Exploration and discovery: a nonlinear approach to research by design

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DISCOVERY-BASED RESEARCH IN LANDSCAPE ARCHITECTURE requires design strategies that are open-ended and nonlinear, rather than research models that are focused on pre-determined outcomes or objectives. This should not mean a loss of rigour. A nonlinear model of landscape design is proposed, which adapts from scientific enquiry the distinction between the context of discovery and the context of justification. This model permits open-ended investigation by design, and provides a framework for peer review. It also provides a way for researchers to apply discovery-based design to practical consultancy.

THE LAST DECADE IN LANDSCAPE ARCHITECTURE has been characterised by calls to increase the intellectual capital of the discipline, and by responses to these calls. The 1990s began with James Corner's two part Landscape Journal article that reviewed the history of the idea of theory in landscape architecture. Corner found the discipline wanting in its ability to use theory to 'help figure and orient the collective unconscious of a modern culture still caught in transition' (Corner, 1991, p 131). In 1992, John Dixon Hunt accused landscape architecture of a 'poverty of discourse' of which its 'ignorance or cavalier disregard of history' was merely a part (1992, p 285). Steven Krog suggested that landscape architecture was in a 'crisis of belief' demonstrated by 'the triumph of attitude over insight and authenticity' and 'little depth of thinking' (1991, p 100).

One of the ways the discipline has responded to this criticism, at least on the academic side, is with a new interest in research, and in the refereed article.[1] New journals have appeared, Landscape Review being one of them, and educators are being encouraged by their institutions to involve themselves in funded research. One very welcome aspect of the trend towards landscape research has been the recent development of the refereed studio as a way for studio tutors to participate in research (Bowring, 1997). The concept of the refereed studio is that a landscape school studio project is framed as an investigative design programme. The programme reflects the educator's interests and explores issues that are specific to and can most tellingly be investigated through design.

The role of research in landscape architecture is topical. Landscape architecture needs technical research, but that is not the kind of intellectual capital that Corner, Hunt and Krog regard as most important, nor I believe, is it the kind of research that the refereed studio can most profitably address. A critical engagement with history, culture, art and nature (a theme common to the above writers) is what landscape architecture needs most. While Corner warned against the nihilistic

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excesses of avant-gardism, and Krog bewailed the 'storefront design religions' which produce flashy but empty landscapes, underlying their critiques (as I read them) was an urgent call for new philosophies: not new objects or processes, but new ways of seeing, new interpretations of traditional concerns, rather than a jettisoning of that which we have received from the past. Ten years on from the critiques of Corner, Hunt and Krog, the need for theoretical advancement and for new perspectives on landscape thinking and practice persists. This paper therefore addresses the possibility of the invention of new concepts within a context of continuity, of both the values and traditional concerns of landscape architecture, and the ongoing critical enquiry into these.

The paper has a dual theme: integration and exploration. It asks two related questions:

1. How can we research this holistic discipline without separating the subjects of this research into artificially discrete entities?
2. How can we explore *unconditionally* the possibilities of landscape design?

A recent article in *Landscape Research*, a British landscape architecture journal, discusses issues that arose at a meeting of the British Schools of Landscape Architecture Research Working Group (Thwaites, 1998b). The Working Group concluded that research in landscape architecture needs to progress on two fronts:

1. Through exploiting opportunities derived from consultancy (an approach which argues for strengthening ties between education and practice).
2. Through the intellectual development of the discipline (a call for a wider and more coherent theoretical framework for design).

What struck me about this discussion was the way it brought together research, consultancy and design. It hinted at an integrative model of landscape research, and paved the way for the development at UNITEC Institute of Technology School of Landscape and Plant Science of the UNITEC Landscape Unit, a research centre that could act as a focus for integrated research. Many staff have been involved in design outside their UNITEC commitments; the Landscape Unit, conceived as the consultancy wing of the school, harnesses their energy and directs it into projects that further its research and teaching objectives. The school received endorsement for the unit from its advisory committee, composed principally of practising landscape architects and other industry representatives. The advisory committee felt that the formation of the unit was a useful way of addressing a commonly cited problem in design education: the claim that the parameters within which landscape architects operate in the real world are quite different from the artificial, conceptualised environment of the design studio. The committee thought, as did landscape architecture staff, that the unit offered a mode of educational delivery that could help dissolve the barriers between real and artificial, between theory and practice.

Practitioners and staff also agreed that students typically have little exposure to the possibilities inherent in design strategies that are generated out of the constraints and opportunities of professional practice. This means that they may

·not develop the skills required to turn a poorly written and unexciting brief into an engaging and appropriately theorised project, while also fulfilling the more prosaic requirements of the brief. Conversely, it is often argued that recondite landscape design theory, developed in studio and seminar, needs to be tested before the tribunals of client and community for robustness and relevance.

