
Pre-composition and Algorithmic Composition: Reflections on Disappearing Lines in the Sand

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When invited to write about my pre-compositional practice and in attempting to reflect upon that, a couple of significant points struck me; what exactly *is* pre-compositional practice, and do I engage in this activity at all? My compositional practice is largely algorithmic in nature, and it is in its output equally as often electronic as it is instrumental. I am sure that this has an impact on any kind of pre-compositional practice in which I engage, which must be related to the final compositional practice anyway. Therefore, from my perspective, I do not engage in much pre-compositional practice—I am not much of a pre-composer. Nevertheless, as what is meant by the term ‘pre-compositional practice’ and where the boundaries are demarcated must relate to the practice of composing a piece of music, I will discuss this topic in general, with however much pre-composition as I can muster.

The invitation did prompt me to think about other composers and how they work, particularly with respect to whatever *pre*-composition they may undertake. By pre-composition, I imagine activity to construct musical material that can be used later in a composition, and considerations of material or musical elements and worlds that are outside of the composition proper, or outside of the composition’s timing considerations. For example, constructing a scale for a piece or developing a tuning system may be pre-compositional work. Perhaps this activity may have been a particular speciality of the serialists because part of the concept of serial composition involves the pre-composition of the rules and rows along with their inversions, retrogrades and so on, before composition with these materials takes place. I cannot recall composers earlier than the serialists engaging in an activity to build compositional material, that is, in a process which is devoid of the composition proper (note that I do not include sketches in this; as sketches build material within the compositional process, I regard that as composing). Although many earlier composers certainly use pre-determined structures such

as numerology or geometry as a means of structuring their music, I see this as firmly in the realm of the main composition process as they are structuring their composition and thinking compositionally. Alternatively, pre-composition may be something that became part of the array of potential techniques for composers with the great expansion of aesthetic possibilities that accompanied the twentieth century. The discussion of developing tuning systems brings immediately to mind some notable non-serialist composers, such as Harry Partch and Clarence Barlow, who developed tuning systems and the music to use these systems, and who thus may have engaged in pre-composition, although it depends on how the term is defined, and these composers may not agree.

In discussing the notion of pre-composition with composers Richard Barrett and Gerard Pape, I was heartened that both of their responses to the question were very similar to my own: 'Pre-composition? I never do it, for me it's all composition.' For Richard Barrett, that is because he considers all stages of creating a work as part of a seamless composition process.¹ Gerard Pape develops the concept in some depth: while he constructs a detailed formal plan for a composition before writing the score, the organisation of time structures, micro to macro, is always a consideration for him when developing the formal structures, and even when composing what Xenakis called 'out-of-time' structures. 'It is impossible to avoid time considerations for very long,' says Gerard Pape, who offered the following example, 'Timbral change has no meaning at all unless it refers to a change of spectrum "in time." There is an aspect of timbre which is in time and there is an aspect which "is" time. Just changing the duration of a sound changes its timbre.'² Pape further stated that there is little to compose without the consideration of time, and thus composition is all a seamless activity.

So, does pre-composition exist at all for algorithmic composers? If so, where exactly does the pre-composition process or activity end, and where does composition begin? Where and how is that boundary demarcated? I imagine that individual composers would answer this question in ways that reflected their own practice, and in terms of their own interpretation of the activity. There are some examples of other prominent and extraordinary algorithmic composers who appear to have had at least *some* pre-compositional practice, such as Gottfried Michael Koenig, discussed below. If I engage in this activity at all, possibly it would be during the phase of investigating the acoustics and limits of the instruments with which I am working.

Xenakis, as an algorithmic composer, used shapes and densities controlled by probabilities, controlling contour abstractions in a general way with statistical methods and explored these to create a relevance for stochastic principles in composition. Xenakis probably engaged in pre-composition only in his use of sieves.³ The sieve theory as developed and used by Xenakis is an application of the filtration process of set-theory, where compositional materials (durations, rhythms, textures, densities, pitches, timbres and so on) are restricted to members of deliberately chosen sets that feature cyclical internal characteristics. The logical set operations of union, intersection and complementation are applied to individual cycles of musical attributes, which are characterised by their interval size and transposition level, such that a collection results which may be so great and complex that it completely masks the cyclical nature of the

¹ Personal communications with the author, July and August 2003.

