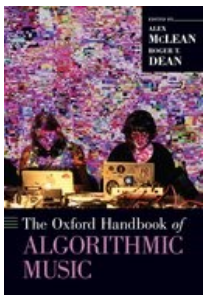

The Oxford Handbook of Algorithmic Music

Roger T. Dean (ed.), Alex McLean (ed.)

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CHAPTER

26 Form, Chaos, and the Nuance of Beauty

Mileece I'Anson

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Abstract

In general, musical forms iterate from axioms of pitches and intervals organized by a set of principles, yet when describing music as 'desirable' or 'effective', we are pointing not to its form, but to our experience of it. In successful music, the composer moves the listener through a series of emotive states in some sense predetermined by the composer, but that are not reducible to the patterns and principles. The argument in this chapter concerns what makes some music capable of eliciting 'exaltation' rather than a routine response. Designing chaos into the musical patterns themselves is proposed as one such route. The author uses the evolution of the stochastic processes underlying her 'aesthetic sonification' of natural systems and the vocal variabilities of Emma Kirkby and Amy Winehouse to elucidate her thoughts on how chaos can interact with musical forms. Growth in natural systems, while still engaging with 'choreographed chaos' has particularly motivated the author.

Keywords: chaos, growth, natural systems, sonification

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IN general, musical forms iterate from axioms of pitches and intervals organized by a set of principles. By these defining characteristics, we may think it possible to lay operations upon variables and produce successful musical oeuvres. Indeed, from the ancient Greeks through to modern times, formulaic and even algorithmic compositional systems have been successful in creating 'desirable' music.

It is reasonable then to infer that the same can be achieved via algorithms programmed in a computer. Yet when describing music as 'desirable' or 'effective', we point not to its form, but to our experience of it; in successful music, composers move their listener through a series of emotive states. It is given that these states are predetermined by the composer, who employs formula to aid in their manifestation. However, if we then deduce that music should require little other than the arrangement of numbers within procedural structures, we equally suggest that we are merely beings of order and predictability, automata of sorts. This is arguably contrary to perhaps the most significant reward music provides: a key to engaging the elusive nucleus of our psyche.

Music, like almost nothing else, overrides our most stagnant emotions, reorients our mental states, and even propels us into spontaneous, physical movement. While this effect also tempts appropriation into sonic propaganda, such as in didactic marches or corporate retail environments, music primarily exists as the gateway to beyond the barriers of our patterned systems of perception, the usher of the nebulous manifests of poetry to the depths of our being.

p. 500 I propose that this juncture between inciting a routine response versus intangible exaltation is a matter of dipping pattern and form into the infinite pool of the nonrepeating, uncontrollable, unmeasurable source, chaos. That it is through flirting with the untouchable that a functional yet forgettable song can transcend to the status of masterful oeuvre. More specifically to this query regarding algorithms, it is a matter of weaving chaos into the patterns themselves, and thereby creating true beauty through math.

It is perhaps reasonable to surmise and restrict this this proposition as being a question of nuance. This is to say that in all instances (composition, performance, timbre, sound design, etc.) fine variances are where a dance with form and chaos manifests itself. Nowhere is this quite so starkly in evidence than in music generated by machines; it can be manifestly cold if left to iterate solely as strict formula. Yet quite paradoxically, by examining algorithmic computer music architecture, we arrive at a unique ability to peer into the workings of where formula entwines with fuzzy particularities.

As with the excitement of the use of algorithms in the 'Turing Machine', stochastic processes offer an otherwise impossible exploration into the iteration of music purely through numbers and logic. Although compositionally this is perhaps not such a wide departure from nondeterministic or aleatoric processes already employed at least from the common-practice period, computing power applied to sound design can offer a probe from mathematics into the heart of what tips structured rota into a more organic beauty.

It is no surprise that forms of algorithmic processes where self-referential decisions interplay with dynamic variables, especially those based on mimicking natural patterns, can be categorized as low-level artificial intelligence. As a defining element of nuance in nature, we point to how 'outside' forces become distorting influences on the replication or iteration of otherwise stagnant patterns and constricted formulae; to where the sheer density of variables can equate to a dose of chaos, resulting in recognisable yet unique forms. Within algorithmic processes, we can declare such functions and operations as partially nondeterministic navigational or even divinatory tools (depending on how you wish to perceive them), allowing for structures to generate autonomously much in the same way as a plant or any other living entity would. It can be a question of finely parameterising chaos[1] to introduce varying digressions and extraneous elements so as to start with a set of principles and 'organically grow'. These are the logical foundations that generate form with such nuance, whereby a certain glimmer of life, even in the inorganic, emerges.

