Generative Creativity
Program Report

1.0 Introduction

The program I created using the SuperCollider environment, is a generative music system, which makes use of Markov models and randomness to generate sample based music. The aims of this program are:

- To generate a piece of music using randomness and Markov models which will be continuously changing throughout the performance through loudspeakers.
- For the musical output to be both strange and un nerving for the audience to listen to in comparison to the originally ambient sounds inputted into the system.
- For the piece to be different each time it is played.
- To see whether this fairly limited use of mathematical methods could create a piece, which could effectively meet these aims and to question how creative they could really allow my program to be.

In order to explain how I came to formulating these aims and to whether they were eventually met, I will begin by talking about some of the artists that provided me with inspiration and I will then go on to explain and discuss the relevant theories and techniques used in terms of my own program and in terms of their creative potential.

1.1 Brian Eno

"Since I have always preferred making plans to executing them, I have gravitated towards situations and systems that, once set into operation, could create music with little or no intervention on m part. That is to say, I tend towards the roles of planner and programmer, and then become an audience to the results." – Brian Eno

Brian Eno is a composer primarily of ambient music. My original inspiration for my generative composition was taken from his album Music for Airports, which was created as a continuously looped sound installation to try and ease the anxious atmosphere that often exists when waiting at the airport.

This was achieved by looping sounds such as simple piano loops or soft "ahh" vocal sounds and repeating them at differing times so that they fade in and out of each other creating a constantly changing and evolving texture. I found some ambient samples and experimented with this myself in SuperCollider. I found that it did sound quite soothing but it didn't personally inspire me enough to base the whole program on it. Another conflict I had with the concept (in terms of using it as a basis for my own program) was that Music for Airport's is supposed to hover at a distance, 'barely discernible yet lingering in the outreach of one's attention' (Cesare-Bartnicki, 2008). I thought about how I wanted this generated composition to be performed and I felt that it could be effective as an installation in which the audience focus was centered on listening and being immersed in the music rather than it playing more of a background role.

I decided to apply randomness to some of the musical parameters that could be used to make changes to the samples. I made a routine that randomly changed the duration, amplitude and start position of an ambient sample. I found the musical result interesting and that changing the duration in particular seemingly lowered the pitch of the sound when it randomly selected a longer duration. This gave a much less ambient/pleasant sound and feel to the music. I loaded more ambient samples into an array and then made a few more functions again changing the duration, amplitude and start position. I found this enhanced the idea of having a constantly changing and evolving texture. I then loaded in a sample of a little girl talking which comes as an example with SuperCollider. I found the result of this sound being manipulated through the program much more interesting as the voice looping combined with a range of changes each time sounded quite un nerving and frightening. This I think is down to the fact that it sounded so un-natural. I associated this strange, manipulated sample sound with Musique Concrete and from there went on to explore this style further.

1.2 Musique Concrete

Musique Concrete is music that was originally made directly on tape with real sounds (Apel W, 1972). For my system I used ambient and vocal samples, which contrasts to some Musique Concrete music such as Etude Aux Chemins De Fer, which is comprised of sound samples from steam train. In this piece sounds that are usually perceived as non-musical are turned into sounds which make up the sonic material for a composition. My system does not focus on this aspect but does however make use of taking on a non-traditional musical approach to aspects such as rhythm, timing, melody, structure etc.

In Schaeffer and Henry's Symphone Pour Un Homme Seul the rhythmic pattern of speech is a central theme and is used along with repeated loops and juxtaposed extracts with fragments of instrumental and percussive elements. Again, as with the SuperCollider example sample I felt that the use of manipulating vocals was very effective as it sounded very surreal and disjointed and gave the piece a confusing, chaotic feel.

I then went on to listen to work by Delia Derbyshire who in 1960 began work at the BBC Radiophonic workshop. It was here that she could combine her interests in the theory and perception of sound; modes and tunings, and the communication of moods using purely electronic sources [11]. I was particularly interested in a collaboration she did with Barry Bermange which consisted of 4 different compositions made up of spliced/reassembled recorded interviews with people talking about disturbing dreams containing themes such as drowning and falling.

