University of Adelaide

A CONTINGENT SENSE OF GRAMMAR

A dissertation submitted to

the Faculty of Architecture and Urban Design

in candidacy for the degree of

Doctor of Philosophy

by

Dean Bruton

Adelaide, South Australia

November 1997

Contents

Abstract

This thesis investigates the *contingent* senses in which concepts of *grammars* and *grammatical design* apply in the practice of form making in art and design. It uses three complementary research strategies: a literature review, the examination through a perspective of *grammatical design* of some selected bodies of art work, including interviews with artists, theorists and some designers; and the reflective practice of image making with computer media in my own work as an artist.

The major hypothesis is that a *developed contingent sense of grammar can facilitate the understanding, creation, and discussion of form-making in art and design*. The sub-hypotheses are that (1) *An understanding of grammatical design can enhance a reflective design activity*, and that (2) *Revealing the contingency of grammars can expose moments of inspiration and redirection in a reflective design activity.*

Chapter 1 describes the key concerns, background and scope of the thesis. Chapter 2 reviews some ways in which "grammar" is used in art and design discourse and posits "contingency" as a key concept in understanding the nature of grammars. Grammars are described as a metaphor, as a computational scheme and as a description of a kind of computer program. The contingent nature of rules and grammars in art and design is discussed. Chapter 3 examines work by some selected artists from a perspective of grammars through some writings by and discussions with theorists and artists. Chapter 4 describes some reflective experiments in which senses of grammars and grammatical design are traced in image making with computer media. These experiments demonstrate how the development of images can be seen to follow from the contingent operation of transformational grammatical ideas in hermeneutical reflective

action. Chapter 5 draws together these separate studies, discusses how they support the major hypothesis and two sub-hypotheses set out above, and suggests some ways in which a contingent sense of grammar may empower art and design novices.

Acknowledgments

Sincere thanks to all those participants, both nationally and internationally who contributed to this project. Special thanks to Anthony Radford for his kind, patient and persistent supervision and to his colleagues at the University of Adelaide, particularly Robert Woodbury who supported me through a part-time candidature. From the University of Sydney, Adrian Snodgrass and Richard Coyne (now University of Edinburgh) sparked new philosophical directions in the early years. I also wish to thank Royal Melbourne Institute of Technology for the 1993 Domus Academy Winter School scholarship that enabled me to establish new friends and colleagues in the design field.

I wish to acknowledge the special assistance and advice of those international participants that contributed to my successful study tour of Australia, USA, Britain and Italy. The list of interviewees included: Lionel March, Mark Tapia, Bill Barminski, Raymond Lauzzana, Tom Seebohm, George Stiny, Terry Knight, Philip Pearlstein, Sid Sachs, Larry Becker, Robert Venturi, Denise Scott Brown, Scott Chase, Joan Kirsch, Russell Kirsch, Marco Zanini, John Wood, John Rollo, Catherine Teeling, Paul Richens, William Fawcett, John Lansdown, Gregory Moore, David Walker, Paul Margerison, Richard Wentworth, Alvy Ray-Smith, Philip Cox, Richard Coyne, Robert Woodbury, Adrian Snodgrass and Neil Hanson. Thankyou all for stimulating, productive and most pleasant encounters.

I am grateful to the Faculty of Art, Architecture and Design, of the University of South Australia who assisted me through the provision of a Cathie Scholarship for study leave. Finally a warm thanks to my family, friends for their support, and, especially to my partner Judith for her understanding and encouragement.

Statement of Originality

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give my consent to this copy of my thesis, when deposited in the University library, being available for loan and photocopying.

Signed

Date 2.3.98

As both a practising artist and design educator within the art, architecture and design fields, my work has been concerned with understanding and knowledge of the visual world. My experience suggests that:

• art and design theory needs clear articulation to be effective in education;

• philosophy contributes to better understanding of art, design and designing;

• systematic, pragmatic and contingent views of design are all relevant for scholars and practitioners of art and design.

This thesis began in response to the assertion of a colleague that design had rules where art appeared to have none. It attempts in an hermeneutical mode to open a space, to unsettle thinking about rules, grammars, language, vision, design theory and practice, in art and design. It outlines a particular conception of form making in design: the view that while judgments in art and design are variable and contingent, there is considerable force and significant function for a strong sense of grammars and grammatical design.

Early work was initiated through the observation that patterns of behaviour in the design domain reflected those I had encountered

during my research into the theoretical foundations of art museums. My previous Masters thesis, *Personal Taste and Public Office* (Bruton 1988) concerned the nature of art and the quality of judgements about art in public institutions. The work researched the nature of decision-making in relation to curatorial judgement of art excellence. The criteria for judgement sometimes espoused by experts in the curatorial field was found to often conflict with institutional charters and public policy.

The lack of theoretical consistency in the fields of art and curatorship developed a corresponding curiosity about theoretical discourse concerning qualities of design excellence. This interest developed to foster strategies for rigorous theoretical discourse in a traditionally pragmatic environment. Grammars appeared to offer a certainty which was attractive in this uncertain world, but it proved to be not as simple as that—in fact any sense of grammars appears to operate contextually and contingently.

The subject of this research became, then, a contingent sense of grammars: the hypothesis that contingency can make the ideas of grammars and grammatical design more, not less, interesting and productive as ways of looking at form making in art and design.

1

Introduction

This thesis investigates the contingent sense in which *grammars* and *grammatical design* apply in the practice of form making in art and design[1]. *Form*[2] *making* is the definition and modelling of spatial elements and objects in two or three dimensions, as both abstract or representative art, and in a design as some functional object[3].

The terms *grammar* and *grammatical design* are used in the literature of art and design in several senses as:

1 The term *art* is problematic. For example, Brook (Brook 1983) would argue that a concentration on form-making indicates a view that subscribes to the theory of art as craft or design. It will be argued here that through a grammatical understanding of art "so-called", one can more readily encounter art "properly so-called". Similar qualifications apply to *architecture.*

2 Paul Duro and Michael Greenhalgh describe *form* in a broader sense than that used here: "That part of a painting, sculpture or artefact that may be described purely through the configuration of line, mass, volume and colour. In practice, it is almost impossible to separate form from content, even in the works that appear rigorously abstract. Form is best considered as a constituent part of an art work that needs to be considered in relation to a work's iconography, social and historical context" (Duro and Greenhalgh 1992, 24). This thesis concentrates on formal issues that are tangibly *opaque,* that is, issues of iconography, social and historical context are treated as deferential to material manifestations of *form.*

3 In addition to the traditional understanding of *design* as applied art, I emphasise the broad (Itten 1964; March 1976; Stiny 1976; Wong 1977; Wojtowicz and Fawcett 1986; Wong 1988) interdisciplinary notion of *design as form making* because popular concepts of discrete discipline categories of design (eg graphic design, industrial design) seem to foster a limited understanding of art.

(a) a metaphor linking the rules, elements, transformations and compositions which might be perceived in form making in design and art, relating to the rules, elements, transformations and expressions which constitute a grammar in a spoken or written language; and,

(b) a computational paradigm using a schema of rules[4], elements (shape, colour or forms), transformations and designs as a computational system such as a shape grammar which generates a language of designs in a consistent[5] style, and

(c) and a term used in computer programs which implements a formalisation.

I shall use these terms in the same way in this thesis.

It uses three complementary research strategies: a literature review, the examination through a perspective of grammatical design of some selected bodies of art work, including interviews with artists, theorists and designers; and the reflective practice of image making with computer media in my own work as an artist.

The domain of this research is necessarily broad. Its aims within this broad domain are to note and make connections between the different senses in which the idea of grammars are used in art and design discourse, to place contingency in the forefront of the way the idea of grammars is presented, and to trace a contingent sense of grammars from within the practice of art rather than as an observer.

The significance of the thesis resides in its contribution to the facili-

---

4 For example, Owen Jones wrote: "What is evident is, that the Greeks in their ornament were close observers of nature, and although they did not copy, or attempt to imitate, they worked on the same principles. The three great laws which we find everywhere in nature—radiation from the parent stem, proportionate distribution of areas, and the tangential curvature of the line—are always obeyed, and it is the enerring perfection with which they are, in the most humble works as in the highest, which excites our astonishment, and which is only fully realised on attempting to reproduce Greek ornament, so rarely done with success" (Jones 1856, 33).

5 For example, Emmanuel-George Vakaló developed a universal shape grammar with ANADER, a computer-based framework for analysing and deriving the morphological structure of two-dimensional designs. ANADER analysed seven houses of architect Tadao Ando to "yield a more explicit account of these activities" (Vakaló and Liou 1996, 2) by revealing three architectural rule schemata that were consistently employed. Vakaló claims that ANADER's schemata allow comparison "not only between the members of a class but also between members of different classes" (Vakaló and Liou 1996, 10). Consistency is one of the characteristics of the grammatical approach.

ty, efficiency and cost of form making in art and design as it concentrates on strategies for the acquisition of understanding that are transparent and accumulative, that is, knowledge and experience becomes more readily available, discursive, recordable, and generative. Some implications of the thesis for both practice and pedagogy of art are significant because there is no extant writing on grammar from the perspective of the artist/practitioner.

Contingency

The term *contingency* embraces both the ideas of *in addition to* and *dependent upon* given circumstances. In this thesis, grammars in all the above senses are seen as contingent: that is, as both "in addition to" the main thrust of design activity—as an associated formal adjunct—and "dependent upon" particular environments and specific contexts[6]. A *contingent sense* refers to an ability to appreciate situational insights into a specified state of affairs, particularly in designing.

Both self-judgment of design through reflection on designing, and self-reflection on one's values as one judges the design as it develops, maintain a distinct *sense* or acquired meaning of the moment of insight[7]. Self-creation is a key concern in artists' activity. Richard Rorty describes the self as "a tissue of contingencies rather than an at least potentially well-ordered system of faculties" (Rorty 1989, 32).

In adopting the term *contingent*, I am following the work of Barbara Hermstein Smith in literature who emphasises that contingency is a

---

6 Schön notes the importance of contextual rules for designers: "It is important to notice not only what rules the designers hold but also how they hold them. Rules are almost always treated as contingent and contextual. They are held tentatively, always admitting exceptions" (Schön 1988, 186).

7 "Sense" here does not connote to *sensationalism*, the belief that all mental states are derived by composition or association, from sensation, or that sensations provide the only evidence of our beliefs or that the world can be reduced, without loss, to statements about sensation as Daniel Dennett might argue (Dennett 1981). On the contrary, the conditions that are explored here relate to the mind's reflection on its own operations and as a contingently independent source of ideas.

starting point[8], not a reason for abandoning a paradigm:

> If we recognise that literary value is "relative" in the sense of *contingent* (that is, a changing function of multiple variables) rather than *subjective* (that is personally whimsical, locked into the consciousness of individual subjects and/or without interest or value for other people), then we may begin to investigate the dynamics of that relativity. Such an investigation would, I believe, reveal that the variables in question are limited and regular—that is, that they occur within ranges and that they exhibit patterns and principles—and that in that sense, but only in *that* sense, we may speak of "constancies" of literary value (Herrnstein Smith 1988, 12).

Arguing that literary value is "radically relative and therefore 'constantly variable'", Herrnstein Smith reconsiders notions of relativism as not a conviction but a conceptualisation:

> Relativism, in the sense of a *contingent* conceptualisation *that sees itself and all others as such*, cannot be found, ground, or prove itself, cannot deduce or demonstrate its own rightness, cannot even lead or point the way to itself (Herrnstein Smith 1988, 183).

Using this conceptualisation of relativism, contingency may be applied to metaphors of grammar to instigate new vistas of exploration for both the novice and mature artist. This view echoes notions explored by Rorty who argues that a vocabulary of Enlightenment rationalism is an impediment:

> I shall try to show that the vocabulary of Enlightenment rationalism, although it was essential to the beginnings of liberal democracy, has become an impediment to the preservation and progress of democratic societies. I shall claim that the vocabulary...which revolves around notions of metaphor and self-creation rather than notions of truth, rationality, and moral obligation, is better suited for this purpose (Rorty 1989, 44).

Further, I shall argue that it is in the nature of grammars in design that they are continually modified, adapted and invented depending on the situation, and this contingency is what makes the idea of grammars rich and productive. Thus the context of the design situation determines the extent that grammars may be found and the grammar or grammars that appear to be operating. Similarly, when seen from a contingent perspective, grammars are never a complete

---

8 Herrnstein Smith illustrates this point: "The botanist who observed that the growth rate of the plant he was studying varied under different conditions would not murmur *De gustibus* and end his research at that point, but on the contrary begin it" (Herrnstein Smith 1988, 11).

representation of a design; they are contingent to design.

Grammars

The idea of art and design grammars draws on analogies between "visual languages" and "natural languages". A developed knowledge of grammars can reveal "intelligent" understanding in visual domains as well as in natural languages. Unfortunately, deep understanding of grammars in art is rare. Artists and designers are usually unable to say what they know, to put their special skills and understanding into words. On the rare occasions when they try to do so, their descriptions tend to be partial and mistaken: myths rather than accurate accounts of practice. Yet their designing seems to reveal a great deal of intelligence (Schön 1988, 181).

Although I shall argue later that the similarities between the two domains are limited[9], it is useful to briefly outline the role of grammar in natural language. (Concepts of *grammars* and *contingency* will be further developed in Chapter 2).

Natural proto-languages may have appeared as early as two million years ago and modern (mother tongue[10]) language 100,000 years ago (Renfrew and Zubrow 1987; Renfrew 1995). The traditional categories of grammar[11], rhetoric and dialectic date from the ninth century AD (Posner 1992, 40) As Pierre Hélie (1150) from the Université de Paris maintained, there are as many grammatical systems as there are languages (Kristeva 1989, 138). Alexandre de Villedieu in *Doctrinale puerorum* (1200) subordinated linguistic studies to logical principles through the discovery of the order of words and the form of words (Kristeva 1989, 137). Charles W Morris coined the terms *syntactics, semantics* and *pragmatics* (Morris 1971), building upon the work of Charles S Peirce who formulated the basic principles of

9 Chomsky recognised the general cognitive links between visual and natural languages and questioned claims that language learning is an instance of "generalised learning capacities"(Chomsky 1975, 21).
10 Renfrew suggests there are currently about 5000 languages spoken in the world (Renfrew 1995).
11 On regarding grammars as logical, Otto Jespersen quotes Stuart Mill: "Consider for a moment what Grammar is. It is the most elementary part of Logic. It is the beginning of the analysis of the thinking process. The principles and rules of grammar are the means by which the forms of language are made to correspond with the universal forms of thought. The distinctions between the various parts of speech, between the cases of nouns, the moods and tenses of verbs, the function of particles, are the distinctions in thought, not merely words...The structure of every sentence is a lesson in logic" (Rectorial Address at St. Andrews. 1867) (Jespersen 1924,1934, 47).

pragmatism[12].

The role of grammar in natural language is to facilitate the communication of meaning by providing an organisational structure that links human utterances (words or parts of words). Universal13 principles of natural language were put forward by Noam Chomsky (Chomsky 1957,1975). His theory of transformational grammar was based on a system of internalised rules[14] capable of generating an infinite number of grammatical sentences.

> Linguistics itself, based on the conception (permitted by the theory of the sign) that *la langue* is a formal system, has lost interest in the symbolic aspects of language and studies nothing but its formal order as a "transformational" structure. Such are the theories of Noam Chomsky...Instead of trying to discover why *la langue* is constituted as a system of signs, the generative grammar of Chomsky shows the formal, syntactic mechanism of the recursive whole of language, whose correct realisation results in *signification* (Kristeva 1989, 17).

For generative grammarians[15] in linguistics, *grammar* refers to the entire system of structural relationships in a language, viewed as a set of rules for the generation of sentences. Transformational generative grammars emerged with the use of computers for the analysis

---

12 Peirce wrote two seminal articles, *The Fixation of Belief* and *How to Make Our Ideas Clear* (1877-78) (Robert 1995, 727).

13 Chomsky suggests "linguists must be concerned with the problem of determining the fundamental underlying properties of successful grammars. The ultimate outcome of these investigations should be a theory of linguistic structure in which the descriptive devices utilised in particular grammars are presented and studied abstractly with no specific references to particular languages"(Chomsky 1957,1975, 1).

14 As Kojin Karatani describes qualities of internalised language rules: "Moreover not only the figure of chess but metaphors of games in general tend to lead us to the conventional preconception that a rule must be able to be explicitly given. Grammar for example, is usually understood as a rule of language. But does one who speaks Japanese know its grammar? Having originally been invented as a method to learn foreign and classical languages, grammar is less a rule than a regulation that, if not mastered, makes language acquisition very difficult for foreigners. The grammar of one's native language, in contrast, is not only unnecessary but also impossible to conceive. Consider the fact that before the advent of modern nationalism, people did not even dream that there could be grammars of their vernacular languages. The rules of languages are constructed not from the standpoint of those that speak them, but from the standpoint of 'foreigners' who wish to learn them"(Karatani 1995, 134). In Chapter 4 rules for my own art are considered from the point of view of both a "speaker" (form maker) and a "foreigner" (reflective practitioner).

15 Generative linguists develop grammars that they test by probing whether they generate the sentences of the language and no others. In Chapter 3 the work of Joan and Russell Kirsch and others demonstrates how shape grammars may be used similarly in art.

of natural language, concentrating on formalist[16] approaches. While still conceiving of *grammar* as "the study of forms and constructions", recent work in linguistics has brought about a "blurring of the boundaries" between grammar, lexicography and semantics leading to a new theoretical science[17] called *grammatology* (Kristeva 1989, 31).

These developments in linguistics are echoed in the visual arts. The metaphorical use of *grammar* in art and design has a long history, and especially in architecture[18]. Traditional visual arts attempt to make seemingly tacit[19] practice transparent through rhetoric and so-called rigorous critique. Viollet le Duc uses both *grammar* and *language* in *Dictionnaire Raisonne de l'Architecture Francaise:* "The first condition of design is to know what we have to do; to know what we have to do, is to have an idea; to express this idea we must have principles and form; that is grammar and language" (Viollet-le-Duc 1866). Shape grammar exponents such as Lionel March propose a merging of world views and a contingent view of rationality:

> Contrary to conventional wisdom, rationality does not flourish in the presence of objective certainty but actually thrives around subjective volition. To be rational requires the willingness to restructure the world on each contingent occasion, or in just two words: to design" (March 1996).

This thesis explores the idea that tacit rules of art and design may

---

16 A contingent basis for grammatical analysis in art and design is suggested by Chomsky's claim that "knowledge" and "predispositions" for language, though innate, depend on environmental conditions for their formation. However, some critics such as John Lyons question whether Chomskyan claims of universality and the innate origins of language accounts for the problem of a child's success in constructing a grammar of her/his language on the basis of utterances s/he hears around him. Chomsky says, "the language is reinvented each time it is learned, and the empirical problem to be faced by the theory of learning is how this invention of grammar can take place" (Lyon 1970, 112). Lyons points out that "Work in the comparative study of animal and human behaviour which is normally described as instinctual requires particular environmental conditions during the period of 'maturation'. Whether one says that such behaviour is innate or learned by experience is a matter of emphasis: both instinct and environment are necessary, and neither is sufficient without the other" (Lyon 1970, 113). Contingencies of particular environmental conditions seem to play a part in the formation of our mental set or rule sets for living.

17 Grammatology studies the unseen trace, a mechanism of "difference", and in this view, when writing something is traced but not represented (Kristeva 1989, 17).

18 Johnson recognises three theories: "two having a behavioural base—Oscar Newman's 'defensible space' and Roger Barker's 'behaviour setting' theory—and the third having a semantic base, the theory of signs by which architecture is construed as a language consisting of a vocabulary arranged according to a grammar by which meaning is conveyed" (Johnson 1994, 13). Regarding the latter, Johnson suggests the theory of architecture as a (universal) language "has reached both its local and temporal limits" but recognises (after Broadbent) some architectural languages as grammatical codes that use consistently recognisable formal elements (Johnson 1994, 16-17).

19 Polyani is a strong advocate of the idea of tacit practice (Polyani 1967).

become conceivable in discourse through grammatical analysis.

Thesis statement

Using the terms set out above, the major hypotheses and two sub-hypotheses of this research can be stated.

The major hypothesis of the work is that a well developed *contingent sense of grammar can facilitate the understanding, creation, and discussion of form-making in art and design*. This hypothesis requires that the idea of grammars is generalisable and that particular grammars are contingently generalisable. I suggest that a contingent understanding of grammars enables novel explorations of form making, the new understanding of past achievements, and interdisciplinary discourse about form making.

Sub-hypotheses

The first sub-hypothesis focuses on the process of form making:

(1) *An understanding of grammatical design can enhance a reflective design activity.*

Jürgen Habermas describes how rational reconstructions may contribute to self knowledge:

> Self reflection leads to insight due to the fact that what has previously been unconscious is made conscious in a manner rich in practical consequences: analytic insights intervene in life...A successful reconstruction also raises an "unconsciously" functioning rule system to consciousness in a certain manner; it renders explicit the intuitive knowledge that is given with competence with respect to the rules in the form of 'know how' (Habermas 1979, 23).

This contention that interpretation of each moment of the design continuum is enhanced by recognition and understanding of rules for form making is particularly relevant in education. The novice is encouraged to be aware of patterns and codes of behaviour in her/his own and other's work, and hence to be in a better position to reflect on (and perhaps change) these patterns and codes. A recognition that the contingency of grammars means that these may be *turning* or *change points* in the progress of design leads to the second sub-hypothesis:

(2) *Revealing the contingency of grammars can expose moments of inspiration and redirection in a reflective design activity.*

While grammatical design understanding can contribute through the identification of codes and patterns of behaviour, the points where these patterns change is also significant. These are points where the design is being re-framed[20], where different possibilities are seen. Computer based media provide new arenas for the construction of 2D and 3D compositions that may be examined and recorded through the conception and construction phases[21], and through the ease of transforming and recording images, highlight both the continuity and apparent sudden changes[22] in the development of designs.

Significance

This thesis aims to contribute to art and design practice and related pedagogy. The practices of art and design are embodied in its discourse[23], where *discourse* refers to both the literal and metaphorical meaning; the writing about the work and the work itself. In any discipline, *vital*[24] discourse and practice depends upon the lucidity and elegance of both the analysis, and generation of ideas. By using first hand accounts of a contingent sense of grammar the thesis demon-

---

20 See, for example, Schön's description of the derivation of a design by an architecture tutor in *The Reflective Practitioner* (Schön 1983a). Schön suggests that by expanding the boundaries of design to include policies, institutions and behaviour itself that "We risk ignoring or underestimating significant differences in media, contexts, goals, and bodies of knowledge specific to the professions. But we may also discover, at a deeper level, a generic design process which underlies these differences" (Schön 1983a, 77).

21 Most design software (eg *Photoshop, Director, Form•Z* and *Strata Studio Pro*) incorporate transformation operations, as are explicitly rule based research software such as *DiscoverForm, Tartan Worlds* and the various components of the *SEED* project (Flemming and Coyne 1993).

22 Schön suggests a generic process shared by the various design professions. He describes designing as "a conversation with the materials of the situation...In a good process of design, this conversation with the situation is reflective. In answer to the situation's back-talk, the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which has been implicit in his moves" (Schön 1983b, 79).

23 "The term discourse designates in a rigorous and unambiguous fashion the manifestation of *la langue* in living communication" (Kristeva 1989, 10).

24 The term "vital" refers to discourse on the nature of reason. José Ortega y Gasset observed "mathematical reason, pure reason, is only a particular species or form of reason. To understand mathematical reason as reason pure and simple is to take the part for the whole: an error. Alongside mathematical, 'eternal' reason, and above it, is *vital reason*", and that, "Vital reason and living are 'one and the same thing'; life itself is vital reason, because 'to live is to have no other remedy than to reason in the face of one's inexorable circumstance'" (*En torno a Galileo; Complete Works*, V, 67). Quoted in (Marías 1967, 453).

strates a facilitation of art practice, an elucidation and generation of visual ideas, and thus contributes to the empowerment of actors in the visual domain.

Controversies raised by this thesis are of major significance for the visual arts. For example, Coyne articulates a twentieth century shift away from dualist Platonic essences by invoking the relevance of Dewey's pragmatism[25] and the tropic[26] cogency of participation in multiple layers of discourses (Coyne 1996). Coyne argues that grammatical approaches are privileged because they maintain a dominant and disabling Cartesian legacy of control based on misguided notions of unity and a search for conventional ideas of reality and truth. However, this thesis emphasises that ideas of grammars, contingency, and rules can on balance, enable artists, and apply regardless of whether some discourses are privileged.

This kind of debate reflects significant concerns about the fundamental operation of languages for communication and the empowering abilities of grammars in the visual arts. For example, proposing a hermeneutics of freedom whilst aware of the privileging of some discourses, Gerald L Bruns suggests a *sens sauvage*, "a sense that cannot be completely domesticated", resides within as a link between freedom and contingency (Bruns 1992, 260). Notions such as these are not denied in the computational metaphor as suggested by some critics of grammatical paradigm but reside within unspecified realms of *signification.*

The substance of the thesis also resides in its contribution to concerns about the value of tropology, typology, principles and pedagogical guidelines. Paramount related issues are

- the value of the use of metaphorical tools in art and design (such as the computational metaphor)

25 Dewey's view stresses a process rather than product emphasis in art (Dewey 1980).
26 White and Kristeva portray tropology as a basis for discourse development (White 1978; Kristeva 1989). Their view widens the scope of the thesis to include broader cycles of intellectual history.

• fundamental views about the operation of language and visual communication

As Coyne and Snodgrass suggest, all metaphors simultaneously reveal and conceal. Searching for those that are potentially capable of revealing more than they conceal is a key task.

The aim should be to understand and thereby assist what already works rather than to bind designing in a methodological straitjacket. This involves a close examination of the part interpretation plays in the design process; how preconceptions function in the process of selection and evaluation; how preconceptions lead to prefigurations of the design product; and how tacit experience and skills enter into the situation (Coyne and Snodgrass 1991, 21)

Whilst any study at some point will involve language, the controversial aspects of grammars reside in the problem of whether thinking occurs essentially in terms of language and whether language may be adequately or usefully represented by grammars of visual language.

Roman Jakobson's work on the fundamentals of language (Jacobson 1956,1971; Jakobson 1971) led many researchers to investigate the emergent features of sound that serve to distinguish sound units from each other. In discussion about the ways poetry differs from prose, Jacobson's work suggests ways of exploring form making discourse: by the use of interrelationships, by emphasising resemblances and promoting through repetition *equivalences* or *parallelisms* of hue tone, line, volume, texture and movement, form patterns and opens spaces, *foregrounding* its formal qualities, and consequently *backgrounding* its capacity for sequential, discursive and referential meaning. Similarly, constructing a different kind of language through a grammatical approach to art suggests a significant re-examination of current strategies, releasing them from nineteenth and twentieth century "methodological straitjackets". This thesis significantly argues that additional alternative protocols are required for this release in the visual arts.

Audience

The intended reader will be familiar with the notion of grammar

and the shape grammar paradigm and will be interested in how the notion of grammar connects with art and design practice. As a contingent sense of grammar is ubiquitous, an inter (and multi) disciplinary audience with an interest in art and design practice may find material that contributes to their respective discourses.

Discourses are human interactions, which seek to show the grounds for thinking. Thinking may be construed as visual as well as verbal. Einstein, for example, first constructed his model of the universe with nonverbal signs[27] and wrote to Hadamard[28]:

> The words or the language, as they are written or spoken do not seem to play any role in my mechanism of thought. The psychical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be 'voluntarily' reproduced and combined (Sebeok 1991, 57).

The approach adopted in unfolding this view follows Coyne and Snodgrass who suggest an approach based on the hermeneutical account of how understanding in any area of endeavour is acquired (Coyne 1991, 2).

My argument recognises that metaphors of grammars in art promise practical value by encouraging deeper reflection on form making, and consequent legitimation of action: through reflective action, ideas of grammars, contingency, rules and form making in art and design can contribute to vital discourse and practice. Just as Habermas sought to discover an interdisciplinary viewpoint from which practical interest and theoretical contemplation will justly fall together, an audience of artists, designers and educators also may reconsider their theoretical position and practice in relation to concepts of grammars, rules and contingency.

Methodology

---

27 Following Thomas A Sebeok, pioneer of Semiotics, Kristeva conceives of *grammar* as "the study of forms and constructions", and outlines a current linguistic view of sign types: "Envisaging *la langue* as a formal system, linguistics currently distinguishes, among linguistic forms, those that are autonomous (they signify notions: people, to live, red etc.) and others that a re semi-independent or simply links (they signify relations: *of, to, where. of which*, etc.). The former are called *lexical* signs, the latter *grammatical* signs" (Kristeva 1989, 31).

28 Jacques Hadamard is considered a pioneer of computational approaches to shape grammars for his early work in mathematics (Hadamard 1945).

This thesis uses a research methodology consisting of a literature review, interviews with key participants in the field and a documented experimental program of personal practice. Each strategy contributes a distinct view upon the domain of grammars and contingency to highlight the concept of a contingent sense of grammar.

The original contribution is:

- to frame a sense of grammar within a recognition of contingency and the hermeneutic circle, rather than within a rationalist view
- to research how this view accords with:

(a) the experience of a corpus of interviewees chosen because of their work in theory, art and design practice and teaching

(b) the literature on a small corpus of art work

- to demonstrate a contingent sense of grammar in action through reflection on my own work as an artist.

Literature

Architectural history demonstrates the use of grammars as typology (giving many types and their instances, eg Vitruvius, Palladio), but the problem of computationally representing visual arts grammars was not addressed in the literature until the late 1960s.

Concepts of grammatical systems in visual languages began with pioneering work on picture languages (Kaneff 1970) that was initiated by Russell Kirsch (Kirsch 1966). The Serialist movement in music and art influenced Lionel March who used grids to restrict the set of dimensional values used in his art work[29] (March 1981b; March 1981a). The formalisation of *grammars* of art and design as a computational system[30] following Chomsky's ideas was developed in the early work of Gips (Gips 1975) and Stiny (Gips and Stiny 1972; Gips

29 March's interest in contradiction and chance within rational design established a relational logic based on the work of Charles Sanders Peirce (March 1983). His art work is discussed in Chapter 3.

and Stiny 1973; Stiny 1975; Stiny 1976), Downing (Downing and Flemming 1981), Flemming (Flemming 1978; Flemming 1986; Flemming 1987b; Flemming 1987a; Flemming 1989), and (Oksala 1979). Early applications of shape grammars may be seen in (Stiny 1977; Stiny and Mitchell 1978b; Stiny and Mitchell 1978a).

By 1980, the idea of grammars became intrinsic to Stiny's proposal that "develops the idea that a language of designs can be defined from scratch by rules which apply to a vocabulary of building elements" (Stiny and Mitchell 1980a, 416). George Stiny[31] proposed a *constructive* approach[32] to languages of design by means of shape grammars. For Stiny, this program,

> provides for languages of designs to be defined by moving from a completely unstructured situation where anything is possible (designs constructed by combining transformations of shapes in a given vocabulary by shape union and shape difference) to highly structured ones where only things with properties are possible (designs constructed by shape grammars based on the vocabulary and spatial relations between the shapes in it). The transition from stage to stage in the program allows for the definition of rules which apply to construct designs (Stiny and Mitchell 1980a, 459).

A formal theoretical machinery for the definition of languages of two- and three-dimensional spatial design was established (Stiny and Mitchell 1980b, 343). Applications of this theory have been developed in architecture[33] but the art field[34] has relatively few recorded explorations[35]. Specific study of "computer art" in relation

---

30 Alan Newell and Herbert Simon encouraged an understanding of human problem solving as rule (Newell 1972). John Lansdown refuted the view that *all* designing could be reduced to problem solving and suggests that in knowledge based design systems, "The currently available knowledge representations, with their emphasis on purely logical inferences, also seem to be inadequate to describe the richness of designers' reasoning powers and, with the exception of 'possible world' models, none of the proposed extensions to the representations are without severe theoretical problems" (Lansdown 1987, 265). Richard Coyne's early work endorsed the idea of the utility of design grammars (Coyne 1985) but he later rejected this view on the grounds that it was more disabling than enabling in the practice. Other studies suggest similar conclusions (McLaughlin 1993).

31 As an artist, Stiny used his own paintings in his series *Urform, Anamorphism, Bridgework*, in his PhD thesis (Stiny 1975), which led to *Algorithmic Aesthetics*(Stiny and Gips 1978).

32 Stiny suggests that a *constructive* approach like shape grammars "will ultimately replace the kindergarten method in the studio and in practice" (Stiny and Mitchell 1980b, 416).

to language and "artificial imagination" was approached by Peterson (Peterson 1986).

Recent previous studies in the field concentrate upon more technical aspects of grammars. Recent theses support the field of grammars as a topic of international significance (Tapia 1996; Chase 1996). Tapia's study suggests a relation between shape and style may be represented with shape grammars using computation, presentation and selection, while Chase proposes that by using formal logic models of design one may identify emergent features as a useful tool in architectural design. Both studies suggest grammars complement and add to the repertoire of strategies for art and design exploration but do not concentrate on the application of grammars to the field of art.

Recent work in computer aided architectural design suggests grammars remain a source of speculative potential for the visual arts. Many have postulated grammars as a computer tool for designing (Junge 1997), but few studies have used grammars first hand in an art practice or in education.

Gerhard Schmitt has used a grammatical approach to architectural design education for 15 years and reports his work as effective and potent while addressing a "serious deficit in education regarding the new roles of computing in design" (Junge 1997, 3). Others such as John Habraken in the field of architectural design and Suguru Ishizaki in typographic design have clearly demonstrated the utility of the grammatical design paradigm in their respective practices. A 30 year history of grammatical design research suggests the grammatical paradigm may provide similar results in the field of art. For

---

33 Examples may be found in the following: (Eastman 1973; Gero 1984; Hanson and Radford 1986; Wojtowicz and Fawcett 1986; Chase 1989; Welsh 1989; Tapia 1996; Vakaló and Liou 1996; Fawcett nd).
34 Examples in art are often early explorations of proof of concept: (Gips and Stiny 1972; Stiny and March 1981; Cohen 1984; Makkuni 1986; Kirsch 1988; Lauzzana and Pocock-Williams 1988; Makkuni 1988; Lansdown and Earnshaw 1989; Edmonds 1992; Knight 1993; Knight 1994; Petrovich and Tanaka 1994; Colan 1995; Grabska 1995; Tarransky 1995).
35 A history is reported in (March and Stiny 1985). Raymond Lauzzana documented a general history of colour and visual formalism (Lauzzana 1993; Lauzzana 1994). The journal *Leonardo* records various early attempts to formalise computer experiments throughout the 1970s and continues to uncover this research endeavour (King 1995).

a report on the status of the field and detailed reference of the developments in design and computation see (March and Tapia 1997).

Interviews

My interviews provide first hand original accounts by selected participants about the nature and role of grammars. Some are very well known international figures, others are less well-known but selected because of their personal experience in an area of theory, education and/or practice which is relevant to this research. The interviews use the same open-ended questions (as supplied in the Appendix) but often generate diverse responses. Each interview was recorded on audio and video tape. Transcriptions were sent back to the interviewee for proofing before a legal release was sought. The list of 32 interviewees was: Bill Barminski, Robert Stern Galleries (artist), Robert Woodbury, University of Adelaide (shape grammarian working on computational models of solid grammar interpreters), Adrian Snodgrass, University of Sydney (philosophical writings on hermeneutics), Richard Coyne, University of Edinburgh (philosophical and computational experience of logic and hermeneutics), Lionel March, UCLA (artist, mathematician and early adopter of shape grammars), Mark Tapia, UCLA (interest in shape grammars in art and design), Raymond Lauzzana, Pratt Institute, (artist, editor of *Languages of Design* journal), Tom Seebohm, University of Waterloo (architect with first hand involvement and philosophical interest in grammars), George Stiny, MIT (artist, mathematician, and pioneer of shape grammars), Terry Knight, MIT (theorist and implementer of shape grammar in design education), Philip Pearlstein, (artist using traditional life drawing and painting skills), Sid Sachs, Lock Gallery, Philadelphia (curator with interest in grammars), Larry Becker, Becker Gallery, Philadelphia (curator and collector of contemporary art interested in grammars), Robert Venturi, (architect, and architectural theorist); Denise Scott Brown, (architect, and architectural theorist), Alvy Ray-Smith, Microsoft (artist), Scott Chase, National Institute of Standards and Technology,

Washington(architect using shape grammars in research), Joan Kirsch, (art historian with interest in grammars), Russell Kirsch, NIST (researcher who pioneered computational shape grammatical approach in art), Marco Zanini, Sottsass Associati, Milan (artists/designer), John Wood, Goldsmith University (artist, philosopher, educator), John Rollo, University of Bath (architect using shape grammars in research and education), Catherine Teeling, University of East London (architect using shape grammars in research and education), Paul Richens, Director Martin Centre, Cambridge (architect and researcher in computer-aided design), William Fawcett, Cambridge Architectural Research (architect, and architectural theorist), John Lansdown, University of Middlesex (Emeritus Professor, architect, artist and researcher), Gregory Moore, University of Middlesex (architect, and architectural theorist), David Walker, Open University, Milton Keynes (architect and editor of *Codesign* journal), Paul Margerison, Open University (doctoral research on computational graphics), Richard Wentworth, (artist), Philip Cox (artist and architect) and Neil Hanson, (Sydney architect, with experience of shape grammars). The Appendix contains a complete transcription of each interview recorded at the interviewee's address during July and August 1996.

The artists included in Chapter 3 were chosen because they each contributed a unique example of the interpretation of grammars within their work and discourse, and a first hand viewing of their work was possible. Two groups emerged: (Group 1) those whose works appear grammatical without themselves using the term (Richard Diebenkorn, Joan Miro, Ed Moses, and artist/film director Derek Jarman), and (Group 2) those that took a grammatical view of their own work (Lionel March, Alvy Ray Smith, John Lansdown, Philip Pearlstein).

Statement of Assumptions

Contextual assumptions about the nature and role of current discourses, impinge upon the concerns of the thesis. In the field of natural language, following Kristeva[36], *discourse* involves both social[37]

and formalist devices for communication. *Discourse* can be distinguished from *speech* and *history* because it "designates any enunciation that integrates in its structure the locutor and the listener, with the desire of the former to influence the latter" (Kristeva 1989, 11).

Discourse through art, architecture and design traditionally occurs in statements and responses of image and object making[38]. Sharing ideas through the written word, for many designers, is a secondary[39] concern. Current art discourse includes dissension, such as whether "materiality" and "realms of logic" simultaneously drive art and design practice[40]. This occurs in rapidly changing circumstances[41] that suggest the following strategies:

(1) *A redefinition of sense of self and place due to the changing cultural practices brought on by recent technology.*

Academic paradigms of scientific inquiry have been challenged by more interpretive and critical sociological research frameworks

---

36 From Saussure, according to Kristeva, the study of language may include both psycho-logical and psycho-physical aspects. The term *la langue* is used to isolate the psycho-logical (social) from the individual parts of speech including phonation. For Kristeva, "The term *discourse* designates in a rigorous and unambiguous fashion the manifestation of la langue in living communication. Clarified by Emile Benveniste, discourse is contrasted with *la langue*, which thence designates language as a collection of formal signs, stratified in successive layers that form systems and structures. Discourse implies first the participation of the subject in his language through his speech, as an individual" (Kristeva 1989, 10).

37 For structuralist psycho-analyst Jacques Lacan, discourse is the realm of psychoanalysis: "Its means are those of speech in so far as speech confers a meaning on the functions of the individual; its domain is that of concrete discourse, in so far as this is the field of the trans individual reality of the subject; its operations are those of history, in so far as history constitutes the emergence of truth in the real" (Kristeva 1989, 11). He supports Roman Jakobson's formulation of how language works. Jakobson argues that "a universal 'competition' between both modes (metaphor and metonymy) will be manifested in any symbolic process or so called system of signs, be it intrapersonal or social, and instances that of painting where it is possible to distinguish between Cubism as metonymic and Surrealism as metaphoric in mode" (Vesey and Foulkes 1990, 80).

38 Throughout art, architecture and design history forms develop as statements or homages to previous work. Three well known examples are, Marcel Duchamp's response to the earlier work of Leonardo Da Vinci (*La Giaconda*); Pablo Picasso's to Diego Velasquez' (*Las Meninas*) and Richard Diebenkorn's to Henri Matisse (*The Studio, Quai St Michel*, 1916).

39 In a changing electronic communications environment that relies upon direct visually transmitted messages the two may become intertwined. For example, Bob Cotton and Richard Oliver suggest new ways of exploring images through hypermedia: "Starting by selecting an object within the painting, the user can explore the context and content of the image from a variety of different perspectives" (Cotton and Oliver 1993, 48).

40 Mainstream accounts of the art of today uphold the dialogue between tradition and the avant-garde while proposing identity as a key component of 1990s art practice: " In some ways the most powerful conflict has been between the Conceptualist position and work rich in declared significance that belongs within a referential or narrative mode: work that wishes to speak directly of issues of gender, race, identity. Such work, that elevates legible content over form and strategy, became the most general category of advanced art in the decade to 1995 (Taylor 1995, 167).

41 Umberto Eco distinguishes between context and circumstance: "The context is the environment where a given expression occurs along with other expressions belonging to the same sign system. A circumstance is the external situation where an expression, along with its context, can occur" (Eco 1990, 214).

(Connole 1990) leading to revised foundations for design research and practice (Winograd and Flores 1986) in a rapidly changing technological environment (Forester 1985; Mitchell 1995). For example, Mitchell describes the change of sense of the importance of physical space due to the onset of virtual digital representation of previously bricks and mortar institutions in financial, educational and political fields[42]. These changing conditions impinge upon any expression of self and place through art, architecture and design.

(2) *A realisations that previous scientific understandings of the nature of knowledge are more vulnerable to criticism than previously thought.*

Art and architecture, as with all design fields, are redefined (in the Wittgensteinian[43] sense) by sociological discourse. Post structuralist frameworks herald a deconstructive attitude and approach to form making (Ferraris 1989; Derrida 1976; Liebskind 1981). Art theory simultaneously embraces cultural relativity through multiple views of phenomenology and feminist frameworks while incorporating linguistic references and analysis in critique.

There is a broader acknowledgment of the place of metaphysical exploration, and consequently qualitative agendas, within traditional research frameworks. Twentieth century Western culture has more clearly recognised traditional aspects of Eastern philosophical thought such as transcendentalism, through phenomenology and hermeneutics. References to the metaphysical (Collingwood 1938; Carr and Kemmis 1986) have been more readily accepted by writers on the philosophy of science such as Paul Davies (Davies 1987, 1995).

---

42 Mitchell stresses a digital revolution that replaces bricks with bits: "Electronic linkage is substituting for physical accessibility and for convenient connection by internal circulation systems of buildings, so that access imperatives no longer play such powerful roles in clustering and organising architectural spaces" (Eco 1990).

43 Ludwig Wittgenstein rejects logical atomism alluding to the reflective nature of discursive practice: "Someone coming into a strange country will sometimes learn the language of the inhabitants from ostensive definitions that they give him; and he will often have to guess the meaning of these definitions; and will guess sometimes right, sometimes wrong. And now, I think we can say: Augustine describes the learning of human language as if the child came into a strange country and did not understand the language of the country; that is, as if it already had a language, only not this one. Or again: as if the child could already think, only not yet speak. And 'think' would mean something like 'talk to itself'" (Wittgenstein 1958, section 62) Quoted in (Kenny 1994, 56).

(3) *A development of new reflective meta languages for interdisciplinary discourse based on a discourse of non-closure and transgression.*

Reflective action (Schön 1983) in practice (via hermeneutical understanding) may reinterpret logical positivist notions of objectivist method and process. Openness is stressed instead of closure; transgression instead of mastery; juxtaposition instead of a binary dialectic. Opportunity for a redefinition of notions of art may reside in reflective meta language strategies that challenge past art institutional dogma.

(4) *A re-evaluation of future grammatical educational directions in keeping with cultural, ecological and technical concerns for action.*

Culturally, historicism[44] and pluralism provide contemporary artists with multifarious directions for future practice while searching for the *nouvelle,* shocking, or so-called creative event or product. Increasingly broader parameters of art discourse are encompassed in the work of art theorists such as Victor Burgin (Burgin 1986; Burgin 1986), Norman Bryson[45], Rosalind Krauss[46], Martin Jay[47] and others. A questioning of the role of theory, the identity of artists, definition of history and the dominance of the ocular sensibility are themes that rely on broader frames of references than formalist anal-

---

44 In his establishment of guidelines for historical studies Wilhelm Dilthey realised that historicism without a new epistemological grounding was exposed to the dangers of relativism (Makkreel 1975, 4). For an introduction to Dilthey's work see (Hodges 1944).

45 Norman Bryson's work exemplifies the increasing tendency in most of the humanities towards an awareness of the interpretative strategies that constitute their individual disciplines. He aims to locate art history within the context of theoretical debates currently taking place in other fields by examining interpretative models that might generate the basis for future art historical work. For example, in his essay, *Real Metaphor*, David Summers questions previous understandings of conceptual art and proffers alternatives to the "linguistic imperialism" that "begins to look more like what I think it is: an episode in modernist formalism, and therefore in modernist iconoclasm" (Bryson, Holly et al. 1991, 257). These issues reiterate the changing context of art practice and point out the complexities inherent in any attempt to analyse art process.

46 Krauss writes of Saussure's notions of *parole* (what it feels like to be inside language) and *langue* (an utterance of separation for purposes of analysis) defending formalist analysis from a primarily connotative viewpoint: "the possibilities that structuralism and the linguistic model offer for deepening our understanding of our social and symbolic systems are too real and too important not to get them right" (Bryson, Holly et al. 1991, 93). Formal analysis by theorists seems to rely on rhetoric and privileged aesthetic discourse. Simple attempts to discuss paintings in terms of formal elements dominated early art history concerns (Harris 1946). Recent analysis has relied on shape grammar formalisms as in the work of Hans Günter König (König 1992; Kluge 1996).

47 Jay questions *ocular centrism*, the dominance of the sense of vision in art history. He explores the configuration of new interpretive strategies of much recent French thought characterised as anti humanist, anti modernist and counter-enlightenment and, calls for a plurality of "scopic regimes" (Jay 1993).

ysis appears to allow[48].

This thesis emphasises that communities of language users maintain a variety of discourses simultaneously and the non-mechanistic aspects of shape grammars as fluid objects (like languages themselves which are also changing, albeit gradually). Other critics seem to concentrate on the formal rigor of shape grammars, missing their real use, as an exploration tool.

(5) *Self creation is enhanced by a strategy of "legitimation".*

In this view, knowledge of one's place in society and the value of one's actions leads to a vital community and the fulfilment of human potential. Following McGowan's notion of a "legitimation" of all action, Karatani proposes a contingent sense of self and community dependent on self-defined systems of rules:

> Thus, community should be redefined primarily as a space enclosed within a certain system of rules, irrespective of its actual scale. Village, race, nation-state, Western Hemisphere, and even the self (as a self-contained monologic space) may be seen as communities (Karatani 1995, 144).

Special communities of language[49] users develop their own systems of rules for discourse. Choosing a metaphor is a matter of contingency:

> These are matters of interpretation, and the correctness of the assessment depends not so much on a knowledge of rules or algorithmic formulae as on skills of judgment, tacit knowledge and experience in understanding the unique case. If this seems lacking in objectivity and rigor, it is no more so than the ways scientists

---

48 Discourses often conflict and reinterpret culture in changing contexts. For example, Vilfredo Pareto identified alternative sociological discourses especially in relation to developing countries that accept a mixture of logical and non-logical approaches to life (Pareto 1963). Secondly, popular schools of thought such as Ecodesign incorporate ecological crisis concepts such as "sacred" design into their redesign credo (Fry 1994, 113). Technically, the explorations of new media are radically influencing design educational theory and practice (Mitchell 1995; Kafai and Resnick 1996). The search for understanding of epistemological issues guides much recent technical education where artists are defining new roles within cyberspace (Mitchell 1995; Kafai and Resnick 1996). As evidenced by key publications over the last decade (Rheingold 1992; Richens 1994; Marchese and Marchese 1995; Bruckman 1996), architectural theory increasingly emphasises reflective approaches to practice and education.

49 For example, George Stiny uses discourse about particular languages that are taken from a universe of languages: "a language of designs contains descriptions of designs of every particular kind taken from the universe of designs. Where the nature of designs is exhaustive, including all possible designs independent of their special structure and properties, languages of designs are selective, including only designs satisfying certain additional criteria fixing their special structure and properties. In this sense, languages of designs may be thought of as corresponding to certain 'styles'" (Stiny 1981, 250).

assess the validity of scientific models. If not objective, neither is it subjective. Skills, experience and tacit knowledge are no more subjective than formal knowledge (Coyne and Snodgrass 1991, 20).

Without a reflective hermeneutic dimension, art practice becomes formularised tradition, as in some craft disciplines where innovation and novelty are lost. The inclusion of *both* aspects of hermeneutics, Dilthey's historicist questioning, and, Heidegger's ontological critique, are corner stones of contemporary art practice that contribute to moments of reflective insight.

Reflective Practice

Reflective practice as defined by Donald Schön (Schön 1983) provides an alternative legitimating strategy for the application of grammars to the field of art. Historically, artists that keep journals (such as Leonardo Da Vinci, Sir Joshua Reynolds and Paul Klee) provide influential reflections on their practice. In music, Arnold Schoenberg (Schoenberg 1948, 1975) exemplifies a critical and theoretical approach demonstrating that new historically aware reflective strategies for self-creation are required for the survival of a vital contemporary cultural milieu.

History suggests for postmodernists, such as Rorty and Habermas, that philosophy has lost its traditional role as seeker of essence and singular truth because they view the world as "made by language". For empiricists, the guiding problem of Western philosophy is the question, "What is a being?". For Heidegger, "Philosophy should strike an alliance neither with the scientific nor with the unscientific, but rather simply with matter itself, which remains one and the same from Parmenides to Hegel" (Heidegger 1980, 13). The notion that our time has no real philosophy in the conservative tradition suggests a focus on *reflective practice* in art and design. A research design that explores reflective practice is used in the personal experimental journal of Chapter 4, cognisant of these philosophical and grammatical issues.

Layout of thesis

This chapter has described the key concerns, background and scope of the thesis. Chapter 2 reviews some ways in which "grammar" is used in art and design discourse and posits "contingency" as a key concept in understanding the nature of grammars. Grammars are described as a metaphor, as a computational scheme and as a description of a kind of computer program. The contingent nature of rules and grammars in art and design is discussed. Chapter 3 examines work by some selected artists from a perspective of grammars through some selected texts and discussions with theorists and artists. Chapter 4 describes some reflective experiments in which senses of grammars and grammatical design are traced in image making with computer media. These experiments demonstrate how the development of images can be seen to follow from the contingent operation of transformational grammatical ideas in hermeneutical reflective action. Chapter 5 draws together these separate studies, discusses how they support the major hypothesis and two sub-hypotheses set out above, and suggests some ways in which a contingent sense of grammar may empower art and design novices.

2

Grammars and Contingency

Outline

Both "grammar" and "contingency" are used in a variety of senses. This chapter reviews some ways in which "grammar" is used in art and design discourse and posits "contingency" as a key concept in understanding the nature of grammars.

Grammars are described as a metaphor, as a computational paradigm and as a description of a kind of computer program. I then discuss the contingent nature of rules and grammars in art and design.

Grammars

1. The Metaphor of Grammars

Grammar is a familiar term in art and design, alongside (although less freely used than) terms such as "series", "themes" and "variations". It highlights awareness of form, repetitive patterns, constituent parts, compositional rules, and "families" of designs that share common formal features. The term is so established that it is now probably a "dead metaphor", meaning that in its use it is

understood without thought back to ideas of words, sentences and paragraphs of natural language (as, for example, the term "architecture" in "computer architecture" no longer conjures up thoughts of buildings).

The term "shape grammar" originated in the early 1970s in the work of George Stiny and James Gips on the characterisation of style in art[50] and design. Using Chomsky's definition of grammar: "a vocabulary of symbols or words, together with a group of rules that specify how elements in the vocabulary may be combined to form strings of symbols, or sentences, in a language" (Knight 1994, 25), shape grammars were conceived to generate languages of designs by manipulating shapes. Each manipulation or "derivation" resulted from the same group of rules that constitute a "grammar".

