This paper contributes to the debate about the utility of the grammatical paradigm in art and design. It reports an investigation of the contingent sense in which grammars and grammatical design apply in the practice of form making in art using two complementary research strategies: 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 major hypothesis is that a contingent sense of grammar can facilitate the creation, understanding, and discussion of form-making in art. 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.
1. Introduction

Formal computational grammatical programs are few while many critics of grammars are often without personal hands on experience. This paper explores the first hand use of computational grammatical programs to generate two- and three-dimensional forms. It investigates the idea of grammars through examining bodies of work from a grammatical perspective, accepting the idea of grammar and rules. It concentrates on the views of some of those who use the idea of grammars: how these ideas relate to art. The work of some selected artists that have been the subject of grammatical analysis are discussed to illustrate the application of grammatical perspective in a formal way.

Special consideration is given to the field of art, particularly painting to enhance links between design fields, especially art and architecture. Ideas of grammar and grammatical design and the associated idea of rule are used and located within discourses of artists and designers. Ideas of contingency, are highlighted, first as a concept and then within the specific discourses of art, architecture, and grammatical design. The idea of rules in art is then discussed. It then reviews some of the positions taken about the nature of grammars as computational systems; as encapsulating knowledge of style and form; as a frame of reference in the composition of shape and form in designing and in discourse about art and design. The contingency of grammars is then discussed to show how rules are used to develop awareness of hermeneutical moments and metaphorical truths.

Contingency is understood as both “in addition to” and “depend upon” the moment of grammatical design decisions and judgements. A plurality of ideas of grammars in art and design is emphasised: when two people refer to grammars, they may be referring to very different concepts. It concludes by supporting a view of the utility of grammars contingently in art and design.

2. Grammar

The idea of grammar in art and design draws on analogies between “visual languages” and “natural languages”. The role of grammar in natural language is to independently facilitate the communication of meaning by providing and organisational structure. Universal principles of natural language were put forward by Noam Chomsky (Chomsky 1957). His theory of transformational grammar was based on a system of internalised rules capable of generating an infinite number of grammatical sentences. For generative grammarians in linguistics, a grammar refers to the entire system of structural relationships in a language, viewed as a set of rules for the generation of sentences. This idea of transformational generative grammars emerged with the use of computers for the analysis of natural language, concentrating on formalist approaches.

The use of grammar as an analogy or metaphor in art and design arose with the mathematical work on production systems of Post (Post 1943), and was developed
for spatial design by George Stiny and James Gips (Gips and Stiny, 1980). Pioneering work on picture languages (Kaneff 1970) was initiated by Russell Kirsch (Kirsch 1966). The formalisation of grammars of art and design as a computational system following Chomsky’s ideas was developed in the early work of Stiny (Stiny 1975; Stiny 1976; Stiny and Gips 1972; Stiny and Gips 1973), Downing and Flemming (1981), Flemming (Flemming 1978; Flemming 1981; Flemming 1986; Flemming 1987a; Flemming 1987b; Flemming et al. 1988), (Oksala 1979) and Gips (Gips and Stiny 1975; Gips and Stiny 1980). In 1966, Lionel March used grids to restrict the set of dimensional values used in his art work (March 1981). By 1980, Stiny’s proposal “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 1980, 416). Using Froebel’s building gifts, George Stiny proposed a constructive approach to languages of design by means of shape grammars declaring it “will ultimately replace the kindergarten method in the studio and in practice” (Stiny and Mitchell 1980, 416). The formal theoretical machinery for the definition of languages of two- and three dimensional spatial design was established. A revised history of grammars in art and design is reported in (March and Stiny 1985). Raymond Lauzzana documents a general history of colour and visual formalism (Lauzzana 1993; Lauzzana 1994).

Although these ideas were subsequently explored and applied in architecture and design by the CAAD research community (Chase 1989; Eastman 1973; Fawcett nd, Gero 1984; Hanson and Radford 1986; Tapia 1996; Valkaló and Liou 1996; Welsh 1989; Wojtowicz and Fawcett 1986), artists and art discourse has been slow to develop the metaphor of shape grammar as a basis for studio practice. Examples in art are often early explorations of proof of concept (Cohen and Cohen 1984; Colan 1995; Edmonds 1992; Grabska 1995; Kirsch and Kirsch 1988; Knight 1993; Knight 1994; Lansdown and Earnshaw 1989; Lauzzana and Pocock Williams 1988; Makkuni 1986; Makkuni 1988; Petrovich and Tanaka 1994; Stiny 1981; Stiny and Gips 1972; Tarransky 1995).

3. Contingency

A contingent sense of rules is proposed as a vital component for the development of art practice. A contingent sense refers to an ability to appreciate insights into a specified state of affairs 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.

In adopting the term contingent, I am following the work of Barbara Herrnstein Smith in literature who emphasises that contingency is a starting point, 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 variable) 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 investi-
gate 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, 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).