The repetition of certain lines helped to re enforce their semantics and I found the music very un-nerving and powerful and I liked the fact it had stirred up some sort of emotion and a powerful reaction in me. I did however feel that there was a very strong focus on the semantic meaning of the words being spoken, which could (arguably) have been conjuring up these feelings more than the sound techniques would have been able to alone. This leads me on to an idea bought up in David Cope's Computational Models of Musical Creativity:

"'Music is often seen to be 'the language of emotions', which 'bypasses the intellect' and takes over, when words do not suffice any longer. Sweeping statements like these require much critical analysis, but this will be left for another occasion" (Cope, 2005).

My interpretation of what Cope is saying here is that the musicality of the piece should be able to portray and generate emotions in people stronger than words are able to. With this in mind I decided I did not want too much emphasis on the actual words, which I achieved through layering and manipulating the samples quite a lot so that the words became harder to follow. I did think it was important to chose a vocal sample that could provoke thought in the listener whether that would be to try and make out what the spliced up and manipulated words playing actually are and to incorporate some of Delia's compositional style of including semantics to enhance the music though I must insist the aim is for it to be done in a much more subtle way and for more emphasis to ride on the music created as a result of the randomness and Markov processes applied by my program.

The lyrics of the sample I used are:

"So my demons your time has come
You will find me lay here
You and I both entwined
How refined an encounter
You ignite within my mind
With one desire
When it falls into place
Rush of fear takes over
Suddenly you succumb to impatience
And Surrender
So my demons your time has come".

They are taken from a song called Deception by a metal band called TesseracT. I chose to use the vocals from this song partly due to the lyrical content as I thought it linked in with some of the

concepts of my piece (demons could relate to the cut up, un nerving music which audience members could maybe link to someone being ‘possessed’, entwined could related to the different samples panning and entwining with each other musically) the words can be interpreted by the audience in relation to the sounds being outputted which could enhance the piece overall. It brings to light the human factor of the audience and that even though the computer could be given any samples and apply the same processes it would could have different emotional effects not so much because of the computational processes but more due to the semantics of the lyrics and the feel of the outputted music.

1.3 Stochastic Music

Iannis Xenakis was accepted into the Groupe de Recherches de Musique Concrete though his main area of study was in stochastic music and the use of mathematical models in musical composition.

Iannis Xenakis began to use Markov models for the generation of musical material in 1958. In 'Analogique A”, Markov models are employed to arrange segments of differing density. Each of these segments, called “screens”, consists of sounds of different dynamics (Nierhaus, p 72).

Hiller and Issacson also used Markov models to generate musical structure as well as selecting notes over various musical aspects when generating the Illiac Suite which is generally regarded to be the first piece of music to be composed using a computer.

In my piece I use three separate first order Markov models, which choose samples from the buffer array and then change either the duration, amplitude or start position of the samples depending on probabilities based on what has been selected previously. I do not bring use them in the piece at the beginning but instead bring them in after they have been built up to by a series of routines. I found that each one created a stronger texture to the piece and gave it extra depth making it sound a lot more surreal probably due to quicker changes to the musical elements in succession.

In discussing the creative use of Markov models Roger B Dannenberg states:

“Markov models can also be used for music generation. One approach is to simply follow transitions according to their probabilities, assembling the resulting sequences of concurrencies into a new composition. The resulting composition is often strikingly good at the local level, because every transition is not only plausible but was used at least once in a master work. On the other hand, Markov models have no higher-level sense of direction or form, so the music typically meanders without any sense of purpose” (Dannenberg, 2010).

In terms of the output of my own composition I could see why he could potentially have this view as after the system has been left to generate for example for 15 minutes then there are not any radical new developments to the music and some parts may start to become repeated or similar to those heard before. However I personally didn’t see the lack of obvious direction as a negative thing and I was really intrigued to sit and listen to it for long periods of time to see how it evolved and to see which parts ended up sounded really interesting and which parts I thought sounded awful. After a while I felt that the interweaving sounds started to be come almost hypnotic and trance like I did find it exciting to listen to even for longer periods of time.

