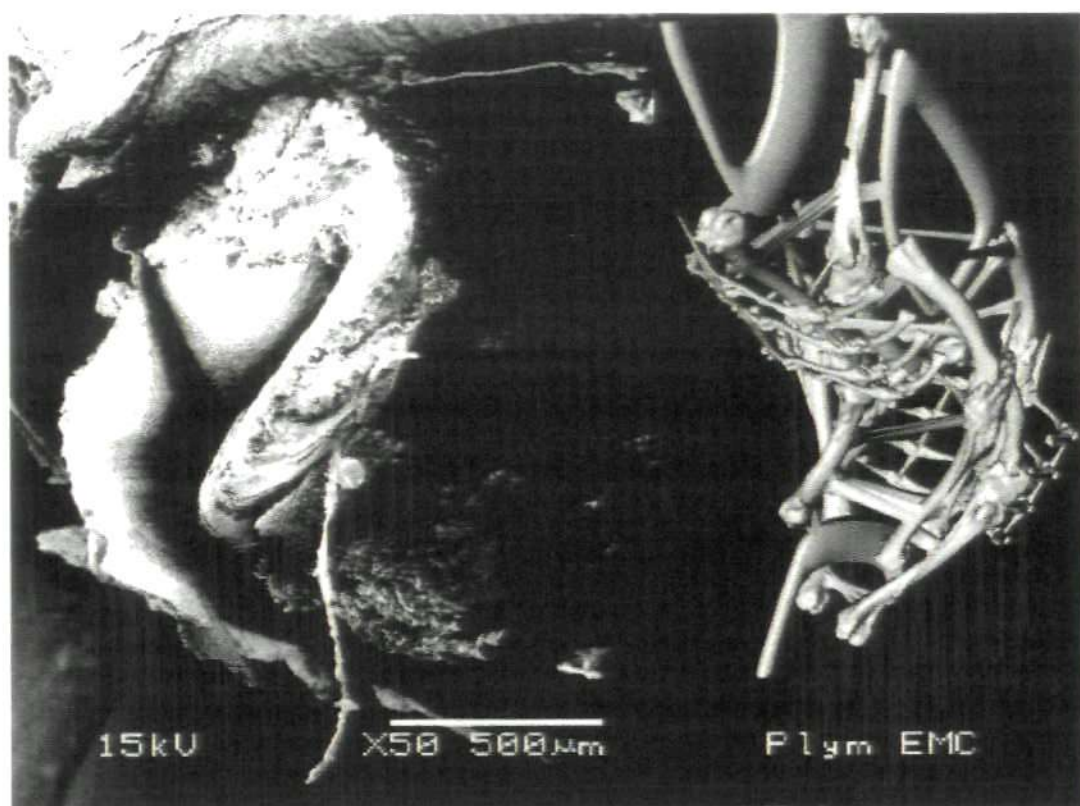


Figure 6-13. Image from SEM and Simulation Model, 2010

Sliding Scales presents a view of our relationship with the peculiar landscapes of digital technology as an ecology. In exploring these landscapes we navigate through a territory that is disturbed, moist, blurred and vacillating. We are forced to focus on the 'relationships between,' where process replaces product in importance, just as systems supersede structure. The tools that form these landscapes are harbingers for a meaningful ecological (both machinic and natural) audit of specific sites and processes. They demand the development of new strategies and protocols for their participants and require that the sites, agents, provocateurs, disparate observers and drifters that consume and influence their output, critically engage with them. The direction of the session is to explore, polemicise and develop architectural ideas and solutions that engage with this digital ecology.

When art is a form of behaviour, software predominates over hardware in the creative sphere. Process replaces product in importance, just as system supersedes structure. (Ascott, 2003: 157)

Sliding Scale explored architecture's relationship with image, digital technology, structure and materials, by focusing upon microscopic detail. The session revealed the unusual relationship that participants have with scale; how the digital systems and measuring tools transform models of actuality, from the precision of the scalpel blade used to make a model to the materials used to construct a finished building. As demonstrated, when faced with such a decision, the participants made some very unusual choices, all of which point towards larger issues fundamental to architecture.



Figure 7-13. Aerial Photograph of Transdisciplinary research session 5, 2010

13.05 Session 5: Arch-OS: Working Drawing, Participant and Environment

Currently data and analysis are used as 'strategic tools' to predict, examine and exemplify situations occurring in all fields. Usually information and data are treated as a commodity which can be bought and sold, and 'act' as powerful tools to predict future trends of our natural, social and technological environments. How can dynamic data and analysis of environments become a 'proactive' detrimental part of construction in 'actual' environments? From these origins, dynamic data and analysis became 'edited' into palettes for a working model. These palettes would come from all fields of knowledge and research institutions that work with all sources of field data, environmental, social and technological. This working model will become a design tool for the process of construction.

To construct working models, participants could, examine the presence of the past through an analogy of process, whereby the forms of previous systems influence the development of form of subsequent similar systems – developing methodologies of communicating environmental, social and technological conditions holistically. What is being suggested is that by using Arch-OS, the form of a system, including its characteristic internal structures and vibrations, become present to a subsequent system with a similar form; the spatio-temporal pattern of the former superimposes itself on the latter. The session was strategic in implementing a working drawing as embedded in the environment of the Arch-OS system. This allowed the participants to communicate drawing through experience and participation through the network of the whole building.

14. Elements

The fact that when architecture can fully exchange information with natural phenomena, with a mutable field of quantum fluctuations, architecture's capabilities for knowledge and communication would be far deeper and more extended than presently understood. It also would blur the boundary lines of our individuality – our very sense of separateness with the built environment. If architecture could boil down to charged particles interacting with a field and sending out and receiving quantum information, where does it end and the rest of the world begin? Where was consciousness- encased inside the architecture or out in the field? Indeed there was no more out there if it and the rest of the world are so interconnected.



Figure 1-14. View from Scafell Pike, which is the highest mountain in England, Lake District, 2010

14.00 Elements

The components of the thematic integration of Eniatype are through context, design and communication. The relationship between the context and design can be described as the *Editor*, whilst the relationship between the design and communication can be described as the *Reader*.

The relationship between context and design is looking towards the coherent qualities between the relationship of working drawings, participant and environment within context, design and communication; to be engaging and become wholly informed in all fields of knowledge and institutions that work with all sources of fieldwork data through the process of constructing our built environment. The role of the editor is to make a difference between our built environment and us.

One of the most important roles of the editor would be to determine effects of this relationship between working drawing, participant and

environment. This would be done through a strategic analysis of all the elements under consideration for that particular project. For example, how is the flora/fauna colony going to grow, change and adapt in relation to the potential of human occupation? This example is currently exemplified into a spatial model at research institutes, like Cranfield Ecotechnology Research Centre. These research centres, like Cranfield, could form a database for an architect. One of the most important roles of the reader would be to enable and demonstrate new methodologies for analysing determining effects of interaction within a field strategy. This would need to be a role that is based on a complex systems approach should contain the following elements:

1. Engage with key processes of existing studies in the environment to be disturbed by the design and link these indicators into field strategies within the design project through its respective Eniatype, which comprises of ecotype, notational, instructional and aesthetical strands.
2. Apply a response methodology for integrating the constructing effects of the proposal as drivers of change in the states between working drawing, participant and environment through the Eniatype.
3. Enable the development of a proposal by implementing a dynamic spatial model of the physical processes through the Eniatype.
4. Design and integrate a dynamic model showing the changes occurring in a target area, whilst interfacing physical and non-physical subsystems through the Eniatype.

Together, these four elements are important because they relate to major methodological research issues and questions that are faced by transdisciplinary design approaches.



Figure 2-14. Newspaper, Jochem Hendricks, 1994

Depending on the elements involved between context and design in our built environment, the reader makes a difference between them. It is suggested that the 'reader' exists in the relationship between the design and communication. As I have described in section 11.00, it is the difference that denotes this relationship. In its very essence the *reader* tries to describe this relationship as complex and contingent. For example, in Jochem Hendricks work entitled newspaper, you are asked to 'read' the reading of the newspaper, revealing the complex relationship between our environment and us. Are we as architects reading the reading from our experience of the environment or are we reading the reading of the environment through a working drawing. If neither of the above is true then how do we communicate our designs *a priori* to building, *a priori* to planning, *a priori* to architecture?

The action of reading embodies knowledge through the experience of reading. It is time-based and you have to traverse it to understand the complexities of the relationship between working drawing, participant and environment. A reader would suggest that we need something in place to translate the complexities of our relationship between design and context. This would be explicit and not delude ourselves that we construct the architecture; we merely put readers in place to translate the complexity and beauty of the world. We should focus on this relationship as a sponge, one that absorbs the elements of the relationship between context and design through a reader.

The reader is the translator of the complexities of the site for construction. It is the trace of the other activities in the field. A reader is the development of what Francis Bacon would call a 'screened existence' (Selz and Stiles: 1996: 204). It is the thin veil between working drawing, participant and environment. It gives real depth of our architectures rather than the flat screen monitor experience we are so used too. The relationship between the context and design is one that is acting out its differences with its environment through the participant. If our only fundamental truth with the environment is our relationship with it, the reader becomes the reflection on our built environment.

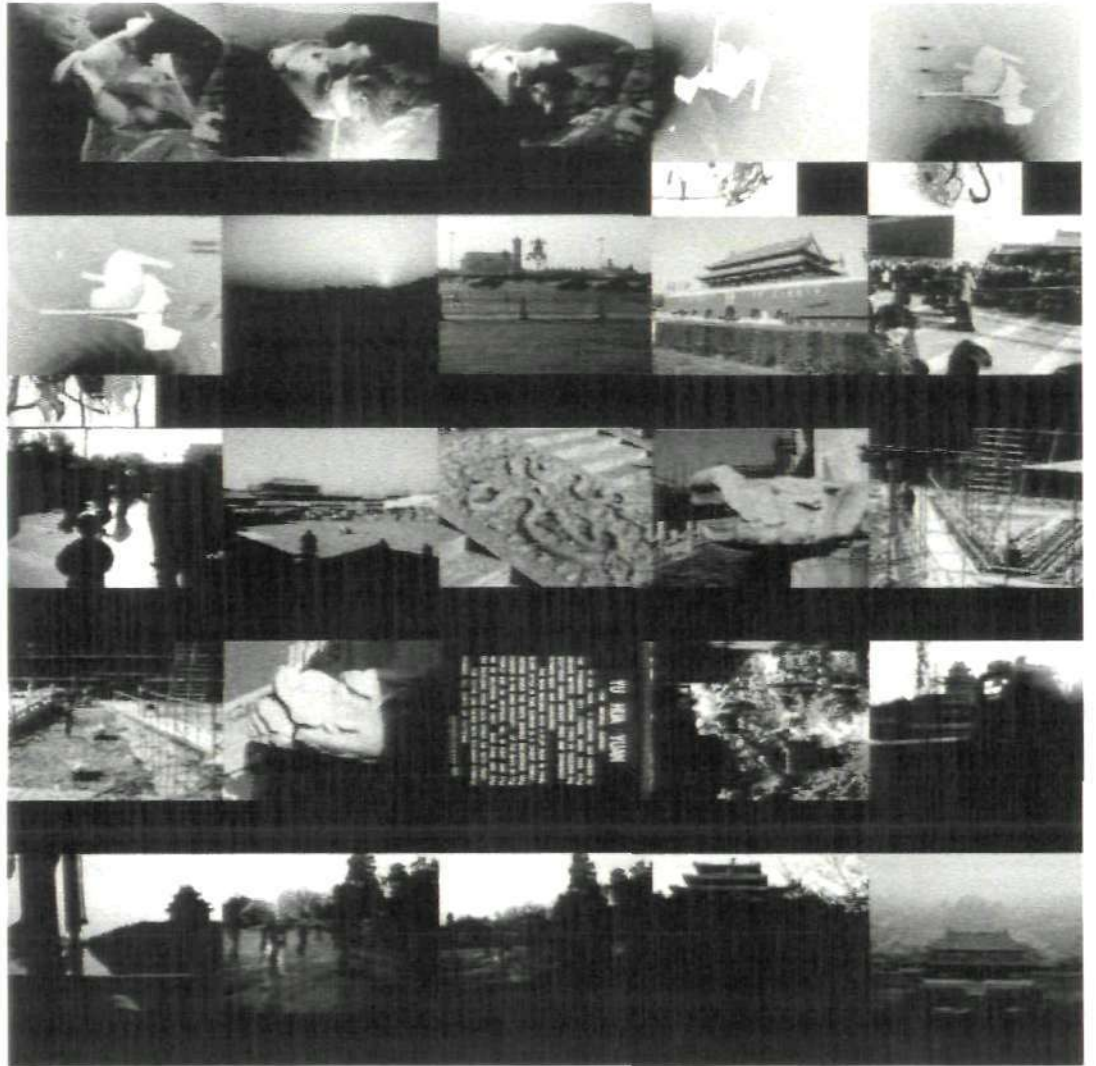


Figure 3-14. Image of working drawing, participant and environment communication strategies, 2010

An editor is about a process of managing uncertainty. The relationship between the context and design is complex and challenging. This relationship is dynamic, like buildings, in that it constantly being refined and reshaped by the environment and participant. As Stewart Brand has stated in his book entitled *How Buildings Learn*, 'buildings have often been studied whole in space, but never before have they been studied whole in time' (Brand 1995:2). An editor is about negotiating the dynamic relationship between context and design. More than any other artefact buildings improve with time, if they're allowed to. Architecture can become the 'editors' of environments through the 'reader', and operate as space-scribers at the intellectual level of intuition and 'active' purposefulness. The importance of this is that you will be able to work with a variety of tools *a priori* to the planning of the project. This would be a liberating and exploratory examination of testing morals, ethics and intuition of the individual and project teams. We need to define tools for the determining effects of interaction between working drawing, participant and environment, so in specific design projects, an editor of space-determining constructs, like a wall, can be resourced *a priori* to planning. This would mean that through the editor *a priori* to planning the architect would be liberated from any linear constraints between context and design. If the environment is the editor of architecture and not the architect, then the participant is the reader.

15. *A priori* Planning

This section will discuss the process of the transformations and the outcome of the architecture.

Through experience of context, design and communication we can be strategic in developing and nurturing the burgeoning field of Eniatype a priori to planning. Drawing forth the idea of working drawing embedded 'within' environment we can begin to describe the architecture before the architecture as architecture. This will be discussed through a sequence of prompts to enable the communication of design through context, from palette to intervene to scope to projection to translation to coherence and construct. There would be a variable sequencing of the prompts in relation to the context and design, for example, one can momentarily prompt coherence – a situation in coherent play with itself.



Figure 1-15. Image of the contexts for the transdisciplinary research sessions, 2010

Through our experience of the environment, I am suggesting that we can enable the communication of design through context. To enable the communication between design and through context, I contend that we would need to develop a sequence of prompts that will enable the reader and editor. The sequence or combination of each prompt would enable an endless flow of spatial notations which will describe the relationship between design and context and communication. This flow would then need to be edited by the editor and read by the reader. *A priori* planning is the process whereby future action is dictated as a response to whatever has already, or is now, occurring. It is a reflex in the relationship between working drawing, participant and environment. The opposite is proactive planning, which sets in motion actions as a function of what is anticipated or probable; it is pre-emptive in nature. In a sense proactive planning is before the changes in the environment, whereby *a priori* planning is after the changes to the environment and effectively responds to dynamic changes in real-time environments. Through *reactive* planning strategy, the reader and editor will be the prominent model of developing a design through the relationship between working drawing, participant and environment. These techniques differ from classical planning in two aspects. First, they operate in a timely fashion and hence can cope with highly dynamic and unpredictable environments.

Second, they compute just one next action in every instant, based on the current context. Reactive planners often (but not always) exploit reactive plans, which are stored structures describing the agent's priorities and behaviour. Although the term *a priori* planning goes back to at least 1939, the term *a priori* has now become to denote a negative effect and used as an opposite of meaning for the word, proactive. Since nearly all agents using *a priori* planning *are* proactive, some researchers have begun referring to *a priori* planning as dynamic or reactive planning. Inspired *a priori* planning should encourage change to our built environment.

In theory, the *a priori* planning system can handle exogenous events as well as uncertain effects and unknown initial conditions: it is possible to provide a reaction prompt for every possible situation that may be encountered, whether or not the circumstances that would lead to it can be envisaged.

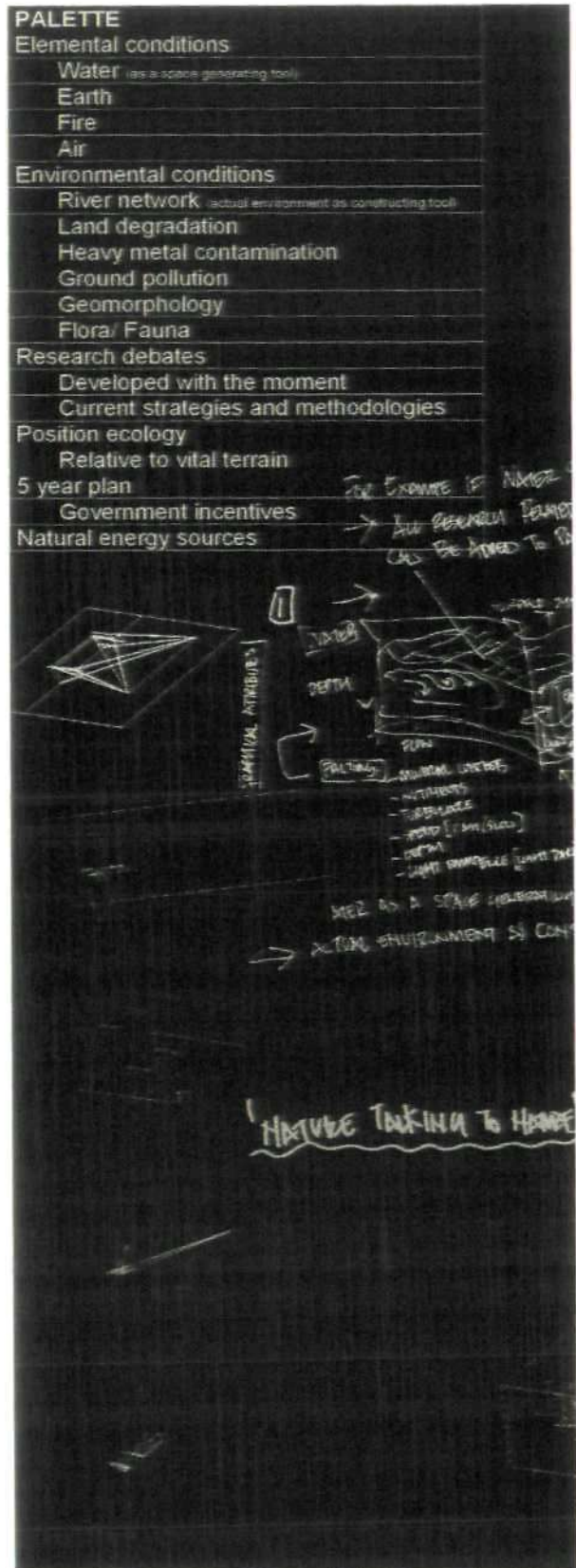


Figure 2-15. Part of Ecotype diagram: Network, 2010

15.01 Prompt: Network

The prompts came out of the experience of the transdisciplinary research sessions. A combination or sequences of prompts were evident through the relationship between the working drawing, participants and environment. These prompts provide a unity of knowledge through the relationship between the working drawing, participants and environment. The prompts enable the reader and editor to be active in the field of reciprocal relationships between the working drawing, participants and environment.

Every action in the sequencing of the prompts will have a spatial consequence on other Eniatypes. Within these ecologies of our relationship between the working drawing, participant and environment, the habitat is fragmented. Through the second research session on Outside/Inside, landscape ecological research indicates possibilities to address fragmentation of habitat by using a 'network' approach. The research focuses on fragmentation of habitat and the opportunities to mitigate it by planning 'architectural ecological networks'. Through addressing ecologies we should be able to reveal the network between them, whereby they become programs or networks that focus on ecological research over long temporal and large spatial scales to develop a worldwide program and the infrastructure necessary to facilitate communication. An architect will only be a participant in the network if their work enters the two-way traffic of receiving from the network and sending their prompt back to widen their participant's network. It is a process of managing uncertainty through potentiality and receptivity of the network.

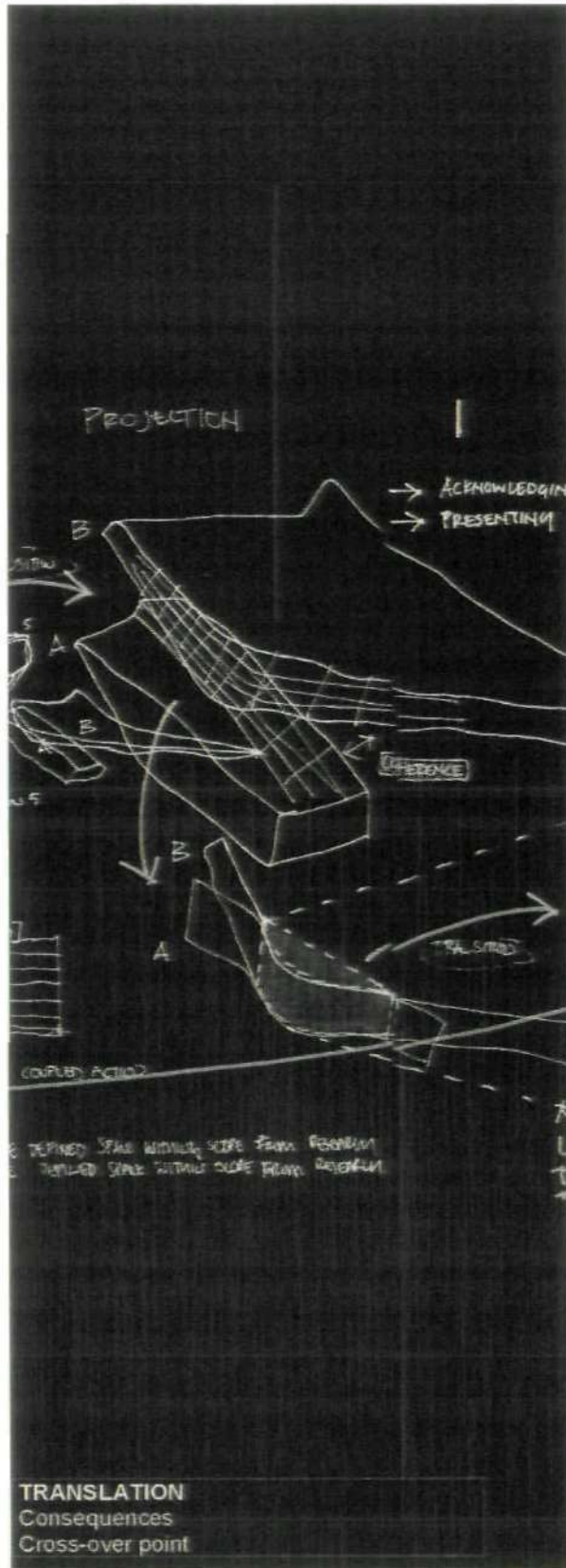


Figure 3-15. Part of Ecotype diagram: Translation, 2010

Throughout the research sessions the participants brought their own experiences and practices to the development of the work they did within the session. Through different participants working together, each with their own individual experiences and practices. It became obvious that participants needed to translate what they were developing in the session to communicate their findings to other participants. This 'translation' describes the 'carrying across' or 'bringing across' of information between design and communication through context within the session. Through the sessions, translation was about interpreting the relationship as it is carried across and through the relationship between design, context and communication. A common misconception with translation is that some participants proceed as if translation was self-evident to other participants. But as all us know through experience of dealing with context, design and communication, that this is not true. Translation between context and design, and design and communication, sometimes proceed as if translation from one to one correlations existed in-between these relationships, rendering translation fixed and identically reproducible. Translation could be viewed as the encoding and decoding between something and something else.