For Paul-Alan Johnson contingency is ‘the anticipation of uncertainty, the chance that something might or might not happen, the possibility of an accident or unforeseen event or circumstance; we say for example, “we must be prepared for any contingency.” In mediaeval Latin it meant circumstance, the context which surrounds an event and, like context, makes contact with it, hence its etymology from tangere, to touch, such that to be contingent is to depend upon. Its opposition with uncertainty seems to be reconciled by the tangent, the fleeting touch of one upon another, accidental or incidental yet consequential” (Johnson 1994, 343).

Using this conceptualisation of relativism contingency may be applied to metaphors of grammar to instigate new vistas of exploration. 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 representation of a design; they are contingent to design.

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’” (Plant 1984, 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, where different possibilities are seen.

4. Rules

In natural language grammatical “rule” construct a sentence. Grammatical metaphors may use “rule” in a variety of formal guises. Visual language analogies such as shape grammars use rules that describe a vocabulary, operations, a start state for transformations that produce derivations in a design space. March and Stiny recognised that rules were a basis for languages of designs: “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 design behaviour, a behaviour previously tacit and opaque. Using that system to enhance artistic practice requires an acceptance of the metaphor of rule. Writers on grammars typically use a language based on the metaphor of rules that may choose to incorporate intervention and displacement. Schön’s work links design behaviour and reflection uniting the concepts of art, understanding, hermeneutical circle and historical relativism (Schön 1988). Despite criticism that the foundations of shape grammars are logical and atomistic, shape grammarians utilise many discourses by adhering to a pragmatist view of design that contributes to all kinds of picture language discourses. Stiny urges a reconsideration of grammars and computation: “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).

4.1 ARTISTS THAT USE GRAMMARS IN THEIR WORK

Three types of artists use grammars. First there are those that use grammars explicitly. Few artists fit this category because a knowledge of computer systems such as LISP has been required. Exponents such as Lionel March, Harold Cohen (Fifield 1995), Raymond Lauzzana and Alvy Ray Smith, use grammatical systems to generate conventional experimental patterns and illusions. Russell and Joan Kirsch described a grammar for the work of Richard Diebenkorn and Joan Miro. The idea of a visual pattern language was established but not developed by artists except informally in mainstream image production. The second group of artists use grammars informally. When they discuss their work
they can identify elements, rules, operations and derivations of an image. Often ideas of themes, sequence transformation and documentation guides their work, especially in painting. For example, in the figurative painting, internationally renowned New York artists, Jennifer Bartlett (Johnson 1995) and Philip Pearlstein (Bowman 1983) work in these terms. In the digital image field, Los Angeles artist, Bill Barminski describes his work in traditional painting and internet media as corresponding to rules and visual relationships (Bar. An informal use of grammar as a production metaphor seems to guide artists of this type.

Thirdly, a group of artists that use grammars for the grammatical production of forms is developing. These artists seek a refinement of their understanding of self-creation. Form making is a means of self reflection and discovery. This group merge both the logic of grammatical formalism with philosophical hermeneutics. Holistic notions of an event are reflected upon in conjunction with the metaphor of grammatical design. This approach offers significant gains in terms of formalisation of major concerns and development of key form making ideas and personal interests. Grammars are understood as a catalyst as well as a logical system for form analysis and generation. For example the Bowl Grammar Series (Figure 1) represents an early experiment that reveals moments of insight through reflection on the narrative and arrangement of the forms, using a grammatical frame of reference. Elements of the image became identifiable for further exploration. A vocabulary of images refined future possibilities. Operations were recorded and available for evaluation and repetition. Meaning and understanding develop through play. Elements of the Bowl Grammar Series were selected and used in Tartan Worlds, a grammatical computer program that generates forms based on defined rule sets. The results are then used for further experiments outside of Tartan Worlds.

By documenting changes in personal ideas and practice through reflection on grammars and grammatical formalisms in art, moments of insight are found such as the formal possibilities of black and white; the colour filter variations; fragmentation and distortion operations; and repetition as abstraction. Further computer operations could grammatically develop many of these early images and also provide scope for refinement and addition to holistic understandings. Images that are generated from rule sets without intervention may be contrasted or combined within a manipulated grammar adding to the complexity and unpredictability of outcomes.

