How should we consider artistic creativity, in relation to recent debates about computer based generative art and music?

Chapter 1- Introduction

> To some extent this match is a defense of the whole human race. Computers play such a huge role in society. They are everywhere. But there is a frontier that they must not cross. They must not cross into the area of human creativity. It would threaten the existence of human control in such areas as art, literature, and music.[1]
> [Karaspov before the 1991 chess tournament against the "Deep Blue" computer]

The power and influence that the modern computer has upon our everyday lives is unprecedented. Maybe it is because we feel that this power is developing faster and spreading wider than we could have ever imagined, that the human race is beginning to fear its new invention as much as it reveres it. In 1991, the world was witness to Kaparospov's untimely defeat against the “Deep Blue” computer, an event that signified just how far the modern computers processing abilities had come. If the computer can surpass us at mathematics and logic in a game of chess, surely we are right in thinking that we can still hold our own in the creative arts?. Throughout the course of the essay I would like to explore the impact of the emerging creative autonomy of the computer in the arts [and most explicitly music] and how this has influenced our long held views concerning human creativity.

Definition of creativity

Boden in "The Creative Mind" describes creativity as the ability to come up with ideas or artifacts that are "new, surprising and valuable"[2], the genesis of these ideas being either "p" [personally] creative or "h" [historically] creative[3]. Boden claims "p" creative ideas to be original within the context of an artists former schema’s or body of work, and "h" creative ideas to be original within the context of the wider art world, or world at large[4]. Throughout the essay I wish to ask whether Is it possible for a computer to be either "p" or "h" creative. Does such a creative program exist? is the program only displaying the illusion of being creative?

Generative programs such as David Cope’s EMI, and Harold Cohen’ s AARON claim to imitate human expression through the use of learning and rule based algorithms. Can the breadth of creative thought really be contained in such algorithms, and is art this shallow and transparent?. To what extent has art followed rules throughout the course of history? And what can the modern algorithm tell us about our cherished canon of timeless art?

Scope of study

Throughout the course of this essay I hope to answer these questions by exploring the works of Cope and Cohen who have used generative techniques to explore how humans create. Through analyzing the work of Cope I shall explore how artists have used rule based generative techniques to extract the fundamentals of creative style, and through analyzing the work of Cohen will consider how generative techniques have been used to explore notions of human cognition. The Study shall conclude by bringing human and machine closer together, looking at how artists such as Eno have used generative techniques to evolve ideas, and considering the use of generative collaborative techniques in the world of jazz improvisation, focusing in particular on the work of George E Lewis.

What is generative art?

Galanter describes generative art, as art making based on systems. The systems used can be ordered or disorded, simple or complex. He defines generative art as follows:

> "generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art...The key element in generative art is then the system to which the artist cedes partial or total subsequent

control"[5]

generative art- "as old as art itself"

As Galanter points out generative art may or may not be "high-tech" but must be well defined and self-contained enough to operate autonomously[6]. Taking this definition to its logical conclusion- he later claims generative art to be as "old as art itself"[7]. Galanter describes below the oldest known art work in existence to be based on generative principles. He explains:

> "In 1999 and 2000 a team led by archaeologist Christopher Henshilwood of the South African Museum in Cape Town uncovered the oldest known art artifacts. Etched in hand sized pieces of red ochre more than 70,000 years old is an unmistakable grid design made of triangular tiles "[8]

Galanter continues:

> "While the etchings, like all ancient archaeological finds, are not without controversy, many find them compelling examples of abstract geometric thinking with an artistic response. In a related article in Science anthropologist Stanley Ambrose of the University of Illinois, Urbana-Champaign says: “this is clearly an intentionally incised abstract geometric design…It is art”[9]

On human creativity

"[creativity is] that state of nascent existence in the twilight of imagination and just on the vestibule of consciousness. The imagination...the true inward creativity, instantly out of the chaos of elements or shattered fragments of memory, puts together some form to fit it" [10] [Colleridge on Creativity]

Before we can claim a computer to be creative, we must first understand what it is to be creative ourselves. David Cope rightly points out in "Virtual Music", that creativity cannot exist in a void. He goes on to outline an interesting model which describes the creative process to be born out of everyday experience. Such experience he claims to be re-enacted subconsciously into raw material, which is then evaluated consciously through human judgment and instinct.[11]

Understanding human motivation

If human creativity by its very nature can seen to be founded in everyday experience, then how can a computer even begin to simulate such a complex and ineffable process. Computers as of yet, do not have bodies, do not feel pain or emotions- so how can such entities even begin to be creative?

