

Transformative mappings: the cartographer's house in the ecologist's garden

Reporting on a work-in-progress

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INTRODUCTION

MY THESIS, entitled 'Transformative Mappings: the cartographer's house in the ecologist's garden', part design and part text, is concerned with contemporary design theory. However, its main ambition is to manifest theory in the action of designing and building a house for a cartographer within one of the world's most biodiverse landscapes. The principal aim of the research is to investigate possibilities for making highly site-specific architecture within biologically significant sites, linking mapping techniques to computer-aided design and manufacture processes.

Contrary to local and global trends in architecture I am not seeking a romanticised vernacular nor trying to emulate the hyper-sensual form-making of practitioners such as Greg Lynn and Frank Gehry. Rather, I am interested in a *complex ecology of architecture*; an architecture generated through the agency of mapping, design, construction and landscape itself.

KEY WORDS

Biodiversity
Technology
Site-specificity
Measure
Representation
Ecology of seeing

Part one of this report explains the context of this project and is divided into three sub-themes: Ecologist's Garden, Mapping Techniques and Computer-aided Design and Manufacture. In part two, the writings of James Corner, the main theme for this issue of *Landscape Review*, form a critical framework for discussing the principal philosophical themes of the thesis. The sections, New Ecology of Seeing and Enacted Cartography describe creative projects developed specifically for the thesis.

PART ONE: TECHNOLOGY AND SITE

The ecologist's garden

The Fitzgerald Biosphere Reserve, in Western Australia, contains one of the most diverse botanical regions in the world. At its core lies the Fitzgerald River National Park, which represents nearly 20 percent of the total number of plant species in the State, many of which are only found within this particular area.¹ Surrounding the national park is a crescent-shaped area of farming and towns. Together, with the Fitzgerald River National Park, these areas make up the United Nations

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Figure 1: Location of the Fitzgerald Biosphere Reserve.

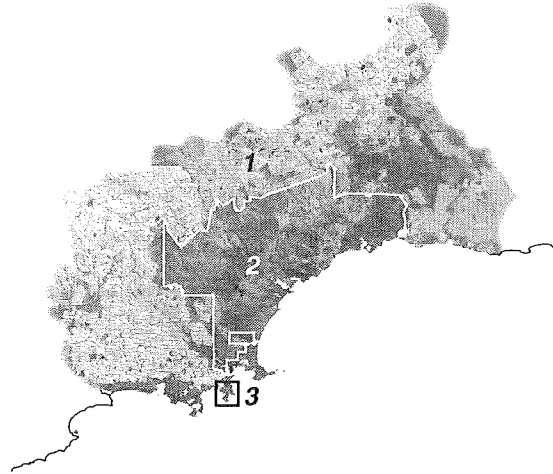


Figure 2:

- 1 Fitzgerald Biosphere Reserve
- 2 Fitzgerald River National Park
- 3 Peninsula housing development.

Educational, Scientific and Cultural Organisation (UNESCO) designated biosphere reserve (Figures 1 and 2).

Biosphere reserves, of which there are nearly 400 to date, are one of the instruments employed by nations worldwide to implement the Convention on Biodiversity.² Biosphere reserves characteristically include ecosystems *and* human activities. Rather than excluding one from the other they attempt to “promote solutions to reconcile the conservation of biodiversity *with* its sustainable use” (emphasis added).³ The Fitzgerald Biosphere Reserve provides the thesis with an overarching philosophical context of ‘sustainability’ whilst setting the physical limits to the ecologist’s garden, an area of some 1,350,000 hectares.

The cartographer’s house will be built on a richly vegetated coastal peninsula that lies directly south of the national park (Figure 3). It was once proposed that the peninsula be included within the park because of its own biological significance, however, prohibitive land costs and its proximity to a coastal township have contributed instead to its development for housing.⁴

The predominant vegetation on the peninsula is a low-lying coastal heath, known as ‘kwongan’.⁵ My undergraduate thesis ‘Naming Point Henry Peninsula’ (1997) examined the visual perception of the local kwongan landscape, and found that, to the untrained eye, the area is seen as having little biological value. The thesis argued that when the layperson thinks of biological diversity they think of a corresponding visual diversity, and while the kwongan has equivalent biodiversity to any rainforest system in Australasia it does not express a visual variety at scales to which most of us are accustomed (Figure 4).⁶



Figure 3: Location of the cartographer's house.