² Personal communication with the author, 16 July 2003.

³ Iannis Xenakis, 'Sieves,' *Perspectives of New Music* 28.1 (1990): 58–78.

original collections. Thus, Xenakis's sieves are purpose-constructed collections of elements that have the characteristics of intertwined chains of events, which may have no obvious repetition. This allows for internal structures within the resultant music that may lead to a degree of coherence by the use of such a technique. Working in such a manner, developing material for a composition through the use and application of sieves, implies a degree of pre-planning and probably pre-composition before the act of composition proper is undertaken. Xenakis described this as working 'outside-of-time.'⁴ However, other composers may see such activity differently, as while such an activity may indeed take place with little regard to the time element of a composition, it is easy to imagine a case where a composer may undertake such a task and regard it as so fundamental to the structure of a piece that it is held to be part of the composition process.

Gottfried Michael Koenig is a highly renowned composer of electronic and instrumental pieces who worked at the West Deutsche Rundfunk (West German Radio) studio from 1954 to 1964, creating compositions and assisting others such as Stockhausen, Ligeti, Br  n, and so on. Koenig collaborated with Stockhausen for eight years, and assisted with the composition of such works as *Gesang der J  nglinge* and *Kontakte*. During his time in the WDR studios, Koenig composed a number of important and elaborately constructed works, including *Essay*. Koenig was appointed artistic director of the newly established Sonology Institute in Utrecht (the Netherlands) in 1964, and both he and the Institute established a worldwide reputation in electronic music and algorithmic composition techniques. Koenig, working from his background as a serial composer, decided to create computer and algorithmic systems that generalised his own compositional practice by creating relatively simple, generalised, abstractions from his compositional 'rules.' Koenig planned his compositions by creating strategies and the computer programs to realise those strategies. After reading and studying Koenig's various papers and works, it seemed to me that the activity of pre-composition in Koenig's practice appeared to be the programming of the software (*Project 1*, known as *PR1*, and *Project 2*, known as *PR2*) to assist in the realisation of his compositional practice and ideas.⁵ Somewhat to my surprise, Koenig himself does not see it this way: to him the act of writing software to assist the composition process is still part of composition practice, as he says that he has general ideas about a composition in mind at the time of writing the software. Koenig also said recently, 'I realised later that writing *PR1* was actually making a composition; a composition—not a piece. Or better: being busy in the realm of compositional practice.'⁶ Koenig has stated in earlier writings that the act of composition terminates in a piece of music, and that it is the application of a grammar that generates the structure of a piece.⁷ The development of systems that provide abstractions of compositional practice, planning of compositions and the selection of rules and data, I thought possibly pointed to the act of pre-composition. However, when I asked, Koenig sees it as part of the main compositional practice because during this activity he is acting and thinking as a composer. In further discussions, Koenig's attitude is

⁴ Iannis Xenakis, 'La voie de la recherche et de la question,' *Preuves* 177 (November 1965): 34.

⁵ Gottfried M. Koenig, 'Project 1,' *Electronic Music Reports* 2 (1970): 32–44; 'Project 2: A Programme for Musical Composition,' *Electronic Music Reports* 3 (1970): 4–161.

⁶ Personal communication with the author, 23 July 2003.