The limitations of computer creativity

Below is an excerpt from an early 1980's computer generated Agatha Christie Novel. Grammar aside, the extract below perfectly illustrates the monotony that can occur in computer art as result of not understanding the complexity of human motivation:

> "The Day was Monday. The Pleasant weather was sunny. Lady Burley was in a park. James ran into Lady Buxley. James talked with Lady Buxley. Lady Buxley flirted with James . James invited Lady Buxley. James liked Lady Buxley. Lady Buxley liked James. Lady Buxley was with James in a hotel . Lady Buxley was near James. James Caressed Lady Buxley with passion. James was Lady Buxley's lover. Marion following them saw the affair. Marion was jealous."[12]

Analyzing the paragraph above one could conclude that for a piece of work to be creatively valued, it must at the very least sustain our interest. Commonly ideas appeal to our creative interest through reference to our everyday emotional landscape and deep rooted experience . Although more modern literary programs such as “Minstrel” [a program devised in1999- that writes short stories in a classic fantasy style] have produced coherent stories which explore story lines based on abstract human motivations, it is still fair to say that the computer has barely scratched the surface of real life complex human behavior. A behavior that we ourselves cannot always claim to fully understand.

Empty program debate

If we can see the groundwork of human creativity to be founded in human experience, then it seems only logical to claim conscious thought to be the basis of much of our aesthetic judgment. Many still believe that is impossible for a computer to be creative- as it is not conscious, but to what extent can computers be said to be already concious?

The AI community seems split on this matter. Whereas some critics in the AI field such as Kurzweil have claimed the computer to be already conciouss [working on the premise that "consciousness is just a machine reflecting back on itself"[13]], others have sided with the more common consensus referred to as the Empty Program debate. The "Empty program" argument pioneered by philosopher Serge's states that the computer see all operations as "pure syntax rather than semantics"[14] -that all the symbols dealt with by a computer are utterly meaningless to the computer itself[15]. Hence the computer only gives "appearance" of conscious thought, this appearance only being illusory due to it's lack of contextual understanding of the real world.

Empty program debate: drawing conclusions

Both of these arguments have a certain currency, yet sadly we are in no position to prove or disprove the theories in hand due to our relative lack of understanding of our own concioussness, yet alone a computers. As Boden notes:

"we hardly know how to speak about it, still less how to explain it. when we say with such experience that we have consciousness, we do not know what it is that we are saying. in these circumstances we are in no position to prove that no computer could conceivably be consciousness."[16]

She concludes:

"the question must remain open, not just because we do not know the answer, but because we do not clearly understand how to ask the question"[17]

A multi-layered question

The consciousness question is also not as simple as it initially appears. When one is to ask if a computer can be conciouss, one must in turn also ask- how and in what way could a computer theoretically be conciouss. Cope in "Virtual Music" proposes creativity to be a fundamentally pro-active activity. If we side with Cope's claim that true creative consciousness concerns “questioning assumptions”, then one can only really claim a computer to be consciously creative when we see plausible evidence of the computer violating its own rules, and re-writing itself in it’s own image[18]. An everyday event in the world of science fiction, but an event yet to noticeably occur in reality.

