Rules and Contingency in Teaching Digital Design

Introduction

The theme of this conference is 'The ethical challenge of multidisciplinarity: Reconciling the three narratives of Art, Science and Philosophy'. From the narrative of philosophy we shall take the relatively new concept of responsive cohesion from Warwick Fox's 2006 book *A Theory of General Ethics*.[1] From the narrative of science we shall take the logic of mathematics and mathematical operations that underlie the computational technology of digital media. From the narrative of arts we shall take the idea of personal creativity and expression. All this fits well into a theme of electromediative art education, referring to both digital and analogue electronic technologies in the creation, form, presentation and study of artworks.[2]

A key idea of responsive cohesion is that any 'thing' (idea, design, environment, society) can be cohesive (hang together) either by a rigid organization (fixed cohesion) or by the parts responding to each other with mutual benefit. Fox argues that experts in all fields praise structures that have this second character of *responsive* cohesion. This applies to art, architecture, music, dance and any other kind of creative endeavor; since it applies to everything this necessarily follows. Further, it is more important that any part of a design has this relation of responsive cohesion with its contexts (other parts of the design, and with the environment within which the design is located) than between its internal

components. The priority for a musical fragment is to enhance the symphony, for a building to enhance the street, and for a knife to work well with a fork. In ethics, this 'theory of contexts' works so that the ultimate priority is that the global biophysical system works well, because that sustains all other systems, but that is beyond the scope of this paper.

Computers, of course, compute. To work they need information to be represented in digital form that can be the subject of defined mathematical operations. Computations are rule-based, and software can be characterized as complex packages of linked rules.

We argue that rules permeate design, too. Many artists and designers react warily to the term 'rule' as suggesting something too fixed, too rational.[3] It seems to contradict romantic stereotypes of artists as 'rule-free radicals'. Nevertheless, 'anyone learning how to paint, write music, poetry or the skills of architecture' will 'inevitably find that the learning of recipes, principles, rules of thumb and more exact rules for achieving varieties of effects and results' will be just as prevalent as in any 'less exalted' trade or profession.[4] Indeed, Arthur Koestler, a writer who crossed disciplines of philosophy, science and politics, noted:

> All ordered behaviour, from embryonic development to verbal thinking, is controlled by 'rules of the game', which lend it coherence and stability, but leave it sufficient degrees of freedom for flexible strategies adapted to environmental conditions.[5]

To use digital media effectively we need to find a kind of responsive cohesion between the digital media and the human designer (meaning that the media-plus-human system is as effective as possible) in order to make designs that have the quality of responsive cohesion (to be as effective as possible). In electromediative art education, we need to create opportunities for students to develop the skills to work with digital media in their chosen field.

Table 1 lists some computer characteristics, design characteristics, and some strategies (tasks for students) that a teacher can adopt that respond to computer characteristics.

	Computer Characteristic	Design Characteristic	Teaching/Learning Strategies
1	Ubiquitous representation	Design description	Making multiple views of a single design model
2	Transformation	Design development	Transforming designs
3	Multiple versions	Record of design development	Retaining and journaling versions
4	Modularity	Stages in design development	Moving between software systems, and Moving between ‘traditional’ and digital

			media
5	Interface	Making and changing design descriptions	Experiencing interfaces

Table 1: Designing teaching/learning to match computer and design characteristics

Adopting Koestler's terminology of games, in digital design the rules of the game of designing are combined with the rules of the game of using digital media and the two sets of rules have to be compatible for success. We argue that a combination of systematic thinking (understanding and using rules and patterns) and intuitive thinking (adapting and inventing rules and patterns for specific situations) can enhance productivity and creativity when designing with digital media.[6]

Teaching digital design can be approached through the explicit recognition of rules and patterns, and encouraging students to engage with them. Within the overarching idea of design as a hermeneutical reflective practice,[7] in this approach students learn by a process of play subject to rules.[8] They look for patterns that can be adopted and adapted in their design endeavours, including patterns that are known and recommended for various design fields[9] and patterns that can be found in nature and the history of art and design. They also look for the rules and patterns that are contained in the digital design software that they are using, and seek to frame their design aims and processes in ways that makes it easy and productive to use that software.

