

Generative Art: Music Generation, Digital Art Production and *Nebula*.

By Russell Richards

Abstract

This paper is concerned with exploring the concept of generative art. The purpose of this approach is to uncover methods of analysis that foreground digital art as a discrete mode of production as opposed to an adjunct of other art forms. This aspiration operates both at the level of art production itself and also at the level of critique. I make no apologies for using my own work as a series of examples to justify why digital art is a discrete mode of production. I had already begun some tentative steps in the field of digital art before I came across Brian Eno's analysis of generative music. I have widened the scope of analysis to draw upon my analysis of modes of interactivity. I argue that there is little point in either critiquing digital art as a 'noughts and ones' version of other art forms nor should a digital artist have to see their practice in those terms. Let us revel in the variety of creative forms, the range of treatments and the wonders of happenstance made possible through digital technologies. For me this means finding great pleasure in creating beautiful art while teasing away at the contradictions imposed upon this vibrant mode of production. This is not about emulating existing artistic styles but about investigating the myriad of different forms made possible by 'the digital.'

Introduction

Of course it is possible to find antecedents. Indeed, a small industry has developed, seeking to place 'the digital' simply as an adjunct to previous modes of cultural production. This is appealing because it means that we have to do no more than extend an existing field of analysis to include the digital. This can be promoted as a cost-effective and efficient way of dealing with what is a many-headed and dynamic phenomenon. An example of this approach will be briefly explored below to exemplify the field.

During the ten years that I have been tracking these attempts at academic hegemony I have become more and more convinced that 'the digital' is qualitatively (not to say quantitatively) different from other domains. A not so hidden sub-text of a number of my previous papers has been to attempt to map out why the digital is different. I have sought to 'update' Raymond Williams' analysis of communication and control to include 'the digital' (Richards, 1998). I have examined the use of advanced 3D technologies in

teaching and learning environments (Richards, 2001). I have written on digital aesthetics going back into the production processes of digital packages (Richards, forthcoming (a)). More recently I have attempted to redefine the methods of analyses as applied to the concept of interactivity (Richards, forthcoming (b)). All these examinations can be seen as mapping exercises in the area of the digital. Indeed, they are all asserting that there is an area there to examine. And generative art has a place in that area.

In addition to these academic examinations I have engaged ‘the digital’ in general and generative art in particular as a practitioner. I have used web site architecture to examine a specific concept, namely ‘memory’. I have used Newtek’s *Lightwave* to create 3D *Moire* objects. I have created a music generator: *DiskO*. More on this below. I have printed a 1m by 2m digital print of a recursively-reproduced image. I have developed a digital art creation application: *Covertor*. And more recently I have created *Nebula*. These excursions have taken me into a variety of realms from installation, to print, to on-line, to off-line, to pre-built, user-effected and user-generated art works. Furthermore, I have sought to examine specific issues that are pertinent in the digital domain. For example, the web used for explication of a concept not just representation and commercial exploitation; the simulation of a music machine rather than the emulation of a *Technics* deck; the creation of an application that can enable users to create their own digital art whilst at the same time carrying on with their daily tasks and most recently with *Nebula*: a critique of the ‘all content now’ imperative of the web, exemplified by the ‘skip intro’ convention. However, I have not until now sought to publish my thoughts on digital art in general and generative art in particular. It is now time to attempt to offer a perspective.

Music Generation and much more

Brian Eno, in a talk delivered to the ‘Imagination Conference’ in San Francisco, on 8th June 1996, examined the components of Generative music (Eno: 1996). His analysis in fact went far beyond music to include artificial life, screensaver art, architecture and the use of metaphor in art. The theme running through his talk was that of the inputting of