Computer originality

At this point I feel it necessary to pose a few examples in favor of the possibility of true computer creativity in order to present a balanced argument. Although computers have struggled with the constraints of creative adaptive reasoning, there is still evidence to suggest that computers do have the potential to be essentially innovative i.e. they can produce original and interesting ideas. Where-as human creativity is constrained by our real world perception, computer creativity is empowered by its very lack of it. If human creativity can be said to be heavily influenced by the fundamentals of contextual visual representation, computers lack this connectionist cognitive grammar, and often conceptualize problems in the abstract. It is the power of abstraction in which computers excel.

One such program that has excelled in abstractive creativity is Eurisko. In 1991 Eurisko famously designed a 3-d computer chip which enabled one and the same unit to carry out two different logical functions simultaneously[19]. Working on the heuristic that "if you have a valuable structure, try to make it more symmetric", the computer produced an original and sleek design that wowed and amazed the human programmers at the time[20]. As Boden notes: "Human designers favor symmetry too! but they had not thought of doing this, nor of the possibility that a single unit could perform 2 functions"[21].

EURISKO also won an official creativity competition in which all the other contestants were human, two times in a row. The contest was a war game , in which one has to design a battle-fleet within certain cost limits, and then test it [in a simulation] against the fleets of the other players. Speaking of the original competition programmer Lenat noted:

“This win is made more significant by the fact that no one connected with the program had ever played this game before the tournament, or seen it played, and there were no practice rounds”[22]

Principa Mathmatica

Another example of automotive computer based creativity was pioneered by the 1955 research group Newell and Simon/JC Shaw. This group famously developed a program that proved theorems from AN Whitehead and Betrand Russell's "Principa Mathmatica" in 1910. By 1955 the groups innovative thinking machine had not only developed proofs for theorems in the "principa", but in a demonstration of innovation and creativity it developed an original shorter and more elegant proof for theorem 2.85[23]

Summary

It should be remembered that, computer creativity is still in its early stages. Although its claims to fame [via the Principa and Eurisko] have not been exactly poetic, both the Eurisko program and the thinking machine solutions both seem to display a common elegance of style, an inhuman sleekness which should be treasured in itself. Suffice to say, from this evidence one would be foolish to expect the next artistic second coming. So perhaps for now, it would be safer to side with the cynical words of Boden, and proclaim that "to await a computer Shakespeare is to wait for godot"[24]

Chapter 2- Computer generated music and academia

Computer composition and the modern algorithm

Since the late 70's academia and research teams alike have used the computer to explore the musical composition process using complex generative algorithms based on the concepts of AI.

Within the scope of this chapter I would like to use the models of recent research and academia to discuss the three main types of algorithmic composition: rule based algorithms, learning algorithms and genetic algorithms. All algorithms discussed are raised on a training set of melodies [whether this be a simple folk melodies or a fragment from a Bach piece] this raw material can be treated by the computer in a variety of different ways.

Rule based composition

Rule based algorithms perform their behavior in accordance to predefined rules specified by the programmer. Rule based compositions are rarely genre breaking and are unlikely to produce surprising results[25]. Mozart's Dice Music could be considered as an early version of an rule based algorithm, bus as Todd notes: "One could hardly be shocked by the results of Mozart's "Dice Music"

Learning based composition

Learning based Algorithms are algorithms that can be adapted by a human user. Learning based algorithms work to the simple formula: generate test, repeat. The results are generated, tested to some criteria and the ones preferred are kept for later use, the favored compositions are then used to create new compositions through methods such as pattern selection. This loop continues for generations until the things we are making are good enough according to the criteria being used.[26] Thus the big advantage of learning composition system over a rule based one is that, as the saying goes users "don't have to know much about music, they only have to know what they like."[27] One such example of a learning based algorithmic system is Mozer's 1994 CONCERT program, Mozer like many other composers using this method of composition found the results to be distinctly unsatisfying, commenting that his self made program produced "compositions that only there mother could love".[28]

Human vs. computer judgment

Essentially the problem encapsulated in the judgment of algorithms is one of agenda on the part of both the computer and the human. Whereas a human can be too sloppy and forgiving, a rule base critic can be to rigid and strict29. Leading to situations of conceptual conflict in given examples, i.e. "a rule based critic may rave about technically correct but trite melody, whereas a human being may pan the same example for being to bland and nondescript".30 Vice-versa a computer may: "pan the inspired but "slightly off" passage created by just flipping 2 notes, whereas the human critic may value this very example for precisely it's oddity".[31]