Through these experiences, students better appreciate the compelling advantages of

digital design media but also recognise that design software will struggle to cope with what appears to be outside its rules. Importantly, they learn to recognise, welcome and exploit the unexpected, and how thinking in terms of systems and rules is not incompatible with intuition and creativity.

Games and play

The essence of 'games' lies in our immersion in play, that is subject to rules. Immersion implies a complete absorption in the activity: '...in this intensity, this absorption, this power of maddening, lies the very essence, the primordial quality of play'.[10] This absorption must be willing: 'First and foremost ... all play is a voluntary activity. Play to order is no longer play: it could at best be a forcible imitation of it ... Play is not 'ordinary' or 'real' life. It is rather a stepping out of 'real' life into a temporary sphere of activity with a disposition all of its own'.[11] Play licenses us to neglect practicalities and expectations, to take risks and to suspend our sense of what is possible.

Following rules is subject to responding to contingency, unexpected events. The German philosopher Hans-Georg Gadamer has written on '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'.[12] Indeed, the rules may change many times in the course of the play.

According to Johan Huizinga, all manifestations of civilisation — religious ritual, language, law, war, science, poetry, philosophy and art — are essentially forms of play. Eric Berne in Games People Play[13] draws attention to the way people act as if they are playing games in the various circumstances of life. But this sense of play assumes relative safety, that the adverse consequences of 'poor play' are always limited. There is the spice of danger, but never a debilitating fear of failure.

Some kinds of games to facilitate learning about key features of design with digital media are listed in Table 2. In all of them, it is important to recognise and exploit the effects of contingency.

	Theme	Approach	Actions ('games')
	Patterns	Patterns (and precedents) as a basis for designs	Players provided with a patter Players choose their own patterns
	Vocabularies	Make vocabularies	Explore vocabularies
	Rules	Rules and relationships	Explore rules Explore recursive rules (fractals) Follow a series of defined rule or rule types Use parametric design

	Sequences	Derivation	Record derivation sequence Move design to next player
	Explorations	Multiple derivations	Make several derivations from design stage Players make derivations from the same design and compare outcomes
	Multiple views	Making multiple abstractions and views from a design description	Figure and ground views Grayscale and colour views 2D and 3D views Abstracted and detailed views Soft and hard views

Table 2: Approaches and actions to reinforce understanding of some themes in design

Although these ideas apply to any kinds of design, how the games are presented will depend on the design domain that is the subject of the students' education. In Table 3 we list some possible projects that can be formulated as games, ordered by design domain. We are an architect/urban designer and an artist, and do not have the knowledge to suggest projects in music, dance or engineering although we are confident that comparable projects focusing on vocabularies, rules and patterns exist. These are shown shaded in the table.

Examples from teaching

In our own teaching we have conducted many studios in digital design with students of art, design, architecture and landscape architecture.[14] There we can find design projects where those engaged in the studio have been challenged by broad 'game rules' and 'game goals'.[15] These games are always open-ended, with clear and attainable design objectives but offering opportunities to go beyond the expected.

The games are organised into three groups:

1. Series. The first group emphasizes the notion of series and derivation, primarily in 2D but extending to vocabularies of 3D shapes. The aim is to make many instances of designs within a 'language' that are all derived in similar ways with essentially the same grammar and patterns.

2. Fabrication. The second group emphasizes the notion of fabricating digital 3D objects and places, using defined spatial organisations or restricted vocabularies as the bases for the games. The aim is to work towards a 3D system of form making in which various elements of the piece are ordered according to predetermined rules, and variations on them.

3. Surreal. The third group emphasises the surreal, the boundary between the apparently 'real' and 'surreal', and how variations in expected grammatical attributes and

relationships lead to a sense of the surreal. The aim is to explore how bending the implicit and usually unacknowledged rules of the 'real' world leads to the making of surreal virtual worlds.