Furthermore,

> To those who are familiar with shape grammars and the considerable body of work that has been represented in shape grammars, the terms "grammar" and "grammatical" have become used in relation to designs and designing as metaphors for their use in shape grammars. A painting or a series of paintings are described as grammatical, meaning that they engender in the viewer a sense that a shape grammar could be written for them, not that they have been generated by the use of a shape grammar. In this sense it is a term understood in the discourse of the "grammatical cognoscenti" but misunderstood by others (Radford and Bruton 1997, 2).

Multiple understandings of the term grammar are beneficial; although there is a risk of confusion, these enframings also add to the richness of form making and its understanding. Metaphors and models do not have static, one-off meanings, but are potentially capable of revealing multiple meanings, which can be progressively disclosed by the to and fro movement of the hermeneutical circle:

> This takes place within a context interpreted through metaphors or models of the world. Not only do we pick up cues from within the metaphor or models themselves, but also from the situation in which they occur, so that the conceptual environment in which they

50 Knight describes the early evolution of the term "shape grammar" in her *Transformations in Design* as based on the linguistic theory of Chomsky, the pattern recognition models of Russell Kirsch and the pattern language work of Christopher Alexander and K S Fu (Knight 1994, 25; 251).

function plays an important role in the way we interpret and assess them. As the context changes so also does our understanding of the meanings of the models and metaphors we encounter (Coyne and Snodgrass 1991, 15).

Alongside grammar are associated terms originating in natural language that are also used in art and design: composition, syntax, meaning , and others. These other terms are also understood within art and design without reference back to natural language. This group of associated terms provide a frame of reference, but need not be read as a complete or formal system. Scruton, who objects to the idea of architecture as an equivalent to a formal system, observes: "If it were true that architecture were a language (or, perhaps, a series of languages), then we should know how to understand every building" (Scruton 1979, 158). This is only true if "architecture as language" implies identity[51]. Metaphors typically shed light on aspects of an issue (and simultaneously shadow others). The use of metaphors of language, grammar, and associated terms does not imply belief that the referee of the metaphor is in all respects the same as the referent. The ideal of a universal visual language that uses common notation (or scores) and works the same as a natural language in promoting "understanding" was dreamt of in the Bauhaus[52] but none eventuated. As Lansdown writes, "Art works such as musical compositions, poems, paintings, dances and so on do not carry messages in the same clear cut way as everyday prose. Decoding them is usually not easy—nor is it meant to be. Ambiguity and multiple meanings are inherent in such things" (Lansdown 1989, 67).

An insight into the nature of grammar that may be seen in art and

---

51 Even then the understandings would differ. In natural language words are variously interpreted, as Kripke recognises: "There can be no such thing as meaning anything by any word. Each new application we make is a leap in the dark; any present intention could be interpreted so as to accord with anything we may choose to do. So there can be neither accord, nor conflict" (Kripke 1982, 55). Quoted in (Karatani 1995, 121). Multiple meanings need dialogue and negotiated interpretation.

52 "There were people like Kandinsky, who felt they did have a notation. If you used reds or used blues, or use greens, you would be projecting very specific emotions. Or if you used certain lines, and shapes, you would also be conveying certain emotions. So they did have what they felt was a notation, but it's been far from universal. Perhaps this was useful for the painters whose work was intended to be especially symbolic" (Kirsch and Kirsch 1996).

design is provided by in Valéry in "Reflections on Art":

In general, if we examine a man-made object, if we consider its form, its *external structure*, and compare it to the *internal structure*, we should find a relation which is not the same as the relation we find between the internal and external structures of a so-called *natural* object, whether geologic or organic. I do not claim that the problem can always be solved; there are ambiguous cases, but quite frequently we find—on superficial examination, without the aid of a microscope—that in the human work the structure of the internal parts seems less important than the *form* of the assemblage. Thus the human work, regardless of its material, would seem to be an assemblage whose manipulator takes very little account of the internal structure of the thing he is fashioning. You can make similar things with very different materials; regardless of whether a vase be of glass, metal, or porcelain, it can assume pretty much the same form, but this means that (except during the actual process of manufacture) you have disregarded the *material* of which you have made the vase. Moreover, if you continue to examine the man-made object, you find that the form of the whole is *less complex* than the internal structure of the parts, and this suggests a disarrangement. In this sense, *order* imposes *disorder.* I recall that I once took this example: if you line up a regiment, you obtain a geometric figure composed of elements, each of which is far more complex than the whole, since each one is a man. Similarly, if you make an article of furniture, you disturb the organisation of the tree, for you cut it up and reassemble the pieces without concern for its internal structure. The wood provides you with stable elements which you can consider as invariable in relation to the forms and contours you give the assemblage (Valéry 1964). Quoted in (Karatani 1995, 26).

The metaphor of grammar captures this sense of order in matter and form. In this way, grammars, through enframings, may articulate a part of an artist's direction(s). Philip Pearlstein, for example, as a result of his graphic design career, enframed the world in terms of a pica ruler for many years (Pearlstein 1996). An artistic grammar may be regarded as a summary of an artist's current knowledge of the elements available to create art works (the vocabulary), and of how to make appropriate use of them for that purpose.

The alternative terms used in talking about the formal qualities of art and design (both as products and processes) emphasise other ideas. "Style" (both as noun and verb) is more general than "grammar". It is lacking the specific connotations of sequential derivation, of parts and wholes and the ability to identify the parts, of the deliberate concentration on form rather than meaning, of the importance of rules and regularities in the way the parts fit together.

Further, "style" is a label which can be applied to the way a grammar is used, as well as the grammar itself. Herbert Simon writes that "style is a way of doing things, chosen from a number of alternative ways" (Simon 1988). For example, it can apply to the choice of rules used in a shape grammar written to generate a particular series of paintings, or to the recognised differences between the work of painters from different eras. "Composition", like "assemblage" or "collage", is a more specific term: it suggests the ordering of wholes and parts but lacks the connotations of derivation. None of these terms suggest the "family" of like-designs which result from a sense of the "same" (or similar) grammar(s) in a corpus of work.

As in natural language, a sense of grammars in art and design suggests an awareness of grammatical rules. Artists and architects[53] interpret the term "rule" as a general axiom to describe the production process in which form-making rules are applied as "guidelines" rather than as "strict" rules. Referring to rules in art, Stiny said,

> The problem with artists, (at least recently) is, it is generally unfashionable to say you are working to any scheme or have any idea at all. Most artists that are good work too fast in the sense of being able to produce more things, one after the other. They have to have some set of rules that they are appealing to that let them work that rapidly.
>
> All you have to do is look at the difference between a student and an accomplished artist or accomplished designer. The accomplished designer will do it in the click of a finger and it all looks stylistically consistent with what they have done in the past. You can see links to it—it gets done. The student will sit there and agonise about it for six months and come up with a pile of rubbish, and not understand why, or why it was so hard, or what was involved. That seems to me to be a perfect indication that there is some computation going on, and computation that is pretty well worked

---

53 Artists interviewed as a part of this research (Barminski 1996; Lauzzana 1996; March 1996; Pearlstein 1996; Woods 1996) accepted the idea of a rule set for their design and identified changes in the derivations that were made both as a result of changes of metaphor and to rule systems. Amongst architects interviewed, architect/artist Philip Cox stated that his form making is dependent on general process rules about environmental constraints (Cox 1996). The final form is decided through discussion, ie in this sense, discourse about "designs" within particular contexts and within personal idiosyncratic metaphorical languages. Likewise, for another architectural practitioner, Neil Hanson, (Lawrence Nield and Partners), design is described using ideas about rules that are more specific (Hanson 1996). The recognition of the use of rules to decide directions and possibilities refutes claims that suggest form *only* emerges from tacit knowledge and interpretive understanding.

out. It might take the artist forty years to do it, to get to that point, but then the work gets defined and well known. It develops into a reasonable corpus.

Does the artist know it? Well, I don't know. Is any body going to say it? Well, I don't know. Is it an interesting way of looking at the material? Yes, I think it is. Do you want to make vast wild claims about it, that everybody works to rule? No, I don't want to do that. I think it is irrelevant. I don't think it means anything (Stiny 1996).

Some artists do explicitly refer to rules. For example, in the early twentieth century, the artist Paul Klee who taught at the Bauhaus typically wrote notes such as: "The rule is: extension or contraction of tonality combined with dimensional change, results in enlargement or reduction of area content" (Spiller 1970, 143). He described the cosmic evolution of style: "style developed cosmohistorically or cosmogenetically" (Bayer 1968, 63). Serendipitously inventing rules for form making became an acknowledged approach for the analysis and generation of visual languages in response to the modernist's vision of utopian communication systems (such as Bayer's *Universal* typeface)[54]. But the notion of finding a grammar (understood as rule set) in art seems to contradict twentieth century romantic stereotypes of artists as "rule-free radicals". Many artists warily react to the term "rules", as David Walker notes:

The problem with *rules* is that they sound a little bit too severe, and a little bit too rational, sequential. Whereas in fact the method of working for a lot of painters, sculptors, fine artists, architects, designers and so on, does not feel like that. They may be half consciously searching and deriving rules for themselves but the rule may not be explicit, nor exact, nor can it be replicated beyond the work. There is no fuzziness in *a rule* , but there is a lot of necessary fuzziness of work in progress, and that is the problem (Walker 1996).

Nevertheless, without some consistent features, an artist's work would become unrecognisable. This alone indicates rules are a part of the operation of art practice, as for other practice:

54 For example, Steven Holtzman concludes, "Visual art can be thought of in terms of grammars just as can other languages and systems of communication. Though to many it is less intuitive to think of the visual arts as languages, to the extent that they are forms of communication they must have sets of rules that permit interpretation...Experiments do date have barely begun to define the rich visual languages that address colour, texture, the rules of composition, dimensionality, and visual structures in time" (Holtzman 1994, 190-1).

You will always be guided by the rules or rules of thumb that are the content of any settled practice, by the assumed definitions, distinctions, criteria of evidence, measures of adequacy and such, which not only define the practice but structure the understanding of the agent who thinks of himself as a "competent member". That agent cannot distance himself from these rules, because it is only within them that he can think about alternative courses of action or, indeed, think at all (Fish 1985).

2. Computation and The Shape Grammar Protocol

In *The Logic of Architecture*, Mitchell (1990) argued for a logical model of architecture that would set a precedent for all design fields and claimed it was the next logical development in architectural theory[55]. He held that critical appraisal and understanding of design proceeds with the identification of formal properties:

Once we have established the space, shapes, primitives, properties, functions, and relations that will concern us in a design world, we can go a step further and axiomatize that world. That is, we can state necessary relationships between shapes that exist within it (Mitchell 1990, 54).

Over the last three decades the term "grammar" has been used to denote a well established and documented formal and computational protocol for describing designs in terms of shapes and relationships between shapes. The literature of *shape grammars* dates from the 1960s: "designs derived from a properly specified rule system, a *grammar*, constitute a *language*. Transformations of rules provide a translation from one language to another" (March and Stiny 1985). A discourse emerged that developed an articulate system of rules that describe designs. Past work (a Mondrian painting, a Greek vase pattern, a Palladian villa) may be interpreted and characterised by using the shape grammar mechanism to illustrate both a sense of grammar and particular grammars that can be seen in the work. By studying, using and contingently making particular shape

55 This claim has been reconsidered since 1990 as the design of virtual communities have dominated architectural discourse. Mitchell reveals that his *City of Bits* "will be connected by logical linkages rather than by doors, passageways, and streets"(Mitchell 1995, 24). His international virtual design studio critique developed with Jerzy Wojtowicz (Wojtowicz 1995) parallels a logic model of architecture in its asynchonous and fragmented construction of design spaces. Allied formal approaches such as those that seek solid model interpreters within an internet environment also use language based metaphors to describe the grammar of logical design systems (Flemming, Coyne et al. 1993).

grammars, a "sense of grammar" is made manifest. They exemplify a sense of grammars as if design existed in a simpler rational world. In them, "rules" and "characterisations" of process are clearly set out.

While there are variations in the way the shape grammar protocol has been described in the literature[56], it depends upon the following key ideas:

1. *Vocabulary*: A vocabulary consists of the elements of a an image or form. Sometimes known as "primitives", these elements may be used to describe states of affairs or things. Recognition of an element may be the initiation of an analytical or generative use of the shape grammar mechanism.

2. *Start State*: A start state is the preliminary circumstances for a grammatical action. The start state may be represented by particular domains in different ways.

3. *Rules*: Rules describe changing conditions and show how a state may be altered. A rule shows how a condition may be changed by an action. "If-Then" decriptors are commonly used to describe the left hand side and the right hand side of a rule. Shape grammars show formal possibilities by encapsulating a restricted amount of information about a corpus of work using rewrite rules with labels and description schemes. A shape rule may be applied to a shape whenever there is a Euclidean transformation which will match the left hand side of the rule to a sub shape of the shape. *Spatial* and *state* labels may be used with rules to specify *where* and *how* rules apply to forms (spatial) and *when* rules apply (state). A spatial label's orientation and size is inconsequential but it has a definite

56 Terry Weissman Knight describes a shape grammar simply as "A set of shape rules, an initial shape, and a final state", and gives four simple example of shape grammars and the languages they define (Knight 1994, 63). Some examples may be found by Stiny (Stiny 1972); March (March and Stiny 1985); Knight (Knight 1994); Mitchell (Mitchell 1990), Tapia (Tapia 1996) and Chase (Chase 1996). Knight's description of the shape grammar mechanism recognises description schemes and Mitchell's both the *unary* and *binary* nature of transformations (Mitchell 1990, 122), with different types of rules such as those of recognition; replacement; labelled or unlabelled, and parallel or sequential replacement (Mitchell 1990, 127).

location in a spatial system of coordinates.

4. *Transformations*: Transformations result from rule application. Labels, if used, trace the orientation of forms in the transformation process. Operations such as addition, subtraction, reflection, rotation or change in position and scale transform a spatial state. Shape rules apply to generate designs nondeterministically. *Description schemes* describe associated transformations of content and meaning.

5. *Derivations*: Derivations are the result of transformations of a design space. Derivations may be finite or infinite, that is, some grammatical systems arrive at a final resolution, while others continue to evolve infinitely, (eg Mandelbrot Set).

6. *Spatial States*: Spatial states are the syntactical (structural order) and semiotic (interpretative meaning) circumstances that describe a shape. In formal terms a spatial state may be altered by a rule application creating a derivation of a design space. A final state is a spatial state from which no further derivation is made. Figure 2.1 shows a simple "rectangle and circle" grammar in which transformations are made to a spatial state using subtraction, addition and description schemes, following Knight's description of mechanism (Knight 1994, 57-61).

Chase (1996) provides a concise demonstration of the variety of designs that can emerge from a shape grammar with one rule in Fig 2.2.

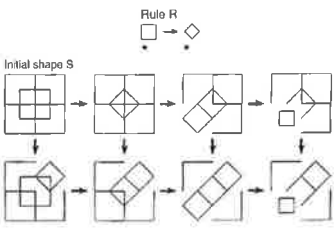


Fig. 2.2 Demonstration of the principle of shape grammars and derivation using rules. Application of rule R to initial shape S, and possible shapes generated (Chase 1996, 13).

Rules are applied in a design space seen as if from a window on the world of possible shape possibilities. Knight claims that "by demanding that shape rules take this simple form, the different spatial and non spatial mechanisms behind the generation of designs are distinguished" (Knight 1994, 67-69).

By using labels, and assigning values to parameters within a specification of a geometric transformation, two and three dimensional forms in an algebra can be articulated (Mitchell 1990, 141). By parameterising all the vocabulary elements of a grammar, spatial

The vocabulary of shapes consist of any circle and any rectangle but it is assumed they will be represented in the same location. Only those designs in a final state and with all spatial labels erased are in the language defined by the grammar.

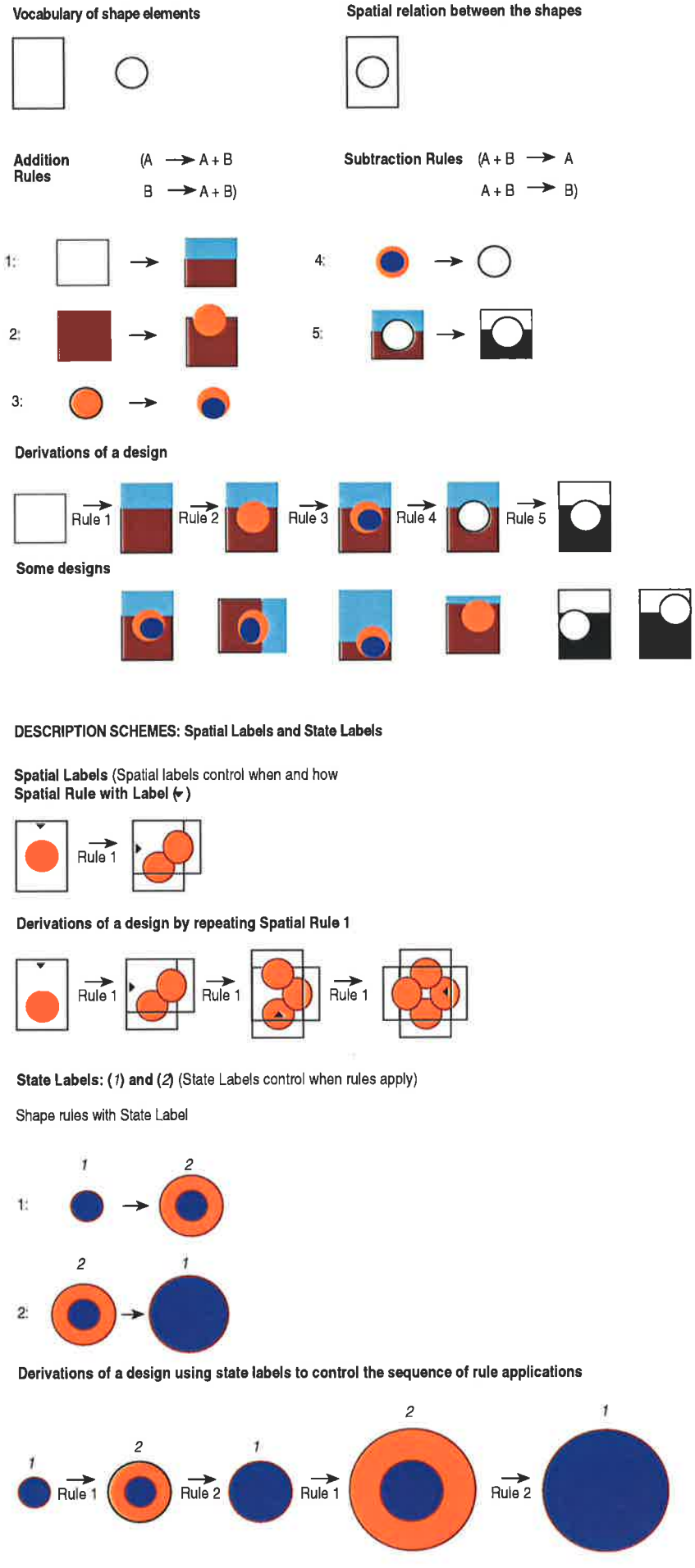


Fig. 2.1 Shape Grammar Mechanism

relationships of elements in a design space become flexible and applicable in many contexts. The important aspect of shape grammars for artists is that

> design exploration is rarely indiscriminate trial and error but is more usually guided by the designer's knowledge of how to efficiently put various types of compositions together and that such knowledge can often be made explicit, in a concise and uniform format, by writing down shape rules (Mitchell 1990, 181).

Shape grammars by themselves define languages of form making but give no indication of "meaning". No indication should be expected of a "grammar", where context and interpretation are also necessary. Knight proposes that an explanation of the content or meaning of a form or spatial relation can be associated with it in terms of a *description scheme* which consists of "a set of rules expressed in terms of words, symbols, or even pictures. Each rule of a description grammar is linked to a rule of the corresponding shape grammar. Whenever a rule in the shape grammar is applied to generate a design, the corresponding rule in the description scheme is applied to generate a description of that design" (Knight 1994, 33).

Knight describes her own approach to writing a grammar for a body of existing work thus:

> What I have done in my own work is to look at as many things as possible. First I look at the works in an as unbiased way as possible so that I can formulate my own visual opinion of what is going on. I might go to secondary sources to see if that either contradicts what I have done or confirms it or leads me in a different direction. Most of the grammars that have been written for artists or architects are pretty much original in the sense that they don't come from someone else's ideas about what was happening. At a certain point they kind of go off in their own direction, the grammar becomes the grammar writer's own theory of what is going on (Knight 1996).

The resulting interpretation is, of course, a simplification of the complexity of a human designing. The idea of treating the world as if it was simpler and more mechanical occurs in many domains. It is not in itself a valid criticism of the shape grammar enterprise.

Stiny depicts such grammars as computationally open for exploration, aiming to foster a critical tool that has a range of potential

applications in art and design. They articulate derivational options for the artist and designer by making the judgemental process more transparent. Stiny views shape grammar approaches as a revolutionary formal tool for art education, and as the metaphor for all particular formal investigations regardless of discipline or media. He maintains that grammars are incomplete most of the time but may be added to in a far more useful way than previous understandings of art and design provide.

> Computationally the issue is, how hard it is to add a rule to a system that has done something. In most systems it is impossible. The reason being: suppose I thought of an artist in terms of squares, all my rules are defined in terms of squares. All of a sudden I see there is a triangle there...And then you look at it again and you say well those are not really the kind of units that I want because there are some other units that work and I can write some rules for those to better articulate what is going on in some part of the picture.
>
> Well, that is fine, it is something you should be able to do critically, but the issue is: "Can I stick that rule in the grammar I have already got?"
>
> If you write rules in the normal way where they are written in terms of vocabulary units and particles, the answer is no. There is a set of things that get manipulated and the new rule is a different set from the ones that you have. It does not even show up in the grammar—the grammar is blind to it...
>
> If you use a shape grammar, where there is no lexicon, where you have completely thrown the idea out the window and said, "I don't need it, it is not part of the computation", that is, that you can set it up by imbeding all this stuff in the object that you are manipulating. Then, you can put the rule in any time you want so that the grammar itself, the computational process is as open, as anything you can do critically; as anything you can do perceptually with your eye or your ears, etc that is the whole point of it. But that is the point that people miss (Stiny 1996).

Stiny's view as described here is very "contingent". Grammars are ubiquitous, formal and develop as critical reflection identifies new rules that are needed. This "practical" approach ruptures the strictly positivist metaphysical label that some have stamped on shape grammar research.

Coyne and Snodgrass and others cast shape grammar and similar discourse as positivist (Dreyfus 1972; Coyne and Snodgrass 1991; Coyne and Snodgrass 1991; this is discussed further below) and very limited. They argue that it relies upon an Aristotelian view that

a stylistic essence of things exists, and that all living forms are arranged in a hierarchy from simple to complex[57]. Other interviewees (such as John Lansdown, Gregory Moore, Marco Zanini, John Woods, and David Walker) also expressed concern in various ways about the "Cartesian" basis of the shape grammatical research program. Contemporary Continental thought questions essentialist doctrines and supports the hegemony of pluralism and difference. Stiny refutes essentialism:

> I don't think anything has an essence—with all due respect to Aristotle. Maybe that is why people find some of the things I say cavalier, but I don't think it gets you anywhere. It is just that somebody made these things. If you are really interested in them, one way to understand what is going on, is to figure out how to make another one. If you can, well you have grasped something that is interesting and exciting. If you have done it in such a way that you can teach it or talk about in a way that expands the repertoire of devices that allows you to make other things that are new and different, then that is all to the good.
>
> If at the end of the day you just say that it is too hard, and it has an essence, and you leave it at that, well—that is it, it is dead! —it is closed off and empty. You can stick it in a museum and people can come and do the social thing and pay their respects. You pay your respects to the dead. (laughs) I am interested in moving on, the dynamic part of it (Stiny 1996).

3. Computer Implementations of Grammars

To be useful in the generation rather than the understanding of designs, shape grammars need computer implementations. The number and richness of design possibilities that a grammar of any sophistication encompasses is beyond manual exploration. Neither Stiny nor Knight have themselves been involved in computer inplementations of the idea. Nevertheless, others have created systems. Most of these are implementations of particular grammars or other rule-based systems[58] rather than general shape grammar inter-

---

57 Lansdown (Lansdown 1996) and others (Brown 1996) agree that shape grammar research has not yet produced enough evidence to be optimistic about its future (Snodgrass 1996).

58 Steven Holtzman describes attempts to generate art and music with computers and gives a more detailed account of postwar serialism in his book *Digital Mantras* (Holtzman 1994). This development was linked to the activities of computer scientists, design theorists and early AI advocates such as Alan M Turing (Minsky 1967), John McCarthy, Marvin Minsky (Winograd 1972), Terry Winograd (Winograd 1972) and Herbert Simon and Allen Newell (Newell, Simon et al. 1958; Newell and Simon 1972; Newell 1973).

preters. They are important in understanding the nature of computational grammars as generative systems.

An example of this understanding is provided by the pioneering work of Russell and Joan Kirsch. In the early 1960s work on grammars in linguistics being carried out in computer science began to be applied to the field of art. Russell Kirsch was one of the first to develop the idea that pictures could be grammatically represented on computers (Kirsch 1964). He argued that any systematic underlying phenomenon that accounts for structure in pictures could be built into the syntax of the language used to describe the pictures. His interest was in "the rules of arrangement of these primitive symbols that allow certain arrangements and disallow others, and that allow new language objects to be constructed from previously constructed ones" (Kirsch 1964, 364). Seeking the analysis and generation of grammatical instances, Russell Kirsch devised a picture syntax tool called "synthesis testing, by which one could synthesise instances of things that satisfy the description, look at them, and see what was left out of the description. Eventually this process would lead to an adequate description, if such in fact exists" (Kirsch 1966).

Russell Kirsch explained the initial exploration of grammars in art:

> The original idea for this occurred quite a long time ago, in the early 1960s, when we were all doing work in mathematical translation of languages. People were very excited about the notion of writing grammars for language. This was the first attempt, growing out of Noam Chomsky's work, to be formal about a language that all the computational linguistics people were using. For such work as this, I was one of the fortunate people who had the use of SEAC, the only powerful computer around, which we had built originally at the National Bureau of Standards. It was the first of the contemporary computers in this country.
>
> I thought that it would be interesting to see whether you could extend this notion of language to describe images. So I wrote, for the SEAC, what was probably the first picture grammar with regular productions operating on rectilinear arrays of symbols and generated a simple class of images like triangles. That notion caught on and it became a little sub field called picture syntax in the pattern recognition community devoted to writing grammars (Kirsch and Kirsch 1996).

Kirsch suggested the formal aspects of each work of art could be clearly represented on a computer with rules, and a set of rules in a

grammar could represent all works of art and design given they fall within the defined domain of that grammar. Gombrich's "schemata" (Gombrich 1960) are examples of what Russell Kirsch referred to as "rules of syntax" (Kirsch 1964, 365). He argued that the complexity of visual language could be syntactically characterised by computers, giving an example of a two dimensional grammar for triangles (Kirsch 1964, 371). He concluded that "descriptive theories" (or grammars) for text and picture languages may be used by computers to "analyse individual information items at a purely syntactic (formal) level", and found that it "is tempting to identify these interpretation operations with the informal notion of "understanding'" (Kirsch 1964, 376).

The work by Kirsch and Kirsch on Diebenkorn is described in Chapter 3. They agree that formal grammars in art are not easily discernible. For example, colour in Diebenkorn's paintings was very difficult to describe in a grammar (Kirsch and Kirsch 1996). As abstractions, they present one reading of the work but there is no claim to be comprehensive in the representation.

Whereas Kirsch and Kirsch set out to implement a grammar describing Diebenkorn's work, most generative work in computer art has been concerned with new grammars. John Lansdown broadly classifies three types of generative technique in graphical computer art as *Functional, Manipulative* and *Birth/death-like*[59]. Lansdown suggests the last classification has unrealised potential for the growth of drawings "from cell-like elements whose presence or absence and position are determined by rules which depend entirely on local considerations and not on the drawing as a whole" (Lansdown and Earnshaw 1989, 57).

---

59 John Lansdown recognises that artists' work generally is represented by different types of geometry and lists a toolkit for the computer artist that includes: *Classical* geometries such as nets, bands, tessellations, classical Euclidean geometry, non-recursive functions, parametric curves, Lissajous figures, cardioids and cycloids and, *Recursive* geometries such as iterative functions, random numbers, recursive patterns, fractals and graftals, particle systems, growth models, linear and array grammars, Markov chains (Lansdown and Earnshaw 1989, 45).

The practical use of grammars in design fields such as architecture rely on computer implementations. As an architect, Catherine Teeling asserts:

> Many of the formal grammars can be written into a (computer) program to actually control practical aspects of the site and the physical environment. I'm not saying they're not of any use as papers, as they are, but they'll be of more use in a practical sense. Used in that way, in some sort of computation program there is more benefit to architectural practices (Teeling 1996).

In architecture, the SEED project builds on the early work of Ulrich Flemming and others (Flemming, Coyne et al. 1988) and develops a software environment that supports the early phases in building design: to provide support, in principle, for the preliminary design of buildings in all aspects that can gain from computer support (Flemming et al., 1993). In this case the computer is used for analysis and evaluation and for the generation of designs. SEED is to bring the results of two multi-generational research efforts focusing on "generative" design systems: 1. LOOS/ABLOOS, a generative system for the synthesis of layouts of rectangles (Flemming et al., 1988; Flemming, 1989; Coyne and Flemming, 1990; Coyne, 1991) and, 2. GENESIS, a rule-based system that supports the generation of assemblies of 3-dimensional solids (Heisserman, 1991; Heisserman and Woodbury, 1993). Design firms - from housing manufacturers to government agencies accumulate considerable experience with recurring building types. SEED intends to provide systematic support for the storing and retrieval of past solutions and their adaptation to similar problem situations. It exemplifies a view of computer implementations of grammars as highly practical professional tools.

Grammars and Contingency

Having outlined the metaphor of grammars and its expression in formal and computational systems, this section will highlight the role of contingency. "*Contingency* is the anticipation of uncertainty, the chance that something might or might not happen, the possibility of an accident or unforseen event or circumstance" (Johnson

1994, 343). It corresponds with Rorty's "ironic" view of the world:

> The ironist is a nominalist and a historicist. She thinks nothing has an intrinsic nature, or a real essence. So she thinks that the occurrence of a term like "just" or "scientific" or "rational" in the final vocabulary of the day is no reason to think that Socratic inquiry into the essence of justice or science or rationality will take one much really are (Rorty 1989, 9).

"Contingencies infect every design task" (Johnson 1994, 257), and the way in which both the metaphor of grammars and computational systems operate suggests that contingency pervades the concept. Rorty suggests we drop the idea of "intrinsic nature" and adopt the idea of "the *contingency* of the language we use" (Rorty 1989, 9). He argues that

> a recognition of contingency leads to a recognition of the contingency of conscience, and how both recognitions lead to a picture of intellectual and moral progress as a history of increasingly useful metaphors rather than of increasing understanding of how things really are (Rorty 1989, 9).

The rules of art and design which grammars embody are contingent rules. Grammars are recognised contingently; they are used contingently; and they are modified and changed contingently. The grammatical metaphor is itself used contingently by designers in their self-development. The very notion of grammar (and hence the discourse centred on that notion) is itself contingent upon a view onto domains[60].

In this section each of these contentions are examined in turn. This discussion focuses on shape grammars, because if contingency can be demonstrated in the formal expression of the metaphor it will certainly pervade informal expressions[61]. For example, formal properties of notation distinguish literary works from paintings and

---

60 Rorty sums up a view onto all domains that supports a contingent sense of *all* things: "The line of thought common to Blumenberg, Nietzche, Freud, and Davidson suggests that we try to get to the point where we no longer worship *anything*, where we treat *nothing* as a quasi divinity, where we treat *everything* —our language, our conscience, our community — as a product of time and chance. To reach this point would be, in Freud's words, to 'treat chance as worthy of determining our fate'" (Rorty 1995, 22).

61 George Lakoff and Mark Turner describe what is not metaphorical: "In brief, to the extent that a concept is understood and structured on its own terms—without making use of structure imported from a completely different conceptual domain— we will say that it is not metaphorical" (Lakoff and Turner 1989, 57).

highlight the role of contingency in art. As Nelson Goodman recognised, a painting does not have an alphabet in the same sense as a literary work has notation:

> In effect, the fact that a literary work is in a definite notation, consisting of certain signs or characters that are to be combined by concatenation, provides the means for distinguishing the properties constituitive of the work from all contingent properties—that is, for fixing the required features and the limits of permissible variation in each... In painting, on the contrary, with no such alphabet of characters, none of the pictorial properties— none of the properties the picture has as such— is distinguished as constitutive; no such feature can be dismissed as contingent, and no deviation as insignificant (Goodman 1989, 116).

Fundamental to a contingent view of grammars is a contingent view of rules, and I begin by returning to the nature of rules.

1. The Rules of Grammar are Contingent Rules

Marías, in discussing Kant's *Critique of Pure Reason*, encapsulates two kinds of knowledge:

> Knowledge can be either a priori or a posteriori. The former is knowledge whose validity is not based on experience; the latter is knowledge whose validity relies on experience. A posteriori knowledge cannot be universal or necessary; therefore, science requires a priori knowledge, that is knowledge that is not limited by the contingencies of experience in the *here* and *now* (Marías 1967, 288).

These "two kinds of knowledge" are mirrored in two kinds of rules.

> The Greeks in their political theory distinguished between *kosmos*, a spontaneous form of order, and *taxis*, a made order. In *taxis* the rules are known to the members of the society, because they were created deliberately and were written down. In a *kosmos*, on the other hand, the rules may not be explicit; they are often used without full awareness (Campbell 1983, 258).

Campbell argues that this is why rules of language are so difficult to identify and describe: they are hidden in the unconscious mind[62].

Snodgrass (1991) suggests that these kinds of rules are apparent in two distinct approaches to viewing them in the design process:

> There are two ways of viewing the rules which govern the design process. On the one hand, as viewed by design science and CAD,

62 The rules of design appear to have similar qualities, belonging to what Campbell describes as a "second-theorem" society, characterised by an unconscious internal structure, of inner rules and principles (Campbell 1983, 258).

they belong to a theoretical knowledge which exists prior to any practical application. In this view designing consists in selecting pre-given rules from a store of epistemic knowledge and then applying them in a methodologically prescribed manner. The rules remain unchanged in their application, so that they are applied in the same manner in every case. This presupposes that the rules are objective, logical and unchanging in both their formulation and application. For this they must stand remote and as objects to the designer who acts as a subject to manipulate and control them.

By contrast, practical design rules are not objective, nor are they applicable in the same way in each design case, but are analogous to the rules which govern the conduct of societies or games, being efficacious and appropriate to the degree that they are capable of giving rise to inexhaustible possibilities of interpretation and action (Snodgrass 1991, 6).

Given the pervading nature of contingency, one would expect that all rules (whether or not ostensibly encoding a-priori knowledge) would be subject to interpretation in different ways in different situations. Snodgrass in his review of Gadamer's interpretation of juridicial understanding characterises two contrasting approaches to rules (absolute and hermeneutic) and notes Aristotle's interpretation of rule:

To show that law is only understood in its application Gadamer cites Aristotle's concept of equity (*epiekeikeia*), the correction or accommodation of the law. Aristotle says that no law has a straightforward and clearcut meaning but has a certain internal tension in that it can be applied in a number of ways; it contains a number of possibilities of action as it relates to specific cases....This means that the text of the law must be understood in a new way each time it is applied (Snodgrass 1991, 2).

Snodgrass's polarisation characterises "design science and computer-aided design" as a homogenous unit, locating the literature of grammars, and certainly of shape grammars, within that discourse. Coyne argues that there is no middle ground where non-determinist and determinist discourse may be fruitful and that the reason for this impasse is that shape grammarians have avoided issues of institutional critique of their work: hermeneutic aspects appear to be limited to mechanical decisions (Coyne 1996). Yet the writing about grammars, even the literature about formal shape grammars, does not support a view that the discourse fits neatly inside a scientific paradigm of a priori knowledge. For example, Mitchell supports Snodgrasses's view of "practical design rules" when he states

"...designers both apply and construct them, in much the same way that courts both apply and construct the law by engaging specific contexts of application" (Mitchell 1990, 238).

This characterisation of the "rules of design" by both Snodgrass and Mitchell matches the "rules of grammar" in natural language. In everyday life grammar is taken for granted:

> Parents do not teach their children the rules of language, they simply talk to them and correct their mistakes when each child begins to speak. The parents do not know the rules of language, they simply practice them. "When I obey a rule, I do not choose. I obey the rule blindly" (Wittgenstein 1958). Quoted in (Karatani 1995, 135).

Clearly, language must be invoked in order to understand a rule of language. Practice in natural language, as in in the visual arts contingently supplies meaning.

> Wittgenstein's well-known definition, "the meaning of a word is its use in the language," should be understood neither as a denial of meaning nor as an insistence on meaning as pragmatics. Instead, it suggests that we know the use or rule of language practically but not theoretically. 'And hence also "obeying a rule" is a practice. And to think one is obeying a rule is not to obey a rule. Hence it is not possible to obey a rule "privately": otherwise thinking one was obeying a rule would be the same thing as obeying it.' Even if I believe that I know the rules of a foreign language, I cannot prove that I really know them unless the other acknowledges it (Wittgenstein 1958). Quoted in (Karatani 1995, 137).

Consequently there are a range of contingent possibilities for the rules of design:

> The rules are never fully "played out"; they are never categorically captured in the playing; and the inexhaustible range of possibilities contained within the rules allow the game its richness, spontaneity and fascination. So likewise design rules are never applied twice in the same way, because any number of contingent factors contribute to endless variations in the design process (Snodgrass 1991, 6).

Domains of art and design practice appear to contain many implicit rules that are difficult to make explicit. Rules for art practice were mostly informal and ad hoc, until the emergence of systemic approaches such as Serialist art (March 1966; March 1981) in the

1960s[63], although this depends on what is regarded as a rule. Apart from nineteenth century art and design guilds and religious groups that adhered to a fine art dogma for form making, such as Russian icon painters, art history contains many mannerists.

Black in his analysis of rule-formulations notes three distinct though connected aspects of the use of rules: "a class of possible human actions, a class of performers of the actions (ie, of the persons affected by the regulation), and an indication of whether the actions are required, forbidden, or permitted" (Black 1962, 126). Rules also may contain actual (or alleged) uniformity. Using this framework, Black shows that unformulated rules may occur as a result of some logical relations. Black concludes that implicit rules are possible, even if those rules are not logically inferable from explicitly formulated rules. For example, in some communities there are rules which are sacred and secretly understood without explicit public or private regulations or acknowledgment.

I argue, then, that rules are inevitably contingent in nature. At times (as in the scientific paradigm) they are formulated as a priori statements, but in these circumstances their application is always contingent on the circumstances of their application; one *contingently chooses* to apply *a priori* rules. Before examining how the rules of shape grammars are applied, I shall discuss the contingent nature of their recognition and definition.

2. Grammars are Recognised Contingently

(a) Grammars emerge as a result of contingency: "Personal Grammar"

The process of identifying and writing a shape grammar is a contin-

63 Serialist musicians such as Karlheinz Stockhausen and Pierre Boulez (Ewen 1971) inspired, Lionel March who was involved in Serialism (March 1966) in his early artistic career. Inspired, as was Stiny, by Klee's *Pedagogical Sketchbook* (Spiller 1970), March used the metaphor of game theory (Wittgenstein 1958, 23). He was very aware of the links and contrasts between music and art but understood both as being defined in terms of rules, (eg in Chapter 3, March discusses the role of rules in his art).

gent process. Suggestions that grammatical interpretation is "mechanical"[64] (Coyne, 1996) often miss the point that grammars are written to look *as if* the design world is mechanical. The process of *writing* a grammar is not mechanical at all; any writer of grammars is well aware of the long hermeneutic process by which rules are inferred, tested, related and incorporated. Knight provides an example. Despite her aim in writing a grammar to "look at the works in an as unbiased way as possible", she acknowledges that "the grammar becomes the grammar writer's own theory of what is going on" (Knight 1996). Knight expands on her approach to writing a grammar thus:

> I don't think that anybody has written a grammar for an entire body of an artist's work. One of the first things you have to do when you are trying to write a grammar, is to decide what the corpus of the grammar is going to be, ie, select the works that you are going to write the grammar for, because there are always works that are, or seem to be inconsistent.
>
> You need to look at as many works as you can. Then, narrow down that group of works to a body of works that have certain consistencies, formal consistencies, spatial consistencies, obvious regularities. That might mean even getting rid of some works that seem emblematic of that person's career. You might narrow it down to a series of works; to a specific time period. So that is really the first step in deriving a set of rules.
>
> Once you have a corpus narrowed down then, really, it is a difficult and sometimes painful process of trying to extract shapes or forms that are common to the works; relationships between forms that are common to the different works, and then express the relationships and vocabulary in terms of rules.
>
> It is often very frustrating because you might come up with a set of rules that seems to work for almost all of the different pieces but not one that you really want to include. So you either have to change your rules or remove one piece. So it is a long process of discovery, essentially.
>
> There are many different approaches, some people prefer to just look at the works themselves and not be influenced by what other people have written. Other people prefer to immediately go to secondary sources about the artists and find out what other people think about the works and try to work from these ideas—but that

64 Compare Berthold Lubetkin's view: "Since a subjectivist sees things as they appear to the senses and not as they are, he is incapable of rational appraisal, and is led to ignore the basic function of architecture, which according to Professor Worringer is "to wrest it from temporality, confusion and obscurity, and raise it from contingency into the realms of necessity" Berthold Lubetkin, *Royal Gold Medal Address*. In (Murray 1982, 45-49) Quoted in (Johnson 1994).

may lead you nowhere too (Knight 1996).

Knight's account demonstrates the contingency of the "rule-based" approach. A grammar does not purport to be the true or only representation of a body of work. Its form is contingent upon the perspectives, choices and judgements and aims of the grammar writer. It is also contingent upon the available documentation of the work and what has been written about the work.

This contingency applies whether or not the description of the grammar is as a metaphor, paradigm or formal computational system. For example, my first reading of the grammar of one of Lionel March's paintings was based on a reading of positive shapes on a green background. From March's perspective, this reading was flawed because it misunderstood the basis of the work. Once March explained his approach used classes of grids (March 1981) and that his imagery was based on the orientation of stripes conceived with "point-set theory as its generative grammar", new understanding of his painting emerged with alternative readings. March wrote: "My works were rule-bound in a way not determined by logic alone" (March 1981, 242).

The contingent derivation of a grammar for an artist's work can bring new insight for the artist. Alan Tarransky, after studying grammars with Raymond Lauzzana (Tarransky 1995) worked with Frank Stella to develop a grammar for some of Stella's art (Lauzzana 1996). Stella was impressed with the grammatical reconception of his work, as Lauzzana explains:

> One of my students worked on a grammar for Stella's *Rainbow Series* the ones that were sort of Arabic. It's actually hidden in those arabesques, as something very beautiful and very elegant. There is Arabic script in there, so Alan wrote a grammar for it and discovered all these relationships. He took it to Stella who was impressed beyond belief. Stella actually then had Allan work for him for about three or four months developing a language which he then used in his later work (Lauzzana 1996).

The grammar is drawn from an interpretation of past work. The reuse of past patterns is not unusual; many examples of art include traces of past images or events by representation within alternative

contexts to generate reinterpretation or awareness[65]. While these informal notions of grammars are an accepted part of conventional art practice, few artists intentionally use repeat patterns in particular contexts to create conventional art[66]. In other design contexts, (eg industrial design, architecture or landscape design), the notion of repeating patterns in work is well accepted; consider the architecture of Murcutt, Mies van der Rohe, or any other well-known architect.

Ulrich Flemming in a review of recent papers on computational grammatical approaches to art concludes,

> The experience reported by these authors are similar to my own experiences with rule-based systems used by me as experimental tools to arrive at a deeper understanding of the compositional principles underlying certain corpora of architectural designs. My reaction too, was that the construction of an effective set of rules through a series of experiments was a creative process with its own rewards.
>
> An obvious difference between this (and related work with shape grammars) on the one hand and the work of Edmonds and Cohen, on the other hand, is that the application of shape grammars to architectural problems has so far been restricted to the analysis of existing designs and not tackled the creation of new designs based on novel principles.
>
> It is true that the absence of external constraints and functional requirements makes the creation of abstract art seemingly an easier target for this type of approach, but I see no reasons why it could not be applied in principle, also to the creation of novel "languages of architecture" (Flemming 1996, 242).

In summary, the understanding of a grammar in a body of art or design work is contingent on the preconceptions and biases of the reader, and multiple grammatical interpretations of the same work highlight different facets of the work. Similarly, the formulation (whether as a metaphor, conceptually, or as a formal system) of a new grammar is contingent upon the preconceptions and biases of

---

65 Examples include the portrait work of Philip Pearlstein, that refers to ancient Roman portraiture but questions current identities (of both the sitter and artist) using painting as an investigative tool. In my interviews, Robert Venturi and Denise Scott Brown acknowledge their use of historicism to reinvent and question their languages of form making. Bill Barminski also used references to previous painting styles and advertising in his work to generate questions about consumerism and technology.

66 This point is further discussed in Chapter 3.

the artist or designer.

3. Grammars are used Contingently

Grammars are always a part, and not the whole of, a design process. There is a clear distinction between the use of "grammar" in a general sense (to refer to a broad understanding of rules in many contexts); the particular sense (in terms of a particular grammar, eg shape grammar); and, the computational sense (in terms of computer formalisation).

In their use:

- The act of using a particular grammar (as a computer implementation, as a formal system, or as a loosely-defined but coherent grouping of vocabulary and rules about form) is always contingent upon the design situation. The grammar may be used for all or only a part of the process.

- When using a particular grammar, the act of applying a rule is always contingent upon the state of the design (which determines whether the rule is applicable) and may also be contingent on the designer's intention and preferences.

The rules in a shape grammar supply frameworks akin to the rules in a game, in which the "play" according to the rules of the grammar lead to the goal of a design:

> ...Gadamer's treatment of the way in which the rules of a game relate to its playing...The rules provide a framework for the playing of the game and determine the range of appropriate actions the players can take, but they do not account for the way the game is played or the way it turns out each time it is played (Snodgrass 1991, 5).

To critics, the rules in this game are too limiting, making the game one of configuration within a very limited range of possibilities.

Stiny comments:

> That is one of the things that in many ways is distressing about some of the negative commentary that we get about grammars and computation, because people think too narrowly about it. They tend to think that it is a combinatorial activity, where you have got a bunch of your little pieces that you are moving around a board, in a mechanistic way, or that it is something like playing chess.

> But it is not like that at all, computation is a much more general kind of enterprise where as much as the process is to do with picking out what you move and refining it and constantly reconfiguring dynamically what you are playing with. It is an entirely different kind of situation (Stiny 1996).

Consider a future in which computational design systems of the shape grammar kind are routinely available to artists and designers (some limited grammar systems—for example the *Tartan World* symbol grammar—already exist; see Chapter 4). Within these systems rules are expressed and interpreted algebraically in the generation of designs. Is there a hermeneutic process going on within the computer system? No, unless one attributes human-like qualities to computers. Shape grammars as shape calculators are like number calculators, and no-one claims hermeneutic understanding for a calculator.

Is there a hermeneutic process going on when a human uses such computer systems in design? Of course; following Snodgrass and Coyne, all design is hermeneutical. The shape grammar is not the whole of the design system, which always involves humans. A shape grammar is used, modified, and "steered" (by choice of rules to apply) in a hermeneutic process. The degree of awareness of this hermeneutic process will vary; the same benefits that Coyne and Snodgrass argue stem from being aware of the hermeneutic process apply whatever the means of design that are used. When using *Tartan Worlds*[67], or any similar highly interactive grammar system which allows the ready postulation and change of rules "on the fly", one is very much aware that grammatical rules do not and cannot remain "unchanged in every situation". The fact that *Tartan Worlds* has a very limited scope does not change the mode of use.

The essentially hermeneutic nature of design does not prevent an artist from exploring (within a hermeneutic process) the deterministic operation of a sequence of rules. Lansdown refers to the "mathe-

67 This is discussed further in Chapter 4, where I reflect on a process of working with *Tartan Worlds* and another "grammatical" computer system, *DiscoverForm*.

matical art" of Manfred Mohr as an example of an artist who, in the tradition of Mondrian, Malevich, Pasmore and Moholy-Nagy, exemplifies the use both of intuition and algorithmic manipulation (Lansdown and Earnshaw 1989, 67). He advocates a deterministic generative technique, as a key direction for genuine artistic discovery using computers:

> There are certain things that you wouldn't think of doing if you didn't have computers. Imagine the following array grammar: -You divide a canvas into an array of tiny squares. You give each square an address. You give an address in an horizontal direction and an address in a vertical direction. For each square you divide the horizontal address by the vertical address. Then you look at the third decimal place of the resulting dividend and then you put a colour from zero to nine in, according to what that third decimal place is. Now as a rule based piece of art, you and I have no idea what the outcome of this will be, it is entirely deterministic. But in addition we wouldn't have thought of doing that if we didn't have a computer to help us do it. The rule set which is just this one rule for a simple array grammar derives entirely from having a computer because no-one would dream of thinking of making an artwork conventionally that way. You would have to have a computer to do it (Lansdown 1996).

Far from being rare and arcane, the decision to apply deterministic rules contingently in art is ubiquitous in the use of electronic media. Use of computer graphics systems involves use of rule-based operations on a design through their use of filters, transformational and scripting mechanisms. Such systems do, however, typically include "undo" options; deterministic rules are set within a process which allows for reflection and reconsideration in a hermeneutic process. Examples such as Flemming's work on interpreters for building design suggests the design studio may use grammars as a term for the enabling of creative possibilities. Others view grammars as inspirational tools by adopting a holistic approach as in Tapia's case in design studio at UCLA (Tapia 1996) and Rollo's studio program at the University of Bath (Rollo 1996).

4. Grammars are Changed Contingently

Changes in grammars occur in art practice in two ways:

- When an artist follows a similar theme or process but changes an aspect of the work such as the media, location, construction or other

identifiable contributing factors. This is developed in Chapter 3, where the work of a number of artists is reviewed in terms of grammar.

• When an artist introduces a new rule or vocabulary element in the course of production of a work. In the derivation of a piece of work, it may be possible to see several grammars operating consecutively or in parallel. I suggest that in their work, most artists and designers do contingently change the grammar with which they work during the course of production of a piece of work. This is developed in Chapter 4, where the process of production of some art work is reviewed in terms of grammar.

Art history traditionally has used ideas of paradigm shifts, the avant-garde and the "shock of the new" to signal change and revolutionary style. Arnheim recognised how language elements frame context: "... words have different connotations in different contexts and for different individuals or groups... 'The birth of a new concept', says Sapir, 'is invariably foreshadowed by a more or less strained or extended use of old linguistic material'" (Sapir 1921, 17). Quoted in (Arnheim 1969, 245).

Critical of traditional art historical approaches, Arnheim comments on the characterisation of styles and their boundaries:

...one of the most stubborn and awkward ways in which the practical mind interferes with the seeking of the truth consists precisely in replacing types with container concepts based on the staking out of territory. In art history, for example, one can gain genuine understanding by defining styles, such as Expressionism or Cubism, as pure types of attitude and manifestation and by showing how in a given artist such ingredients combine in a particular blend. In that way, one begins to understand the history of art as a fluctuating interplay of underlying types of approach, by which a particular pattern comes to the fore at some time or place or in some person, only to dissolve into another. But to try to stake out historical territory by determining when the Renaissance began or ended or whether Cézanne belongs amongst the impressionists or the Cubists is an absurd and hopeless undertaking. It is not justified by any practical necessity for compromise between types and container concepts. In the history of art, just as in other areas of science, one can find the occasional *Glücksfall*, that is, an approximation of the pure type in the flesh, but owing to the one-sidedness of generic types, such purity is found in the arts more often among the limited talents than among the richly endowed. The most typical Cubist

was not the greatest (Arnheim 1969, 177).

If art is considered in terms of transformations of grammars that consist of rule addition, rule deletion and rule changes, turning points become easily identifiable and facilitate exploration of new languages of art and design[68]. Turning points are both starting and ending points, that concurrently encourage reflection on past actions and future directions.