simple rules/content into some form of responsive architecture enabling complex multi-layered output. What is refreshing about Eno's analysis is that he plies a path through both the technical rigours of the digital and the prescribed conventions of music, art and architecture (to name but three). He conveys an enthusiasm for the generation made possible by the digital in terms of the alternatives it can offer us as users: 'I realised that for me this was the future of computers. Computers seen not as ways of crunching huge quantities of data or storing enormous ready-made forests of material, but [that] computers are a way of growing little seeds.' (Eno: 1996) Eno identifies a shift here from computers offering pre-determined content to a user, to being able to offer facilities for generation. I had come to the same conclusion from a different direction through my analysis of the concept of interactivity. I have extended the concept of 'positioning' explored by the French sociologist Pierre Bourdieu (Bourdieu: 1993, 1998). I argue that interactivity should be assessed in terms of 'the positioning of user's in relation to the creation of content'. The implications of this approach are profound because it means that we can analyse 'the digital' through the experiences of users, not just at the level of usability but also 'producability'. In this way we can move from a functional analysis of 'task completion' to a dynamic analysis of the variety of ways that digital packages facilitate various forms of generation. I have identified three modes that build each on the next i.e.

1. Consumer Interactivity – where the user is conventionally positioned in a reception mode with regards to the creation of the content i.e. a book's contents cannot be changed by a user as a facility offered by the book (of course there are various attempts to actually offer this). However, all books, indeed all texts (following Fiske's analysis of 'inter-textuality' (Fiske, 1987) interact in our heads, enabling the generation of new ideas/emotions etc.
2. Processor Interactivity – where the user is positioned so as to be able to process the content available but not fundamentally change it. An example being the early versions of amazon.com. Filters, search engines and agents such as EPG (electronic programme guide) offer processing opportunities to the user where they can input their preferences and generate an edited selection of content.
3. Generator Interactivity – where the user is positioned as the creator of content within a system. An example being later versions of Amazon.com where the

user can contribute a variety of different forms of content into an environment.ⁱ

This analysis enables a number of fruitful investigations to take place.ⁱⁱ At a general level we can see that the forms of control that a user has over the generation of content change depending upon the facilities on offer and specifically how they are positioned by/through the environment. We do not have to get sidetracked over how many buttons can be hit or otherwise. Nor do we have to get caught up in attempting to list different forms of interactivity as new media are developed. More specifically, in the case of generative art we can examine what is being generated and to what extent that generation is in the control of the user. Eno offers examples of generative music in each of the modes i.e.

1. *It's Gonna Rain* by Steve Reich. Two audio loops of a preacher slowly going out of sync over a 17-minute period. Simply a piece of music.
2. *Stained Glass* by Gene Tantra. Screensaver art that can be processed by the user using the screensaver utilities.
3. *Unnamed Generative Musical System* by the Sseyo group. A music composing application, controlled by the user, that once started will create an infinite variety of melodies, rhythms and harmonies.

This short talk by Eno has had a lasting effect on my thinking about digital art in general and specifically generative art. However, it was not in Eno's remit to define what generative music was/is, rather to make people aware of some of its components. It is clear to me that it is time to develop a definition of digital art as a separate domain within which generative art/music resides. Why is this so important? The lack of discrete definition has encouraged the development of methods of analysis that have been simply extended out into the digital from other domains. The classic analysis of this type is Lev Manovich's *The Language of New Media*. Manovich sees Vertov's film *Man with a Movie Camera* (1928) as a database of techniques that can be used to define the digital. This might offer something at the level of an academic exercise, but this inter-linking of a movie with the dynamic of the digital is formalism taken to new depths. Yet these

attempts at reductionism are, of course, tempting. They make life easy. They place the can of wriggling worms that is the digital back in the same cupboard as everything else.