	Domain	Aspects	Teaching/Learning Projects
	All		*Base on patterns and precedents* *Base on rules* *Base on vocabulary*
1	Art	2D 3D	Designing series – the postcard Sculptures based on digital 'found objects'
2	Industrial design	Sets and series	Designing tableware, lamps, furniture, street furniture, letter boxes
3	Film	Character Plot Camera angle Lighting	Designing and making short animations
4	Dance	Choreography	*Outside the authors' expertise*
5	Music	Score	*Outside the authors' expertise*
6	Built environment (architecture, landscape architecture,	Tectonics Imagining space Designing for different	Design a village Design a place to meet Design a formal place Design an informal place

	interior design, urban design)	vocabularies of materials Exploring tectonics Human scale Context	Design with a vocabulary of heavy mass Design for a vocabulary of light frame and panels Design a building form to work in an existing urban context
7	Virtual environment	Sense of place Navigation Community	Design a web site Design a virtual blackboard
8	Engineering	Relation between form and performance	*Outside the authors' expertise*

Table 3: Design domains, some issues and possible design projects

It is how these games are played that matters. The successful studio is characterised by a vibrant creativity, the games being starting points for students to produce results outside expectations.

The most recent studio based on these ideas was held at Uganda Martyrs University in Uganda in 2012. This course explored the use of digital modeling in the design of urban places, landscapes, and buildings. The emphasis was on the exploration of alternatives and how digital modeling fits in a creative process of reflective practice (the combination

of making design proposals and mentally thinking about and then modifying those proposals). Because of the context of the built environment, the course did not explore series or the surreal but concentrated on fabrication. The students were in their second or third year of a program in design of the built environment. Here we shall list the ‘game’ descriptions and show just a few examples of the design products.

The anticipated learning outcomes for students were to:

- Understand the benefits of digital modelling in design and some techniques for exploiting those benefits;
- Understand the differences between surface and solid modelling;
- Better design attractive and elegant small places and spaces using digital modelling;
- Use SketchUp and FormZ software as tools in their own design processes.

Game I: Studies for a small urban community

Design and represent a small urban community of about 80 dwellings with a chapel, shops, workshops and community centre. Assume the site is flat and located close to Kampala.

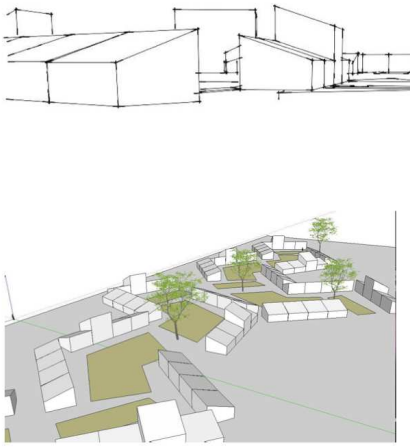
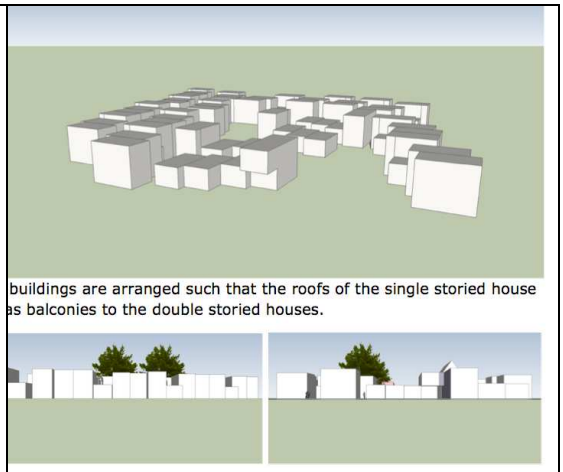
(1) Explore groups of about 15 houses around a shared open space

(2) Explore the linking of five of these groups to make a small community

(3) Adapt the design to add a chapel, shops, workshops and community centre.

Include trees in your designs, and show shading – for at least one design show shading in the morning and late afternoon.