1.4 Randomness

In my program I have implemented the use of randomness through use of rrand in SuperCollider to choose the sample that is played, the duration of the sample, the amplitude, the start position and the amount of time it will wait before playing again. I have also randomly chosen the time that some of the effects will be applied.

I found that through using randomness I was able to create some interesting sounds and textures and it meant that my piece is different each time it played. The question of how creative a program can actually be through use of randomness, is discussed in The Creative Mind, Myths and Mechanisms by Margaret Boden:

“I have argued that creative thinking is made possible by constraints, which are the opposite of

randomness. Yet many people see unpredictability as the essence of creativity. How can these views be reconciled?" (Boden M, 1990).

In this chapter she talks about how random randomness actually is due to that randomness will always need some sort of constraints in order for it to be set into a particular context. She says that useful creative outcomes are often down to co incidence and serendipity both of which are unpredictable. She believes chance can only really give us creativity if it is used with judgment.

She feels that a lot of the time creativity benefits from 'mental mutations' and serendipity, coincidence and unconstrained conceptual association are useful as they give provide unexpected ideas that can be fed into the creative process (Boden M, p225).

I agree in terms of my program as I have set randomness to happen within certain parameters which I have provided, it could be argued that this is not completely random so therefore randomness is not actually very creative but I have found that it can breed creativity when used in conjunction with judgement from myself (the composer/program designer in this case) and produce interesting results.

In Gareth Loy's Musimathics he states that: "The crucial characteristics of useful random processes is that chance events must be independent of each other"[9]. I feel that my system takes this idea into account as the random processes set in the routines do happen independent of each other which helps to make it infinitely random and constitutes a 'inexhaustable source of novelty and surprise'.

2.0 Illustration

I will provide a series of screen shots along with details of the inputs and outputs of my program.

The code below demonstrates a SynthDef containing PlayBuf.ar. This is a sample playback oscillator. This will allow me to use sound samples (the inputs), which will later be manipulated using randomness and first order Markov Models. The buf rate is also randomly chosen which will change the pitch (between server's sample rate and an octave and a half down). The output will be panned in stereo and will have created a sample playback oscillator with an envelope.

```
(
SynthDef(\sampleplayer,{arg bufnum=0, dur=10, amp=0.1, pos=0.5;

    var sound, env;

    env = EnvGen.ar(Env([0,1,1,0],[0.1,0.8,0.1]*dur),doneAction:2);

    sound = PlayBuf.ar(1,bufnum,rate:Rand(0.25,1.0),startPos:pos*BufFrames.ir(bufnum),loop:1);

    //sound = LPF.ar(sound,Rand(2000,10000));

    Out.ar(0,Pan2.ar(sound*env,SinOsc.kr(Rand(0.05,0.25))));
}).add;
```

2. The code below shows the SynthDefs I created to later add effects to the program's output.

```
//A SynthDef which creates a comb delay line effect which can be later a
SynthDef(\combeffect,{
    var effect;

    effect = CombC.ar(In.ar(0,2),0.1,0.1,10);


    Out.ar(0,effect)
}).add;

//A SynthDef which creates a delay effect which can be later applied to
SynthDef(\delayeffect,{
    var effect;

    effect = DelayC.ar(In.ar(0,2),0.3,0.1,10);

    Out.ar(0,effect)
}).add;

// A SynthDef which creates a 'ping pong' delay effect which bounces sou
SynthDef(\ping, {
    var effect;

    effect = PingPong.ar(In.ar(0,2),0.5,0.4,1);

    Out.ar(0,effect)
}).add;

//A SynthDef which creates a reverb style delay effect which can be late
SynthDef(\freeverb, {
    var effect;

    effect = FreeVerb.ar(In.ar(0,2),0.5,0.6);

    Out.ar(0,effect)
}).add;
);
```

3. The code below shows the samples being located via their file path. They are then put into an array named b.

```
//load samples (using the file paths defined) into an array and read into a buffer.
b = ["sounds/atmosphere.wav","sounds/atmosphere2.wav","sounds/atmosphere3.wav","sounds/atmosphere4.wav","sounds/VoxDelay.aif","sounds/
Voxreverb.aif","sounds/verse.aif","sounds/Wishywasha.aif","sounds/demons.aif"].collect{|filename|  Buffer.read(s,filename); };

b[0]
b[1]
b[2]
b[3]
b[4]
b[5]
b[6]
b[7]
b[8]
```