AI researchers have suspected that the reasoning underlying this aesthetic disagreement concerns the fundamentals of how humans and computers experience music. Whereas humans hear a history of sounds humans sensitive to variety and novelty, computers hear examples in comparative isolation[32]. Biles and Colleagues claim that humans value rare fragments over common repeated fragments, and declare this factor to be confusing for computers- as computers cannot cope so easily with such frequency dependent preferences.[33]

The key to instinctual human composition is to know when to break the rules, a context specific brittle judgment system at the moment lies beyond a computers rule based comprehension[34]. This fundamental aesthetic mismatch has caused many developers much frustration, in 1994 the author of GenJam "gave up" claiming: "the populations [of measures] that so Clearly evolve for the better under the guidance of a human mentor are so much statistical mush to a neural network"[35]

Genetic algorithm composition and co-evolution

Many genetic algorithms have solved the aesthetic mismatch of computer and human judgment through maintaining algorithmic balance and adding diversity to the gene pool through mutation[36]. This process is referred to as co-evolution.

Genetic Algorithms are models of composition loosely based around evolutionary structures and ideals. Like learning based Algorithms ideas are generated tested and repeated, genetic algorithms however are based on the principles of natural selection, in which algorithms literally compete among each other for their survival and to find a mate. Algorithms mutate, share their gene pools and adapt in order to increase there chances of survival[37]. The test criteria can be judged by humans or rule based critics.

Methods of co-evolution

Horner, Assard and Packard put the ideals of co-evolution into practice in 1994 producing reportedly excellent results. The system works on the idea of a male varying his song to attract a "picky" females attention[38]. The female judges the song and chooses whether to mate or abstain- if the melody is successful it will carry on to the next generation. The premise of the system being that females will be attracted to males with different qualities[39].The team employed three different methods for scoring the male songs using tables. Using percentage table variance technique based on ideas concerning local expectance, global expectance and local and global surprise[40].

Tested by human composition

To conclude, co-evolution does seem to nicely balance the subjectivity of computer and human based judgment in the progression of algorithmic complexity. But what about the human element? although the algorithms themselves do exist nicely in there own right, what about human interaction? does the use of algorithmic/generative techniques in art composition actually help us in the present or the future? do algorithms and generative techniques actually help human composers get somewhere interesting?[41].

I would now like to discuss this notion further through discussing a number of human composers who have used algorithmic/generative techniques in order to progress the way we as humans think about the arts and creativity in general. I shall start by discussing experiments in rule based and learning algorithms. In particular I shall discuss the work of Cope and Cohen, 2 artists that have used computer algorithms to explore how humans create. I wish to look at how Cope in his work has used generative techniques to extract the individuality of personal style, and how Cohen has used generative techniques to explore the nature of cognition respectively.

I would then like to conclude by bringing man and computer closer together, through exploring notions of computer/man partnership, examining how artists such as Eno, and Jazz improvisor George E Lewis have aimed to interact with the computer [using evolutionary algorithms and other methods], through bouncing ideas of the computer and communicating with the entity in real time.

Chapter 3: Cope and Cohen- Examining the human creative process

Cope and the aesthetics of recombination

What is it that makes a piece of music recognizably someone's style? Is it the emotional intensity of the work or something far more formulaic- such as process. These are some of the questions that are naturally provoked when listening to a piece by Cope's generative music software EMI, a software program that aims to produce pieces in the style of famous composers such as Mozart, or C.P.E Bach. How does it work? EMI is fed a series of pieces, it evaluates its given traits [repeated patterns and stylistic mannerisms etc.] it then chops up the elements and re-arranges them according to a given set of rules. Cope calls this process: "Recombinancy". Aswell as composing small-scale mazurkas, and 2 part inventions- it can also compose larger scale works such as Sonatas, Concertos and Symphonies.[42] Cope aims not to directly copy a given composer work [i.e. he does not want to reproduce whole melodic lines], his agenda is rather to copy a composers given traits and creative mannerisms[43]. An obvious analogy would be Cope dividing a composition into a series of finely chopped grains which he then realizes into a fully fledged stylistic composition[44].