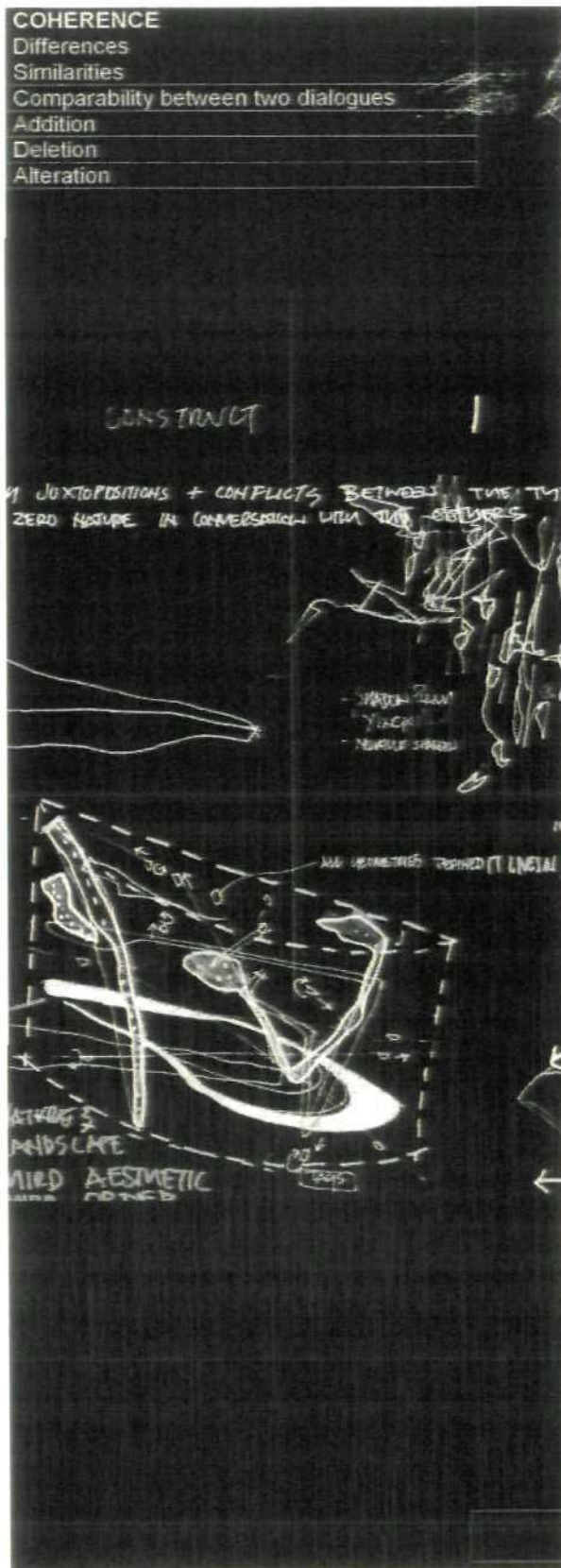


Figure 4-15. Part of Ecotype diagram: Coherence, 2010

Throughout the transdisciplinary research sessions, the prompt of 'coherence' was important in understanding the relationship the participants through context, design and communication. Through discussion with the participants, coherence in architecture and their parts are still treated, for all intents and purposes, as machinery through diagrams and working drawings. In relation to design and architecture, the participants understood that they don't need to understand everything and break things down. For example, the building is not understood through the working drawing, the participant is not understood through environment. The relationships between context, design and communication is connected through an 'invisible web of relationships' (McTaggart, 2003: 5). This invisible web is something Lynne McTaggart would describe as 'The Field'. Coherence was necessary in understanding about our connectedness with the environment, where everything is connected to everything else through something else. Through the outcomes of the sessions the participant's understood that *coherence* in architecture varies widely. The coherence of the transdisciplinary research sessions could commonly be thought of through the terms 'sustainable', 'environmental' and 'conservation', which all belong to the language of appropriation – suggesting that a degree of coherence is important to maintain or prolong the relationship between context, design and communication rather than be attached, engaged and indivisible. Coherence in architecture is about being connected to a vast dynamic cobweb of energy exchange with a basic sub-structure containing all possible versions of all possible forms of matter. Coherence, as suggested by Mae-Wan Ho, could be seen as the relationship, which means that all elements are able to cooperate (Mae Wan Ho 1997: 47).

Coherence establishes communication. It's like a sub atomic telephone network. The better the coherence, the finer the telephone network and the more refined wave patterns have a telephone. The end result is a bit like a large orchestra. All the elements are playing together but as individual instruments that are able to carry on playing individual parts. Nevertheless, when you are listening, it's difficult to pick out the instrument. (Mc Taggart 2003: 54)



Figure 8-15. Part of Ecotype diagram: Construct, 2010

15.04 Prompt: Construct

Throughout the transdisciplinary research sessions the participants developed a construct through their outcomes. Each construct was tailored through the individual participant through negotiation of the prompts network, intervene, scope, projection translation and coherence. This development in the field between context, design and communication is a construct – a construct with no definitive meaning – an architecture that has been edited by the environment and read through the reader. Depending on the intention of the architect, the constructs are connected in the field, so any adaptations and modifications will always be challenging the participant's morals and ethics. Can the view that the basis of architecture is developed within 'the field' as a networked web and establishes itself within the environment as a construct, constructing architecture as viable in situated contexts. As it has been noted by Capra in his book entitled *Hidden Connection*, 'to understand the meaning of anything we need to relate it to other things in its environment, in its past, or in its future. 'Nothing is meaningful in itself' (Capra, 2003: 73). Or, as will Alsop says: 'It's not about designing something, it's about discovering what something could be – and I think that's a very important distinction.' (William Alsop, *The Guardian*, 2 November 2009)

16. Recursive Infrastructure

Could we consider new approaches to the construction of architecture and ask how it may be possible to develop an alternative approach to the construction of our built environment that is more environmentally responsive – one that works with the natural energy flows within matter and which is connected to natural systems not insulated from them?

'The user is the content; the interface creates the context, always to be renegotiated' (Ascott, 2006)

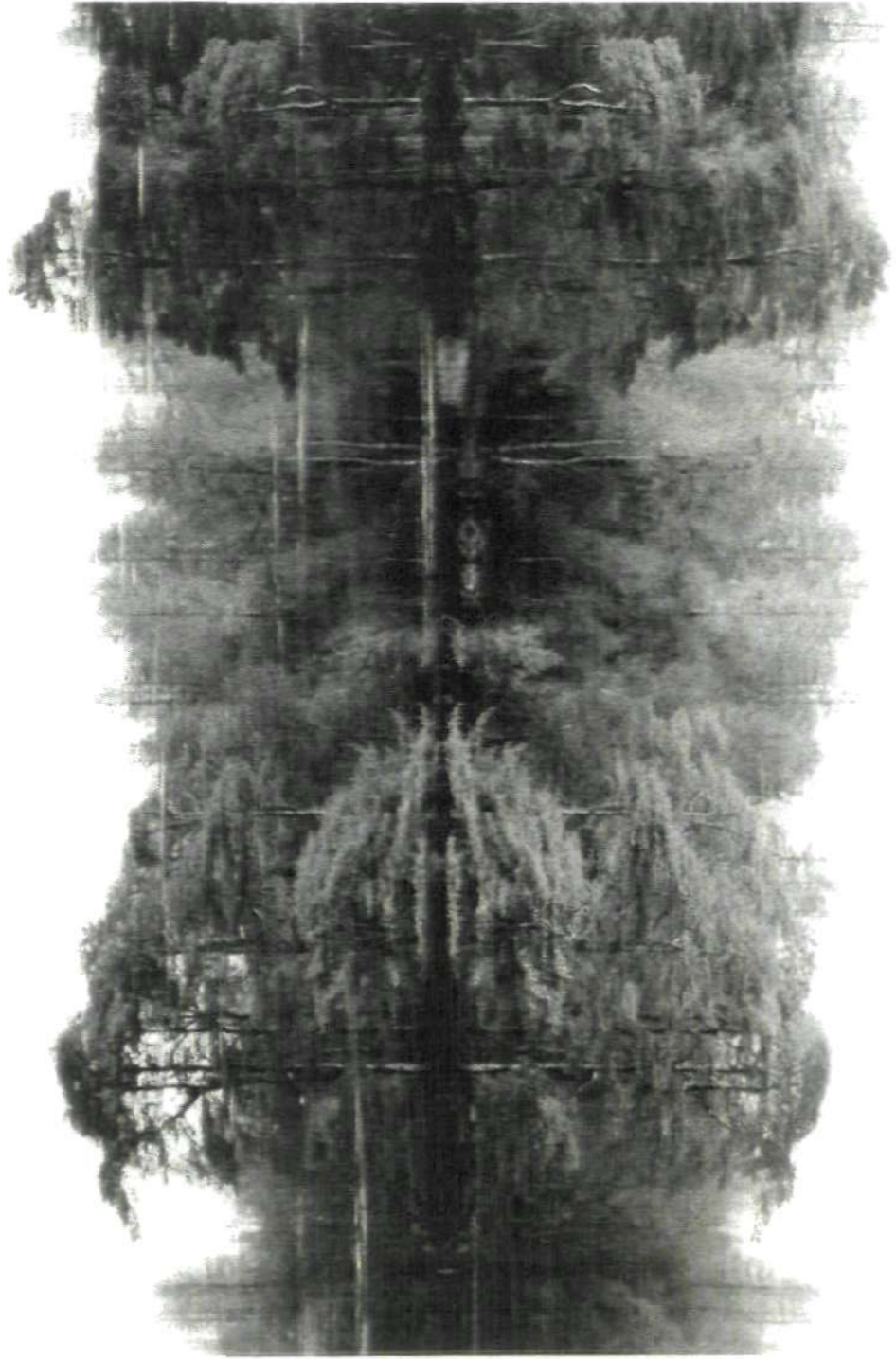


Figure 1-16. Photograph of High Dam, Lake District, 2010

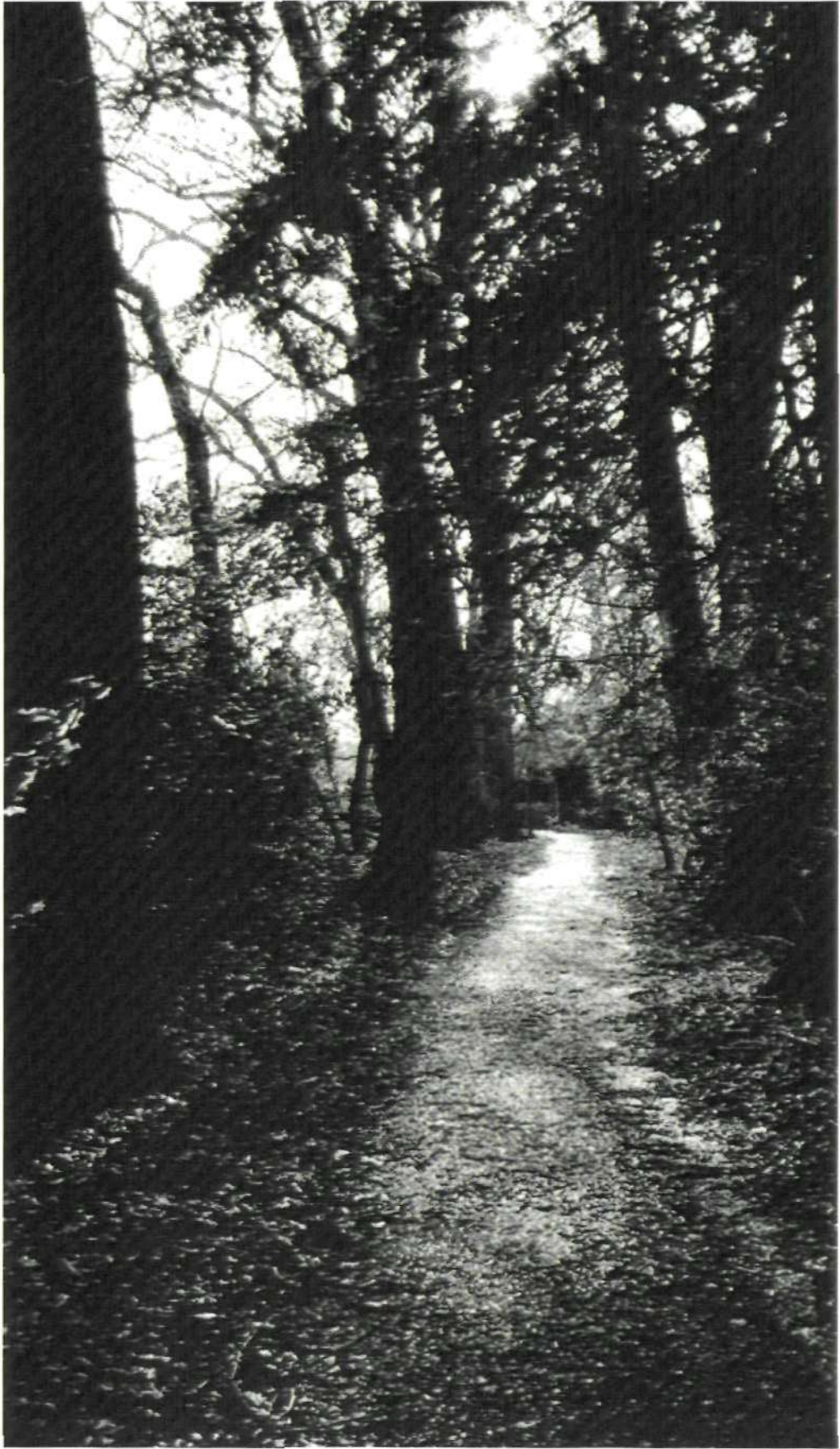


Figure 2-16. Photograph of Charles Darwin's Garden, 2010



Figure 3-16. Photograph of Grizedale Forest, Lake District, 2010

Our times are such that we seek different forms of communication through our ecological, notational, instructional and aesthetical interfaces. That is true of Eniatype, which aims to disturb the boundary lines of our individuality – our very sense of separateness with the built environment. As designers we are constantly renegotiating between working drawing, participant and environment in the natural and artificial. This kind of reality exists not only in the future but is here with us now. It is not limited by time but exists with its own operations as something which is somehow expedient. It is a direct intervention in the quality of the world, a space in which beauty acts.

The framework provides the architect with a view to becoming a progenitor in the ecology of design. It is clear that relationship between working drawing, participant and environment constitutes complex components. Each of which is connected to the other through context, design and communication. Therefore the framework provides us with a fundamental basis from which Eniatype could be approached.

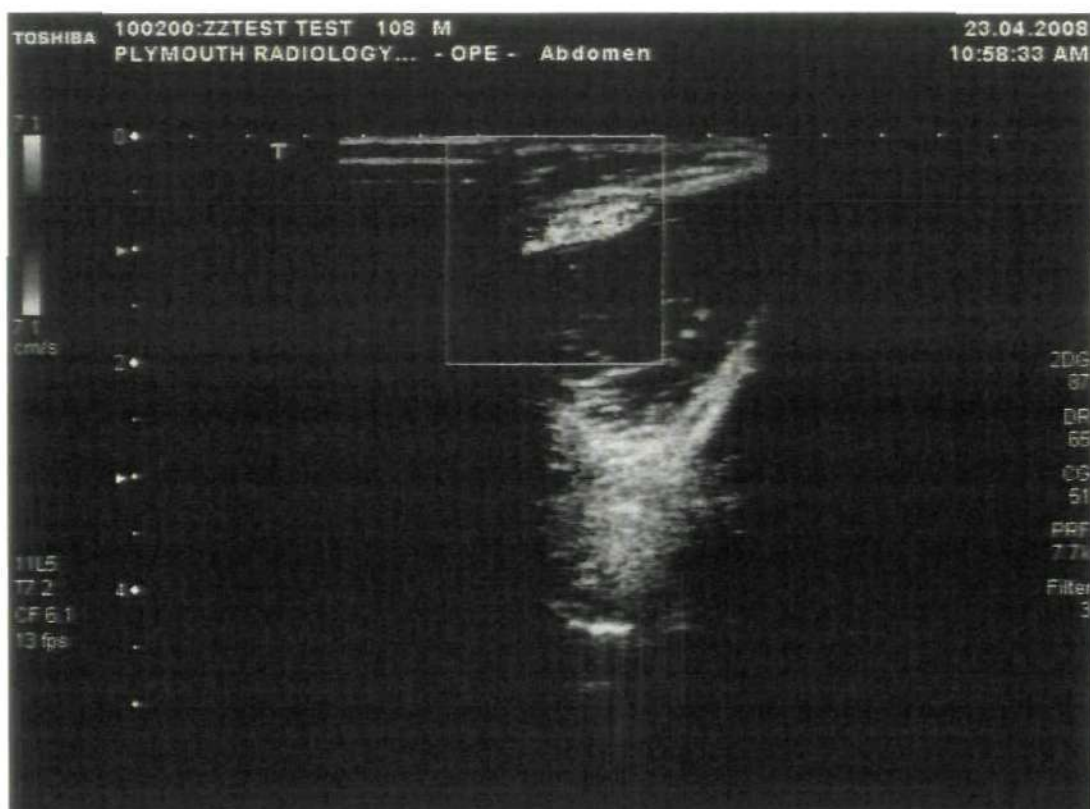


Figure 4-16. Image from participant in Transdisciplinary research session 2, 2010

16.01 The Field

'We are attached and engaged, indivisible from our world, and our only fundamental truth is our relationship with it' (Mc Taggart, 2003: xvi)

The Field describes a space of propagation, of effects. It contains no matter or material points, rather functions, vectors and speeds. It describes local relations of difference within fields of celerity, transmission or of careering points – in a word, what Minkowski called the world (Kwinter, 1986: 88-9).

The relationship between the field and Eniatype should be like a sponge to water. Eniatype should soak up the natural energy fields, and when it is squeezed it distributes the natural energy field back through the architecture in the environment. This relationship becomes guidelines for actions, definitions of measures to be taken, which are laid down by countless authorities endeavouring to control the effects of developments. Neither the local nor the global landscape is immune to the advance of these nervous reactions as we

aim to fix on the moving target of an uncertain future. The field helps us describe the web of relationships, to aid architecture to develop strategies in tandem with the surrounding natural cycles of our environment.

The field within architecture could be challenging to the tactile sense, as it would from an anthropologist or a botanist engaged in fieldwork. This would parallel the shift within architecture from the analogue to the digital and back again. An examination of the implications of the field in architecture would necessarily reflect the complex and dynamic behaviour of architecture's participants, and speculate on new methodologies to communicate the complexities of the relationship between working drawing, participant and environment in architectural practice.

The recursive infrastructural elements of our built environment, by their nature linked together through open-ended intelligent networks, offer another example of the field in our environment.

Through the development of 'fields' such as Harold Saxton Burr's 'life fields' (1972) or Rupert Sheldrake's 'morphogenetic fields' (1981), we should, through the Eniatype, tap into gravitational and electromagnetic fields these are spatial structures, invisible, intangible, inaudible, tasteless and odourless; they are detectable only through their respective gravitational and electromagnetic effects.

This focus on the field is crucial in understanding the relationship between things and not the thing themselves. As we strive to develop a relationship with our environment the latter is constantly in a relationship with itself.

17. Synthesis

Finally, in the Eniatype section, the previous concepts are synthesized to form new methodologies for communicating architecture. This act of communicating different methodologies of designing were researched in the professional offices of Alsop Architects and Mass Architecture and three academic institutions: in University of Plymouth, University College London and in Oslo University, the Oslo School of Architecture and Design. This research was done through transdisciplinary sessions. This research was developed into particular elements that synthesise these approaches in a series of design projects entitled "twenty-six rule translation" and "meaningless objects in featureless space".

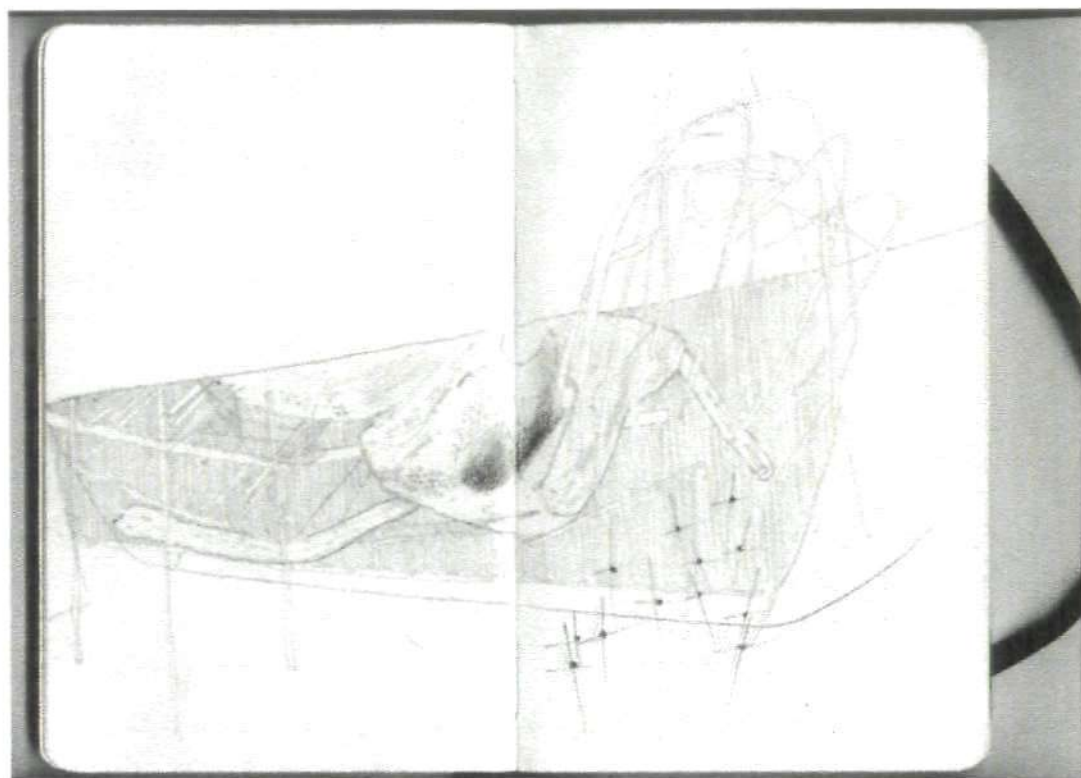


Figure 1-17. Sketchbook, 2010

All of the Eniatype projects throughout address environmental and drawing issues in different ways. The project summations of ecological design challenges are as follows:

- Increase spatial notational strategies
- Increase structural coupling
- Increase singularity
- Increase collective subjectivity
- Increase existential values

This thesis aims to demonstrate a rethinking of methodologies of communication through ecological design. Human communication and ecological accountability are inextricably linked in architectural design. In fact, there are potentially innumerable forms of holistic designs that will connect and shape environments for human communication. Contained within are new design ideas and explorations for prospective models of designing. These conceptions are achieved towards an emergent protean set of collective principles aptly labelled as Eniatype.