4.The code below shows the variables being set to store the first order Markov Matrices. I then entered the probabilistic values into the matrices:

```
(

var markovmatrix;
//start in one of three states. Choosing which pr
var currentstate=3.rand;
var markovmatrix2;
var currentstate2=3.rand;
var markovmatrix3;
var currentstate3=3.rand;


//Defining probabilitic values in Markov models
markovmatrix= [
[0.7,0.2,0.1],
[0.0,0.5,0.5],
[0.3,0.4,0.3],
[0.2,0,5,0.3]
];


markovmatrix2= [
[0.5,0.2,0.3],
[0.0,0.5,0.5],
[0.2,0.4,0.4],
[0.1,0,4,0.5]
];


markovmatrix3= [
[0.4,0.3,0.3],
[0.2,0.4,0.4],
[0.2,0.4,0.4],
[0.1,0.7,0.3]
];
```

5. The next section makes up the compositional aspect of the piece using a set of routines. Timing is controlled using .wait. A random sample is selected from the buffer (or set in the instance of the first two routines). The duration, amplitude and start position are randomly selected from within the parameters I have set in the brackets. There are 8 routines like this in total.

```
plays through the sample 10 times (10.do).
{
    2.wait;
    10.do{

        Synth(\sampleplayer,[\bufnum, b[5], \dur,rrand(5.0,15.0), \amp, rrand(0.1,0.2), \pos, rrand(0.0,0.5)]);

    rrand(2.0,4.0).wait;
    }



}.fork;


{
    12.wait;
    10.do{

        Synth(\sampleplayer,[\bufnum, b[4], \dur,rrand(1.0,5.0), \amp, rrand(0.1,0.2), \pos, rrand(0.0,0.5)]);

    rrand(2.0,7.0).wait;
    }

}.fork;
```

6. The code below shows the routines I used to put samples into Markov Matrices, the parameters I

set (in these examples for amplitude and duration) and choosing the probabilistic state of the matrix. The matrices do not come in straight away, the first one comes in 72 seconds into the piece to add texture and variation.

```
{
    72.wait;
    10.do{
            Synth(\sampleplayer,[\dur, [4.0,5.0,7.0].at(currentstate)]);

            currentstate = [0,1,2,3].wchoose(markovmatrix[currentstate]);

        5.0.wait;
            };

}.fork;
```

7. This part of the code applies effects to all of the elements of the piece. The first effect is applied after 20 seconds whereas the \delayeffect is added randomly between 30 and 60 seconds. This helps to make the piece different each time.

```
//This applies the \myeffect comb delay effect 20 seconds into the piece.
    20.wait;
Synth.tail(s,\combeffect);

//This applies the \delay effect at a random point between 30 and 60 seconds into the piece.
    rrand(30.0,60.0).wait;
Synth.tail(s,\delayeffect);
```

3.0 System Overview

I have included a full copy of the program in Appendix 1. My system is fairly simple and it works by going through these steps:

- A SynthDef containing a PlayBuf UGen with an envelope is created to allow for the playback of samples.
- I then created some effects to be later applied to the system output using SynthDefs.
- I created an array to store the buffers and then assigned the samples to different numbers in the array so that I could index them easily if needed.
- I created variables to store the Markov Matrices and set their probabilities.
- I then created a set of routines which are structured using time through the use of .wait. The amount of times the samples are played is set along with the probabilistic parameters for duration, amplitude, start position and the amount of seconds it waits before repeating.
- I created routines to set the values for the parameters being determined by the Markov models.
- The effects are applied to the output either at times I have specified or at random times within parameters, which I have specified.
- The texture of the output will start off thinner. It will then build up and gradually decline as we are left with the routines that were given inf.do.

The program will output stereo sound so it will need to be played through L and R speakers in order to get the full effect of the panning and interweaving of sounds. Headphones could also be used and

allow for listening with closer attention to detail.