But a model of landscape research that simply uses real world opportunities to test research hypotheses developed in an academic environment is more likely to exacerbate than to dissolve the boundaries between theory and practice. It can amount simply to testing the unknown against the known, the radical against the conservative, the imagined against the given – to procedures which can relegate studio-developed designs to the impractical. This can mitigate the development of new ideas and does not necessarily push design investigation beyond the problem-solving level. An integrative research model should not rely on a distinction between theory and practice for its validity or efficacy. This is where the refereed studio comes in.

In 1997, Dr Jacky Bowring of Lincoln University published an article in *Landscape Review* suggesting that 'the refereed studio follows the model of any research project carried out with a team of willing and active researchers. However, in this case, research equates with design.' Bowring outlined the criteria for 'research by design', (the rationale of the refereed studio): 'clarity of objectives; relevance and insight; creative and innovative process and presentation; and outcomes which are coherent, original and fruitful' (1997, p 54). These criteria are extended in the procedures of another research-by-design initiative – the Committee of Heads of Architecture Schools of Australasia (CHASA) Refereed Design Scheme,[2] by the inclusion of a category that requires the work to be a contribution to the cumulative body of knowledge of the discipline. The relevance of the refereed studio for my discussion is, first, that these criteria can be fulfilled without reference to practical efficacy and, second, that the evaluation of such design research is conducted by peers who are required to engage critically with the theoretical programmes that inform the research.

Accordingly, the Landscape Unit was conceived as a vehicle for undertaking refereed studios, and would therefore have to conform to the requirements for such studios. These requirements, as set out by Bowring, 'are those of any research project' (1997, p 54): a clear statement of objectives, the critical review of substantive focus, the presentation of process and the review of outcomes. Unfortunately, there is a danger that this model could become counterproductive by being overly deterministic. By deterministic I do not mean that the finished design is univalent, but rather that the outcome is predicted by the means – certain actions yield certain results, such as legibility, functionality and shareable meanings.

What is the problem with such results? In landscape architecture, as in other design disciplines, one of the recent permutations of thoughtful practice has been a renewed interest in *modus operandi* (Corner, 1999a; Rowbotham, 1999; Allen,

1997). If landscape is understood not so much as a physical network of enduring structures of cultural meaning, but rather as a way of constructing culture which continually changes through time (Cosgrove, 1998), then consequently, less emphasis should be placed on meaning as a generator of design than on what could be called the poetics of landscape architecture; that is to say, on the processes involved in the making of designs. Designers are becoming more interested in means rather than ends. Indications of this renewed interest in the poetics of landscape architecture include a broadening of the scope of the design process, and the introduction of new media and practices of visual communication.[3]

This refocusing on process[4] is attended by a revaluation of representation in landscape design. It is now a truism that representational techniques and conventions structure and condition the outcomes of design (Cosgrove, 1999). For instance, the ordering of space implicit in traditional techniques of cartography and perspective expresses a world view for which the human observer is the permanent focus and occasion (Monmonier, 1993). Such a representational methodology now seems inadequate to the flux and contradictions of contemporary life, and to the landscape as an active surface, the physical processes and events of which structure and condition human lives.[5] It is also inadequate to the forces which comprise (and reveal) the interpenetration of human subjectivity and natural systems. Today, landscape architects, influenced by the decentring accounts of the 'web of life' now common in ecology and evolutionary biology, are less inclined to see nature as somehow 'out there' and 'for us'. The anthropocentric humanism implicit in such a viewpoint[6] is regarded as contributing to the division of humans from the natural processes that both surround and constitute us.

Corner said 10 years ago that we are caught in a state of transition, and nobody would doubt that we are still so caught. Exploration is a characteristic of transitional times, and we therefore need a research model appropriate for this exploration. The problem with the refereed studio as outlined above is that it may encourage a tendency to frame research by design in much the same way as an experiment in biology or generative grammar, by adhering to a scientific model of research. An example of the determinism that such a model implies is found in Motloch's *Introduction to Landscape Design* (1991), where he states that 'problem definition consists of two major components: the definition of human needs, which is generally referred to as programming; and the definition of site structure and function, and the opportunities and constraints these afford, a process called site analysis'. The functional diagram, he says, 'can facilitate the discovery and exploration of desired organisational and spatial relationships'.[7] These are then evaluated against preformulated criteria. I believe that a truly exploratory design process will not require the evaluation of competing schema according to objectives or criteria.