Eniatype is the design of such innovations. In the development of form, we should not think of this system of operation in architecture, as just a set of changes in the architecture in a particular location, but instead as constancy in the relationship between working drawing and environment through the working drawing, participant and environment. There are many kinds of relationships between drawing and environment; an extremely important one is who communicates with whom and who instructs whom. It is the ecology between working drawing and environment which survives and slowly evolves. In this evolution, the relation between the working drawing and environment through the participant, the reader and space undergo changes, which are, indeed, adaptive from moment to moment. Bateson proposed in his book *Steps to an Ecology of Mind*, that if 'the process of adaptation were the whole story, there could be no systemic pathology' (Bateson 1972: 338). The architect, Warren Brody, as early as 1967, characterized such behaviour as a *soft cybernetics* that not only responds to its participant but also learns from them anticipating

their needs. In Brody's phrase, the 'time grain' of the adaptation is different from that of the ecology. The relative constancy – the survival – of the relationship between working drawing and environment through the participant, the reader and space is maintained by changes in both relationships. But any adaptive change in either of them, if uncorrected by some change in the other will always jeopardise the relationship between them. We all must continually develop strategies to synthesise our thoughts on unravelling the complexities between context, design and communication.

For an example, we can refer to a quote from the renowned geneticist and biophysicist Mae-Wan Ho:

To give you an idea of the coordination of the activities involved, imagine an immensely huge super orchestra playing with instruments spanning an incredible spectrum of sizes from a piccolo of 10^9 metres up to a bassoon or a bass viol of 1 metre or more, and a musical range of 72 octaves. The amazing thing about this super orchestra is that it never ceases to play out our individual song lines, with a certain recurring rhythm and beat, but in endless variations that never repeat exactly. Always, there is something new, something made up as it goes along. It can change key, change tempo, change tune perfectly, as it feels like it, or as the situation demands, spontaneously and without hesitation. Furthermore, each and every player, however small, can enjoy maximum freedom of expression, improvising from moment to moment, while maintaining in step and in tune with the whole. (Ho, 1997: 46-47)

This quote is a theory of the quantum coherence that underlies the radical wholeness of communication between working drawing, participant and environment.

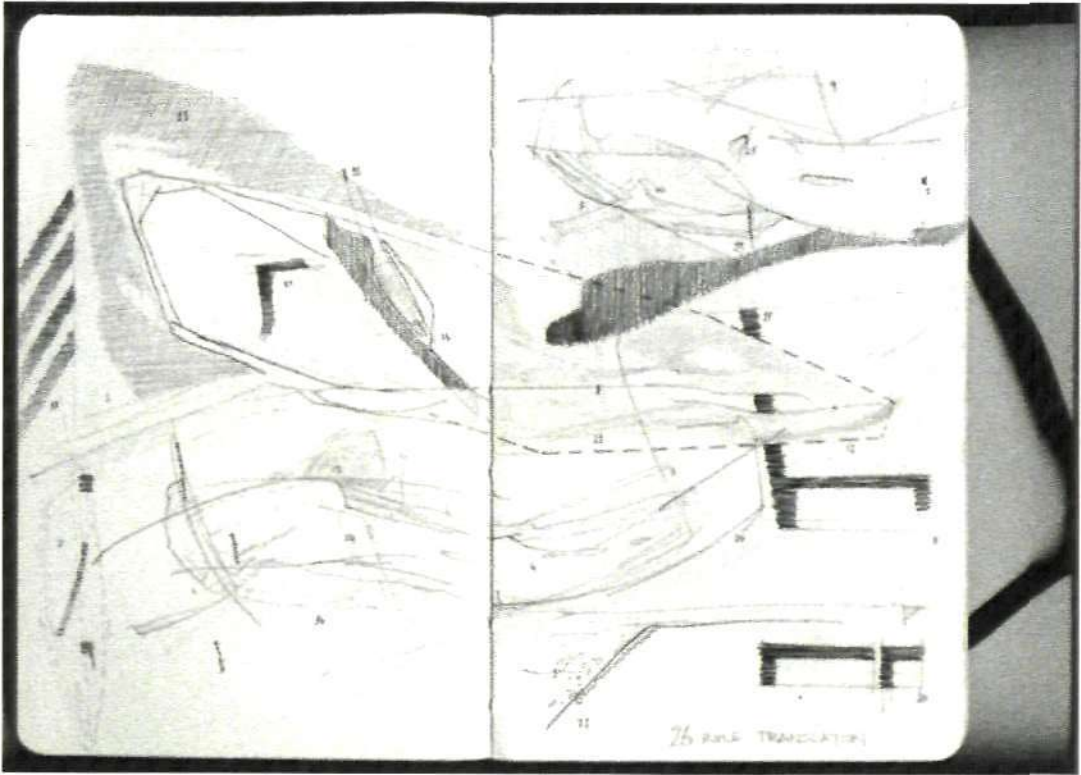
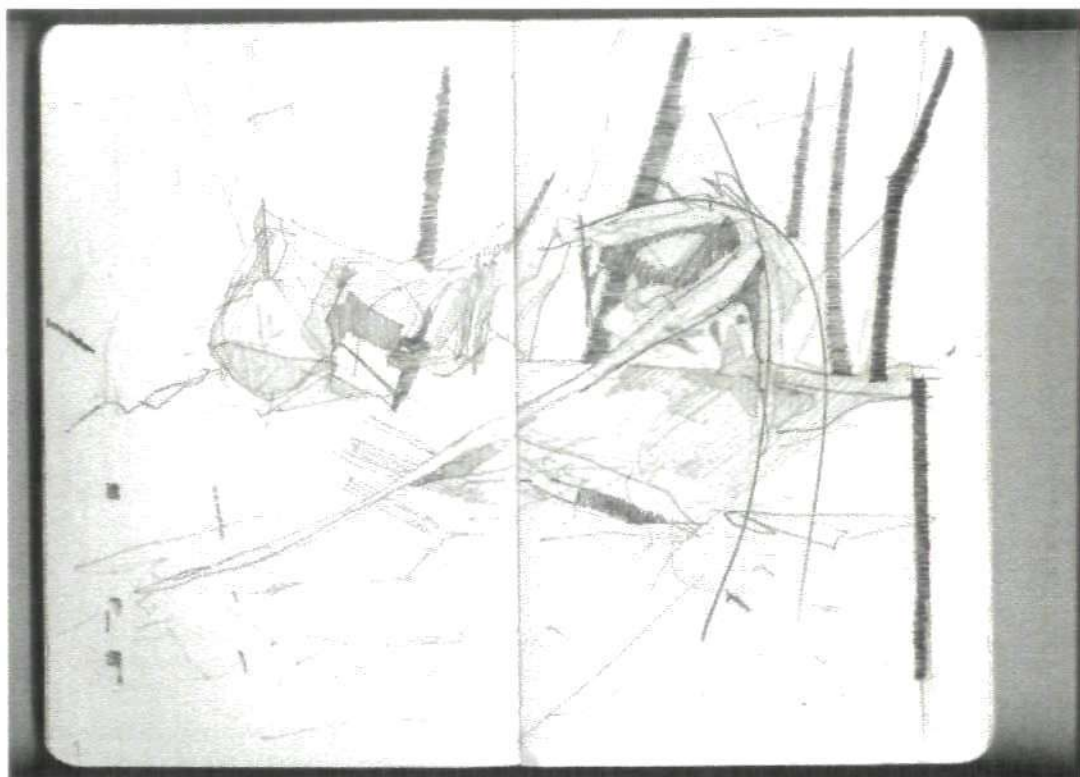
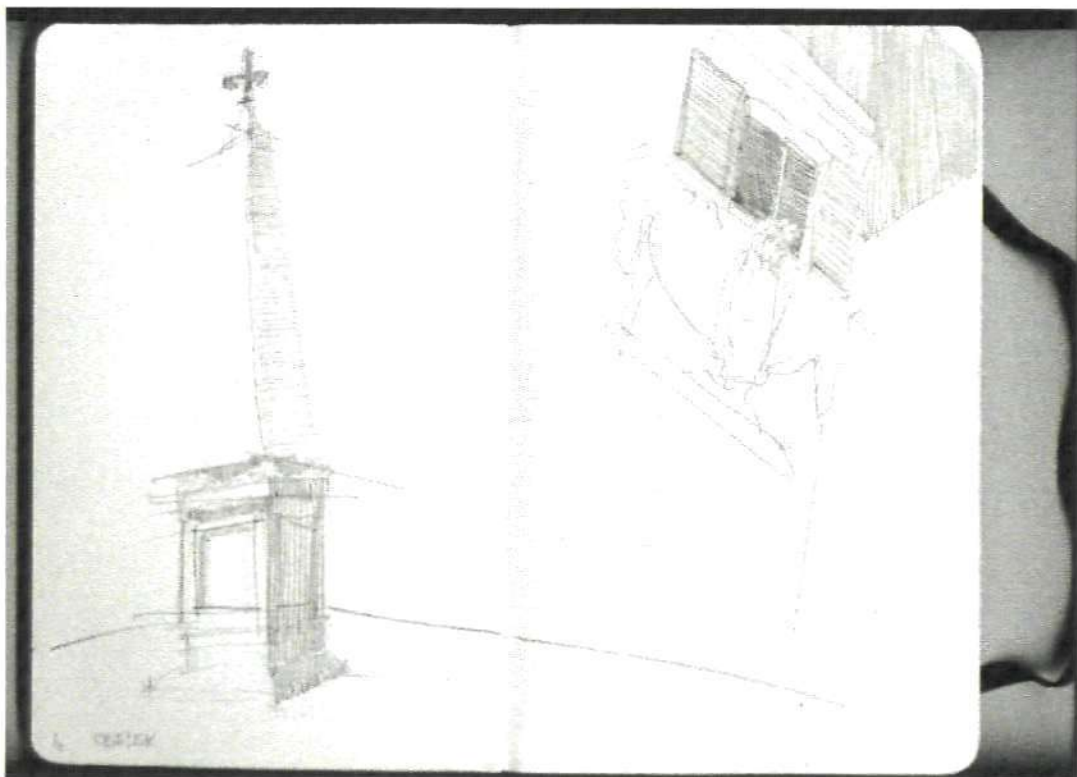
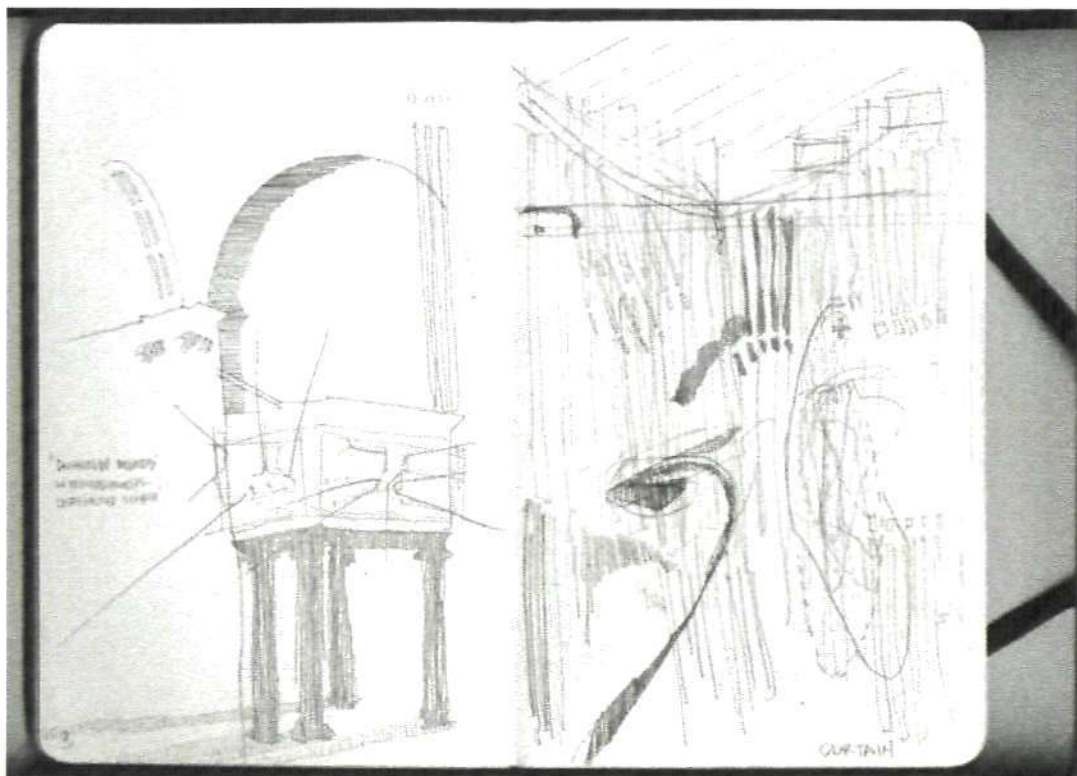
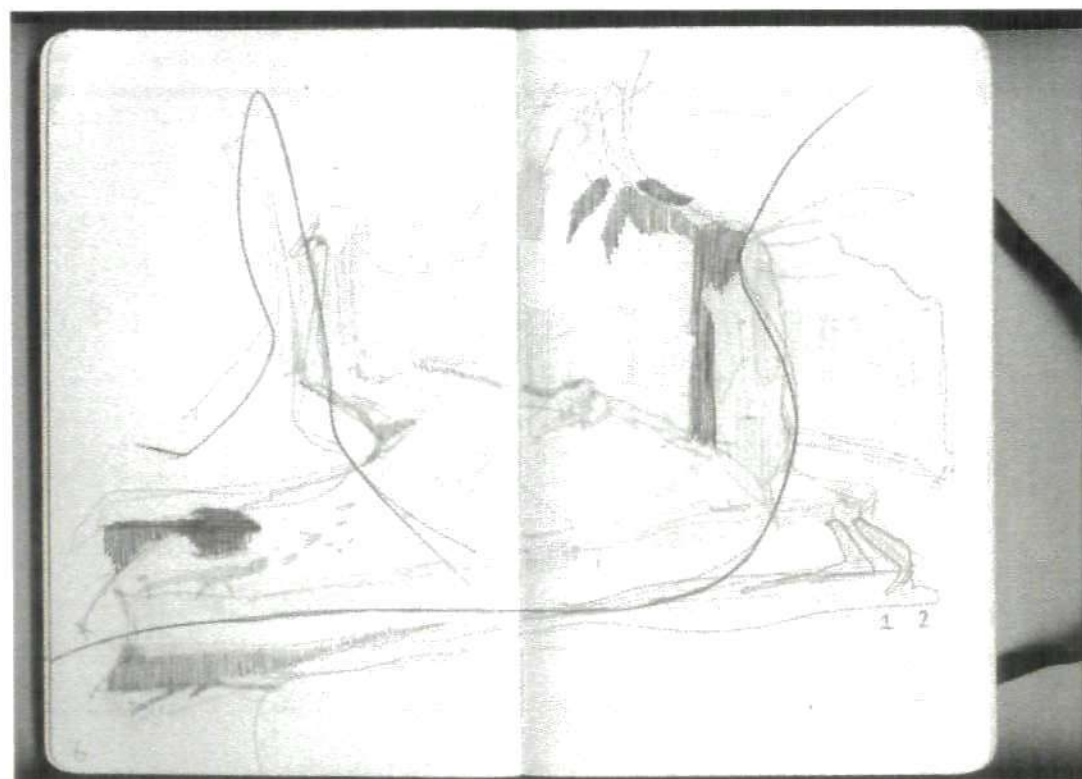
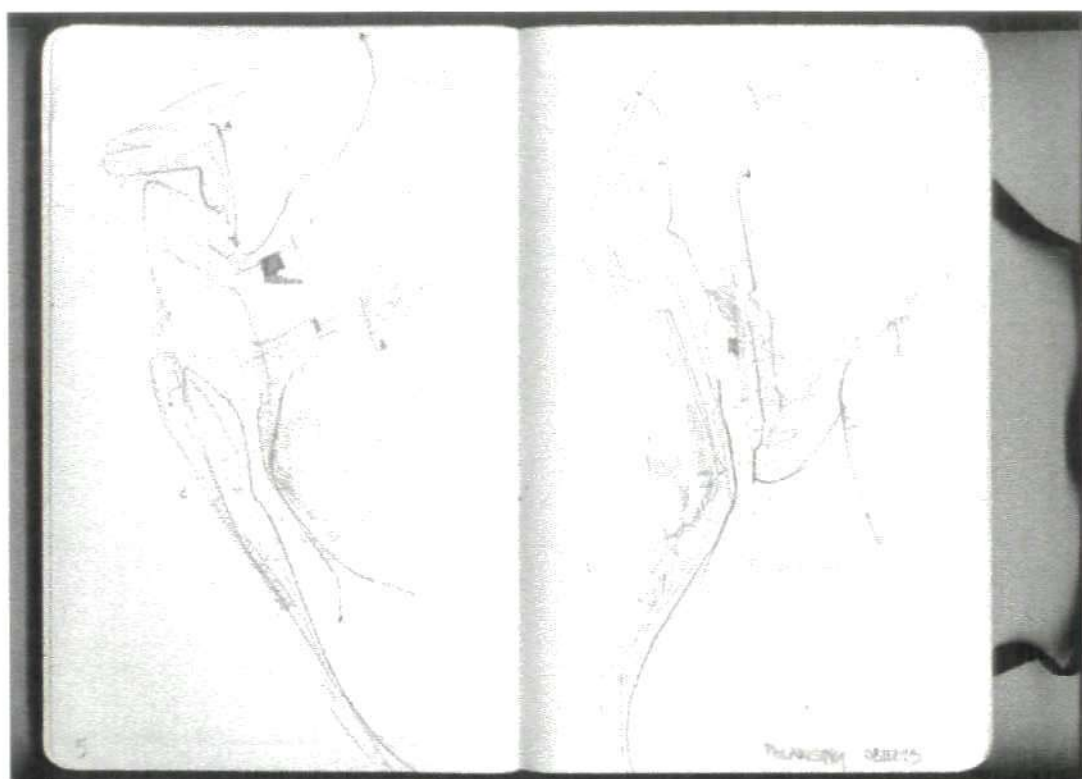
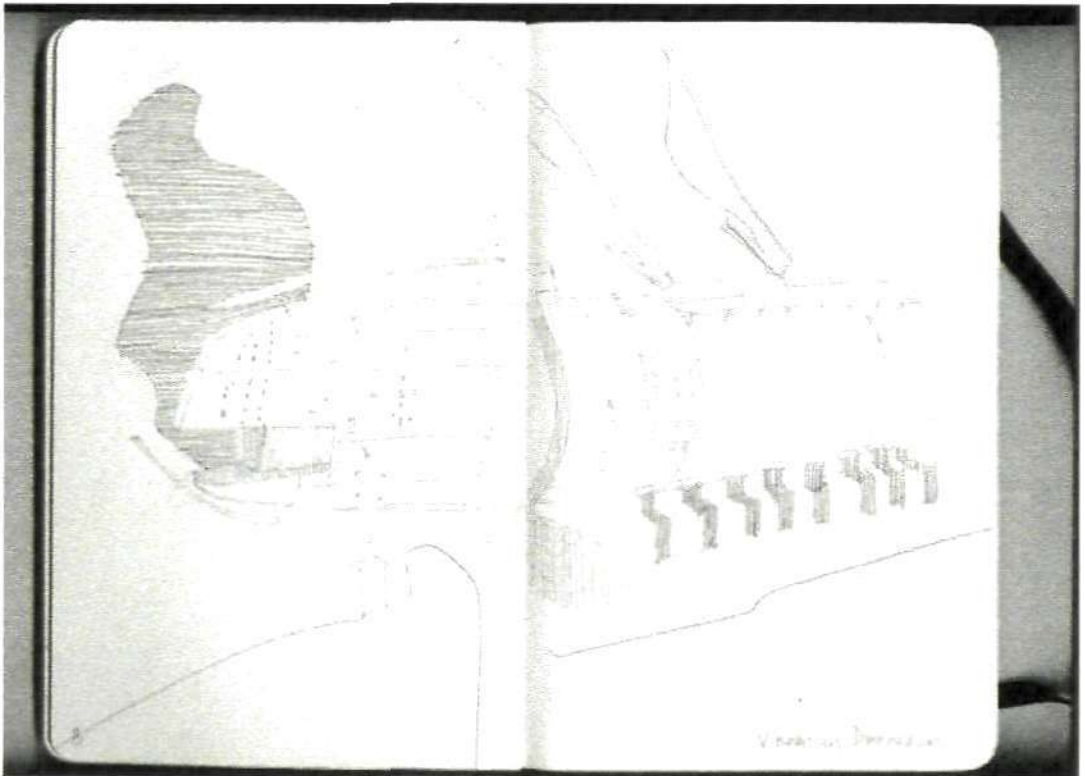