Cope is so convinced by the realistic stylistic imitation of his works that he has often challenged audiences to distinguish between his generative stylistic composition, and the works of the real masters. He has called this challenge simply "the game". Please consult the CD cover for details and draw your own conclusions!

Cope's method

Cope's method of style imitation is reliant on extracting repeated patterns [what Cope calls signatures] in a given body of work[45]. The program also looks for treatments, if a composer has repeated a motif a number of times, the program takes this into account- and examines how the composer altered the motif on successive iteration [i.e. did the composer invert the phrase, take the phrase up an octave etc.]. These features are given as indicative of a composers style[46].

Cope has achieved this unique stylistic synthesis through various methods. one method being SPEAC analysis [Statement, Preparation, Extension, Antecedent, Consequent analysis], an analytical tool that correctly identifies and imitates a realistic hierarchical tension and resolution status within given pieces[47]. SPEAC analysis is a particularly useful tool for judging dissonance and tension within a piece aswell as for expressing abstract emotions such as anger and surprise.[48]

Another important component in Cope's program is the use of earmarks. Earmarks can be thought as protocols in the program to tell the program about the global context of a piece of music, a useful tool to foreshadow important event. An earmark can also tell the program where an event should occur begin or end, this is particularly useful for achieving thematic separation and avoiding abrupt changes in the music.[49]

EMI limitations

Despite being an immensely powerful too, EMI does have it limitations. In many cases Cope's recombinancy process can be said to compromise the integrity of the original pieces. Pieces entered into EMI must have a common key[50], in some cases this means Cope must compromise the tonality of a given piece to suit his agenda, altering a piece's given tonality can lead to complications of range and fingering when re-assembled.

Expressiveness has also been a problem for EMI, all pieces produced on the program are free of trills, embellishments and dynamics, and to date Cope has often used human subject to perform the programs output rather than the computer itself. Examples of EMI’s mechanical delivery can be found on the accompyaning CD.

Cohen: Rule based art

Cohen like Cope is another artist fascinated by the potential of rule based generative systems to model the human creative process . Whereas Cope's work is focused on notions of style, Cohen in his work is interested in modeling human cognition and perception and considering how humans visualize problems [and form].

Since his debut 1973 paper “Parallel to perception” Cohen has single mindedly pursued an investigation into the nature of art itself, asking whether it could be possible for a computer to be creative? and whether it would be possible to simulate its own artistic process[51]. To aid his work Cohen invented an mechanical artist entitled Aaron- who embodied the rules of drawing.

Cohen before developing Aaron was a formal painter preoccupied with exploring the psychology of art, and how we cognitively respond to open and closed curves, to symmetry and shading . In his early work he systemically explored the conceptual space generated in our minds by the interaction of line, form and color. A similar pro-occupation can be seen in his work with AARON[52] Discussing his work Cohen says:

> "I was fascinated by the power of the machine to double as a decision making device. Then it eventually dawned on me that maybe I could use the machine in relation to my work, actually to face some of the problems I'd sort of put on one side because I couldn't think of any way of handling them. When I got involved with the computer my work was passing through a rather formalist set of preoccupation’s...like "How do you distribute colors on a flat surface?" What's a reasonable algorithm for something like that"[53]

The progression of Aaron throughout the years has been unprecedented. Whereas Aaron's early work has quite a