A change in a shape grammar occurs through a change in the vocabulary, or a change in the rules. As rules are generally easier to understand than the designs they generate, the act of changing grammars is transparent and accessible. For example, using Frank Lloyd Wright's changing grammar from Prairie into Usonian houses, Knight illustrates how spatial labels and state labels may define the turning points in the transformation of a grammar. In Chapter 3 grammars are changed contingently by artists as time and place impact on their lives. In Chapter 4 I reflect on the grammatical changes to both a personal sense of grammar and the formalisation of my imagery.

5. The grammatical metaphor is itself used contingently by designers in their self-development

Herrnstein Smith suggests that artists and designers judge their work by "(a) articulating an estimate of how well that work will serve certain implicitly defined functions (b) for a specific implicitly defined audience (c) who are conceived of as experiencing the work under implicitly defined conditions" (Herrnstein Smith 1988, 13). This relates to an artist's often iterative task of finding a "voice". Valéry describes a typical reflective dimension in the search for style and form often found in art and design practice:

I look *for the first time* at this thing I have found. I note what I have

68 Knight clearly demonstrates this aspect of grammars in studies of Greek ceramicswhere changes in spatial labels become significant operatives in the identification of complex meanders of Attic and Argive pottery schools (Knight 1994, 158).

said about its form, and I am perplexed. Then I ask myself the question:

Who made this?
Who made this? asks the naive moment.
My first stir of thought has been to think of *making*.
The idea of *making* is the first and most human of ideas.
"To explain" is never anything more than to describe a way of *making*: it is merely to remake in thought. The *why* and the *how*, which are only ways of expressing the implications of this idea, inject themselves into every statement, demanding satisfaction at all costs. Metaphysics and science are merely an *unlimited* development of this demand (Valéry 1956, 117). Quoted in (Karatani 1995, 24).

I suggest that artists and designers contingently refer to a sense of grammar in understanding their work through a process of reflective action in a hermeneutical design process. Schön's work demonstrates this process (Schön 1988). Such a practice takes into account explicit and implicit rules, contextuality, interpretation and re-interpretation of designs and context, and a growing understanding of the interrelationships of forms in the artist's or designer's work.

The term "understanding" is multi layered. Husserl suggests that deepest understanding is synonymous with a kind of transcendental ecstasy of realisation, or sense of life force (Husserl 1970). Wilhelm Dilthey following Schleiermacher refers to an element of "divination" in the process of interpretation. It has a logical component but "it rests on understanding, which rests on a projection of the self into the other, and this is not an intellectual but an imaginative act" (Hodges 1944, 28). Hermeneutical understanding as a part of self-development seems to rely on a similar "imaginative act". For Dilthey, hermeneutical understanding emanates from *autognosis*, or consciousness of one's self, proceeding from knowledge of the life of others, comprehending interpretation of others lives, and thus of history.

Self creation, identity, and understanding of one's legitimate place in a community are important aspects of artistic endeavour. A sense of grammar offers increased transparency of systems of rules and understanding of languages, generates new lines of thinking through interpretation and translation of tacit practice, and fosters discussion through interdependent reflection on the circumstances

of utterance.

6. The discourse on grammar is itself contingent upon views onto domains

I have remarked above that the notion of grammar captures a sense of order in matter and form in art and design and may articulate a part of an artist's or designer's direction(s). There is no claim that a grammatical view is the only valid view, or that it is sufficient alone to describe a domain. A plurality of views on to domains results from the contingent positions available for the interpretation of any moment. Discourse is contingent upon these views, and the discourses of shape grammars, generative computer systems, and "the grammar and language"' of art and design depends on commonality in views onto domains of those engaged in the discourse. To those with other views onto the same domain, the discourse of grammars may appear irrelevant.

Discourse comes from the Latin *discurrere* and suggests movement "back and forth" or "to and fro". Discourse through speech and language develops through shared concerns, values and communication[69]. The shared use of codes enables a linguistic community to evaluate through comparison and generate democratic values through notions of free information exchange. Thus enframed discourse fosters shared perception and engenders reflection on aspects of self-creation.

Engagement in diverse discourses between communities is an integral part of the learning process. Communities of scholars debate the value and validity of discourses in relation to rational, privi-

69 The need for effective natural language discourse is evident from the proliferation of communication courses in education today that are cross disciplinary in nature. Professional communication design has become a major industry as the use of new media such as the Internet spread throughout the world. The need to understand arguments and use clear communications is seen by many as a major asset for professional survival spawning electronic texts such as (Anderson 1995).

leged and hermeneutic[70] qualities. As Richard Rorty and others have noted[71], discourse is impossible without some rationality and depends upon the nature of contingency within language.

The French theorists Roland Barthes, Gérard Genette and especially Michel Foucault extended the meaning and relevance of the term discourse through their emphasis on the speech and writing of "fields", such as economics or natural history, and the conventions according to which they were classified and represented in particular periods. The discourses of power were of particular concern for Foucault[72] who revealed the power of apparently objective and natural structures of discourses. The meaning of discourse is simultaneously defined and questioned in the work of Jean Francois Lyotard:

> For Lyotard, discourse implies the domination of textuality over perception, conceptual representation over pre reflexive presentation, rational coherence over the "other" of reason. It is the realm of logic, concepts, form, speculative reciprocity, and the symbolic. Discourse thus serves as the locus of what normally passes for communication and signification in which the materiality of signifiers is forgotten. Whether in the guise of dialectical sublation or diacritical synchronicity, discourse entails a belief in transparency and lucidity (Jay 1993, 564).

---

70 Bruns describes the so-called history of hermeneutics using a break down of philosophical categories: "Hermeneutics belongs to multiple histories and so cannot be made into any one thing that begins and ends and suffers conceptual revolutions along the way, although in our effort to make sense of hermeneutics this is very much the sort of story we are apt to be looking for and inevitably come to rely on. Thus in the second part of *Truth and Method* Gadamer sketches out a history of hermeneutics that begins with romantic idealism of Hegel, Schleiermacher, and Dilthey, where hermeneutics is defined in terms of a consciousness whose objects are the products of an expressive spirit in order to clarify and participate in or to appropriate and go beyond, its self understanding. But with Heidegger, as the story goes, this history splits in two. There are those who continue Dilthey's Kant-like concern with how knowledge of historical and cultural products is possible. Husserl's phenomenology, with its transcendentalist conceptions of meaning and consciousness, is regard by many as a way of determining the logical conditions of *verstehen*. But those who follow Heidegger understand that consciousness is never alone with its objects but is always situated, always historical and contingent, so that it is no longer enough to think of understanding as an activity of consciousness at all. Here the other always constitutes the limit of understanding as such. The other can never be objectified; it can never be appropriated once and for all in any finite interpretations. For Gadamer, it is this excessiveness of the other, this finitude or situatedness of understanding, that callas for reflection. Historicality, not history or historical transmission, is the true object, the *Sache*, of hermeneutics" (Bruns 1992, 213). In an extended sense, John Caputo (Caputo 1987, 1) after Jacques Derrida posits a procedural "postal-service theory" (using the principle of message bearing) of hermeneutics that relates to grammar as a metaphor in natural language (Bruns 1992, 213).

71 Artists are often familiar with the "rationalist" problems of separating form, content, structure and semantics. Despite known mathematical difficulties with non-uniqueness, many twentieth century art movements such as abstraction, Minimalism and conceptual art relied on the methodological holism of Reductionism.

72 Foucault's *The Order of Things* (Foucault 1970) depicted major shifts in the conventions of discourses using a method called "intellectual archaeology". Later, using the ideas of "distanciation", Foucault stressed the significance of relations between discourse and other social practices (Ricoeur 1973).

Discourses often overlap, interweave and shift ground. Thus the idea that there is a scientific art[73] and an artful science[74] is a mix of discourses[75] that may enable new understandings. Discourse on grammars interweaves with the discourse of artificial inteligence on the one hand and with the discourse of artistic style on the other hand. Metaphors become linked in views on to domains. For example, the idea of rules of art and design may be linked with the metaphor of grammars either as *play*[76], as a formal pursuit, or combination of theses two attributes. The revealing idea that grammars may be used in a game to promote play is inherent in these views on to domains.

This brief excursion into discourse reinforces the important contingency of a sense of grammar on the way in which a domain is viewed, as for any other framing of a domain.

Summary

This chapter has reviewed three senses of grammars (as a metaphor, as a formal system and as an implemented computational system)

---

73 Paul Davies, Professor of Natural Philosophy, laments the refusal of many critics to embrace science as art, "There is a widespread feeling throughout the English-speaking world that poets and priests, writers and painters have some God-given monopoly to interpret the world and nurture the human spirit...Science's claim to deal in reality, and to represent the most reliable knowledge about the world, is dismissed with the mantra of cultural relativism . . . Nature, as revealed by science and mathematics, is altogether richer, more inspiring and more astonishing than our finest poets can portray" (Davies 1996).

74 The idea of tacit knowledge contributes a crucial question as Michael Polyani notes: "The declared aim of modern science is to establish a strictly detached, objective knowledge. Any falling short of this ideal is accepted as a temporary imperfection, which we must aim at eliminating. But suppose that tacit thought forms an indispensable part of all knowledge, then the ideal of eliminating all personal elements of knowledge would, in effect, aim at the destruction of all knowledge. The ideal of exact science would turn out to be fundamentally misleading and possibly a source of devastating fallacies" (Polyani 1967, 20). "Tacit knowledge" may be connected to notions of "artfulness" because artists seem to "know" what "is" art and express judgments of quality based on tacit experience.

75 Debate continues between those grammarians (after Saussure) that view language as discourse, suppressed by the semiotic subordination of *parole* to *langue* , and, those that contend that language cannot be reduced to a system of signs because language in use betrays a synthetic structure that is "undissolvable by the postulates of semiotics" (Klemm 1983, 76). Klemm conceives of this debate in terms of subjective or objective but interprets Ricoeur's theory of discourse as signalling "the pursuit of a middle path between structuralist and Romantic alternatives at either extreme, while it allows Ricoeur to incorporate aspects of each alternative into his own theory" (Klemm 1983, 79). Ricoeur places the dialectic between the event of language and the meaning of language at the centre of discourse as in Schön's ideas of reflective practice (Schön and Bucciarelli 1989). For instance, Ricoeur refers to composition as the "teleological structure of a work of art as a system of wholes and parts" (Foucault 1970).

76 Science and art coalesce in *play*. After Gadamer's proposal for practice that transcends the thought/action dichotomy, Adrian Snodgrass argues for a pedagogical practice based on *play* rather than on an enframing based on techno-rationality (Snodgrass 1993).

and argued that all three senses inevitably involve contingency. The plurality of a contingent sense of grammar leads to many emphases: computation and computability, knowledge, understanding of patterns of artistic and design behaviour, self-reflection. There are radically different views about the importance of these various emphases. Notably, Coyne recognises that "grammars and rule systems provide metaphors for the understanding of some phenomenon such as art and design" (Coyne 1996), but questions their enabling nature, because of his characterisation of the idea as positivist and determinate:

> One of the big issues about rules is that they are a very privileged entity within particular discourses. The idea of rule is very much favoured in particular ways of thinking. If you say, I am looking at this phenomenon such as design through the issue of rules then you are saying something more than if you say you are looking it at it in some other way, say through the idea of inspiration or one of the other many ways of looking at design. The idea of rules suggest something determinate. It suggests that there is something fixed, a certainty, that there is something to hang on to. It is a kind of metaphysical concept (Coyne 1996).

In this chapter, I have presented a counter view. I have framed grammars as contingent, suggested that the idea of determinacy in the use of grammars is a simplification, and argued that a contingent sense of grammars is necessary and enabling. The fact that the rules of law and science also suggest a determinacy which is not borne out in the application of those rules does not limit their usefulness. The postmodernist language of irony (ironic discourse) (Rorty 1989) appears to discount any possible rupture in the nature or use of rule[77]; it can certainly be adopted as a metaphor. The use of contingency and irony to characterise postmodern discourses avoids the alignment of discussion with a Cartesian framework that many see as inappropriate for our times.

I have argued that all form-making is grammatical[78]:

---

77 "Informal formality" for example is an oxymoron that cannot exist but, artists appear to use this metaphor all the time, just as chaos theorists speak of rigorous chaos and fractal disorder.

78 Lionel March quotes Wassily Kandinsky on this point: "The final abstract expression of every art is number" (March 1981, 243).

All artists and designers are aware of the formal structures, ordering systems and even rules that permeate the process of designing. All designers are aware that designs do not spring unheralded in final form but derive in some way through a series of studies and developments. They are aware that the work of some artists and designers exhibits a clearer, more articulate form than that of other designers. They are also aware that these things are contingent, depending on circumstances (Radford and Bruton 1997, 4).

This does not imply that form-making is the only part of art and design. Kolb writes of architecture:

Like linguistic expressions, a building may be a move in many games at once. The choice of architectural vocabulary and the way that vocabulary is handled is also a social and political statement. No language game exists alone, although they all have some independence. We exist as the intersection of many codes and games, at once constrained and constituted by that multiplicity. (Kolb 1992, 109)

The hermeneutical process is inherent in the process of design; that is the way artists, architects, other designers and, for that matter, scientists have to work. It is argued cogently by Snodgrass and Coyne (1990) that bringing the hermeneutic process to the surface, being aware of it, benefits the process. Bringing an awareness of grammar to the surface, making it more apparent, also benefits art and design. Being aware is not a prescription for conservatism and changelessness; it is a precondition for informed development and change. This position is tested in the following chapters where the work of some artists, and some of my own work, is examined with "a contingent sense of grammars". I end this chapter by quoting from Paul Klee:

We are artists, practical craftsman, and it is only natural that in this discussion we should give priority to matters of form. But we should not forget that before the formal beginning, or to put it more simply, before the first line is drawn, there lies a whole prehistory: not only man's longing, his desire to express himself, his outward need, but also a general state of mind (whose direction we call philosophy), which drives him from inside to manifest his spirit in one place or another. I emphasise this point to avoid the misconception that a work consists only of form (Spiller 1970, 99).


ERUT DOOD

3

Grammatical views of artwork

Scope of Chapter

This chapter explores the idea of a sense of grammar through examining some bodies of art work from a grammatical perspective, adopting the various senses of grammars and rules set out in Chapter 2. It concentrates on the views of grammars that relate to art by a) expanding notions of a "sense of grammar" and b) exploring its computational enframing. The shape grammar protocol and particular implementations of shape grammars are discussed in the work of some selected artists to illustrate the application of grammatical perspective in a formal way. Qualities of art that demonstrate a sense of "contingent grammar" are discussed in relation to aspects of derivation and formalisation.

Fig. 3.1 *Mummy Portrait of a Woman*. Attributed to the Isidora Master. Romano-Egyptian, ca.A.D. 100-125. Encaustic and gilt on a wooden panel wrapped in linen. H: 21.625. Example of an early rule-based tonal representation system.

Following the work of Terry Knight on the application of shape grammars in art, (Knight 1980; Knight 1981; Knight 1981; Knight 1983; Knight 1983; Knight 1983; Knight 1988; Knight 1992; Knight 1993; Knight 1994; Knight 1996), I am particularly interested in what is "contingently grammatical" in art work—what is happening when people use rules: How do they go about formulating rules and how do they change them? What kinds of rules are contingently kept? What sorts of rules are contingently dropped out? The intention is not to prove or disprove that art or design is grammatical. The intention is to look at these sites from a perspective of

grammars, without denying that they can be looked at from other perspectives. Another thesis might discuss the same set of sites in terms of politics, or other views that shed some interest or relevance.

Grammatical Qualities: What to look for?

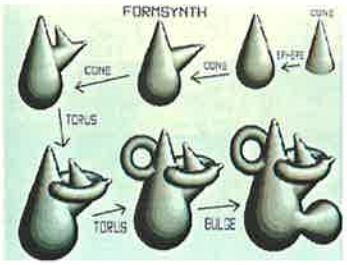


Fig. 3.2 William Latham. c1989. Using *Form Synth* to computationally generate sculpture.

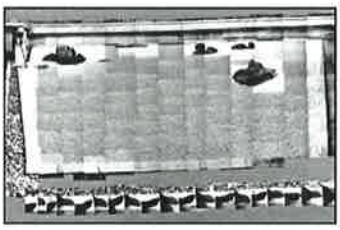


Fig. 3.3 David Hockney. 1983. *Walking in the Zen garden at the Ryoanji Temple Kyoto* Feb 21st 1983. Hockney describes this photocollage as a "key work"; a turning point.

Fig. 3.4 E. Steiger. 1876. *Kindergarten Gifts. First and Second Gifts.*
As a child, architect Frank Lloyd Wright used Froebel's rule based form making educational program.

This chapter sets out to show how a contingent sense of grammar enables understanding of bodies of art work. No claim to complete understanding is made: the scope and applicability is limited but dissimilar products may be looked at. Some form-makers of these cited works are very aware of their grammaticality. Others are not—but when asked are able to identify some kind of rule base. (For example, artist David Hockney describes his work as focusing on "the same set of issues—the clear depiction of space in time, the widening of perspective", regardless of the medium. Looking back over his work, Hockney recognises turning points: "What you're aware of, I suppose, as the years pass, you might recognise that certain works were the key works in that you realised that you really discovered something there" (Weschler 1988, 94) see Fig. 3.3).

As experienced by architect Frank Lloyd Wright, the use of Froebel's (wooden blocks) *Kindergarten Gifts* (Fig. 3.4) suggests that in looking at work from a grammatical perspective, there are certain outstanding qualities sought by the viewer. Clearly the interest centres on form and formal qualities such as continuity in the flow of ideas, colour and spatial relations as in artist William Latham's sculptural derivations (Fig. 3.2). Because grammars imply a language, there is an interest in membership of a set of similar works, and some kind of formal consistency amongst the works in the set. Artists may use different words to refer to "contingent grammar", as in Hockney's case, above.

For Stiny "the serious issue is what you have to do to add to the grammar or change the grammar to get another derivation that tells you something else that gives you more insight to carry on or expand what you have already. It is just like criticism" (Stiny 1996). An acknowledgment of rule sets is often retrospective since artists

tend to make up production rules as they produce (whereas designers tend to be more constrained by the rules of a client's brief). Rule sets are usually not consciously featured in an artist's production repertoire due to the widespread view that invention occurs despite, rather than because of, previous rules and traditions. Russell Kirsch describes his recognition of an artist's rules for personal vision:

> I think best evidence of art is, when you look at an extraordinarily protean artist, like Picasso. And if you are fortunate to see a major retrospective of the work as we did some years ago in France, you see that from the time when he was a little boy until he was an old man, changing media, changing styles, creating whole new movements, some of the same things ran through all his work. Of course capturing that same thing is the challenge of writing formal rules for an artist's language (Kirsch and Kirsch 1996).

It may be that "same thing" is a contingent sense of grammar—but artists perhaps need greater awareness of their rule base to achieve their maximum derivational potential. Do the most prolific artists produce the most work because they are more aware of their rule set? Prolific image making artists (Rembrandt, Lautrec, Van Gogh, Picasso, Matisse, Vasarely, Rubens, Seurat, Monet, Kandinsky, Hockney, Hokusai, Wyeth, O'Keefe, Mondrian, Rothko, Hodgkin, Beuys, Wentworth) used distinctive rule sets. It might be argued that these rule sets *were* their art (as in Alfred Jensen's work Fig.3.15) and that an awareness of their rule set improved potential derivation. Similarly, in architecture, consideration of rule sets (Durand, Palladio, Meis van der Rohe, Le Corbusier, Johnson, Aalto, Stirling, Krier, Rogers, Gehry, Meier, Graves, Cox, Foster, Calatrava, Botta) seems to explain abundant output. Perhaps even more clearly, graphic design (Chéret, Beardsley, Cassandre, Rockwell, Tschichold, Ruder, McKnight Kauffer, Glaser, Brody), photography (Fox Talbot, Man Ray, Adams, Muller Bröckman, Brandt, Arbus) and computer graphics (Latham, Cohen, Edmonds, King, Wright, Lansdown, Margerison, Barminski), have examples of prolific image making exponents who have distinctive, and transparent rule sets[79]. Those that are not prolific perhaps choose not to develop an expression of their radical rule set or interrogative

Fig. 3.5 Pablo Picasso. *Femme nue*. 1907. Oil on canvas. From his childhood to old age, "some of the same things ran through all his work" (Kirsh 1996).

Fig. 3.6 Howard Hodgkin. 1972. *Interior 9AG*. Oil on wood. 109 x 137. Private collection, Hodgkin uses a distinctive rule set.

Fig. 3.7 Richard Wentworth. 1984. *Jetsam.* Galvanised and enamelled steel, cable. 86 x 74 x 91. Objects may be conceived as part of a grammatical approach to sculptural environments.

Fig. 3.8 Bill Barminski. 1996. *Deluxo items.* Barminski uses an awareness of rules and a variety of traditional and digital mediums.

Fig. 3.9 Paul Gauguin. 1888. *The Vision after the Sermon.* Oil on canvas. 73 x 92 cm. Gauguin created a "rule set" for the Synthetic Symbolist style in 1888.

proposition relying on single public statements to inspire revolution or redirection of the corpus of art history. Generally, artists seek new (often seemingly illogical) rule sets that challenge convention, as Les Levine recognises:

> Good taste at this time in a technical democracy ends up to be nothing more than taste prejudice. If all that art does is create good or bad taste, then it has failed completely. In the question of taste analysis, it is just as easy to express good or bad taste in the kind of refrigerator, carpet or armchair that you have in your home. What good camera artists are trying to do now is raise art beyond the level of mere taste. Camera art must be completely devoid of logic. The logic vacuum must be there so that the viewer applies his own logic to it and the work, in fact makes itself before the viewer's eyes. So that it becomes a direct reflection of the viewer's consciousness, logic, morals, ethics and taste. The work should act as a feedback mechanism to the viewer's own working model of himself (Sontag 1973, 194).

This chapter offers examples of practitioners' work using a discourse of personal "working models" that include a contingent sense of grammar to demonstrate formal continuity and sequential rule application. For example, the early work of Roman portrait painters (Fig. 3.1) shows a systematic approach to tonal representation of space. Whilst not conceived in terms of a formal grammar as in the early work of Froebel (Fig. 3.4), the work of Picasso (Fig. 3.6) intentionally thwarted previous spatial conventions leading the way for abstraction as in Hodgkin (Fig. 3.6) and conceptual art such as the work of Wentworth (Fig. 3.7). Many artists use seemingly simple rules (credos) that guide their form making either in terms of structure, colour or some other dominant element. Some are well known because of their formal approaches to image making, eg Paul Gauguin and Richard Hamilton. Gauguin (Fig. 3.9) inspired the School of Pont-Aven style (Pickvance 1994), and elaborated a general rule when he refused to subscribe to the Impressionist's docile copying of nature, insisting that an artist be free to choose what was, to him, significant

79 William Latham expands on this point: "As a result of the continuous exploration and discovery of new art styles it would appear that art has no long-term goal. Since each new art style is different from the previous art style it would seem that art is undergoing an evolution based on changes in the current cultural environment, historical context and general aesthetic an that the development of a new art style is based on altering and extending the rules which defined the previous dominant art style. The artist's purpose is to invent new images, shapes and forms which in terms of human perception have artistic qualities; these qualities can be defined as being aesthetic or expressive (Lansdown and Earnshaw 1989, 80).

Fig. 3.10 Richard Hamilton. 1956. *Just What Is It That Makes Today's Homes So Different, So Appealing?* Collage. 26 x 24.7 cm.

Fig. 3.11 Richard Hamilton. 1990. Digital updated version of *Just What Is It That Makes Today's Homes So Different, So Appealing?*

Fig. 3.12 Richard Hamilton. 1990.(detail of *Lawnmower man* clip on television screen).

in nature and transform it into something entirely personal by means of what he called "a synthesis of form and colour derived from the observation of the dominant element only" (Preston c1980). This doctrine originated in 1888 and became known as the "Synthetic-Symbolist" style (Denis 1912). General guides such as these (eg critic Clement Greenberg's credo: "Paint flatter than flat") were to become the bench mark for other avant garde rule sets throughout the twentieth century (Wolfe 1975).

Formal thematic continuity is demonstrated in the work of Hamilton a founder of the 1960s Pop art movement. A contingent sense of grammar is apparent in his 1990s rework (Fig. 3.11) of the first Pop art image (Fig. 3.10) using artist, Jack Davis' images from the classic cyberspace film *Lawnmowerman* (Fig. 3.12).

These examples illustrate diverse qualities that can be viewed as contingently grammatical. The next section discusses computational aspects of grammars and art from a grammatical perspective.

Art and Computation

Computational possibilities for image making that extend a sense of grammar might seek pure algorithmic images[80] or "robotics" systems[81]. Computational systems may be used by artists, who may also be called computer scientists, mathematicians or consider themselves a part of a different community of language users (Deken and Rosenfeld 1983; Franke 1985; Kerlow and Rosebush 1986). Consistency (of selection and rejection) is often a key factor in modern art which suggests a computational approach may be helpful. Artists that build on a consistent visual language often do so without recourse to a formal mathematical description of

80 William Mitchell explores the idea of removing human intention for image making. He suggests a preprogrammed space shuttle photograph as an example of the most algorithmic form of photograph: "one produced by a mechanism that has nobody looking through the viewfinder when the button is pushed (Mitchell 1992, 234).

81 Mitchell notes Goodman's distinctions between one and two stage and, autographic and allographic arts: "A copy of a (musical) score need not, then be the product of the composer's own hand on order to qualify as a genuine instance of a work, but a painting can be a genuine work only if it is actually an object made by the purported artist. If it is the work of some other hand it is a forgery...Digital images, then are two stage, allographic, mechanically instantiated works" (Mitchell 1992, 49).

Fig. 3.13 Valerio Adami. 1966. H. *Matisse travaillant sur un cahier de dessins.* Acrylic on canvas. 198 x 147 cm Galerie Maeght, Paris. Adami's deconstructed environments contingently represent alternative historical, linguistic, social and psychological meanings.

behaviour as in Adami's imagery (Fig. 3.13).

On the other hand, contemporary Postmodern and deconstructivist art consistently seems to attempt to contravene attempts at consistent finality. Benjamin Buchloch supports this view:

> At the initial moment when the work is engaged in practice, the degree of alienation that is articulated in the work of Arman, by contrast to the degree of cultural continuity in the work of Beuys—even though they both work with found objects, industrial objects, etc.—seems to me to be a necessary condition for work which defines itself as contemporary after the war, whereas there is a totalising tendency in Beuys' work which is impossible for contemporary art to fulfil (Buchloh, David, Chevrier 1997, 396).

In this framing, the role of contingency in the epigenetic development of an individual's thinking is recognised by philosopher Dominique Lecourt:

> Contingency—which can also take on the guise of the most coercive necessity—makes its entry here and disputes the empire of the "genetic" program. And because the nervous system is in no way isolated, much to the contrary, from the other major systems of the organism...the "basis" of thought cannot simply be confined to one system (Lecourt 1997, 664).

Fig. 3.14 Alfred Jensen. *The Pythagorean Theorem.* 1964. Oil on canvas. 4 panels: 62 x 50 inches each. Pace Gallery.(detail).

Attempts at formal descriptions of art behaviour are often reduced to familiar cliches that seem to guide "art" production. For example, postmodernist art discourse sometimes subscribes to a simplification of its philosophical basis, as when Frederic Jameson advocates understanding by using characterisation: "One of the most significant features or practices in Postmodernism today is pastiche" (Jameson 1985, 113). The task of analysis of the formal properties of an art or design product as a grammar is more difficult than the generation through synthesis of a large number of derivations given a new grammar while computation is used for repetitive generative strategies such as the Mandelbrot set (Fig. 3.15), cellular automata systems imagery and recursive imagery such a s that of Paul Brown (Fig. 3.16), analytical computer programs that emulate artistic strategies like Mondrian's (Fig. 3.17) are rare. For many artists it seems easier to make and break their own rules rather than analyse rules used in the past. As Russell Kirsch notes:

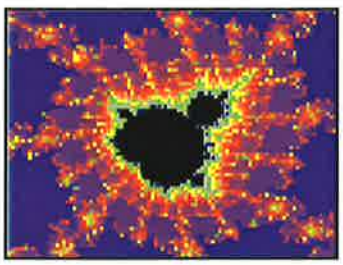


Fig. 3.15 Example of the *Mandelbrot set.* A generative grammar of an infinite structure generated from a small rule set.

> We cannot understand their behaviour and when you look at some complex phenomenon and you say it's complex, therefore the rules must be complex, that simply doesn't follow. The rules might in fact

Fig. 3.16 Paul Brown. 1996. *Infinite Permutations.* An example of a recursive grammar.

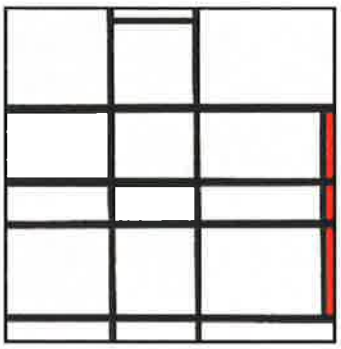


Fig. 3.17 Piet Mondrian. 1936. *Composition with Red.* Oil on canvas.

Fig. 3.18 John McCormack. 1996. *Cellular automata landscape.*

be very simple and so going uphill from the behaviour to the rules—essentially is a difficult task. Fundamentally it's a very difficult task. Whereas going from simple rules to complex behaviour is, of course, a simple job. That's the reason why you have computer graphics today, because writing programs that will produce complicated behaviour is easy, but starting with something which is complicated behaviour and finding the rules is essentially difficult.
So the whole computer field is devoted to doing synthesis, not analysis: synthesis is easy, analysis is hard (Kirsch and Kirsch 1996).

Analysis of art is also complex because meaning is dependent on dynamic cultural factors. In natural language, Kristeva suggests the causes of changes of meaning are historical, linguistic, social and psychological (Kristeva 1989, 39). Just as in "linguistic innovation", artistic innovation puts propositions using a transfer mechanism of names and meanings. The meaning of the term "art", for example, has changed in this way throughout history, especially since the eighteenth century (Kristeller 1951a; Kristeller 1951b). Traditional discourses of artistic creation suggest that artists endeavour to subscribe to "real" art[82] rather than art "so-called". That is, they are committed to interrogative invention, rather than innovation through elaboration of an idea.

In practice, so-called art is often craft (characterised by the repetition of a known rule base and derivational sequence whether or not the process is computational). Computational examples of art may also demonstrate inventive potential, as in the work of Brown (Fig. 3.16); Barminski (Fig. 3.8) and McCormack (Fig. 3.18). As computation adds a greater capacity for memory, complexity and repetition to an artists' repertoire, developing instances of a type and attempting formal description of artistic behaviour may be facilitated (as evidenced in some CD-ROM productions (Leggett and Michael 1996)). Within any computational frame of reference, artists may be viewed with metaphors of grammars and contingency. Speaking from first hand art experience of Form Synth (see Fig. 3.2) a generative computational form interpreter, William Latham advocates a computational

82 Donald Brook's work on art as "transinstitutional non-specific experimental modelling" elaborated this distinction (Brook 1977; Brook 1980; Brook 1981; Brook c1974).

grammatical approach: "Without his realising it, the artist's creative output rises as he never runs out of new forms to discover. Form Synth could be seen as a way of improving an artist's creativity" (Lansdown 1989, 95).

Looking at Artists

Artists that appear grammatical

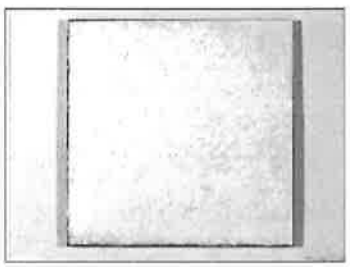


Fig. 3.19 Robert Ryman. *Constant*. 1987. Acrylic on board. 43 x 42.8 inches. Private collection, New York. Using a rule set based on reductionist Minimalism.

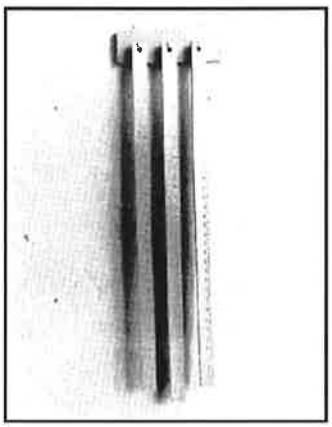


Fig. 3.20 Robert Morris. 1963. *Three Rulers*. Choreography as rules for art.

Artists whose work seems particularly grammatical may be found in the literature, often in relation to debates about formalism in the United States and Britain, eg Robert Ryman (Fig. 3.29) and Robert Morris (Fig. 3.20). The use of operational rules such as series and spatial transformation tend to apply in these cases. Generally, artists appear to develop an idea in relation to both their medium and their philosophical position. For example, Robert Morris clearly acknowledges his use of rules based on contemporary dance to reject the rules of conventional arbitrary aesthetic attitudes (Buchloh 1994, 31). Morris typifies the rebellious approach many artists attempt by reversing traditions while looking for alternative strategies and describes his work using different words to refer to a "contingent grammar". This transformational notion relates to the phenomenon in natural language called *metathesis*, the transposition of elements that account for changes in language (Knight 1994, 93).

In a more computational view, Lansdown uses recursion[83] and array as categories for the analysis of computational works of art but found images seem to lie in between these two extremes. Many illusions are based both on array type grammars and some formal recursive systems (Lansdown 1996). Artists have traditionally used media that have not been able to repeat or store information efficiently. It is unsurprising that most "pre-computer" work has little evidence of

83 Lansdown previously described these categories of geometry in his book, *Computers in Art, Design and Animation* as recursive and classical. "In a recursive geometry the positioning of the geometric elements such as lines or motifs is the result of successively using the output of one calculation as the input to the next. The classical geometries, while often using some repetitive technique, do not base a given calculation on the previous one" (Lansdown 1996, 45).

Fig. 3.21 Paul Cézanne. 1886. *The Bay from L'Estaque*. Oil on canvas. 80 x 97.7 cm.

consistently applied shape rules other than in a broad transformational[84] sense. Rules[85] of perspective aside, expressionist and post-modernist approaches to art consist of very few rules generally applied in an ad hoc manner in relation to particular contingencies. For example, to write a score[86] (as in Goodman's sense) for many art works would be an impossible task.

Artists such as Cézanne (Fig. 3.21) and Matisse understood systems of illusion and representation that might be likened to grammartical rules. In the early 1900s, Cézanne's descriptions of the world in terms of cones, spheres and cylinders led to fresh insights[87]. Matisse's well known Fauve painting of Mme Matisse, *Portrait with a Green Stripe*, 1905 (Fig. 3.22) provided a selective colour system alternative to the traditional tonal systems that had been used for centuries. Describing artists' works in terms of rules requires a delimiting process before form construction may be understood[88]. By reflection upon the qualities of art work rules emerge that would normally be

84 Islamic art might be an exception.

85 Some representative work that illustrates the use of rules and a loose analogy of the metaphor of grammatical design are found in the following: USA—Harold Cohen (Roth 1977; Dietrich 1987; Reichardt 1987; McCorduck 1991; Cohen, Brown et al. 1993; Buchloh 1994; Fifield 1994; Johnston 1994; Fifield 1995; Johnston January, 1994); Alfred Jensen (Diehl 1995; Diehl 1995); Jennifer Bartlett (Galligan 1985; Cotter 1986; Lawson 1986; Solomon 1989; Cebulski 1990; n.a. 1993; Thorson 1994; Johnson 1995); William Latham (Lansdown 1987), Ernest Edmonds (Lawson and Loke 1996); Robert Ryman (Kuspit 1989; Rorimer 1991; McEvilley 1992; Decter 1994; Webster 1994; Wood 1994; Wood 1994); John Cage, Philip Pearlstein (Viola 1982; Pearlstein 1996), Forest Best, Myron Stout, Richard Bellamy, Frank Metzker, David Wickland, Larry Weiner, Dan Graham (Johnson 1990; Salvioni 1990; Metzger 1993; Gintz 1994; London 1995), Bill Walton (Sachs 1987; Neff 1992; Schwendenwien 1995), Matthew Abbott (Hirsh 1995; Volk 1996), Robert Morris (Clarke 1992; Buchloh 1994; Karmel 1995; Rudolph 1995), Sol Le Witt, Charles Biederman, Hanne Darbhoven (Bruggen 1988; n.a. 1991; Hixson 1992; Bobka 1993; Gisbourne 1994), Beryl Korot, Richard Cramer, Karl Fudge, Ed Ruscha (Kuspit 1991; Nixon 1991; Armstrong 1994; Dooley 1994; Gibson 1995; Wei 1995), William Wegman (Raczka 1991; Kramer 1992; Coupland 1994);William T Wiley (Hudson and Wiley 1991; Rau 1995), Anna Chave, Archie Rand, Joel Fischer, George Brecht, Robert Filliou, Alice Neel, Al Held (Katz 1995; Petkanas 1995), Adam Elsheimer. Britain—Patrick Heron (Morley 1994), John Lansdown (Lansdown 1996), John Wood, Fiona Banner (Barrett 1996), Jourdan Baseman, Michael Craig Martin (Perrin 1993; Bevan 1995; Wilson 1995), Simon Patterson (Harris 1996), Douglas Gordon (Maloney 1995), Agnes Martin (Krauss 1995; Simon 1996).

86 Nelson Goodman in his book *Languages of Art*, describes a theory of notation using scores (Goodman 1976, 154).

87 On April 15, 1904 Cézanne in a letter to Emil Bernard wrote: "Treat nature by means of the cylinder, the sphere, and the cone, everything brought into proper perspective, so that each side of an object or a plane is directed towards a central point" (Reff 1960). Quoted in (Rand 1970, 231). Paul Rand notes: "Ironically, what was new was not Cézanne's statement but the mistaken interpretation, which was, perhaps, most influential in changing the course of modern art and design in our time" (Rand 1970, 231).

88 Wilson contends that one direction in which painting has travelled recently reinterrogates the ways in which meaning can be created and communicated through the seemingly intractable and determining surfaces of Modernist painting. He suggests that work carried out in this vein can be identified by steadfast attention to the "facts" of painting. In the paintings under discussion the writer continues, "the gaps that open up between subject and content—the 'how' and—the 'what' are bridged by the construction of meaning". He contends that one aspect of this development is the realisation that the pluralities of a Postmodernist culture do not constitute a reversal or death of Modernism (Wilson 1995).

Fig. 3.22 Henri Matisse. 1905. *Portrait with a Green Stripe*. Oil and tempera on canvas. 40 x 32.5 cm.

taken for granted as in the work of Roy Lichtenstein: "The pictorial vocabulary, typography and arrangement of texts and images in the comic are borrowed from the aggressive language of advertising, from the slogans used by the packaging industry, for example" (Osterwold 1990, 183). Process knowledge of rules extend artistic possibilities as seen in the nineteenth and twentieth century art academies and avant garde movement (Shapiro 1976).

A contingent sense of grammatical analysis by modern masters provides rules for the twentieth century based on unity, harmony, variety and contrast as used as in the past, but with the addition of an analytical reductionist overview.

The understandable post war need to thwart any kind of hegemony became a grammar of modernism based on the rule that an artist's role was to seek freedom through expression (eg Picasso). Hence systems of colour and formal structure became the experimental domain of art leading to a complex plurality and ultimately, (at least for the Nabis), a Symbolist quest for individualism. To probe the boundaries of being human, to interrogate old formulas and to seek alternative strategies seem to be principles underlying art practice in the late twentieth century that form the foundation of an identifiable sense of grammar.

Fig. 3.23 Roy Lichtenstein. 1964 *As I Opened Fire* (detail) Stedelijk Museum, Amsterdam.

Derivations

Consistent rule application contingently enables derivational vitality. Using the same rules in different ways may lead to alternative derivations as in natural language when a sentence may be altered using syntax. In a formal system such as a grammar, derivations depend upon the kind of inductive, deductive or abductive operations used. As a term in art and design "derivation" maps on to artists' exploration of a theme. For example, a grammatical view of derivations (see Meier Fig. 3.28) reinterprets systematic visual analysis begun by the Bauhaus. Constructivism in Russia and the Swiss graphic design movement used similar disciplined analysis to develop new forms of typographic and formal expression. Artists such as Vladimir Tatlin, El Lissitsky, Theo Van Doesburg, Piet Mondrian, and

Fig. 3.24 Koning Eizenberg Architecture. 1995. *Record House.*

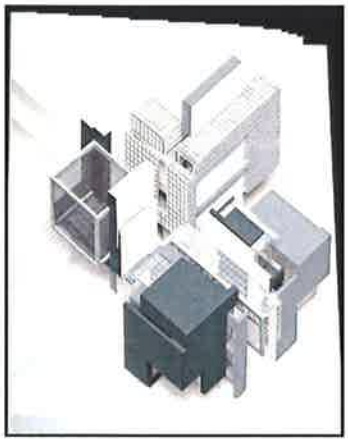


Fig. 3.25 Peter Eisenman. 1982. *House X.* Axonometric model, Scheme H, view from northeast.

Fig. 3.26 Sol LeWitt. 1969. *Lines, Colors and their Combinations.* (16 part composite) Coloured ink on paper. Overall: 124.5 x 124.5.

more recently Vasarely, Dieter Roth, Agnes Martin Hanna Darbhoven and Sol LeWitt (Fig. 3.26) demonstrate formal composition that may be represented in computer systems. In architecture and design, exponents such as, Adolf Loos, Josef Hofmann, Frank Lloyd Wright, Peter Eisenman (Fig. 3.25) and Koning and Eisenberg (Fig. 3.24) have shown that systems thinking can extend our knowledge of the visual world in ways that hitherto were taken for granted as regular pattern or simple texture.

Subtle changes in the order of things were too complicated to completely analyse before computers were available. They enable deeper analysis of systems and patterns, contributing to visual dialogue for today's online systems. Moments of insight are more identifiable because computers record, represent and display process more efficiently than previous human attempts.

Graphic artists such as Lucille Tenezas, Bill Barminski and April Greiman use a variety of digital media in a loose grammatical sense. Tenezas acknowledges a use of repetitive operations such as layers of dissolving grids, transparency, and a conscious choice of orientation and scale that seeks a balanced unity similar to that of a Matisse painting. Barminski uses a consistent repetition of theme and subject in his Internet and traditional painting media. April Greiman plays electronic spatial games with her graphic design that appear to obey a consistent aesthetic style incorporating overlap, disjunction and juxtaposition. For many mature artists such as these variation within a theme and repetition of a sensual pictorial element seems prevalent. Derivations are integral to art and design because they assist an explorative use of media beyond a mediocre outcome.

Design Formalisation

For Franz Reuleaux, George Stiny and those concerned with grammatical approaches to design descriptions, the belief that "design can be formalised" will be validated as "more and more formal devices are suggested, and proven in design" (Stiny 1989, 187). Stiny's emphasis on formalist analysis and the need to belong to a

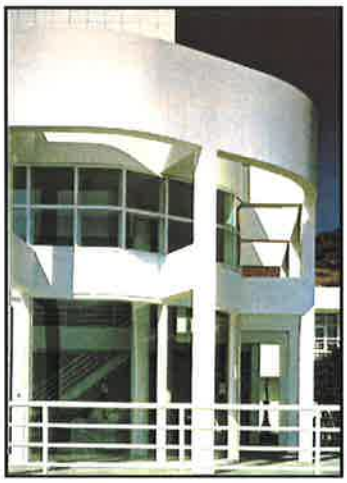


Fig. 3.27 Richard Meier. 1984-6. *Ackerberg House*, Malibu. South East corner Facade.

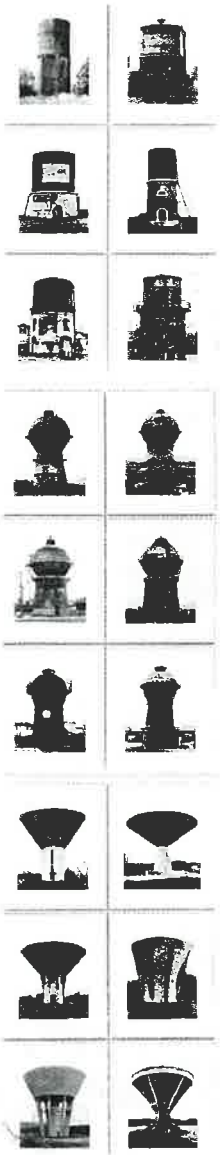


Fig. 3.28 Bernd and Hilla Becher. *Wassertürme*, 9 Tpologien zu je 9 Fotos.

system of science is echoed by David Kolb's comment:

It is certainly possible to point out formal features that show up in virtually all architecture. Symmetry, balance, scale, flow of space, and so on, are present (affirmed or denied) in any building. But these formal characteristics do not make a universal vocabulary; they are features that can be exhibited in different ways by different vocabularies. They are analogous not to elements of a vocabulary but to features of a text; texts can be described as balanced or symmetrical no matter in what language or genre they are written (Kolb 1990, 110).

The extent to which formalisation is achieved in various areas of design may be judged from those who have proposed formal devices in art (Fig.3.28) and design (Fig. 3.27). Lutyens recognised both grammar as a formal system, and its absence when he commented:

I require of a building, as of an individual, that a statement should be made gracefully, perhaps with distinction and humour. Many modern buildings, to me, are just shouting very loud and quite unintelligibly. I catch a phrase here and there, recognising a scrap of English or Italian, may be. There is vitality, heaps of it. But there seems to me no grammar and little sincere effort at style.
I feel about the new mode of building that it is easy to design because there is, as yet, no grammar (Lutyens, observation made to students at the Royal Academy, London, c1940 as President of the Royal Academy). Quoted in (Hussey 1953, 1984, 558).

Artists on record show explorations of narrow paths of visual languages as well as systematic grammatical approaches as in the typological images of Becher (Fig3.28). Perhaps these instances may be added to the body of growing evidence that supports contingent formalisation, as in Knights's work for example, in the grammar of Georges Vantongleroo (Knight 1994, 177).

The following two groups of artists and their work are chosen from many candidates. They are chosen to exemplify particular points about the senses in which grammars may be seen to apply. The first group contains five artists about whom others have written in senses of grammars. The second group contains five artists that I interviewed in 1996. Although some of these are also known as architects or designers (sometimes both), they all create and exhibit artwork. In the next chapter I reflect on some of my own artwork created as experiments for this thesis.

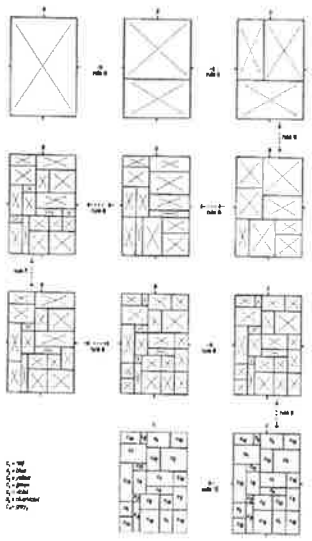


Fig. 3.29 Terry Knight. 1994. A derivation of a stage I design in one of the seven stages in the development of Georges Vantongleroo's paintings. (Knight 1994, 177).

Fig. 3.30 Richard Diebenkorn. *Ocean Park No 7*. 1968 oil on canvas. 236.2 x 203.2 cm

Group 1: A grammatical view of the work of five artists

(1) Richard Diebenkorn: *Ocean Park* series

Diebenkorn's *Ocean Park* series of paintings were made between 1967 and 1980 when he was living in Los Angeles, California. Diebenkorn is a major twentieth century artist, and in 1980, Robert T Buck Jr, Director of the Albright-Knox Art Gallery[89] described the *Ocean Park* paintings as "among the major contributions of the past decade to contemporary American painting" (Buck 1980, 42).

The *Ocean Park* series of paintings provide a first example of a grammar that may be defined loosely by enigmatic rules that seem to react to earlier developments of art history, including Cubism, German expressionism and American abstract expressionism (Buck 1980, 48). The influence of the work of Matisse and Mondrian is especially important for an understanding of the formalism inherent in the *Ocean Park* series and Diebenkorn's work generally. The characteristics of these forms are its abstract structuring and its painterly worked surfaces. Masses are represented by flat shapes with an overriding existential but holistic formal concern. In 1980, Diebenkorn acknowledged his debt to modern masters and had spoken of rules in his earlier University of New Mexico master's project completed in June 1951. He said of these works: "There is little of conventional fine handling or seductive surfaces in these works. They have a toughness as of the New Mexico desert. They are "right" but at the same time foreign and obviously subject only to their own rules" (Buck 1980, 55).

In 1988, Joan and Russell Kirsch wrote a formal grammar for generating images in the style of the *Ocean Park* series. Joan Kirsch described why Diebenkorn's work was chosen for this seminal study of artists and grammars:

The proximal answer is that we had a Diebenkorn reproduction on my icebox! But, of course, it was on my ice box because I have

89 In 1980, the gallery that produced a colour catalogue featuring the *Ocean Park* series of paintings was the Albright-Knox Art Gallery located at Buffalo, New York. Richard Diebenkorn died in 1993.

Fig. 3.31 Richard Diebenkorn. *Ocean Park No 83*. 1975. oil on canvas. 254 x 205.7 cm.

always liked his work a great deal.
Richard Diebenkorn was a good artist to start with in terms of describing a composition. That is, at first glance, his work appears geometrically formal, which might imply that he works out everything ahead of time in a cerebral fashion.
But Diebenkorn said (as do most artists) "I don't have a plan. I don't have rules." Yet, insofar as we can recognise his work so easily, he does have rules. And so this was the challenge—to uncover his unspoken rules.
Of course there have been artists, such as Mondrian and members of the de Stijl movement whose work was deliberately governed by an explicit program which was not the case for Diebenkorn (Kirsch and Kirsch 1996).

Simply put, rules for the *Ocean Park* series might be described as creating an alliance or striking a balance between structural concern and spatial illusion. Space is negotiated by definition and redefinition of line and tonal fields. Lines and bars may be interpreted as spatially ambiguous. Figure-ground relationships are subdued by an emphasis on surface texture and subtle tone and colour variation. Colour is used to diminish or strengthen the key linear elements providing a total structural and spatial unity. The vertical format is important to the *Ocean Park* series because it relates to views from the windows as shown in the artist's original sketches of the Ocean Park area. Flatness of the depiction of space locates the images at a relatively fixed distance from the viewer. Spatial illusions rely upon the luminosity of transparent layers in some sections. Lines and shapes bleed into underlying colours or forms showing traces of previous layers of space. Traditional perspective is subsumed. Forms are contrasted through varied densities of paint. Overpainting reveals areas integrated into the entire composition to reinforce the linear structure. Time is depicted in this way, as well as a dialogue between intellectual control and spontaneous invention. Diebenkorn seeks harmony and integration of elements of surface, space, luminosity and illusion of depth. It appears as though no ultimately fixed linear system divides areas of the composition or defines colour but for the use of the edge of the frame as a major force in the composition, that is, edges rather than the (traditionally depicted) centre is a key concern.

Fig. 3.32 Richard Diebenkorn. *Ocean Park No 114*. 1979 oil on canvas. 205.7 x 205.7 cm

As a series of paintings that are reliant on the above, the derivations are similar in appearance. Though recognisable they are each differ-

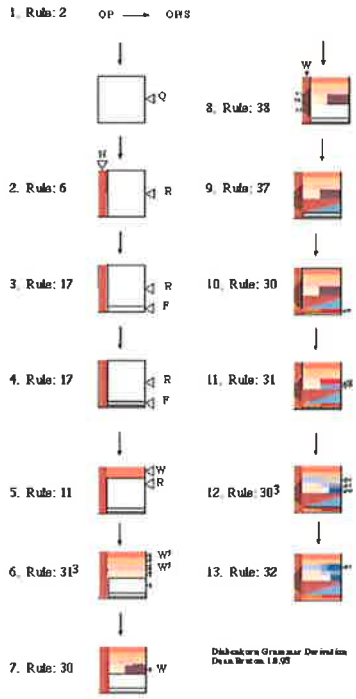


Fig. 3.33 Author's derivations of Diebenkorn's *Ocean Park* series using Kirsch and Kirsch's Diebenkorn grammar rules.