Another example of deterministic design is found in Filor (1994). In this article, which promotes the 'designer's own vision' as 'the most important component in the process of design', Filor argues that problem-solving 'is usually achieved by a designer's initial conceptualisation of a design solution which can be used as an ideal model against which to test the constraints and opportunities imposed by the

site and the requirements of the brief and the users'.[8] Alluding to Christopher Alexander, Filor writes: 'every project must first be experienced and then expressed as a vision seen in the inner eye, so strongly that it can be communicated to others' (1994, p 124). He cites Hillier and Leaman, who argue that the designer's preconceptions 'are what makes design possible at all, and indeed what makes possible the identification of a design in the first place' (cited in Filor, (1994), p 124). I am not claiming that these descriptions of design process are not apt. Instead, I am suggesting an alternative method of landscape design that may be more open. Filor regards landscape design as the process through which useful, comfortable and attractive spaces and places are achieved as a result of the manipulation or management of a site. Most landscape architects would agree with this definition. When landscape design is truly *creative*, however, it encompasses something more. New ways of seeing are not guided by objectives or guidelines. 'Concepts are not waiting for us ready-made, like heavenly bodies. There is no heaven for concepts. They must be invented, fabricated, or rather created and would be nothing without their creator's signature' (Deleuze and Guattari, 1994, p 5). But, as Nietzsche warned, after we have created new concepts, we must present them and make them convincing (cited in Deleuze and Guattari, 1994, p 5). And it is to this aspect of research by design that I want to turn to now.

When design is conceived of as an experimental investigative tool, the distinction between theory and practice (where design is 'applied theory') will disappear *if and only if* design outcomes are not already forecast by a set of objectives.[9] The traditional model, however, does just this. After all, the most obvious way of legitimising the design-as-research paradigm is to establish an experimental framework that begins with a hypothesis or question, follows a methodology, and results in outcomes that can be tested in a variety of ways, from practical efficacy through to aesthetic considerations. In this model, a range of performance criteria that a design proposal must meet are arrived at by considering a range of issues, including the physical and research contexts. The success or failure of the design is established by how well these criteria are met. Obviously, there is room for flexibility – the criteria range over social and cultural as well as formal, physical, and ecological measures or standards. Where, why and by whom the criteria are established, and according to which social, cultural and political agendas, are important issues. Typically, the criteria are set up before design begins. This, however, may have the effect of influencing design, by imposing predetermined options or constraints, or requiring a certain representational order.[10] In short, the traditional model can become deterministic. The model I explore in this paper has been developed to overcome determinism in design, to break down the theory/practice and studio/ real world distinctions and, in doing so, to seek new discoveries. It begins with the previously stated conclusion of the British Schools of Landscape Architecture Research Working Group, that research in landscape architecture needs to progress by critically engaging education with practice, and vice versa, and by the development of more explicit theoretical frameworks for design.

The UNITEC Landscape Unit aims to bring these objectives together. In the

scientistic form of this research/consultancy/design model, the Landscape Unit may well treat a commission as in the research project outlined above, with a hypothesis, methodology and conclusion, on the model of a refereed studio. This would require the development of a programme of theoretical investigation for each project. Clearly, such a programme does not rule out incorporating a theoretical agenda formulated specifically to move student thinking beyond the normative, representational order often associated with public works projects. In my experience there are many advantages to be gained within the limits imposed by this model. For instance:

* a commission can be treated like a research project
* theoretical issues can be brought to a project (a practical framework for theory)
* staff bring real projects into the studio
* students can participate in each phase of the project, from design concept to detail
* ties between education and practice are strengthened.

These practical and important outcomes do address some of the concerns of the British Schools of Landscape Architecture Research Working Group. Certainly, the range of educational opportunities to be derived from consultancy are well covered. The scientistic research model outlined above is definitely suited to this purpose. It is difficult, however, to escape the determinism of a model that requires that certain objectives and criteria be met in order for the designs to be evaluated as more or less successful. It is my view that, while this approach has its place, it does not contribute to the intellectual development of the discipline (at least in the way that Corner, Hunt and Krog had in mind), and thereby fails to address the second conclusion of the Research Working Group: What kind of research model will avoid separating theory from practice?

One way of dissolving the practice/theory distinction, and the implied real/ artificial distinction that becomes attached to it, may be through the elaboration of an approach that focuses on process rather than outcome, and the origin of ideas, rather than the ideas themselves. It is more like the voyage of discovery described by the radical philosopher of science Paul Feyerabend in *Against Method* (1993), in which he argues that the only feasible explanations of scientific successes are historical ones, and that anarchism should replace rationalism in the theory of knowledge, with a view to enhancing serendipity.

Similarly, the model that I advocate describes a process that has no prior object or content, a process that does not follow rules, but creates them. The qualities to be found in landscape architectural design that travels without a destination can be found in all forms of work, including scientific work. These forms eschew method, despite discipline, genre, location or technical form; despite the material and cultural conditions that inform them. If design is conceived as a process of discovery, the result of which is not ready imaged, and if the process of design is to be as free as possible, then the representational order should be correspondingly unconditional.