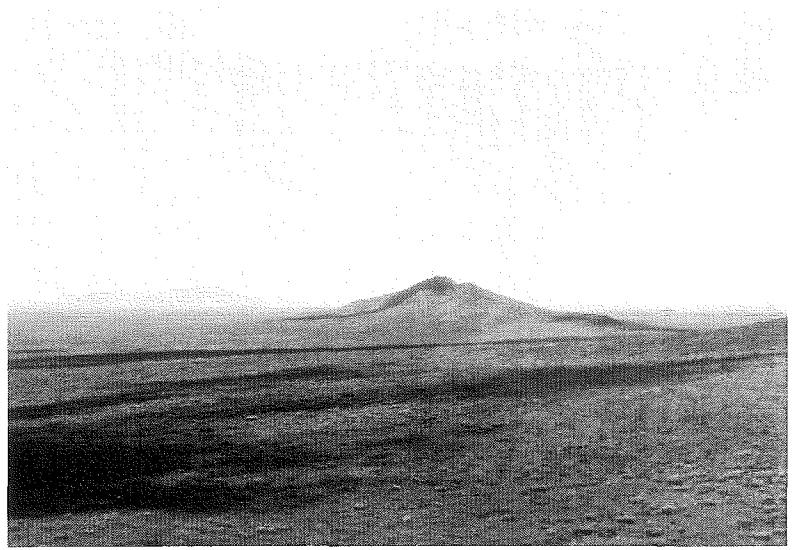


Figure 4: Kwongan heath around West Mount Barren.

Not only is the kwongan misrepresented as an homogenous landscape, it is also feared because of its extreme flammability. As the perceived threat from bush fire increases so too does the removal of the kwongan and, consequently, sedentary modes of inhabitation, which is the work of architecture, have little chance of achieving any proximity with, let alone sustaining, biodiversity.

Mapping techniques and technologies

The extreme diversity and endemism of the flora of the national park, and the presence of agricultural activities that threaten it, have encouraged scientific mapping within the biosphere reserve at a range of scales. Satellite remote sensing is employed to monitor land salinity and, along with aerial photogrammetry, is used by botanists to determine botanical distribution at *landscape* scale; global positioning systems define coordinates of individual plants at *species* scale; and genetic analysis determines diversity within individual plants at *genome* scale.⁷ These mappings, however, do more than merely represent; they construct our understanding of the landscape and its processes. The biologically significant site, which provides the 'ground' for this study, is constituted by the physical landscape and an 'information landscape'; one formed through the technological mediation of mapping.

The tangled character of plant distribution and the dynamic flux of the ecosystems in the national park present a considerable challenge to conventional mapping techniques, particularly with regard to the study of scale and process. For example, the rectangular study-plot has been replaced by continuous linear transects that are better suited to measuring species distribution at varieties of scale, and the aerial photograph is giving way to satellite data-sets that are available every 16 days, enabling the animation of previously unseen dynamic processes. Similarly, the registration of both scale and process present the two primary challenges for the design of the

cartographer's house. First, how can an inhabitation engage with the greater scale of the reserve and the close-grain scale of local vegetation at the same time? Secondly, without resorting to nomadic typologies, how can the inhabitation respond to the dynamic forces and processes that constitute the temporal site?

Architecture and landscape architecture traditionally use very low-resolution measurements of sites, and employ construction methods of low, easy-fit tolerances. The opportunity is now available to employ spatial survey systems that are capable of high-precision measurement of extremely complex shapes. 3D Total Stations, which were developed for construction control in the shipbuilding industry, permit sub-millimetre point-measurement (in the form of three-dimensional coordinates) of site features and built forms. This measurement data can then be used to design and manufacture new elements to equally high precision. Terrestrial Laser Scanning, while less dimensionally precise than 3D Total Stations, is a surface-measurement system capable of producing three-dimensional digital maps of large-scale environments. The applicability of this technology to the thesis lies in its ability to create highly detailed three-dimensional maps of vegetation, landform and built works (for which drawings do not exist).

Computer-aided design and manufacture

The computer linking of design to manufacturing processes is facilitating the ability for architecture to respond to localised conditions, with increasing material and energy efficiency. However, to date, computer-aided design and manufacture is almost exclusively applied to building within complex urban sites. Transformative mappings identifies the opportunity to engage computer-aided technology with the complex conditions of biodiverse sites.