Digital Art Production

It is interesting to compare this psychological need for difference to be described in existing frameworks with A. Michael Noll's description of early experiments in digital art back in the 1960s (Noll, 1995). Noll actively sought to reproduce Mondrian-style and Bridget Riley-style digital art works. This may in part be because he was trying to justify his research to his paymasters at Bell Laboratories. Again we can see that there are a wide range of pressures to prescribe new art forms with conventional art techniques and in Noll's case he had internalised that process. However, he quickly moved on from the emulation of other art works to create a wide range of digital art. Indeed, it can be argued (as Noll does) that he created the forerunner of virtual reality as a usable device. Noll was able to move on from the encumbrances of pre-existing domains and create digital art that was unprecedented. In fact, art that was unprecedented. A good proportion of this artwork was generative in the sense that small algorithms were employed to create it. Indeed, Noll had to cross swords with the Copyright Office at the Library of Congress in the US when he tried to copyright *Gaussian Quadratic*, a computer generated print. They initially refused to register it because 'a machine had generated the work' (Noll, 1995). When Noll countered that he had written a program that generated the artwork from a mix of randomness and order, the Copyright Office again refused him. This time on the grounds that he was not the author if the art form was randomly produced! Finally Noll managed to convince the Office by assuring them that, while the program appeared to act randomly 'the algorithm generating [the numbers] was perfectly mathematical and not random at all' (Noll, 1995). Noll alleges that *Gaussian Quadratic 1962* was 'the first registered piece of copyrighted art produced with a digital computer' (Noll, 1995).

It is fascinating, 40 years on, for me to examine the trials and tribulations that Noll had gone through. In so many ways the experience of a digital artist today is qualitatively different from those early days, not least in the sense that I can go anywhere with my

digital creation soft/hardware. Yet, for example, the issue of emulation is still to the fore. I have produced digital art works that can be described as *Futurist*, *Bridget Rileyesque*, *Pointillist*, *Pop Artesque*, *Turneresque*, *Russian Constructivist* and so on. In none of these instances was I endeavouring to create artwork in that style. So do I play that game and deliberately create/promote work in pre-existing styles to appeal to these conservative tendencies? Answer: No. I can honestly say that I find an increased enthusiasm for the original works of art as I create, often through happenstance, similar pieces of work. This is particularly the case with my latest work *Nebula* detailed below. For me the apt word here is ‘treatment.’ Computers enable a myriad number of treatments to be applied both to the medium and to the message. Representation, emulation, simulation are all possible, as is *innovation*.ⁱⁱⁱ The best way into my understanding about at least the issue of emulation can be illustrated by the development of my *DiskO Music Generator* (2003) fig. 1