Nietzsche claimed that a research model that shuns objectives against which outcomes can be tested is no research model at all. My proposal adapts a well-known characterisation of scientific activity in order to address this issue. The history of science teaches us that much genuine scientific discovery is made when scientists do not know what they are doing or where they are going.[11] Feyerabend goes so far as to conclude that '[t]he only principle that does not inhibit progress is: *anything goes*' (1993, p 14). He cautions scientists to focus on practice rather than method, and demonstrates that methodology is neither value-free, nor the key to progressive results.[12] The more conventional characterisation of scientific work describes two phases: a context of discovery and a context of justification. It is generally agreed by science historians, philosophers of science and scientists themselves, that in the discovery phase, insights can come from anywhere.[13] It is the context of justification that requires rigour and standards. Both phases are important. After all, we need to be able to explain eventually what has been discovered. We must be able to communicate it and place it squarely before the tribunal of peer review. Landscape design occurs in the context of discovery. In the studio environment the context of justification is the peer review, in which exploration and evaluation occur.

So just what kind of design research am I talking about? I have been experimenting (and I stress the experimental nature of this work) with an attempt to extend design-based research beyond a linear model of research, which typically moves from hypothesis through investigation to conclusion. This model tends to separate the human agent from the problem, or from the objective processes that are being studied. A nonlinear model of landscape design is proposed, which introduces uncertainty and indeterminacy into a design methodology that can, in the pursuit of justifiable outcomes, become overly rationalistic or even mechanistic. It is also designed to destabilise the scientistic rationalism that sometimes characterises the very notion of research in the social sciences. Many landscape educators interested in design methodology have looked at this before, and the survey/analysis/design prototype has been significantly enriched by their work. I do not wish simply to extend this work, but to revisit the assumptions and theoretical ideas that underpin it. For instance, Motloch states '[d]esign processes are not linear in character nor definite in length' but goes on to add that '[d]esign is, however, goal-oriented' and 'problem-solving in essence' (1991, pp 239–240). I have suggested that the invention of new ways of seeing in landscape architecture requires a design process that is free from such restrictions. Steinitz provides a further example: '[t]he design itself is the medium of social communication' (1995, p 200). This implies that landscape design 'requires a sender with a message, a medium of expression, and a comprehending recipient' (1995, p 200). This information model is useful in the forming of user-friendly landscapes and, as such, has its place. But my experimental model differs, in that it attempts, through the exploration of new spaces of discovery, to renew landscape architecture and, in particular, the urban landscape.

A number of presentations at the Australasian Educators in Landscape

Architecture 2000 Conference investigated issues similar to those discussed here. Clearly, the winds of change are blowing through schools of landscape architecture in the Australasian region. However, entries into national and international (especially International Federation of Landscape Architects-promoted) student design competitions continue to attest to the prevalence of design criteria such as functionality, predictability and repeatability, and give the impression that many conventions of landscape design theory and process remain unchallenged. The designs are sound, sustainable, technically proficient and often beautifully integrated. They are also more often than not conventionally picturesque, derivative, grimly worthy and fatefully restricted to the known. Most attempt somehow to transfer signification from the mental realm to that of the purely visual, to 'picture' theory, or to 'figure' pre-existing subjects. I want to review the possibility that fascinating new subjects for landscape architecture might be brought into being by design – might, in fact, be identical with it. In doing so, I explicitly question the wisdom of separating design studio from consultancy along the lines of a purported theory/practice division, and implicitly argue for the elimination of a design vocabulary that supports this division.

An exploratory landscape architectural design will put the emphasis on process rather than on product, on discovery rather than on justification.[14] If the product is already defined, then the process will not be free. Many recent thinkers[15] stress that humans have to overcome the tendency to divide the physical world into discrete visual or physical parcels, in order to comprehend the continuous forces and flows that inform natural and cultural systems. Moreover, we must learn how to work with these forces and flows. In doing so we may discover (*pace* Deleuze and Guattari) that, ultimately, the divisive categories of nature and culture, theory and practice, real and artificial are irrelevant. Likewise, a discovery-based model of design research will emphasise the stochastic and unpredictable nature of a landscape design that proceeds by encompassing the multiplicities inherent both in site and thought.

My example is from a fourth year studio at UNITEC.[16] This studio took the form of an examination of random or uncoordinated development in Auckland's central city. It is actually a counter-response to the wide call for an urban design masterplan for that city's Central Business District (CBD) and waterfront. Instead of classical techniques of analysis, synthesis and reasoned appraisal, the studio used a random approach to the selection and design of specific sites. Site design was not required to refer to context, or to other sites, but if and where it did, such references were to be non-hierarchical, non-unifying and non-totalising (ie anti-masterplan). It was hoped that by using a stochastic design process that the predetermined specification of form (according to normative urban landscape design principles) could be avoided.