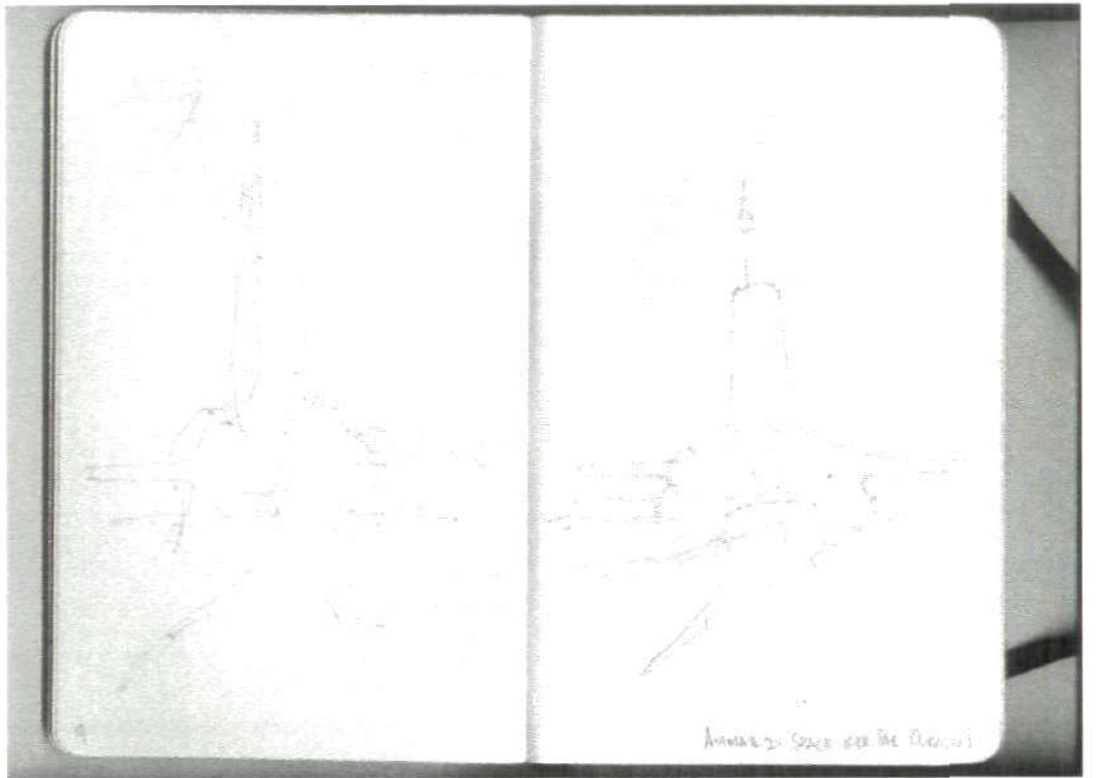
Figure 2-17. Sketchbook, 2010

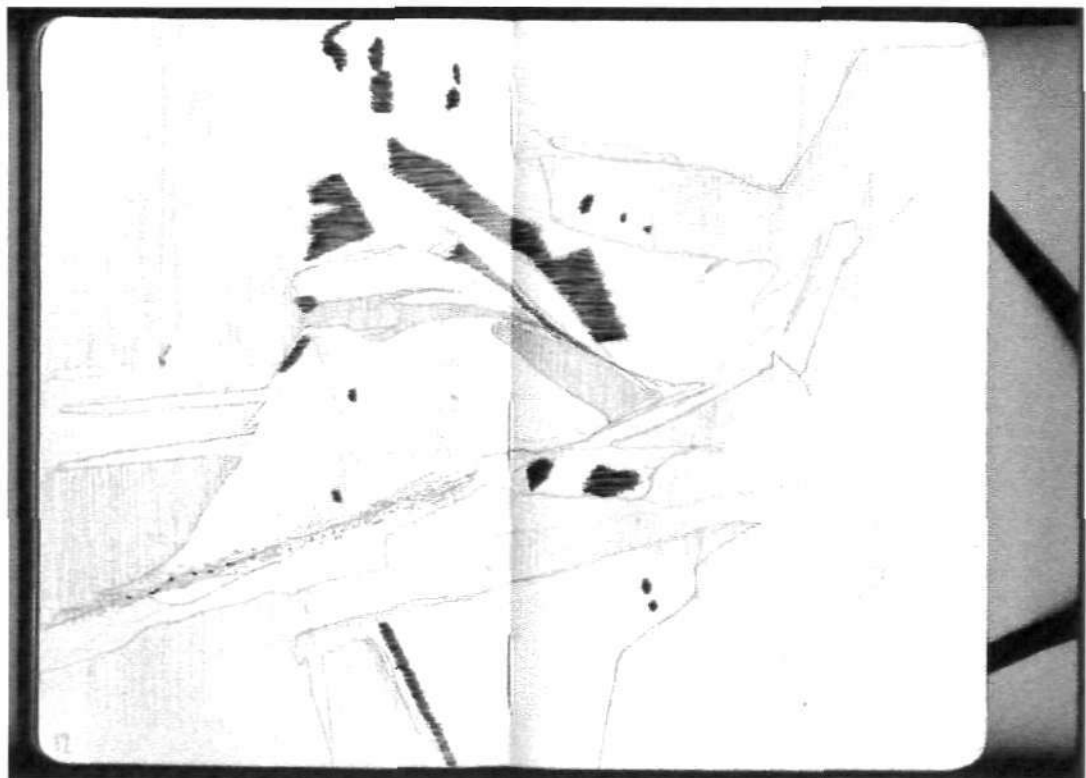
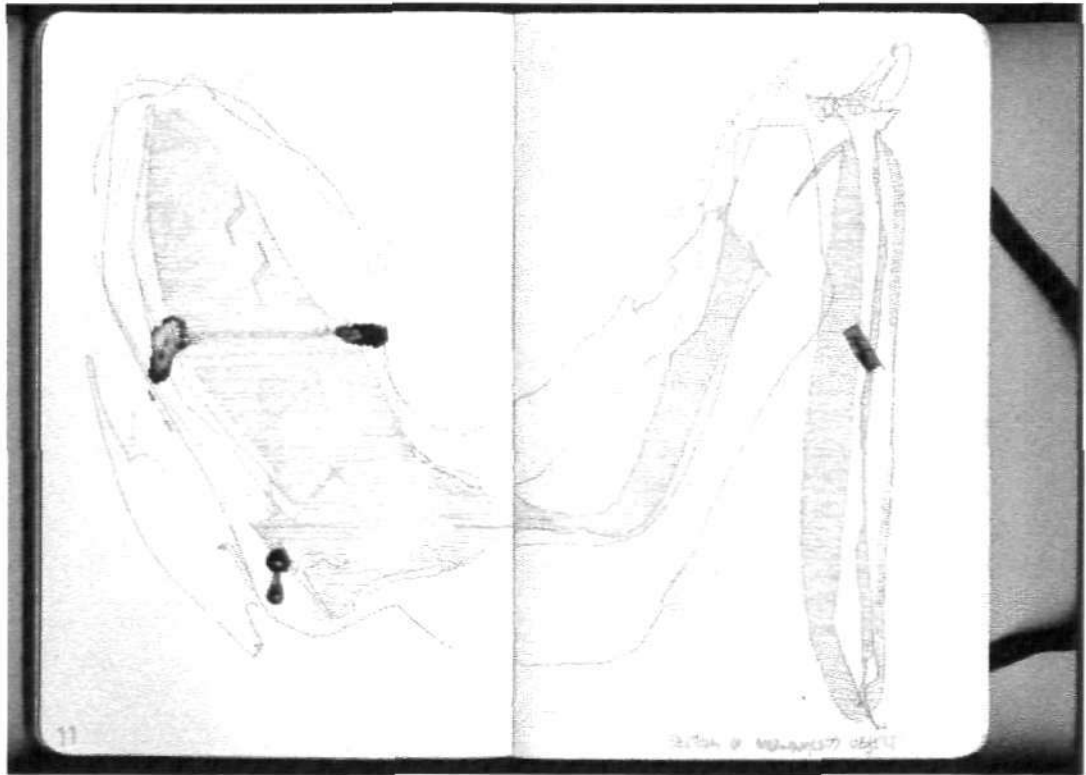


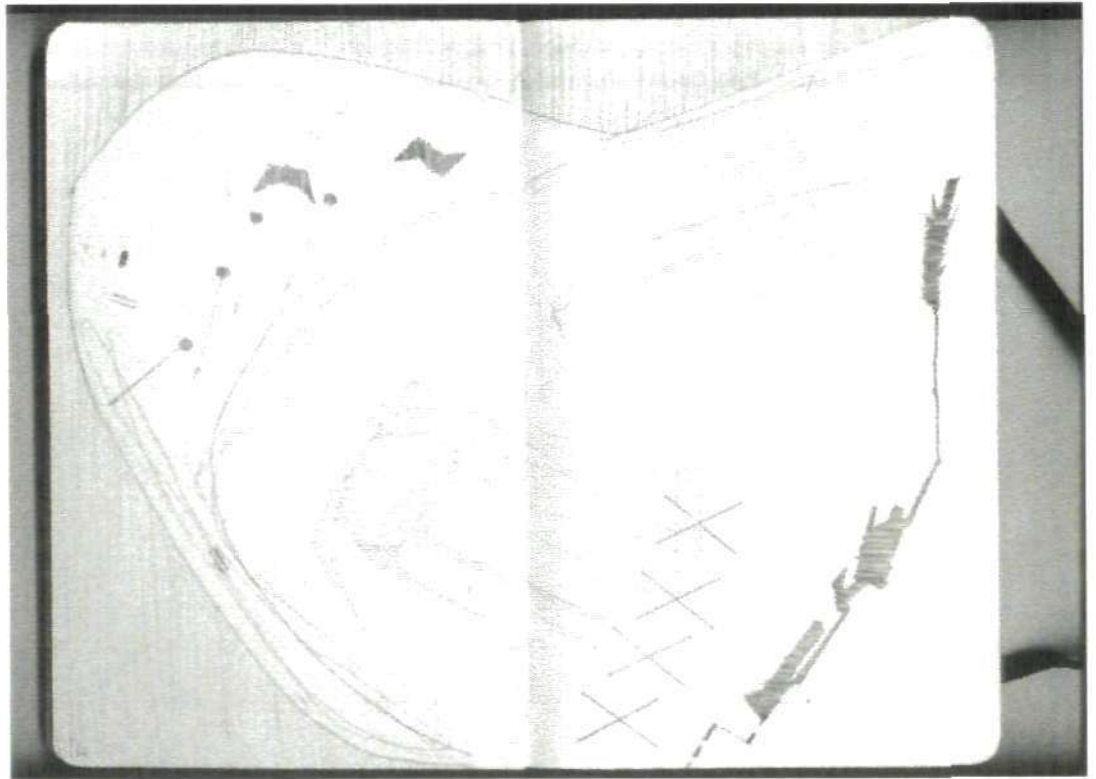
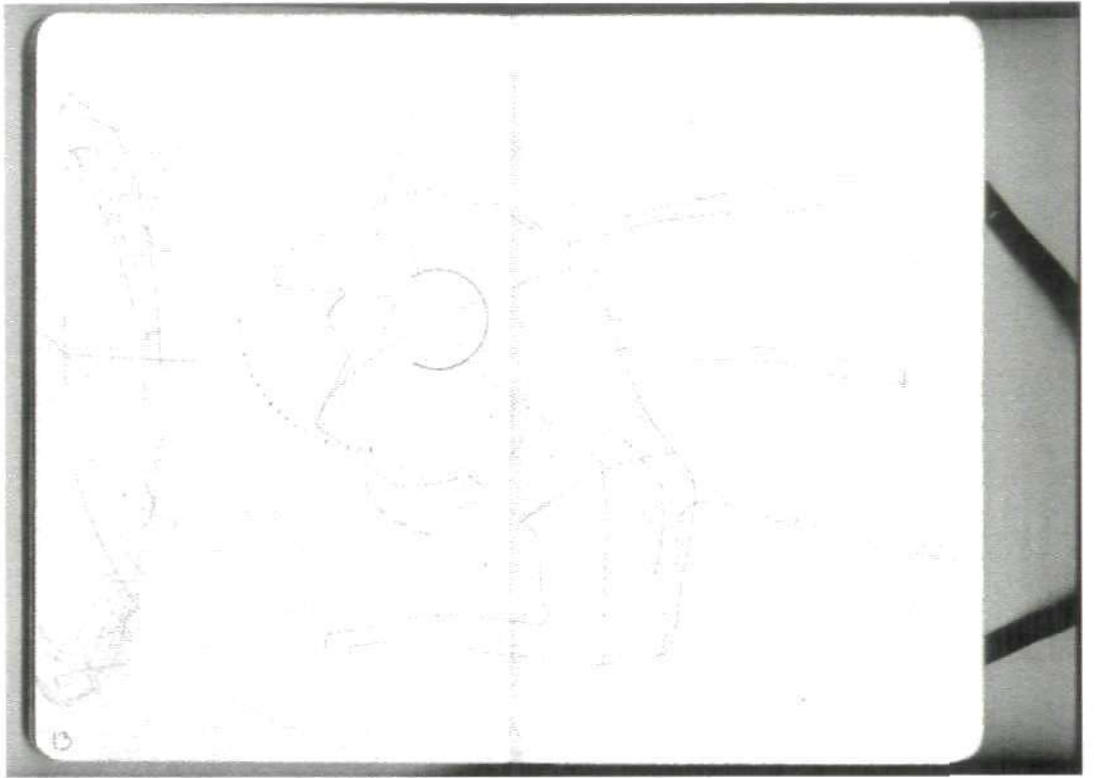


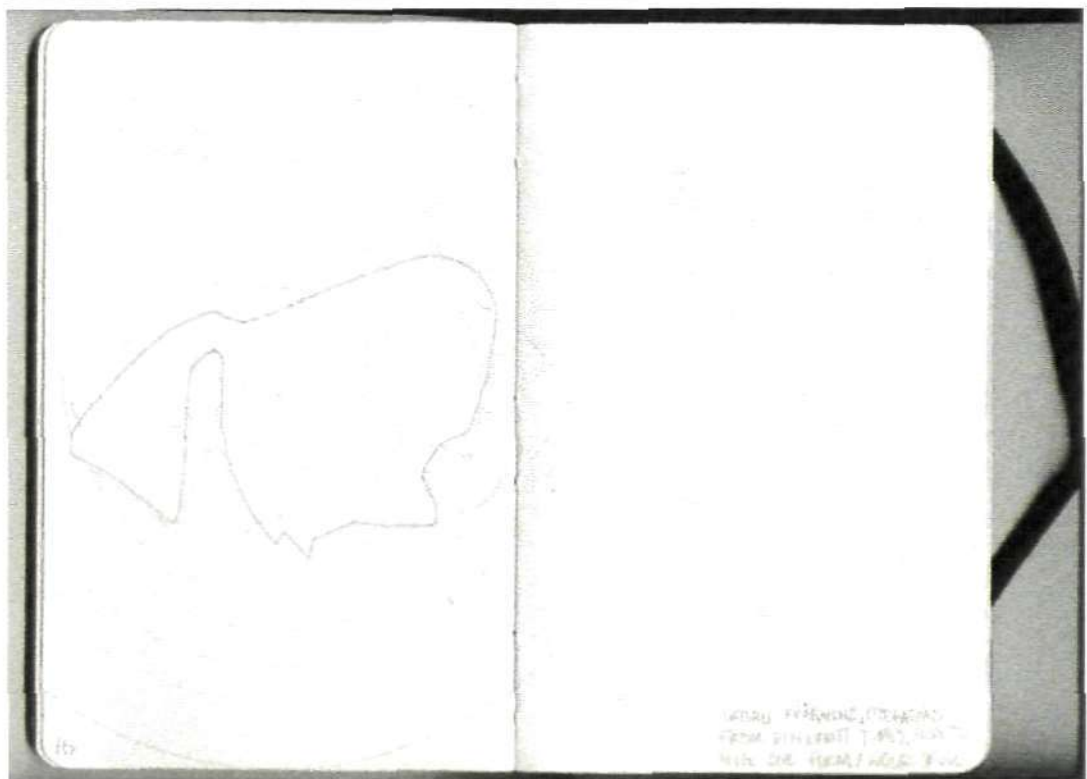
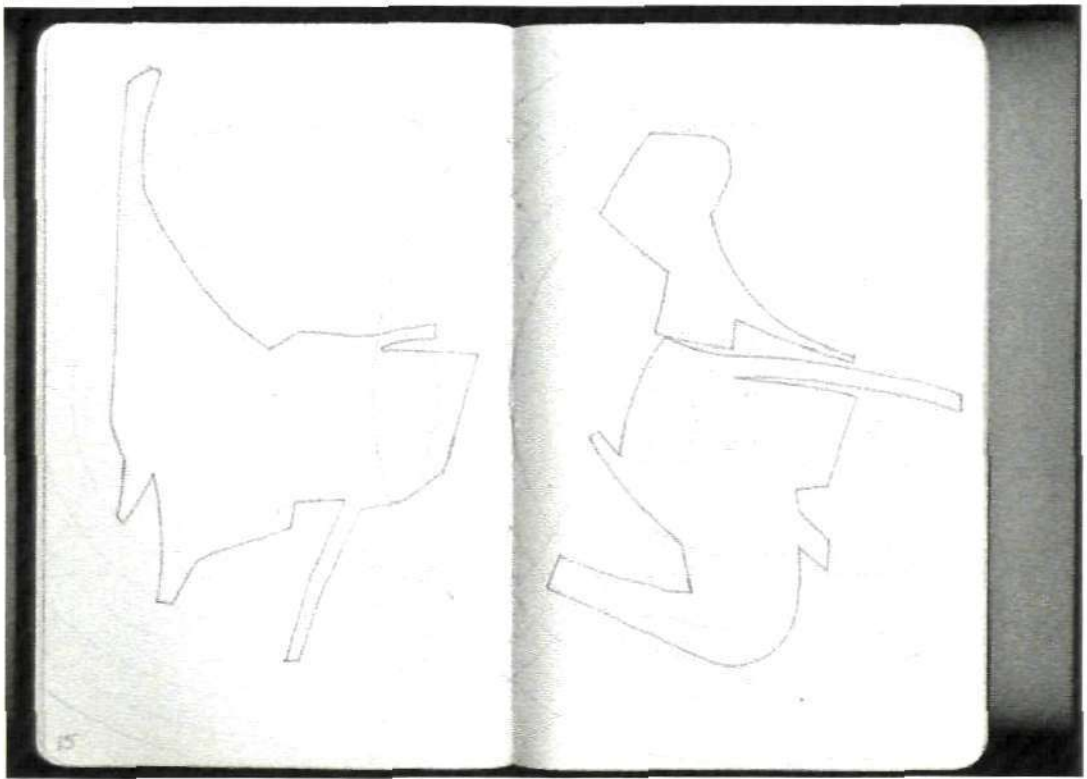


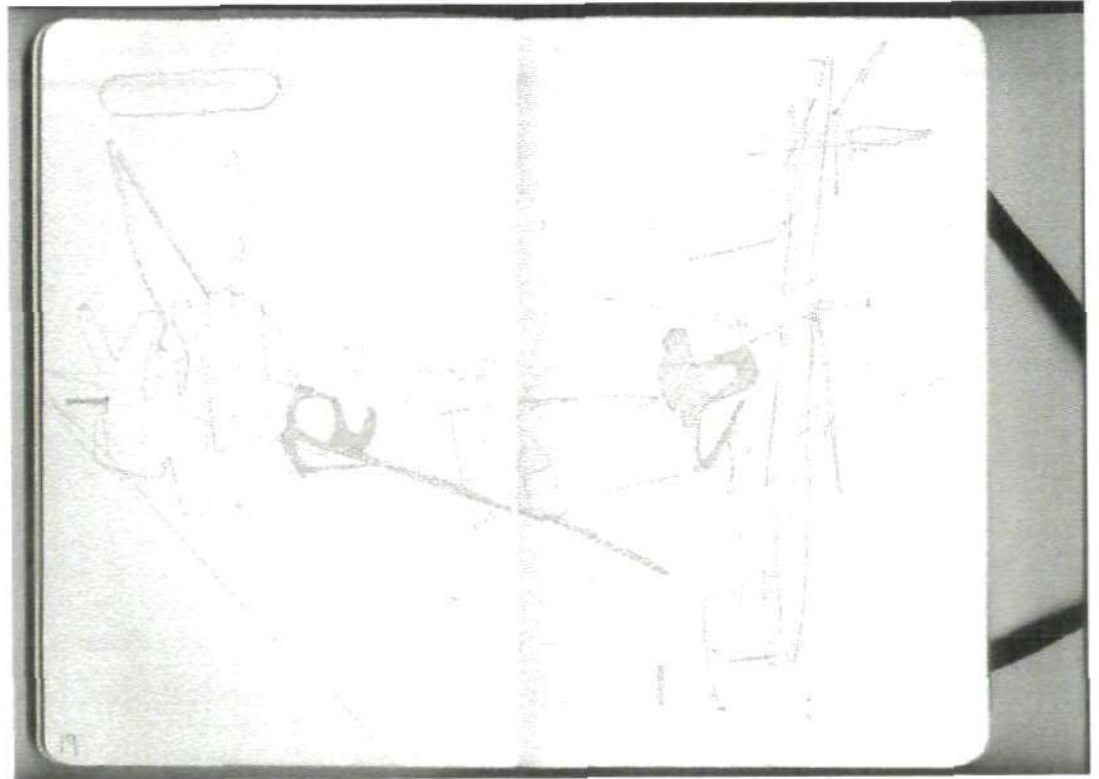
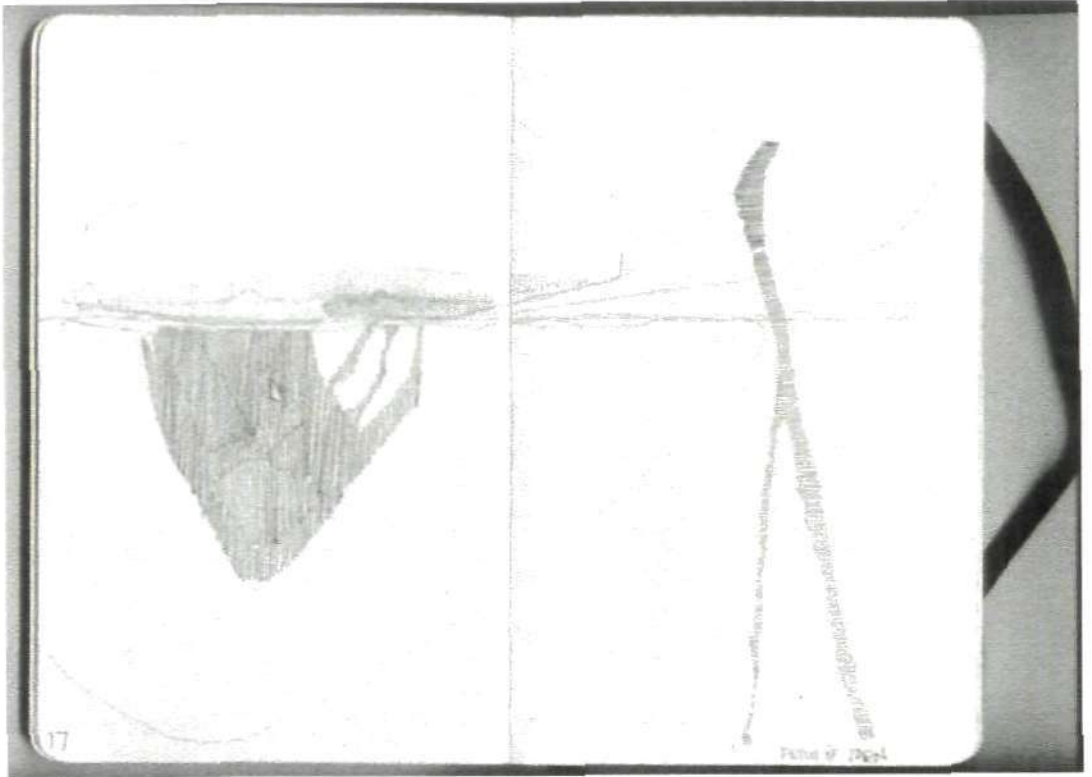


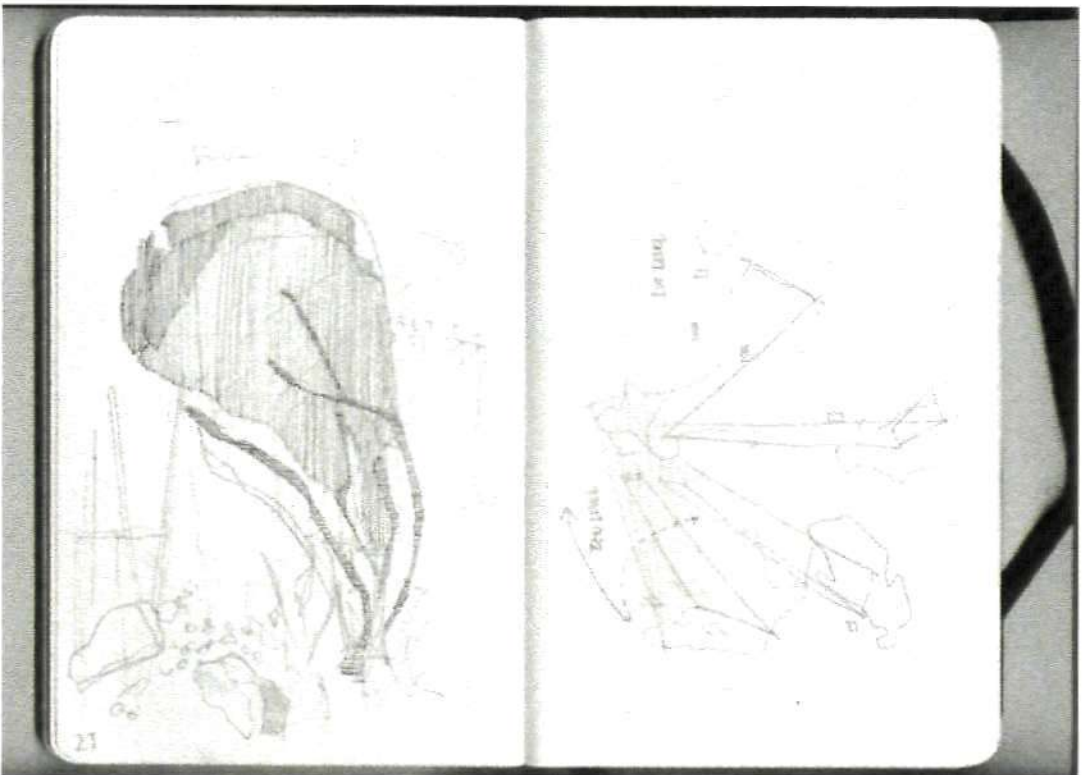
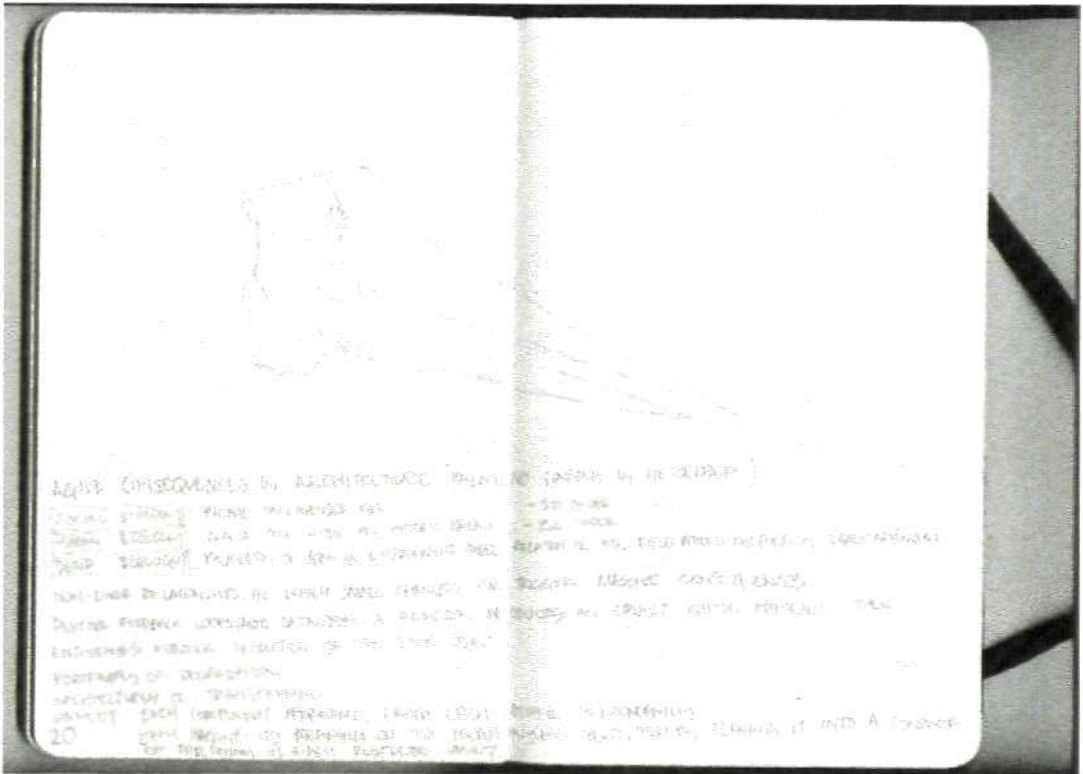