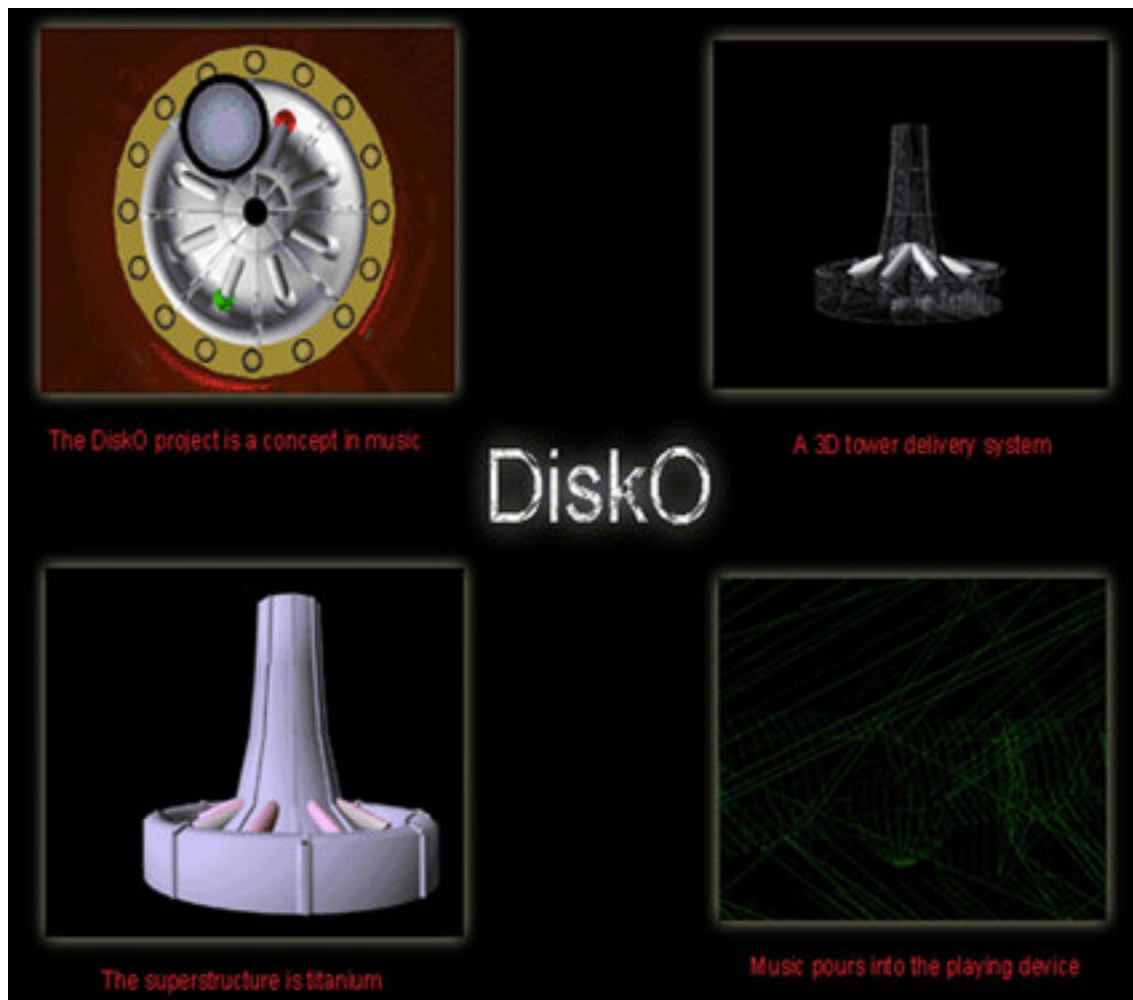


Fig.1 *DiskO Music Generator (2003)*

From mid 2002 to the early part of 2003 I had been building an emulation of a *Technics* deck (in fact three of them!) with the view to create a sample playing application that would make new music. This was designed with the three modes of interactivity in mind i.e. the initial version was automatic in its sample choice. This was quickly followed by a version that had 16 samples that the user could choose from to create a multi-track and unique ‘song’. This output could be recorded and replayed. It was also envisaged that mates could e-mail each other their creations to swap and share. In addition to this processor level version, I also created a version that could import 16 samples of the user’s own making/acquiring thus the user could create, in both senses the track both in raw materials and in final outcome. This process seemed to be going along swimmingly until I suffered a moment of crisis. I suddenly became aware of the contradiction of emulation. Namely, that no matter how much I made *DiskO* ‘the same as’ a commercial deck, it would never be as much fun to use.^{iv} More importantly, in terms of my personal development, I decided that I needed to concentrate on creating and innovating in the digital domain rather than the unsatisfying mechanics of emulation. I decided to create a music generating application based on orbs filled with liquid music. I also utilised the z-coordinate to give the impression that these orbs were flying up and at the viewer. The whole thing was rendered in a bit-mappy way that referenced video games. And further, I created a myth to go with the *DiskO* i.e. that it actually existed and was the size of a house (see *DiskO* promotional material above, fig. 1). *DiskO* was premiered in July 2003 at the summer open exhibition aptly entitled ‘Disco’ in the Anthony Minghella Theatre, Quay Arts Centre, Newport, Isle of Wight, UK. It was projected on a three metre by three-metre screen with the samples playing through the house PA. And it rocked! The exhibited version was configured to create a three-minute ‘radio-edit’ then reset. As with Noll’s experience above I could not copyright what it played because it never played the same thing twice. Indeed, I found myself coming back to the theatre again and again so that I could hear/see it performing. It seems quite natural to compare this feeling of pleasure in having created something and set it free with being a parent. Yes that is sentimental but how else to describe the feelings of displaced authorship? Apart from

being an ideological break from emulation, *DiskO* was also my homage to Brian Eno's sentiments as expressed in his talk with specific regard to generative music.

Since then I have been engaged in a number of projects that have sought to challenge other conventions/expectations regarding digital art production. The two most significant are my *Covertor* and my *Nebula*.