Computer-aided design and manufacture, or Cad/Cam, can be defined as the linking of digital drawings (for example, Autocad) to computer-controlled machining and fabrication processes such as laser cutters, multi-axis routers and sheet folders.⁸ This technology is well developed in Perth, Western Australia due to demand from mining and shipbuilding industries for dimensionally accurate one-off fabrications.

The remote location of the biosphere reserve (600 kilometres from Perth) does not preclude the use of Cad/Cam for construction, rather it renders it more applicable because the inherent difficulties of acquisition of material and labour, supervision of construction and the vagaries of weather are alleviated by off-site construction in controlled workshop conditions.

Cad/Cam facilitates the convergence of one-off hand crafting with systemic mass production. A direct flow of information from designer to machine provides a responsive feedback loop analogous to that of the crafts, whilst enabling unique, differentiated and mathematically precise objects to be manufactured economically en masse. For example, the Guggenheim Museum in Bilbao, Spain, by Frank Gehry is a highly differentiated and crafted object that could not be realised without the direct link between three-dimensional design software and computer-controlled fabrication and machining.

However, Cad/Cam it is not simply about making complexity for complexity's sake, it can also be utilised to engage with highly localised events, at a variety of scales, to achieve the economical performance of a diversity of functions; a key characteristic of sustainable systems. This potential of maximum service for minimum effort has considerable implications for developing sustainable architectures, shifting typically low-technology sustainable idioms towards more advanced technological production.

PART TWO: THEORY AND PRACTICE

Measure

In *Taking Measures Across the American Landscape*,⁹ James Corner describes how the instruments and quantitative units through which we measure land ultimately affect the reality we construct, and our actions taken within landscape.

Indeed, calculative systems of measure such as satellite remote sensing and geographic information systems, do affect our inhabitation of landscape, however, this occurs in a somewhat indirect manner. The physical outcomes of these measures result from secondary processes such as planning regulations and, in less measurable ways, from the re-conditioning of our perception of a landscape. This design project proposes to link spatial survey systems (described above) to Cad/Cam. What is implicit within this linking is that the physical outcome attains an immediate relationship to the system of measure wherein the ability to measure highly localised features corresponds directly to the ability to make forms to engage with them.¹⁰

The users of modern calculative technologies, Corner warns, can be guilty of the "excesses of instrumentality" caused by neglect of social and cultural concerns in favour of technocratic impositions in landscape. While I heed (ardently) Corner's warning, this project does, however, seek to reconcile the conflict between 'ecological sustainability' and calculative technologies, a conflict evidenced in much 'green' architecture in non-urban Australia. Indeed, the employment of Cad/Cam within biologically significant sites is considered anathema to 'environmentally sensitive' design by those who attribute 'sensitivity' to only that which is handcrafted, intuitive and organic.

At the heart of this conflict is the opposition between qualitative values and quantitative measures: where what is considered beautiful, intuitive and poetic cannot be reconciled with that which is precise, calculative and statistical. The paradox of modern calculative measure is that its rational and prosaic instrumentality renders it incomprehensible to many, yet at the same time it provides the 'lens' through which we understand natural systems. For example, the satellite image is remarkably effective at mapping the progress of land salinity, but to the salt-affected farmer, the coarsely pixelated and synoptic image remains essentially abstract.

The very rationality of modern measure, its bias toward quantitative rather than qualitative values, and its abstract representational medium, work to restrain the

possibilities of closer human/nature relations. It is, however, within spaces such as the one between the satellite image and the farmer to whom it is presented, where more poetic, and simply more comprehensible landscape representations might be actualised.

In *Taking Measures Across the American Landscape*, Corner and aerial photographer Alex MacLean have discovered the aerial photograph to be the most appropriate medium for imaging and understanding the American landscape. In turn, we must ask for each landscape, what instruments of measure and what representations have the most correspondence with the scales and dimensions of that landscape? And, if the Fitzgerald Biosphere Reserve is indeed unique, then it follows that not only is there a need to develop site-specific modes of inhabitation for it, but also site-specific modes of measure.

A new ecology of seeing

New ecology of seeing acknowledges the two ways in which landscape representation precedes architecture. First, it is the images, maps and plans that are made prior to building; secondly, and more significantly, place-specific landscape representations are critical cultural constructions that must precede architecture to generate the necessary 'eyes' to see our relations to place. Therefore, I have chosen to initiate my research with a series of representations made both in and of this landscape. These photographic works are set in direct opposition to the most common representations in the region; the tourist's snap-shot and the scientist's data-set.