I tried to keep my code fairly simple and explicit in terms of using sensible and appropriate variable names such as var \combeffect, which creates a comb delay line effect. I made sure my samples were named clearly and relevantly so that it was easier to locate them using their file path. I have tried my best to make the code as clear and simple to understand as possible as this helped to make things logical and easier for myself when programming. I have also commented my code clearly to reinstate what it is doing. I know that my system is not very complex but I think that it still produces rich and interesting musical results despite this which helps to demonstrate the power of computational creativity and how it gives us the possibility to generate ever changing music all day long using a fairly limited amount of resources.

A system can be defined as modular if it partitions the processing of musical information into several units which have a varying degree of interaction with each other (Camilleri L, 1992). My program is made up of small independent components, which can be tested/debugged separately to the rest of the program. I have broken down the information for the musical outcome into several units as Camilleri describes. It is easy to see how the program is built up musically through use of these components.

4.0 Limitations

The first limitation I want to consider is the use of samples. Maybe it would be interesting to create a system where people could input their own samples (maybe from a database such as the Spotify data base) and then use the system to create musique concrete inspired generative compositions based on songs of their choice. It would be interesting to see if the 'creepy' and un-nerving effect would be as prominent if the audience were familiar with the input material. It would be interesting to see how it would work with samples that contained strong rhythmic elements as this may destroy most sights of any sort of ambience though it may create an even more chaotic and un-natural sounding piece of music.

In terms of the stochastic processes there are huge amounts of mathematical techniques that could be applied to the samples including linear congruential methods for generating random buffer numbers of samples or chaotic systems could be implemented, which could generate values that appear to be random. In terms of Markov models it would be possible to extend the size of the matrices to add to the texture and range of samples and probabilistic events that could happen. 2nd or 3rd order Markov Models could also be used instead.

It would be possible to venture into using models from aspects of computing such as AI (for example neural nets or genetic algorithms) to adapt and change musical parameters.

I could have also made use of groups in SuperCollider so that I could have added effects to certain routines rather than adding them globally to the output.

Overall I must admit these limitations are in occurrence due to a lack of confidence in coding ability on my part but with time and perseverance these ideas for program extension could be applied and the possibilities are vast.

5.0 Conclusions

Overall I believe that to some extent I achieved all of my original goals. I created a piece using randomness and Markov models to generate music through loudspeakers. The output definitely had a strange and un-nerving quality. The music outputted was different each time the program was run and I did question and discuss how creative randomness and Markov models could allow me to be.

One way to assess the effectiveness of the system is to talk about the reaction to the audience and whether they considered it to be a strong display of computer art.

Boden believes that the art audience approach art works with certain philosophical assumptions in mind. These Include that:

1. art must spring from human agency
2. art must be grounded in emotion

3. art must involve the communication of human experience;
4. art must be honest, and/or produced in good faith,
5. art must be unique/rare and
6. art must be transformational.

(Boden M, 2007)

I believe that my generative composition took into account all of these assumptions to a certain degree. But how effective was it? In testing the system before presenting it to a larger audience I found that the reaction was fairly positive. The friends I tested it out on all seemed to comment that it sounded 'weird' but they seemed intrigued by the outcome and the fact that it was continuously changing and transforming. When I presented it to the class it had a fairly well received reaction in terms of comments on it afterwards though there were still a fair few blank/bored expressions in the room whilst it was playing. I wonder if this is due to the fact that it was played over loudspeakers to a larger group of people that would have potentially detracted from the emotional and communicative experience that was offered through headphones to the people I tested it out on.

Overall I personally felt that my system created an interesting piece of generative art even if it did evolve from a fairly limited range of processes. If I were to do it again I would use and test out a wider range of samples to see how the emotional (un-nerving) mood changed depending on the inputs given. I would think about including and combing synthesized sounds to create further ambience and to give me a wider range of parameters to generatively control. I would also experiment with implementing other probabilistic or random mathematically based processes to see how that could shape the structure and overall outcome of the music.