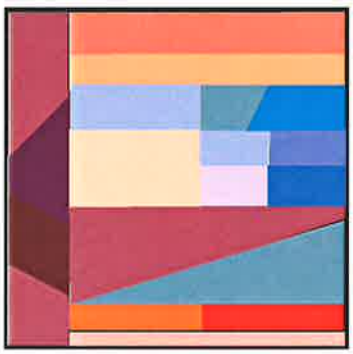


Fig. 3.33a Author's derivation (after Step 13 above) of one of Diebenkorn's *Ocean Park* series using Kirsch and Kirsch's Diebenkorn grammar rules.

ent due to rearrangement of structure, intensity of colour and predominance of hue. Throughout the series, a familiar holistic spatial quality and sensitive surface texture is clearly recognisable. A sense of restraint is evident within the carefully placed layers of transparent veils of colour. The texture of all of the works is consistently thin with some built up surfaces from successive layering. Key syntactic rules for the composition seem to be based upon the speed and direction of movement of the eye around the surface of the image. For example, clusters of derivations might be made by using criteria such as horizontal and vertical lines emphasis, diagonal emphasis, edge emphasis, high key colour contrast emphasis, or combinations of these.

The Diebenkorn Grammar

After studying the *Ocean Park* paintings chiefly from reproductions, Joan Kirsch started to put together a set of rules noting which things always go into a painting and even the presumed order of the compositional elements. The colour and textural qualities of Diebenkorn's work posed difficult problems for Joan and Russell Kirsch but their attitude was one of "Let's see what can be captured" rather than "We can capture the essence of the entire oeuvre." Joan wrote a set of rules and Russell programmed them and linked them as a formal system.

The grammar consists of 33 rewrite rules, depicted in simple linear fashion, that may be used to derive compositional structures that emulate Diebenkorn's *Ocean Park* series of paintings. When Joan and Russell Kirsch generated some Diebenkorn-like compositions with their grammar they contacted Diebenkorn expectantly:

We sent them to Diebenkorn and then phoned him expecting him to say "Fellers, you just don't understand all the process", but he said just the opposite. His exact words were "I had the shock of recognition. Those were my compositions" (Kirsch and Kirsch 1996). He did not collaborate with them, though, to develop the grammar in a more detailed way.

A grammatical perspective is useful in looking at this work because

it highlights general themes, concerns and formal decision making processes. It articulates moments of change of direction and combination of ideas. With this information a clearer understanding of the original works may be found because extra dimensions of consideration are added to previous appreciation of the works.
This facilitates discussion of the work's construction and meaning. By applying a grammatical perspective to other artists' works insights into the general development of art styles may be discerned. This work indicates a grammatical view facilitates analysis and generation of both art criticism and art production, particularly for those such as Diebenkorn who declare they have no rule set and assume that knowledge of design behaviour is mysterious, indescribable and always incomplete.

(2) Joan Miro

Further work was done on the work of artist Joan Miro. Miro was chosen because "he, more than most artists, says he works intuitively. I mean his works are exquisitely finished, when they get finished, but if he is working as a Surrealist would, he would have intentionally worked from the point of view of "accidents happenstance, unconscious notions" all kinds of things, which made it interesting" (Kirsch and Kirsch 1996). A two part process was used to develop an interactive shape grammar program for a series of Miro watercolour paintings. This was done by offering shapes that occurred in the body of works with a menu that allowed the operator to change the size and character of the shapes.
Operations were also defined, for instance shapes could be overlapped but an operation that imbeds a shape entirely within another shape within the Miro vocabulary was not allowed. The computer voice politely announced that this task was not allowed.
By dragging selected shapes out of the vocabulary they became dark icons that formed the compositional elements of a painting derivation. Colour could be added but was not represented within the grammar. This generated a version of a Miro that could be developed to a detailed derivation that included many subtle intri-

Fig. 3.34 Joan Miró. 1928. *Dutch Interior II*. Oil on canvas. 92 x 72 cm.

Fig. 3.35 R A and J L Kirsch. 1993. *Artificial Joan Miró drawing*. Computer generated drawing.

cacies of these Miro compositions.

Miro derivations took a few minutes to demonstrate with the computerised Miro grammar. Although still in prototype form the final result had clearly defined spaces that were characteristic of Miro's *Constellation* series that were chosen for study. Joan and Russell Kirsch' work on Miro extended the Diebenkorn example by articulating seemingly indescribable aspects of art work using shape grammars and computation:

> ...we decided to try work on Miro, for two reasons. First of all, his shapes are of course much more elaborate than Diebenkorn's rectilinear shapes (and represented a new challenge) and his colour is simpler. So we chose the set of 23 gouaches that he did until 1942, called "The Constellations". We started to write programs with a Macintosh to generate compositions in the style of Miro's Constellations. (Kirsch and Kirsch 1996).

The spaces between objects were clearly defined by the rule set of the grammar and the flat spatial arrangement that developed illustrated the typical Miro character.

> The Miro stuff is not in fact, a formal grammar. It uses LISP code written by the world's oldest bad LISP programmer, me. What it does is give you the opportunity to try to create a composition by giving you various menus with continuously variable parameters, so you can generate shapes.
> But of course it forces those shapes to be Miro shapes. It then allows you to take these shapes that you have generated, that you think you have generated, and to drag them into a composition. And again it constrains you to do only the things that presumably Miro would have done. So the net result of this "trying" to be Miro, is that you create what looks formally like a Miro composition (Kirsch and Kirsch 1996).

As with all form-centred grammars, these derivations and spatial arrangements are unrelated to Miro's meanings beyond shape, composition and elemental relationships. Apart from reference to formal qualities the derivations seem to exclude direct involvement of the original work's deeper *raisonne d'etre*. The Miro program spawned specific questions, "...it tries to appropriate a process. Not only the shape, but—how did you get to that shape? What would be the obvious way to draw a shape?" (Kirsch and Kirsch 1996).

On a formal level the construction of a Miro painting using defined shape rules was surprisingly fast, allowing the maker to evaluate aspects of the composition in relation to original works. Finer

points of composition and colour immediately rise to the surface for discussion because the interpretation of the grammar may be debated.

Qualities of the original Miro work are highlighted and enhanced as the grammar offers detailed drawing and painting operations. When discussing his 1958 mural Night and Day, Miro's own statement suggests a contingent grammar: " I sought a brutal expression in the large wall, a more poetic one in the smaller. Within each composition I sought at the same time a contrast by opposing to the black, ferocious and dynamic drawing, calm coloured forms, flat or in squares" (Arnason 1969, 353).

This work questions key decision making aspects of design such as: "What are the fundamental processes of construction behind a pictorial language?", "How are formal elements integrated as a whole in this corpus of Miro's work?", and "How else can this work, or other artists work, be represented using grammars?"

(3) Harold Cohen

Fig. 3.36 Harold Cohen. *Stephanie and Friend.* 1993. Computer generated painting. AARON.

Artists that use strict formalist methods exist, but very few seem to use purist algorithmic approaches. Harold Cohen is a prime example of an artist that has used algorithmic approaches exclusively:

> Cohen came from a fine art background and had a reputation as an abstract painter in the 1960s. He was introduced to computers at the University of California at San Diego in 1968. In the 1970s Lauzzana worked with Harold Cohen, who set out to invent everything by himself, "even using glue to hold his plotter prototypes together!" This development of early types of plotters in the seventies with Cohen initiated Lauzzana's own move into computerised aspects of art (McCorduck 1991).

Cohen's first computer program was written in Fortran (formula translation) in 1968. This program developed into "Aaron", an artificial-intelligence (AI) program that became capable of generating figurative drawings by the mid 1980s. Mike King describes Cohen's use of rules: "Cohen has used programming to incorporate rules of painting or composition derived from an analysis of his own and other's work, including children's drawings" (King 1995). In 1996, Lauzzana describes Cohen's rules:

Cohen's rules are heuristic. He maintains a database of conditions and states and continuously tests and takes actions that modify this database. It's actually rather "informal". He has no formal definition of what rule is other then an "if-then" clause. So it really falls into the model of an "expert system" rather than a formal language. Obviously, someone could take the effort to analyse his code and describe it as a formal language. But, nobody to my knowledge, has done this (Lauzzana 1996).

His imagery is not based on mathematics, geometry or algorithms in the same sense that these form the basis of computer artists like Karl Sims and William Latham, who use scripting language to control their Boolean modelling. It is based on rewrite rules, ie "if-then-else" statements. Cohen describes it: "The program [AARON] has always been structured in terms of cognitive behaviour, not in terms of form" (McCorduck 1991, 68).

According to King (King 1995, 117) "cognitive primitives" are used by Cohen to derive forms instead of strict mathematical algorithms. The cognitive primitives are generated in relation to the subdivisions of a surface, and may be put in the category of algorithmic synthesis from primitives.

A characteristic linear quality distinguishes Cohen's derivations from other works. Colour was applied by hand until the 1990s, when slides photographed from the computer screen were used as colour studies for a series of paintings. In Holtzman's view, "Cohen's rules are a grammar for drawing. From them, an infinite number of pictures can be generated that all share a common style, an underlying system for organising visual structure" (Holtzman 1994, 188).

Cohen's forms are woven together spatially by a very distinctive line and a shape configuration that appears to avoid large spaces. The work is coloured in a simple flat pattern style that appears less than three dimensional. A unified appearance across the picture surface puts Cohen in the synecdoche domain where harmony is achieved by families of shapes with similar genes.

A traditional tonal system is used to depict flat overlapping spatial relations with colour but with limited tonal variation applied by hand. Cohen's statement reflects a contingent grammar: "I don't know why it took so long to come into focus for me. The most

important element of colouring is not hue—where individual colours fall on the spectrum—but how light or dark the colours are in relation to each other" (Holtzman 1994. 187).

As Holtzman writes:

> AARON has evolved over the past twenty years, from a simple drawing system capable of creating childlike images to a sophisticated drawing system capable of creating detailed and realistic portraits of people set against abstract backgrounds that it is hard to imagine were not created by a skilled artist. (Holtzman 1994, 181).

(4) Ed Moses

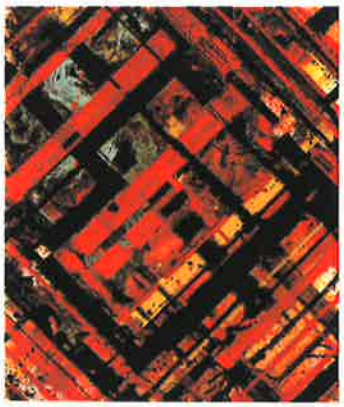


Fig. 3.37 Ed Moses. *Cubist and What*. 1985. Acrylic and asphaltum on canvas. 198 x 167.6 cm. Collection Sally and David Vena, Los Angeles.

Ed Moses represents an abstract painter that uses a consistent motif, (a brush mark that appears wormlike) throughout many years of apparent stylistic change. This motif indicates a simple rule that might constitute the beginnings of a grammatical analysis.

In 1996 the Museum of Contemporary Art in Los Angeles held Ed Moses' retrospective exhibition—painting and drawings from 1951-1996. Moses worked mostly in Southern California, hovering between abstraction and figuration. He acknowledges his antecedent influences as Picasso, Malevich, and Mondrian. His works may be split into a number of groups depending on the medium and overall appearance of the works.

Early work based on Venice Beach, California is architectural. There was a small line etching that seemed to select the minimal linear elements, and others that represented planar spatial descriptions of the beach front. Well known conventional operations such as "look and put", "select and reject", harmonious arrangement of compositional elements are prevalent.

Media such as graphite and colour pencil dominate the early works. These images appear as a dark rectangles with flower motifs that subtly mute the strength of a dark linear tonal pattern. Closer inspection reveals iconic flower forms as in a regular wallpaper pattern. According to Alma Ruiz, these works were inspired by Mexican fabric design, and Navajo blankets (Ruiz 1996). One can discern elements that might be construed as a lexicon and some operations that repeatedly derive novel propositions, so that a sense

of grammars is apparent. What at first appears to be "intuitive" decisions that guide the general direction of the work seem more rational in retrospect.

This 1996 show contained sixty paintings and drawings giving insights into the corners turned throughout his career. To think of his work in terms of grammar helps explain the diversity.

During the 1960s, Moses worked almost exclusively on paper. These works generated a series of large scale paintings that brought notoriety in the 1970s. They were inspired by Non-Western cultures, exploring a calligraphic texture and space: a move to abstract aesthetic construction.

Grids and cris-cross patterns develop into tartan grids in his work of the 1980s. The grids transform from regular to unpredictable, subtle, propositions. In the late 1980s he softened the grid structures and introduced brush trails he calls "worms". These forms meander through the large paintings eventually becoming a signature of his imagery.

Generally a shallow spatial "minimalist" illusion dominates with little three dimensional space being constructed in a conventional abstract manner. An Eastern viewpoint of the cosmos as all encompassing is perhaps a more appropriate viewpoint for many of the works, rather than the singular western perspective with its dominant finite vanishing point.

Later works are wall-size, dwarfing the viewer and encompassing the eye in a colour field with a few sporadic circles to break the strength of colour. The spatial relations in these paintings depend upon the ambiguity of colour and shape juxtapositioning. Flat brightly coloured surfaces give little indication of conventional illusions of depth.

As Ruiz writes, "Ed Moses intuitively knows what he wants and he has been pursuing it for the last forty-five years" (Ruiz 1996).

Interestingly, Moses' deep philosophically inspired mid career work might much more easily be explored via the computer program *Tartan Worlds* (see Chapter 4).

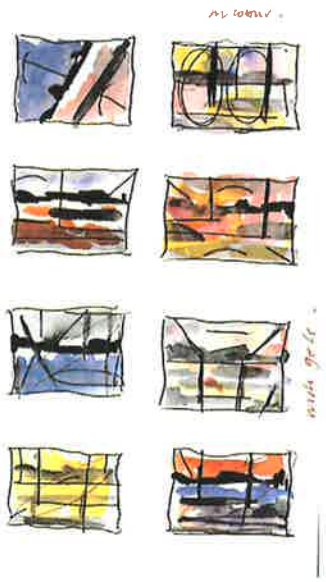


Fig. 3.38 Derek Jarman. 1974. *Eight landscape sketches, from Notebook C3E*, June 1974.

(5) Derek Jarman

Derek Jarman was chosen because his work represented a cathartic approach that seemed to break all conventional art rules but adhered to the idea of series and reflected dramatic changing concerns of the art world over a period of thirty years.

His early works had a visual spatial quality and a liveliness/commanding sense of space that survive throughout all his work. I understood his work as a series of grammars that use alternative rule sets (either for figurative depiction of space or for violent expression of feelings towards his tragic demise from AIDS).

Jarman's early serial work demonstrates the use of transitional rules. Repetition of symbolic elements, colours, and the linear application of elements and colours are continuing themes that reside throughout Jarman's later developments. His later work uses the Serialist idea but incorporates vastly different themes. His contraction of AIDS and a personal crisis is evident in his choice of textures and colour. As in other expressionist work, rules for the description of art works may be quite simple. Jarman uses shallow spatial illusions in his early work .

Later the works become completely two dimensional textures, sometimes with text scrawled into the paint. Formally these images may be described with rules about the elements of pictorial composition, but consistent application of rules is difficult to determine beyond a consistently unified composition and daring totality. For example, works completed just before his death were completed by scraping words into large areas of brightly coloured paint. These works contrasted to the tight formal constructions of his 1960s work but a sense of unity remains.

Each work in each of Jarman's series, such as the 1973 *Avebury Series*, develops from a chosen thematic style and relevant metaphor based on personal reflection. His work may be grouped by use of media, for example the series that uses cracked glass and gold leaf typified by *Silence*, or by conceptual obsession, for example, the series that uses wild expressionist colour marks as in his 1992 *Landscape*.

Fig. 3.39 Derek Jarman. *June 1992*. Landscape. oil on canvas.

Each series develops a distinct voice. The images are determined with some element of chaos or chance occurrence to perhaps defy rationalism in some way. Jarman uses the particular qualities of each media to advantage, including photocopies on canvas as in *Sightless*, 1993.

His filmwork with Ken Russell and others shows a surrealist quality that is expressed in his garden works at Prospect Cottage, completed just before his death in 1995. Jarman's work shocks in its humour and joyous physical involvement in contrast to the formality of, say, the mature work of Diebenkorn or Miro.

The spatial relation of forms in Jarman's works vary with the thematic instigation of the work, media and presentation. Jarman worked in traditional painting mode in the early works but in his later production included film work and a garden as his art. Provided one looks at a particular series the spatial relation of forms may be discussed. To try to extrapolate these qualities to other works spawns leaps of the imagination. The early works rely on a few well known formal rules of representation while others depend on alternative spatial concepts and ad hoc media exploration.

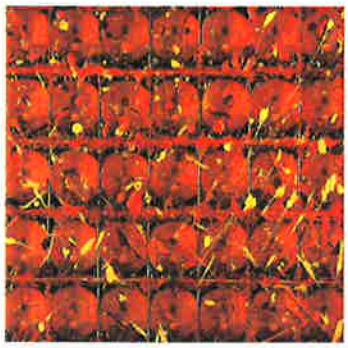


Fig. 3.40 Derek Jarman. 1993. *Sightless*. Oil on colour photocopies on canvas, April 1993.

A sense of grammar brings to looking at Jarman's work an understanding of production process, particularly the role of inconsistency and passion in art. It shows the disruption and conflict inherent in an artist's desperate fight with disease and death. With admiration for the scale, organisation of ideas and media chosen various possible grouping of works appear.

Passion and anger become a legitimate part of grammatical analysis because questions of emotion become reflected or intervene in part of the rule set. Distraction, anger contradiction and sensual passion are communicated in a range of rules.

Questions of what grammars can represent emerge. Looking beyond content to structure for links that exist throughout the entire corpus of an artists work intensifies the experience and enhances formal appreciation.

Group 2: Five Artists taking a grammatical view of their own work

(1) Lionel March

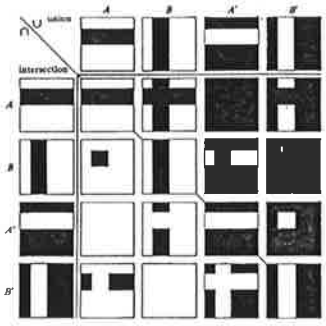


Fig. 3.41 Lionel March. 1981. *Tableau*, illustrating the operation of union and intersection on two sets A and B and their complements A' and B'. The basis of March's paintings.

March refers to his art work as algorithmic research: "I have for more than 30 years now, made use of rule systems in art work—things like the grids and all the rest of it that I've used consistently over a long period of time" (March 1996). His use of contingency is evident in the sense of game playing inherent in his work: "...we need to have the piece in front of it and talk about how it comes about and what kinds of games have been played. I think the advantages of a more formal approach, if you like, a rule bound approach, is that you can really play games when you have got rules" (March 1996).

March uses a reflective practice reliant on his contingently grammatical use of grids in relation to aesthetic experiences:

> I start from some aesthetic experience which in my world I do through various games that I play with some rules that I set up a long time ago and which have been transformed since. But I know what I am doing, and as I try and develop that, I ask questions which take me back into, if you like, a reflective mode (March 1996).

Currently based at UCLA, he was influential in establishing theoretical research foundations at the Martin Centre in Cambridge during the 1970s. His origins in the British painting domain resonated with the worlds of Klee and Kandinsky. His work was influenced by Serialist music and De Stijl:

> The question of taking—I am something of a minimalist in my starting point in that—Mondrian could put a stripe down on a canvas and somehow seemed to make it important. I found that fascinating.
> I started arguing that it was like a composer striking one note. What happens if you strike more notes, more stripes, and what happens if you intersect these?—You start playing with symmetries...a lot of my work was done with a musical analogy (March 1996).

Bauhaus ideals of Moholy Nagy and Max Bill were influential for March in his early years. Formalism has been decried by those that witnessed the American reductionism at work in the 1960-70s. The nineties have shown little of interest in formalist art except in digi-

tal technologies and global communications. In this light, March's ambitions seem heroic:

> Music is kind of like a line, it's one thing to have symmetry along a line and transformations around the line but in painting you have got a two dimensional field in which you work and of course in architecture you have a three dimensional field so that the symmetries, the transformations gradually become richer and richer as you move through these dimensions, but that was the whole point of it: if musicians can do so many wonderful things around a line, effectively the time line, the duration and so on, surely we could do it.
> Show me an abstract work of art that has the power of a Beethoven[90]. Why can't it have the power of a work by Beethoven? It's got more dimensions. You can do as much in two dimensions as you can do in one dimension and I don't find works that powerful.
> One can stand before Jackson Pollock and it is powerful and wonderful and you kind of get absorbed in it but it just doesn't do what Beethoven seems to be able to do, or most, many musicians are able to do (March 1996).

For more than 30 years Lionel March's art has used a grammatical rule system based on grids and the philosophy of Wittgenstein[91]. His rules have been strictly applied in a mathematical sense to develop images. The use of rules for the artwork was inspired by an interest in both philosophy and music. March explains the basis of his approach:

> It is Wittgenstein's arguments about rules: If you want to play a game you need some rules. You can play according to the rules. You can become an expert using the rules. People begin to appreciate just what you are doing and get enjoyment out of that watching the game being played. At some point or other you can, as it were, break the rules which basically means instituting a new rule which basically means introducing something else.
> If you play, as it were break a rule, you are going to introduce something else to take its place. I've always felt very strongly that you can clearly use it reflectively in terms of an analysis of works and so on, but you can also certainly do it the other way around constructively (March 1996).

Rules for his art began with a study and appreciation of the visual qualities of mathematical relationships. He was inspired by artists that appeared to use rules such as Paul Klee, Wassily Kandinsky, Piet Mondrian, Mark Rothko, Richard Lose, and Max Bill.

The derivations of March's art followed the musical systems set by

---

90 Few interviewees agreed that one could find a visual equivalent to a Beethoven. One notable exception was Robert Venturi who suggested the west wall of the Vatican by Michelangelo.
91 See (Kenny 1994, 48-9).

Schoenberg, Stockhausen and Boulez who were interested in Serialism. March explains,

> I was a mathematician and I was then doing architecture and I became really intrigued by the methodology which these musicians [the second Viennese School] were using to produce these aesthetic products and these expressive products.
> It seemed to me that the visual artist ought to be able to do very similar things, and why not. There was a play on symmetry on different kinds of scaling techniques they were using and overlays of different scales to produce new patterns, all kinds of things which were very understandable to me as a mathematician which were easily translated into graphical or visual material, pictorial material (March 1996).

The derivations were generated by recursive rules. By layering grids and transforming their orientation and size mathematically, March achieved many derivations with relatively few rules.

The early outcome was a series of works that were composed of plastic layers of grids. These instigated paintings and three dimensional constructions that formally used the same grammar.

In contrast to the prevailing Abstract Expressionists' intuitive approach, March intended to use algorithmic means to define structure for his expressive purposes:

> I made up some very large works using plastic and plastic film on plastic sheets, actually, so I wanted a kind of industrial approach, I wanted a hands-off from a point of view of the sort of "touchy feely".
> I wanted to deny myself that opportunity so that if there was anything expressive in this, it was coming out of the structures that I was using and not out of the surface, not out of materiality, all the things that painters can use. I denied myself that, and these were quite striking images anyway (March 1996).

March's grammatical view of his own work provides an understanding of the importance of rule selection, combination and representation. His algorithmic approach does not deny an emotional expression nor a physical involvement with media.

The grammatical view provides a sphere of activity that is personally relevant and accessible in ways that allow rapid production and derivational documentation. Visual research carried out in this manner is rigorous and offers new understanding of personal decision making and style.

Fig. 3.42 Alvy Ray Smith. 1996. *white.sands*.

(2) Alvy Ray Smith

Alvy Ray Smith has a history of involvement in the digital domain based on his work at Xerox PARC, Lucasfilm, Pixar, and Altimira (Platt 1996). Considered an expert in 3D graphics, Smith cofounded Pixar, the producers of the fully animated three dimensional feature film Toy Story. In 1991, after moving on from Pixar, he started a company called Altimira that produced a new kind of image-editing and composition program more flexible than Photoshop. It was marketed for 9 months and then withdrawn when he was invited to join Microsoft, his current employer.

Smith contingently uses a formal rule based grammar for some of his work. He wrote: "My work on computer-generated plants, however, is language based, using what I call "interpretations" of formal grammar types known as L-systems, or Lindenmayer systems. See my piece *white.sands* on my web page under Art for a grammar-driven work of art" (Smith 1996).

Smith distinguishes between the strict formal grammar and the art in the result which he understood as strictly his. He explains,

> The grammar emits a formal string, but it is my interpretation of that string (of 0s, 1s, [s and]s) that transforms the boring string into an interesting "plant" (nothing like them really exists). I select the colours, the widths, the curvatures, the directions, the lighting, the "flowering", the viewing angle, etc. There is nothing grammar-driven about these choices. Another way to say this is that there are an infinity of interpretations of a graftal grammar string. It is the artist's job to sort through these and prune the infinity down to size (Smith 1996).

Work on cellular automata has been used for the generation of artworks based on sound (Miranda 1995) as well as visual elements. Smith sees the artistic process as included in the choice of sets of rules. Smith discussed the aforementioned *white.sands*, and described its derivation as follows:

> This was generated using several generations of a grammar, starting with a single "axiom", namely a single 1. The grammar has eight rules and is context sensitive. So a single "cell" or "segment" of the final plant (my interpretation of the 0s and 1s) changes from generation to generation according to itself (whether 0 or 1) and to its two nearest neighbour segments (whether they are 0 or 1). Some of these transformation rules do nothing. Others cause a branch to form (indicated by a [,] pair). Others cause a state change (0 to 1, for example). Others cause a splitting of a cell or segment into

two—ie., "growth". Note that segments, branching, growing are all parts of the interpretation of the otherwise meaningless 4-ary string generated by the grammar. So each generation is one step in a logical series of plants = snapshots of its growth. A derivation is application of the transformation rules to every cell/segment in the current generation, simultaneously, to create the succeeding generation. The artistic process includes choosing interesting sets of rules from all those possible, choosing the interpretation parameters listed above, and deciding which generations to actually realise as phenotypes (of the string genotypes). If the piece is an animation, this adds further choices: how to interpolate the given frames to form smooth growth, the effect of tropisms, the path and other camera parameters, etc (Smith 1996).

As a mathematician, Smith understood grammar and derivation as,

...the rules and what they apply to and how they are applied is the grammar. It is customary to define the sequence derived from application of a grammar to be the "language" of that grammar. One can derive English sentences from an English grammar, but the sentences are considered part of the English language rather than its grammar. The grammar of DNA is well understood. The strings created are called genes, or genetic sequences, not grammar, which is only the rules used for the derivations (Smith 1996).

Spatial relations are determined by the context of the decisions made about the derivation. This contingent sense of grammar is discussed by Smith in relation to DNA and shape grammar:

One of the trickiest problems in mathematics and physics is the generalisation of textual notions, such as grammar and language, to graphical or pictorial elements (in case of mathematics) and to actual physical, space-occupying elements (in case of physics and chemistry). Nature has solved this problem for DNA by having the language interpreted (cf. graftals) as proteins, in a manner still not understood completely (the folding problem). One can imagine that a grammar can be expressed directly in picture, or geometric, or even molecular form. In fact, shape grammars of a very rudimentary form are about as close to this as we have come. Beyond that, the math gets very hard very fast. Certain graph grammars have stretched the bounds, but they are in general quite difficult to use. All this is strictly speaking, of course. The art world has often spoken loosely of the grammar of, say, Mondrian, or Picasso, or whoever (Smith 1996).

Extending Smith's example, Rudolph Arnheim discusses the work of Picasso's *Guernica* in these terms but from a psychological point of view (Arnheim 1962). Alternative views of *Guernica* are offered by (Clark 1941; Darr 1966; Masheck 1967; Chipp 1973-4). On the difficulties of grammatical aspects of the psychological components of art, Smith comments: "One of my beliefs is that exploration of actual grammars, as opposed to implicit ones, is one of the great

uncharted oceans of art, one that the computer has uniquely made available to us artists" (Smith 1996).

*White.sand*s appears to represent a natural plant with a shadow using traditional spatial illusions based on a single light source. The combination of image with chop is surprising and leads the viewer to consider a more philosophical aspect of the plant by implying a connection with the iconography of Chinese calligraphy.

Using lessons from the work of Benoit Mandelbrot and others, Smith's grammatical view of his own work extends beyond conventional understanding of image making. He uses grammars such as fractals to create algorithmic illusions of photographic representations of pictorial space. This is a key event in the history of picture making resulting from the use of computation. Smith's imaginative possibilities are expanded by his grammatical view of representation using computer technology to explore cellular automata. Yet he as the artist, interprets the formal outcome emitted by the grammar; the results of the rules are interpreted contingently.

(3) John Lansdown

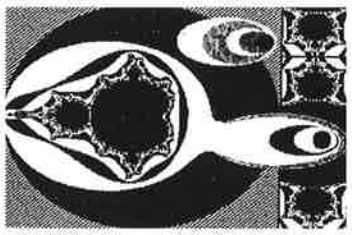


Fig. 3.43 John Lansdown. 1989. *"Tongue in Mandelbrot's cheek"*. A modified Mandelbrot set.

John Lansdown, Emeritus Professor of Computer Aided Art and Design, University of Middlesex, is an artist/architect who has worked in computer graphics in advertising, art, television and choreography. He has worked with colleagues at System Simulation on computer animation sequences for such films as Alien, Saturn III and Heavy Metal . He and his colleague, Gregory Moore (interviewed with Lansdown) advocate a formalist approach to form generation. In his own work Lansdown interprets contingency in terms of qualities of randomness: "I have pursued over the years the ideas of entirely rule based art mainly through my work on computer generated choreography and entirely random work" (Lansdown 1996).

Lansdown's work in choreography was inspired by mathematical principles and he suggests an art based on strict grammatical lines would generate far more worthwhile artefacts than traditional approaches to art with shape grammars. He describes his approach

in terms of rules that avoid reference to human actions: "The way I approach things, from a point of view of recursive grammars in choreography, is that I have not attempted to explain or duplicate human actions" (Lansdown 1996). In this context, his reservations about the use of shape grammars were expressed:

> People are good at certain things and not good at others. Two of the things they are not good at is working entirely randomly and working entirely to rule. It seems to me that, at least some of us should be looking at rule based art and design where we follow exactly the rules. Computers are very good at following rules and very good at generating random output. It is these two areas that I think we should be using the computers to exploit. Whenever we have seen examples of rule based work in the past, like for example Schoenberg's 12 tone system, we have found when the output did not suit the feelings that they had about the music then they changed the rules. This seems to me a poor way of going about things and if we are going to look at rule based art, music or dance then we should fully exploit the rules: devise rules and accept what output comes from them without any intermediate aesthetic judgment (Lansdown 1996).

Lansdown saw grammars to be useful as an explanatory medium but not as a generative medium despite the approach taken in his own work. To date, Lansdown viewed the use of shape grammars in art as unimpressive. For Lansdown the rules are the art work, rather than the derivation that results from their application: "All my work on computer choreography has been based on a generative approach. I take the view that once the rules have been devised in this hierarchical and recursive fashion the output is largely irrelevant. It is the rules that are the art work" (Lansdown 1996).

Used as rule-based generative systems, Lansdown suggests computers are useful tools:

> It does seem to me that we should be using rules based approaches to generate works that might not have been made by people. People can, and who do their own art are very good at it and we can respond to it. We should use rule based techniques to generate artworks that people wouldn't be able to do themselves (Lansdown 1996).

Lansdown advocated two types of grammar:

> My recent work suggests there are only two forms of grammar that are likely to have creative potential. The first of these are recursive grammars. Natural language is recursive. It works with recursive grammar. This allows us with a fairly limited set of grammatical rules to generate an infinity of sentences. The other form are called array grammars. These are quite different. Whereas recursive gram-

mars are essentially hierarchical and top down, with array grammars such as cellular automata what happens at a particular point is only dependent on what happens around it (Lansdown 1996).

Lansdown questioned shape grammars because they were not "recursive" and they were not "array" types. Shape grammars seem to use arbitrary decisions to develop a description of language and in Lansdown's view, did not appear useful as a design generation tool unless used recursively and hierarchically.

> I think this is the problem with the shape grammar approach—it is a collection of arbitrary rules chained together and that is not what happens with language. Words are not chained together...You have to say, a grammar must mean something special which is distinguishing it from a set of related rules for instance.
> What they are wanting to mean by grammar is that you could devise a set of unrelated rules. But if one believes that, you could define anything in those terms. That is not the same as saying it is a grammar which would be some sort of structure, and in my view, recursively structured arrangement (Lansdown 1996).

Lansdown's recursive approach can be implemented in programs like *Tartan Worlds* (Taplin 1992) that supply a format for the exploration of rules and decision making (Woodbury, Radford et al. 1992). However an array grammar also can be implemented in *Tartan Worlds*. The categories of recursive and array help distinguish types of images and may help distinguish grammatical approaches to art. The generative algorithmic possibilities of computer art give rise to a new aesthetic that fundamentally differs from conventional art:

> First, there is a special quality of drawings plotted in the very precise and regular way that computer output devices can often achieve. The output, untrammelled by the intuitive and subconscious modification that artists often add to manual drawing, invariably gains something simply by its mechanical perfection. Second, unlike the conventional case, artists using the sort of [generative] techniques discussed here very often wish to reveal rather than disguise the generative principles and processes involved in the creation of their works: to, as it were, let the grammar—and even the selector—play their own visible parts in the created image (Lansdown and Earnshaw 1989).

For Lansdown the "loose analogy" and "formal system" views of grammars were not a continuum (as suggested by Stiny (Stiny 1996)). Lansdown said:

> ...you have to set up the grammar in order to be recursive, so I am not clear what he [Stiny] means. I don't think there is a continuum

in that sense but for example, recursive grammars in the form that I suggested are very different from array grammars and these are not on the same continuum. So these are distinct and separate things...(Lansdown 1996).

In regard to shape grammar, Lansdown said,

I think there has been too much simplification, too much belief that you can explain a corpus of work with minimal rules. Most of the architectural rules for example are two dimensional and of course architecture isn't two dimensional...The problem is perhaps too hard to be tackled in the way that people have gone about it (Lansdown 1996).

Gregory Moore supported Lansdown's view that shape grammars were only one approach among many for the generation of design. He agreed shape grammars have a place as an explanatory medium but not as a generative medium. From an academic perspective, Moore suggested that other approaches might[92] be more useful for their explanatory and creative potential:

I think another thing about grammars is that the only grammars that I have come across until the early 90s,—I have to say I haven't actually studied them in depth,—dealt only with spatial positioning and most of them were architectural. They had reduced an architectural problem which was an immensely rich and complex problem down to a two dimensional arrangement of spaces (Lansdown 1996).

Rather than use context free grammars, Moore suggested a deeper study of context dependent grammars:

How we put sentences together is enriched by using context and how we understand the meaning of sentences is enriched by using context. One of the problems is that the shape grammars have come out of the formal grammar movement and are largely context free. I don't think design can be done with context free grammars. I think they require context dependent grammars (Lansdown 1996).

In a design training context, many projects that are initially context-free become context dependent as the novice-turns-professional-context takes over. Lansdown's contingently grammatical view of his own work suggests rules may be used with minimal or no human interference to produce art works: "We should use rule based techniques to generate artworks that people wouldn't be able to do

92 By contrast, Knight suggested the applicability of the grammatical metaphor to art was appropriate: "Yes, because even though in architecture the goals are more explicit in working towards a more particular end, in art, in the end you do have certain goals in mind. You are not creating thoroughly whimsical pieces most of the time. You set certain constraints for yourself on what you want your final thing to be like in terms of form or expression" (Knight 1996).

themselves" (Lansdown 1996). Derivations produced in this way are completely unpredictable and hence fit any metaphor of art as new or novel. Moore's view stresses context as an important practical consideration for any grammatical exploration of art and design. Together these views suggest open algorithmic experiments that may use arbitrary rules to generate images without artistic intention.

(4) Philip Pearlstein

As an artist of international standing, Pearlstein represents a figurative tradition in art. He recognises the contingently grammatical aspects of his work: "Essentially I have been trying to solve the same problem that I presented to students when I first began teaching which was in 1959 at Pratt Institute" (Pearlstein 1996). The problem emerged from the contingently grammatical aspects of perspective:

Fig. 3.44 Philip Pearlstein. 1996. *Jane Kaplowitz*, 1996. Oil on canvas. 60.9 x 76.2 cm. Collection of Jane Kaplowitz. This kind of portrait echoes the tonal rendering system of early Roman portraiture.

> I decided then that trying to solve those problems of not necessarily drawing from rules but using perspective and accounting for all the space in a painting where things were—how light fell on the surfaces and so on. In other words, to take full command of everything and really be responsible for every mark that I put down—and that should all add up to a particular kind of construction. It seemed to me to be far more interesting than being expressive,—just sloshing around and hoping something would emerge,—which is a crude way of putting it but that's more or less as understood abstract expressionism (Pearlstein 1996).

Working from his studio in the textile district in New York, Pearlstein has consistently exhibited paintings of the figure at major galleries since the 1960s. He based his general philosophy on the ideas of Marcel Duchamp and Francis Picabia. The intention to rupture rule sets was evident but within this framework a logic was acknowledged as necessary for the production of images. He paraphrased Picabia and Duchamp:

> Picabia and Duchamp said all these wonderful things. My favourite statement of Picabia's was that, "Our heads are round to allow thought to change its direction", and Duchamp's was something like, "Working according to the rules of chance." I forget the exact statement,—but letting things happen accidentally became embedded in my idea, in my head. That became a rule: an accidental combination of visual elements (Pearlstein 1996).

Pearlstein explains his methodology in terms of rules, but maintains a conceptual rule set beyond the physical manipulative operations.

An overview of some of Pearlstein's rules are as follows:

...three fixed overhead lights are used to cast shadows for reference points; first drawn form is near the centre of canvas; the first form establishes the scale of the other forms in the painting; an imagined grid is used to judge horizontal and vertical measurements using the tip of the brush; palette: titanium-zinc white, Naples yellow, raw sienna, raw umber, Mars yellow, cadmium orange, cadmium red light, cadmium red deep; canvas Belgium portrait linen, fine weave, double primed in lead white; brushes: flat hog's hair filbert preferred to sable brushes; paint surface kept thin with 1/4 Damar varnish, 1/4 boiled linseed oil, 1/2 rectified turpentine + pigment on the brush; Head and feet kept in the same position—left edge of the canvas is approximately three feet from the elbow of the foreground model; canvas and easel are moved as necessary to work on specific areas; charcoal drawing first then the first layer of colour; works on one to two layers of paint at a time only, then, they are left to dry; highlights and darks are reworked with transparent glazes until they maintain intensity after the paint has dried; lastly edges sharply defined; in 15-20 working sessions of four hours each or approximately 80 hours in total for a complete oil painting (Viola 1982).

As Pearlstein worked as a graphic designer he illustrates the idea that a rule system may guide artists. He used a pica rule for so long that it became tacit knowledge:

I no longer have a pica ruler in front of me in my head but the idea of subdividing the canvas according to some kind of scheme, has remained intuitively. I discovered that it just happens by itself. I don't have to worry about it. I draw from it in terms of proportions. I start with one element, one unit and then just visually measure everything according to that. Whether it's right or wrong in terms of anatomy - correct proportions of anatomy, I don't care. It's really about the distances from the edge of a form to another (Pearlstein 1996).

The derivations are based on the heuristics of a) working out from a centre point, b) developing the relationships within the painting based on a nominated measure so that all parts of the painting relate to that segment, c) enhancement of particularly strong relationships in the composition, d) relation of tonal patterns so that both three dimensional and two dimensional space is convincing and visually balanced.

Superficially, the subject matter also changes as follows: Figure in studio under strong lights; Figures with rugs; Figures with chairs;

Figure with mirrors; Figures furniture (with easels, rugs and chairs, stools); Portraits; Full figure compositions; Part figure compositions; Part clothed figure(s).

Pearlstein's paintings emulate the early Roman funerary portraits in technique. His derivations are dependent on the contingent choice of subject matter. Each portrait maintains a consistent oeuvre in terms of size, painting texture, tonal system and composition. Currently he uses human figure(s) in a conjured environment of personally collected items. He describes the method of building each derivation:

> I always start my paintings in the centre...So the initial line would have been this line along the back and then of course the space under here became the dominant element, the central element. Everything grows out of that...its all in terms of skipping around and measuring the distances...It's just freewheeling measuring. Then at a certain point logic has to take over (Pearlstein 1996).

Pearlstein is aware of a gap between the appearance of things and the representation of space in a system such as Renaissance perspective. Hence he develops his composition from the centre and then applies a perspective system to it to reconcile spatial ambiguities and structural balance: "Essentially it's like a jigsaw puzzle" (Pearlstein 1996). By changing position around the same subject Pearlstein derives new compositions: "Moving myself around, so these new works in a sense, are serial, much more than previously" (Pearlstein 1996).

Forms are defined by their relations to the first central form of the painting. The background appears to be determined by the negative shapes that harmonise with the total picture frame. A balance of suggested formal movements is implied in the composition of the figures. Complexity gives way to open space but open flat spaces never dominate. Three dimensional space is intensified with foreshortening. Cropping of parts of the figure occurs by the edge of the frame. Shadows dictate and articulate parts of the total composition. Volumes are depicted with a tonal range that depends upon the intensity of observed light. Colour is local except where important compositional accents are needed.

A figurative realism dominates based upon an observation of live

models. Tonal descriptions of form in the picture plane show a window with objects seen as three dimensional. There is an understated variance to the picture plane; with an avoidance of textural qualities in the paint surface. A questioning of the fixed relationship occurs between objects with a rejection of, say, an exclusive one point perspective. The grid influence of Muybridge's work (1870s) is evident from cast shadows that are compositionally important. Usually a large canvas size (2m x 2m) is used to enable emphasis on even the smallest forms, eg hands and feet, knuckles and nails.
The first stages of the painting seem to be defined in terms of shape relations:

> I start with one element, one unit and then just visually measure everything according to that. Whether it's right or wrong in terms of anatomy—correct proportions of anatomy, I don't care. It's really about the distances from the edge of a form to another.
> The composition is manipulated by the choice of still life items for the subject of a painting. There's a way of breaking up certain areas into smaller units—more complex designs and there's a way of bringing other transit colour into the painting (Pearlstein 1996).

Later developments of the paintings address spatial concerns. Pearlstein uses colours based on the colours that he sees, but usually a tonal system that is aware of the temperature of colour is used, in a subtle interplay with his compositional framework:

> I learned to use it and it's amazing. Even a colour like raw ochre when you become sensitised to it. You can make it more intense or less intense—cooler or warmer and so it assumes a position in space. I work with colours that way. Even greys, cool greys can become warm or cool or intense or dull (Pearlstein 1996).

Light is an important variable in the control of spatial relations. Three ceiling spotlights are used to organise intricate shadows arrangements. Although never working from photographs, Pearlstein's sense of space was influenced by his use of stereoscopic photography. Together with a formidable knowledge of art history Pearlstein illustrates a familiarity with shallow and deep spatial relationships that reflect many visual aspects of painting discourse. Proudly Pearlstein claims that academics (and some critics) are unhappy with his work. Pearlstein insists there is no meaning to his paintings, saying simply, "They mean what they are."
Pearlstein's grammatical sense of his own work is apparent: from

his sense of placement of the grammar of a work in a continuity of historical events; from his sense of measurement and placement of forms in his paintings, and from his use of systems of production that enable his prolific exhibitions record. He contingently maintains a shape-grammar protocol in his work that fosters a consistent appearance in his images. A conceptual consistency is recorded in his imagery, writings and interviews. Pearlstein offers an example of a prolific artist that reflects on his systems of conceptualisation while maintaining a contingently grammatical sense of his production technique.

(5) Philip Cox

Fig. 3.45 Philip Cox. 1994. *Sydney Harbour Longueville*. oil on canvas. 190 x 219 cm.

Philip Cox is an architect of international standing (Cox 1984; Cox 1988; Towndrow 1991; Cox 1994) who is primarily known for his highly distinctive sculptural architecture but has always considered painting to be of equal importance in expressing his feelings for the Australian landscape. His architecture and paintings reflect similar concerns. He describes the relationship:

> Architecture has many more disciplines and influences such as, political, economic and other situations which make it an extremely difficult art form in which to participate. Architecture is conditioned by those constraints whereas painting has a greater sense of freedom. Necessarily there is an interrelationship between the two in terms of the approach that is made to the subject and the responses that are inherent in both media (Cox 1996).

A grammar, to Cox, was the rational aspect of design. He said, "People do confuse intuition and rational design approach. I think that the rational approach to design is really merely the creation of a grammar. It is nothing else but a grammar in which people can take intuitive leaps" (Cox 1996).

Painting "is a pure expression of emotional, visual and intellectual response to whatever the subject matter is" (Cox 1996). Rules for practice were described as elusive but identifiable through reflection on the making process:

> I find that it is natural forms or the more metaphysical reactions that trigger off your thought process into the creative side of it. It is very difficult to always analyse exactly what stirs and what is the sequence. I always remember Lloyd Rees saying that he always

experienced that great mystery where he didn't know what he was doing when he was painting. He looked at the work and said, "Who has painted that?",—still holding a wet paintbrush. The spirit moves in such a strange way within the thought process. There seems to be somebody else doing it for him and then there is a realisation,—that is, coming back, and reflecting on what that process was that he actually had gone through (Cox 1996).

The qualities that are contingently grammatical in Cox's work are described in terms of general axioms:

The key rules I suppose if I am creating an architecture for instance,—I am so concerned about the bare bones sort of structure and the spatial qualities that go with that creation. I am also interested in structure with my painting—of how that painting goes together in the structural sense. Obviously in architecture it is a much more sophisticated situation. Whether you look at nature or look at anything it always is the structural form (whether it is a human body or a skeleton form or parts of the structure) that is a terribly significant and useful aspect of it. The structure actually forms its own space. That is the overriding thing.
If I took one single grammatical gesture it would be the structural aspect of, and compositional aspects of how that thing hangs together. The rest is embroidery, it is what you do to that to embellish it almost: what do you fill it in with? How do you explore within that bigger structure—the delights of details or delights of something else?
In the same way in a painting, provided that structure is overwhelming and convincing where it is the surface of paint somewhere or it is a detail within that painting that is adding to the general structural aspect of what we are doing (Cox 1996).

Derivations within Cox's paintings were loosely described as follows:

The symbols might be emotional symbols, but certainly in an architectural stroke, that could be a piece of concrete or actually a steel girder, it could be whatever I want it to be and I would implant that with a new message.
So the symbols change between them and it is easier to be on the more emotional side of painting rather than the intellectual side of having really to worry what does that mean, and if I do another line on that one what does it actually do to the structure of the situation?
It is just not two lines crossing it is connected in a way that piece of geometry is revealed. In painting I could do that and it is a different message and it has got a different set of symbols to it. It might be known, but it is certainly not steel girders as in the other thing (Cox 1996).

A key to the derivational sequence in Cox's work seems to lie in the search for a reaction to qualities of his environment, especially Australian landscape.

...if you fly over Australia, any part of this continent, the landscape

really overwhelms you. You feel that whatever you do in an artistic sense has to respond to this continent. It is such a difficult response too because it is not an easy environment to work within: it is a harsh light; it is very clear bright skies; the detail of the landscape is intriguing and complex.
We only have to look at our flora and see incredible complex Grevillia or Calistamens or Eucalypt forms that other plants probably don't even have.
When you look at those complexities and you can see how you are responding in terms of looking at that landscape, and how your emotions respond to it, whether it's translated into the form of a painting or a building that is going within that landscape: you're constantly trying to work out that relationship of the object to the landscape forms itself; how they work; how they integrate, how they may not integrate (Cox 1996).

Rules about integration of forms and structure in relation to key philosophical concerns seem to underpin the derivations of Cox's work. His colour is always fractured, broken up into components as in nature. The scale of his images vary from small to the monumental. A sense of movement consistently appears.

Spatial relations in his paintings are spontaneous responses to colour and form using an expressionist system of tonal atmospheric perspective. Shallow textural space appears at first and dominates the image but responds to a larger conception of the depicted landforms. A strong rhythmic flow between forms dominates the action of the images and brings together the parts into a whole.

You obviously read two dimensional forms that are in art very differently to the three dimensional forms that are created in architecture. One is looking at a different spatial sensation in architecture as opposed to painting.
Painting is the illusion of space where architecture is the creation of space. You have always got this sort of counter-action between the illusion, the reality of art and the reality of an architectural form in space (Cox 1996).

Cox's grammatical sense of his own work was expressed in relation to architectural constraints and practical design qualities, emotional response and symbolic reference. His frame of reference relies on metaphors of art as expression developed by post impressionist doctrines of symbolism and cathartic representation. Using a formal system of emotional responses to landscape that incorporates expressionist painterly technique, Cox loosely views painting as a personal language.

Summary

This chapter cites examples that show how a sense of grammar and grammatical views of practice impinge upon the ideas and art of some selected eminent practitioners. It views a sense of grammar as a ubiquitous underpinnning, in a variety of layers, of the thinking, production processes, and products of many artists. It demonstrates how discussion of an artists' sense of grammars in relation to their work assists the understanding, creation and discussion of art. Qualities of artists work that are contingently grammatical are identifiable through their descriptions and statements about their practice. Exploring their sense of grammars within descriptions of their own practice facilitates an appreciation of their aims and aspirations leading to insights into moments of inspiration and change.

In the next chapter I will report on some personal experiments with recursive grammatical programs and reflect on the sense of grammar in art.

4

Reflection on Grammars: an experimental journal

Fig. 4.1 Hugh of Fouilloy. after 1277. *Concerning the Dove.* In *De avibus* (of Birds); northern France. Tempera and gold on vellum. 9.1 x 6.4 cm.

Grammars and Reflective Action

This chapter is a journal recording theoretical reflections and form making experiments. It explores metaphors of grammar to locate "a contingent sense of grammar". Using observations from first hand experience, "grammar" is located as: a "sense" of grammar; a shape grammar protocol; computation; specific instances of shape grammar. Self creation is inherently part of these strategies for identifying, analysing and extending moments of inspiration when rule transformation occurs.

Development of a form requires both experiential and reflective action: "The principle is that one works simultaneously from the unit and from the total and then go in cycles—back and forth, back and forth"(Schön 1983, 78). Schön distinguishes reflection "in action" from, reflection "on action" which is more theoretically retrospective. These journal experiments include reflections on my developing

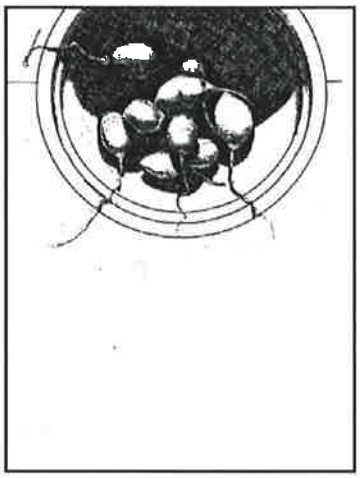


Fig. 4.2 *Tamarillos*. 1984. Etching. Arches. Edition 20. 10 x 12.5cm.

Fig. 4.3 *Persian Tamarillos*. 1996. Digital image. 10 x 12.5cm.

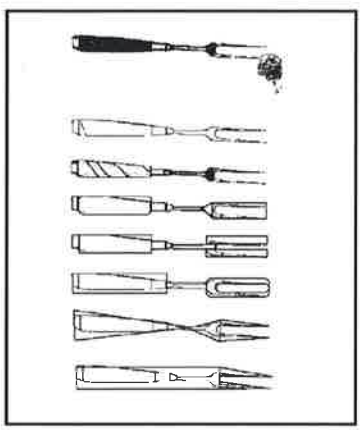


Fig. 4.4 *Top-down Fork Grammar Sketch*. 1991 Computer drawing.

understanding of "grammar", its formalism and the role of computers in the exploration of spatial grammars for art practice and education.

Early Work: traditional mediums

Artists' early work in traditional mediums is often used to illustrate their development of style in retrospective exhibitions. Many consider the style of an artist is discernible from the earliest works. This phenomenon suggests that artists' rules for form making are inherently part of their practice—a personal grammar, or sense of grammar is present form an early age. It is in this sense—for retrospective analysis—that my early work is relevant for the presentation in this chapter.

From 1975-85 early work used themes, series and transformations in paintings, drawings, prints and ceramic sculpture. From 1991, ideas of grammatical design developed on paper by designing cutlery, furniture and architectural forms on computer. From 1986 computer programs were used for writing and serial based image making. The following section describes and reflects on some early experiments, influences and subsequent form making experiments:

1. Tamarillos

This series may be seen as a shape development from line to point using a closed to "open" tonal pattern of rendering. Computer filters were used to rework etchings such as in *Tamarillos* (Fig.4.2) which developed further in 1996 (Fig. 4.3) from a scan of the original 1984 paper print. A transition from paper-based to digital media occurs.