Contemporary understandings of ecology are facilitated in large part by modern calculative measure and imaging. Corner suggests the rationalism and excessive instrumentality of these actions perpetuates an "excessively hard world, one that has lost much of its enigma and mystery". This "scientistic ecology", Corner believes, needs to be replaced with a "culturally animate ecology", one more capable of embodying and bringing forth inter-relationships between people and "unmediated Nature".¹¹

Corner defines "unmediated Nature" as the enigmatic and mysterious aspects of nature that exceed human understanding. Our concept of nature, on the other hand, is the nature that is revealed to us through a screen of language. In excluding the subjective and unmeasurable, this mediating screen objectifies nature as 'other', thus, bringing into effect the binary opposition of human/nature, where nature or 'the environment' is considered external to humankind.

Corner believes we must seek ways to fuse this opposition in order to arrive at more ecological practices, observing that ironically, much conservation planning simply exasperates the condition: "Progressivist ecology", he states, "merely conditions a particular way of seeing that effectively severs the subject from the object. It is this culturally perpetuated relationship to landscape, this continual objectification, that prohibits a more emphatic reciprocity between people and the world".¹²

The graphic conventions of scenic photography further perpetuate human/nature oppositions. In order for the tourist to construct a strong graphic composition, the landscape must typically present high levels of visual variety. But, when this convention is applied to kwongan landscapes it is not the vegetation, but the greater physical landform, particularly where land meets sea, which provides the necessary visual variety. Consequently, a 'good photograph' or a 'good view' focuses invariably upon elements in the middle to background, leaving the foreground to be simply 'seen over'.

As the kwongan is negated in these representations so too it is eliminated from the house site. The new homeowner does not acknowledge it, or, it is removed because of fear of fire and to gain access to long-distance views (Figure 5). The outcome of the representation and the inhabitation is the same: the relationship of people to unmediated nature is severed by the objectification of a nature that is 'out there' in the background. Whilst the peninsula and the national park both have biological significance, 'biodiversity' and 'wilderness' are considered as attributes belonging solely to the park. Here, biodiversity is not considered to be where one lives, it is a phenomenon confined to the protected places that one visits.

The images shown in Figures 6, 7 and 8 are taken from an exhibition of original landscape representations held at the University of Western Australia in August 2000. Entitled *Earth as Light*, this project investigated the notion of *lightness of earth*: an attempt to lighten our perceptions of the earth through mapping and imaging landscape with light-based mediums. Lightness is opposed to heaviness; inferring 'inanimate', 'inert' and 'weighed-down' and, in a less obvious sense, to darkness; light being the medium through which the earth itself is revealed from darkness.

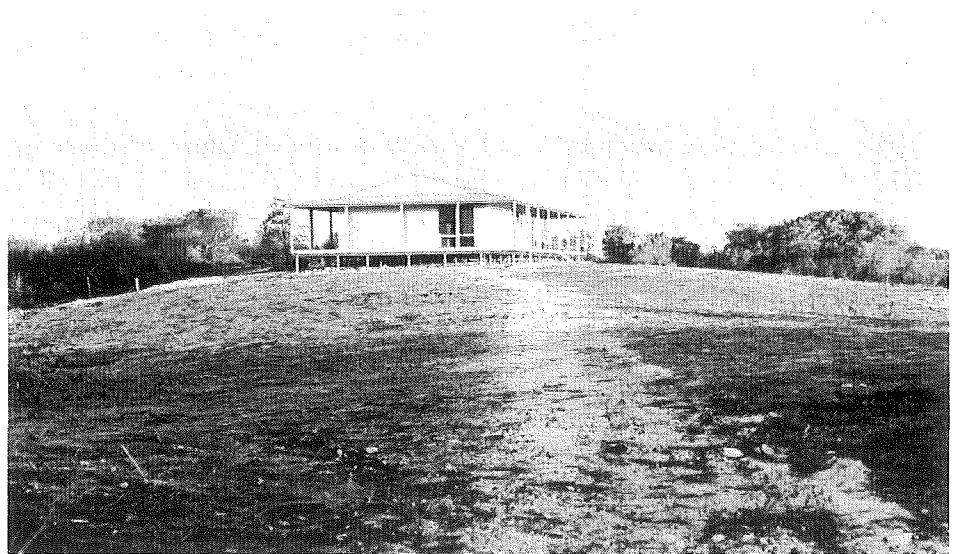
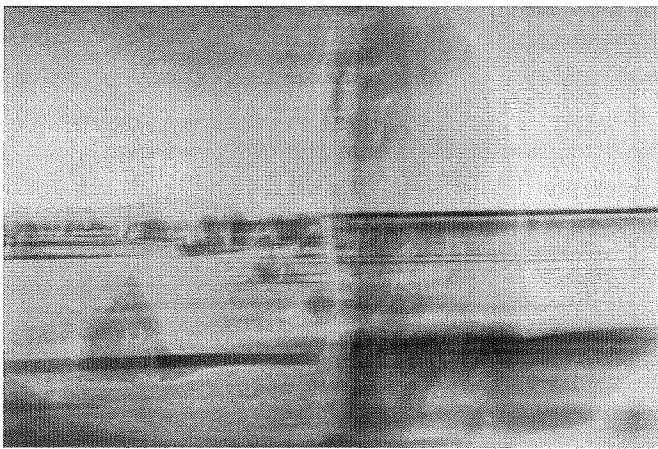