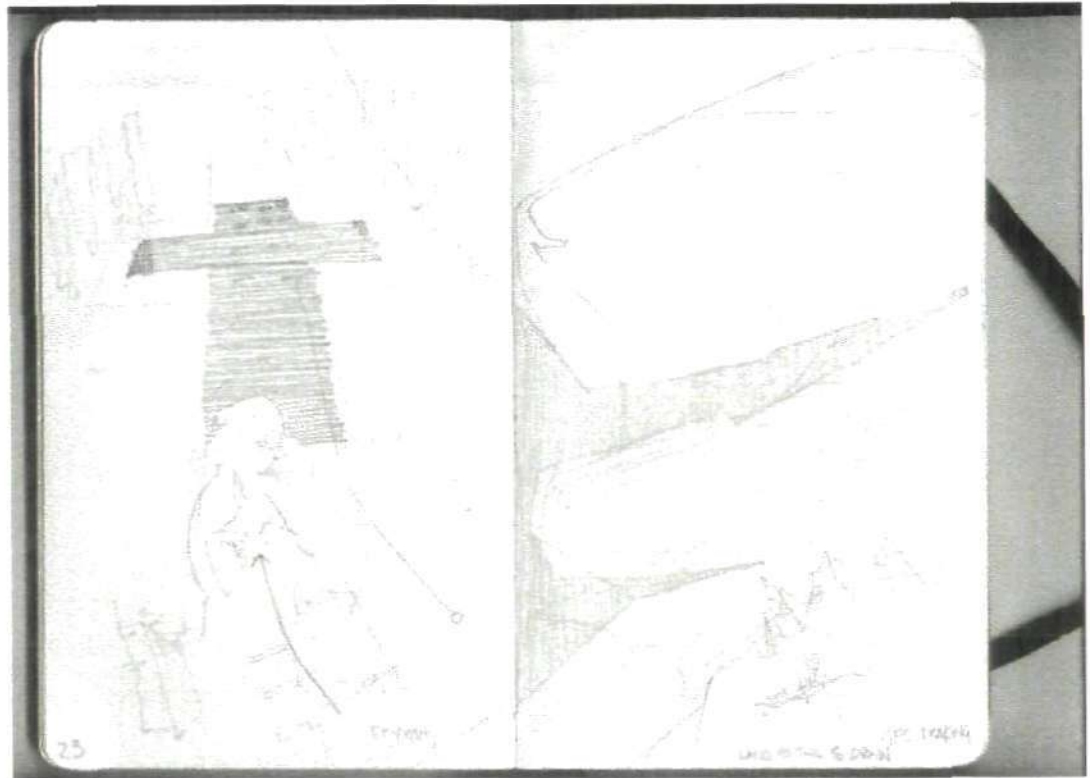
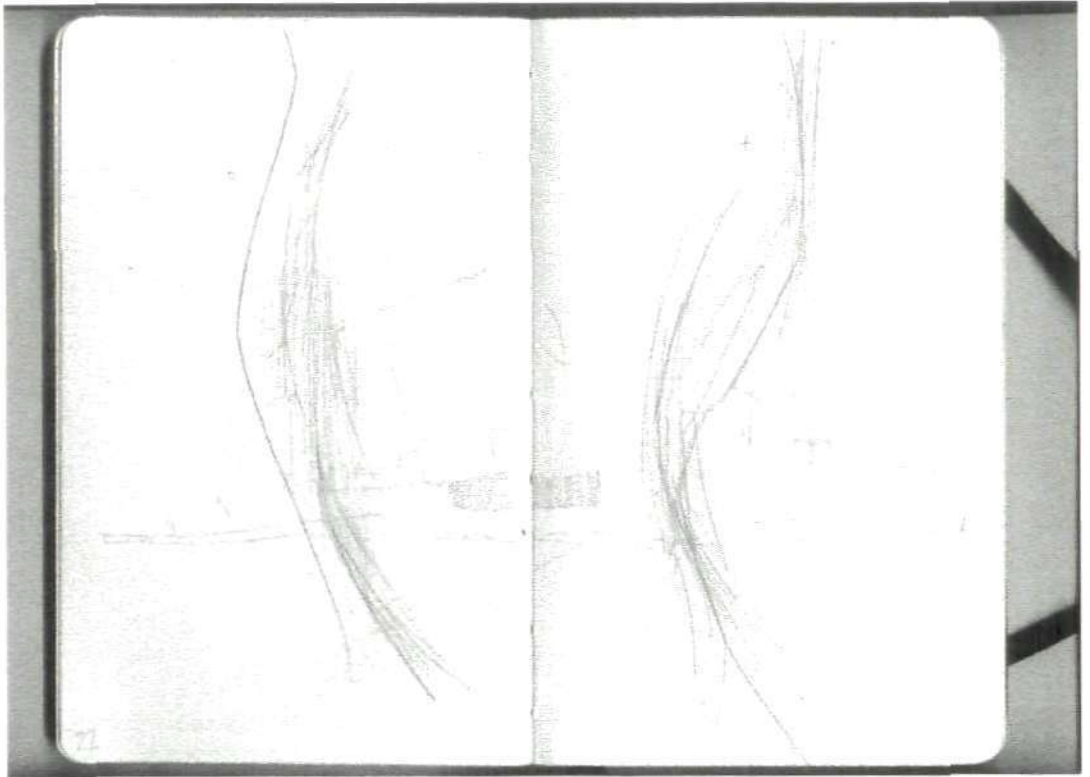


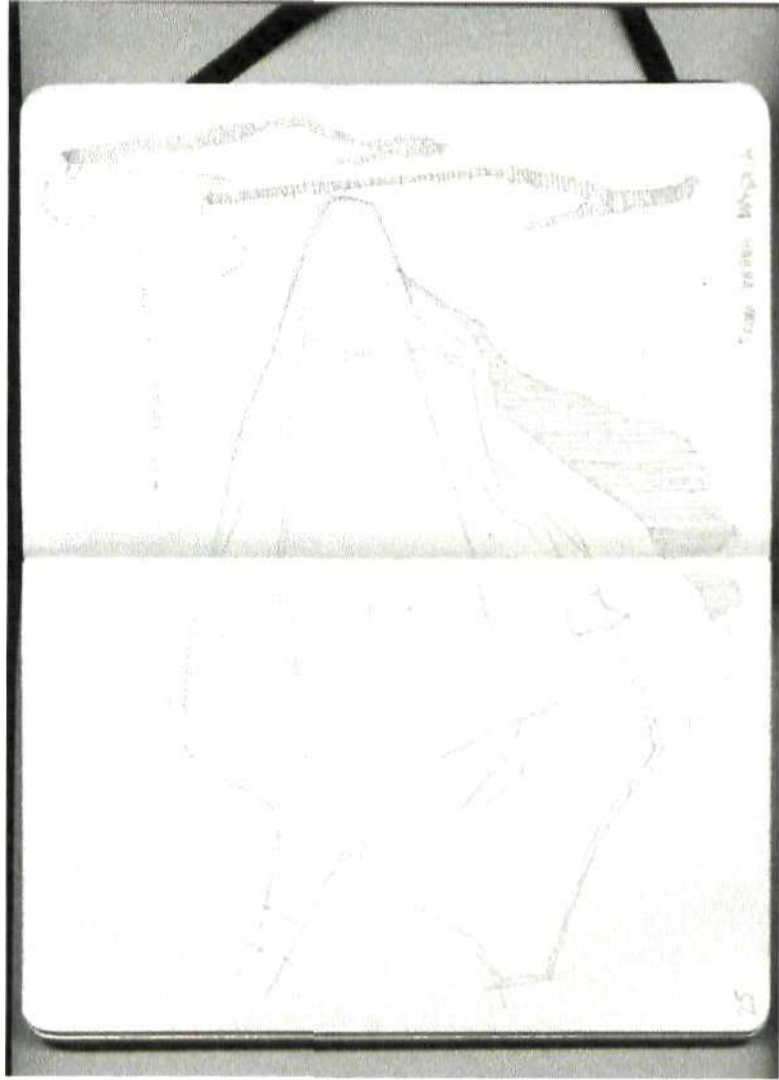
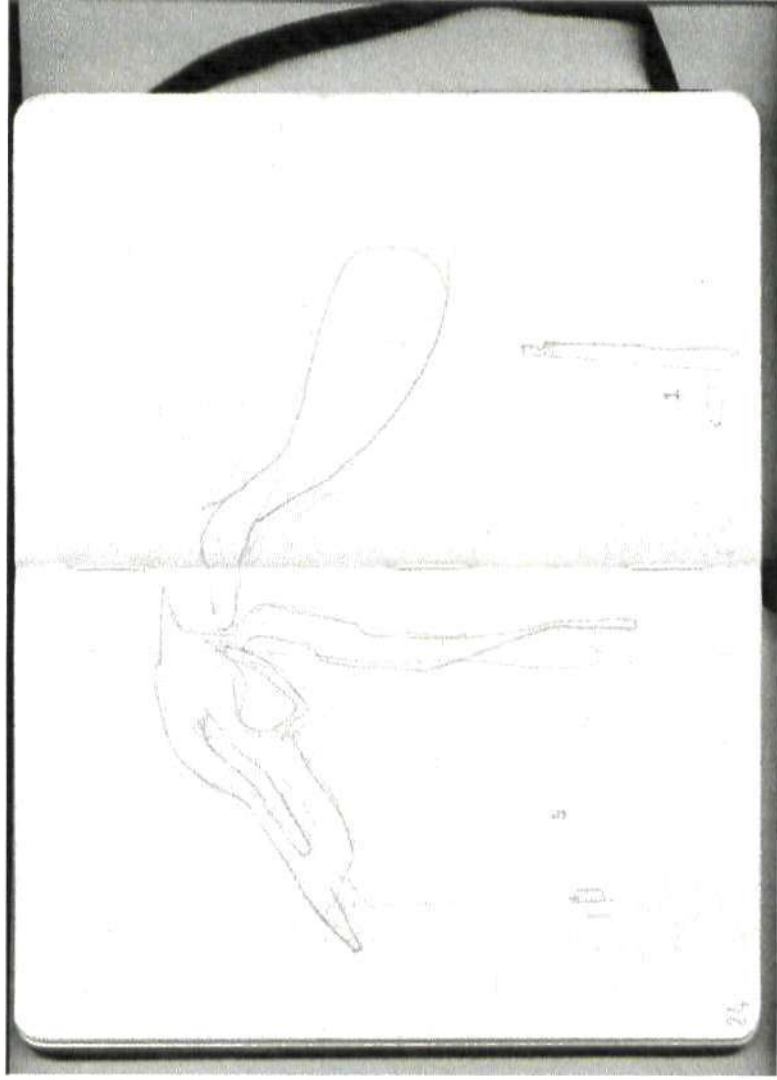


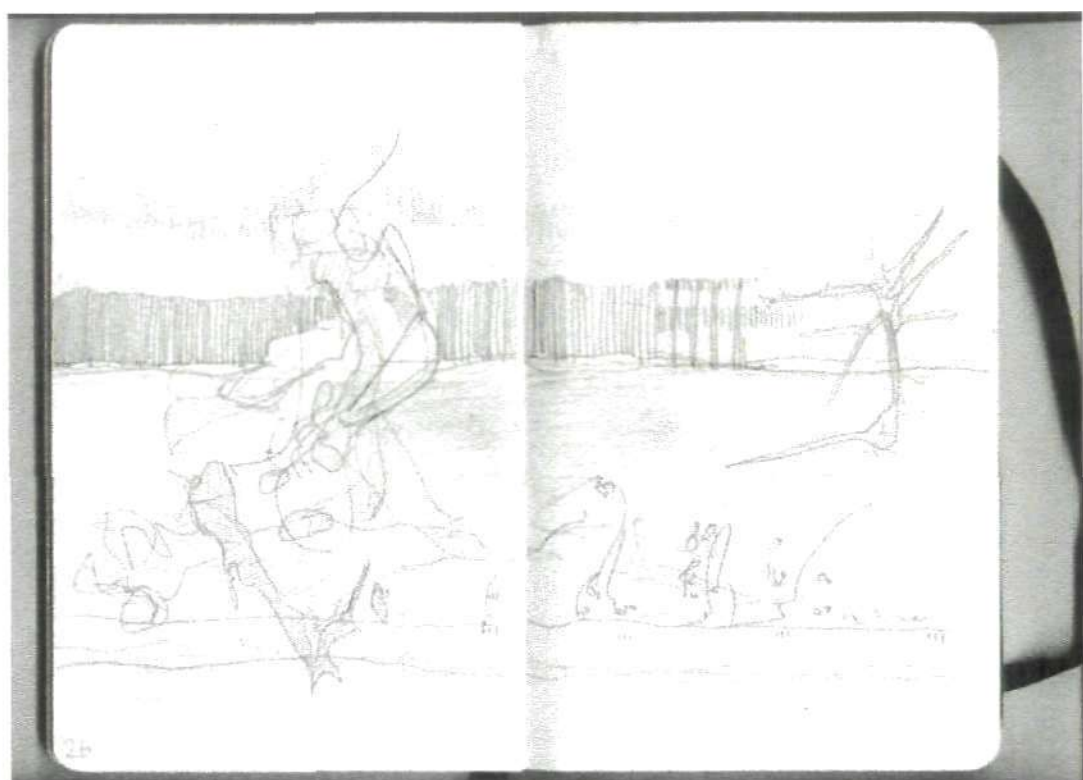


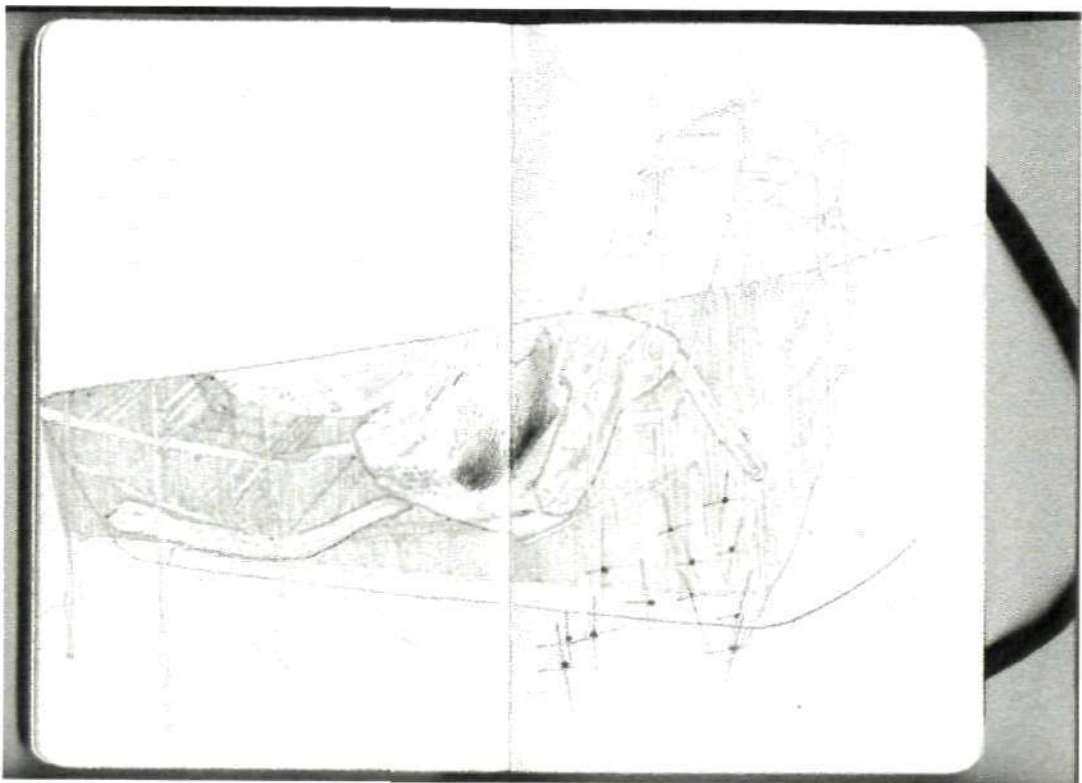
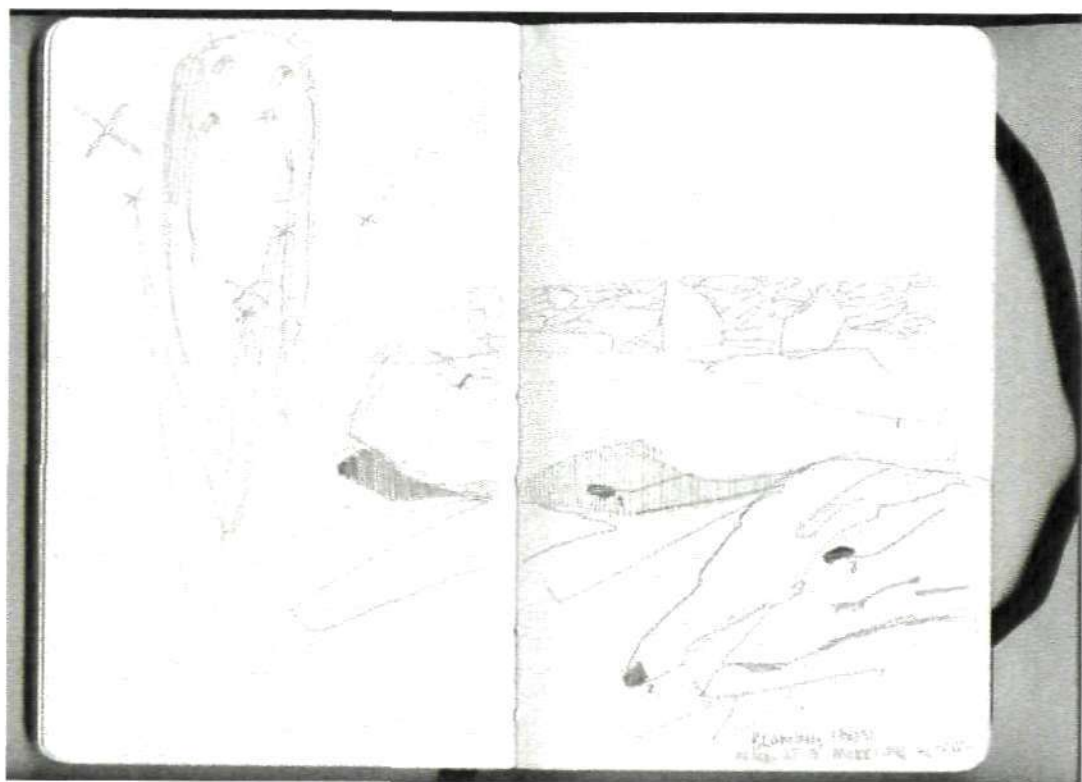


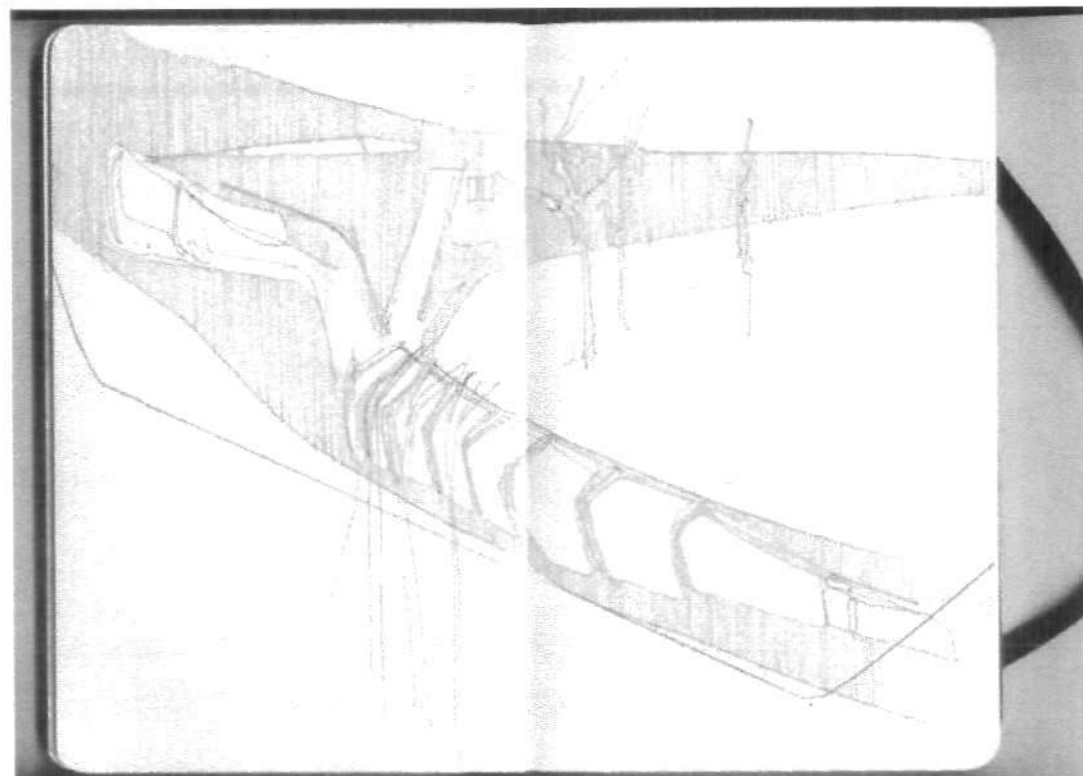
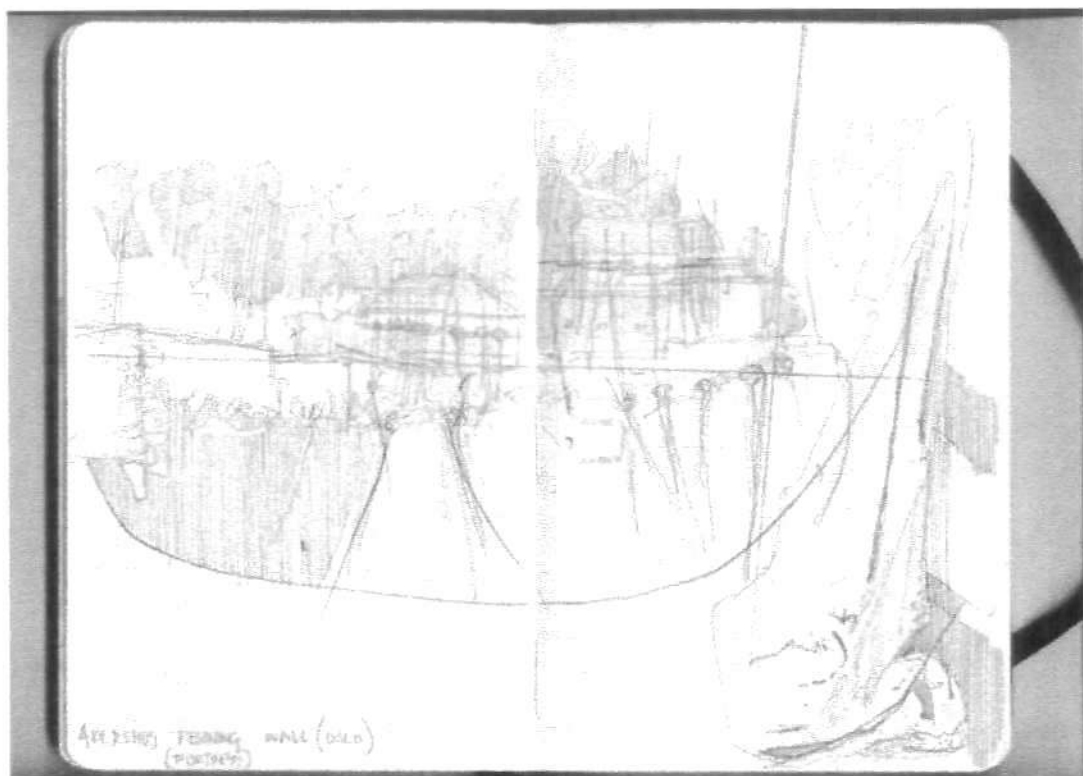