2. Fork Series

These early computer drawings were forerunners for experiments in grammatical form making. The *Fork* series (Fig.4.4) uses structural arbitrary modifications—addition and subtraction of detail in a top-down formal simplification. Concerns were: transitions between functionality and ornament, diagrammatic and photo-realist representation, simplicity and technical efficiency.

Fig 4.5-7 *Koala Suite* Sketches. 1993. Computer drawing.

3. Koala Suite

Grammatical ideas (Alexander, Ishikawa et al. 1977) of top-down and bottom-up grammars then facilitated the conception of furniture in the *Koala Suite* 1993. This experiment used repetition of variations of curvilinear shapes that suggested a koala motif.

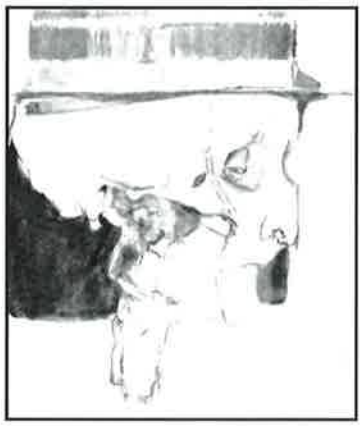


Fig. 4.8 *Head study*. 1973. Graphite and oil wash on paper. 37.5 x 50 cm.

Fig. 4.9 *Head study*. 1973. Graphite and oil wash on paper. 37.5 x 50 cm.

4. Medical Museum Head Series

Inspiration for art work may begin with a strong experience such as an experience of death, of European travel or one's home environment. Early paintings (1973-5) from anatomical studies at the Medical Museum (Fig. 4.9, 4.10) were a traumatic exploration of death and existentially reflected on life through the exploration of colour systems and scale. This series used severe framing and close up views that compressed "photographic" perspective. Colour was used for compositional variety and abstract spatial illusions (Fig 4.11). A painterly dialogue of surfaces between two dimensional reading and three dimensional illusion attempts to reveal "something" behind the skin (or glass case). These drawings and photographs continued as a portrait series of figurative paintings of friends. A colour system (based on Cézanne's work) used the warm and cool qualities of colour (Figure 4.12). It depicts a cylindrical cross section with the yellow at the apex (closest point to the viewer). Image cropping of photographic sources (after American painter Chuck Close) and geometric simplification of compositional elements unite a tonal system that used light to "dissolve" shapes. Using larger image sizes (of approximately 155 x 110 cm) increased the impact of these images because the texture and scale.

Fig. 4.10 *Head study*. 1973. Acrylic on canvas. 153 x 108 cm.

4.11 Colour scheme: colour system (left) may represent a tonal system (right).

Fig. 4.12 *Journey. 1997*. Photoshop. 37.5 x 50 cm.

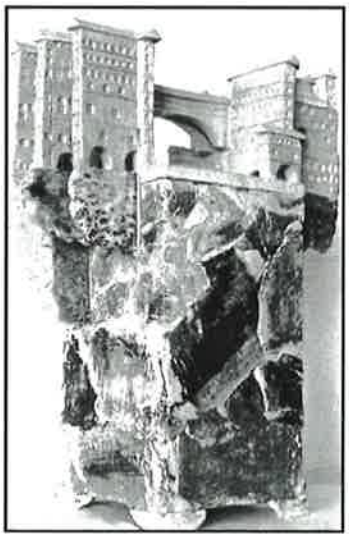


Fig. 4.13 *Benedictine Temple*. 1982. Stoneware. 17 x 31 x 43 cm.

5. Temples/Utopias

After touring many European galleries in 1981, I exhibited a series of ceramic sculptures described as "Temples and Utopias". This series of twenty sculptures were whimsical explorations of colour and architectural form. Each piece was built using a rectangular base embellished with detailed forms, such as buildings and cliff faces. A vocabulary was established: towers, bridges, cliffs and variegated colour loosely based on the aforementioned colour system. Each piece incorporated a variation of clay type, colour, texture or form using these vocabulary elements (Fig. 4.13). This "type and instance" work marked a turning point in its use of asymmetric form and the play of formal simplicity against areas of complex colour.

6. Tram Series

Similar formal devices occur in the *Tram* series—rectilinear elements appear akin to those used in the earlier ceramic sculptures. A figurative element is used as a counterpoint to the rectilinear geometric shapes (Fig. 4.16). A colour system utilising the screen print medium suggests a grammatical approach in the restriction of vocabulary elements, the selection of colours and simplification of composition. This series used Glenelg, my local environment where original C19th trams still run. Trams and trains are often used as metaphors for

Fig. 4.14-16 *Tram Series #1-3*. 1989. Screen prints. Arches buff. 39.5 x 32 cm. Edition 30.

finding personal direction and exploring interiority.

The "series": *Medical Museum* (head) studies; *Temples/Utopias*, *Trams* and *Guitar* were metaphors for key events in my life depicted with conventional media for form making experiments. An emergence of grid-like structures and "windows on the world" may be identified in theses works that reappear in later work.

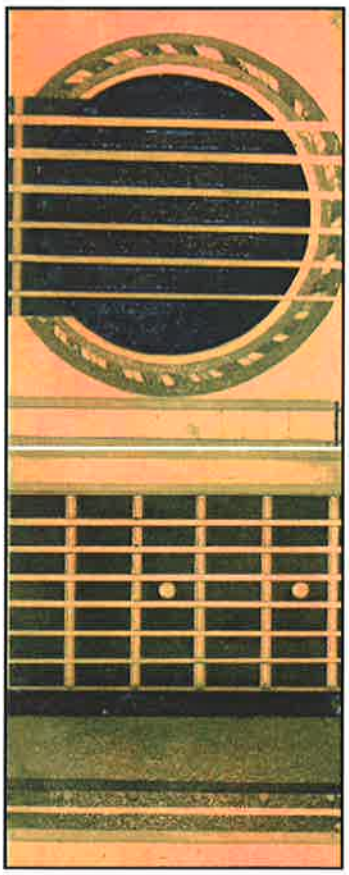


Fig. 4.17 *Guitar*. 1984. Etching. 12.5 x 10 cm.

7. Guitar series

Early etchings also use simplified colour schemes and selected shapes. In reflection on these works a dialogue between the rectilinear and the circular shapes dominates these images while colour is a key element. Many ideas (such as this series) were not fully explored because the images were dependent upon semantic inspiration rather than form making—a grammatical sense of form making was restricted by an urge to communicate symbolically.

From 1991, more consciously grammatical work began to build on earlier influences. For example, Giorgio Morandi's work was an early influence because of its tight considered composition and tonal relationships, together with the colour systems of Max Bill, Josef Albers and Gyorgy Kepes, Paul Gauguin, Paul Cézanne and Henri Matisse. The work of El Lissitsky, Pablo Picasso, Victor Vasarely, Stuart Davis, Edward Hopper, Marcel Duchamp, Andy Warhol, Armin Hofmann, Richard Diebenkorn, Sir William Coldstream and Philip Pearlstein inspired my first experiments. I adopted an

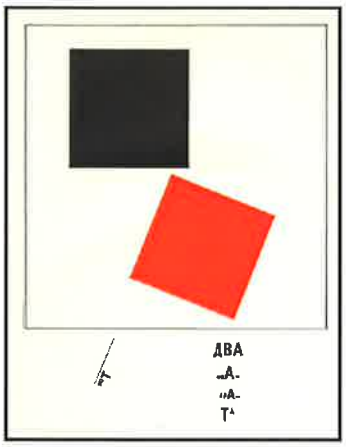


Fig. 4.18 El Lissitsky.1922. *Here are two squares*. Sythian, Berlin.

Fig. 4.19 Giorgio Morandi. 1918. *natura morta con manichino*. Oil on canvas.

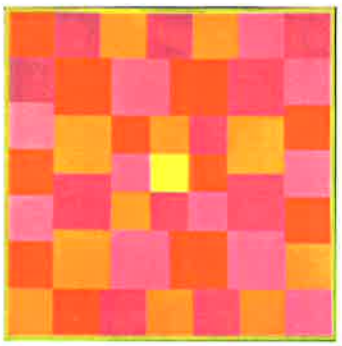


Fig. 4.20 Max Bill. 1966-7. Mathematical progressions attempt to create a painting as abstract as music.

Fig. 4.21 Bill Viola 1996. Video installation artist.

approach that maintained a contingent reflective and informal system of deciding upon forms while primarily responding to an "observed" rather than "felt" abstract world of objects and figures.

Structuralist influences were Giorgio Morandi, Giorgio de Chirico, Sol Le Witt, Frank Stella, Richard Meier, Mario Botta, Lionel March, Raymond Lauzzana, Jennifer Bartlett, Robert Morris, Francis Picabia and Bill Viola,—too many to mention here. Designers such as Josef Hofmann, Saul Bass, Bradley Thompson, Paul Rand, Dieter Rams, Neville Brody, Massimo Vignelli, April Greiman are key points of reference, as were the ceramic sculpture of Shoji Hamada, Pablo Picasso, Bernard Leach, Colin Pearson and Bryan Newman. Spatial representations refer to frameworks inherited from Giotto, Post-Impressionists and contemporary installation art. These are modified by Antonio Tapies and Valerio Adami in a melting pot of reference and interrelations.

Twentieth century poststructuralist moves in thinking from Chomsky through Foucault to Derrida and deconstruction influenced later computational experiments—that assume openness rather than closure. The inner life of a person mediates all other sensory input. Edward Hopper recognised the psychological aspects of art production as an important contribution:

> In every artist's development the germ of the later work is always found in the earlier. The nucleus around which the artist's intellect builds his work is himself...and this changes little from birth to death. What he was once, he always is, with slight modification. Changing fashion in methods or subject matter alters him little or not at all (Hobbs 1987, 23). Quoted in (Renner 1990, 14).

A contingent sense of grammar does not take away these sentiments but adds to possibilities by retrospectively enabling the identification of points of change. By looking back on work completed over thirty years, patterns of continuities and differences emerge and become starting points. For example, differences between the non computational and the computational work become apparent. Personal grammars of style become apparent in a variety of media as self awareness is heightened by attempts to synthesise a corpus of work in

Fig. 4.22 Neville Brody. 1992. *ORF* Pre-trailer television signations.

terms of a personal vocabulary.

Considered in this way, my early work seems to reflect the following qualities: a fineness of line; an attention to edges; awareness of eye movements around a composition; awareness of tonal and colour systems; preference for asymmetry and decentred forms. Moving from painting, drawings, printmaking to ceramics, and then to computational programs—reflects an interest in the impact of information technology on traditional media. These broad qualities may be refined further as a grammatical exploration clarifies the rules for one's personal visual languages.

The above overview of early work and brief description of influences supports the view that one's sense of grammar may be enhanced through critical reflection on one's work. Links with past work are too often neglected or forgotten. Past work is revisited with fresh insights that can grammatically contribute to a revised understanding of current work.

Experimental Journal

The following experimental journal reports form making experiments that explore a sense of grammar; a shape grammar protocol; computational experiments and particular shape grammar interpretations of a contingent sense of grammar.

Fig. 4.23 Bowl used for *Bowl Grammar Series*. 1996. Digital photograph.

Example 1 The Bowl Grammar Series

A bowl on the side of a pool was recorded as a tourist might, with a snapshot. The first example (Fig. 4.29) is an image exploration that began spontaneously but developed into a deeper meditation on the motivations and processes of form making. These images were later combined into a single postcard image developed from the standard proportions of the first image. Some distortion occurs in the resizing of the images for the postcard grid. The *Bowl Grammar Series* sequence (Fig. 4.24 below) reads from left to right, and top to bottom.

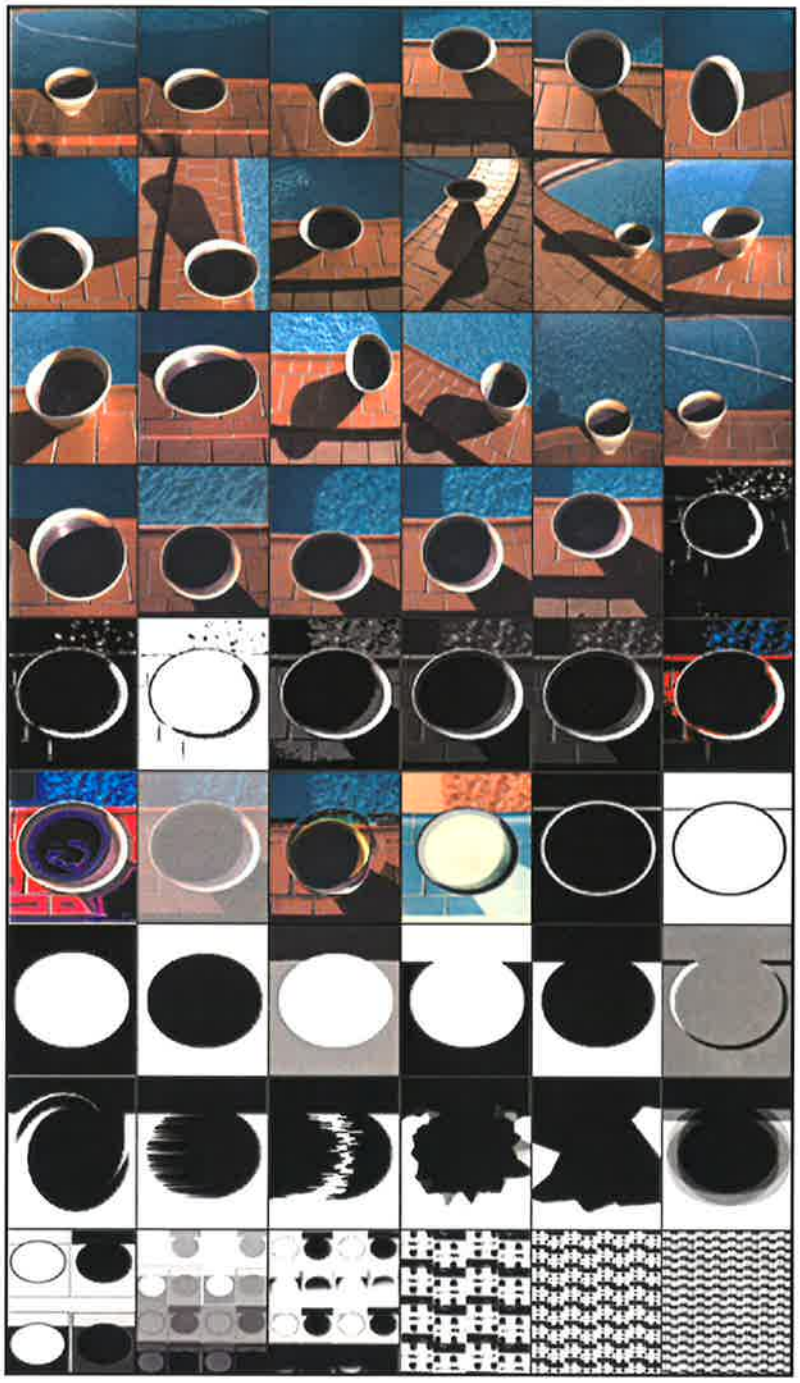


Fig. 4.24 *Bowl Grammar Series.* 1996. Photoshop derivations from early experiments with a digital camera.
The series is also shown as a sequence in the bottom right hand corner of pages 109-166. Flicking over the pages from front to back gives an impression of the series as a changing image over time.

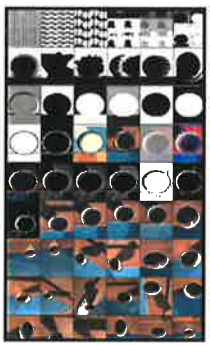


Fig.4.24 (a)Upside down version of the Bowl Grammar Series

Upside down it looks like a coral reef or prickly pear cactus. At different times one picks out different images that appear to dominate. Reversal of the whole and the parts (like the well known duck-rabbit illusion) appear. It may be read in many ways—as a concern for the removal of the literal—as in the work of Minimalists or as a narrative sequence. When exploring a bowl, a chair, a pool and a camera, multiple meanings emerged, which upon reflection, develop in relation to the photographic experience and later computer manipulation.

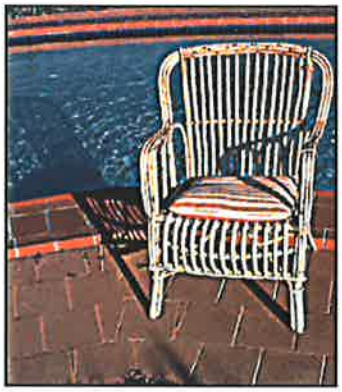


Fig. 4.25 *Chair Series*. 1996. Photoshop modified digital photograph.

Fig. 4.26 *Pool 1995*, petunias and northwest ocean view, Adelaide,

Reflections on Bowl Grammar Series

In the following section each paragraph indentation represents a different period of reflection. (As the text indentation expands to the right the reflections become more recent).

The genus of this series of images, and image, may be found in a conviction that a starting point in nature; a grounded *fact* of personal experience, could prompt action and reflection. Still life images of bowls and fruit (Vermeer, Carravagio, Matisse, Cézanne, Picasso, Dali, Morandi, Gauguin, Nicholson, Scott, Oldenburg, Caufield, Tapies, Adami) suggested an exploration of the qualities of my environment and a good starting point: "Think global—act local".

Reflections on Selecting an Image (August 1995)

The selection of a subject is often difficult because the reasons for an image to signify more than a trivial meaning are elusive. It seems that "doing" may be more productive than "thinking it through" in the early stages. My choice became motivated by the theme "objects" and was limited to those things available at the moment of initial motivation—chairs, ceramic bowls and the swimming pool became the initial subjects.

A QuickTake 150 digital camera recorded qualities of the light on the water and the shadows—the forms of the cane chairs and the bowl. A frail organic cane quality could be contrasted with the strength and rectilinearity of the pool tiles. Colours were almost complementary: turquoise and light mustard; yellow with the deeper blues of the water being a significant backdrop for the paver pinks. The images were taken quickly with little but intuitive planning—front, back, side, three quarter views of each object.

The photographic results (viewed on the computer) were immediately disappointing because the colours were too weak compared to the original experience. Using the computer I altered the colours and began to impose flat colour areas on top of the shapes that were captured by the image. This led to a variety of combinations

Fig. 4.27 *Bowl Series #1 copymax blend/sens*. 1996. Photoshop. A "code" for recording image operations.

of colour that became exciting. Coded records need to be kept of each variation. I used abbreviations of *Photoshop* filters and settings (Fig. 4.27). I sought a system for the derivations and contemplated a return to rules and variations after Oxman and Radford's guide (Oxman, Radford et al. 1987) for my next experiments. The main consideration was the retention of the essential character of the image while altering the following variables:

Parametric Variations

Values—hue; tone; contrast; transparent overlay

Shape—length, width, area

Geometric Variation

Vary the geometric system by changing: (all circular etc)

Shape of bowl—foreground

Shape of tiles—background

Shape of field—entire image

Topological Variations

Frame was constant but bowl, tiles, water, and pavers changed.

Towards a Formal System for Bowl Grammar Series

A familiarity with possibilities expanded as I tried to apply a formal approach to the understanding of the relationships between concepts of bowls and my *finite vocabulary* of elements: bowl; tiles; pavers and water—or, circular and rectilinear forms. Questions about strategies for formalisation of derivations and their semiotic relations emerged.

A finite set of rules between instances of the vocabulary were postulated as follows:

Colour

1. If there is a colour—then it should be an average of the range of colours shown in a large area of the photograph.

2. If there are two colours—then their interaction should compliment the entire image without dominance.

3. If there is a colour—then it is multi coloured at the edge.

3a If there is a colour—then it is not multi coloured at the edge.

4. If there is a colour—then the colour contains variety within the shape

5. If colour not in foci—then needs addition of complementary grey.

Composition

6. If the image has a central form—then it should contain some asymmetry.

7. If there is a shape—then it should have a harmonious relation with the entire framework.

8. If a there is a shape—then it should correspond to a dominant central vertical axis.

9. If there is a shape—then a variable grid pattern will guide arrangement.

10. If there is a *foci* —then a variety of *sub foci* is needed to allow the eye to travel across and around the field.

A Finite set of elements (with labels for orientation):

Bowl; bowl shadow; tile; tile join; paver; paver join; water

An initial labelled element: Bowl.

Looking back on these rule based ideas it seems that framing grammatical speculations on the experience enabled a useful breakdown of the form making experience. Elements of the image were reconsidered separately and altered in relation to larger frames of reference such as topological and symbolic domains.

Reflections on initial images (February 1996)

Why the pot and the pool? The bowl has a significant history. It was made by a close potter friend during a period of rapid personal change in my life. It carried my pets and my food. My cat slept in it as a kitten. Our pet pigeon slept in it, and often perched on its rim, and watched us through the living room window during winter rains and hot blue summers.

Fig. 4.28 *Pigeon*. 1996. One of a pair of 10 year old companions.

Reflections (October 1996)

Our dove died of old age in October, 1996, but the images of the birds stay with us and have given us many happy moments. The white of the feathers related to the white of the Richard Meier building, a Film and Television Museum that I saw in Los

Angeles, and connected with other artists who have explored the pleasures of feathered friends such as Picasso and Derek Jarman.

The stoneware bowl lived with us for many years in the dining room. It has a glaze that connects with a tradition of Australian matte glazes (and reminded me of Australian ceramicists, Milton Moon, Derek Smith, Les Blakeborough). It speaks of the many hours of working with clay, fire and glass to evoke a special form and physical relationship between these physical substances and an inner sense of coastal landscape.

The pool was built using materials and design of my own specification in 1994. It represents a union on several levels: within my personal relationship, within the sea and my place, within sky and water. The terracotta tiles were selected for references to Italy and Spain. The colour evokes memories of De Chirico and Tuscany, Barcelona, Nice and the Picasso legacy. It represents a chance for the good life to be found, to cherish the moods of the sea and sky and to enjoy them by being in them.

When photographing the bowl, I was aware it was only a small and particular view, but I continued to explore it, to see what boundaries emerged; how far one could push a subject in different directions to find alternative, but satisfactory solutions. Solutions to what? The problem of feeling the moment, the totality of a lifetime of looking, the experience of memory contained in the objects and the pleasures of colour, form, texture, light and shade, the feel of the combinations of perceptual "epi-phenomena", that result from a magic of a captured instant in time, a fragment of a life's inner visual sensation.

Later, reflecting on these reflections,—the space that opens as one begins to practise is often difficult to articulate at first. Where does one start? The blank page, the empty "canvas" or screen call up problems of value and relevance.

> Looking back now in late 1996,—a revision of my personal visual vocabulary began as a new visual representation of my environment—just like learning a new language. Thinking in terms of rules and grammars reveals (and from studying the work of Russell and Joan Kirsch et al) that my *oeuvre* could be extended and defined more clearly.

> Strategies inevitably arose for deciding what to keep. Finding the most valuable kinds of rules became a key concern.

Much later (1996), I began to change my behaviour from using general assumptions about design process to a belief that an awareness of a search for rules and their various applications may dramatically assist form making for artists.

> Looking back, the *Bowl Grammar Series* experiment was a change in my general approach to form making that incorporated elements of previous attitudes and values. Insights into rules for derivation and formalisation emerge after reflection on grammatical possibilities.

Reflecting on the Bowl Grammar Series Sequence

Fig. 4.29: The first photograph is taken. A bowl on the side of a pool. The attitude is candid—a simple record shot to start. No tricky composition.

> There is no "innocent eye", the camera records only a slice of composed vision. Left on its own the camera would provide little of interest to viewers beyond the voyeurist gaze and the empty recording of time-space, as in the Warhol films of the Empire State Building at night. Perhaps blandness, emptiness, the rhetoric of existential nihilism is a transition to more fertile ground (July 1997).

Fig. 4.30: A few seconds later, the pool hose (a white line)—remove it; deeper colour in water; balance the shadows with other side of pool fragment; emphasise the horizontal band of terracotta; the

Fig. 4.29 Bowl Grammar Series. 1996. Digital photograph.

Fig. 4.30 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.31 *Bowl Grammar Series.* 1996. (detail). Digital photograph.

shadows are too ordinary in arrangement; a lack of the bowl's profile is an improvement.

In retrospect, it is difficult to remember a sequence of thoughts clearly. General strategy: photograph the bowl by the pool in morning light, then, see what emerges. When "codes of event" are captured, a more formal applications may be explored.

Fig.4.31: What can be seen in a composition from the top? A much more powerful, simple and direct image, —a half moon lit on the edge of the bowl, anonymity and universality, but still a particularity of my making. Memories arise: of bowls of cherries, grapes and pomegranates, of Hamaguchi, a San Francisco artist's mezzotints.

Still Life,—subject and image, related by presence and illusion, become a nebulous representational dialogue that matures into patterns of observation and analysis. Extraordinary and the ordinary interweave as in Ben Nicholson's, Brancusi's or Jean Arp's work.

Fig. 4.32 Yozo Hamaguchi. 1977. *Red Cherries in blue Bowl.* Mezzotint.19 x19 cm.

> The importance of a physical connection with objects is as important as the lessons of history: "It is in the past that I found the lessons of history, of the reasons for being of things. Every event and every object is 'in relationship to'" (Le Corbusier 1930, 33).

Fig. 4.33 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.34 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.35 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.33: Trying the shadow on the other side—or perhaps move to other side of pool—What can be done with the shadows on the ledge of the pool? Link it with the bowl's shadow to give a sweeping movement in the foreground. Interesting composition, but too far away,—too loose. Top water shape around the bowl is attractive. I prefer the bright half moon on the lower edge of bowl. But is this a traditional view, inherited from all those diagrams in physics and photography classes where the light comes from the top left?

> Shadows have been a key consideration in all my work but I had not formalised this aspect until reflection on this image. "Space is a necessary a priori representation, which underlies all outer intuitions...The apodictic certainty of all geometric propositions, and the possibility of their a priori construction, is grounded in this a priori necessity of space" Immanuel Kant *Critique of Pure Reason*. Cited in (Flew 1971, 242). Quoted in Johnson 1994, 357)

Fig. 4.34: Close in—reveals a great shadow shape in rear. Remove other distractions where possible. The diagonal angle of the edge of the pool seems uncomfortable.

> The fusion of illusion and abstraction—ie the illusion of the photographic representation of the event and an abstraction of the constructed "post-event" forms is sought within the framing of the composition.

Fig. 4.35: Concerns are: the shadow position; cropping of fore-

ground and an unwelcome bright reflection on the rim of the bowl.

Can a visual experience overwhelm one's reflection of a moment? A suspension of judgement while the experience was "ingested" through the camera led to a blind optimism that a better solution was coming up. This apparent division between experience and reflection, that Donald A Norman discusses in his book *The Psychology of Everyday Things*, (Norman 1988) may be the reason why many artists are reluctant to discuss their work in print.

Each time one returns to reflect, new associations and different ideas appear depending on what one brings to the viewing. A "sense of grammar" seems to guide the repetition of rule applications.

At this point in the process the possibilities of future computer manipulations were concealed by the photographic exploration. A computer grammar applies by default once the images are transferred to *Photoshop* or other computer software.

Fig. 4.36 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.36: Achieving a far more interesting composition by using a larger blue water shape. Interesting changes appear in the water colours attempting to balance movements in the shapes of each larger segment within the composition; the bowl seems like our house on the edge of the sea, by the lighthouse, with its rays of light symbolically radiating in an arc across the back of the bowl.

Avoiding the didactic seems part of a sensible grammar that searches for a unity—a complete harmony of form although consciousness of a contrasting need for open spaces and flow between forms (non-closure).

Fig. 4.37: Attracted by the long shadow and the implied movement to break the rules set in the previous images where movement is to the right and the intersection is horizontal. Cutting space vertically the image becomes disturbingly disjointed. The bowl seems "dangerous" when so close.

Fig. 4.37 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.38 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.39 *Bowl Grammar Series.* 1996. Digital photograph.

Cameras speed up image capture, but increase meaningless experimental derivation, that is, sidetracks and diversions.

> The tension between the bowl form and the right hand edge is a familiar concern with edge relationships that take interest from the central action of the image.

Fig. 4.38: Again breaking the pattern by moving back. The verticals of the pavers can be used but repeats the composition in Fig. 4.30.

A self-consciousness pervades the next three shots (Fig.4.49-41). A return to the main tightly cropped idea occurs in Fig. 4.42, 4.48 and 4.51.

Fig. 4.39: Moving even further away, into the sun a diagonal shadow becomes the subject. The thesis "Reality and its Shadow" (Bruton 1993) comes to mind. The mood seems foreboding.

> This action illustrates a preference for close in views, or distant views that may be read as "close up" abstractions. In Fig. 4.40 the interest is in the tensions between smaller shapes (such as the top right corner), the broken line of bowl shadow or the intrusion of the lines at top left. Incidental movements and subtle suggestions that counteract the grand centrality of the supposed subject, ie, the "supporting cast" is more important than the

Fig. 4.40 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.41 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.42 *Bowl Grammar Series.* 1996. Digital photograph.

grand theme (central bowl) in this image. A moment of insight is recognised here as the dominance of subsidiary elements also may be found in other works.

Fig. 4.40: Changing the diagonal to enter from the other side, the curve of the pool gives a nice sweep across the rectangular frame. A "vagueness" about foreground relationships and the position of bowl is apparent.

Fig. 4.41: The bowl's profile cannot be included comfortably and proves to be too naked, too incomplete and predictable.

Another moment of insight here in recognising and avoiding cliches such as this "standard" view of a bowl.

Fig. 4.42: The sun moved so that a closer shot attempts to show the interior of the bowl. Interior and exterior can merge using the surrounding shapes to find a balance by cutting back the shadow.

Fig. 4.43: Removing the profile view proves to be better and simpler with a Japanese feel in the smooth curves. Some interesting darker water tones match the interior blue tones of the bowl.

Fig. 4.43 *Bowl Grammar Series.* 1996. Digital photograph.

A strong simple formal composition was sought to depict a mystery of the dark interior of the bowl and the moodiness of the distant darker water.

This image returns to (Fig. 4.31) in composition and "feel". Formalising these elements through grammatical analysis enables a recognition of similar "visual moments".

Fig. 4.44 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.45 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.46 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.47 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.44: Top down views seem best. From a distance, the long shot with shadow that looks like a bird, perhaps the dove.

Fig. 4.45: Again, the same idea but with a diagonal line through the composition. It is like standing on a diving board, but still too indulgent in its narrative, and symbolic qualities.

Fig. 4.46: Trying to emphasise a feeling of being on the edge of a cliff with a view across and down, fused together in the same image.

> Symbolic aspects (of location) became a guide to the next images. These aspects are difficult to translate in the computational sense of grammar.

Fig. 4.47: What happens with more elements added? Add a white line through the blue just like the boat's wash that cut across the sea. Still unhappy about the profile of the pot showing. I prefer a central top image of bowl rather than to the side.

Fig. 4.48 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.48: What happens close in? Can I reach a final decision about the best arrangement of shapes and form? Dark blue water: like moon at midnight, like distant tropical mountains.

> Poetic associations, non-verbal thinking seems to be prevalent at this stage. A repositioning of the bowl with some adjustment took place before the next image was taken.

Fig. 4.19 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.50 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.51 *Bowl Grammar Series.* 1996. Digital photograph.

I now recall images of bowls collected on my first overseas trip to the USA in 1981. I photographed bowls of cherries and strawberries in San Francisco. Figurative African bowls also made an impression at that time.

> This image reveals two aspects of my image making rules: a) a compositional search for balance of form and colour, and b) a poetic association that seeks interaction with the formal arrangement.

Fig. 4.49: Taken from further away, this image is close to a resolution of the feelings sought—balance of forms and colour seem right, but the image still seems unconnected. "Only connect" (E M Forster); the sea meets the land—the object moves in to view.

The camera seems too far from the subject but could be recomposed in the printing. The proportion of the main areas of colour appeared somehow more balanced, graceful and more elegant than previous attempts.

> This image appeals after a long separation from the original experience perhaps because of its new readings. The idea of "intervention" for instance, ie the way the shadow bleeds into the edge of the frame and the overlap of the pool edge by the rim of the bowl—an integrated disruption or intervention.

Fig. 4.50: Offsetting the bowl shadow on the dark blue water shape

Fig. 4.52 *Bowl Grammar Series.* 1996. Digital photograph.

looks more dynamic. Improvements are possible through removal of the centrality/stability elements as in the work of Richard Diebenkorn or Sam Francis: "use the edges, work at the boundaries".

Removing the foreground shadow line at the edge of the frame and introducing a shadow in the water at top left creates a more satisfying dynamic interplay between the two shadows outside the bowl.

Fig. 4.51: Stronger and simpler, this image feels and looks good to record. It has monumentality, ambiguity, can be large or small, deep or flat, and retains a power and positive mood.

This seems the best arrangement for these shapes because the bowl becomes a flat abstract shape. The contradiction between the flatness of form and the knowledge of the three dimensional spatial reality was intriguing.

Fig. 4.52: The final image of this sequence considers whether the pool ledge shadow might be used in a more complicated way: "Select and reject—look and put"—memories of South Australian painter and mentor, Geoff Wilson's painting classes and early discussions of Canaletto's work. The previous image (Fig. 4.51) is preferred because it is less complex and directs attention in and through the image with ambiguity and strength of purpose.

The *Postcard* of the "Bowl Grammar Series" image was constructed from all the individual images and their variations. It shows a compression of space and depicts my local environment in microcosm. The view of the sea from a cliff top is a thrilling sensation because one knows one is high up. That is, a depth of vision combined with a feeling of height adds a strange sensation to the experience of a clifftop environment.

This sensation generated Fig. 4.51, a turning point that revealed an alternative framing of spatial elements and consolidated a completion of this series of photographs.

Fig. 4.53 *Bowl Grammar Series.* 1996. Image 24 . Digital photograph, colour & tonal dropout.

Fig. 4.54 *Bowl Grammar Series.* 1996. Image 25 . Digital photograph, colour & tonal dropout.

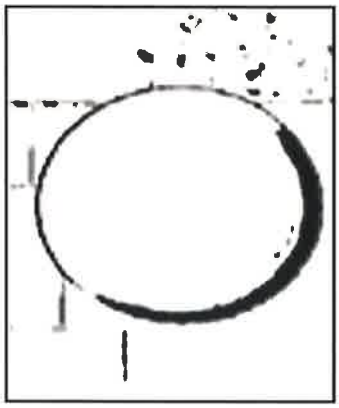


Fig. 4.55 *Bowl Grammar Series.* 1996. Image 26. Digital photograph.

Fig. 4.56 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.57 *Bowl Grammar Series.* 1996. Digital photograph.

Fig. 4.58 *Bowl Grammar Series.* 1996. Digital photograph.

The Transformations and Derivations

Fig. 4.53: A search for a manipulation strategy now takes over using *Photoshop.* After removing colour, it still has impact but loses too much detail. Further directions for abstraction are sought.

Fig. 4.54: Closing in, a flat strong simple abstraction occurs.

Fig. 4.55: Inverting the white background, possibilities emerge for more dramatic treatment. Default tonal ranges are added in the next three images to explore depth and texture.

Fig. 4.56: Tonal scale of four is used in a sombre black and white image. Colour opportunities appeal more at this stage.

Fig. 4.57: A tonal scale of sixteen gives unsurprising results.

Fig. 4.59 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

Fig. 4.60 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

Fig. 4.61 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

Fig. 4.58: Using full tonal range with an "auto" setting—Tonal detail may be carefully controlled using mode, layers and adjustment controls under "Adjust".

Fig. 4.59: Colour may be altered by using extreme values eg maximum blue, or minimum red.

Fig. 4.60: A Blend filter is used at maximum blend giving Pop art type or Abstract expressionist variations.

> This image marked a turning point for colour possibilities using the computer filter effects. Other filters were explored in the following sequence.

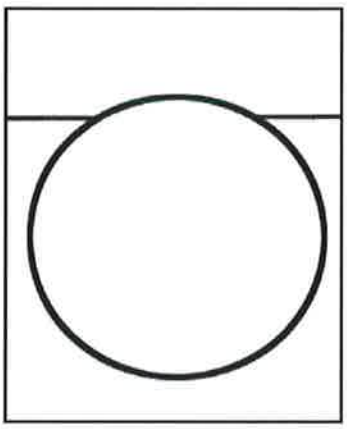


Fig. 4.62 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

Fig. 4.61: A ghost-like appearance is produced with a filter that decreases opacity and suggests an overlay of transparent layers. Traces: Derrida, contingency and differánce.Aspects of the "other" emerge.

Fig. 4.62: A white background seems to make the circle look bigger.

> A turning point, this image dispensed with the photographic and led to possibilities with drawn forms that could be constructed without a camera. Computation has its own grammar free of illusionist spatial representation. The previous image simplifies Fig.4.54.

Fig. 4.63 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

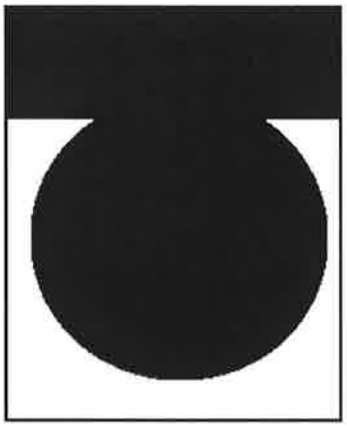


Fig. 4.64 *Bowl Grammar Series.* 1996. Digital manipulated photograph.

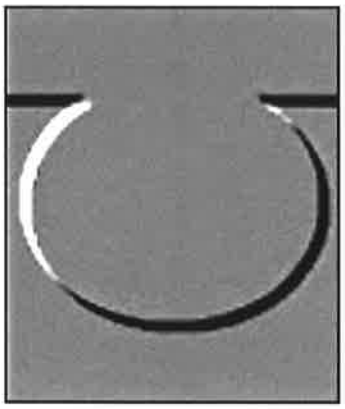


Fig. 4.65 *Bowl Grammar Series.* 1996. Digital manipulated photograph.

Fig. 4.63: This image suggests a logo design (as in the previous image), but gives a strong presence suggesting: an egg, Japanese flag, cosmic black hole and other metaphors.

Fig. 4.64: A reversal of the previous image gives a dominant hanging black form. A "jigsaw" illusion suggests cliffs and the sea below—a positive-negative exchange suggests male-female or good-evil symbolic types.

> A moment of insight occurs: the connection of forms and the local physical environment suggest ways of seeing and metaphors seem constructed from local experience.

Fig. 4.65: Using the Emboss filter suggests a range of possibilities for relief panels.

> Another turning point, this image remains unique in the series because it compares in impact with the colour images due to its three dimensional presence and simplicity.

> Later experiments in three dimensional modelling and grammatical programs extend this observation. Colour is powerful but three dimensionality and reduced colour may have strong impact. The Constructivists often used this strategy.

Fig. 4.66 Bowl Grammar Series. 1996. Digital manipulated photograph. Photoshop.

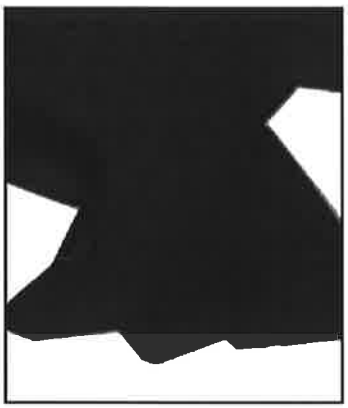


Fig. 4.67 Bowl Grammar Series. 1996. Digital manipulated photograph. Photoshop.

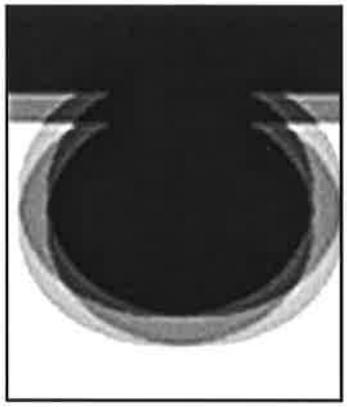


Fig. 4.68 Bowl Grammar Series. 1996. Digital manipulated photograph. Photoshop.

Fig. 4.66-4.68: Filters are used for the six following images as computer grammars took command—those shown are: wind (Fig4.66), wave (Fig4.67) and fragment (Fig4.68).

> These abstraction tools offer fast emulation of traditional painting techniques. The work of painters such as Nicholas de Stael and Franz Kline come to mind.

Fig. 4.69-4.71: Three of six images that use a repetition and reduction in scale by half of the original image. Associations arise: carpet squares; 1960s abstract expressionists; 1980s Neo-Geo paintings; William Scott; Patrick Heron; Hajek's sculptural work at the South Australian Festival Centre; and painters such as Victor Vasarely,

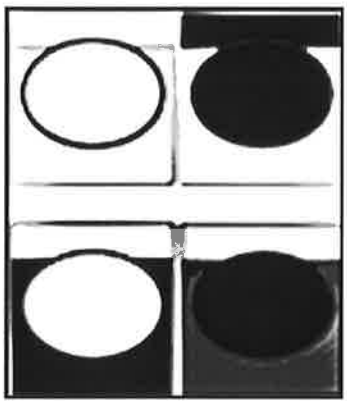


Fig. 4.69 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop: repetition.

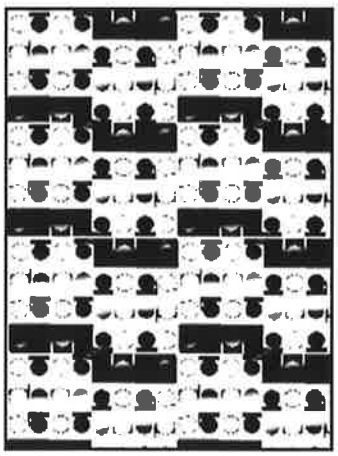


Fig. 4.70 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

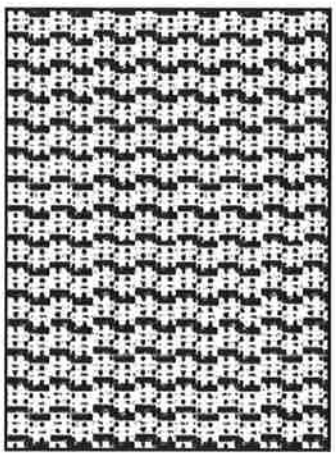


Fig. 4.71 *Bowl Grammar Series.* 1996. Digital manipulated photograph. Photoshop.

Max Bill, Josef Albers, Andy Warhol, Nam June Paik. References to the original image are faint. A regeneration occurs at this point. Directions seem to need reassessment at this point.

Later reflections (June 1997)

The *Bowl Grammar Series* formalisation began with the repetition of circular and rectangular shapes. The rectangular shapes were layered or divided so that combinations of shapes may occur resulting in the transformation of the circle. *Photoshop* filters assist this process (as in their application at the turning point, Fig. 4.53, where a grayscale system is used) with scaling and repetition rules (Fig. 4.69).

Colour systems are rule based in that they rely upon the *Photoshop* set of colours used by the computer system or printer. As in the experiments with tonal scales, extremes of each colour variable (eg contrast, brightness, hue, saturation and reversal) are altered as in image (Fig. 4.59).

The contingent sense of grammar is clearly dominant in these works. Emergent strategies evolve such as the move from a general to a close up view; reduction in scale and repetition of elements. This dynamic corresponds with a formal move from photographic representation towards abstract pattern; from colour to black and white; from static conventional depiction of space to a more dynamic repetitive optical illusion based on black and white contrast.

Switching a grammar may be seen in the changes of the vocabulary elements. Photographic elements change to abstract elements as in the key turning point Fig.4.62, that was loosely traced over a photographic image. Turning points may be found in the following images:

- Fig. 4.31 (standard to top view)
- Fig. 4.33 (minimal to dominance of foreground shadows)
- Fig. 4.37 (front to rear shadows)
- Fig. 4.39 (medium to long view)
- Fig. 4.48 (return to top view)

- Fig. 4.53 (colour to black and white)
- Fig. 4.56 (contrast to regular tonal filters)
- Fig. 4.59 (grayscale to colour filters)
- Fig. 4.62 (photographic to hand drawn shapes)
- Fig. 4.66 (regular to distortion filters)
- Fig. 4.369 (scaling down and repetition)

These turning points changed my awareness of a sense of grammar through the recognition of vocabulary alteration and rule transformation. Upon reflection, some give particular insight into the formalisation of imaging and the derivational process at work in my practice, eg Fig. 4.51 (composition and vocabulary selection), Fig. 4.60 (filtration through computation), Fig. 4.65 (three dimensional grayscale potential) and Fig. 4.69 (abstraction through scaling and repetition).

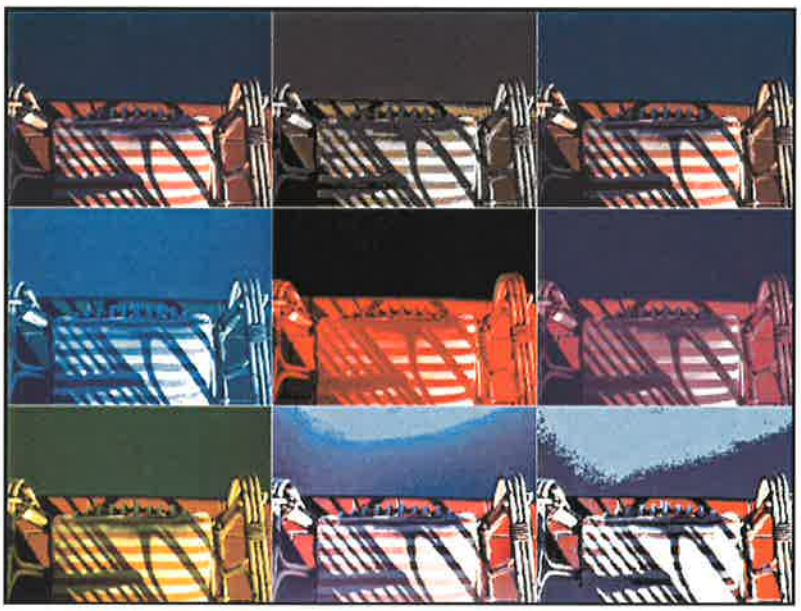


Fig. 4.72 *Chair Grammar Series A*. 1996. Photoshop. Colour exploration using filters.

Example 2: Chair Grammar Series

Early attempts to explore the limitations and possibilities of colour variations used an image of a cane chair by a swimming pool. Cropped images emphasised the abstract shapes around and within the chair, rather than giving the chair full centre stage.

Fig. 4.73 *Chair Grammar Series B.* 1996.
(from left -right, top-bottom)
Chair #1 balexpdef; Chair #1 cont100; Chair #1 balexpdefcont
Chair #1 maxred; Chair #1 maxblue; Chair #1 maxgreenadjminb/r
Chair #1 maxred/balcont; Chair #1 minblue; Chair #1 mingreen
These labels were initially, a simple procedure to document the transformations. Repetition of the exercise later became more complex.

Elements and Operations

In a more computational use of grammar, the *Chair* series were manipulated using the colour scale in *Photoshop* by by setting the variables to the maximum or minimum. Blending and posterisation were included.

As the complexity increased better codification of operations were sought. A sense of grammar can contribute to the documentation of art works.

The use of the grid is unavoidably symbolic but might be seen as invisible also. As Sol Le Witt suggested, it becomes a regular element in the rule set that can bring other variables to the forefront. It becomes a facilitator for action; that is, the formal experiments may be appreciated as a narrative because of the grid, and in spite of it. To disrupt the grid structure is a constant temptation but is resisted because it assists the image making process.

Reflections on Chair Grammar Series (June 1997)

Computational variables were: colour scales, filters for resizing, repositioning and distortion. Some rules for construction were spontaneously devised such as:

- use a maximum or minimum of one available variable
- use a maximum and a minimum of two available variables
- repeat and combine images in a grid.

These rules are inherently part of the computational program.

Example 3 Tool Series

Tools are the basis of art practice. Voltaire in his book, *Candide* gives useful advice—to go "back to the garden" (Voltaire 1947, 144). With this in mind, tools were chosen for their visual appeal and textural character. For example, the shears seemed to hold an immense presence; my family history included a generation that knew blacksmithing in Australia. While thinking of Ruskin's "eternal" values, these objects communicated a hand wrought tradition and a substantial materiality. Combinations of image and text seemed a natural way of merging metaphors of substance, time, place and emphemerality. The images became "archival" through the representation of mythically monumental notions of work—physical versus mental labour. A spontaneous "poetic" text comments on the objects as they were scanned to fit the grid and the shape of the screen.

Reflections on Tool Series (May 1996)

Each of the images uses the same vocabulary and generally apply the same transformation rules. This systematic or modular focus was part of the construction process, but becomes more potent as the grammar allows a broader conception of possibilities.

Key operations include:

- crop, overlap and rearrange
- linking of shapes;
- removal of grid;
- colour variations using links, filters and reversal options;
- use of symmetry, duality.

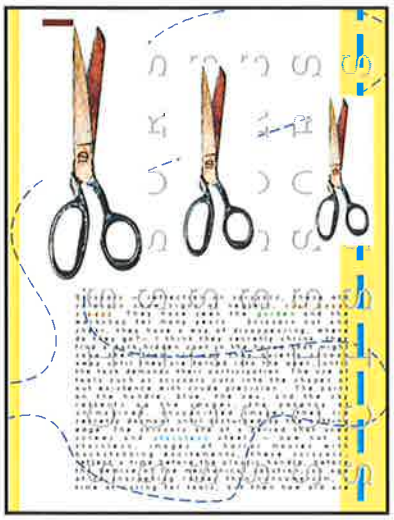


Fig. 4.74 *Scissors*: *Tools Series*#2. 1996.

Fig. 4.75 *Axes: Tools Series*#3. 1996.

Fig. 4.76 *Pliers: Tools Series*#5. 1996.

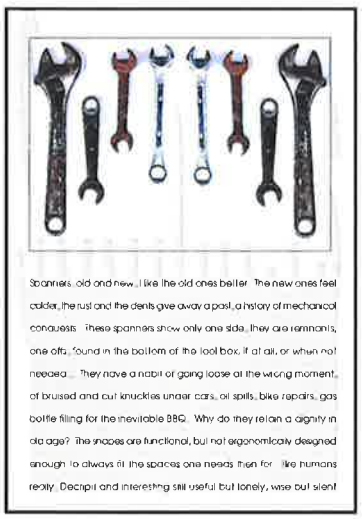


Fig. 4.77 *Spanners: Tools Series #6.* 1996.

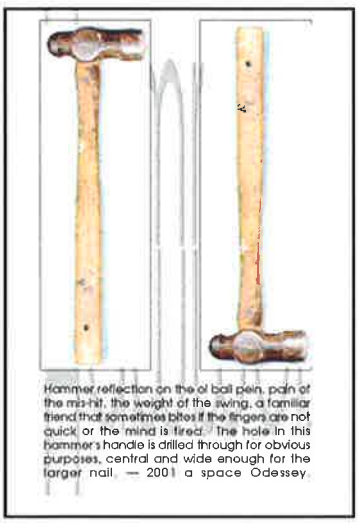


Fig. 4.78 *Hammers: Tools Series #7.* 1996. .

Fig. 4.79 Chisels: Tools Series #8. 1996. .

Reflection on Tool Series (June 1997)

The well known romantic poet, William Carlos Williams wrote of *vers libre* as a contradiction in terms. It is the "contingent motion of each line" that gives life to Williams verse (Tomilinson 1979, 18). This view of artistic freedom is echoed and experienced in this series.

Metaphor

A contrast between the sophistication of digitisation equipment and the rusty and scarred surfaces were related to an imagined history of

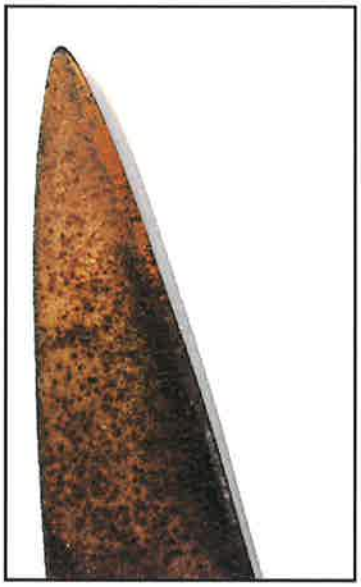


Fig. 4.80 *Shears texture.* Tools Series. 1996.

each tool. The text boxes were adjusted in size to suggest a more complex and subtle composition.