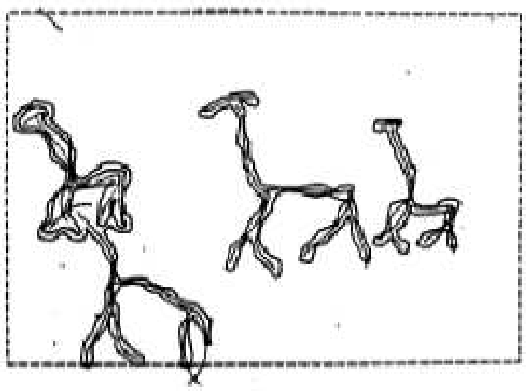

Figure 5a: AARON, animal drawing

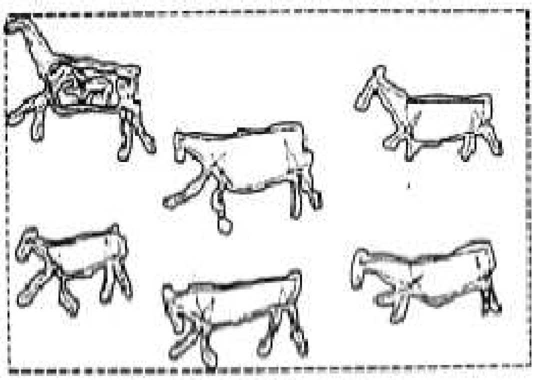

Figure 5b: AARON, animal drawing

From the *Bathers* series of hand-colored, computer-generated drawings by Harold Cohen. (Photo by George Johnson)

primitive abstract feel, Aaron's newer material is comparatively more representational and formal- due to the increasingly complexity of Cohen's re-modeling and re-coding . Below are some examples of Aaron's early work and some recent examples of AARONS representational agenda.

Cohen below discusses the complex programming of Aaron:

> "The program was able to differentiate, for example, between figure and ground, and insideness and outsideness, and to function in terms of similarity, division and repetition. Without any object-specific knowledge of the external world, AARON constituted a severely limited model of human cognition, yet the few primitives it embodied proved to be remarkably powerful in generating highly evocative images: images, that is, that suggested, without describing, an external world [Cohen, 1979]."[54]

One of the limitations of Cohen's program is its lack of adaptive creativity. Unlike a human it does not test limits of creativity, As Boden notes: "it explores but does not tweak and transform. Aaron is like a human artist who has found its style and is sticking it"[55]

Cohen concludes:

> "I don't regard AARON as being creative; and I won't, until I see the program doing things it couldn't have done as a direct result of what I had put into it. That isn't currently possible, and I am unable to offer myself any assurances that it will be possible in the future. On the other hand I don't think I've said anything to indicate definitively that it isn't possible. Many of the things we see computer programs doing today would have been regarded as impossible a couple of decades ago; AARON is surely one of them."[56]

Chapter 4: Evolution and collaboration

Eno and the music of systems

Whereas artists such as Cohen and Cope have used generative process to analyze the nature of human creativity, many artists such as Eno have explored generative techniques in a more collaborative sense, using the computer to co-evolve works of art. We can see examples of such evolutionary systems in the work of Brian Eno, in his 1994 release "Generative Music" .Eno uses the generative music program "Koan Pro" to produce gently evolving ambient textures.

Systems and Koan

Talking of the progression of systems in his work Eno states:

> "One of my long-term interests has been the invention of machines and systems that could produce musical and visual experiences… the point of them was to make music with materials and processes I specified but in combinations and interactions that I did not. My first released piece of this kind was "discreet music" [1975] in which two simple melodic cycles of different duration’s separately repeat and are allowed to overlay each other arbitrarily.."[57]

He continues:

> "however what I always wanted to do was sell the system itself, so that a listener would know that the music was always unique. Since this would involve persuading my listeners to buy 4, or 5 CD players instead of just one, and then buy the set of four or 5 CD’s to play on them, I didn't spend to much time on the project."[58]

It was not until Eno discovered the program "Koan" that his ideas where fully realized.