For such an approach, new practical and theoretical operators must be found, and new operations developed. One such operator is represented by the figure of the parasite,[17] and the operation can be called *interference*.[18] This became the theme of the studio project, as outlined below.

Within any system an ordering principle is at work. This principle selects, modifies, adapts and organises according to certain sets of determining factors. Interruptions, interferences and glitches are dealt with according to the rationale that constitutes the system. The urban landscape has often been represented as a system, ordered by instrumental hierarchies pertaining to the reticulation of traffic, information, capital etc. Traditional urban design methodology also has the properties of a system based on the model of linear progression, of movement from analysis to design solution. It therefore has its own hierarchy of dos and don'ts, of valid and invalid moves.[19] When interference is encountered, the system relocates, deletes or disguises it. Another approach is possible. In dynamical systems theory, turbulence is the motor for transformation. By integrating rather than invalidating the parasite, a system passes from a simple to a more complex stage. Thus the interference constitutes the condition of possibility of the system's development. By way of disorder, it produces a more complex order. The parasite invents something new – it expresses a logic that was irrational prior to its introduction. Thus turbulence from outside the system prevents the system from implosion, weakening or decline. Such interference can also come from conditions intrinsic to the system; an internal 'chaos'. Perhaps this is the more interesting event for landscape architecture.

Perturbations that act on an orderly system offer unpredictable possibilities for the system. This could be one way, for instance, that the city is opened up to poetry and art. Perhaps the very viability and vitality of the city is dependent on the degree to which it is open to its poetic other. The urban system develops and transforms when exposed to the unpredictable and miraculous. The poetic impulse is its lifeblood, not its nemesis.[20] Chaos makes order possible.

Students were not required to design to a predetermined outcome; there were no typologies, no talk of 'urban park', 'plaza', or even 'landscape intervention'. Students selected their sites by throwing a dart at a map of the Central Business District of Auckland city. Wherever the dart landed was their site. They then had to map the site, adapting a technique from Corner (1999a).[21] Once a site plan was derived, they selected randomly (out of a hat) an operational technique (such as layering, folding, burning, erasure, extension, transposition), and then performed this operation on the site plan.[22] Thus began a sequence of iterations, where each new version of the plan was operated on again and again. Iteration was used because it generates a kind of inherent morphogenesis, a self-similar but non-identical repetition that effects a movement from the known to the unknown.[23]

Into this controlled but stochastic process, interference presents itself as a malfunction. Normally the emergence of a parasite elicits a strategy of exclusion. Epistemologically, the ordering system appears as primary, and the parasite as an addition that it would be best to expel. But Serres argues that the parasite is actually an integral part of the system. 'Parasite' in French can mean noise or static, and Serres considers noise to be essential to communication – it is the chaos from which order emerges.

Student designs

Glenice Anderson's dart landed on a multi-storey carpark. By means of the iterative process, using the operator of transposition, this nondescript building metamorphosed into a sublime landscape. The parasite emerged in the form of an ambiguity as to figure and ground (Figures 1A and 1B). After several iterations, Anderson became unable to distinguish object and field. Eventually she found that the either/or categorisation of figure and ground so commonplace in urban design and architectural discourse was no longer applicable. The resulting drawing showed an urban landscape in which both figure *and* ground were co-present. The parasite moved the representational order from one where the multiplicities of the lived world are reduced to hierarchical categories, to one in which landscape is no longer presented as a receptive backdrop for the objects of architecture, but instead as a turbulent field in which perceiving participates in the construction of reality.

Melanie Burleigh's operation was erasure. Her dart fell on Auckland's disused railway yards. But, rather than operate directly on the site plan, Burleigh chose to erase from Auckland City's District Plan certain randomly selected words that referred to commercial building height restrictions and property boundaries. Turning to the site plan and graphically recording the consequences of this erasure of controls, she found that the site was immediately invaded by structures, forms and spatial orders from outside (Figure 2). Each iteration took her farther from equilibrium until, quite suddenly, a new order appeared and the marginalised landscape of the old railway site revealed its potential as an extraordinary urban park. This piece demonstrated what can happen when the process of drawing becomes automatic. Rather than starting with an idea, the ideas were initiated by the process itself.

Louise Beaumont and Corene Higgins mapped their site (a petroleum tank 'farm') exhaustively, recording road signs, boundary markers and vehicle types as well as topographical features and spatial form. For the operation, Beaumont and Higgins subjected their carefully delineated and photo-accurate drawings to deformation by spraying a formula on them that caused them to melt and dissolve unpredictably. The iterative procedure was 'perturbed' by a bizarre version of the traditional functional diagram, that enabled the process to evolve into a punning and ironic subversion of this analytical convention (Figure 3).