Figure 5: Kwongan clearing on the peninsula.

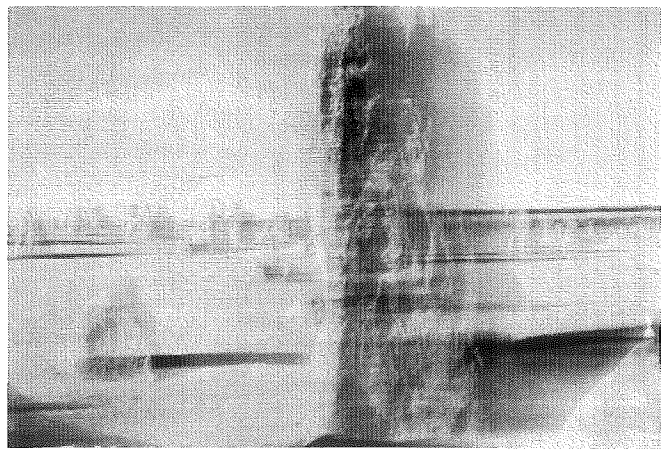
Figures 6a and 6b are stereo-durational photographs, so named because they combine the techniques of stereography and blurred-motion photography.¹³ When viewed through a stereoscope the paired images combine to reveal a volumetric cloud of photons, a distinctly different character to the flattened surface of objects depicted in scenographic images. The tourist's scenic photograph is the result of passive visioning, where the photographic process of taking and making the image remains unregistered and unquestioned. Stereo-durational photographs, on the other hand, demand much more active participation from the viewer, requiring them to interpret, focus and adjust what are much more mysterious and enigmatic images.

While most ecological practices try to prevent the 'loss of landscape' or the 'loss of biodiversity', a new ecology of seeing on the other hand is concerned with the loss of landscape's ability to contribute to its own imaging and knowing. 'Landscape' is that which is revealed to us through a framework of cultural constructions, such as literature, mapping, representation and architecture. However, this framework is typically constructed before it is brought into presence with unmediated nature, subsequently closing down the aperture through which possible landscapes might be revealed. This is certainly the case with the Fitzgerald River National Park, where conventional means of scientific measure and landscape representation have been found to be wholly inadequate at registering the complexity and richness of that particular biological condition.

This new ecology of seeing seeks to discover, outside of the boundaries of convention, new means of representation that (re)animate landscape's pedagogical capacities. It demands an artistic and poetic visioning that is commensurate with the rich, heterogeneous and polyphonous character of unmediated nature, and capable of generating more engaging, place-specific human/nature relationships.



6a



6b

Figures 6a, 6b:
Pinnacles as Light (2000), stereo-durational photograph.