Eno: generative music

Eno when promoting his album "Generative Music", claimed the emergence of self generating systems to signal the “end of an era of reproduction”[80]. In his lectures he discussed "imagining a time in the future when kids say to there grandparents. So you mean you actually listened to the same thing over and over again?"[59]

Eno Continues:

> "what I sell is not a recording of the piece but a system that generates the piece. And of course, the system generates he piece endlessly and differently all the time, Since the rules aren't deterministic it means that every version is going to be different...we’ve had a hundred years of reproduced music: the record. And before that, ten thousand years of music which wasn't produced, where every performance was unique. This sort of completes the loop...What I'm interested in is the computer as a generator, not as a reproducer."[60]

Eno's "Generative Music" in a sense can be interpreted as a simple act of redefinition. Moving away from composition as a fixed and static process, and instead proposing a place where compositional seeds [interacting sets of rules and parameters] provided by the composer can be grown.[61]

Koan and the principles of evolutionary Software

As Eno explains:

> ”Koan works by addressing the soundcard in he computer.. enabling a composer to control about 150 parameters that specify things like sound-timbre and envelope , scale, harmony, rhythm, tempo, vibrato, pitch range, etc. Most of Koan's instructions are probabilistic. So rather than saying do precisely this [which is what a musical sequencer does] they say choose what to do from within this range of possibilities..”[62]

On the artistic credibility of the work, he claims:

> "Some of the works I’ve made in "Koan" sound to me as good as anything I’ve done before. That’s important: they work as music and are not - as so much computer based music has been- just a neat idea."[63]

George E Lewis and computer jazz improvisation

Away from the world of musical composition, many improvisors have used generative techniques as an aid to improvisation. Interacting with the computer in real-time to create new and interesting compositional forms that reach beyond the human, and fuse creative sensibilities with the computer. Perhaps the most famous experimenter in the field could be said to be George E Lewis. Lewis began improvising with a virtual performer in the forth programming language in the late seventies, he has continued a similar agenda ever since.

He explains:

> “Coming from a tradition [African-American] that emphasizes collective improvised expression in music,
>
> this way of doing music with computers seemed quite natural. The computer was regarded as "just another musician in the band". Hours were spent in the tweaking stage, listening to and adjusting the real-time output of the computer, searching for a range of behavior that was compatible with human musicians. By compatible, I mean that music transmits information about its source. An improviser [anyone, really] takes the presence or absence of certain sonic activities as a guide to what is going on" [64] [Lewis 1994]

Lewis's strategy allows for a great deal of independence between a computer and a performer, establishing musical personalities that do not directly control each other, but rather have mutual influence that contributes to the final outcome of an improvisation. His goal is to make the computers playing listenable as music on its own by viewing its behavior as separate from and independent of the performer.
He explains:

> "For me this independence is necessary in order to give the improvising musician something to think about. Later, when I speak of musical interaction with some of the later models of this computer program , I mean that the interaction takes place in the manner of 2 improvisers that have their own personalities. The program's extraction of important features from my activity is not reintroduced directly, but used to condition and guide a separate process of real-time algorithmic composition. The performer interacts with the audible results of this process, just as the program interacts with the audible results of what I am thinking about musically; neither party to the communication has final; authority to force a certain outcome-no one is in charge. I communicate with such programs only by means of my own musical behavior." [65]

Summary

Throughout the course of the chapter we have explored how artists have used generative techniques to create exciting probing and useful work. Work that has not only probed into the fundamentals of how humans create, process, and produce, yet has gone one step further and has initiated itself deep within the human creative process- to reform how we think. In the work of Eno we have seen humans use computers as creative aids, and in the work of Lewis humans have as gone as far as to embrace computers as creative partners. In the concluding chapter of my study I would like to explore what issues this raises and how we should consider such partnerships within the context of future contemporary practice.

Chapter 5: Conclusion

The human need for an author

When human audiences view computer generated art we encounter an undeniable prejudice. Humans could quite easily appreciate an Aaron painting, or a Cope score that is until they found it was made by a computer- and then there fundamental conception about the piece radically alters. As if a computer piece of art is a second class piece of art compared to human art- due to the computer's supposed inability to feel emotions. Bathes in his essay “Death of the author” discusses claims the human need for emotion in art stemming from the human need for an author, a concept that he claims to detract from the true meaning of the art itself[66].