Pay special attention to the public space that is created between the buildings and the views that are seen through the development. Show buildings only as blocks without openings – this is a study of the public space and not about the design of houses.

	
Carina Musila	Joseph Agaba

Game II: Studies for an outdoor place – Using SketchUp

Design and represent a small outdoor place where people can meet and talk in a pleasant shaded environment.

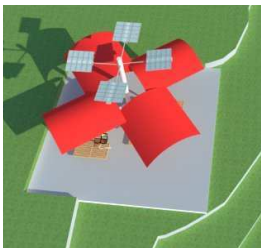
(1) Make a vocabulary of five elements – a platform, a wall, a seat, a shade and a solar panel powered on a post.

(2) Arrange these elements to make a design composition. Elements may be repeated in the design.

(3) Group the elements and repeat them to make a small cluster of meeting places.

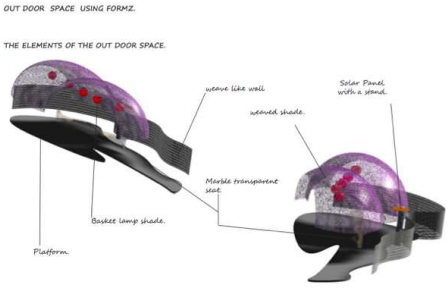
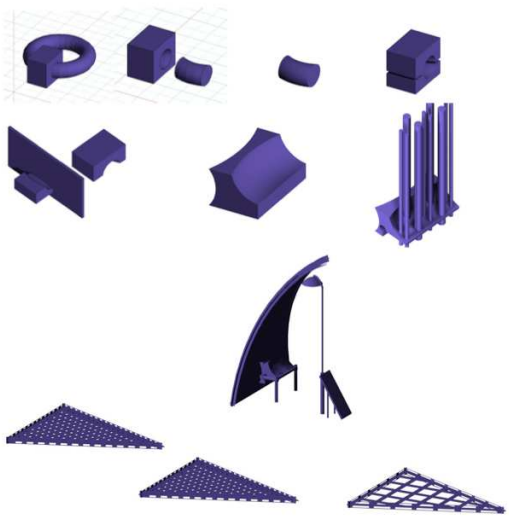
(4) Adapt the design for site that slopes at an angle of about 1 in 5, showing contours.

Do not show how the shade or other elements are supported – just show these main elements.

	
Aggrey Agaba	Amil Joseph

Game III: Studies for an outdoor place – Using FormZ

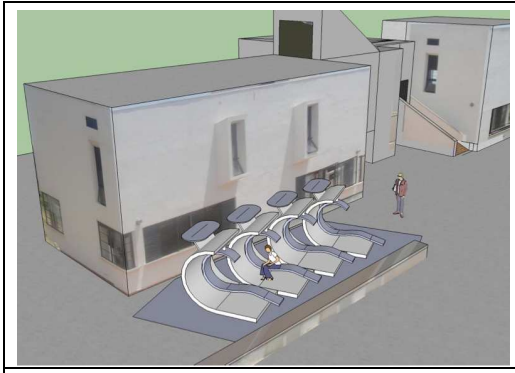
Design some new versions of the outdoor place described in Assignment II, this time using FormZ instead of SketchUp. Make the five elements exploiting the Boolean addition and subtraction of solids capability of FormZ that is not included in the free version of SketchUp.

	
Rita Nomagisha	Gedeon Lukoo

Game IV: Studies for an outdoor place at UMU – Using SketchUp

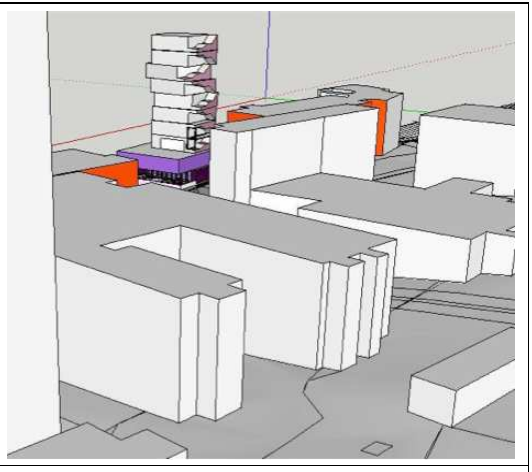
Using SketchUp and a background photograph, make a digital model of a small area of

the UMU campus and adapt some of your designs from Assignment 2 to fit in this digital model.