Enacted cartography

In 'The Agency of Mapping: Speculation, Critique and Invention', James Corner defines 'mapping' as a performative process that "actualises potential", brings about the "emergence of new realities" and, rather than being descriptive, representational and static tracings, are "infinitely promising explorations" relevant to our experiential sense of space today.¹⁴

Corner describes mapping as a three-part consecutive process: beginning with the creation of a *field*, then the *extraction* of data (or 'parts') from a milieu of information, and, finally, the *plotting* of new relationships and re-territorialisation of data onto the field. He cites the performative mappings of several practitioners (Peter Eisenman, Rem Koolhaas, Winy Maas, The Situationists and others) stating that "[their] artistry lies in the use of technique, in the way that things are framed and set up".¹⁵ However, with the exception of The Situationists, all of these practitioners have an essentially passive relationship to the data and information to which these techniques are applied. By this, I mean they are not actively involved with the generation of data itself, they acquire pre-prepared data (statistical, topographical, dimensional, historical) from other, outside sources.

Enacted cartography proposes a deeper level of action, and might be defined as: the active extraction of spatio-temporal data through direct engagement with the instruments and activities of measure. Enacted cartography recognises that this extraction (mapping survey) it is not an act of mapping for merely the sake of design of future inhabitations (buildings, landscapes), it is an act of inhabitation itself. The site becomes a literal theatre within which spatio-temporal events are enacted and recorded by the mapmaker, whose instruments of measure are now as portable as they are precise.

Figures 7 and 8 are photographs taken from the same position and angle of view, within a sand-dune in the biosphere reserve. Figure 7, which is a conventional photograph, reveals little three-dimensional information of the dune compared with Figure 8, which was made over a three-hour period at night. This 'enacted cartograph' is a single photograph, constructed from 17 successive exposures to light projected onto the dune surface by an industrial laser leveller. The rotating leveller, which casts a precise horizontal beam, was lowered 200 mm after every exposure.

The value of enacted cartography lies not so much with the end result as it does in the process itself. While the final image has value as a spatial map, the means by which it was attained is characterised by engagement, action and immersion within both the spatial and temporal dimensions of the site. The process of making the map is itself a construction, albeit an ephemeral one of light and time. In this sense it is a creative act or performance, the true value of which is difficult to quantify but is directly related to the performer's (and perhaps the audience's) own inspirations and epiphanies within the landscape. Thus, enacted cartography intends to respond to James Corner's call for more imaginative practices of measure and geometry by recognising that "[o]nly through the temporal and phenomenal processes of doing and making can revelation occur".¹⁶ In this manner, the gap between the authenticity



Figure 7: Dune blow-out, still photograph.

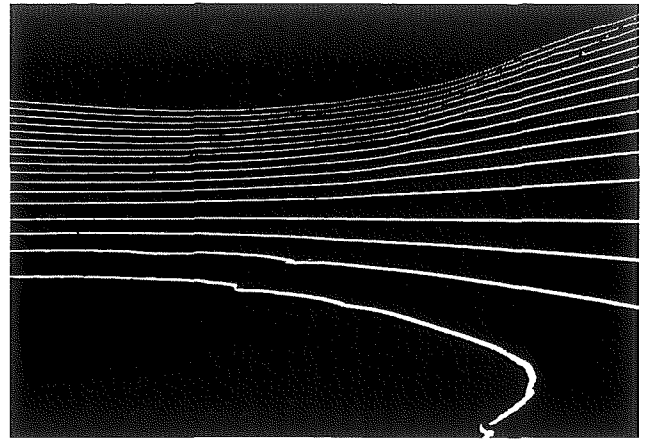


Figure 8: Blow-out as Light (2000), enacted cartograph.

we associate with inhabitation and high technology's abstract, disinterested vision is closed down.

The cartographer's house in practice

The philosophical themes discussed above are to be tested in practice by the construction of the cartographer's house during the tenure of the PhD. The building of the house is necessary for several reasons: it gives focus to the application and testing of theory, it provides a gauge to measure the outcome against the principal aims of the thesis and it fulfils a demonstrative role by presenting a model for dwelling, specific to this particular place.

The thesis takes its inspiration from the unique biological character of the region, the philosophical context of biosphere reserves, and existing inhabitations on the peninsula that demonstrate very poor engagement with place. This is the first time that the peninsula has been inhabited, in a static sense, with permanent structures, yet the homeowner's only design guide is a set of building regulations. Even though these were drafted to minimise visual and environmental impact they are now seen as limits and restrictions to development rather than cues and keys to engagement with place. The cartographer's house seeks to register and reveal the physics of the landscape with more poetic modes of inhabitation and, thus, provide cues and keys that transcend the obligatory nature of regulations.