Notwithstanding a vast array of other relevant subjects in general, there are several angles of consideration to investigate where and how nuance permits a departure from formula in algorithmic music and sound design, but it serves to limit them to a few particular manifestations I have implemented in my own work within SuperCollider, providing a properly assessed commentary to remain within the boundaries of this contribution.

The first series of algorithmic pieces I wrote were essentially deterministic processes containing stochastic elements. They were based on the premise of programming computer music that did not seek to mimic
p. 501 other acoustically or electronically created ↳ sounds or methods. Notably it was an exercise in restricting the number of harmonics on tones which otherwise unavoidably manifest in the acoustic domain through the resonation of physical objects as well as the timbral colorations from room or environment dynamics. In this respect, it was an experiment in *removing* nuance, which in itself brings up an interesting point regarding the so far discussed element of chaos in the formation of beauty; the purity of the sine wave, and our natural affinity towards it, proposes that there are exceptions where the opposite may also hold true.

Consider the voice of Emma Kirkby versus that of Amy Winehouse. Kirkby's restrains itself from distorting harmonic variance, emanating a sort of clarity of tone we often ascribe to angels, whereas Winehouse's 'overtoned' raspiness (noise) elicits intrigue and something unpredictable, even naughty. Both can be equally as pleasurable to listen to whilst constituting opposite ends of the question of chaos's role in nuance. The former 'angelic' voice offers solace and comfort by 'reining in' the indeterminate universe, whilst the latter becons it.

Similarly to Kirkby's voice, a sine wave with limited harmonics creates an honest and undemanding sound. In my earlier works, this allowed for the more basic forms of nuance to be the source of musical depth. The envelope, amplitude, and decay of the fundamental and harmonics were partly modulated through algorithmically parameterized randomisers. This created simple but engaging flows where interplay with functions based on natural patterns (divisions of frequencies) modulated by an additional set of chance operators, formed the cadence of gently nuanced sine tones.

In one piece called *Formations*, such patterns iterated as sections cycled upon themselves with precise division, which with the above characteristics created a self-generating stochastic music within a linear composition. It was originally designed for a diffusion system as four stereo pairs with each cycled section delegated to a combination of the pairs with the individual channel distribution relying on nondeterministic operators.

For me, the exciting possibility of such a music is the referential sonification of some of the core mechanisms behind formulaic growth in natural systems and the subsequent creation of a recognisable 'piece' of music, where random or chaotically driven nuance in timbre and cadence coalesce to form a sort of fluttering livingness. Moreover, these factors dictate that each iteration exist only once; whereby enforced by its own nature it remains eternally unique like an individual tree or snowflake.

Some curious side notes of the project were the unintended manifestations of working with such constrained timbral properties, such as acoustically generated sum and difference tones, binaural beat frequencies, and, more relevant to this angle of consideration, the wide amplitude dynamics which led much of the piece to be relatively quiet and thus subject to digital encoding distortion. This sort of uniform, even harmonic distortion carries an unappealing quality to it, whereas with analogue signal generators and processors, the stochastic interplay of 'rogue' electrons draws us in though their 'warm' feeling, odd harmonics. In this instance, the question arises as to whether the structure of this form of chaos sways towards odd numerical ratios to determine if we feel it a 'beneficial' nuance.

p. 502 Subsequent to working with music generated by stochastic process embedded within a deterministic format, I inverted the procedure by using biological and sensor-derived data as controllers in formulating what can be defined as a continuous stochastic process. Here a live stream of variable data, such as from bioelectrical signal generated by a living plant, directly animates a series of set parameters. Only a few deterministic processes employ algorithmic functions; mostly it's a free-form program, allowing direct modulation of elements within maximum and minimum thresholds, set by the limitations of what is reasonable in terms of synthesis and the computational capacity of the computer. This creates a music where the timbres and cadence are collectively generated in reciprocation with an organic input.

Compositionally, both mechanisms and angles of approach form compositional templates which have a discernible motif, or recognizable formula, based on overarching musical principles, but whose more captivating qualities are derived through the gentle engagement with the nuance of chaos. Composing using algorithmic operators with carefully choreographed 'chaos' is essentially the practice of weaving structure with the stochastic to transcend formula and manifest what feels almost a living sort of beauty that nuance of this sort can infuse.

Note

1. Of course pertaining to algorithmic computer music we are not usually referencing pure chaos, but rather functions that generate relative randomness; true randomness by definition cannot iterate from a function and therefore within a computer program. They are, however, more than adequate to offer strikingly similar renditions of natural modulations.