	
Jonathan Mugisha	Paul Mugomba

Game V: Studies for an infill development – Using SketchUp and FormZ

Using a provided SketchUp model of a part of Kampala, make some design studies using SketchUp and FormZ of buildings to fit into sites in the model. These designs should explore possibilities of different size, form and style. They should only explore external form, not the planning or details of the design.

	
Victor Luguwa	Frances Nakabuye

The process followed two iterations, with students being asked to review and revise their work in a digital folio submitted at the end of the course.

Conclusion

The following final table lists our claims about the importance of understanding the roles of rules and contingency. Those who are immersed in these grammatical studios adopt techniques of journaling and annotations to record their reflections. In a group, students are also encouraged to critique each others' work, to share interpretations, to help each other in the use of software and media and to go further by suggesting possible ways to develop work. This combination of playful making and reflective recording, always pushing boundaries and seeking the unexpected, makes the grammatical electromediative studio a highly effective site for developing skills in design and creativity.

	Key claims
1	Understanding the roles of vocabulary, rules and patterns can make the use of digital media more effective.
2	Revealing the contingency of vocabulary and rules can expose moments of inspiration and redirection in a reflective design activity.
3	Being explicit about vocabulary and rules assists in learning about design and the collaborative efforts of dispersed groups.

4	Being explicit about vocabulary and rules is required in the automated exploration of alternatives and the linking of design with production.

Table 4: Importance of understanding vocabulary and rules

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[1] Warwick Fox, *A Theory of General Ethics: Humans, Nature and the Built Environment*, (Cambridge, MA: MIT Press, 2006).

[2] See Dean Bruton and Antony Radford, *Digital Design: A Critical Introduction* (London: Berg, 2012).

[3] D. Walker, Interviewed 1 in London at the Open University by Dean Bruton for PhD Thesis, The University of Adelaide, 1996.

[4] A. Harrison, *Making and Thinking*, (Hassocks: The Harvester Press, 1978), 60.

[5] A. Koestler, *The Act of Creation*, (London: Hutchinson, 1964), 96.

[6] Bruton and Radford, *Digital Design.*

[7] Donald Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1982).

[8] K. Salen and Z. Eric, *Rules of Play*, (Cambridge, MA: The MIT Press, 2004).

[9] See for example Christopher Alexander, *A Pattern Language: Towns, Buildings, Construction* (London: Oxford University Press, 1977).

[10]J. Huizinga, J. *Homo-Ludens: A Study of the Play Element in Culture*, (London: Paladin, 1970), 21.

[11]Huizinga, *Homo-Ludens,* 26.

[12]Adrian Snodgrass, A. (1991), "Hermeneutics and the Application of Design Rules", in *Gadamer Action and Reason: Conference on the application of the hermeneutic philosophy of Hans-Georg Gadamer*, (Sydney: The University of Sydney, 1991), 5.

[13]Eric Berne, *Games People Play*, (Harmondsworth: Penguin, 1964).

[14]See Antony Radford, "Games and Learning about Form in Architecture", *Automation in Construction*, 9(4) (2000): 379-385; Dean Bruton, D. "Fusing Horizons: A Grammatical Design Approach for the Arts and Humanities: using rules, contingency and hermeneutics in design education", *Arts and Humanities in Higher Education*, 6(3) (2007): 309-327; Dean Bruton, "Learning Creativity and Design for Innovation", *International Journal of Technology and Design Education*, (21 May 2010), available online http://hdl.handle.net/2440/59765 (accessed 9 January 2011)

[15] Examples are illustrated in Chapter 5 of Bruton and Radford, 2012.