> After Coyne's insistence on the power of metaphor for design, this work relates to the metaphor of visual grammar as language. After Snodgrass' conception of "play", language is used playfully, both as a conceptual device and formally within the images.

Whole and the Parts

Working towards the whole, the entire garment, the fabric seems an inherent part of art and design practice. *Scissors#1* (Fig 4.74) introduced a free roaming blue line that weaves through layers of the image and text referring to the process pattern making of dressmakers and tailors. This idea led to the addition of colour bands. Pale yellow refers to the colour of dressmakers' tracing paper. I made some of my own shirts years ago and remembered the impression left by the layers of pattern paper, and textiles joined with the cotton thread.

Scale, Hierarchy and Order

The images were conceived as A1 size but reduced in scale featuring reduced readability of text and distortion of the initial intentions. Single images as complex events were considered a distillation, or a series of multiple distillations of a theme, ie, tools and their "doxa".

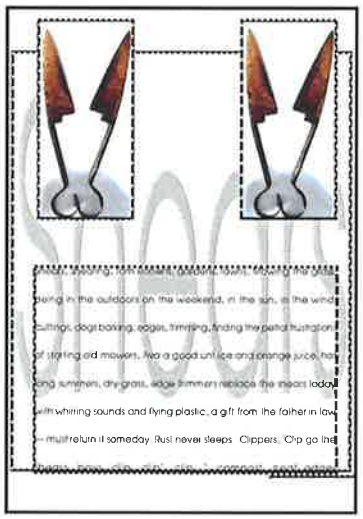


Fig. 4.81 *Shears: Tools Series#1.* 1996. Spontaneous text was added in relation to the objects used for imagery.

Ordering of the pictorial elements into a hierarchy occurs as the grid of the series reflects a conceptual narrative. Pairs of objects—a comparison of illusions—encourage poetic reflection. The text sporadically flowed in the image *Shears* (Fig.4.81) as follows:

Shears, shearing, Tom Roberts, gardens, lawns, Mowing the grass, being in the outdoors on the weekend, in the sun, in the wind, cuttings, dogs barking, edges, trimming, finding the petrol, frustrations of starting old mowers, Ava a good un! ice and orange juice, hot long summers, dry grass, edge trimmers replace the shears today with whirring sounds and flying plastic, a gift from the father in law—must return it someday. Rust never sleeps. Clippers, "Clip go the shears, boys, clip, clip, clip...", compost, neat edges

Other images in the series (Fig. 4.74-4.79) followed this approach, contingently repeating to a large degree the rules I had devised with *Shears* (Fig.4.81).

> Using repetition rules I experimented with the shears. A series was envisaged that might use this simple rule set. Similarly the text and image combination soon became repetitive in the application of similar principles.
>
> Rules emerged as the forms were devised. Enlarged rotated text was sent to the back layer of the image. Object names were metaphorically used, like kindergarten name tags for children learning their first words. Unexpected technical interventions contributed to outcomes in each case. Artist/writer Barbara Hanrahan's past advice was present—to include the darker side in images and to be aware of alternative offerings.

Symbolism and Metaphor

As a device it became more obvious with repetition of the grid formulae established with the *Bowl Grammar Series*. The *Tool Rack Series* showed how an idea might move conceptually from openness to closure. Forms might be linked with open white space or tied by a black grid.

Repetition of a form may give symbolic power and particular significance to an object producing reflections about dominance and repression, violence and disease. A Celtic double axe image suggests a double edge—a key symbol reiterating ideas from Ricoeur's *The Rule of Metaphor*: the "poetic schemata of inner life" (Ricoeur 1975, 246). Coincidence may guide experience leading to a "metaphorical truth". In mythology the doubled headed axe represents the sacred union of the sky god and earth goddess; thunder and lightning.

In *Axes* (Fig. 4.75), a single axe image was a family connection with my father in law whose "gift" seemed only related to gardening. The conquest of error, or dominance of nature was not an obvious associ-

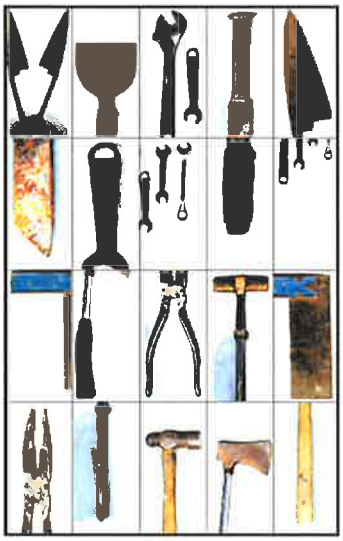


Fig. 4.82 *Tools Rack Series#1*. 1996. Photoshop

Fig. 4.83 *Tools Rack Series#2*. 1996. Photoshop.

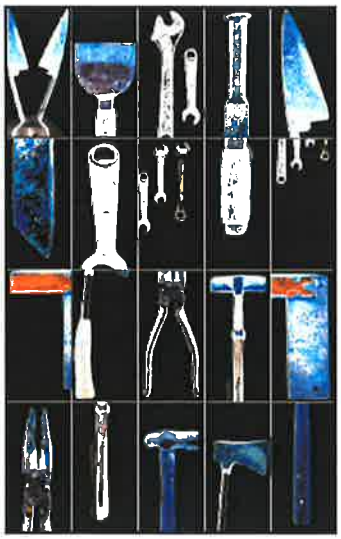


Fig. 4.84 *Tools Rack Series#3*. 1996. Photoshop.

ation. Later metaphors of freedom and anarchy emerged.

> The "absent presence" of the order imposed by the grid features in these images. Elements are obviously cut off by invisible demarcations or disappear into each other. Moving from one frame to another finally led towards a "breaking" of the grid in the next set of works.
>
> > "Magic is defined as the art of producing a desired result through the use of various processes assuring control of the supernatural and the mystical forces of nature" (Angelil 1989, 64). Quoted in (Johnson 1994, 176).

A shape grammar analysis of the *Tool Series* using *Shears* (Fig. 4.81) illustrates a transition from a "sense of grammar" to the exploration of the shape grammar protocol. A vocabulary, set of rules and derivations are presented that illustrate the application of the shape grammar protocol.

The *Tool Series* grammar (Fig. 4.85)provides further insight into the relationships between views of grammars within exploration of spatial states.

The Tool Series Grammar marked a turning point in understanding of a contingent sense of grammar. The aim of the work was to explore the effects of constraints on a set of works that were generated from personal associations and objects. The conception of the work incorporated the shape grammar mechanism as an organisational tool using the following key ideas:
1) A rectangular field was assumed.
2) Overlap of elements was integral.
3) Linear colour elements were used to balance the weight of other shape elements.
4) A symmetrical directional emphasis dominated.
5) Poetic qualities in the text provide a counterpoint to the otherwise Euclidean nature of the series.
6) The process followed a specific order.

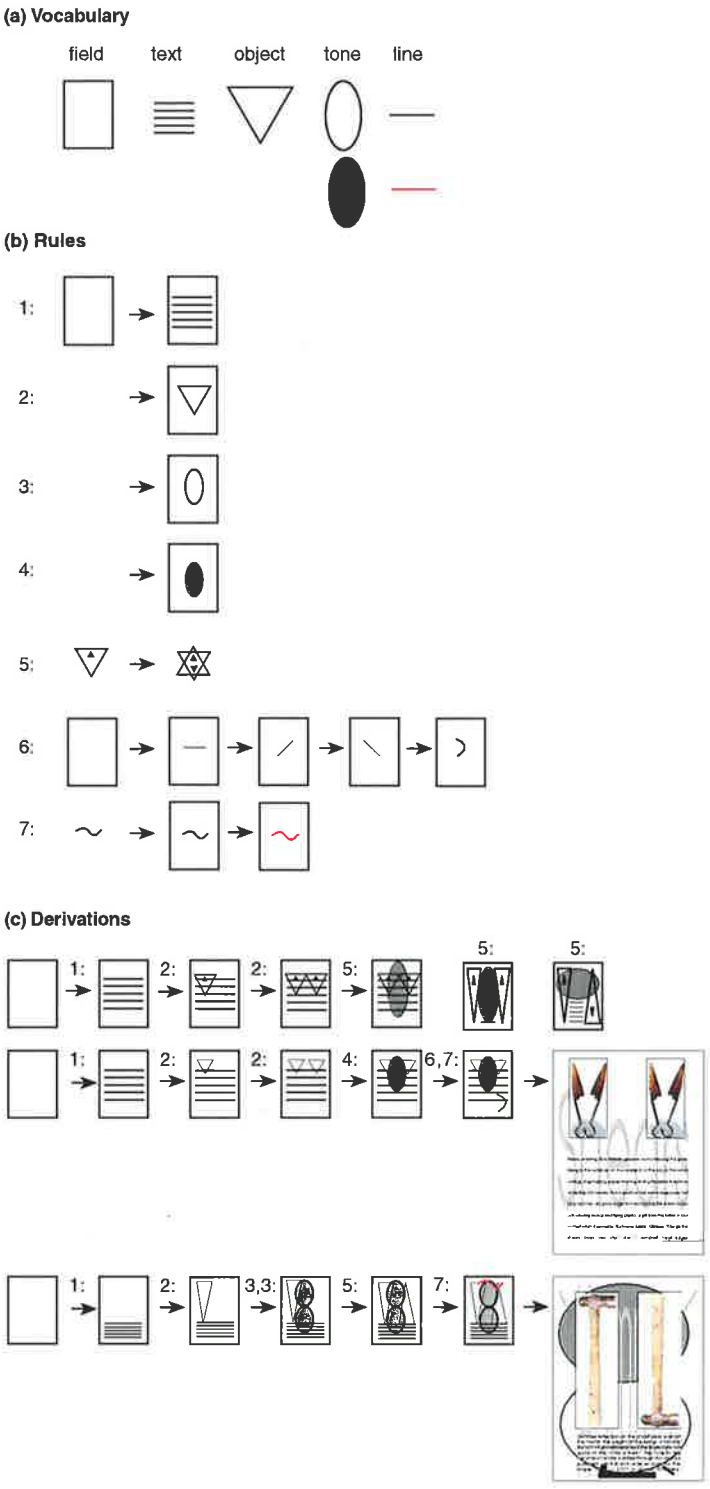


Fig. 4.85 Tools Series grammar

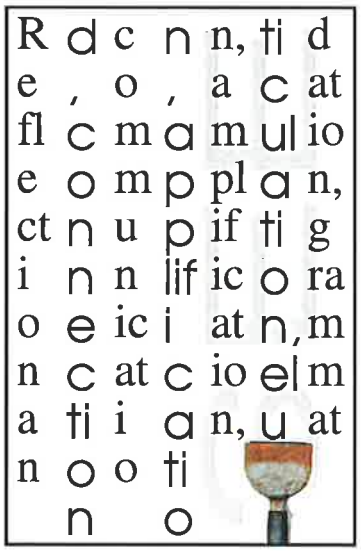


Fig. 4.86 *See Series #1*. 1996.

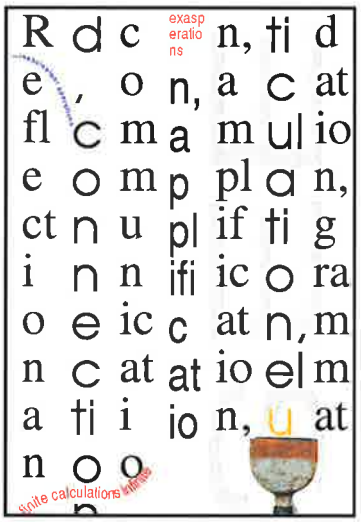


Fig. 4.87 *See Series #2*. 1996.

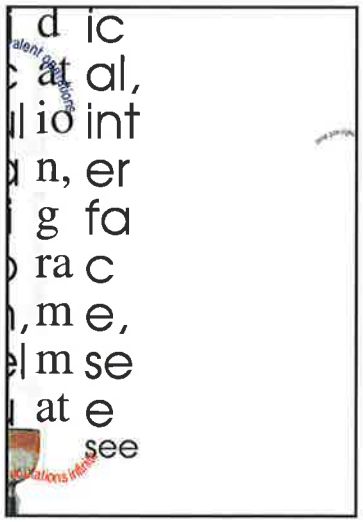


Fig. 4.88 *See Series #3*. 1996.

Example 4 See Series

The *See Series* explores notions of knowledge, using a metaphor of sight to explore "non-closure". A playful approach using typography attempts to divorce the text from its readability making visual entertainment and intrigue the conceptual emphasis. Movement around the image was the graphic game play: to find a satisfying balance of structure, movement, and colour that suggested both literal and visual readings.

In *See Series #1* (Fig. 4.86), words, images, elements, operations, language, dialect, and grammar use reflection on text as a starting point. Words were linked via the underlying grid. Kerning and font size were varied. A chisel metaphor suggests paint scraping—revealing the layers underneath, clearing a path, finding the "metaphorical truth".

More colour elements began with the blue line in *See Series #2* (Fig. 4.87). The title was decided at this point. Movement and colour around the grid added a more lively, cheerful, mood.

In*See Series #3* (Fig.4.88) moves the action to the edge to deny the centrality and regularity of the preceding images. Curved text became a moving colour element that dynamically abstracted the image giving emphasising to key areas of the composition.

See Series #4-7

The *See Series #1-#3* (Fig 4.86-8) were reduced to10% of their original size. By increasing *See Series #3* to 150% and repeating the image produced the large text forms in *See Series #4-7* (Fig.4. 89). The font *Times* dominates all these images. The vocabulary exploits overlap, focus and rotation.

> Combined as a larger image (Fig.4. 89), the initial rationale and literal qualities seen in the earlier images is lost. These formal experiments use reflections that dominate ideas about content. Formal considerations offer alternative insights.

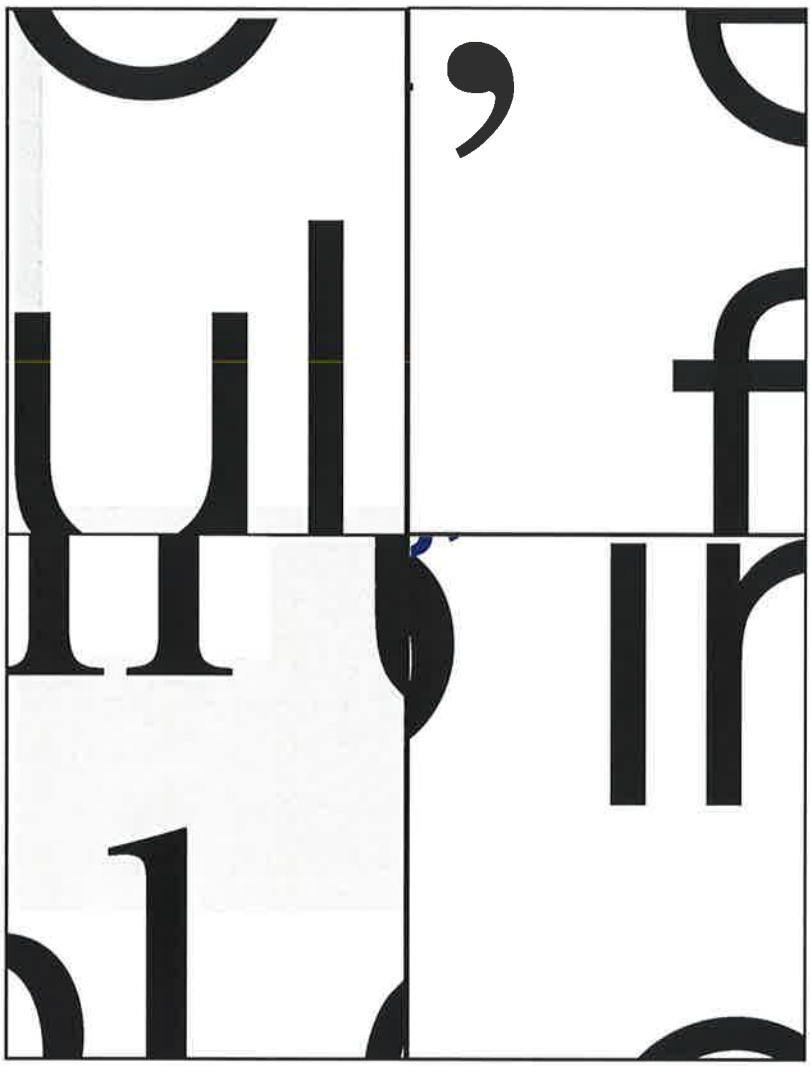


Fig. 4.89 *See Series #4-7.*

See Series #8 (Fig. 4.90) uses slightly overlapped letterforms generates a new set of possibilities. After a deconstruction of the standard order and layout in Fig.4.87, the following experiment inserted text over the replicated *See Series #4* (top right corner of Fig. 4.89):

Fig. 4.90 *See Series #8.* 1996.

„Postmodernist type is overlapped, contradictory and moves the baseline".

Interest was developed by the invisible edge of the text box being contrasted with the complex forms on the outer edges. This strategy generates alternatives, such as de-centred forms, contrasting type weights and fonts, overlap, and tonal changes. Colour adds visual accents and a separate layer of visual interest. Layering is a key aspect of this typographic approach.

Fig. 4.91 *See Series #9.* 1996.

Fig. 4.92 *See Series #10.* 1996.

See Series #9 (Fig .4.91) combines secondary source images and text in a collage of layers and sections, and generates another graphic alternative. Using See Series #8 (Fig 4. 90) as a starting point, a detail of Rembrandt's *Bathsheba* (1654) was added. Chosen for its "classic art" status the image was loaded in place of the previous text and sections were chosen for their appeal and compositional elegance.

See Series #10 (Fig. 4.92) relates detail of *Bathsheba* to textual understatements at the edges of the frame. The hand appears to reach out to something beyond the picture frame. A contrast between the image and text remains problematic.

> As with most attempts to use imagery from other periods the image becomes a reference to something beyond current concerns and temporality. Formal shape grammar issues are not used here. A sense of grammar that relies on tacit rules seems to apply until deeper reflection simplifies and orders previous actions.

Reflections on See Series (June 1997)

Insights into the formal relationships between image and text are revealed in the layering process in this series. New views of previously well known images result from reapplying and composing forms.

Formal operations in this series were:

- reordering colour additions to typography
- incorporating secondary source photographic images (#1-#3)
- addition of a background grey layer (#2)
- addition of a close up segmentation (#4-#7)
- overlapping of shapes and layers (#8)

> This series refers to a large body of artists' works. Many artists explore image and text relations—since the invention of paper. The interest here is in the selection of a rule set for the construction of the images. Clusters of ideas replace initial attempts at single "one-off" visual solutions.

Example 5 Doors and Mirror Series

Overlapping rectangles construct an ambiguity of spatial planes as doorways or mirror-like entries to either a dark place or an intense light. These images (Fig. 4.93-99). evoke mysterious and foreboding places and memories of aeroplane or train doors to unknown destinations.

These simple overlap and gradation experiments reveal a concern for an internal as well as external space.

Reflections on Doors and Mirrors (June 1997)

A gradient tool repeats and overlaps rectangular shapes adding colours loosely based on sea and sky . Centres, either dark or white add to the poetic and graphic possibilities. Colours are based on the tiles, sky and water elements as in the *Bowl Grammar Series*.

Fig. 4.93 *Door and Mirror Series#7*. 1996. This series explored overlap an gradation within Photoshop.

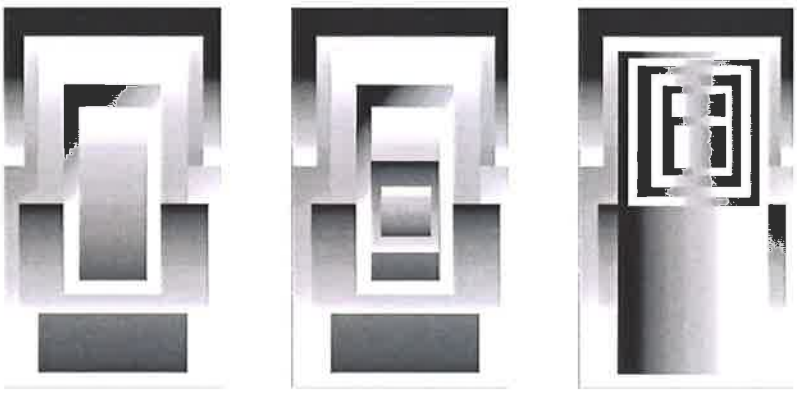


Fig. 4.94-6 *Door and Mirror Series#1-3*.

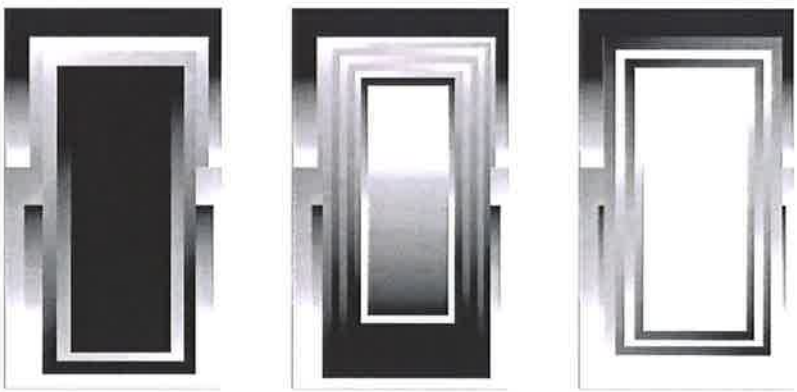


Fig. 4.97-99 *Door and Mirror Series#4-6*.

Fig. 4.100 *Text Series#4*. 1996.

Example 6 Text Series

The same rules used to construct the *Doors and Mirror Series* were used with this text. By altering the tone and quantity of text and overlapping the text boxes (Fig. 4.100), illusions and allusions about the nature of inner discoveries emerge. This series evokes a link with early manuscripts, the *Rosetta Stone* and the timelessness of typographic forms.

> These textural images were originally conceived as wall size so that the viewer might become enmeshed in the visual experience of text. Illusions of a space between "recognition" of things and "meaning" were part of the allusion. These kinds of images seem to thwart attempts to find grammars for subtlety and nuance, but on a simply formal level the rules are easy to use. As one plays with formal elements, different meanings arise. Here the passage to darkness or light is through the text, both as form and in the literal sense, the passage of text discusses the idea of grammatical understanding in the work of contemporary artists.

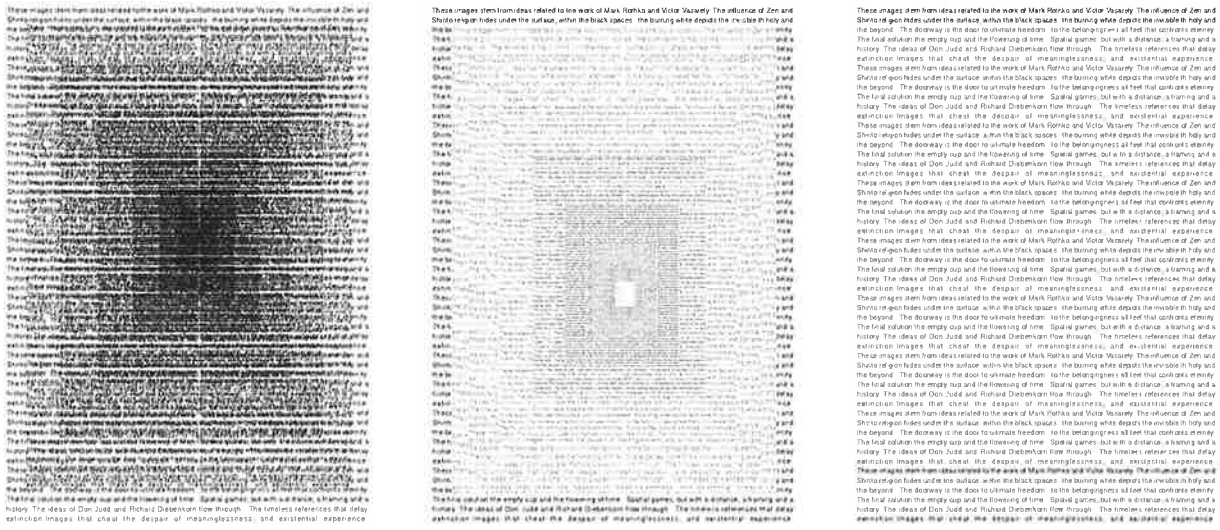


Fig. 4.101-3 *Text Series #1-3*. 1996. Freehand.

Reflections on Text series (June 1997)

This series (Fig. 4.100-103) emerged in relation to the previous *Doors and Mirrors* series. Qualities of density and readability were explored as the text became overlapped and scaled into a central focus.

Assymetry provided alternatives that began to repeat previous experiments in the *See Series*. A moment of insight occurred in this work—the realisation that many of the images began to repeat operations with different vocabularies. Ideas of a personal approach, or a general operational grammar, emerged more clearly.

> Design procedures are shaped by rules of computer programmers in that we follow their methodologies for production. Points of inspiration occur at intervals throughout production as rules are enframed with alternative views. These often show a dramatic change in the use of elements. These early 2D experiments suggest that by thinking in terms of grammatical rules the changes become more apparent.

Shape Grammar Experiments: Tartan Worlds

Example 7 Topiary Series

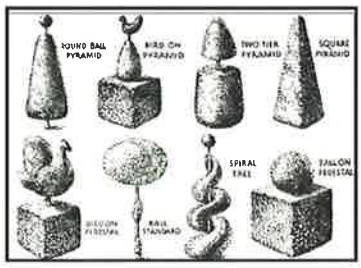


Fig. 4.104 Topiary Tree Forms

Metaphorical associations of control and freedom prompted this series. *Tartan Worlds*, a grammatical computer program, offered new possibilities for the discovery of algorithmic alternatives using three dimensional images of tree forms in combination with other shapes and images. *Tartan World*s is a grammatical design system tool that enables the construction of user-defined symbols (Fig. 4 105) to create a grammar of rules and the worlds in which they will operate. Operations are performed on two dimensional Tartan grids. By taking snapshots of the screen (Fig. 4.106) for further visual experiment, personal symbols were incorporated. *Tartan World*s provides a clear visual demonstration of a rule-based approach to form making based on the application of clearly specified rules.

Fig. 4.105 Symbol used as starting point for *Tartan Worlds* topiary grammar.

Reflections on Topiary Series (June 1997)

This series depends on the selection of a distinct topiary symbol and the asymmetric quality of the shape rules. As the rules are recursively applied and reapplied with the introduction of new symbol elements, the derivations become more asymmetrical and colourful. Groups of forms emerge and compete for dominance of the design

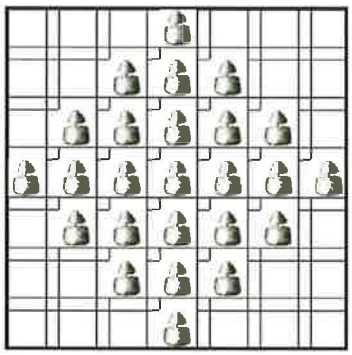


Fig. 4.106 Screen capture used for symbol in the rewrite rules for the image below.

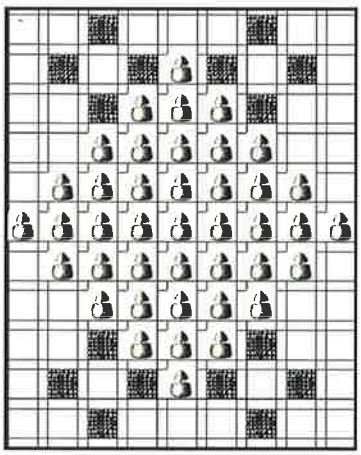


Fig. 4.107 Topiary Series#1. 1996.

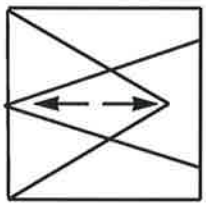


Fig. 4.108 Interplay of dominant groups of forms emerge in the Topiary series.

space. This interplay of groups develops as shown in Figure 4.107. The ease of this process is deceptively simple but facilitates further compositional developments through analysis of rules and their application sequence in the series.

Rules, Operations and Symbols

An initial surprise for the novice is that patterns occur with very few rules, and may be incredibly complex. An arrangement of symbols soon becomes impossible to predict as the number of rules and the number of applications of the rules increase (Fig. 4.109).

Tartan Worlds supplies a grid that may be designed to the artist's specification to become a visual world of symbols. The world may be altered by changing the distance between the lines of the grid. Hence "Tartan" patterns result. The application of rules may be selective (to particular cells, or may be non-selective (applied to all available instances of a spatial arrangement). The operation of the application of rules is as complex as a construction of the rule set and choice of vocabulary.

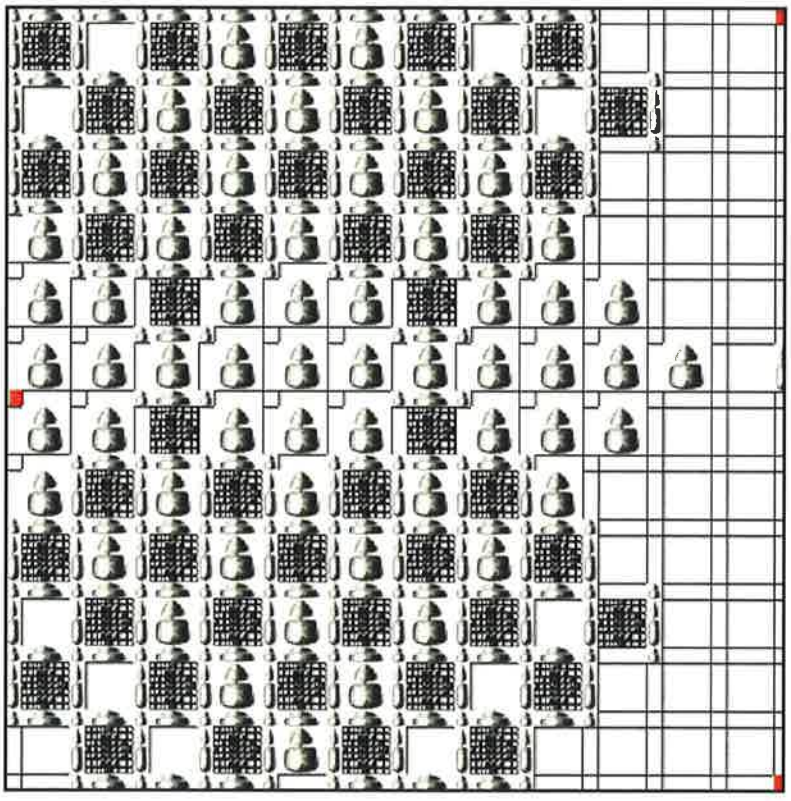
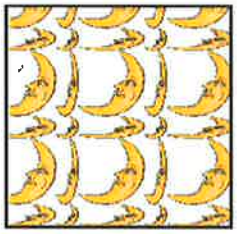


Fig. 4.109 *Topiary Series#2* (detail)



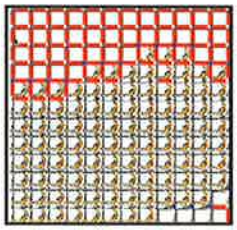


Fig. 4.110-112 Moon Series #1-3. 1996.

Example 8: Moon Series

Pictographic Symbols

Other possibilities are apparent depending upon the sophistication and limitations of the software design. For example, the colour and shape of the symbols in the symbol palette may include a special symbol by pasting in symbols to the palette as in the Moon series and the light globe example (Fig. 4.114).

Reflections on Moon series (June 1997):

By working with standard, readily available symbols a "semiotic neutrality" was sought. Using standard symbols like the moon is less personally engaging and offers less interest for the viewer who seeks insight into personal motivations and meanings in the work. This series explored asymmetrical groups of shapes by selectively adding to both the rules and start states within the design space. An interference with the recursive aspects of *Tartan Worlds* seemed necessary to encourage interesting variations in the emergent shapes of the *Moon Series* derivations (Fig. 4.113).

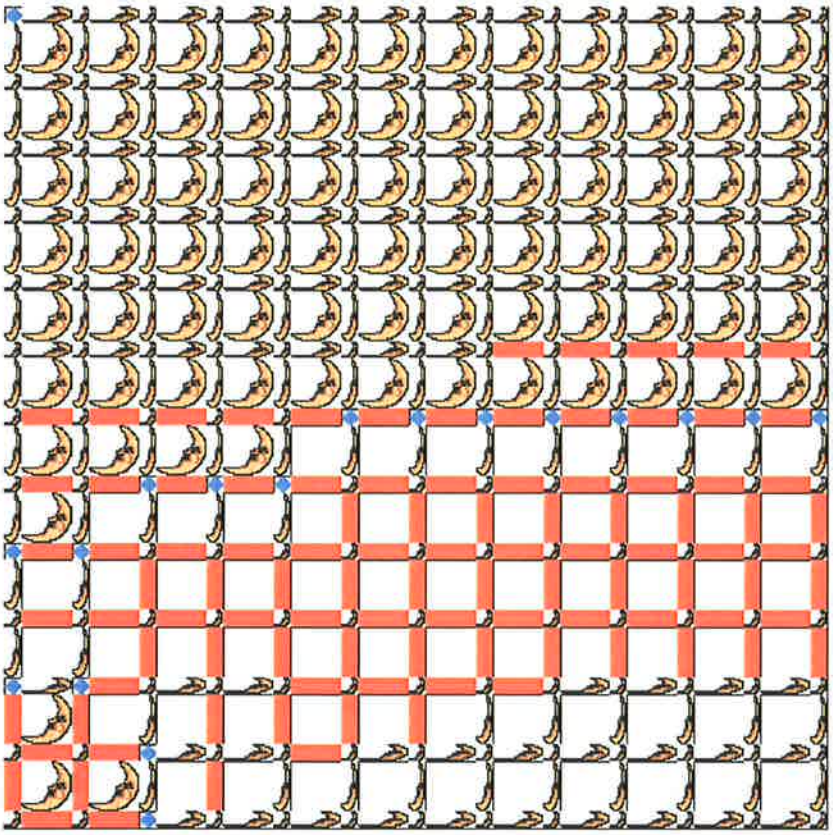


Fig. 4.113 Moon Series #4. 1996.

Fig. 4.114 Symbols: coloured shapes or pictures.

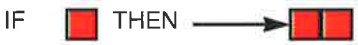


Fig. 4.115 Rule 1 (a rewrite rule)

Example 9: Light Globe Series—Grammatical Worlds

Tartan Worlds operates grammatically in a visual domain called "World 1" with a simple 5 x 5 grid structure. The grid may be varied in dimension. Rules are constructed and applied in "Rule Lists".

Procedure—Using If-Then Rules

A very simple demonstration of a grammar at work uses one symbol, one rule and one operation of that rule. From this example the principle of If-Then rules may be described visually.

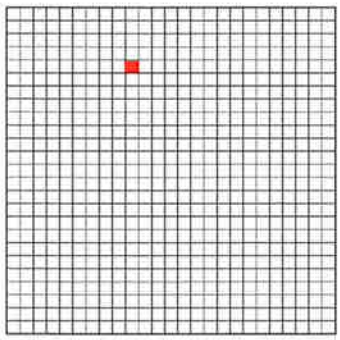
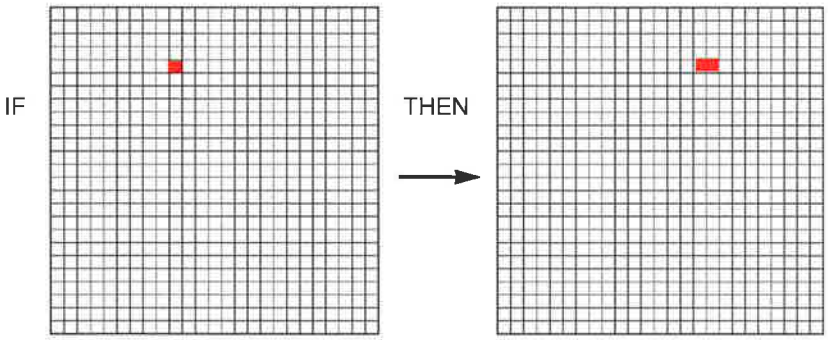


Fig. 4.116 Start state in World 1.



4.117 First application of Rule 1.

Operation of Rule 1

If Rule 1 (Fig. 4.115) is repeated by finding the matching starting point until no further pattern development occurs the result is a small group of four intermittent red linear shapes, as shown below in Figure 4.118. Any part of the grid could have been used in either side of the rule description. Operation of the rule occurs when the computer is instructed to "Find Matches"—all instances of the left hand side of the rule are found. These are converted into the right hand side of the rule when one of the commands, "Apply Rule 1" or "Apply all Current" or "Apply all Active" are chosen. In this simple instance, few derivations result.

This example belies the extraordinary capacity of the system for generating complex images. Advanced levels provide a surprising kinetic display of the rule application. A flashing sensation generates an amoebic growth throughout the grid, providing fascinating glimpses of seemingly chaotic but actually ordered design.

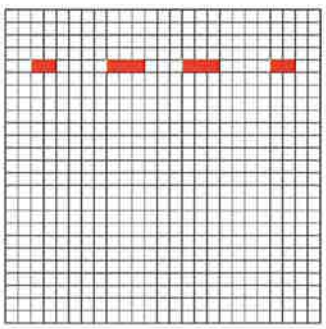


Fig. 4.118 End state in World 1 after repeated application of Rule 1.

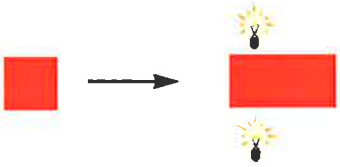


Fig. 4.119 Example 9, Rule 2

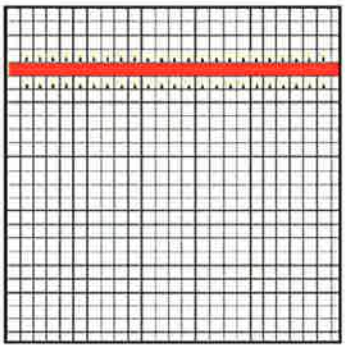


Fig. 4.120 *Light GlobE Series #1.* End state after repeated application of Rule 1 and 2.

Fig. 4.121 Symbol added to the palette of Tartan Worlds.

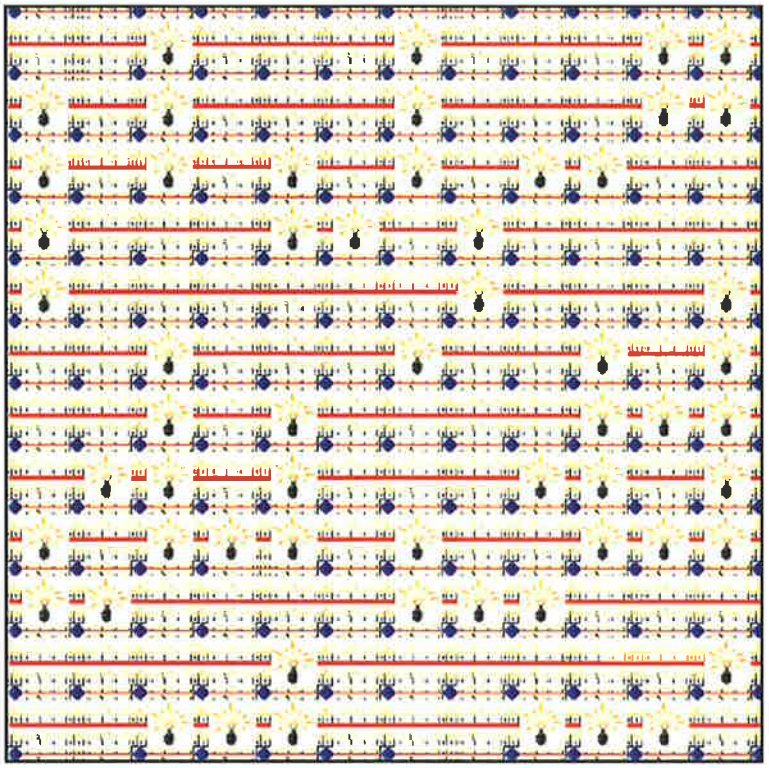


Fig. 4.122 Light Globe Series#3.

Applying Rules—Light Globe Series

The second example uses a pictographic symbol and two rules to change the grammar. The second rule adds a light globe symbol to the world of forms. The repeated application of Rule 2 (Fig. 4.119), as well as Rule 1 (Fig. 4.115), results in a horizontal red line with light globes lining each side, extending the full width of the grid (Fig. 4.120).

Reflections on Globe Red Line series (June 1997)

This series began with the use of standard icons for a Macintosh scrapbook, but an intervention of the added symbol (fig4. 121) resulted in Fig. 4.122), a group of horizontal red lines with 1 or 3 globe image attached each side.

This grammar was very homogeneous and prompted further experiments to generate rules for asymmetrical groups of forms. The density and colour of the image suggested some of the Serialist paintings and Minimalist works of artists such as Larry Poons, or in Australia, Godfrey Miller and George Balson.

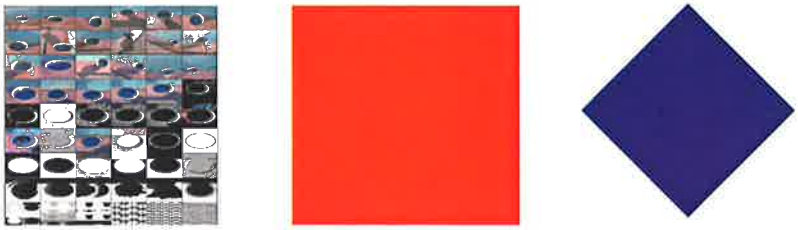


Fig. 4.123 Postcard Series Icons. 1996. *Tartan Worlds*.

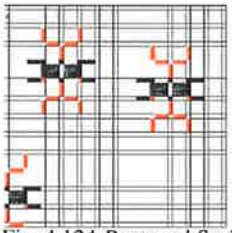


Fig. 4.124 *Postcard Series #1*

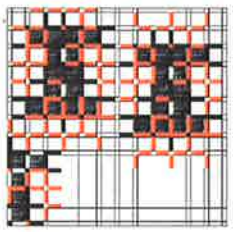


Fig. 4.125 *Postcard Series #2*

Fig. 4.126 *Postcard Series #2*

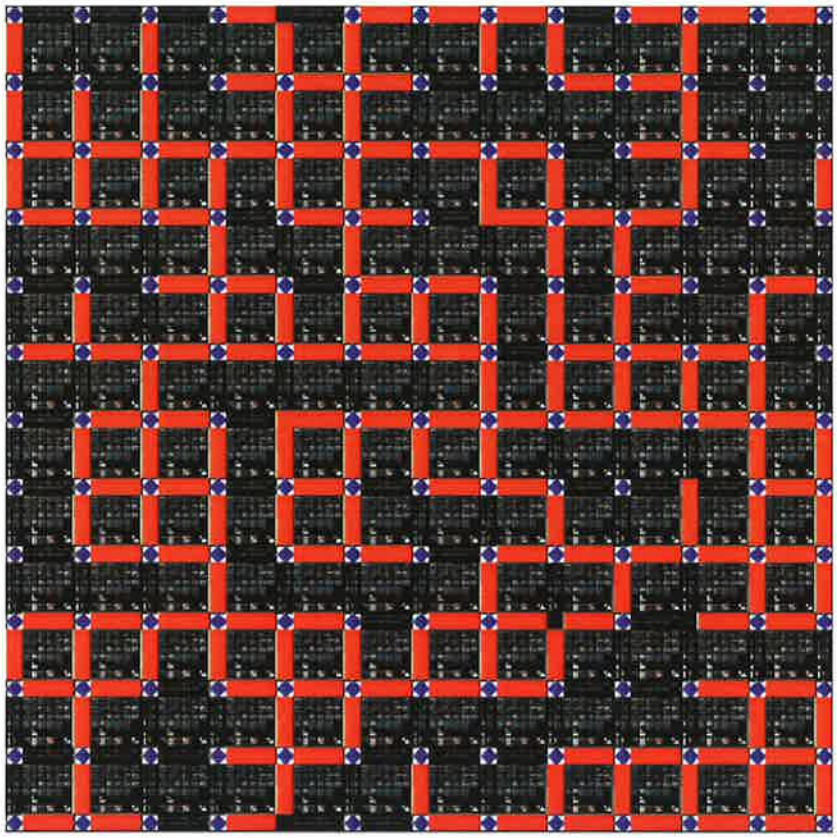


Fig. 4.127 *Postcard Series #4*. 1996. *Tartan Worlds*.

Example 10 Postcard series

Tartan Worlds illustrates the difficulty of predicting the outcome of even simple rule applications. Derivations with three rules become even more complex if altered by selective application of the rules either to an individual or group of individual symbols. Usually seven rules provide enough complexity. A return to the *Bowl Grammar Series* to use the postcard image as a symbol (Fig. 4.123) was irresistible. The result was a tapestry that diminished the original images but provides a fascinating and unique textural pattern.

Example 11 Natural Forms Series

This work explores restraint and repression. The compression of natural flower forms into a grid emerged in response to a personal interest in growing flowers in a new area of the garden. A vocabulary of different coloured flowers grew from the scanning of pansies.

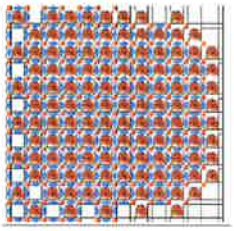
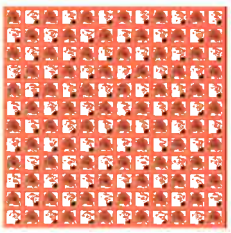


Fig. 4.128-130 Natural Forms #1-3. 1996.



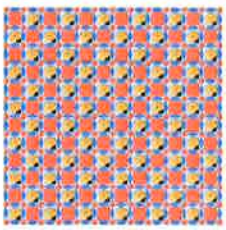


Fig. 4.131-133 Natural Forms #3-6. 1996.

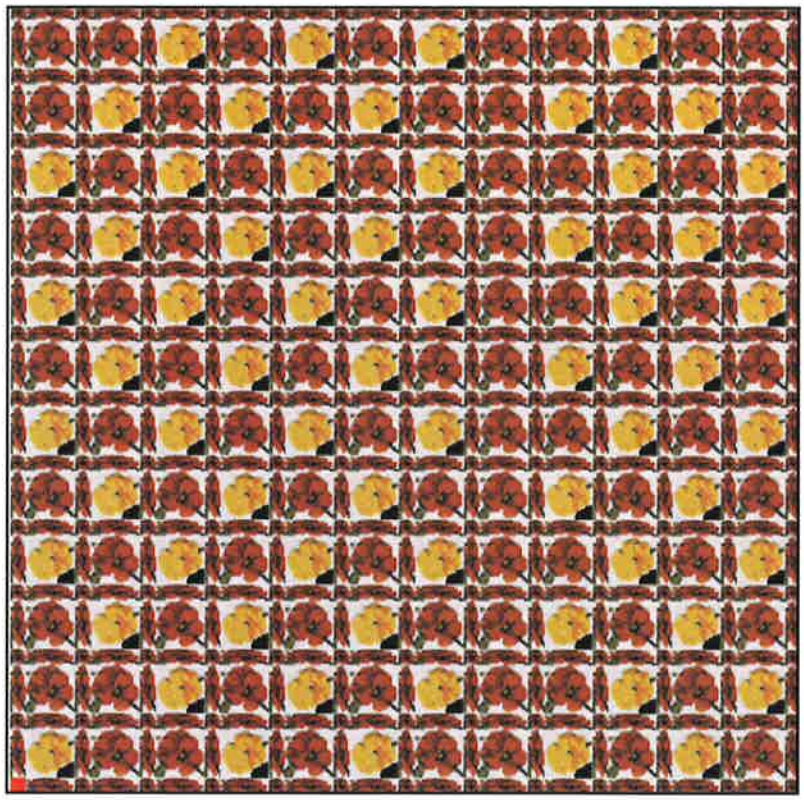


Fig. 4.134 *Natural Forms #7*. 1996. Tartan Worlds.

Fig. 4.135-137 Gates Series Icons

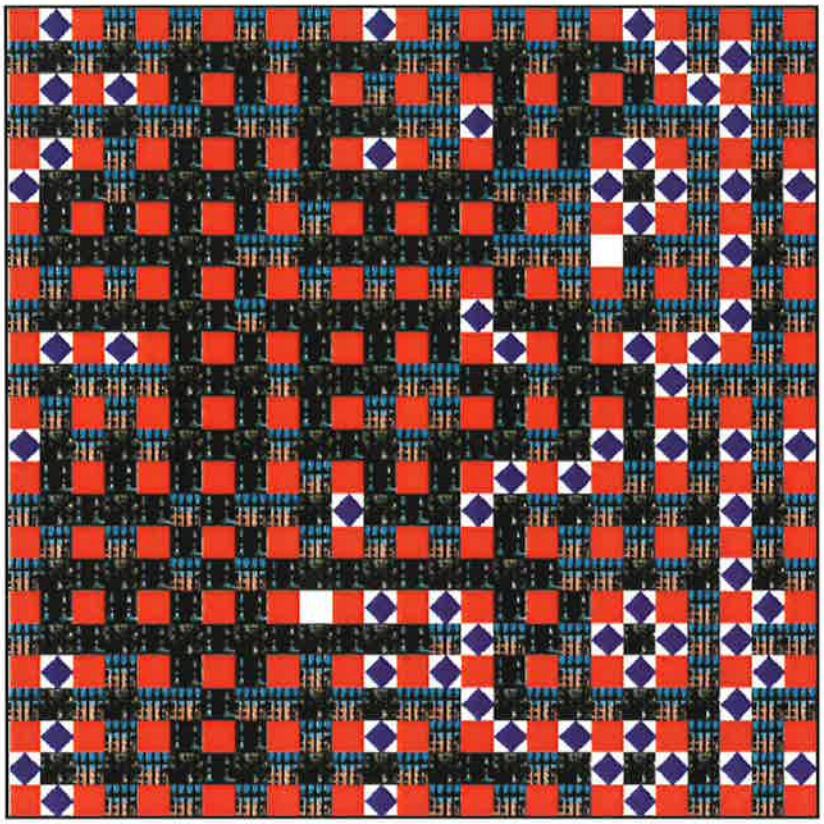


Fig. 4.141 *Gates Series #1-4*. 1996. *Tartan Worlds*.

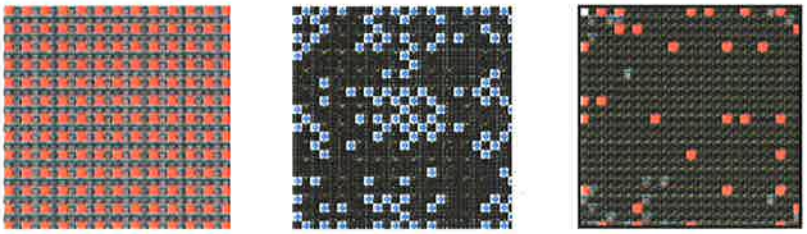


Fig. 4.138-40 *Gates Series #1-4*. 1996. *Tartan Worlds*.

Adelaide University (AU) Series (Gates; Towers and Windows)

Inspired by regular visits to the library, three grammars were developed from the University gates, windows and towers.

Example 12 (AU) Gates series

The *Gates* series illustrate switching a grammar by changing the vocabulary or order of the rule application. Turning points are shown by:

- the use of alternate combinations of forms;
- changing the start state or order of rule application.

A dramatic mood swing was noticed as switching occurred in this series due to changes in the images used for symbols(Fig. 4.135-137).

Fig. 4.142-144 *AU Windows Series* icons.