In reference to Donald Schön’s (1983) suggestion that designers know more than than can say, Johnson suggests intuition is a key factor in design decisions: “This knowledge in action is the one ability architects and designers have that artificial intelligence will probably never achieve: the capacity to both change minds and to accommodate the mind changes of others, or changes obliged by shifting circumstances, and to then intuit the right path in the midst of wrong clues” (Johnson 1994, 345). My experiments use Schön’s approach, one that reflects on action as it happens and symbiotically experiments with the situation adjusting received theory and counteraction. Rather than argue against the use of algorithmic interpretations of the world, a metaphor that incorporates a reflective hermeneutical dimension is assumed.
4.2 EXPERIMENTS IN FORM MAKING

Using a grammatical frame of reference, the *Bowl Grammar Series* demonstrates the influence of the shape grammar mechanism. Finding elements in the vocabulary requires reflection on the key thematic directions for the communication. Decisions depend upon a holistic understanding of the moment as much as upon the mechanism in play. Interpretation was necessary for selection of fundamental qualities of the image (h) from a range of possibilities (e-g). The large range of possibilities requires a selection of a vocabulary to refine the qualities and overall direction of the work. Early Tartan World experiments established the possibility of using the entire image as a symbol in conjunction with red and blue shapes (Figure 3).

Figure 3. *Bowl Grammar Series* used as a single vocabulary element

Four elements of a vocabulary were chosen and used as symbols in the exploration of the computer program Tartan Worlds. Four simple rules were decided upon in relation to the circumstances surrounding the initial form making experiment and the
technical demands of the program (Figure 5-6). Results were dynamic and prolific. Derivation#8 was chosen for its qualities of structure and visual interest (Figure 7).

Figure 5. Start State

Figure 6. Tartan World Screen

Figure 7. Derivation #8 from BG Series

Following the work of Terry Knight, (Knight 1980; Knight 1981; Knight 1981; Knight 1983; Knight 1983; Knight 1983; Knight 1988; Knight 1992; Knight 1993; Knight 1994; Knight 1996), key concerns are: How do artists go about formulating rules and how do they change them? What kinds of rules are kept and what sorts of rules are 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. In looking at work from a grammatical perspective, there are certain qualities that stand out and are 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. 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.

Associated with grammars is the idea of rules. So a set of work is viewed with an interest in consistent compositional rules that might be inferred from the work. Derivations, particularly in serial art suggest a sense of progression of ideas from one member of the series to another. 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.

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 view that invention occurs despite rather than because of, previous rules and traditions.

5. Discourse

Discourse is speech or language. It comes from the Latin discurrere and suggests movement “back and forth” or “to and fro”. In linguistics, discourse analysis is often applied to the study of those linguistic effects — semantic, stylistic, syntactic — whose description needs to take into account sentence sequences as well as sentence structure. Discourse through speech and language develops through shared concerns, values and communication. The shared use of codes enables a linguistic community to evaluate through comparison and generate democratic values through notions of free information exchange. Thus 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, privileged and hermeneutic qualities. As Richard Rorty and others have noted, discourse is impossible without some rationality and depends upon the nature of contingency within language (Rorty 1989). Discourses often overlap, interweave and shift ground. Thus the idea that there is a scientific art and an artful science is a mix of discourses that may enable new understandings.

Tacit knowledge provides rules about 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, 81e.) Quoted in (Karatani 1995, 137). Traversing from practical to theoretical realms through reflection encourages acknowledgement of language interpretation. Studies that search for grammars of creativity and principles of visual language follow a Cartesian discourse although some claim to maintain a completely “neutral” objectivity. Karatani submits there is no universal, neutral position between languages: “In the case of Saussure, however, he was aware that in the comparison or translation of two languages, the translator, even if bilingual, necessarily places himself or herself within one or the other of these languages at a time. There is no universal, neutral position between languages” (Karatani 1995, 138).
This view suggests there is no universal, neutral position between grammars. A position is contingently assumed for each utterance. Discourse on art is often concerned with authenticity and interrogative practice that questions a status quo. Nevertheless, artists often seek acknowledgement of art institutions for some validation of their practice. Twentieth century distinctions between art and art so-called contribute to essential theoretical discourse. Sociological questions about the role of art establish a vital discourse based on notions of plurality and complexity which displace many mainstream aesthetic activities. Grammars provide a means for further recognition of these changes in the understandings of art practice.

6. Conclusion

This paper suggests that for artists, finding methods to discuss and use complex visual information can be assisted by formal grammars framed by the metaphor of a contingent sense of grammar. Through reflective action some strategies for identifying and defining moments of inspiration when rule-transformation or invention are demonstrated. By documenting changes in personal ideas and practice through reflection on grammars and grammatical formalisms in art and design, moments of insight are found to be more transparent and educationally germane. Through contingently incorporating ideas of vocabulary, rules, frames of reference and metaphors of grammars, a significant prototype is demonstrated for a more transparent art practice and vital visual education. As Steven Holtzman suggests, “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 to 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).

Chomsky’s lead in the pursuit of a universal natural language grammar has been superseded by notions of many languages that are culturally dependent for their form making. The academic division between making forms and discerning their significance has extended since the early days of Chomsky’s universalist structuralism. A contingent sense of grammar may contribute to self-judgement grounding art and design behaviour in legitimate societal concerns. All of this concentrates on form. I end 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).
References