Susannah Kitching's dart landed on an intersection in Queen Street, Auckland city's main retail and commercial street. Kitching mapped, among other things, pedestrian pathways across the busy intersection, the texts of advertising signs and billboards and the names of buildings. She performed two operations on her data. The first involved extending pedestrian lines of force through built structure, and the second permitted scrambled texts to fill the spaces created by the first operation (Figures 4A and 4B). Turbulence occurred when Kitching had to import ideas from outside the iterative programme (a reading of Lefebvre).[24] This enabled her to move from a textual to a spatial milieu. And then, by combining the cultural coding of the various social languages she had mapped (advertising, naming, describing) with
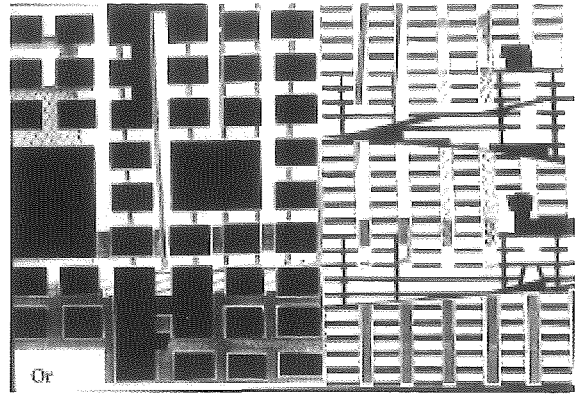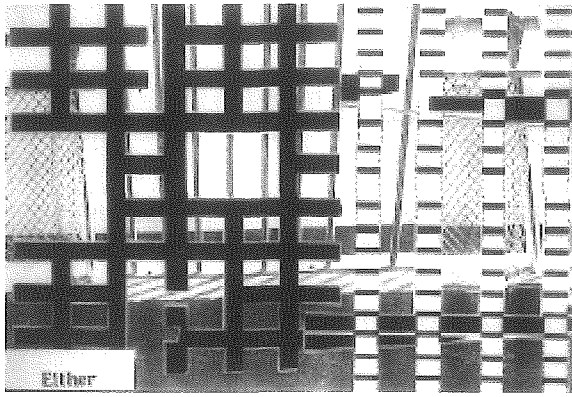
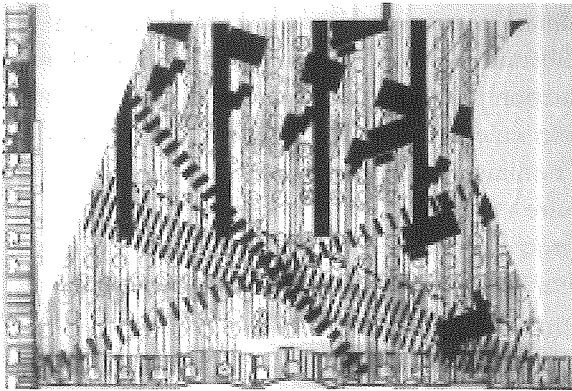*Figures 1A and 1B: This design makes no hierarchical distinction between figure and ground*

Figure 2: Intergration of the parasite led to a design for an urban park that refers formally to the visible and invisible processes that generated it
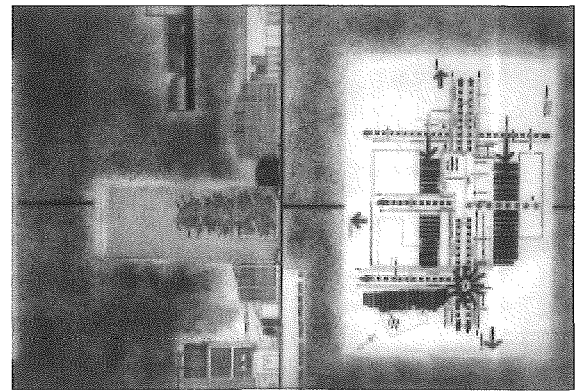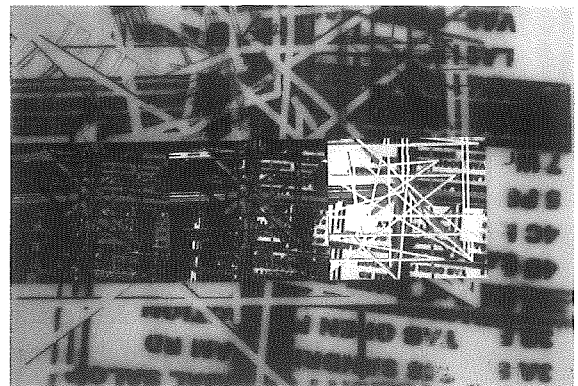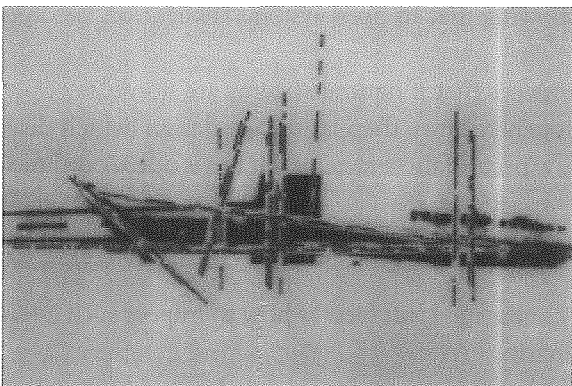