Fig. 4.145-147 AU Windows Series #1-4. 1996. *Tartan*

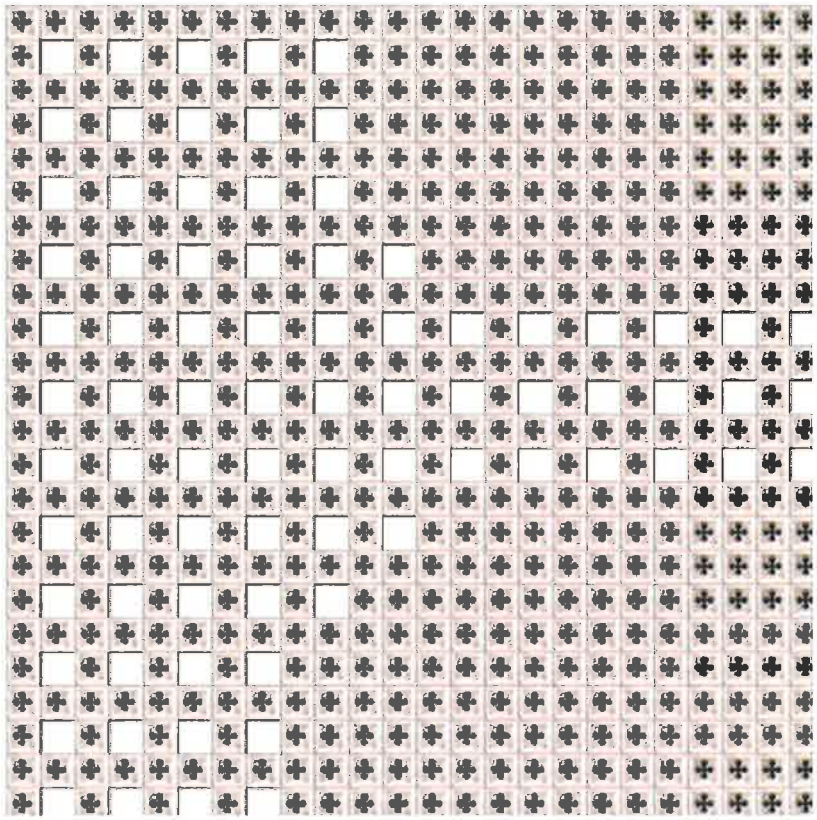


Fig. 4.148 *AU Windows Series* icons.

Example 13 (AU) Window series

Changing a grammar by changing its rules illustrates the use of a grammar in a contingent context, ie within the context of a particular environment. In the particular context of *Tartan Worlds*. AU Windows are a powerful symbol and might evoke many other unexpected metaphors beyond a grammatical view. The application of a rule contingently is also illustrated in this series as white spaces are considered for intervention with red lines (Fig. 4.145-147). The "non-use" of coloured shape elements in a vocabulary led to a sporadic rule addition resulting in Fig. 4.144. Interesting formal comparison between each series highlights a diversity of grammatical derivation.

Fig. 4.150-152 *AU Towers Series icons.* 1996. *Tartan Worlds.*

Fig. 4.153-155 *AU Towers Series #1-3.* 1996. *Tartan Worlds.*

Example 14 (AU) Tower Series

Similarly, the *Tower* series provides insight into how grammars are changed contingently. As the *Tower* series emerged, rule deletion and rule addition accrued by introducing vocabulary elements from other *Tartan World* grammars such as the *Natural Form* series. Decisions were contingent upon the need for a colour element that contrasted with the tower roofs' blue gey stone ochres (fig. 4.156).

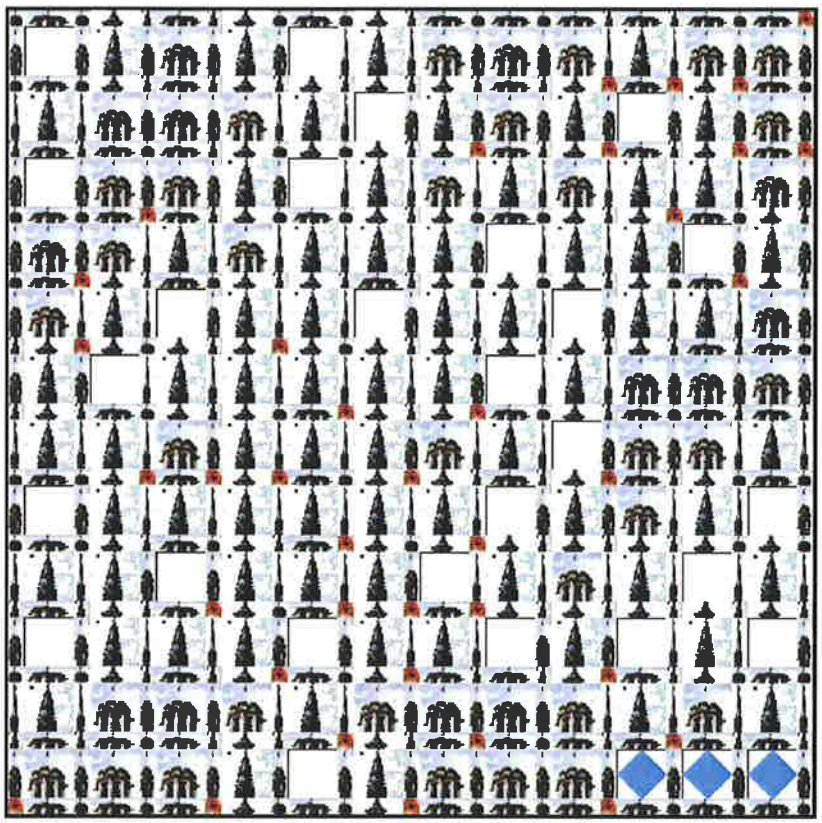


Fig. 4.156 AU *Towers Series #4.* 1996. *Tartan Worlds.*

The use of grammars in this series was aimed at increasing self awareness through the exploration of my University environment. Self creation was apparent as the images were collected and transformed by the grammatical application of rules. My sense of self and my relation with the University became the focus of reflection leading to contemplation of how grammars might contribute to art practice and whether some qualities of University life might be communicated.

> An insight gained here was that the images were too small to be recognised as particular locations, but the *feel* of the visual elements in the textural qualities communicated a potent synthesis of my selection of images and shape rules. An abstraction was apparent that incorporated the photographic realism of each vocabulary element in the grammar. This series evoked a tangible sense of grammar of a personal kind.

Three Dimensional Experiments

Three Dimensional Modelling and Animation

For architectural and sculptural exploration, solid modelling applications were explored such as *Form Z*, *Strata Studio Pro* and *DiscoverForm*. *Strata Studio Pro*, like many 3D applications, provides sample forms to experiment with such as a steel block (Fig. 4.157). The surface of a smooth cube can be easily transformed using a palette of textures. Initial ideas of contrasting grids with "escaping" organisms such as tree forms, became a challenge to interpret within the grammatical rules of the 3D modelling program.

Fig. 4.157 *Big Steel Block*. Strata Studio Pro.

Example 15 Earth Folly Series

This group of images used readily available symbols provided by the program to experiment with a three dimensional collage. The various views provided by the programs were helpful and an enhanced sense of space developed to place things in the right position. Views from all sides could be checked and rotated. Wire frame or solid shaded forms were used to build and light objects.

Fig. 4.158 *Earth Folly#1*. 1996. Strata Studio Pro.

The result was a simple construction that combined some existing forms (sphere; pedestal) with a steel cube (Fig. 4.158). The earth's sphere(Australia to the fore) appeared to emerge out of itself. This fast virtual experiment illustrates some advantages of computational modelling over traditional sculptural media such as stone or clay.

Form making was easy and fast. Object oriented thinking predominates in the program's examples, giving priority to a finished product (rather than the rules for its form making).

Formal systems, such as the shape grammar mechanism, necessitate a more rigorous examination of the vocabulary and operations one uses to transform imagery and objects.

By looking back on previous work, elements may be discerned in a variety of ways that enriches form making processes.

By providing new avenues for exploration, and intensifying the impact of the work by experiments, new formal possibilities are made apparent. This would not have occurred except for revisiting past work with a fresh and discerning eye that was looking for patterns and rules of some kind. Clearly "unitarian" compositional approaches are important to the works, whether in two or three dimensions.

Layering as a transformational operation is often used as a key device, as is the balance of colour and tonal arrangements of form. Rules may be found for the conception and construction of both the general approach used and individual groups of work.

All work is produced in a series, or seems thematically related. This led to further exploration of 3D tools such as *Extreme 3D* and *Microstation* (Bentley) in conjunction with *Director*.

Fig. 4.159 *Bowl Still.* 1996. One image from hand drawn animation. Painter 3.0.

Animation Experiments

Multimedia and electronic publishing media are still in early stages of refinement for the practitioner. Using *Painter* is one approach toward animation agendas of multimedia in art and design. Animating drawings seems to provide a useful record of decision making and helped to recognise latent moods and formal trends in the process of construction of a form.

Example 16 Animated Bowl Grammar Series

By playing back the complete drawing process in an application such as *Painter* new understandings of a sense of grammars may be discerned (Fig.4 159). I explored an image from the *Bowl Grammar Series* by limiting my series to ten frames and the animation produced an hypnotic illusion of breathing generating unique visual experience that extends each static individual drawing frame. The image making is controlled by a tracing paper layer that may guide the next frame if needed.

Reflections on Animation of Bowl Grammar series

This series of images changed the *Bowl Grammar Series* by using the same elements but different operations in the application *Painter*. Movement and mood are dynamically altered in this development. A hand drawn quality is used in each frame and the rapid changes from frame to frame generate a less mechanical kinetic feel than that of *Tartan Worlds*. Animation is reliant on continuity but is not a shape grammar. A more detailed consideration of inside to outside tonal and colour transitions became a painterly focus during the drawing of these animated images. All this is part of transforming a grammar by changing spatial relations, particularly through resizing and repositioning elemental shapes and their mode of depiction.

> This is a kind of rule based grammar that relies upon the artist's attention to each individual frame, unlike *Tartan Worlds* where the frames are decided upon by the making of the rule set. Interestingly, *Painter* offers a fractal option and also a

Fig. 4.160 *Fruit Folly#1*. 1996. Strata Studio Pro.

Fig. 4.161 *Fruit Folly#1*. 1996. Strata Studio Pro.

> Tartan pattern that may be varied using several sliding scales. *Strata Studio Pro* gives wider options in solid modelling because of its facility to alternate between views. However, these programs are not as overtly grammatical in their operation as *Tartan Worlds* and *DiscoverForm*.

In his analysis of multimedia in the design studio, Richard Coyne argues that computer systems make a difference: "Computers certainly make a difference. If that difference is not simply better and more efficient design, then what is the difference? I have attempted to address this difference in the body of this paper"(Coyne 1996, 275). Some *Strata Studio* experiments were made in an architectural mode for the design of a house addition. The actual construction of the addition emulated the animated design but varied with the contingencies of the site, dimensional and material demands. For example, the discovery of expensive to move plumbing altered the floor plan.

Example 17 Fruit Folly Series (1997)

For fun, some fanciful forms experiments combined fruit with three dimensional constructions. Using a banana and an orange became an intriguing starting point for a series of architectural follies (Fig 4.160-1).

> Perhaps I was thinking of Frank Gehry's *Fish* building, and Michael Sorkin's dinosaur building designs (presented at the RAIA's *Challenge of Excellence* Conference in Melbourne, 1992).

This series of CAD forms illustrate the opposition of organic and geometric themes. The arrangement of forms was intuitive and the banana was added on top for a final adjustment of formal arrangement from several viewpoints. The insight here is that a grammar may use very general rules such as "IF there is a space—THEN there may be a rectilinear form or an organic form". Instead of thinking that all grammars are complicated, different domains provide alternative views of form making possibilities, leading to a productive

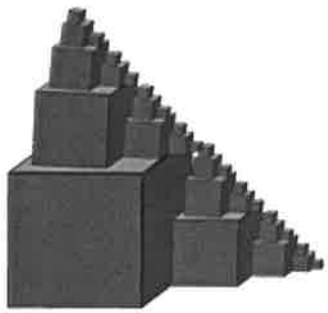


Fig. 4.162 *Form #1*. 1996
Discoverform.

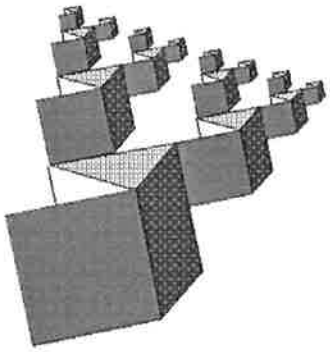


Fig. 4.163 *Form #2*. 1996
Discoverform.

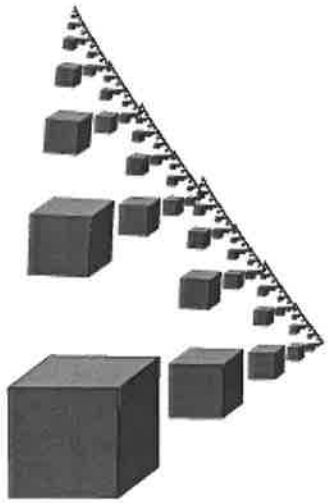


Fig. 4.164 *Form #3*. 1996
Discoverform.

view of events. The idea of a type and instance is extended in this series and relates to the earlier ceramic work that used a similar grammar.

DiscoverForm

DiscoverForm is a computer program that uses the principle of self-similarity to foster awareness and innovation in form exploration, especially for sculpture and architecture.

The initial "blind" explorations provided a feeling for the uncontrollable depth and complexity of form generation possibilities. A tutorial gives the basic operations but facilitates a sense of play at the same time.

Example 18 Form #1-3 Series

Form #1 (Fig. 4.162) used preconceived ideas about stacking to explore possibilities. With *DiscoverForm* one creates a form and a clone of that form and then may generate more instances of the same forms in levels of iteration. The interesting aspect of these generations is that the angles of the shapes and forms may be rotated about a single point and the scale of the parts may be altered at any time in

Fig. 4.165 *Form #1*. 1996. *Discoverform*.

the design process. This leads to spectacular kinetic effects when the form swivels and looms large as it rotates toward the screen giving an illusion of a digital space that might be understood as two, or three dimensional depending upon the point of view and arrangement of form (see *Form* #2, Fig. 4.163). Possibilities depend upon the contingency surrounding the moment of design. *DiscoverForm* provides opportunities to explore fractals and the generation of geometric creations that change in scale and time.

In Form #2-3 (Fig. 4.163-4) the left plane of the main cubic form is moved inwards to the centre of the form causing a dramatic shift in the sense of space. This kind of grammatical relation is very dependent on the frame of reference with which one views the design space.

In *Tartan Worlds* and *DiscoverForm* the element of time, the movement of the images, was a key component of the work that is lost in a static single photographic representation of a derivation. Size and complexity beyond the tenth level of generation is not really visible on the computer screen. *Form #3*, (Fig. 4.164) gives some idea of the changes that occur at the tenth generation of clones. Through an open arrangement of forms an illusion of solidarity and underlying structure becomes apparent.

Reflection on Form Series (July 1997)

Breaking down solidity and order into a free flying form that was full of a "sense of space" and finding the limits of what might be depicted was an interesting aspect of these investigations. Process planning of sculptural work gave way to interventions of spontaneous formal arrangement. Unforeseen variations of form emerged quickly and easily.

Example 19 Box Form Series

Initial interest in the box forms and their disintegration developed in

the "Box Form" series using *DiscoverForm*. Cubes could be made less "correct" in appearance, that is, like cubes of hand-formed clay. It was not until the generation of six levels of clones that the larger "actions" of the form became apparent, for example the slight curve of the top line in *Box Form* #1 (Fig. 4.165). This form related to early work in traditional media more than any other grammatical experiment.

Reflections on Box Form Series (June 1997)

This series builds on the stacking rules used for the earlier ceramic sculptures as well as incorporating general themes of organic and geometric opposition seen in the earlier Folly series. Scaling and gradating forms in *Box Form #1* (Fig. 4.165) lead to insights about the potential of recursive spatial environments for sculptural media such as clay, metal and stone. The cost and ease of use advantages of computational visualisation are obvious. The particular contingent view of work with ceramic sculpture may not occur to other users of the system.

Fig. 4.166 Initial drawn form using *Discoverform* (above) for *Spiral Form Series*.

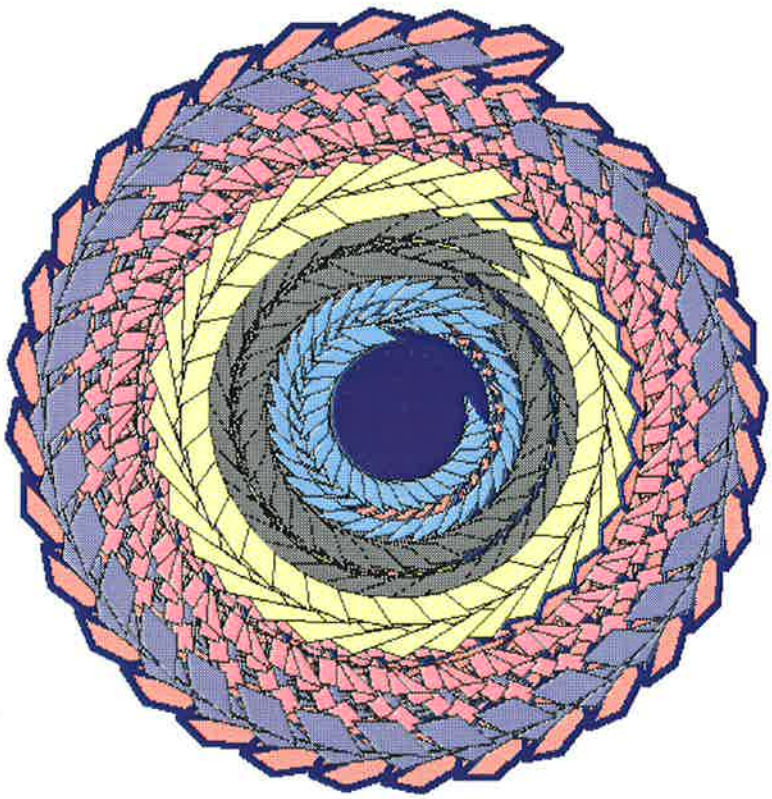


Fig. 4.167 Spiral Form, DiscoverForm, 1997.

Example 20 Spiral Form Series

To *play* one needs a sense of adventure, a faith that there is something to reveal and a confidence in an outcome. In practice, a sense of discovery and the time to use it are necessary for beneficial exploration. This series of explorations with the addition of colour (Fig 4.167) brought forth a circularity that upon reflection echoed previous work. This kind of insight is less likely to occur without continuous reflection and documentation of previous work.

Reflections on Spiral Shadows (June 1997)

This *DiscoverForm* grammar depends upon the self similarity and the contingent operation of spatial controls over spiral repetitions of shape (Fig. 4.166). The initial shapes were hand drawn and coloured. The movement of the image is part of the impact of the work as it rebounds upon itself, perhaps suggesting reflective practice is infinite. Unfortunately this dynamic aspect is lost in a hard paper copy. Computational systems may create meaningful works of art given an openness to alternative frames of reference and a willingness to incorporate grammatical systems into retrospective and prospective aspects of practice. Movement is a key distinguishing element.

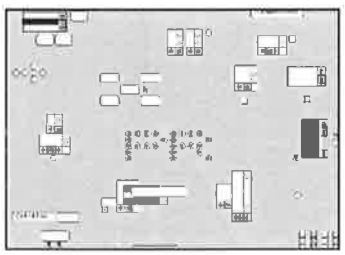


Fig. 4.168 *Form Art #2.* Tartan World grammar, Ars Electronica 1997.

Example 21 Form Art Grammar

The form art grammar developed from an international internet event called "Ars Electronica" (Fig. 4.168). This event called for art to be submitted that used the elements of computer screen formats such as scroll bars. my experiment consisted of an attempt to make an interesting image from as few rules as possible. the result was a *Tartan World* grammar that used three simple rules. I was surprised to see the construction of a circular form within three derivations of the entire rule set of the shape grammar. Other derivations that used these same rules without intervention are shown.

Reflections on Form Art Grammar (July 1997)

My experiments in this chapter assist in the contingent recognition and generation of grammars and illustrate how grammar is used in

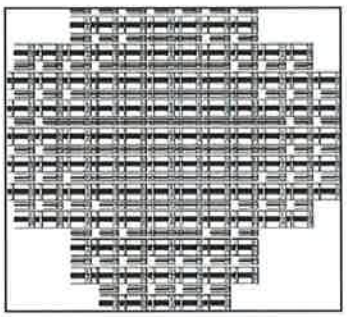


Fig. 4.169 *Form Art #2*, Tartan World grammar, Ars Electronica 1997.

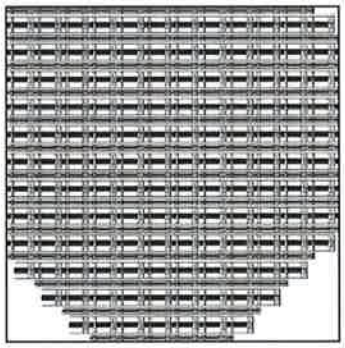


Fig. 4.170 *Form Art #3*, Tartan World grammar, Ars Electronica 1997.

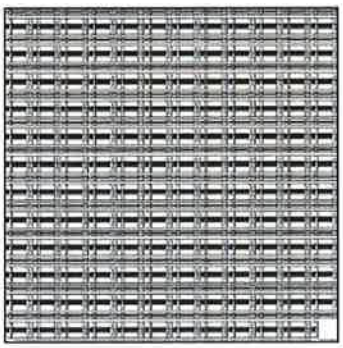


Fig. 4.171 *Form Art #4*, Tartan World grammar, Ars Electronica 1997.

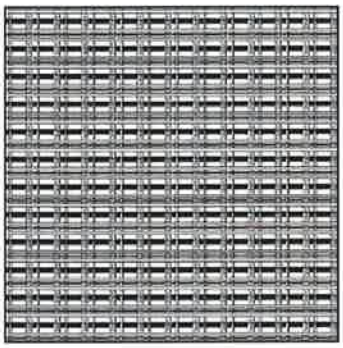


Fig. 4.172 *Form Art #5*, Tartan World grammar, Ars Electronica 1997.

contingent contexts such as art. *Form Art Series* reflects a pattern of rule selection that repeats a sequence of circular, asymmetrical and finally symmetrical arrangement of elements. This sequence invites intervention and subsequent reapplication of rule. This kind of overview of one's work is only available after considerable experience in image making and reflection on one's actions in the light of a contingent sense of grammar.

Moments of insight and points of change are recognised through reflection of these form making experiments using traditional and computer media, the latter inherently rule based in their own operation. The ubiquitous role of grammars in the design derivation process demonstrates that grammars can be used contingently in particular contexts such as art, and that they may be changed and switched contingently. These aspects of contingency and grammars show that artists may increase awareness of self creation and encounter insights into judgement.

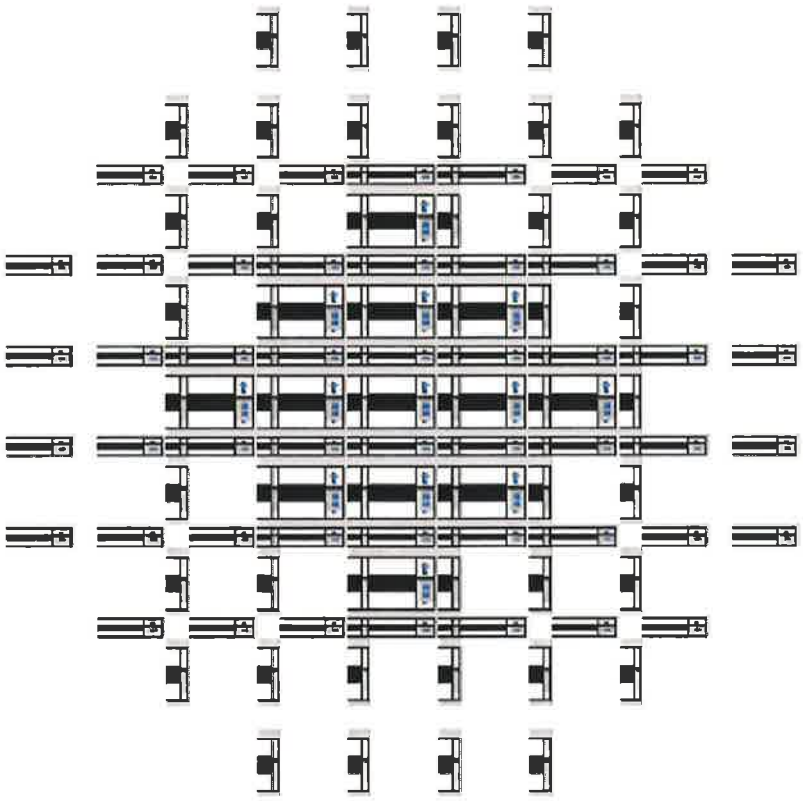


Fig. 4.173 *Form Art #1*, Tartan World grammar, Ars Electronica 1997

5

A Contingent Sense of Grammar

In this final chapter I return to the thesis statement set out in Chapter 1 and review the thesis in the light of the studies, interviews and experiments reported in Chapters 2, 3 and 4, drawing further on the interviews using architectural as well as art examples. I then discuss how the thesis statements have implications for education in art and design, again drawing on the interviews. I end by summarising the intended contribution of the thesis to the understanding of grammar in art and design, and affirming the enabling nature of a contingent sense of grammar.

The Hypotheses

The major hypothesis of this thesis is that *a contingent sense of grammar can facilitate the understanding, creation, and discussion of form-making in art.* The sub-hypotheses were (1) *An understanding of grammatical design can enhance a reflective design activity,* and that (2) *Revealing the contingency of grammars can expose moments of inspiration and redirection in a reflective design activity.*

Looking back over the artwork of others and my own experiments, moments of inspiration and redirection have been exposed by explicitly thinking in terms of grammars, rules and derivations. Indeed, explorations of grammatical primitives and rules assists in understanding and generating artwork. Metaphors of grammars

enable analytical and generative possibilities while opening and facilitating discourse in relation to Herrnstein Smith's notion of contingencies of value, Kristeva's notion of *la langue* and Rorty's notion of irony. Formal grammatical systems supply an additional approach to critique through rigorous retrospective analysis. Foundations laid by Stiny, Gips, March, Flemming, Joan and Russell Kirsch, Knight, Lauzzana and others suggest that grammars provide a pictorial means of describing form without the traditional critical reliance on words that entail circularity and ambiguity.

Education

Educational infrastructure is undergoing a revolution. Within the visual languages learning domain there is a constant need to facilitate understanding, creation and discussion of art and design. Computational elements of education are becoming the norm: "As the twentieth century draws to a close, the idea of a virtual campus—parallelling or perhaps replacing the physical one—seems increasingly plausible" (Mitchell 1995, 70). A contingent sense of grammar participates in this scenario whether viewed as computational or not (as as discussed in Chapter 2 and demonstrated in Chapter 4), and may contribute to an elucidation of strong personal art and design philosophies that contribute to vital form making practice.

Facilitating Understanding

I set out to explore whether a contingent sense of grammar facilitates understanding in a variety of discourses. Within postmodern discourse a sense of grammars can open spaces for artists to become more aware of hermeneutic reflection in action[1]. Within Cartesian discourse computational grammars offer strategies for artists and designers that quickly elicit large numbers of derivations, and the expandability of formal languages. The dilemmas of reconciliation

1 Hermeneutic reflection might include all kinds of discourses, such as Mearleau-Ponty's metaphysical suggestions about dimensions of meaning: "Meaning is invisible, but the invisible is not contradictory of the visible: the visible itself has an invisible inner framework, and the in-visible is the secret counterpart of the visible" M Mearleau-Ponty, *Working Notes*, quoted in (Hillman 1996, viii).

between discourses of Enlightenment hegemony and Humanist liberal agendas are overcome by a liberal pragmatism[2] that corresponds with Rorty's view of contingency. For an artist, expression in a visual language is a part of their "final[3] vocabulary". Referring to well known artists, Denise Scott Brown illustrates this point:

> If you look at the retrospective exhibition of famous artists, you'll find they look like their masters and they look like their friends. Cézanne shows very strongly how eventually they grow into themselves and they develop their personal grammar. Cézanne developed several grammars. You can see them running in parallel with each other in his work and they are there very strongly. It's interesting that at different stages his grammars became whole learning exercises for other artists, who took a certain grammar as a point of departure. There are people taking off from Cézanne in a sense, using his several plans. So, there's one kind of a grammar (Venturi and Scott-Brown 1996).

A "sense" of grammar in design helps in discerning and developing a visual language or "personal grammar". For example, the comments of interviewed artists Pearlstein, Barminski, Woods, Ray-Smith, Lauzzana, March and Wentworth all suggest a developing awareness of self is related to recognition of rules and metaphors for their practice.

Knowledge of grammatical design also gives insight into structure, intention, transformation, contextual generalisability, and

---

2 Marías encapsulates the fundamentals of *pragmatism* as Charles Sanders Peirce coined it, as the function of thought is to produce habits of action. The second formula states: "In order to ascertain the meaning of an intellectual conception one should consider what practical consequences might conceivably result by necessity from the truth of that conception; and the sum of these consequences will constitute the entire meaning of the conception" (Marías 1967, 395).

3 Pablo Picasso illustrates his awareness of a "final vocabulary" in his comment: "I don't develop; I am" (Hillman 1996, ix). Robert Wright finds representation of things outside the physical impossible: "Of course you can argue with the proposition that all we are is...genes and environment. You can insist that there's...something *more*. But if you try to visualise the form that something would take, or articulate it clearly, you'll find the task impossible, for any force that is not in the genes or the environment is outside of physical reality as we perceive it. It's beyond scientific discourse...This doesn't mean it doesn't exist" Robert Wright *The Moral Animal* quoted in (Hillman 1996, viii). Grammars assist representation of a visible world but with reflection may impinge upon many types of discourses.

metonymic discourse. But artists and designers[4] can use a "sense" of grammars often because their mandate is very broad. An architectural illustration of how a metaphor of grammar can contribute to understanding was offered by architect Denise Scott Brown:

> I remember the artist's story of Norma Evanson, who studied at Harvard, but taught at Berkeley, who said that the architecture students at Harvard were thrown into confusion by the faculty, who told them, "You have not understood the industrial imperative of the technological society". And she said, "If they'd just said you didn't design a Harvard box, they could have understood". So they had a grammar, it was the Harvard box, but you weren't supposed to have a grammar, so you were meant to derive the Harvard box out of the "industrial inheritance of a technological society". Well that is much too broad a mandate for ever arriving at how to do architecture (Venturi and Scott-Brown 1996).

We have to consider methods of using the grammatical metaphor that encourage an open attitude and sense of vitality in derivation discovery. I found in interviewees' statements, particularly (March 1996; Rollo 1996; Tapia 1996; Teeling 1996), many suggestions that conventional art, architectural and design education denies deeper and vital knowledge of art and design activities through often inarticulate and opaque pedagogy. Eizenberg summed up these issues:

> If you say "doing a grammar", some people argue that a grammar is self limiting, it limits what your choices are and that therefore is not a very creative way to do things. That is one argument.
> If you believe that you can't go through every possibility of the universe anyway, —and that's a pretty unproductive way to work and, that you have a natural predilection to select, —so that you have a sort of an intuitive framework. You could call it "taste", (you could call it whatever you want),—in which you make decisions, then the idea of having a grammar is basically just helping you find out what the parameters of the decision making are. So it's just sort of a shortcut, it doesn't necessarily generate new ideas, —it might, —but it clarifies what the limits of your decision making are.
> Now you can see,—it is happening intuitively with everybody any-

4 For example, at the 1992 *Touch the Earth Lightly* Conference architect Glenn Murcutt described his "experiential" system: "I have been practising now for twenty five years as I refer to it: 'knitting one, plain one, purl one, my eyes down, and operating well below the radar level'. The work has been small, lots of architects have been highly critical of its scale but there has not been much done on a large scale in this country that is even worth thinking about. In 1984 an architect operating in Western Australia, Brian Popper said to me at an event of National Awards in Melbourne, that he felt that my work was very closely related to an Aboriginal statement in Western Australia. He first used the words 'to touch the earth lightly'. Now that expression was used later, and later, and later including song lines and it has been forever with the Aboriginal people. It does not mean that you do not touch the land firmly, but you touch it lightly. And you touch it with responsibility. To seek brings together, to find can separate. It is about journey and God forbid that we should ever arrive because the arrival is insignificant to that journey. It is the experiential to me in life that has been so important and nearly at 58 years of age, I am as enthusiastic about architecture as I was when I was a student" (Murcutt 1992).

way otherwise you couldn't distinguish one set of work from another set of work. How do you distinguish Hockney from Lichenstein? Hockney is not interested in Lichenstein, Lichenstein is not interested in Hockney. If you are able to tell one visual artist from another there is definitely a set of choices (Eizenberg 1996).

Ahistorical understandings of design and duplication of innovative effort in the arts may be avoided by using specific computational grammars to reveal knowledge embedded in existing art and design languages. Grammatical design may facilitate the understanding of form making because "externalised" aspects of design appear logical and coherent. Rollo writes:

> The benefits of shape grammars over other language mediums when analysing and communicating the design of form, is that they offer not only, as Koning and Eizenberg claim, "a compelling means to represent (one's) detailed understanding of the composition of designs in existing languages of architecture" (Koning and Eizenberg 1981, 320) but they also facilitate as a means of:
> 1. exploring the generation of other designs with the same style or convention,
> 2. comparing separate interpretations of the same body of work,
> 3. comparing the compositional make up of two or more styles of design,
> 4. developing new styles of design, and
> 5. transforming from one style to another (Rollo 1995, 79).

A retrospective critical view articulates new awareness and leads to lucid evaluation of a product's contribution to a field. This view proposes that grammars might be used to enhance critical appreciation and develop rigorous critique, to diminish vague characterisation of styles based upon personal responses of often self appointed experts (Bruton 1990, 118).

But Smith's assessment of a mainstream art system that relies on exemplars of key centres that use a "rule-governed" activity survives in the nineties:

> There is a structural hierarchy in the operations of the international art world which centres on the bright stars in the constellation, the few artists, galleries, etc. who are "on top" this decade. No matter how naturally part of the New York art world they might feel, however personally humble they might be as individuals, they remain the ones who define what currently defines art in the culture. In so doing, they become the only artists with the chance to project their work into the long-term history of art. What gives them these powers is their exemplification of one simple, fundamental law within the rule-governed activity which art-making is: whereas most artists are rule following, these are both rule following and rule generating creators. They propose ways of making art which "falsify" given

ways, they satisfy doubts about these given ways, and they generate new problem areas for other artists to explore. Above all, they are in a situation which is culturally privileged for making their moves count (Smith 1984, 51).

Facilitating Creation

Creativity is often understood as the coming together of two old ideas to make a single appropriate and novel idea (Koestler 1969). According to Rogers (Rogers 1961) and Maslow (Maslow 1959) creative behaviour can be fostered in order to achieve that common educational objective known as self-actualisation (Bruton 1973, 7). For Herrnstein Smith artistic creation is a paradigm of evaluative activity:

> Every literary work—and, more generally, artwork—is thus the product of a complex evaluative feedback loop that embraces not only the ever-shifting economy of the artist's own interests and resources as they evolve during and in reaction to the process of composition, but also all the shifting economies of her assumed and imagined audiences, including those who do not yet exist but whose emergent interests, variable conditions encounter, and rival sources of gratification she will attempt to predict— or will intuitively surmise—and to which, among other things, her own sense of the fittingness of each decision will be responsive (Herrnstein Smith 1988, 45).

Some interviewees suggest creation can be enhanced with a contingent sense of grammar, especially if computational assistance is involved using syntactic methods. In a broader sense, a contingent sense of grammar offers "multiplicity" rather than an "either-or" alternatives.

As Rorty comments about his view of a more embracing "final vocabulary" that people develop, "All we can do is work with the final vocabulary we have, while keeping our ears open for hints about how it might be expanded or revised" (Rorty 1989, 197). Rorty argues that thinkers such as Nietzsche, Freud, and Wittgenstein have enabled societies to see themselves as historical contingencies, rather than expressions of underlying, ahistorical human nature or as realisations of suprahistorical goals.

In my view, following Rorty, a sense of grammar helps the theorist within the private realm of self creation, to fashion an artistic "final vocabulary". Grammars can provide a genuine chance for empowering self judgment through theoretical reflection: "The generic task

of the ironist is the one Coleridge recommended to the great and original poet: to create the taste by which he will be judged" (Rorty 1989, 197). This lesson apparent in the experimental journal and documentation of a postcard[5] in Chapter 4, is important for artists. Proust and Nietzsche are exemplary non metaphysicians who spent their lives replacing inherited, with self made contexts. This does not suggest an attempt is needed to devise a single canon that might explain all art and design behaviour. That grammars might be universal is, as Stiny suggested, of no consequence in this context.

Terry Knight thought grammars facilitate creation "because they can give you a whole multiplicity of solutions to the same set of constraints" (Knight 1996). From a shape grammar perspective, Mark Tapia suggests "selection" is a key element:

Instead of just imaging every single possible world, grammars enable you to home in and to develop a rule and then to concentrate on which rule you are going to select or how you are going to acquire, — rather than on how you are going to do something with a white piece of paper (Tapia 1996).

It is argued that by offering artists the means to clarify the nature of their own genuine self creation can occur through reflection on rules. This redescription of things is understood as a continual process: "For there is no big secret which the ironist hopes to discover, and which he might die or decay before discovering. There are only little mortal things to be arranged and redescribed" (Rorty 1989, 99). This contingent view offers a constructive future for artists through reflective action, rather than a canon of taste making through careerist avant-gardism. Robert Venturi illustrates this point:

I think there are moments in history where breaking the rules do not make sense. I mean, I would be very careful to say as other philosophers might: "I'm not trying to set up a way for all time." One thing for our time, which is one of enormous complexity, is that an architect today works for enormously different kinds of peo-

5 Derrida claimed that he would publish only postcards and speak to *them*. Rorty notes Derrida's constant preoccupation with the self-referential paradox involved in his making any general programmatic statement: "They will never know if I do or do not love the postcard, if I am for or against (Rorty 1989, 129).

ple. An architect in the fifteenth century Renaissance, was an architect for a relatively small group of middle class people (Venturi and Scott-Brown 1996).

Rollo reiterated these thoughts and described his approach to the use of grammars as a creative design tool:

Over the last few years because we have been in America and Cambridge a lot of my work has actually been on the analysis side of it. But because I really can't go for a couple of months without doing something on the synthesis process, whatever it is, whether it is designing posters or whether it is designing an exhibition or whatever I will adopt it straight away.

I will develop a series of parameters. Whether it is a series of shapes I am working at if it is an exhibition; whether it is a certain panel that I am working with and how I am going to actually work with that panel, then how I am going to combine these panels, I adapt it straight away. It's use to me now is to —say, if I am confronted with just a blank wall or whatever, and somebody says "Go away and design", —and you might previously have thought, "What am I going to do now?!"

It gets you into a discipline and into developing a program for yourself, for developing a construct and a design very quickly. With the rules—a lot of it has to do with geometry and the placement of form. The whole thing then starts to sing and you really start getting through one or two very simple and basic ideas and a wonderful coherent structure. It's fun. It really is. It's something which can be quick. What you actually start to find is that it is not a laboured process. You then start to form your own intuition very quickly. You develop a very acute process of vision and a recognition of knowing that if you transform something, —what that is going to give you and what it's not going to give you (Rollo 1996).

Julie Eizenberg attests to the flexibility of grammars and their ability to represent all kinds of creative situations:

You can make the same object from a number of different grammars so there will be objects that overlap. You can read an object made by a grammar in more than one way. That is not precluded, this is it, this is an example in the language. So if that is the case, what you are doing when you use a grammar as a base is you say, what you have got is a mental construct for a range of possibilities. But you don't have to have anything that is considered to be formal to make a grammar. So it really doesn't matter, it is basically a framework for describing anything that is visual. It doesn't have to be tidy (Eizenberg 1996).

Creation is developed through definition of and focus on a formal situation that the artist or designer is concerned with. Rollo argues that, "When we comprehend a corpus of designs, thoughts and

interpretations are enhanced and made clearer when a means of putting our ideas into symbols is developed for communicating our understanding and perceptions with others" (Rollo 1995, 78). Rollo understands shape grammars as "essentially a symbolic record of how we make sense of something" (Rollo 1995).

Why would a free mind that could imagine and depict anything want to use rules to seemingly limit the bounds of possibility? This apparent conundrum may be the basis of artists' and architects' reluctance, at first, to admit that grammatical approaches to concept and design derivation may be advantageous. The old cliché that "the more constraints on democracy the more freedom the citizen has" may also apply to art. Many artists are swamped by possibility. Normally, the selection of a medium and a subject constrains their domain of investigation. Recognising and operating within a style or series of styles also frees the artist to communicate personal derivations upon a theme. This has been the pattern for generations of art and architecture schools—to guide by offering a flexible structure based on a few media and limited strategies for communication. The problem with this scenario is that artists often develop ideas spontaneously without fully understanding their possibilities. Furthermore, the documentation of the creation of art works is potentially less useful to other artists partly because the product rather than the process has been the focus.

Chapter 3 gives examples of practitioners that creatively use a sense of grammar. In my interviews (see the Appendices) using formal grammars for the creation and analysis of designs was illustrated by Stiny, Knight, Rollo and Tapia in an educational setting, and Koning and Eizenberg, Lauzzana and March in both professional practice. and education.

In sum, using metaphors of grammars and grammatical design contingently provide enabling opportunities for artists and designers. That is, it enables an enframing of self-creation through grammatical understanding; artistic practice through the use of a contingent sense of grammar; form making systems using analysis or generation, and, as a basis for creative action. Computational grammars

enrich these metaphors of grammar and rules by adding advantages of transparent documentation, repetition and collective and individual memory.

As terms in art and design, grammar, grammatical design, contingency and rule open dialogues and create opportunities for judgement and self understanding beyond the restricted senses implied in the reliance on absolutes. As suggested in Chapter 2, to capture and characterise the metaphor of grammar (including shape grammar) and rule in Cartesian discourse alone is to conceal other discourses that might utilise various advantages it has to offer. Coyne's restricted view of rule on the basis of its previous Cartesian underpinning limits the possibilities of particularly the shape grammar enterprise by dwelling on a "scientific" claim to a sense of certainties.

By contrast, Robert Venturi and Denise Scott Brown were able to describe layers of rule sets used in their architectural design. Grammars were understood as ubiquitous, continually re-describable, and they connected with convention. Venturi maintains that the extraordinary can be derived from the ordinary:

> Convention is something we are not afraid of—we like it, we embrace it. And that's something again that made modernists more conventional is—the ordinary, we love the ordinary, we make the ordinary extraordinary. We learn a lot from Pop artists who did the Campbell soup can and gave it another context and another scale and it became extra ordinary. So convention again we love looking out of a window of a train or a car and we just learn all the time from the every day. I think that is different from the heroic stance of, as we were saying, I don't learn from the ordinary I despise the ordinary—my job is to be extraordinary. I think that is true, good art is extraordinary, but it can be derived from the ordinary. There is a long tradition of that (Venturi and Scott-Brown 1996).

Facilitating Discussion: Multiple views and discourse

In a variety of discourses[6], many metaphors are used to describe grammars: grammars as natural language; grammars as habit or traditional ways of doing things; grammars as formal and computer systems; grammars as rules; grammars as contingently enabling or disabling. Rorty's view is echoed by Chalmers[7] in highlighting the grammatical heterogeneity of views of artists, designers and educators.

Given this broad understanding of grammars, reflective practice with an understanding of multiple views enhances discursive potential. For Terry Knight and her students, reflection and discussion became a growing factor in grammatical design:

> In the beginning I have to admit there was hardly any reflection in using grammars because most of the work that we did was very experimental and I basically did not know very much about what I was doing or what was going to happen when we used grammars. And that was very delightful in the beginning. I am talking about five years ago (1991). We had very small groups of students that I was working with. We basically ran experiments with grammars and we weren't reflecting very much in the sense that we weren't thinking very carefully about what we wanted to happen. More and more though, as grammars began to be used in the studio, we are reflecting more on what we are doing, when we are doing it, and how we can modify grammars, add rules, take out rules, to achieve some final goal. Even with that final goal, — we also modify it, and discuss what sorts of rules are dropped out (Knight 1996).

Catherine Teeling describes the expressive power of using grammars:

> I think grammars are a very useful tool: in the way in which designers can learn about the language of architecture and ways in which they can express themselves through this language in defining qualities of spaces and forms. I think that is essential for an architect, essential for a designer. I think they don't have that expressive power seen through traditional methods. Those that are very talented will, because they are naturally engaged with the subject. For those who aren't, I think that that's where it has an importance in a way—architecture requires people with many different talents, they'll be good architects, but maybe their expressiveness of a particular design intent can be strengthened through grammar, which maybe they haven't been necessarily able to do (Teeling 1996).

A contingent sense of grammar provides a richer and more detailed

---

6 March and Stiny recognise various strategies and views of grammars on an international stage: "On a spectrum: at one end, the early Cambridge work tends to be aggregate and statistical, assuming that large ensembles and infinite arrays under generalised constraints will inform us of the most probable outcomes, or of general lawfulness; while the Waterloo and Open university configurationalists stand in the middle examining countable populations of lawfully constrained classes of designs; and, at the other end, the Los Angeles shape grammarians produce shape languages, often small and finite, of a very specific rule-determined designs. Each method collects objects together in a class: the ensemble, a population, a language, under either equivalence, or tolerance, the objects may be further ordered according to aspects of interest. The emphasis in the ensemble tends to be on parametric values of state variables: in a configurational population, on the incidence and symmetry of elements satisfying necessary physical conditions; and in a shape language, on the free mustering of production rules and their recursive application in a derivation. The search for a specific design also differs. In an ensemble there is just one most probable case given maximum likelihood in a well tailored shape language all designs fit, and choice is as likely to be a matter of contingent selection as it is to be one of utility" (Stiny and March 1981, 245).
7 Alan Chalmers supports this view: "I suggest the most important function of my investigation is to combat what might be called the ideology of science as it functions in our society. This ideology involves the use of the dubious concept of science and the equally dubious concept of truth that is often associated with it, usually in the defence of conservative positions" (Chalmers 1976, 169).

lexicon for educational discussions of art and design. Difficulties of changing old ways of thinking about art history and criticism (Burgin 1986) has to date been a barrier to the acceptance of the grammatical paradigm in education. As Lionel March notes, if a comparison is made between music[8] and architectural students' knowledge of their respective formal languages, there remains a great deal of work ahead in the visual fields of art and design. March recalled:

> I have done this with my students from architecture and said, "Experience a piece of architecture" then take them back to the studio and say "Well now draw it", and they are quite incapable of doing this. Now one can take musicians and one can just play them a piece of music and say, "Well write down the theme or write down this" and they are usually able to do it. It may be the lower dimensionality, in the sense of music, that makes it more possible. I think we do think linearly. It may well be that our memory is much easier to handle when it is a linear sequence. Many two dimensional things—three dimensional things—if you show them to somebody and they really study them and then you take them away from that, and you ask them to draw it or record it—their recordings are usually very crude, which suggests to me that we don't educate the visual artist in the same way as musicians (March 1996).

The performing arts generally provide metaphors of grammars as tools that may articulate the use of visual language by questioning old formulas and past dogma. Valuable discourse develops by distinguishing between those forms that are part of a grammar and those aspects that are not. In Stiny's view all knowledge belongs to a continuum that may be explored computationally and grammars provide a useful tool for this purpose:

---

8 Similarly Lévi-Strauss speculates upon the relationship between language and music. "The comparison between music and language is an extremely tricky one, because to some extent the comparison is extremely close and there are, at the same time, tremendous differences. For example, contemporary linguists have told us that the basic elements of a language are phonemes - that is those sounds that we represent, incorrectly, by the use of letters - which have no meaning in themselves, but which are combined in order to differentiate meaning. You could say practically the same thing of the musical notes. A note—A, B, C, D, and so on—has no meaning in itself; it is just a note. It is only the combination of the notes which can create music. So you could very well say that, while in language we have phonemes as elementary material, in music we would have something which in French I would call 'soneme'—in English perhaps 'toneme' would do. This is a similarity. But if you think of the next step or the next level in language, you will find that phonemes are combined in order to make words; and words in their turn are combined together, but what you have right away is a sentence', a melodic phrase. So while in language you have three very definite levels—phonemes combined to make words, words combined to make sentences—in music you have with the notes something of the same kind as phonemes from a logical point of view, but you miss the word level and go directly to the sentence" (Lévi-Strauss, 52).

The reason I say that everything is formal is that you can add to the grammar as you are using it. In fact if I didn't have that facility with a grammar then I would make a strong distinction. It is like the presentation and discursive stuff. What you are really asking me is whether the presentation is informal, loose, dynamic and whether you can change your mind along the way, and the discursive stuff is logical, rigid, there are rules and whether you can't change your mind along the way.
Well, it turns out that if you press it the distinction goes away. Most people don't press it that hard because they are comfortable with the distinction, they like the distinction. They like it because they can say there is science, but then there is the arts. They congratulate themselves that there is some realm that is different from what they are doing. I think it is all a continuum, a single spectrum of stuff. The issue is how you make it computational (Stiny 1996).

The advent of computers as a medium for art and design offers new realms of discovery through discussion of frames of reference, comparisons and transformations. Computers are fundamentally rule-based. For example, Steven Holtzman in his book, *Digital Mantras*, suggests serial music and serial art are a sound basis for the pursuit of new languages:

Computers will open new languages—new means of expression—not before possible or even conceivable. Computers will enable new worlds, new realities. We must have open eyes and open ears, open minds, if we are to appreciate these new worlds. We must develop a new aesthetic, a digital aesthetic (Holtzman 1994, 252).

Formalism in art has been a pejorative term in discussion throughout the twentieth century, as Denise Scott Brown's example illustrates:

Reading a piece by a George Collins, about grammars and poetry of vocabulary and architecture, which appeared in the early sixties, made me think very hard about the fact that form follows function. It seemed to me that a lot of people distorted form to make it look functional when it doesn't function. It was a distortion for an unadmitted decorative purpose. People had in their minds a grammar and in some way, there was a function that made them produce that grammar. Rather than saying, "I have a formalist approach, which is looked upon as irresponsible". The word formalism always went with flashy or irresponsible, never with responsible. But they were formalist,—but they try to say that it was all done for functional reasons and also for sculptural reasons. So we were in revolt against that and our thinking was, "If there are forms, we ought to understand them". In *Learning from Las Vegas* and a few articles I wrote at the same time, we followed that line of thinking (Venturi and Scott Brown 1996).

My discussions with Lansdown and Moore (Lansdown 1996) about the nature and development of formal grammars as a means to

develop cutting edge art through non interference with the rules prompted further experiments with grammatical systems. In my work I found that on each contingent occasion new decisions need to be made that shape each project and that discussions contribute to the choice of rules and their application. This is a contingent sense of grammar in practice. My experiments in Chapter 4 show moments of insight are available for inspection and discussion given that a reasonable record of the production of artifacts is maintained. Chapter 3 cites examples that document discussion of views of grammars in practice. A sense of grammar as a natural language metaphor as illustrated by the work of Venturi and Scott Brown is reflected in Chapter 3 demonstrating the generality of the concept of grammars and rules, contributing to their identification of moments of inspiration and highlighting conceptual changes of direction.

In a more formal grammatical sense, the work of Russell and Joan Kirsch, March, Lauzzana and Knight show, in a more detailed way, the advantages of shape grammar approaches for discussion of the identification of moments of inspiration and derivational novelty. The literature on shape grammar supplies discussions of how particular shape grammars may describe pictorial languages (Eizenberg and Koning 1981; Knight 1981a; Knight 1981b; Knight 1983b; Knight 1983c; Knight 1983a; Kirsch 1988; König 1992; Lauzzana 1993; Lauzzana 1994; Kluge 1996). These records assist reflection and identification of moments of change, an important aspect of grammatical design. It was interesting to watch Robert Venturi and Denise Scott Brown as they discussed their well recorded process of planning and prototype production of the Philadelphia Orchestra Hall. They were well aware of the changes in direction and moments of inspiration that grammatically occurred throughout their careers. Denise Scott Brown reflects:

> But it was—to kind of—"break the grammar"—to find a new one. And this was in the sixties in America where we said, "We think social movements need to change in sensibilities, and then when sensibilities change, and our little thing can happen, catch your eye and make you realise a new grammar. I think that's what happened with us. And that was what caught our eye to Las Vegas and began

to give us a new set of forms, a new view of decoration and finally a realisation that symbolism was an important part of architecture. As we started to analyse what was it there that caught our eye and gave us a shiver. It wasn't even that we loved it. We don't know if we hated it or loved it, but it caused something to change. It helped us—it jolted our aesthetic—got us out of a rut and into a new way of thinking.
We had a marvellous time in those days, Bob and I, playing a game, which said, "I can like something worse than you can like", which was again: challenging your own grammars, saying, "Now we're doing the 1950s". All that terrible stuff that we hated in the 1950s, perhaps its good (Venturi and Scott-Brown 1996).