The *Covertor* project came from my experiences with *Macromedia Director* and specifically I became intrigued by the notion of creating an application that 'animated in the background' ^v. From this facility I developed the concept of the *Covertor*. I reasoned that I could create an application that a user would have running behind their usual work-a-day applications like *Microsoft Word* or *Lotus Notes*. As they went about their duties the *Covertor* would track the mouse position and create a digital work. In the space of three weeks I produced in 27 iterations of the *Covertor*. A still from *Covertor_19* is reproduced below: fig 2. The *Covertor* project gave me a chance to examine the relationship that users have with their screens and encourage opportunities to be more than simply procedural with their computers. The added bonus here was that as they performed functions these movements were transformed into a creative and complementary act. The *Covertor* is shortly to be premiered on Hirdazone.com an on-line research hub for digital arts (Richards, forthcoming (c)). Here the project is not about simulation, emulation or representation but, if you'll beg my pardon, 'conversion' of functional activity into creative activity. It is perhaps in the arena of arts installation that the practice of conversion has been most prevalent. However, this has often been simply at the level of a radar switch being triggered when entering the installation. I have decided to build a gallery-based version of the *Covertor* so as to examine how movements of the visitors to a gallery space



Fig 2. *Covertor_19* (2003)

can be ‘coverted’ into the digital art that they will then experience. As with previous work I have the dual aim of producing a pleasurable experience while at the same time illustrating in what ways digital art production can be qualitatively different from other art forms. Part of this process is also to build up the courage of my convictions. To this end, in concert with Graham Coulter-Smith, a Research Professor at Southampton Institute, I assert that I am engaging in *Digital Painting* as opposed to any other definition. Furthermore, this is often a generative experience with the digital paintings themselves dependent upon the users’ predilections.

Nebula

This brings us to *Nebula*. The eponymous art work that I started two weeks before receiving a listserv via Screen-L from this journal. (Takes positive synchronicity to a new

level). Whereas the works detailed above operate in the fields of music and art generation the *modus operandi* for *Nebula* was that of an investigation into AI (artificial intelligence) and complexity theory. I have been investigating information visualisation (which can have an AI component) and complexity theory as part of my PhD research at the LSE (London School of Economics). However, I had previously done very little in either area with regard to digital art production. A paper by Paul Galanter entitled *What is Generative Art? Complexity Theory as a Context for Art Theory* (Galanter, 2003) provided a starting point for reflection on generative art from a more scientific direction. Whereas Eno's description on John Conway's *Life* focused on the beauty of the resulting output from simple rules, Galanter's approach is to talk from the code up (and from art movements down)^{vi}. He writes of an optimum degree of complexity being required for a pleasing result between total order and complete randomness: 'effective complexity'. This seems plausible but then at this level of abstraction a mid-position is always to be preferred and is reminiscent of Aristotle's approach to questions of degree as stated in *The Ethics*. Of greater concern is Galanter's definition of generative art:

Generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer programme, a machine or other procedural invention, which is *set in motion with some degree of autonomy* contributing to or resulting in a *completed* work of art.
(Galanter, 2003)(Emphasis added)

The strength of this definition seems to be that it is inclusive, not just screen-based. However, the result is that prehistoric cave art that is 'systematic' and abstract falls, according to Galanter, under this definition. Yet it is unclear how such artwork can be described as 'setting in motion some degree of autonomy'. This can only be the case if, at the level of the communication of abstract ideas, painted systems on a cave are effective. But if this is the case then Galanter's stricture that any definition of 'generative art' must be 'restrictive enough that not all art is generative' (Galanter, 2003) has been under mind. From my perspective, Galanter is trying to incorporate 'intertextuality' (not by name) but limit it to only the (generative) texts he wants to include. Both a realistic and a schematic depiction of a horse will resonate with a pre-historic cave-person's experiences of real horses. Of further concern is Galanter's conviction that there should be a resulting

completed work of art. This works for Reich's *Its Gonna Rain* and Noll's *Gaussian Quadratic* but what about screensaver art or my *DiskO* or *Covertor* in what sense are those applications complete? And further, Galanter is silent on users as generators of their own artwork or seeing artists as the creators of applications that could facilitate such generation. All in all Galanter provides me with a number of null hypotheses to work with regarding generative art.