6.0 Self Evaluation

Writing – 7%
I felt that I made fairly good use of clear and articulate sentences. For example:

"In Schaeffer and Henry's Symphone Pour Un Homme Seul the rhythmic pattern of speech is a central theme and is used along with repeated loops and juxtaposed extracts with fragments of instrumental and percussive elements. Again, as with the SuperCollider example sample I felt that personally I felt the use of manipulating vocals was very effective as it sounds very surreal and disjointed and gives the piece a confusing, chaotic feel."

Although the sentences are not always kept very short I feel they are well punctuated and written in a way in which they flow and do not feel lengthy. I feel that I took a clear and concise approach when writing this report. Overall my use of grammar is of high standard and I have tried to avoid writing colloquially.

I feel that I have explained my program very clearly and have done this in a well planned out logical order.

Discursive quality – 9%
I think I have put a lot of effort into discussing the different elements that have made up my composition and have aimed to inject elements of critical discussion in order to back up/challenge my work at a number of different points over the course of the essay. For example:

"'Music is often seen to be 'the language of emotions', which 'bypasses the intellect' and takes over, when words do not suffice any longer. Sweeping statements like these require much critical analysis, but this will be left for another occasion" (Cope, 2005).

At this point I have added to the arguments I am raising/discussing about semantic meaning in musical lyrics in comparison with the emotional meaning that can be created through the techniques in my program.

I have added in discussions/ideas all the up to the conclusion where I have used a set of philosophical audience criteria realised by Margaret Boden to add further discursive quality to idea of role of the audience to my generative composition.

I made sure I clearly stated my aims and motivations at the beginning of the report in which step 4.:

"4. To see whether this fairly limited use of mathematical methods could create a piece which could effectively meet these aims and to question how creative they could really allow my program to be".

Immediately opens up the key discursive themes that will be discussed at the start of the report which I then refer back to during the course of the essay, formulating questions and evolving answers.

The beauty of this topic is that there are such wide ranges of relation topics that could be discussed so I think I have been careful in selecting arguments that are relevant to my essay and help enable it to flow structurally to the next section.

Presentation – 8%
In general I felt that my report was well presented as it has been broken down into a series of sections and subsections labeled with numbers for example:

1.2 Musique Concrete
1.3 Stochastic Music
this helps it to flow structurally and makes it clearer and more accessible to the reader.

I think overall the presentation is of good quality though I could maybe have included a few pictures possibly of the Illiac Suite or images demonstrating first order Markov models to make the report more visually interesting for the reader. I have however used illustrations in the form of screen shots of my program.

I was having problems with the compatibility between the version of word on my laptop and the version on the university computers, which I needed in order to print. This did cause some problems for me in terms of formatting number lists but they have now been sorted.

I used Harvard style referencing as recommended by Sussex University guidelines and remained consistent in this (to my knowledge) throughout the report.

I encountered a problem with in text referencing as I did not know who the author of Delia Derbyshire's website was. It claimed she had contributed to it but she is no longer alive and I was unable to source the current author of the site so I just referenced using a number in brackets.

I broke the text down into manageably short paragraphs to make it clearer to read. I separated longer quotes into their own paragraph so as not to present the reader with a huge block of text.

I do understand that it is likely I have made a few errors and that the presentation may not be 100% perfect in terms of indentations for lists so that is why I have not presented myself with a higher mark.

Range of research- 9%

I did a fairly large amount of reading before starting this report and I hope that this is portrayed. I have compiled a bibliography, which I believe contains an interesting selection of sources made up from books, websites and PHD research. I do think that there could have been room for a larger bibliography with a larger range of reading but I think I was very careful with my sources and decided to choose fewer but strong/interesting/relevant that were carefully chosen and well read by me when researching before writing.

I felt that I discussed the literature I used critically although I feel maybe I did not make enough of the opposing or negative argument against certain arguments and sources. For example I could have maybe been more negatively critical about Boden's idea of 'mental mutations' in order to explore

and argue the concept further.