The aesthetics of science vs. art

The Semantics of humanities prejudice against computer generative art seems to lie at the heart of art itself. Boden in “the creative mind” discusses popular conceptions of science, and how science is commonly perceived to “drive out wonder”, “wonder” being a concept she believes to be “intimately connected with creativity”[67].

As Boden notes: “Science in a sense can be seen as opposed to the romance of superstition…When our wonder is based on ignorance error or illusion, it must fade in the light of understanding".[68] We value art and science under the pretense of progress . But whereas science has grounded itself in the concrete, art has always been somewhat more intangible. As Boden notes history's dominant viewpoint of the arts has for sometime been confused and entangled with what she describes as "romantic" and "inspirational ideals", the idea that art [human kinds saving grace] cannot be "sullied by the reductionist tentacles of scientific explanation"[69] The creation of art and particularly music has often been a process shrouded in mystery and superstition. The computer to many represents the world of science, the world of hard facts and icy universalisms- people do not want to equate computers with notions of art, for what it would entail. That man's penchant for creative thought, is not as special as was once thought.

Criticizing the emotional spectrum of Generative music

The problem with judging emotion in art is that it is so subjective. As Cope notes, the emotions in a given piece are dependent on so much superfluous noise on the part of the listener/viewer. In the case of music, emotional response can become blurred dependent on: the cultural background of the listener, previous music experience, quality of performance, mood of listeners, health of listeners, and any number of other factors[70]. Another point to consider is that in many cases music can carry an emotional weight simply due to being at the right place at the right time. There are countless songs that capture an emotion of a time or event- yet in essence are no better or worse than any other of that given context[71]. Take for instance anthems, anthems in essence are often quite dreary- yet the weight of there context gives them a status beyond the actual merit of the composition[72]. To shroud art in the mysteries of emotion is illusory and leads us back to the dark ages, the point is as Cope notes "we have only scratched the surface of what we can begin to understand"[73]

Relating to computers

It is hard too say how computers will develop in the future and whether a computer really will develop the ability to truly act creativity. What we can say is that to this day computers are excelling us in many area especially in terms of it's memory capacity. As Kurzweill notes "Computer can remember billions or even trillions of facts perfectly, while we are hard pressed to remember a handful of phone numbers"[74].

In the future [as Kurzweill speculates] maybe humans will be eliminated from the creative process altogether, maybe computers will be the new artists developing their own reputations[75]. Or maybe the gap between computer thought and human thought will simply widen. Edward Fredkin professor at MIT suggested that we might not be able to relate to machine intelligence in the future:

> "Say there are 2 artificial intelligence's...When these machines want to talk to each other...they can have very wide-band communication. You might recognize them as Sam and George, and you'll walk up and knock on Sam and say, 'Hi Sam what are you talking about" What Sam will undoubtedly answer is "things in general" because there'll be no way for him to tell you... I suspect there will be very little communication between machines and humans, because unless the machines condescend to talk to us about something that interests us, we'll have no communication. "[76]

As Holtzman rightly asks:

"Will humans appreciate further digital languages…or will only computers be capable of interpreting the structures of the enormous complexity that they will create?"[77]

Conclusion

In the infamous 1991 chess tournament we saw the defeat of Karaspov against the deep blue computer. For now though as we have discussed, computer creativity seems to be of little threat to humanity. After all, generative art is nothing new- the use of autonomous systems in art is as Galanter notes "as old as art itself"[78] As computers become increasingly powerful and influential in daily life, it seems more sensible to learn from them rather than appose them. To date: our generative systems have been somewhat unimaginative, on the whole mere simulators of our own worlds and our own reality. There exists in the computer whole other worlds of analysis, humanities recent discovery of the fracal represents one such world of analysis [Inconceivable prior to the computer][79]. It is only natural for humanity to be cautious in a time of such radical change, but if our ultimate goal is towards progression then one must approach the future with an open mind.

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