Figure 3: A functional diagram that re-orders codes and conventions, thereby suggesting new possibilities for design

Figures 4A and 4B: When social space and physical space are pushed far from equilibrium, new urban formations emerge

the physical qualities of the spaces her iterative procedures carved out from the building stock of the street, she discovered how space itself can become a generative component of social life in the city. The whole process helped us realise how important social space is to the structure and development of the city and to those who live in it.

The design process described above is an experiment in nonlinear landscape design. Urban systems are examples of nonlinear dynamical systems (just as are ecosystems and other natural systems). Dynamical systems theory is not a theory of physical phenomena, but a mathematical theory that is applied to a wide range of phenomena. It is a qualitative rather than quantitative mathematics of relationships and patterns, in which thinking shifts from objects to relations, from substance to pattern.

The Nobel prize-winning chemist Ilya Prigogine studied systems under conditions of non-equilibrium. In the 1960s, he realised that systems far from equilibrium must be described by nonlinear equations. He discovered that as a system moves further away from equilibrium (eg uniform temperature throughout a liquid which changes from conduction to convection) it reaches a point of critical instability, at which a new pattern emerges. This is self-organisation, which has become an important feature of nonlinear dynamical theory. Open systems (such as cities and rainforest trees) require a constant flow of energy and matter for self-organisation to take place. New structures and new forms of behaviour only emerge when the system is far from equilibrium. Self-organisation is described by Prigogine and Stengers as 'the spontaneous emergence of new structures and new forms of behaviour in open systems far from equilibrium, characterised by internal feedback loops and described mathematically by nonlinear equations' (1984, p 88).

Classical thermodynamics had led to the concept of 'equilibrium structures' such as crystals. Prigogine introduced the concept of 'dissipative structures' to emphasise the paradoxically close relationship between structure and dissipation. In classical thermodynamics, the dissipation of energy was always regarded as waste. Prigogine changed this view by showing that in open systems dissipation becomes a source of order.[25]

Essentially, my experiment proposes that if natural systems are nonlinear open systems, and cities are nonlinear open systems, then landscape design (which deals with both) might reveal interesting aspects of these systems if it too is open, nonlinear and dissipative.

With regard to the subject of this paper, the issues raised by a nonlinear approach to design are twofold:

1. The problem that the UNITEC Landscape Unit faces is how to import such a free brief into the consultancy scenario.
2. The issue for design studio teachers is how to situate this kind of brief within the framework of the refereed studio.

Although these are *our* problems, they do dramatise the practical difficulties associated with a nonlinear approach to landscape design. The establishment of the UNITEC

Landscape Unit enables senior landscape architecture students to explore these issues in partnership with staff. The most significant impact this model makes is on the spurious and unhelpful distinction in the minds of students, staff and public between an ideational world of theory and an operational, quotidian 'out there'.

This article sketches an argument for integrating research with teaching and consultancy. It acknowledges the importance of the refereed studio and suggests that instead of relying solely on deterministic models for validation, the refereed studio could adopt from scientific enquiry the distinction between the contexts of discovery and of justification. This would pave the way for a more open-ended approach to the design of studio, validated within the context of the peer critique.

The idea that landscape design theory needs to be tested in the real world begs the question as to what kind of criteria must be fulfilled. Can design be truly exploratory and practical?[26] A plethora of recent letters to the American magazine *Landscape Architecture* call for less art and theory and more user-oriented work.[27] In my experience, user-oriented work is based on the satisfaction of a set of user-generated criteria (more seats, more shade, more colour etc) that, while completely valid as performance criteria, tend to overshadow other ways of investigating the site. In the interests of research that discovers rather than repeats, this paper reverses that call.

NOTES

[1] Other responses have been considerable: the development of a theoretically grounded European school of landscape design (Dutch, French and German in particular), the pioneering work of Leon Van Schaik and Peter Connolly in the development of critically engaged studio programmes at the Royal Melbourne Institute of Technology (RMIT), and the advent of the Languages of Landscape Architecture (LOLA) series of conferences at Lincoln University, to mention only a few.

[2] CHASA *Refereed Design Scheme Procedures* 1997 Version LNJ (p 2).