Nebula came out of an attempt to manipulate individual pixels to create digital paintings. I had been stimulated to do this from observing Lisa Jevbrett's work using individual pixels to link out to web sites (Jevbrett, L., 1999). I decided to operate at an even simpler level than Conway and just get a pixel moving across the screen by using a randomiser to move one pixel at a time up/down/left/right continuously at 999 frames a second. I then added some randomised ink effects and the resulting digital painting is shown in fig. 3.

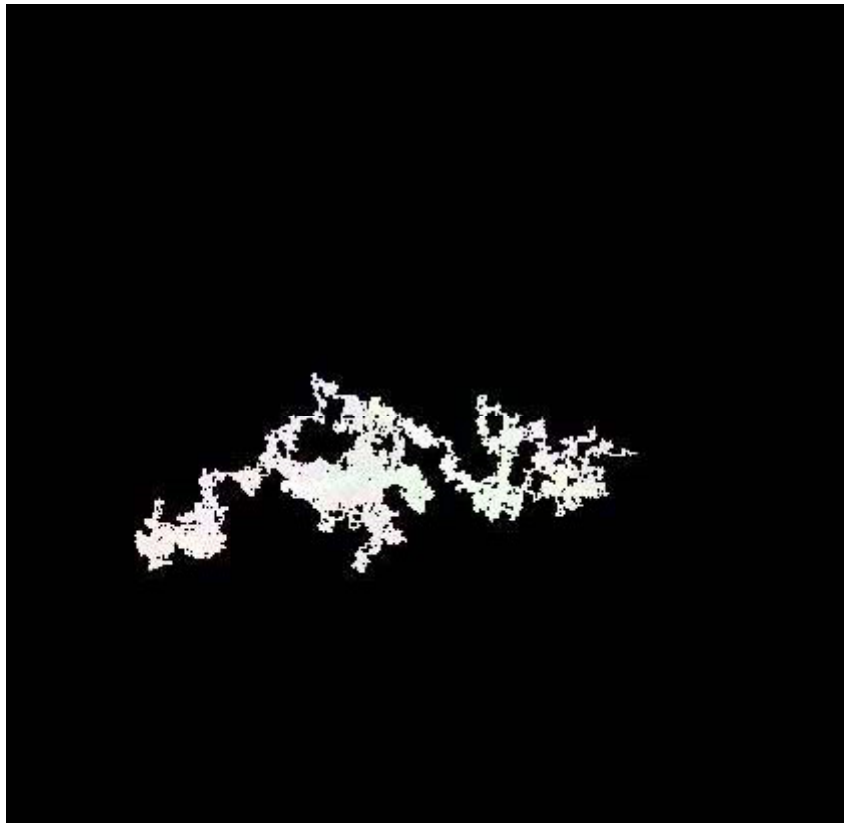


Fig. 3 *version 2*

I continued to add effects, more pixels and collision detection so that the pixels did not leave the area. Then I had my moment of intuition. I suddenly thought that I could use a low opacity level on the pixels ‘just to see what happens’. The result was a *Nebula*. Now exactly one month later there are over 50 distinct iterations of *Nebula*. In some cases, it takes over an hour for anything much to appear on the screen. In other cases large blood-red globules pulsate about. In all cases *Nebula* eloquently critiques the notion that on-the-web content must be delivered spontaneously (exemplified by ‘skip intro’). Obviously I have not had much time to examine the deeper implications of *Nebula*, but it is clear to me that it is an interesting area for further research and gives a different perspective on the notion of a digital painting: a different treatment. But note that I am living with the contradiction that I have called these objects *Nebula* but I do not see them as *emulations* of space-based nebula. Of far more interest is that so few protocols can produce such a variety of effects and such depth of field and beauty. This is a good example of complexity being the outcome of simple components as championed by Eno. These experiences have given me encouragement to look further into AI and digital art generation.



Fig 4 *Nebula_crbcw31*

Conclusion

In the three projects, *DiskO*, *Covertor* and *Nebula*, I have been able to develop digital art works that explore and critique a variety of conventions within ‘the digital’. These works challenge emulation, functionality, and content delivery but not by external referencing to films or other art forms. These investigations show that it is possible to both create and critique within the digital domain in its own terms. There is a continuing need for such investigations if the digital is to be acknowledged as a domain in its own right.