Empowering art and design novices

In my view, there is no reason for the development of educational programs that deny grammatical design a place in a curriculum. Educationally, we cannot look at art and design without a deeper investigation into the formal qualities of these activities. Using a sense of grammars increases a capacity for creative educational action by enabling interdisciplinary links between domains of formal design spaces. The flourishing use of computers in education extends this need. Julie Eizenberg recognises that grammars need to be accepted by a reluctant art and design community:

> The thing with grammars—and I think it's partly to do with Christopher Alexander, in San Francisco, and those people,—is that it is assumed grammars are prescriptive. Grammars are only prescriptive in that they prescribe what it is that you want them to do. But there are as many grammars as you can think of, that can appear as complex—if you can configure complexity as one of the choices. You can make things look orderly or you can make them look complex. It is just another set of choices. I think it's most valuable part would be in education if people would buy into it (Eizenberg 1996).

Art and design novices may be empowered by a contingent sense of grammar, as indicated in Chapter 3 and Chapter 4, where grammars empower artists with insight and lead to deeper and richer practice. The nature of education changes with one's preferred discourse. Education for Plato was subordinate to ideas of justice and community interests and philosophers were neither wise nor ignorant. Knowledge seekers feel a lack of knowledge. The community benefits from a legitimate social sense of knowledge. If education is a cyclic, spiral process as Jerome Bruner suggests, we continually revisit the same concerns as we develop our ideas. Education relies

on reflection and developing hermeneutical awareness.

Grammatical design frees artists and designers from fears of prescription and constraint because moments of insight may be found by responding to historical and circumstantial contingencies. As with Julie Eizenberg, Robert Woodbury describes the powerful effect thinking in terms of grammars has for his students:

> I have stacks of student Honours projects in which we focus on first understanding one of the student's much-loved buildings, by creating a plausible grammatical derivation of it. We then lay that aside, and have the student do her own design project where the only requirement in the end was that she also had to give a plausible grammatical derivation of that design project. You can talk to some of the students about the mind bending effects of looking at architecture introspectively this way (Woodbury 1996).

In this context, the education of artists and designers can become a self creation opportunity together with a possible vocational training. These educational issues lead to questions of identification (for Rorty a philosopher's invention). The task is really to facilitate an identification with "humanity as such", or the group that an individual operates within.

From this larger educational perspective, grammars can be seen as a tool for interrogation and social legitimation. The role of the educator as facilitator of learning with grammars is described by Woodbury:

> It is one of assisting students to discover their own capabilities. It is a very familiar event for me when a student, in essence, figures out a design puzzle, figures out the pieces that they are using and then from that point in their design work, their design transforms from a figuring out of those pieces, to a playing with those pieces, and a realising those pieces in different configurations, and a refining of those pieces. This is often an immense struggle, but it is a very joyful and a very productive struggle to find interesting ways of working with designs (Woodbury 1996).

Practitioners report that using grammars maintains an enabling influence on practice many years after their grammatical rule-based education. To obtain a retrospective view of grammars, some interviewees were chosen because they had first hand experience using and devising grammars. Together with Antony Radford, Neil Hanson worked on interpreting grammars for a corpus of Glenn Murcutt houses (Hanson and Radford 1986). John Rollo has done

extensive work on interpreting grammars of Edward Lutyens' architecture and gardens (Rollo 1997) and (with Knight) on Frank Lloyd Wright windows (Rollo 1992). Hank Koning and Julie Eizenberg developed a grammar for Frank Lloyd Wright houses with March and Stiny (Eizenberg and Koning 1981). Hanson, after ten years in a professional architectural practice, suggested grammars provide a useful tool but highlighted the importance of reflection and an iterative approach to documentation and analysis:

> It might help, certainly it is extremely helpful to state for people working with you what your set of rules are. Most of the time it is just conveyed from one person to another by looking at a problem. It is not often that you sit down and say, "Well I believe in this and this". I still think that is one of the things about design — I still don't think anybody has defined it completely. I think we all do it slightly differently. You still couldn't write down how I design. I can write some of it down, but the older I get the more reasons that I can give for the way I do things (Hanson 1996).

Eizenberg suggests formal grammars are always educationally useful. But this approach requires a period of adjustment as explained by her description of the reception of grammars in the architecture school at UCLA:

> The architects were terrified of these people, absolutely terrified. It started first as a sort of an anti-machine bias. This was 1979 and then everyone was panicked about machine use. We as uni students went in to George Stiny's class. What he said was, 'This class is talking about how machines can design'. I stuck around because I thought it was preposterous—this guy can't go around saying this sort of stuff! I love an argument.
> Then we slowly understood where he was coming from. But there was a great fear among the art side that this was anti-creative, that it was everything but what art was about: machines were bad, computers were bad, numbers were bad, —art was good, art was free. Then over the last five years with the development of visual graphics that bias changed completely. Now machines are good, they are healthy, creative zippy stuff. So the bias is decreasing, but they are still not ready to bite off and actually incorporate the conceptual basis for all the things they can do in an education system (Eizenberg 1996).

Education involves a drawing out of knowledge. Grammars provide assistance to learning through formalisms that limit the design space to manageable proportions and facilitate knowledge acquisition.

A contingent sense of grammar applies within the conception of the architecture of Venturi and Scott Brown, Cox, Hanson, Walker, and,

Koning and Eizenberg. It applies with the conception of art of March, Lauzzana, Pearlstein, Barminski, Woods, and Margerison. Whether or not formal grammars may be found in their work, they understand their work in terms of rules and frequently referred to things that one looks for to find grammars: consistency, repetition and richness and depth of derivation. As Stiny suggests, the link between grammars, art, design and computation is a potent educational strategy. He characterises shape grammars as working with ambiguity and flexibility and suggests it is a sound and productive research direction:

> It has a lot to with ambiguity and flexibility and the ability to change your mind in the process and to still continue. It comes up all the time in the arts and that's why I think when dealing with spatial material, or artistic and design material and computation it is really very helpful and salutary for both enterprises. It makes designers think a little harder about what it is they are doing and artists think reflectively about what they are doing. It also lets you see that computation has much more general enterprise...
> A lot of people just think that design is a Newtonian kind of articulate manipulation that gets you nowhere, (laughs) but they are wrong. It is more general than that. It does not seem to come out in many places, but it does come out when you start to deal with design, art and computation together (Stiny 1996).

A contingent sense of grammar contributes to these links and offers discourses the potential for more articulate and innovative alternative languages of self creation through art and design. Through open reflection and discussion, metaphors of grammars and grammatical design may lead to deeper understanding and legitimation of the creative work of artists and designers.

Summary of Research Outcomes

This thesis brings to the forefront significant issues for both practitioners and theorists in the visual arts. Within the research hypotheses and sub-hypotheses reviewed at the beginning of this chapter, there are a number of specific outcomes to which I wish to draw attention as a basis for future work. The thesis:

1. Links concepts of grammars and views of contingency in art and design to:

- highlight the value of discourse about the linking of concepts of grammar and rules with views of contingency;

• call on and finds relevant both national and international discourse for the evaluation of grammatical views of art and design; and

• bring together a range of views of the shape grammar field, and its contribution and potential in art, architecture and design fields

2. Suggests the idea that grammars and contingency is ubiquitous in art by drawing together examples of views of grammars in art work and artists' views of grammar in their own art work. It:

• reviews the literature and personal views of artists, designers and theorists who use grammatical views of their work both in traditional and new media; and

• investigates and reports on the computational grammatical paradigm and its use in art

3. Illustrates that a developed sense of grammars is enabling and assists self reflection. It:

• extends debate about the existence of grammars and art as a base for computation and the development of strong personal art and design philosophies.

• documents alternative views to the Cartesian paradigm of grammars that open avenues for discussion

4. Asserts that the enabling nature of a developed sense of grammar applies whether talking about art that is not immediately grammatically obvious, or computationally grammatical art—whether in traditional media or interactive grammar programs such as that of *Tartan Worlds* and *DiscoverForm. It:*

• illustrates the relation between grammatical enframing and computational approaches to image making in both two and three dimensional form making

• positions of the shape grammar protocol as a potentially enabling but not exclusive tool for the analysis and generation of form making in the visual arts.

5. Is supported by extensive interviews, a literature review and a personal journal of reflective practice, which collectively

• suggest how artists may benefit from the use of a "a contingent sense of grammar" in their thinking, and actions; and

• provide examples of how "reflection on action" may contribute to moments of insight within a grammatical enframing of visual problems.

6. Highlights the benefits of a sense of grammars in education, given the above understandings. The limited experience in teaching architecture suggests that this is indeed productive. The thesis:

• reflects on the impact that interactive computer applications of "a contingent sense of grammar" may have as "tool" and paradigm offering new possibilities for art and education.

• reports recent work in arts education and art practice that demonstrates the utility of a grammatical approach and extends this view by suggesting that for artists "a contingent sense of grammar" is ubiquitous for the development of a mature artist's *oeuvre* through the use of personal interviews (reported in Volume 2 Appendices)

• enframes the shape grammar protocol and some specific shape grammatical instances as enabling for both the novice in education and the professional artist; and

• draws attention to the pedagogical implications for the education of novices in the visual arts.

Grammars are an eminently rich way of looking at art and design. This thesis is a starting point for a broader view of grammars than that of Enlightenment rationalism and offers productive strategies for art, architecture and design through reconsidered pedagogy and reflective practice.

References

Akin, Ö. (1978). *How do architects design?* IFIP 5.2 Working Conference on Artificial Intelligence and Pattern Recognition in Computer Aided Design, Grenoble, France, IFIP.

Akin, Ö. (1986). *The Psychology of Architectural Design*. London, Pion.

Akin, Ö. (1990). "Necessary conditions for design expertise and creativity." *Design Studies* 11 (2): 107-113.

Anderson, P. (1995). *Technical Writing a Reader-Centred Approach*. Ohio, Harcourt Brace.

Anscombe, G. E. M. and G. H. von Wright, Eds. (1969). *On Certainty*. London, Blackwell.

Armstrong, E. (1994). "Ed Ruscha (interview on the legacy of Duchamp)." *October (Cambridge, Mass)* (70): 55-6.

Arnheim, R. (1962). *Picasso's Guernica: the Genesis of a Painting*. Berkeley and Los Angeles, University of California Press.

Arnheim, R. (1969). *Visual Thinking*. Berkeley, CA, University of California Press.

Audi, R., Ed. (1995). *The Cambridge Dictionary of Philosophy*. New York, Cambridge.

Baker, G. H. (1989). *Design Strategies in Architecture*. London, Van Nostrand Reinhold.

Barminski, B. (1996). Bill Barminski: Interview by Dean Bruton. Los Angeles, unpublished personal interview.

Barminski, B. (1996). Deluxo Web Site: http://www.evolutionary.com/deluxo. Los Angeles, Netscape.

Barrett, D. (1996). "Close up." *Art Monthly* (profile of Fiona Banner) (194): 20-1.

Bernstein, R. J. (1988). *Beyond Objectivism and Relativism: Science, Hermeneutics and Praxis*. Philadelphia, University of Pennsylvania Press.

Bevan, R. (1995). "What is-or was-the Goldsmith phenomenon? (interview with Michael Craig-Martin, Professor of Fine Art at Goldsmiths College, London)." Art Newspaper 6: 21.

Black, M. (1962). *Models and Metaphors*. New York, Ithica, Cornell University Press.

Bobka, V. (1993). "[Leo Castelli gallery, New York' exhibit]." *Flash Art* (173): 111-12.

Bois, Y.-A. (1996). "Whose formalism?" *The Art Bulletin* 78: 9-12.

Broadbent, G. (1984). Design and Theory Building. *Developments in Design Methodology*. N. Cross. Chichester, Open University: 277-289.

Brook, D. (1977). *National Symposium on Art in Architecture*. Art in architecture : a national symposium sponsored by the Adelaide Festival Centre Trust, Adelaide, Adelaide Festival Centre Trust.

Brook, D. (1980). A transinstitutional theory of art. Adelaide, [s.n.].

Brook, D. (1981). *What Art Is*. Adelaide, Experimental Art Foundation.

Brook, D. (1983). "What, Even the Mona Lisa?" *Australian journal of art* (3): 30-38.

Brook, D. (c1974). An epistemology from the visual arts. [Adelaide], [The Author].

Brown, K. (1996). *In Support of Design Grammars: Generating Excitement?* AI in Design Conference, California, USA, Stanford University.

Brown, R. (1993). "Continual Motion: Ocean Observatory and Education Facility." *Crit* 30 (Spring): 42-3.

Bruckman, A. (1996). "Finding One's Own Space in Cyberspace." *Technology Review*(January 1996): 43-54.

Bruggen, C. v. (1988). "Today crossed out, an introduction by Coosje van Bruggen to Today, a project

by Hanne Darbhoven." Artforum 26: 70-3.

Bruns, G. L. (1992). *Hermeneutics Ancient and Modern*. New Haven and London, Yale University Press.

Bruton, D. (1990). Personal Taste and Public Office, Flinders University of South Australia.

Bruton, D. (1995). *Excess and Distress: Principles of Design in Context*. Rethinking the Built: Environment Proceedings of the Catalyst '95 Design & Environment Conference, University of Canberra, 13-16 July, 1995, Belconnen, University of Canberra, Centre for Environmental Philosophy, Planning & Design.

Bryson, N., M. A. Holly, et al., Eds. (1991). *Visual Theory: Painting and Interpretation*. Oxford, Polity Press.

Buchloh, B. H. D. (1994). "Three conversations in 1985 (interview with Claes Oldenburg, Andy Warhol and Robert Morris on Duchamp and their own work)." *October (Cambridge, Mass)* (70): 33-6.

Buck, R. T. (1980). *Richard Diebenkorn*. Buffalo, New York, Rizzoli.

Burgin (1986). *The End of Art Theory*. London, Camden.

Burgin, V. (1986). 'Something About Photography Theory'. *The New Art History*. A. L. Rees and F. Borzello. London, Camden Press.

Campbell, J. (1983). *Grammatical Man*. London, Allen Lane.

Caputo, J. (1987). *Radical Hermeneutics: Repetition, Deconstruction, and the Hermeneutic Project*. Bloomington, Indiana University Press.

Carr, W. and S. Kemmis (1986). *Becoming Critical*. London and Philadelphia, Falmer Press.

Cebulski, F. (1990). "A Resonant Mythology." *Artweek* 21: 11.

Chase, S. C. (1989). "Shapes and shape grammars: from mathematical model to computer implementation." *Planning and Design* 16(2): 215-241.

Chase, S. C. (1996). Modelling Designs With Shape Algebras and Formal Logic. *Architecture*. Los Angeles, University of California.

Chipp, H. B. (1973-4). "Guernica: Love, War and the Bullfight." *Art Journal* XXXIII (2): 100-115.

Chomsky, N. (1957, 1975). *Syntactic Structures*. Paris, Mouton.

Chomsky, N. (1975). *Reflections on Language*. London, Pantheon.

Clark, R. H. and M. Pause (1985). *Precedents in Architecture*. New York, Van Nostrand Reinhold Company.

Clark, V. (1941). "The Guernica mural —Picasso and social protest." *Science and Society* (5): 72-78.

Clarke, D. (1992). "The Gaze and the glance: competing understandings of visuality in the theory and practice of late modernist art." *Art History* 15: 80-98.

Cohen, H. and B. Cohen (1984). *The First Artificial Intelligence Colouring Book*. Los Altos, CA, William Kaufman, Inc.

Cohen, L., R. Brown, et al. (1993). *Imaging Essentials*. California, Adobe Press.

Colan, C. (1995). Paul Klee Grammar, Masters thesis, University of Massachusetts, Amherst.

Collingwood, R. G. (1938). *The Principles of Art*. London, Oxford University Press.

Connole, H. (1990). The Empiricist Approach. *Issues and Methods in Research*. B. Smith, H. Connole, S. Speedy and R. Wiseman. Adelaide, South Australian College of Advanced Education: 93-95.

Conrads, U. (1970). *Programs and manifestoes on 20th Century architecture*. London, Lund Humphries.

Cotter, H. (1986). "The Bartlett variations." *Art in America* 74: 124-31.

Cotton, B. and R. Oliver (1993). *Understanding Hypermedia*. London, Phaidon.

Coupland, K. (1994). "William Wegman: only human." *Graphis* 50: 60-71.

Cox, P. (1984). *Australian architects: Philip Cox*. Red Hill, A.C.T, Royal Australian Insitute of Architects.

Cox, P. (1988). *Australian architects : Philip Cox, Richardson, Taylor and Partners*. Manuka, ACT, Royal Australian Institute of Architects.

Cox, P. (1994). *Architects : selected and current works*. Mulgrave, Vic, Images Publishing.

Cox, P. (1996). Philip Cox: Interview with Dean Bruton.

Coyne, R. (1985). "Logic programming as a means of representing semantics in design languages." *Environment and Planning B: Planning and Design* 12: 351-369.

Coyne, R. (1988). *Logic Models of Design*. London, Pitman.

Coyne, R. (1991). Is Designing Mysterious? Challenging the Dual Knowledge Thesis. University of Sydney.

Coyne, R. (1995). "Mistrusting Hermeneutics." *Environment and Planning B* 22: 623-628.

Coyne, R. (1996). Richard Coyne: Interview by Dean Bruton.

Coyne, R. and A. Snodgrass (1991). Models, Metaphors and the Hermeneutics of Designing. *Department of Architecture*. University of Sydney.

Coyne, R. and A. Snodgrass (1991). What is the Philosophical Basis of AI in Design?, Department of Architecture.

Crary, J. (1996). *Visual Technologies and the Dispersal of Perception*. Jurassic Technologies Revenant, Sydney, Biennale of Sydney.

Cross, N. (1984). *Developments in Design Methodology*. Chichester, John Wiley & Sons.

Darr, W. (1966). "Images of Eros and Thanatos in Picasso's Guernica." *Art Journal* XXV (4): 338-346.

Davies, P. (1996). The Arts Have Lost It. *The Australian Magazine*. Adelaide: 30-31.

Davies, P. C. W. (1987, 1995). *The Cosmic Blueprint: order and complexity at the edge of chaos*. London, Penguin.

Davvetas, D. (1989). Joseph Beuys —Man is Sculpture. *German Art Now*. A. Papadakis. London, Academy Editions/St Martin's Press.

Decter, J. (1994). "[Museum of Modern art, New York; travelling exhibit]." *Artforum* 32: 84-5.

Deken, J. and E. Rosenfeld, Eds. (1983). *Computer images: state of the art*. London, Thames and Hudson.

Denis, M. (1912). *Théories 1890-1910: Du Symbolisme et de Gauguin vers un nouvel ordre classique*. Paris, Bibliothèque de l'Occident.

Dewey, J. (1980). *Art as Experience*. New York, Perigee.

Dickie, G. (1971). *Aesthetics*. Indianapolis, Indiana, Pegasus.

Diehl, C. (1995). "Alfred Jensen (1903-1981)." *Art News* 94: 149.

Dietrich, F. (1987). "The Computer: a tool for thought-experiments." *Leonardo* 20 (4): 315-25.

Dooley, M. (1994). "Ed words: Ruscha in print." Print (New York, NY) 48: 32-42.

Downing, F. and U. Flemming (1981). "The Bungalows of Buffalo." *Environment and Planning B* 8: 269-293.

Dreyfus, H. (1972). *What Computers Can't Do: A critique of artificial reason*. New York, Harper & Row.

Duro, P. and M. Greenhalgh, Eds. (1992). *Essential Art History*. London, Bloomsbury.

Durrell, L. (1958). *Balthazar a novel*. New York, E P Dutton & Company, Inc.

Dziemidok, B. (1993). "Artistic formalism: its achievements and weaknesses." *The Journal of Aesthetics and Art Criticism* 51: 185-93.

Eastman, C. M. (1973). "Automated Space Planning." *Artificial Intelligence* 4(1): 41-64.

Eco, U. (1990). *The Limits of Interpretation*. Bloomington and Indianapolis, Indiana University Press.

Edmonds, E. A. (1992). Knowledge-based systems and new paradigms for creativity. *Modelling Creativity and Knowledge-based Creative Design*. J. S. Gero and M. L. Maher. New Jersey, Lawrence Erlbaum.

Eizenberg, J. (1996). Julie Eizenberg: Interview by Dean Bruton.

Ewen, D. (1971). *Composers of tomorrow's music : a non-technical introduction to the musical avant-garde movement*. New York, Dodd, Mead.

Farrell Krell, D., Ed. (1977). *Basic writings from Being and Time (1927) to The Task of Thinking (1964): Martin Heidegger*. New York, Harper & Row.

Fawcett, W. (nd). The Design Engine, unpublished paper.

Fifield, G. (1994). "Artificial creativity: 3 artists who make art that makes art." *Art New England* 15: 16-17.

Fifield, G. (1995). "AARON (computer programmed to generate images)." *Art New England* 16: 5.

Fish, S. (1985). Consequences. *Against Theory: Literary Studies and the New Pragmatism*. W. T. Mitchell. Chicago, University of Chicago Press: 106-31.

Flemming, U. (1978). "Wall representations of rectangular dissections and their use in automated space allocation." *Environment and Planning B* 5: 215-232.

Flemming, U. (1981). "The Secret of the Casa Giuliani Frigerio." *Environment and Planning B*(8): 87-96.

Flemming, U. (1987). "More than the sum of parts: the grammar of Queen Anne houses." *Planning and Design* 14: 323-350.

Flemming, U. (1996). "Review essay: Good, not so good, and everything in between: current work on computational creativity." *Environment and Planning: Planning and Design* 23(2): 242-3.

Flemming, U., R. F. Coyne, et al. (1993). *SEED: A software Environment to Support the Early Phases in Building Design*. ARECDAO 93 (IV Symposium on Computer Aided Design in Architecture and Civil Engineering), Barcelona, Spain.

Forester, T., Ed. (1985). *The Information Technology Revolution*. Oxford, Blackwell.

Forty, A. (1986). *Objects of Desire—Design and Society*. London, Thames & Hudson.

Foster, S. C. (1975). "Clement Greenberg: Formalism in the '40s and '50s." *Art Journal* XXXVI: 20-24.

Foucault, M. (1970). *The Order of Things*. London, Tavistock.

Fowler, F. g. (1969). *Pocket Oxford Dictionary*. Oxford, Clarendon Press.

Franke, H. W. (1985). *Computer graphics, computer art*. Berlin; New York, Springer-Verlag.

Fry, T. (1994). *Remakings*. Sydney, Envirobook.

Galligan, G. (1985). "Jennifer Bartlett: in and out of the garden." *Arts Magazine* 60: 89-91.

Gero, J. S. and R. D. Coyne (1985). "Logic programming as a means of representing semantics in design languages." *Planning and Design* 12(3): 351-369.

Gero, J. S., Ed. (1984). *Knowledge Engineering in Computer-Aided Design*, North-Holland.

Gibson, J. (1995). "Los melbos." *Art & Text* (51): 20-1.

Gintz, C. (1994). "Beyond the Looking Glass." *Art in America* 82: 84-9.

Gips, J. and G. Stiny (1975). *Shape Grammars and their Uses: Artificial Perception, Shape generation, and*

Computer Aesthetics. Basel and Stuttgart, Birkhauser.

Gips, J. and G. Stiny (1980). "Production Systems and Grammars: a Uniform Characterisation." *Environment and Planning B*(7): 399-408.

Gisbourne, M. (1994). "Time and time again (interview with Hanne Darbhoven)." *Art Monthly* (181): 3-6.

Gleick, J. (1993,1988). *Chaos : making a new science*. London, Abacus.

Gödel, K. (1962). *On Formally Undecidable Propositions*. New York, Basic Books.

Gombrich, E. H. (1960). *Art and Illusion: A study in the psychology of pictorial representation*. New York, Pantheon.

Gombrich, E. H. (1960). *The Story of Art*. London, The Phaidon Press.

Goodman, N. (1976). *Languages of Art : An approach to a theory of symbols*. Indianapolis/Cambridge, Hackett Publishing Co.

Gouldner, A. W. (1982). *The Dialectic of Ideology and Technology*. New York, Oxford University Press.

Grabska, E. J. (1995). "Visual Evaluation in Design Space." *(forthcoming)*.

Greenberg, C. (1961). *Art and Culture*. Boston, Beacon Press.

Greenhalgh, M. (1978). *The Classical Tradition in Art*.

Hamilton, G. H. (1967). *Painting and Sculpture in Europe 1880-1940*. London, Penguin.

Hanson, N. (1996). Neil Hanson: Interview by Dean Bruton.

Hanson, N. R. and A. D. Radford (1986). "On Modelling the Work of the Architect Glenn Murcutt." *Design Computing* 1: 189-203.

Harris, M. (1996). "Simon Patterson at Lisson." *Art in America* 84: 96.

Harris, M. P. (1946). *Art: The Torch of Life*. Adelaide, Rigby.

Hawkes, T. (1977). *Structuralism and Semiotics*. London, Routledge.

Heidegger, M. (1980). *Hegel's Phenomenology of Spirit*. Bloomington and Indianapolis, Indiana University Press.

Herrnstein Smith, B. (1988). *Contingencies of Value*. London, Harvard University Press.

Hillman, J. (1996). *The Soul's Code: In Search of Character and Calling*. Sydney, Random House.

Hirsh, F. (1995). "Matthew Abbott." *Flash Art* (180): 97.

Hixson, K. (1992). "Through the lens darkly (Photography in contemporary German art, 1960 to the present: Walker Art Center, Minneapolis)." *New Art Examiner* 19: 21-5.

Hodges, H. A. (1944). *Wilhelm Dilthey*. London, Kegan Paul, Trench, Trubner & Co.

Hollier, D. (1989). Against Architecture: the Writings of George Bataille. Cambridge, Mass, MIT Press.

Holtzman, S. (1994). *Digital Mantras CD*. Los Altos, USA, Shriek!

Holtzman, S. R. (1994). *Digital Mantras*. Cambridge Massachusetts, The MIT Press.

Hudson, R. H. and W. Wiley (1991). "It's strange to talk about art. . . (a conversation between Robert Hudson and William Wiley)." *Artweek* 22: 28.

Husserl, E. (1970). *The Paris Lectures*. The Hague, Martinus Nijhoff.

Hussey, C. (1953, 1984). The life of Sir Edwin Lutyens. Woodbridge, Antique Collectors' Club.

Itten, J. (1964). *Design and Form*. London, Reinhold Publishing Company.

Jackson, D. (1990). Public Architecture: The Object and the Subject of the City, or Goodbye Singularity and Totality! Hello Multiplicity and Relativity! *On the Public Face of Architecture*. R. W.

Gaston. Melbourne, The Boston, Melbourne, Oxford Conversazioni on Culture and Society: 89-106.

Jacobson, R. and M. Halle (1971). *Fundamentals of Language*. The Hague, Mouton.

Jakobson, R. (1971). Quest for the Essence of Language. *Selected Writings, II: Word and Language*. R. Jacobson. The Hague, Mouton.

Jameson, F. (1985). *Postmodernism and Consumer Society*. Postmodern Culture. H. Foster. London, Pluto: 111-125.

Jay, M. (1993). *Downcast Eyes: The Denigration of Vision in Twentieth Century French Thought*. Berkeley, University of California Press.

Jespersen, O. (1924, 1934). *The Philosophy of Grammar*. London, Geoge Allen & Unwin Ltd.

Johnson, K. (1990). "Small world (a suggestive proposal for recreational building cum public art work, the Children's Pavilion by Dan Graham and Jeff Wall: Marian Goodman Gallery, New York; installation)." *Art in America* 78: 246-7.

Johnson, K. (1995). "Jennifer Bartlett at Paula Cooper." *Art in America* 83: 130.

Johnson, P.-A. (1994). *The Theory of Architecture*. New York, Van Nostrand Reinhold.

Johnston, J. (1994). "Flux acts." *Art in America* 82: 70-4.

Johnston, J. (January, 1994). "John Cage: Music for Museums." *Art in America* 82: 72-77.

Jones, O. (1856). *The Grammar of Ornament*. London, Day and Son.

Kafai, Y. and M. Resnick, Eds. (1996). *Constructionism in Practice*. Mahwah, NJ, Lawrence Erlbaum.

Kaneff, S. (1970). *Picture Language Machines*. Proceedings of Conference, Australian National University, Academic Press.

Kant, I. (1781). *Kant's Critique of Aesthetic Judgement*. Oxford, Clarendon Press.

Karatani, K. (1995). *Architecture as Metaphor: Language Number, Money*. Cambridge, Massachusetts, The MIT Press.

Karmel, P. (1995). "Robert Morris: formal disclosures (interview)." *Art in America* 83: 88-95.

Katz, V. (1995). "Al Held at Robert Miller." *Art in America* 83: 104.

Kenny, A., Ed. (1994). *The Wittgenstein Reader*. Oxford, UK and Cambridge, USA, Basil Blackwell.

Kerlow, I. V. and J. Rosebush (1986). *Computer graphics for designers & artists*. New York, Van Nostrand Reinhold.

King, M. (1995). "Programmed Graphics in Computer Art and Animation." *Leonardo* 28 (2): 113-121.

Kirsch, J. L. and R. A. Kirsch (1986). "The structure of paintings: formal grammar and design." *Languages of Design* 13: 163-176.

Kirsch, J. L. and R. A. Kirsch (1988). "The Anatomy of Painting Style: Description with Computer Rules." *Leonardo* 21 (4): 437-444.

Kirsch, J. L. and R. A. Kirsch (1996). Joan and Russell Kirsch: Interview by Dean Bruton.

Kirsch, R. A. (1966). *Picture syntax*. Pattern Recognition, Proceedings of IEEE Workshop, Las Croabas and Dorado, Puerto Rico, IEEE, Pattern Recognition Comm of Computer Group.

Klein, D. and M. Bishop (1986). *Decorative Art 1880-1980*. London, Phaidon.

Klemm, D. E. (1983). *The Hermeneutical Theory of Paul Ricoeur*. London and Ontario, Associated University Presses.

Kluge, F. (1996). "Die Bildlogik Picassos — Picasso's Pictorial Logic." *Languages of Design* 3 (2): 173-4.

Knight, T. (1996). Terry Knight: Interview by Dean Bruton.

Knight, T. W. (1980). "The generation of Heppelwhite-style chair-back designs." *Environment and*

Planning B 7: 227-238.

Knight, T. W. (1981). "Languages of designs: from known to new." *Environment and Planning B* 8: 213-238.

Knight, T. W. (1981). "The forty-one steps." *Environment and Planning B* 8: 97-114.

Knight, T. W. (1983). "Transformations of languages of designs: part 1." *Environment and Planning B* 10: 125-128.

Knight, T. W. (1983). "Transformations of languages of designs: part 2." *Environment and Planning B* 10: 129-154.

Knight, T. W. (1983). "Transformations of languages of designs: part 3." *Environment and Planning B* 10: 155-177.

Knight, T. W. (1988). "Comparing Designs." *Planning and Design* 15 (1): 73-110.

Knight, T. W. (1989). "Colour grammars: designing with lines and colours." *Environment and Planning B: Planning and Design* 16: 417-449.

Knight, T. W. (1992). *Designing with Grammars*. CAAD Futures. G. N. Schmitt. Wiesbaden, Vieweg: 33-48.

Knight, T. W. (1993). "Colour Grammars: The Representation of Form and Colour in Design." *Leonardo* 26 (2): 117-124.

Knight, T. W. (1994). *Transformations in Design*. Cambridge, Cambridge University Press.

Kolb, D. (1992). *Postmodern Sophistications*. Chicago & London, The University of Chicago Press.

König, H. G. (1992). "The planar architecture of Juan Gris." *Languages of Design* (1): 51-74.

Koning, H. and J. Eizenberg (1981). "The Language of the Prairie: Frank Lloyd Wright's Prairie Houses." *Environment and Planning B: Planning and Design* (8): 295-323.

Kramer, H. (1992). "Man Ray's best friend." *Art & Antiques* 9: 77-8.

Krauss, R. (1995). "The grid, the True Cross, the abstract structure (the paintings of Piero della Francesca and Agnes Martin)." *Studies in History of Art* 48: 302-12.

Kripke, S. A. (1982). The solution and the 'Private Language' Argument. *Wittgenstein on Rules and Private Language: An Elementary Exposition*. Cambridge, Mass, Harvard University Press: 55.

Kristeller, P. O. (1951). "The Modern System of the Arts: A Study in the History of Aesthetics (2)." *Journal of the History of Ideas* XIII (2): 496-528.

Kristeva, J. (1989). *Language the Unknown*. New York, Columbia University Press.

Kuspit, D. B. (1989). "Red Desert & arctic dreams (two heirs of Malevich, Donald Judd and Robert Ryman, continue the nonobjectivist quest for an absolute art)." *Art in America* 77: 120-5.

Kuspit, D. B. (1991). "Signs in Suspense." *Arts Magazine* 65: 54-8.

Lakoff, G. and M. Turner (1989). The Power of Poetic Metaphor. *More than Cool Reason: A Field Guide to Poetic Metaphor*. G. Lakoff and M. Turner. Chicago and London, The University of Chicago Press: 57-73.

Langer, S. K. (1957). *Problems of Art: Ten Philosophical Lectures*. New York, Charles Scriber's Sons.

Lansdown, J. (1987). "The creative aspects of CAD: a possible approach." *Design Studies* 8 (2): 177-81.

Lansdown, J. (1996). John Lansdown and Gregory Moore: Interview by Dean Bruton.

Lansdown, J. and C. Roast (1987). "The possibilities and problems of knowledge-based design." *Environment and Planning B* 14: 255-266.

Lansdown, J. and R. A. Earnshaw (1989). *Computers in Art, Design and Animation*. New York, Springer-Verlag.

Lauzzana, R. (1993). "Chronological Bibliography of Visual Formalism." *Languages of Design* (1): 279-283.

Lauzzana, R. (1994). "Chronological Bibliography of Colour Formalism." *Languages of Design* (2): 353-364.

Lauzzana, R. (1996). Cohen Rules, Unpublished communication.

Lauzzana, R. (1996). Raymond Lauzzana: Interview by Dean Bruton.

Lauzzana, R. G. and L. Pocock-Williams (1988). "A Rule System for Analysis in the Visual Arts." *Leonardo* 21 (4): 445-452.

Lavin, I. (1980). *Bernini and the Unity of the Visual Arts*. New York, Oxford University Press.

Lawson, B. and S. M. Loke (1996). *Computers, Words and Pictures*. Creativity and Cognition, Loughborough University, Loughborough University & Loughborough College of Art and Design.

Lawson, T. (1986). "Toward another Laocoon or, the snake pit." *Artforum* 24: 97-106.

London, B. (1995). "Time as medium: five artists' video installations." *Leonardo* 28 (5): 423-6.

Lucie-Smith, E. (1983). *A History of Industrial Design*. London, Phaidon.

Lyons, J. (1970). *Chomsky*. London, Fontana/Collins.

Maki, F. (May-June 1985). The Public Dimension in Contemporary Architecture. *Maki, Isozaki, New Public Architecture: Recent Projects*. New York, Japan Society.

Makkreel, R. A. (1975). *Dilthey: Philosopher of the Human Studies*. Princeton, New Jersey, Princeton University Press.

Makkuni, R. (1986). A Representing the Process of Composing Chinese Temples, Palo Alto Research Centre.

Makkuni, R. (1988). Diagrammatic Interface to a Database of Thangka Imagery, Xerox Palo Alto Research Centre.

Maloney, M. (1995). "Douglas Gordon, Lisson." *Flash Art* (182): 114.

Mandelbrot, B. (1983). *The Fractal Geometry of Nature*. San Francisco, W H Freeman and Co.

March, L. (1966). "Serial Art." *Architectural Design* (February): 62-63.

March, L. (1976). *The Architecture of Form*. Cambridge, Cambridge Architectural and Urban Studies.

March, L. (1981). "A class of grids." *Environment and Planning B* 8: 325-332.

March, L. (1981). "Editorial." *Environment and Planning B* 8: 241-243.

March, L. (1983). "Design in a universe of chance." *Environment and Planning B: Planning and Design* 10: 471-484.

March, L. (1996). Lionel March: Interview by Dean Bruton.

March, L. and G. Stiny (1985). "Spatial Systems in Architecture and Design: Some History and Logic." *Environment and Planning B* 12 (1): 31-53.

Marchese, S. M. and F. T. Marchese (1995). "Digital Media and Ephemeralness Art, Artist, and Viewer." *Leonardo* 28 (5): 433-435.

Marías, J. (1967). *History of Philosophy*. New York, Dover.

Masheck, J. (1967). "Guernica as Art History." *Art News* (66): 32-35, 65-68.

McCorduck, P. (1991). "Can computers create? (Harold Cohen's computer art)." *Art & Antiques* 8: 26.

McEvilley, T. (1992). "Absence made visible (Robert Ryman)." *Artforum* 30: 92-6.

McGowan, J. (1991). *Postmodernism and Its Critics*. Ithica and London, Cornell University Press.

McLaughlin, S. (1993). Practices and primordial understanding: major implications of Heidegger's

philosophy for computer aided architectural design research. *Department of Architecture*. Sydney, University of Sydney.

Metzger, R. (1993). "[Nouveau Musee, Vileurbanne, France; travelling exhibit]." *Flash Art* (172): 94-5.

Minsky, M. (1967). *Computation: Finite and Infinite Machines*. Englewood cliffs, N J, Prentice-Hall.

Miranda, E. R. (1995). "Granular Synthesis of Sounds by Means of a Cellular Automaton." *Leonardo* 28(4): 297-300.

Mitchell, W. (1990). *The Logic of Architecture*. London, MIT Press.

Mitchell, W. J. (1992). *The Reconfigured Eye*. New York, MIT.

Mitchell, W. J. (1995). *City of Bits*. London, The MIT Press.

Moholy-Nagy, L. (1947). *The New Vision and Abstract of an Artist*. New York, George Wittenborn Inc.

Morley, S. (1994). "The artists as critic (double life of Patrick Heron)." *Art Monthly* (181): 12-15.

Morris, C. (1971). *Writings on the General Theory of Signs*. The Hague, Mouton.

Murcutt, G. (1992). Keynote Lecture at the Touch the Earth Lightly Conference, Melbourne University. Melbourne, unpublished transcript.

Murray, P., Ed. (1982). *Transactions* 2. The Record of Papers Presented to the RIBA. London.

n.a. (1991). "Multiples & objects and books." *The Print Collector's Newsletter* 22: 19-21.

n.a. (1993). "Matisse: a symposium." *Art in America* 81: 74-87.

Nagel, E. and J. R. Newman (1959). *Gödel's Proof*. London, Routledge & Kegan Paul.

Neff, E. (1992). "[Larry Becker Gallery, Philadelphia; installation]." *Artforum* 28: 165-6.

Newell, A. (1973). Production Systems: models of control structures. *Visual Information Processing*. W. Chase. New York, Academic Press: 463-526.

Newell, A. and H. A. Simon (1972). *Human Problem Solving*. New Jersey, Prentice-Hall.

Newell, A., H. A. Simon, et al. (1958). "Elements of a Theory of Human problem solving." *Psychological Review* 65(3).

Nixon, B. (1991). "Words and pictures." *Artweek* 22: 1.

Norwich, J. J. (1984, 1994). *The World Atlas of Architecture*. London, Mitchell Beazley.

Oksala, T. (1979). "The Language of Formal Architecture." *Environment and Planning B* 6: 269-278.

Oxman, Robert, Radford, Antony and Oxman, Rivka. (1987). *The Language of Architectural Plans*. Red Hill, Royal Australian Architectural Education Division.

Oxman, R. (1990). "The Role of Knowledge-Based Systems in Design and Design Education." *International Journal of Applied Engineering Education* 6 (2): 255-264.

Panofsky, E. (1957). *Gothic Architecture and Scholasticism*. New York.

Pareto, V. (1963). *The Mind and Society: a treatise on general sociology*. Vol. 1: Non-logical conduct. Vol. 2: Theory of residues. Vol. 3: Theory of derivations. Vol. 4: The General form of society. London, Dover.

Pearlstein, P. (1996). Philip Pearlstein: Interview by Dean Bruton.

Perrin, F. (1993). "[Claudine Papillon Gallery, Paris; exhibit]." *Flash Art* (173): 119-20.

Petkanas, C. (1995). "Al Held's Italian days (Umbrian farmhouse, Todi)." *Architectural Digest* 52: 178-83.

Petrovich, L. and K. Tanaka, Eds. (1994). *Visual Proceedings: The Art and Interdisciplinary Programs of SIGGRAPH 1994*. New York, Association for Computing Machinery.

Plant, M. (1984). Anything Goes. *Quattrocento Melbourne: Aspects of finish 1973-77*. P. Taylor.

Melbourne, Impact.

Platt, C. (1996). "They Render unto Bill." *Wired* (July): 114-117.

Polyani, M. (1967). *The Tacit Dimension*. London, Routledge & Kegan Paul Ltd.

Posner, R. (1992). "Origins and Development of Contemporary Syntactics." *Languages of Design* (1): 37-50.

Preston, S., Ed. (c1980). *Eduard Vuillard*. New York, Harry N Abrams.

Quinn, E. (1972). *Picasso*. New York, Felicie.

Raczka, R. (1991). "From there to here: tracking video's pioneers (Carnegie Museum of Art, Pittsburgh; travelling exhibit)." *High Performance* 14: 70-2.

Radford, A. D. and D. Bruton (1997). On Grammars. *Department of Architecture and Urban Design*. Adelaide, University of Adelaide.

Rand, P. (1970). *Thoughts on Design*. New York, Van Nostrand Reinhold.

Rau, P. (1995). "William Wiley." *New Art Examiner* 23: 42.

Rees, A. L. and F. Borzello, Eds. (1986). *The New Art History*. London, Camden Press.

Reff, T. (1960). "Cézanne and Poussin." *Journal of the Warburg and Courtald Institute* 23: 150-78.

Reichardt, J. (1987). "Machines and Art." *Leonardo* 20 (4): 367-72.

Renfrew, C. (1995). The Search for the Mother Tongue. Sydney, ABC Radio Tapes.

Renfrew, C. and E. B. W. Zubrow (1987). *Archaeology and Language: the puzzle of Indo-European origin*. London, Jonathon Cape.

Rheingold, H. (1992). *Virtual Reality*. London, Secker and Warburg.

Richens, P. (1994). Does knowledge really help? *Knowledge-Based Computer-Aided Design*. G. Carrara and Y. E. Kalay. New York, Elsevier: 305-325.

Ricoeur, P. (1973). "The Hermeneutical Function of Distanciation." *Philosophy Today* (17): 134.

Robert, A., Ed. (1995). *The Cambridge Dictionary of Philosophy*. New York, Cambridge University Press.

Rollo, J. (1992). Triangle and T-square: The Windows of Frank Lloyd Wright. *Architecture*. Los Angeles, UCLA.

Rollo, J. (1995). "Triangle and T-square: the windows of Frank Lloyd Wright." *Environment and Planning B: planning and Design* 22: 75-92.

Rollo, J. (1996). John Rollo: Interview by Dean Bruton.

Rollo, J. (1997). Jester of Genius: A Reassessment of the Country House Architecture of Sir Edwin Landseer Lutyens. *Architecture*. Cambridge, Cambridge University.

Rorimer, A. (1991). "The Date paintings of On Kawara." *Museum Studies* 17 (2): 120-37.

Rorty, R. (1989). *Contingency, irony, and solidarity*. New York, Cambridge University Press.

Roth, M. (1977). "The Aesthetic of Indifference." *Artforum* 16 (November): 46-53.

Rudolph, K. (1995). "Morris l'insaisissable." *L'Architecture d'Aujourd'hui* (301): 32.

Ruiz, A. (1996). Ed Moses. Los Angeles, Museum of Contemporary Art.

Ryle, G. (1949). *The Concept of Mind*. London, Penguin.

Sachs, S. (1987). "[Paula Cava Gallery, Philadelphia' exhibit]." *New Art Examiner* 14: 57.

Salat, S. (1988). *Fumihiko Maki : an aesthetic of fragmentation*. New York, Rizzoli.

Salvioni, D. (1990). "Dan Graham: I'll call myself a conceptual artist, though I don't like conceptual art." *Flash Art* (152): 142-4.

Sapir, E. (1921). *Language*. New York, Harcourt Brace.

Schön, D. (1983). *The Reflective Practitioner*. New York, Basic Books.

Schön, D. A. (1988). "Designing: Rules, types and worlds." *Design Studies* 9 (3): 181-190.

Schön, D. A. and L. L. Bucciarelli (1989). Design Theory and Methods. *Design Theory '88*. S. L. Newsome, W. R. Spillers and S. Finger. New York, Springer-Verlag: 29-35.

Schoenberg, A. (1948). *The Theory of Harmony: Harmonielehre*. Trans. R.D.W. Adam. New York, Philosophical Library.

Schoenberg, A. (1975). *Style and Idea: Selected Writings*. Ed. Leonard Stein. Trans. by Leo Black . London, Faber.

Schwendenwien, J. (1995). "Bill Walton." *New Art Examiner* 23: 49.

Scruton, R. (1979). *The Aesthetics of Architecture*. London, Methuen.

Seebohm, T. (1996). Tom Seebohm: Interview by Dean Bruton.

Shapiro, T. (1976). *Painters and Politics: the European Avant-Garde and Society, 1900-1925*. London, Elsevier.

Simon, H. A. (1988). "The Science of Design: Creating the Artificial." *Design Issues* IV (1 & 2 Special Issue): 66-82.

Simon, J. (1996). "Perfection is in the mind: an interview with Agnes Martin." *Art in America* 84: 82-9.

Slattery, L. (1996). Of truth, beauty and robots. *The Weekend Australian*. Adelaide: 6.

Smith, A. R. (1996). Alvy Ray Smith: Interview by Dean Bruton.

Smith, R. (1990). *Dictionary of Artificial Intelligence*. London and Glasgow, Collins.

Snodgrass, A. (1991). *Hermeneutics and the Application of Design Rules*. Gadamer Action & Reason: a two day conference on the application of the hermeneutic philosophy of Hans-Georg Gadamer within the human sciences, Sydney, University of Sydney.

Snodgrass, A. (1996). Adrian Snodgrass: Interview with Dean Bruton, unpublished.

Snodgrass, A. and R. Coyne (1990). Is Designing Hermeneutical? *Department of Architecture*. Sydney: 1-22.

Solomon, D. (1989). "A Downtown aesthetic: the residence and studio of artist Jennifer Bartlett." *Architectural Digest* 46: 316-21.

Sontag, S. (1973). *On Photography*. London, Allen Lane.

Sparke, P. (1987). *Design in Context*. London, Bloomsbury.

Spiller, J., Ed. (1970). *Paul Klee Notebooks Volume 1 The Thinking Eye*. London, Lund Humphries.

Spiller, J., Ed. (1970). *Paul Klee Notebooks Volume 2 The nature of nature*. London, Lund Humphries.

Stiny, G. (1975). *Pictorial and Formal Aspects of Shape Grammars on Computer Generation of Aesthetic Objects*. Basel, Switzerland,, Birkhauser Verlag.

Stiny, G. (1976). "Two Exercises in Formal Composition." *Environment and Planning B* 3: 187-210.

Stiny, G. (1980). "Introduction to shape and shape grammars." *Environment and Planning B* (7): 343-351.

Stiny, G. (1981). "Design Machines." *Environment and Planning B* 8: 245-255.

Stiny, G. (1981). *The Grammar of Form*. London, Pion.

Stiny, G. (1989). Formal Devices for Design. *Design Theory '88*. S. L. Newsome, W. R. Spillers and S. Fingers. New York, Springer-Verlag: 173-88.

Stiny, G. (1996). George Stiny: Interview by Dean Bruton.

Stiny, G. and J. Gips (1972). Shape grammars and the generative specification of painting and sculpture. *Information Processing*. C. V. Freiman. Amsterdam, North Holland. 71: 1460-1465.

Stiny, G. and J. Gips (1973). Formalisation of Analysis and Design in the Arts. *Basic Questions of Design Theory*. W. R. Spillers. Amsterdam, North Holland Publishing Co: 507-530.

Stiny, G. and J. Gips (1978). *Algorithmic Aesthetics: computer models for criticism and design in the arts.* Berkeley, University of California Press.

Stiny, G. and W. J. Mitchell (1978). "The Palladian Grammar." *Environment and Planning B* (5): 5-18.

Stiny, G. and W. J. Mitchell (1980). "Kindergarten grammars: designing with Froebel's building gifts." *Environment and Planning B* 7: 409-462.

Tapia, M. (1996). Email on UCLA: Grammars & Education.

Tapia, M. (1996). From Shape to Style, Shape Grammars: Issues in Representation and Computation, Presentation and Selection. *Architecture and Design*. Toronto, University of Toronto.

Tapia, M. (1996). Mark Tapia: Interview by Dean Bruton.

Taplin, P. (1992). Tartan Worlds. Adelaide, University of Adelaide.

Tarransky, A. (1995). Stella, Newman and Fra Angelico. *Architecture*. Boston, MIT, Cambridge.

Tartarkiewicz, W. (1971). "What is Art? The Problem of Definition Today." *The British journal of Aesthetics* II(2): 134-153.

Teeling, C. (1996). Catherine Teeling: Interview by Dean Bruton.

Thorson, A. (1994). "Revisiting old haunts." *Art News* 93: 94.

Towndrow, J. (1991). Philip Cox. Ringwood, Victoria, Viking.

Valéry, P. (1964). *The Collected Works of Paul Valéry*. New York, Pantheon.

Venturi, R. and D. Scott Brown (1996). Robert Venturi and Denise Scott Brown: Interview by Dean Bruton.

Vesey, G. and P. Foulkes (1990). *Dictionary of Philosophy*. Glasgow, Collins.

Viola, J. (1982). *The Painting and Teaching of Philip Pearlstein*. New York, Watson-Guptill.

Viollet-le-Duc, E. (1866). *Dictionnaire Raisonnée de l'Architecture Francaise*. Paris.

Volk, G. (1996). "Matthew Abbott at Boesky & Gallery." *Art in America* 84: 87.

von Wright, G. H., R. Rhees, et al., Eds. (1978). *Remarks on the Foundations of Mathematics*. Cambridge, Mass, MIT Press.

Walker, D. (1996). David Walker: Interview by Dean Bruton.

Webster, M. H. (1994). "Viewpoint: parents and children." *Artweek* 25: 4.

Wei, L. (1995). "Ed Ruscha at Castelli." *Art in America* 83: 120-1.

Welsh, M. A. (1989). Computer-aided Conceptual Ship Design System Incorporating Expert Knowledge, University of Newcastle Upon Tyne (United Kingdom).

White, H. (1978). *Tropics of Discourse: essays in cultural criticism*. Baltimore, Johns Hopkins University Press.

Wilson, A. (1995). "Breaking content from (survey of contemporary British painters)." *Art & Design* 10: 7-19.

Winckelman, J. J. (1755). *History of Ancient Art*. Boston.

Wind, E. (1967). *Pagan Mysteries in the Renaissance*. Harmondsworth, England, Harmondsworth.

Winograd, T. (1972). *Understanding Natural language*. New York, Academic Press.

Winograd, T. and F. Flores (1986). *Understanding Computers and Cognition – A New foundation for*

Design. Norwood, NJ, Ablex.

Wittgenstein, L. (1922). *Tractatus Logico-Philosophicus*. London, Routledge and Kegan Paul.

Wittgenstein, L. (1958). *Philosophical Investigations*. New York, McMillan.

Wittgenstein, L. (nd). The Big Typescript. A. Kenny: 406-35.

Wojtowicz, J. and W. Fawcett (1986). *Architecture: Formal Approach*. London, Academy Editions.

Wojtowicz, J., Ed. (1995). *Virtual Design Studio*. Hong Kong, Hong Kong University Press.

Wolfe, T. (1975). *The Painted Word*. New York, Bantam.

Wong, W. (1977). *Principles of Three Dimensional Form*. New York, Van Nostrand Reinhold.

Wong, W. (1988). *Principles of Two-Dimensional Form*. New York, Van Nostrand Reinhold.

Wood, C. (1994). "Free-for-all formalism (seven artists' continued allegiance to the genre)." *New Art Examiner* 22: 26-30.

Wood, C. S. (1994). "Ryman's poetics." *Art in America* 82: 62-71.

Woodbury, R. (1996). Robert Woodbury: Interview by Dean Bruton.

Woodbury, R., A. D. Radford, et al. (1992). *Tartan Worlds: A Generative Symbol Grammar System*. ACADIA.

Woods, J. (1996). John Woods: Interview by Dean Bruton.