Place-specific architecture is one cultural construction that achieves critical importance perhaps only after we have developed place-specific narratives and representations.¹⁷ In order to reconcile human/nature oppositions a new 'ecology of seeing' is necessary – a visioning that brings into effect more reciprocal relationships between humans and landscape.

'Transformative Mappings: the cartographer's house in the ecologist's garden' seeks to contribute to a richer engagement with this particular place. The thesis also hopes to contribute to contemporary architecture by bringing into relationship a biologically significant place with technology reserved usually for industrial and

urban projects. In this sense it is not so much that 'this place needs great architecture', it is more 'architecture needs this great place'.

NOTES

¹ There are over 1,800 botanical species with 75 endemic to the Fitzgerald River National Park (classified to date). The flora of the south west of Western Australia is considered to be very poorly known. Invertebrates are only partially classified and the study of marine ecosystems along the coastline has only just begun. See also the Department of Conservation and Land Management website at http://www.calm.wa.gov.au/national_parks.

² The Convention on Biodiversity was signed at the Earth Summit in Rio de Janeiro in June 1992, entered into force in December 1993 and has now been ratified by more than 100 countries. The major objectives of the Convention are: conservation of biological diversity; sustainable use of its components; and fair and equitable sharing of benefits arising from the utilisation of genetic resources. Biosphere reserves promote this integrated approach, and are thus well-placed to contribute to the implementation of the Convention. Source, <http://www.unesco.org/mab/docs/stry-2.htm>.

³ See UNESCO's Man and the Biosphere website at <http://www.unesco.org/mab>. The area of the biosphere reserve shown in Figure 2, is the proposed or 'notional' reserve, which is yet to be officially recognised by UNESCO. At present only the national park has been designated.

⁴ Personal communication, Gillan, K (1997) Department of Conservation and Land Management, Western Australia.

⁵ Kwongan is the name given to this vegetation by the Noongah (Aboriginal) people of the south west of Western Australia, and is the name used by botanists today.

⁶ Anthropologist, Tim Flannery discusses the biodiversity of Australian rainforests and heath-lands in Flannery, T (1994) *The Future Eaters*, Kew: Reed.

⁷ Biodiversity refers to variety of living organisms at all levels, from genetics through to species, to higher taxa, variety of habitats and ecosystems, and variety of ecosystems at landscape scale.

⁸ Not only drawings, but also mathematical equations for surfaces and shapes, can be sent directly to computer numerically controlled (CNC) devices: see the work of Bernard Cache from Objectile (www.objectile.com). Other CAM processes are: 'rapid prototyping' (such as stereo lithography) and engraving.

⁹ Corner, James (1996) *Taking Measures Across the American Landscape*, New Haven: Yale University Press.

¹⁰ 3D Total Stations have been employed in the United Kingdom for several years for construction at sub-millimetre accuracy. Two noteworthy projects are from architects Fosters and Partners: the roof of The Great Court, at the British Museum, and the Greater London Authority building to be completed summer 2002.

¹¹ Corner, J (1997) Ecology and Landscape as Agents of Creativity in Thompson, G (ed) *Ecological Design and Planning*, New York: Wiley.

¹² Ecology and Landscape as Agents of Creativity, above n 11, pp 91-92.

¹³ These images were achieved by mounting two cameras side by side with synchronised shutter release and using exposures from half-second to two seconds.

¹⁴ Corner, J (1999) The Agency of Mapping: Speculation, Critique and Invention in Cosgrove, D (ed) *Mappings*, London: Reaktion.

¹⁵ The Agency of Mapping: Speculation, Critique and Invention, above n 14, p 251.

¹⁶ Corner, J (1991) A Discourse in Theory II: Three Tyrannies of Contemporary Theory and the Alternative of Hermeneutics, *Landscape Journal* 2, p 127.

¹⁷ I suggest a "lineage of cultural constructions" where the first place-specific works to be recognised by that region's inhabitants appear in literature or narratives (song, story, etc), then they are recognised in landscape representations (photography and painting), then finally in architecture. My undergraduate thesis (1997), which was essentially a gathering of the disparate narratives from this particular place into one document, focused on the history of inhabitation and the perception of landscape. More recently, novelist Kim Scott was awarded Australia's most prestigious prize in literature, the Booker Prize, for the part-fictional history of his Aboriginal ancestors from the north of the Fitzgerald River National Park.

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