I would like to conclude this paper by quoting Michel Foucault who is here railing against formalism and arguing for a re-invigoration of art through the manipulation of the image. Here he is conceiving of a new space for production by critiquing hegemonic art forms and art criticism. This quote is a call that digital artists can respond to:

How can we recover the games of the past? How can we relearn, not just to decipher or to appropriate the images imposed on us, but to create new images of every kind? Not just other films or better photographs, not simply to rediscover the figurative in painting, but to put images into circulation, to convey them, disguise them, deform them, heat them red hot, freeze them, multiply them. To banish the boredom of Writing, to suspend the privileges of the signifier, give notice to the formalism of the non-image, to unfreeze content, and to play, scientifically and pleurably, in, with and against the powers of the image. (Foucault, 1999)

Glossary ^{vii}

Concept of Interactivity. Many scholars in a variety of domains have attempted to define interactivity. I have come to the conclusion that ‘the position of the user in relation to the creation of content’ provides a way of analysing interactivity without resorting to stimulus-response models (the activity of interactivity) or listing of features (the properties of interactivity). From this perspective, users can be positioned as consumers, processors and generators of content in, and through, interactive environments.

Concept of Positioning. Pierre Bourdieu applied the term ‘positioning’ when analysing the variety of different perspectives 18th Century French novelists were adopting in their writings. The same author could have a class-originated position, a position on a specific

issue and a disposition for further perspectives and all of which could be in tension. I have adapted ‘positioning’ to the concept of interactivity (see previous entry).

Covertor/Coversion. The concept of the *Covertor* can be summarised as a devise that transforms the user’s functional operations with and through an interface into some form of creative output. The term *coversion* can be added to emulation, simulation and representation as a possible configuration for a digital application, i.e. the user’s actions are ‘coverted’ from one frame of reference to another.

Emulation. This is the process by which a (in this case) digital application is created to perform as if it was the same as an off-screen device.

Technics Deck. The accepted system of choice for DJs. Two record decks enabling the mixing, fading and scratching of records. Used in Rap, House, Dance, Electronica and Techno music forms.

Multi-Layered Output. The outcome of mixing a variety of elements in (in this case) a digital application. These elements can be very simple in construction. It is their placement within a dynamic architecture that can create extremely complex output. *Nebula* is an example of this: individual pixels creating complex gas clouds.

Complexity Theory. The theory that starts from the premise that simple actions can, in the right architecture, develop an intricate variety of output. This can be represented by the ‘butterfly effect’: a butterfly flapping its wings on one side of the planet can be the (alleged) root cause of a hurricane on the other side of the world.

Endnotes

ⁱ The summary is explained in close detail in a forthcoming article of *New Media and Society Journal*, (Richards, forthcoming (b))

ⁱⁱ Note that it is not my intention to claim that one form of interactivity is better than another, nor that there is a continuum from one end of a spectrum to another. Rather that the forms of generation are qualitatively different.

ⁱⁱⁱ See Margot Lovejoy’s book (Lovejoy, 2004) for a detailed examination of the various modes/motivations of/for digital art production.

^{iv} I became aware of this when one of my teenage relations demoed the *DiskO*. He wanted to throw my little platter icons off the decks once he had finished with them – a quite natural requirement. However, the way the code was configured made this natural process completely impossible.

^v Upon recently rereading Eno’s talk I noticed that he had referred to being able to have a music creation application ‘making music in the background’ as you use the computer as a word processor (Eno, 1996).

vi John Conway's *Life* is built around the following rules:

1. Divide an area into squares
2. A square can be alive or dead
3. A live square with only one or zero neighbours will die
4. A square with two neighbours will live
5. A square with three neighbours will come alive if it is not already
6. A square with four neighbours will die.

(Eno, 1996)

Very simple rules but the result can be extremely subtle patterns.

vii Please note that several of the terms are highly contested and that what is being offered here is what they are intended to signify in this article.

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