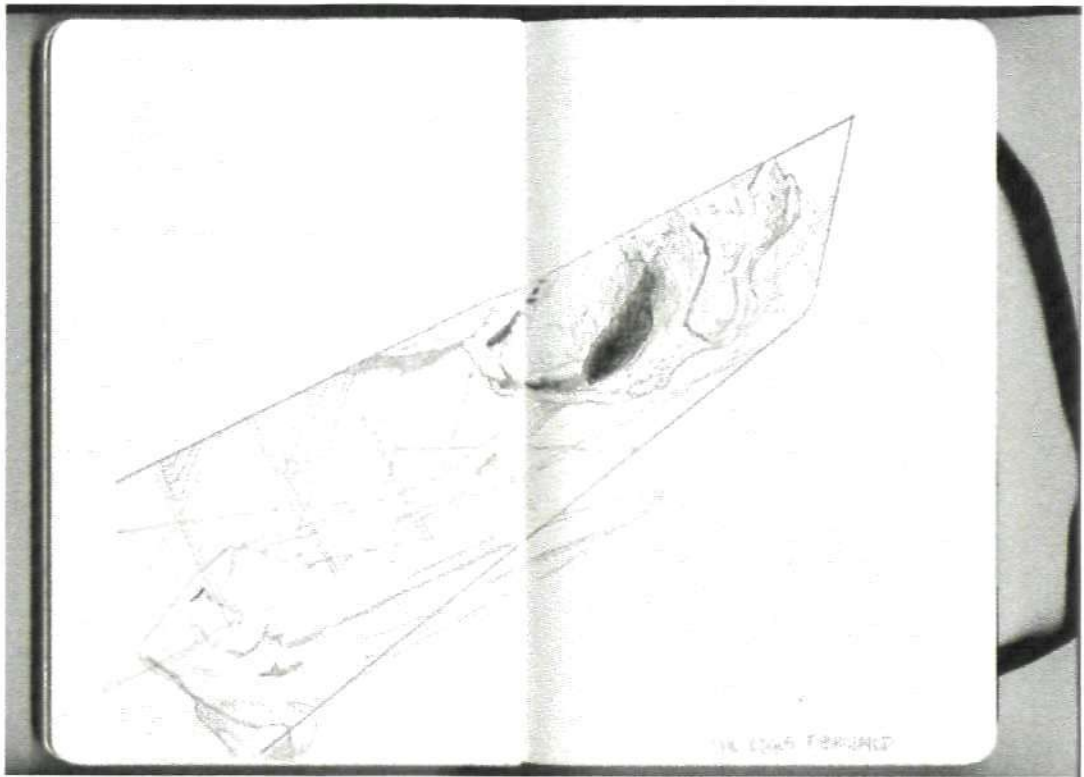


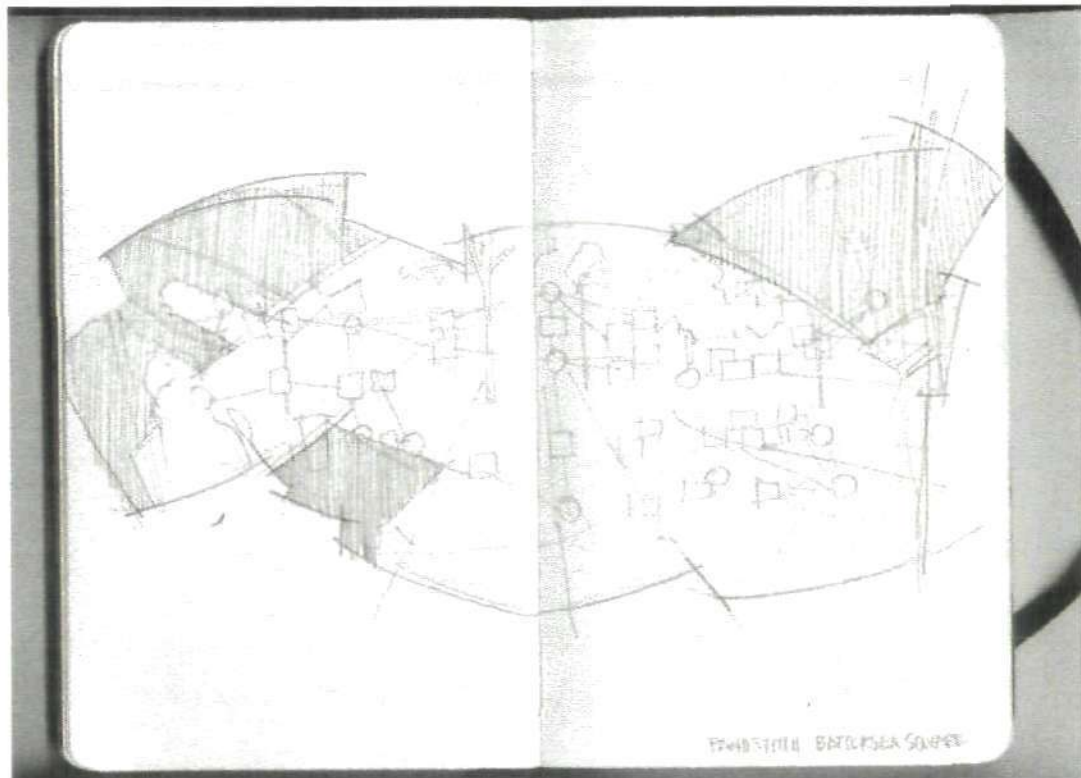
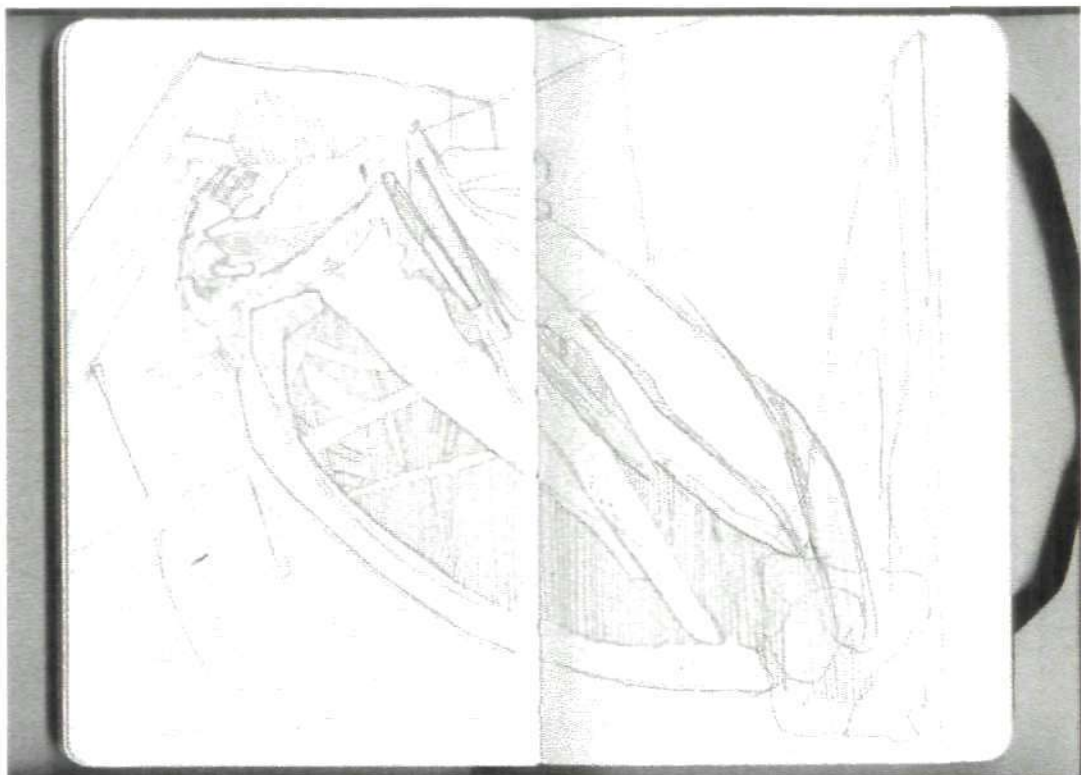


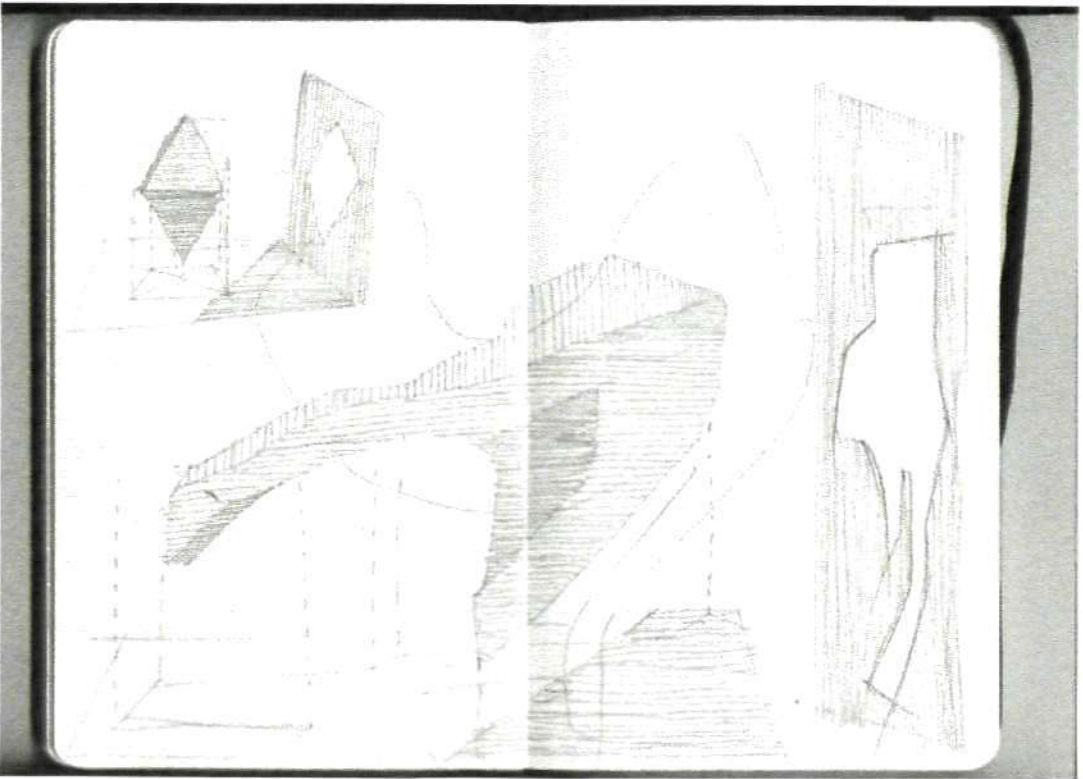
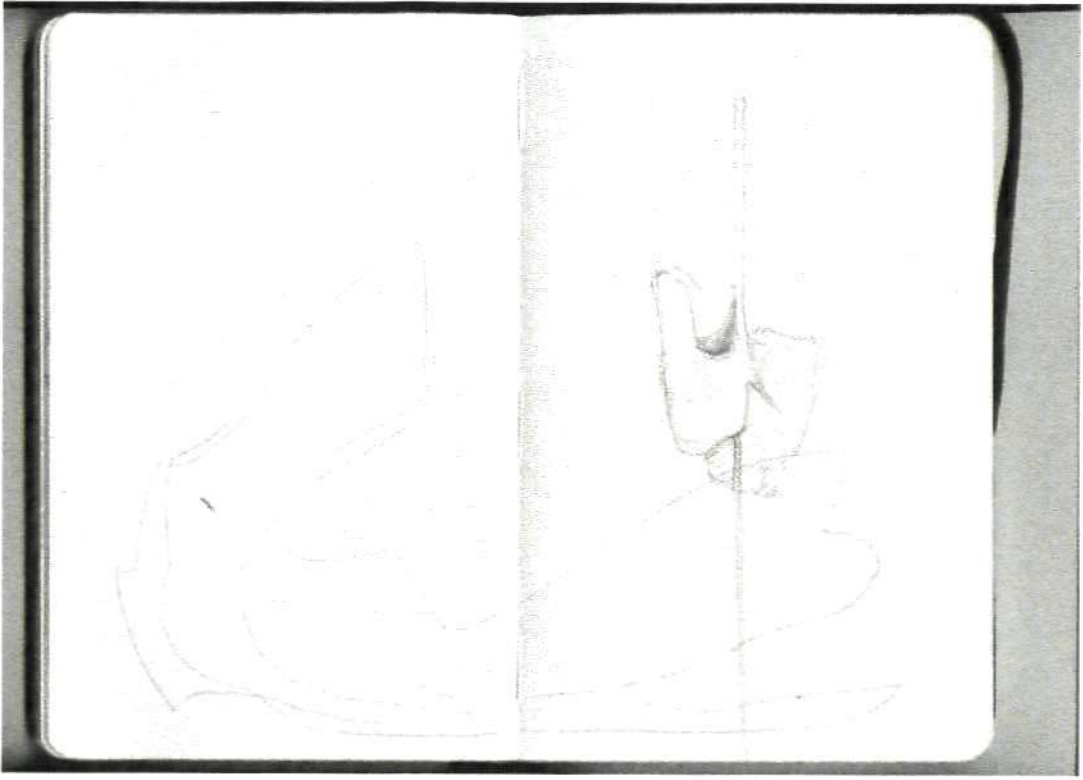


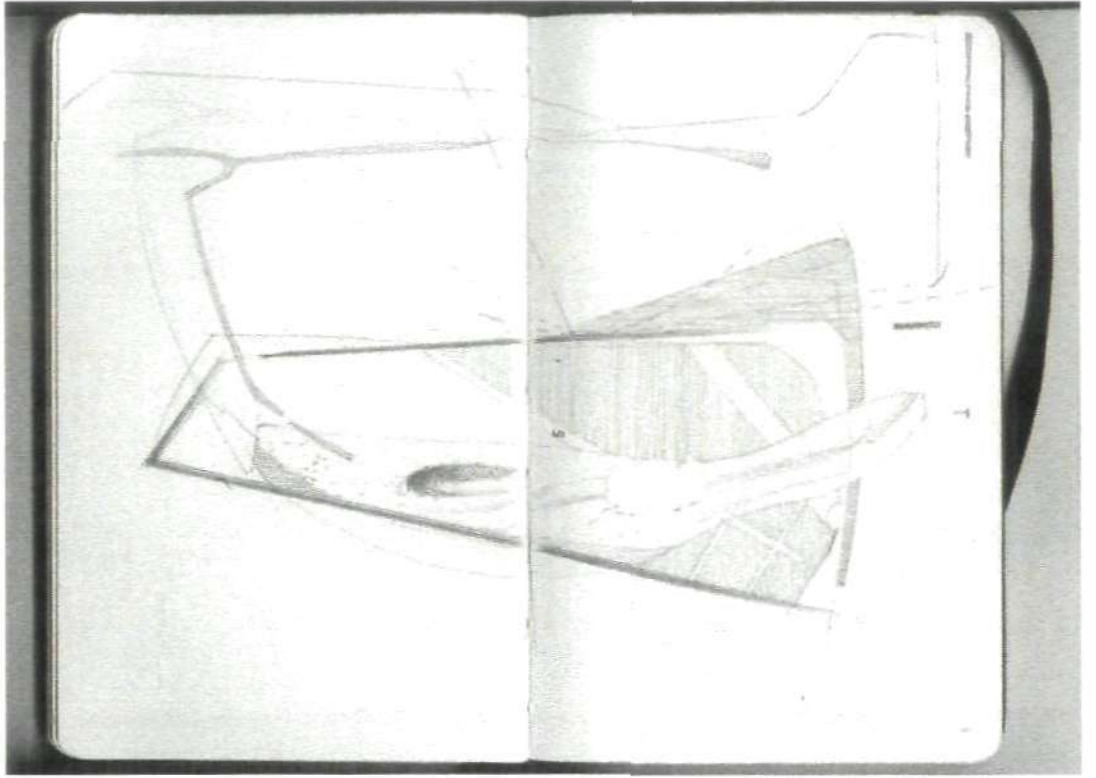














ENIAtype

ENIAtype is a London based architecture practice with an international outlook. The practice was established in 2010 by Shawn Murray.

The practice looks to opening the boundaries of conventional ecological architecture practice by a firm and exploring research to environmental design.

Professional services

Interiors

Urbanism

Energy Practice

Work and space

Shawcross Place 1999

Bank of Scotland Tower 2000

Campania Contemporary 1999

Avonlea 2002

Shawcross Tower 2001

Shawcross Tower 2001

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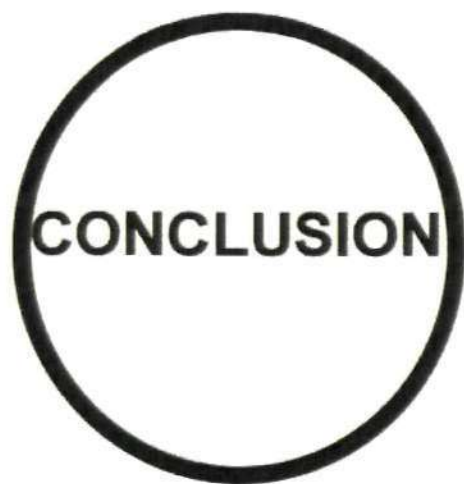
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viii



viii. Conclusion

The conclusion of this thesis supports the field that intentionally facilitates ecological, notational, instructional and aesthetical transitions within the built environment. As a burgeoning sensibility, Eniatype is constituted from joint disciplines. It sits at the confluence of many fields of study, all of which support communication and ecology. Comprised of salient ecologies, reflexive architecture, reactive planning, correalism and recursive vision.

Learning from three major design paradigms – context, design and communication – the ideas of Eniatype were formed. By linking the relationship between working drawing, participant and environment, extensive design solutions for communication have been produced. It is through this unravelling of the complexity of this relationship that we can reveal that an architecture happens prior to building. Throughout the thesis, the instrumental ambiguity of the theory is important in unravelling the complexity between drawing, participant and environment, because it is through participation that experience will define a truth about what is architecture?

Critical Reflection on Thesis

All of the Eniatype projects shown throughout address environmental and drawing issues in different ways. The project summations of ecological design challenges are as follows:

1. Increase spatial notational strategies

We should take into consideration the context of architecture as a critical element in understanding the identity of the work that might not necessarily be captured by notation. It should be suggested that architectural works are in part identified by the architect's act of designing them at a particular time and perhaps for a particular place. If the information falls outside the working drawings, this simply means that the notation fails to capture a buildings total identity, not that the given work is somehow deficient.

With an increase of notational strategies we must understand the shift towards levels and type within the model of describing the relationship between

working drawing, participant and environment would confront this somehow deficiency of a buildings total identity. To look at the wider perspective of the relationships in architecture between working drawing, participant and environment would allow us to connect the flows or the trace of the relationships over time, these 'in', 'off' and 'by' spaces. Architecture is not around the working drawing, it is the people inhabiting the architecture and the environment in which the architecture is correlating through will be an important connection to make. We should not be looking to redefine the edges of the design project by a computer screen or a piece of paper, but allow a web of relationships to evolve in a strategic and important move engaging with this complexity as a whole.

We should rethink the classifications of the developmental relationship between working drawing, participant and environment as a system of classification of types based on the architectural projects developmental relationships rather than their overall similarity of form. Recognising the need to understand the importance, in designing the connections between natural and artificial systems will provide a framework that will produce substantial results. In part, there is a shift; one is the deficiency of ecological systems used in architectural practice, for example, between architect, client and builder through working drawing and environment. The second is the deficiency of notational systems used in architectural practice through plans, sections. The third would be deficiencies of instructional systems used in architectural practice through computer aided architectural design (CAAD) and in building information models (BIM). The fourth deficiency is of the aesthetical systems used in architectural practice, for example, between the form, content and function of the building.

2. Increase structural coupling

These interactions of the logical types of the working drawing and environment together form a spatial unit, which I have termed an ecotype. This system is defined as a unit of interaction with the physical environment so that a flow of energy leads to a clearly defined ecological, notational, instructional and aesthetical neologism. Through this research, my intention here and elsewhere is to produce a kind of cross coding between levels and type through working drawing, participant and environment. The development of my *a priori* models would allow the architect to rethink the classification of the developmental

relationship between working drawing, participant and environment. The ecotype map will become one of continual change and shifting analysis of different levels of coherence, progress and regression of the architecture with the environment through the participant. It is espoused from the *a priori* model to redefine the coded notations and to define the relationships between solid and void, from the relative to absolute, from the rational to the non-rational, from the reducible to the irreducible and from process to development.

Through our environments capacity for regeneration, to the demonstration of numerous species to regenerate as though a hidden blueprint was being followed. Eniatype will be the reflection of an architecture acting out its differences with its environment. Eniatype is important to raise its profile and get closer to perfect coherence, which is a state somewhere between chaos and order. What becomes in the ecotype map is an actual construction site of an architecture in development – a construction with no definitive meaning – an architecture as coupled action.

These construction sites of an architecture within an actual environment will enable determining effects of the environment through chance and necessity. Depending on the intention of the architect the constructions are connected within the field. The field could be described as the wider perspective in which all parts interact. Can we take the view that the basis of architecture is the natural and artificial in coupled action, that is to say, the field is a networked web of relationships, which will become the sites of the architecture *a priori* building? From this perspective the architecture would appear as a dynamical process (and not a syntactic one) of real time variables with a rich self-organizing capacity (and not a representational machinery).