System Comprehensibility –7%
Overall I felt that my system did make a clear use of modularity and it is clear to see from looking at it how the different modular elements work with each other to generate a piece of music. My program is however fairly simple and does not make use of classes so this use of modularity is not very complex. I have recognised the importance of modularity within my essay and believe it has lead me to be able to de bug and fix the program easily if it ever broke. I have commented my code quite thoroughly so that it is easy for a new user to interpret. I do think I have maybe over commented the code and a lot of the functionalities are made clear through use of transparency and simple self explanatory variable names. I have given myself 7% as although I have used modularity my program is not very complex.

System quality and sophistication – 6%
Overall I think my system functions well and it meets its program aims. My system may lose marks as it is not as complex as some examples that I have seen in comparison to other people on my course. I was personally happy with what it achieved as I am still not extremely confident as a programmer and I thought it produced some interesting results but I feel that are a lot of ways it could be further enhanced and develops which I discussed in the limitations section of the report.

Quality of output – 8%
I personally really enjoyed listening to the output of my composition and was always interested to listen to it and see how different it was each time and how it changed and evolved as it played. I did however feel quite nervous about showing it to others as I did not know if they would appreciate it as music due to the fact it is quite abstract in comparison to popular music and I was worried they would just think it sounded plain awful. Overall, even though it is not the sort of music most people would listen to on their headphones walking around for example I think it did stir up interest in the audience by the way it did sound strange and different so in that sense at least it was able to captivate the audience enough for them to listen to, analyse and hopefully be stimulated in someway emotionally by the musical output even if the feelings were of discontent or confusion.
I felt that although mine was a simple program it did still produce an emotionally stimulating output which was strange and exciting to listen to.

Course awareness - 8%
Although I did not explicitly refer to any lecture slides I felt that I was inspired greatly by material taught and discussed in lectures when creating my system. In this report I have talked about aspects in computer art such as whether certain mathematical/computational methods can be considered creative and have discussed my own process of creating a piece of computer generated art through out. I have taken inspiraton from lectures about stochastic music and pioneers such as Xenakis and Hillier and Issacson. Creating an music system can relate back to proving Ada Lovelace's early predicition that computers would be used to create music which was discussed in class along with this quote from Ada from the computer art lecture:

Computers and art:
"Ada Lovelace (1851): "Supposing, forinstance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the [analytical\ engine might compose and elaborate scientific pieces of music of any degree of complexity or extenet" quoted Roads.

Markov models and Boden's theories of creativity, which make up important elements of this report were all taught and discussed in class.

I feel that I could have maybe referenced more to discussions that we had in class as part of my report but in terms of making use of course material and questioning whether computer code can be

used in a generatively creative way which is a strong concept integral to this course, I feel that I have made positive use of course awareness.

Bibliography

[1] Apel, W, (1972) Harvard Dictionary of Music, Harvard University, USA, p. 561.
[2] Boden, M, (2007) Digital Creativity Authenticity and Computer Art [online] Available at <http://dx.doi.org/10.1080/14626260701252285>
[3] Boden M,(1990) The Creative Mind, Myths and Mechanisms, George Weidenfeld and Nicolson LTD, London, p. 217.
[4] Camilleri, Lelio, (1992) Computational Theories of Music: Theoretical and Applicative Issues, Academic Press LTD, London, p. 177.
[5] Cesare-Bartnicki, Nikki, T, (2008) The aestheticization of reality: Postmodern music, art, and performance , Ph.D. UMI. p. 299.
[6] Cope, D, (2005) Computer Models of Musical Creativity, MIT Press, USA, p. 11.
[7] Dannenberg, Roger, (2010) “Style in Music” in: The Structure of Style: Algorithmic approaches to Understanding Manner and Meaning, Springer-Verlag, Berlin, p. 54.
[8] Eno, B, (1975) Discrete Music (p1), [CD liner notes], London, EG Records Ltd, p.1.
[9] Loy, G, (2006) Musimathics, MIT Press, USA, p. 299.
[10] Nierhaus, Gerhard, (2009) Algorithmic Composition: Paradigms of Automated Music Generation, Springer-Verlag/Wien, Morlenbach Germany, p. 72.
[11] N/A. 2008, Delia Derbyshire Electronic Music Pioneer [online] Available at: <http://www.delia-derbyshire.org/> [Accessed 13 March 2012].