[3] For examples of this broadening of design process see Simon (2000), Bradbury (2000), Lynn (1999) and Corner (1998).

[4] I say refocusing because the recent emphasis on *modus operandi* is reminiscent of (and could even be regarded as a continuation and extension of) the interest in design process in the early 1960s, for instance Halprin's studies for Sea Ranch. I owe this observation to Mike Austin of the School of Architecture, UNITEC Institute of Technology.

[5] This theorising of landscape as a dynamic and constitutive 'field' or spatial matrix has come more from architecture than landscape architecture, and reached its best known airing in *Architecture After Geometry*, a special issue of *Architectural Design* (1997). Rowbotham (1999) applies it to urban landscape design and Wall (1999), with a nod to the notion of 'field conditions' (Allen, 1997; Corner, 1999b), usefully reformulates landscape as 'the functioning matrix of connective tissue that organises not only objects and spaces, but also the dynamic processes and events that move through them' (1999, p 233).

⁶ The iconic, modernist designs of Halprin, Kiley and Jellicoe exemplify this humanistic understanding of the world.

⁷ my italics.

⁸ Filor draws on Steadman (1979) in the elaboration of this argument.

⁹ This forecasting can take many forms, from the public authority requirements for 'improved pedestrian connections' (p 19), 'reinforcement of civic values' (p 6) and 'stimulation of appropriate development' (p 8) (all from Auckland City Council's *Aotea Precinct Design Guidelines*), to the studio tutor's marking schedule which requires x, y and z.

¹⁰ Examples of this are: 'At least one perspective, elevation or montage should be included.'; 'Drawings will be displayed on presentation screens that will permit each drawing to abut the adjacent drawing.'; 'The concept plan should be scaled 1:500.' (all from Auckland City's *Aotea Precinct Design Guidelines*, p 5).

¹¹ See, for instance, the autobiography of physicist Werner Heisenberg (1971), or James Gleick's (1998) narrative of the slow emergence of nonlinear dynamical theory.

¹² For discussions of the 'value-ladenness' of theory, see also Quine (1960) and Kuhn (1970).

¹³ The biographies of scientists are full of accounts of serendipitous insights had while fishing, sailing and walking in the woods, rather than toiling in the laboratory.

¹⁴ It is precisely because the product is tangible and the process is not, that process is devalued.

¹⁵ For example see Serres' *Hermes* (1982b) and *The Parasite* (1982a) and his collaboration with Bruno Latour, *Conversations on Science, Culture and Time* (1995). For Deleuze and Guattari see their *A Thousand Plateaus* (1984).

¹⁶ Some of the following sections have previously appeared in Barnett (2000).

¹⁷ This studio is based on the work of Michel Serres and in particular his book *The Parasite* (1982a).

¹⁸ Interference means a perturbation, or turbulence, to use Serres' vocabulary (1982a).

¹⁹ See Moughton, *et al.* (1999) *Urban Design: methods and techniques* for an example of this approach.

²⁰ This paragraph is an adaptation from Serres, who discusses science as the other of poetry and argues that science and poetry are actually different ways of doing similar things, ie creating knowledge (Serres 1995 and Harari and Bell 1982).

²¹ Other mapping techniques may have been just as effective, but Corner's method renders visible the field conditions operating on the site. It visualises both physical attributes and hidden processes and the interactions between them. Importantly, it renders the distinction between the reality and representation unimportant, even meaningless.

²² This was not a conventional site plan, as it included visible and invisible processes, sketches, photographs of site information and a wide range of site-derived material not normally associated with the term 'site plan'.

[23] As Rowbotham explains: the iteration is a 'slow transformation in small jumps' which 'drifts' from 'familiar formal territory to the unfamiliar ground of dissimilar invention by means of a series ofs linked steps' (1999 p 18).

[24] Lefebvre's *The Production of Space* (1991) had been discussed in a parallel course.

[25] Prigogne has written a number of books outlining these findings – see bibliography.

[26] The judges' comments from a recent student competition demonstrate a typical confusion of the context of discovery and context of justification, asking for instance for 'graphics with emphasis on perspectives and axonometric' and cautioning students to 'avoid graphics that are too abstract in appearance'.

[27] The following are quotations from letters to the editor:

'Let us not get caught up in the avant garde and lose sight of what has worked for centuries'*(Landscape Architecture* 4/2000 p 12*)*.

'let's have less of this airy-fairy stuff in LAM, and more articles directed to the user experience' (*Landscape Architecture* 8/1999 p 9).

'Arts for arts sake is wonderful. However, unusable and unaccessible art that disrespects the public and public spaces is not' (*Landscape Architecture* 10/1999 p 7).

'our public open space is a common resource that is far too precious to be given over to the "look at me" school of design' (*Landscape Architecture* 10/1999 p 9).

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