Architecture as a coupled action with the environment could be about creating a fingerprint in the environment and not a blueprint at the drawing board. The outcome will be a carefully crafted architecture, through technological, manual, environmental constraints. It is through the determining effects of interaction within the system of varying power that the architect can become the editor of environments and operate as space-scribers at the intellectual level of intuition and active purposefulness. A structurally coupled system is a learning system as it keeps interacting with the environment. Could we relate structural coupling as the context for an architecture continually

interacting with a site in real-time through ecological, notational, instructional and aesthetical strands?

3. Increase singularity

There are many kinds of relationships between working drawings, participant and environment an extremely important one is who communicates with whom and who instructs whom. The context for all the projects is through an understanding of this relationship through models of thinking, transdisciplinary research sessions, models of experience through practice and methodologies of communication through teaching and practice. Together these models and methodologies aid the foundations of the construction site for Eniatype architecture.

In the development of the site for construction, we should not think of this process just as a set of changes in the architecture in a particular location but as constancy in the relationship between working drawing, participant and environment. This wholeness suggests total participation by the participant and maximises both local freedom and global cohesion through the working drawing, participant and environment. It involves the mutual implication of global and local, of part and whole, from moment to moment. Through the theories of structural coupling, time grain and quantum coherence one can challenge and develop the drawing to handle communication involving multiple logical types. Eniatype, on one level may become mental landscapes of design, which are modelled the way people think about their world through the designing mind and the drawing tool. The task seems overwhelming, but is not impossible. From our new understanding of complex biological and social systems we have learned that meaningful disturbances can trigger multiple feedback processes that may rapidly lead to the emergence of new order in design and practice.

4. Increase collective subjectivity

It is through the experience of the transdisciplinary research sessions that I developed a specific understanding of the complexities of the relationship between working drawing, participant and environment. Through the sessions I identified a widely scattered set of benchmarks or points of reference from which a new burgeoning field could be defined.

In the sessions I was often disconcerted when participants would not know the differences between the working drawing, participant and environment through communication, recursive qualities, authorship of the work and transparency of information. I have always directed the teaching methodologies towards system-based teaching, which aims to be open and reflexive. A group of participants from University College London in 2006 to 2010 were the first design group in the Bartlett School of Architecture, University College London, to collaboratively work on their projects through using online blogs for the purpose of developing their projects. This enabled each participant to constantly observe the other participants design ideas, to help themselves develop their own design projects. The weekly discussions around the table with the groups were a constant reflection of the development I had seen through their own personal blogs. Some other participants were hesitant to post the development of their projects online at first, due to the global access of other people seeing unfinished work in the academic environment. This open access, through the blog, to view the development of the projects was essential in empowering the participants to be more rigorous in developing more complex ideas and systems. The participant's participation through the online environment of the blog was an evolving Eniatype within itself. The participants seemed to frame the development of this open and reflexive teaching methodology by suggesting that there is a tension to the development of their project between solidarity and dissensus.

5. Increase existential values

Throughout the course of the PhD I have been researching methodologies of practice through three professional practices. Each practice was different in its approach to architecture and the types of projects they worked on. Each practice provided me with a first hand insight to their working methodologies and approaches to the design of projects. In Alsop Architects I worked on a large commercial office building and retail pod at Southwark, Central London, a public arts building for West Bromwich and a residential scheme facing Hyde Park in London. In the Metropolitan Workshop I worked on developing the infrastructure of a new self-contained town called Adamstown in Dublin. I also worked with a small green practice called Mass Architecture in East London; here I helped develop sustainable and ecological schemes within the

community of Hackney. The different methodologies in different practices embrace some key fundamentals as a way of communicating their ideas. Through practice I discovered that approaches to designing could be considered a second-order aesthetic, whereby we can position ourselves within the process of design and participate in the making or meaning as we construct the architecture. The aesthetics comes from designing the relationship between two things as we are not designing the thing itself.

6. Increase object-oriented ontology

In recent years there has been quite a bit of scientific research into communication methodologies between working drawing, participant and environment, which can help us to understand what it is and how it works. Is it usual, when believing oneself original, to reinvent the wheel? In architecture and thinking about these issues, this danger becomes particularly acute, especially in an ecologically sensitive age. This approach leads us to the question, what is the relationship between working drawing, participant and environment in the field?

Just as our environments are constantly in the process of being reinvented, so must our drawing of architecture. This could be possible if our participants become both more united and increasingly different. Through my transdisciplinary research sessions completed for this thesis, we can gain an insight to how a working drawing, participant or reader of the relationship between working drawings and environments has a collective subjectivity, singularity and existential values in time and place. All the sessions were developed within the environment through the participant and working drawing.

The *Working Drawing* is not and never has been a self-containing thing. It has always required the services of a participant, the interplay between the way the working drawing unfurls the notations materially and in a way the reader reassembles it mentally. A kind of experience marked out by a selection of a specific type of medium, a particular kind of place and time to participate. As the notations are circumscribed by its materialisation in projects, so participation is circumscribed by the times and places which, socially and culturally, are appropriated for participation. Working drawing has moved from technical drawing to a network drawing through the building information model (BIM) to an idea of an embedded spatial notational model. Working drawings

are cybernetic systems; there is an input and an output and an intervening state. The relationship that exists between the various elements is not static, the input system has an immediate relationship with the output system through the mediating state and this produces a form of loop that is commonly called feedback. Working drawings and their histories are not fixed; the way a working drawing is used is as contingent as the way it may have been produced. Working drawing is itself active; a working drawing changes an idea through its self-construction.

The *Participant* could be defined as the occupant on the site whether that be human or animal, participant is the designer on the project that needs to be involved with the Eniatype architecture through the site. The participant is a visitor or a tourist, a neighbour to the site. Through the advancing models of communication through the internet from geographical positioning systems, Facebook, Twitter, Google, applications through the mobile phone allow for multiple interpretations of participants on sites, some would be more valuable than others through the *a priori* models.

The *Environment* of Eniatype architecture is composed of ecologies. Ecologies within the environment can operate independently or within a group. Eniatype architecture is to operate in tandem with the environment through its prescribed ecology. The concept of environment covers just about everything associated with working drawing. No working drawing exists without an environment. And no environment can exist without a participant.

The research and development of the *a priori* models, for instance, makes it easy to forget that the individual relationship formed by the interaction of people and buildings, not by any one of them in isolation; and all of them are expressed in a complex dance with the surrounding environment, air and earth and other organisms. Even with current progress in chaos and complexity theory, we remain less skilled at thinking about interactions than we are thinking about entities, things. Through difference we can learn about the complex relationship we have with developing sites for constructing Eniatype architecture. The sites for constructing the architecture will bring together of all the elements that make up the whole, inclusive of all aspects of the design process. Through levels and type, we can learn how to weave the different communication strands through the model of working drawing, through the participant and through the relationship with the environment. Eniatype will aid

to drive forward a way of practice that will be able to distinguish levels of logical types in our living architectures. We, as designers, will operate on multi-level system not dissimilar to Bateson's model in part 12.02. Through the paradigm of context in architectural notational systems through to the incessant communication of everything as we experience and have not yet experienced it. Between the exterior world of facts and the interior work of emotions, between reality and imagination, between working drawing and environment, between participant and environment and vice versa. Through developing new models to interact and communicate our architectures as in the ecotype map and *a priori* models.

And finally through context where the focus moves from a system of relationships based on objects towards a system based on distributed environmental systems. We also must find the importance in developing *an architecture a priori* to building at the pre-planning stage in the development of the site of construction, the architecture before the architecture.

Current and Future work

Through the process of doing a PhD by Design, it has raised many issues regarding when does practice become research and when does research become practice. Is the issue of a PhD by Design about researching the process of practice through a design project, or could it be about unravelling your experience of practice as research? To unravel the complexities of your own practice, you would need to define the relationship between you and your practice, and develop methodologies to experience practice through research, which could be guided by a series of research sessions. Then the research could become about creating a platform whereby you could discuss how you understand these relationships of your own practice in different fields. Essentially it is about unravelling the complexities between design and communication in architectural practice.

It became quite fundamental to me that a PhD by Design is exactly that: the term design comes from the Italian 'disegno', meaning drawing, to draw forth an idea. Researching by drawing forth ideas. You are designing a PhD about your practice through design. It is about practising practice through transdisciplinary research sessions not determined through an awkward design

proposal. The idea of a design proposal somehow defeats the point of a PhD by Design. Somehow the PhD by Design needs to be about experience of the relationships of your practice through research. You need to somehow experience the process of design by doing, by setting up something to reflect on your own practice. I chose to do this through a series of transdisciplinary research sessions. It became not about designing things but concerned with the relationship between: the inclusive middle.

For me the process was about designing the thesis so that it became a vehicle in which to understand that practice and how we do it is very complex. And through research it becomes about unravelling these complexities.

The implications of this thesis are broad and it is anticipated that it will stimulate designers and artists to think about the Eniatype to their design work. For the author, extending the use of research and methodology is embedded within two large-scale projects: the development of a new architectural practice and acting as principal editor of the academic journal, *Design Ecologies* (www.designecologies.net).

This journal will develop as the trace of other activities. The aims and scope of the journal reflect my ambition as designer and researcher, which is to address the proposition that human communication and ecological accountability are inextricably linked in architectural design. In architecture, the communication from architect to participant or environment is not at all straightforward. This is also true of the dyadic relation between context, design and communication in architectural practice. Through original design exploration ranging in scale, the aim of the journal is to proffer a critical vision towards the built environment. These conceptions challenge the everyday practices of architectural design by offering a transdisciplinary framework for design production. The journal will conclude with the necessity for a new design field entitled Eniatype.

The value of a transdisciplinary approach is that it allows the various communities to propose and share new methodologies in order to understand how an architecture/object/system can be wholly informed about the implications of social and technological environments through creative practice. The aim is to develop and demonstrate methodologies for analyzing determining effects of interaction within a field strategy. These research projects both require the use, extension and development of my methodology. With, the

breadth of audiences, subject matters, and local and global contexts, I anticipate a thorough use of the method to sustain its use in supporting Eniatype.

Potential applications for research

As well as supporting the author's own future research, it is anticipated that others will benefit from the method that has been presented in this thesis in the construction of Eniatype. As the development of communication technologies continue, and the experience of architecture is demanded *a priori* to building, the need for Eniatype research will become increasingly more important. The need for new graphic interfaces to represent this dynamic model of our environment with an Eniatype architecture.

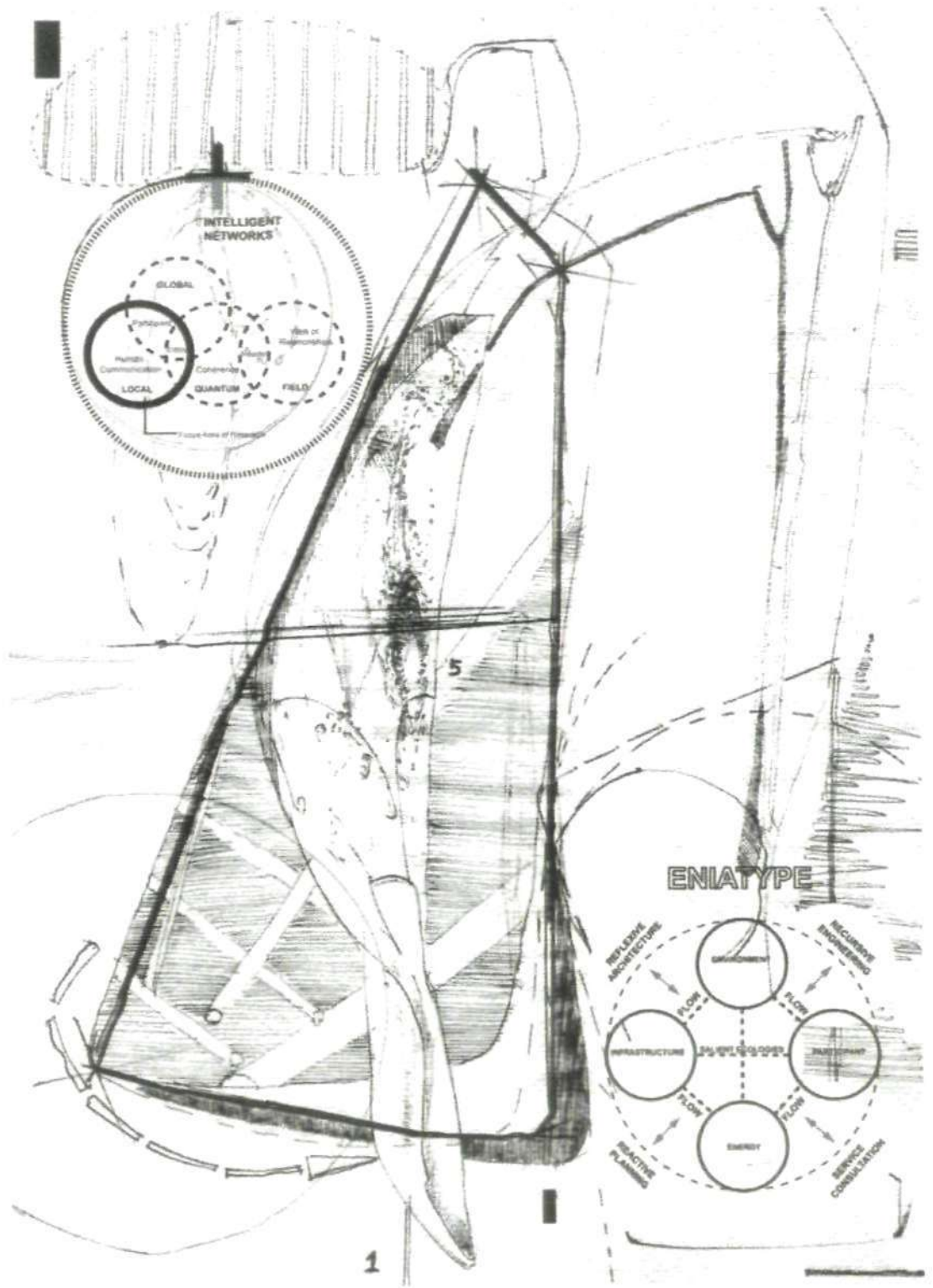
Advances in holographic projections would provide a great opportunity for designers to explore visualisation within the environment of their intended architecture *a priori* to the building. The traditional methods of representation in architectural practice will come under increasing stress through the demands of the increase of real-time 3D applications. In a paper published in *Nature*, on 3 November 2010, they report the transmission of moving 3D images from one place to another in almost real time. This could mean that eventually we may be possible to not only communicate with moving 3D images from different locations. Eniatype architecture will be able to use the technology to step into virtual spaces in actual environments, our working drawing will become ever more immersive and spatial.

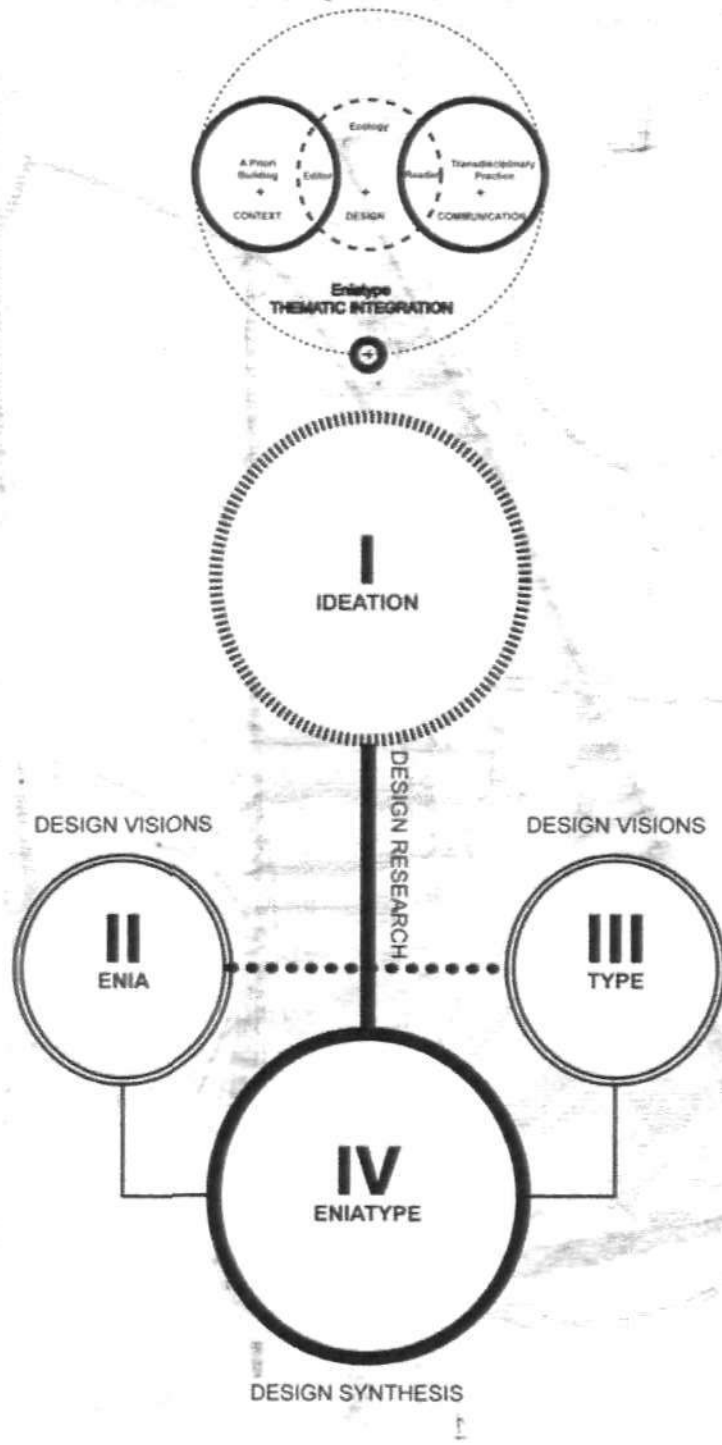
As advances develop in the way we communicate with each other and as Web 2.0 extends onto mobile and locative media devices, the need for a different methodologies to communicate our architecture is even more assured. With the multiple levels in which we communicate daily on our mobile and locative media devices there will be a demand in the way we communicate our architecture. Through the research and development of Web 3.0 and the semantic tagging of content, there will be demands to further develop or methodologies of levels and type with the framework of design.

The current discussions on object oriented ontology allows to move forward from correlationism and onto a different platform where the discussion seems to be moving toward a non-anthropocentric view of the world and onto

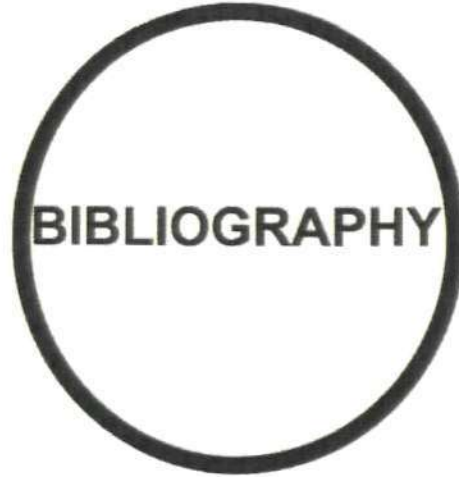
everything having an equal status. This will surely have an impact on the view of architectural communication and research.

In a broader context it is hoped that the concept of Eniatype will constitute the roots of a communicative architecture. With the emergence of burgeoning practices within the field of a non- reductionist, non- localised and non- anthropocentric world view, opens up the potential for a challenging and ultimately an architecture that is communicative. It is also important to consider that it is not research on the means of how we are going to explore this connection between the environment and us in our built environment. The potential for an Eniatype architecture to enable us to situate ourselves within the environment whilst designing should allow a clarity that supports new methodologies of communication in which we can understand what the relationships are in our environment and our responsibility in questions of a transdisciplinary practice.





ix



x. Bibliography

Below is a list of books and journal that have been researched in order to discuss the ideas around the burgeoning field of Eniatype.

Books

Alberti, Leon Battista. 1988, *On the Art of Building in Ten Books*. (Trans) Joseph Rykwert, Neil Leach and Robert Tavernor, London: MIT Press.

Alexander, Christopher. 2002, *The Nature of Order* (4 volume set), California: Centre for Environmental Science.

Alexander, Christopher. 1964, *Notes on the Synthesis of Form*, Cambridge: Harvard University Press.

Allen, Stan. 1999, *Points + Lines: Diagrams and Projects for the City*, New York: Princeton Architectural Press.

Ascott, Roy. (ed). 2005, *Engineering Nature*, Bristol: Intellect.

Ascott, Roy. 2003, *Telematic Embrace: Visionary Theories of Art, Technology and Consciousness*, California: University of California Press.

Ascott, Roy. (ed). 2000, *Art, Technology Consciousness*, Bristol: Intellect.

Ascott, Roy. (ed). 1999, *Reframing Consciousness*, Exeter: Intellect Books.

Ashby, W. Ross. 1956, *Introduction to Cybernetics*, New York: John Wiley.

Augé, Marc. 1999, *Non-Place: Introduction to an Anthropology of Supermodernity*, London: Verso.

Ayres, Robert U. 1978, *Resources, Environment and Economics: Applications of the Materials/Energy Balance Principle*, New York: Wiley.

Banham, Reyner. 1984, *The Architecture of the Well-Tempered Environment*, Chicago: University of Chicago Press.

Bateson, Gregory. 1972, *Steps to an Ecology of Mind*, New York: Ballantine Books.

Bateson, Gregory. 2002, *Mind and Nature: A Necessary Unity*, Cresskill, NJ: Hampton Press.

Beer, Stafford. 1973, *Designing Freedom*, CBC Massey Lectures.

Beer, Stafford. 1979, *The Heart of Enterprise*, London: John Wiley.

Benedikt, Michael. 1992, *Cyberspace*. Cambridge, Mass: MIT Press.

- Bergson, Henri. 1988, *Matter and Memory*, New York: Zone Books.
- Bergson, Henri. 1946, *The Creative Mind: An Introduction to Metaphysics*, New York: Kensington Publishing Corp.
- Bertalanffy, Ludwig von. 1968, *General System Theory*, George Braziller.
- Boden, M. 1977, *Artificial Intelligence and Natural Man*, Harvester.
- Bohm, David. 1980, *Wholeness and the Implicate Order*, London: Routledge.
- Bohm, David and David Peat, F. 1987, *Science, Order and Creativity*, Toronto: Bantam Books.
- Boulding, Kenneth. 1978, *Ecodynamics*, London: Sage Publications.
- Borges, Jorge Luis. 1970, *Labyrinths*, London: Penguin Books.
- Brady, Emily. 2003, *Aesthetics of the Natural Environment*, Edinburgh: Edinburgh University Press.
- Brand, Stewart. 1995, *How Buildings Learn: What happens after they're built*, London: Penguin Books.
- Brown, David. P. 2006, *Noise Orders: Jazz, Improvisation, and Architecture*, Minneapolis: University of Minnesota Press.
- Burr, H.S. 1972, *Blueprint for Immortality*, London: Neville Spearman.
- Butler, Samuel. 1915, *Book of the Machines*. Erewhon, London: A.C. Fifield.
- Cache, Bernard. 1995, *Earth Moves: The Furnishing of Territories*, Cambridge, Mass: MIT Press.
- Cantz, Hatje. 2001, *Frederick J. Kiesler: Endless Space*, Vienna: MAK and Hatje Cantz Verlag.
- Capra, Fritjof. 1982, *The Turning Point*, New York: Simon & Schuster.
- Capra, Fritjof. 1985, *Criteria of Systems Thinking*, October.
- Capra, Fritjof. 1996, *The Web of Life: A New Scientific Understanding of Living Systems*, New York: Anchor Books.
- Capra, Fritjof. 2003, *The Hidden Connections: A Science For Sustainable Living*. London: Flamingo.
- Castells, Manuel. 1996, *The Information Age*, London: Blackwell.

- Casti, John L. 1989, *Alternate Realities: Mathematical Models of Nature and Man*, New York: Wiley.
- Cantz, Hatje. 2001, *Frederick J. Kiesler: Endless Space*. Los Angeles: MAK Centre for Art and Architecture.
- Collins, Peter. 1979, *Biological Analogy & Mechanical Analogy. Changing Ideas in Modern Architecture: 1750- 1950*, Montreal: McGill Queens University Press.
- Colonna, Francesco. 1999, *Hypnerotomachia Poliphili*. (Trans) Joscelyn Godwin, London: Thames and Hudson.
- Council, Arts. 1986, *Eye Music: The Graphic Art of New Musical Notation*, London: Arts Council.
- Cubitt, Sean. 1998, *Digital Aesthetics*, London: Sage.
- Dawkins, Richard. 1976, *The Selfish Gene*, Oxford: Oxford University Press.
- Dawkins, Richard. 1982, *The Extended Phenotype*, Oxford: Oxford University Press.
- Debord, Guy. 1994, *Society of the Spectacle*, London: Zone Books.
- DeLanda, Manuel. 1997, *A Thousand Years of Nonlinear History*, New York: Zone Books.
- Deleuze, Gilles. and Guattari, Felix. 1988. *A Thousand Plateaus: Capitalism and Schizophrenia*, London: Athlone Press.
- Deleuze, Gilles. 1996, *Cinema 1: The Movement image*, London: Athlone Press.
- Deleuze, Gilles. 1988. *Bergsonism*, New York: Zone Books.
- Dennett, Daniel C. 1996, *Kinds of Minds: Towards an Understanding of Consciousness*, Basic Books.
- Dixon-Hunt, John. 2002, *Greater Perfection*, London: University of Pennsylvania Press. Drexler, Eric. 1990, *Engines of Creation*, London: Fourth Estates.
- Dunne, Anthony and Raby, Fiona. 2001, *Design Noir: The Secret Life of Electronic Objects*, Berlin: Birkhäuser.
- Eisenman, Peter. 1999, *Diagram Diaries*, New York: Universe.
- Eisenman, Peter. 1987, *House of Cards*, Oxford: Oxford University Press.
- Ellul, Jaques. 1965, *The Technological Society*, New York: Alfred A. Knopf.

- Emmet, D. 1966, *Whitehead's Philosophy of Organism*, London: Macmillan.
- Erlich, Paul and Ornstein, Robert. 1989, *New World New Mind: Moving Toward Conscious Evolution*, New York: Simon and Schuster.
- Evans, Robin. 1995, *The Projective Cast: Architecture and its Three Geometries*. Cambridge, Mass: MIT Press.
- Evans, Robin. 1997, *Translations from Drawing to Building and Other Essays*, London: Architectural Association.
- Fernandez-Galliano, Luis. 2000, *Fire and Memory: On Architecture and Energy*, Cambridge, Mass: MIT Press.
- Flusser, Vilem. 1999, *The Shape of Things: A Philosophy of Design*, London: Reaktion.
- Foucault, Michael. 1989, *The Order of Things*, London: Routledge.
- Fuller, R. Buckminster. 1981, *Critical Path*, New York: St. Martin's Press.
- Frazer, John. 1995, *An Evolutionary Architecture*, London: Architectural Association.
- Freitas, Robert A. Merkle. 2004, *Kinematic Self-Replicating Machines*. Georgetown, Texas: Landes Bioscience.
- Gibson, J.J. 1950, *The Perception of the Visual World*, Boston: Houghton Mifflin.
- Gibson, J.J. 1979, *The Ecological Approach to Visual Perception*, Boston: Houghton.
- Gleick, James. 1987, *Chaos Theory: Making a New Science*, New York: Viking.
- Goodman, Nelson. 1976, *Language of Art: An Approach to a Theory of Symbols*, Indianapolis/ Cambridge: Hackett Publishing.
- Goodwin BC, and G, Webster. 1996, *Form and Transformation: Generative and Relational Principles in Biology*, Cambridge: Cambridge University Press.
- Goodwin BC, and G, Webster. 1989, *A Dynamic Structures in Biology*, Edinburgh: Edinburgh University Press.
- Gould, Stephen Jay. 1989, *Wonderful Life: The Burgess Shale and the Nature of History*, London: Penguin Books.
- Gould, Stephen Jay. 2002, *The Structure of Evolutionary Theory*, Cambridge, Mass: Harvard University Press.

- Grosz, Elizabeth. 2001, *Architecture from the outside: Essays on Virtual and Real Space*. Cambridge, Mass: MIT Press.
- Guattari, Félix. 2000, *The Three Ecologies*, (Trans) Ian Pindar and Paul Sutton, New York: Athlone.
- Guattari, Félix. 1995, *Chaosmosis: an ethico-aesthetic paradigm*, (Trans) Paul Bains and Julian Pefanis, Sydney: Power Publications.
- Harraway, Donna. 1976, *Crystals, Fabrics and Fields: Metaphors of Organicism in 20th Century Developmental Biology*, New Haven: Yale University Press.
- Harries-Jones, Peter. 1995, *A Recursive Vision: Ecological Understanding and Gregory Bateson*, London: University of Toronto Press.
- Haeckel, Ernst. 1974, *Art Forms in Nature*, New York: Dover Publications.
- Hesse, Mary. B. 1961, *Forces and Fields*, London: Nelson.
- Hill, Jonathan. 2006, *Immaterial Architecture*, Oxen: Routledge.
- Ho, May Wan. 1993, *The Rainbow and the Worm: the Physics of Organisms*, New Jersey: World Scientific.
- Hoffmeyer, Jesper. 1996, *Signs of Meaning in the Universe*, Bloomington: Indiana University Press.
- Holland, J.H. 1975, *Adaptation in Natural and Artificial Systems*, University of Michigan Press.
- Homer-Dixon, Thomas. 1999, *Environment, Scarcity, and Violence*, Princeton.
- Homer-Dixon, Thomas. 2000, *The Ingenuity Gap*, Toronto: Alfred A. Knopf.
- Honzik, Karel. 1937, *A note on Biotechnics. Circle: International Survey of Constructive Art*, London: Faber and Faber.
- Jellicoe, Geoffrey A. 1987, *Studies in Landscape Design: Volumes I, II, and III*, London: Oxford University Press.
- Jencks, Charles. 2003, *The Garden of Cosmic Speculation*, London: Frances Lincoln Ltd.
- Jenny, Hans. 1976, *Cymatics*, Basel: Basileus Press.
- Kauffman, Stuart. 1993, *Origins of Order: Self-organization and Selection in Evolution*, New York: Oxford University Press.
- Kauffman, Stuart. 1995, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*, New York: Oxford University Press.

- Kelly, Kevin. 1995, *Out of Control: The New Biology of Machines, Social Systems, and the Economic World*, London: Fourth Estates.
- Kepes, Gyorgy. 1956, *New Landscapes in Art and Science*, Chicago: Paul Theobald & Co.
- Kiesler, Frederick. 2008, *Co-Realities: Drawing Paper 77*, New York: The Drawing Centre.
- Kiesler, Frederick. 1955, *Exhibition catalogue Galaxies by Frederick Kiesler*, Houston: Museum of Fine Arts of Houston.
- Korzybski, Alfred. 1949, *Science and Sanity: An Introduction to Non Aristotolian Systems and General Semantics*, Connecticut: The International Non-Aristotolian Library.
- Kostof, Spiro. (ed). 1977, *The Architect: Chapters in the History of the Profession*, Oxford: Oxford University Press.
- Kuhn, Thomas S. 1970, *The Structure of Scientific Revolutions*, Chicago: The University of Chicago Press.
- Kwinter, Sanford. 2002, *Architectures of Time: Toward a Theory of the Event in Modernist Culture*, Cambridge, Mass: MIT Press.
- Landers, R. Richard. 1969, *Man's Place in the Dybosphere*, New Jersey: Prentice Hall.
- Laszlo, Ervin. 1987, *Evolution: The Grand Synthesis*, Boston: Shambhala.
- Laszlo, Ervin. 1996, *The Systems View of the World*, New Jersey: Hampton Press.
- Laszlo, Ervin. 2001, *Macroshift: Navigating the Transformation to a Sustainable World*, Berrett-Koehler.
- Leder, Drew. 1990, *The Absent Body*, London: University of Chicago Press.
- Lefebvre, Henri. 1991, *The Production of Space*. Translated by Donald Nicholson-Smith, Blackwell.
- Lewin, Kurt. 1951, *Field Theory in Social Sciences: Selected Papers*, New York: Harper.
- Lewin, Roger. 1992, *Complexity: Life on the Edge of Chaos*, New York: MacMillan.
- Lewontin, Richard C. 1991, *Biology as Ideology: The Doctrine of DNA*, Concord, Ontario: Anansi Press.
- Luhmann, Niklas. 1990, *The Autopoiesis of Social Systems*. In Niklas Luhmann, *Essays on Self-Reference*, New York: Columbia University Press.

- Margulis, Lynn. 1981, *Symbiosis in Cell Evolution: Life and its environment on the Early Earth*, San Francisco: W.H. Freeman.
- Margulis, Lynn. and Sagan, Dorian. 1986, *Microcosmos: Four Billion years of Evolution from our Microbial Ancestors*, New York: Summit Books.
- Margulis, Lynn. 1998, *Symbiotic Planet: A New Look at Evolution*, New York: Basic Books.
- Maturana, Humberto R. and Varella, Francisco J. 1987, *The Tree of Knowledge: The Biological Roots of Human Understanding*, Boston: Shambhala.
- Maturana, Humberto R. and Varella, Francisco J. 1980, *Autopoiesis and Cognition*, Holland: D Reidel.
- Maturana, Humberto R. 2004, *From Being to Doing: The Origins of the Biology of Cognition*, Verlag: Carl-Auer.
- Mc Taggart, Lynne. 2003, *The Field*, London: HarperCollins.
- Merchant, C. 1992, *Radical Ecology: The Search for a Liveable World*, New York: Routledge.
- Mitchell, John. 1969. *The New View Over Atlantis*, London: Thames And Hudson.
- Murray, Shaun. 2006, *Disturbing Territories*, Hamburg: Springer Wein New York.
- Naess, Arne. 1989, *Ecology, Community and Lifestyle*, Cambridge: Cambridge University Press.
- Negroponte, Nicholas. 1975, *Soft Architecture Machines*, Cambridge, Mass: MIT Press.
- Nicolescu, Basarab. 2002, *Manifesto of Transdisciplinarity*, New York: State University of New York Press.
- Nye, David. 1994, *American Technological Sublime*, Cambridge, Mass: MIT Press.
- Nye, David. 2003, *American as Second Creation: Technology and Narratives of New Beginnings*, Cambridge, Mass: MIT Press.
- Pallasmaa, Juhani. 2005, *The Eyes of the Skin. Architecture and the Senses*, New York: John Wiley.
- Pask, Gordon. 1961, *An Approach to Cybernetics*, Hutchinson.

- Perec, Georges. 1997, *Species of Spaces and other Pieces*, London: Penguin Books.
- Perez-Gomez, Alberto. 1994, *Polyphilo: or The Dark Forest Revisited*, Cambridge, Mass: MIT Press.
- Polanyi, Michael. 1974, *Personal Knowledge*. Chicago: University of Chicago Press.
- Porter, Tom. 1997, *The Architect's Eye: Visualisation and Depiction of Space in Architecture*, London: E & FN Spon.
- Powell, Helen. Leatherbarrow, David. 1982, *Masterpieces of Architectural Drawing*, New York: Aberville.
- Prigogine, Ilya and Stengers, Isabelle. 1984, *Order Out of Chaos: Man's New Dialogue with Nature*, Toronto: Bantam Books.
- Prigogine, Ilya. 1994, *Time, Chaos, and The Two Cultures*. In The John C. Polanyi Nobel Laureates Lectures, Science and Society.
- Prigogine, Ilya. 1997, *The End of Certainty: Time, Chaos, and the New Laws of Nature*, New York: The Free Press.
- Rhowbotham, Kevin. 1999, *Field Event/ Field Space*, London: Black Dog Publishing.
- Robbins, Edward. 1997, *Why Architects Draw*, London: MIT Press.
- Rosen, Robert. 1985, *Anticipatory Systems*, Oxford: Pergamon Press.
- Saint, Andrew. 1983, *The Image of the Architect*, New Haven: Yale University Press.
- Sadler, Simon. 1999, *The Situationist City*, Cambridge, Mass: MIT Press.
- Selz, Peter and Stiles, Kristine. 1996, *Theories and Documents of Contemporary Art: A source book of Artists writings*, California: University of California Press.
- Sheldrake, Rupert. 1981, *A New Science of Life: The Hypothesis of Morphic Resonance*, London: Blond and Briggs.
- Shepherd, Paul. 1997, *The Cultivated Wilderness: or, What is Landscape?*, London: MIT Press.
- Simon, Herbert. 1982. *The Sciences of the Artificial*, Cambridge, Mass: MIT Press.
- Spencer-Brown, George. 1969, *Laws of Form*, London: Allen and Unwin.

- Spiller, Neil. (ed). 2002, *Cyber_Reader: Critical Writings for the Digital Age*, London: Phaidon.
- Spiller, Neil. (ed). 2008, *Digital Architecture Now: A Global Survey of Emerging Talent*, London: Thames and Hudson.
- Steadman, Phillip. 1979. *The Evolution of Designs: Biological analogy in Architecture and the applied arts*, Cambridge: Cambridge University Press.
- Sutherland, I.E. 1963, *Sketchpad: Man-machine Graphical Communications System*. PhD thesis, Boston: MIT Press.
- Sylvester, David. 1987, *The Brutality of Fact: Interviews with Francis Bacon*, London: Thames and Hudson.
- Thom, Rene. 1975, *Structural Stability and Morphogenesis: An Outline of a General Theory of Models*, London: Benjamin.
- Thompson, D'Arcy. 1992, *On Growth and Form*, New York: Dover.
- Tomlinson, Kellom. 1735, *The Art of Dancing Explained by Reading and Figures*, London: K. Tomlinson.
- Vale, B. and Vale, R. 1991, *Green Architecture*, London: Thames and Hudson.
- Viller de l'isle-adam, Auguste. 1981, *Tomorrows Eve*, London: University of Illinois Press.
- Vitruvius. 1999, *Vitruvius: The Ten Books on Architecture*, (Trans) Ingrid D. Rowland, Cambridge University Press. First published as *De Architectura* in the first BC.
- Von Neumann, John. 1966, *Theory of self-reproducing automata*, Urbana: University of Illinois Press.
- Waddington, CH. 1939, *An Introduction to Modern Genetics*, London: Macmillan.
- Waddington, CH. 1940, *Organisers and Genes*, Cambridge: Cambridge University Press.
- Waddington, CH. 1956, *Principles of Embryology*, London: Macmillan.
- Waddington, CH. 1962, *New Patterns in Genetics and Development*, New York: Columbia University Press.
- Waddington, CH. 1966, *Principles of Development and Differentiation*, London: Macmillan.
- Waddington, CH. 1968. *Towards a Theoretical Biology I: Prolegomena*, Edinburgh: Edinburgh University Press.

Waddington, CH. 1969, *Towards a Theoretical Biology II: Sketches*, Edinburgh: Edinburgh University Press.

Waddington, CH. 1970, *Towards a Theoretical Biology III: Drafts*, Edinburgh: Edinburgh University Press.

Waddington, CH. 1972, *Towards a Theoretical Biology IV: Essays*, Edinburgh: Edinburgh University Press.

Waddington CH. 1975, *The Evolution of an Evolutionist*, Edinburgh: Edinburgh University Press.

Waldrop, M. Mitchell. 1992, *Complexity: The Emerging Science at the Edge of Order and Chaos*, New York: Simon and Schuster.

Webb, Michael. 1987, *Temple Island: A Study by Michael Webb*, London: Architectural Association.

Weiner, Norbert. 1948, *Cybernetics*. Cambridge, Mass: MIT Press.

Whitehead, Alfred North and Russell, Bertrand. 1910, *Principia Mathematica*, Cambridge: Cambridge University Press.

Whitehead, Alfred North. 1928, *Science and the Modern World*, Cambridge: Cambridge University Press.

Whitehead, Alfred North. 1978, *Process and Reality (Gifford Lectures)*, New York: Free Press.

Wilson, Edward O. 1998, *Consilience: The Unity of Knowledge*, New York: Alfred A. Knopf.

Yates, Francis. 1966, *The Art of Memory*, New York: Routledge.

Yeang, Ken. 1995, *Designing with Nature*, London: Mc Graw Hill.

Yeang, Ken. 1981, *A Theoretical Framework for Incorporation Ecological Considerations in the Built Environment*, PhD dissertation, Cambridge.

Journals

Banham, Reyner. 1965, 'The Home is Not a House'. In *Art in America*, pp. 70-79.

Braham, William W. 2000, 'After Typology: The Suffering Of Diagrams', *Architectural Design* Vol 70, No 3, pp. 9-11.

Blanche, P. A, Bablumian, A. Voorakaranam, R. Christenson, C. Lin, W. Gu, T. Flores, D. Wang, P. Hsieh, W. Kathaperumal, M. Rachwi, B. Siddiqui, O. Thomas, J. Norwood, R. Yamamoto, M. and Peyghambarian, N. 2010, 'Holographic three-dimensional telepresence using large-area photorefractive polymer', *Nature* 468, pp. 80-83.

Fisher, Saul. 2000, 'Architectural Notation and Computer Aided Design', *Journal of Aesthetics and Art Criticism*, 58: 3, pp. 273-89.

Goodwin BC, Cohen HM. 1969, 'A phase-shift model for the spatial and temporal organization of developing systems', *Journal of Theoretical Biology*, No. 25, pp. 49-107.

Grimm, V. 1999, 'Ten years of individual-based modelling in ecology: what have we learned and what could we learn in the future?' *Ecological Modelling* 115, pp. 129-48.

Hendricks, Jochem. 1998, 'Newspaper', *Wired Magazine*, November 1998, p. 186-187,

Ho, May Wan. 1997, 'The New Age of the Organism', *New Science= New Architecture, Architectural Design*. pp. 44-51.

Honzik, Karel. 1937, 'Biotechnics: Functional Design in the Vegetal World', *Architectural Review*, 81. pp. 21-22.

Kiesler, Frederick. 1939, 'On Correalism and Biotechnique: A Definition and Test of New Approach to Building Design', *The Architectural Record*. pp. 60-75.

Kiesler, Frederick. 1942, 'Brief Note On Designing The Gallery', *typescript, Austrian Frederick and Lillian Kiesler Private Foundation Archive*. pp. 1-2.

Kiesler, Frederick. 1949, 'Manifest du Corréalisme', *L'Architecture d'Aujourd'hui*. Special supplement. pp.1-23.

Korzybski, Alfred 1933, 'A Non-Aristotelian System and its Necessity for Rigour in Mathematics and Physics', *Science and Sanity*, pp. 747-61.

May RM, Oster, G. 1976, 'Bifurcations and dynamic complexity in simple ecological models', *Am Naturalist* 110, pp.573.

Odum, Howard T. 1960, 'Ecological Potential and Analog Circuits for the Ecosystem', *Scientific American* 48, pp. 1-8.

Pallasmaa, Juhani. 2000, 'Hapticity and Time', *Architectural Review*, pp. 78-84.

Pangaro, Paul, 1996, 'Dandy of Cybernetics', *The Guardian*,

Pask, Gordon. 1969, 'The architectural relevance of cybernetics', *Architectural Design*, 7(6), pp. 494-496.

Price, Cedric. 'Anticipatory Architecture: Cedric Price Special Issue,' in *Architect's Journal* (5 September 1996), pp. 36.

Price, Cedric. 1969, 'Non-Plan- a proposal by Cedric Price', *New Society*, pp. 435-443.

Rosen, Robert. 1985, 'On information and complexity'. In Ulanowicz, Platt (eds) Canadian Bulletin of Fisheries and Aquatic Science, pp. 221-233.

Spiller, Neil. 1995, 'Forget about form following function', *Architects Journal*, London, 7 Dec. No. 22, Vol.202, pp.25

Spiller, Neil. 1998, 'Architects in Cyberspace II.' *Architectural Design*, Volume 68, No 11/12 November-December. pp. 78-79.

Spiller, Neil. 2001, 'Young Blood.' *Architectural Design*, Volume 71 No 1 February. pp. 36-43.

Spiller, Neil. 2002, 'Reflexive Architecture.' *Architectural Design*, Volume 72 No 3 February. pp.5

Uexkull, J. von. 1982, 'The Theory of Meaning', *Semiotica* 42. pp. 25-82

Wolfram, Stephen. 1984, 'Cellular automata as models of complexity', *Nature* 311, pp.419-26.

Yates, EF. 1985, 'Semiotics as bridge between information (Biology) and dynamics (Physics)', *Recherches Sémiotiques/ Semiotic Inquiry* 5, pp.347-60.

Yates, EF. 1994, 'Order and complexity in dynamical systems. Homeodynamics as a generalized mechanics for biology', *Math Computer Modelling* 19, pp.49-74.

Yates, EF. Kugler, PN. 1984, 'Signs, singularities and significance: a physical model for semiotics', *Semiotica* 52, 1-2, pp. 49-77.

Yeang, Ken. 1973, 'Bionics: The Use of Biological Analogies for Design'. *Architectural Association Quarterly*, No.4. pp.48-57.

Conference papers

Murray, Shaun. 2004, 'Apriori Nature: constructing Architecture'. *Consciousness Reframed. Qi and Complexity Sixth International Consciousness Reframed*, Beijing, China.

Murray, Shaun. 2005, 'Coupling Fields: Towards an Ecological Architecture of Linkages'. Research Conference. *Altered States, Transformation of perception, place and performance*, Plymouth University, UK.

Murray, Shaun. 2005, 'User-Reader-Space'. Research Conference. *Transmodalities: Mind, Art New Media*, Sabanci University, Istanbul, Turkey.

Book Chapters

Ayres, Robert U. 1993, 'Materials and the Environment', in Bever, M.B. (ed), *Concise Encyclopaedia of Materials Economics, Policy and Management*, Oxford: Pergamon Press.

Boulding, Kenneth. 1988, 'Can there be Models of Sustainable Development?' in Alex Davidson and Michael Dence (eds), *The Brundtland Challenge and The Cost of Inaction*, The Institute for Research on Public Policy and the Royal Society of Canada.

Campbell, Tony. 1987, 'Portolan Charts from the Late Thirteen Century to 1500', in J. B. Harley and D. Woodward (eds) *The History of Cartography, Volume one: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, London: The University of Chicago Press.

Evans, Robin. 1989, 'Architectural Projection', in Eve Blau and Edward Kaufman (eds), *Architecture and its Image*, Montreal: Canadian Centre for Architecture, pp. 19–34.

Serres, Michel. 1982, 'The Origin of Language: Biology, Information Theory, & Thermodynamics', in Josue V. Harari and David F. Bell (eds), *Literature, Science, Philosophy*. Baltimore: John Hopkins University Press.

Thom, Rene. 1989, 'An inventory of Waddington concepts', in Goodwin BC, Saunders PT (eds), *Theoretical Biology: Epigenetic and Evolutionary Order from Complex Systems*. Edinburgh: Edinburgh University Press.

Yoxen, E. 1986, 'Form and strategy in biology: reflections on the career of C. H. Waddington', in Horder TJ, Witkowski JA, Wylie CC (eds) *A History of Embryology*. Cambridge: Cambridge University Press.