⁷ Gottfried M. Koenig, 'Composition Processes,' lecture delivered at the UNESCO Workshop on Computer Music, Århus, Denmark, June 1978.

that the 'whole act of imagining music involves many structural relationships that are "out-of-time"—in addition to others, of course, which are "in-time." Both streams of thought are so closely intertwined that I am not able to distinguish them.'⁸

Trevor Wishart is a composer of mostly electronic works and he sometimes uses algorithmic techniques. One of Wishart's main focuses is his development of theories and practice of composing with sound itself, as contrasted to composing with 'notes,' and one of the characteristics of this is that sound is an infinite set. Wishart uses a generative system of small variations of sounds generating a tree-like structure of sounds with nodes and branches of variation. This is done to find sounds that are perceptually related. Sounds are selected from this set to use in the composition or to develop further in a similar manner. The selection is made on the intrinsic aesthetic qualities of the sounds or their audible relationship to other sounds.⁹ This generation of material is not arbitrary. While it may seem that this activity is out-of-time of the composition process proper, which some might think of as the assembling of the sounds, Wishart does include this sound generation activity into the act of composing the work and does not think of it as pre-composition as he acknowledges that the two streams of activity overlap considerably.¹⁰

As a composer who uses algorithmic techniques, I have found, like others, new musical horizons and aesthetic worlds by means of the exploration of music through algorithmic abstractions. Creating some kind of computer process or algorithm, which is an abstraction of my compositional and musical ideas, makes me examine those ideas more closely and become more aware of my compositional schemes. The work with computers in this way has caused me to have compositional ideas that I would not otherwise have had. Thus, I find that my compositional practice has most in common with the likes of Koenig and Xenakis (*et al.*). However, while I may have something in common with such composers, I also find that I have some differences, and the grey and ill-defined area of pre-composition is one of these. Also, I compose with sound itself, not notes. To me, sound is an extension of the physical world; it is corporeal and visceral. This is perhaps somewhat more akin to Xenakis's and Wishart's compositional approach than to Koenig's.

I can largely imagine a piece before I write it—perhaps that is the pre-compositional stage for me. Because of this, whenever I start working with the tools and algorithms to create the piece (be that a notated part for traditional instruments or recording, synthesising and transforming sounds for an electronic part), I am dealing with elements of the composition, and thus it is part of the composition process proper. My music is definitely constructed, and in that sense it can be called 'modernist,' or perhaps preferably 'new modernist,' as I construct an intellectual layer in my works very precisely. It is certainly not *post* anything, as I adopt the attitude of musical progress and development as the only viable route to a music that is appropriately expressive to our current and future times—there is no turning back. I see my challenge as a composer to realise musically, as nearly as possible, the audible fantasy in my imagination.

⁸ Personal communication with the author, 24 July 2003.

⁹ See Trevor Wishart, *Audible Design: A Plain and Easy Introduction to Practical Sound Composition* (York: Orpheus the Pantomime, 1994).

¹⁰ See Trevor Wishart, *On Sonic Art* (Amsterdam: Harwood Academic, 1996).

A factor related to my lack of pre-compositional practice may be that many of the tools used for algorithmic composition are largely interactive. Even 'old tools' may be practically interactive, due largely to the speed of modern personal computers, which can take previously tedious and time-consuming tasks and make them extremely quick, thus making the turnaround time for testing or tuning an idea very small and effectively interactive. The interactive nature of these tools means that there is less need for pre-compositional planning to achieve the required results from the tools.

Some examples of my own composition may make the foregoing clearer. The *Continuity* series of pieces is concerned with the concepts of continuity, and with the fragmentation of musical elements and dimensions.¹¹ *Continuity 2*, for bass recorder quartet and electronics, achieves this specifically for the block flute and electronics in the musical domains of timbre, time, articulation, microform and macroform. The overarching gesture is one of fragmentation, which slowly transforms to continuity and then becomes excited and fragments again, implying a cyclic activity.

The piece begins with a brief introduction to this idea, with a continuous single tone which is a recording of a middle-G played on an F-bass block flute transposed electronically four octaves higher. After this longish (30 second) sound, it returns, but this time it transforms gradually into the sound of tearing corrugated cardboard through a spectral mutation process—continuity to fragmentation in the timbral and spectral domains. The recorders enter with percussive sounds and an extremely fragmented breathing and fingering technique that results in extremely disjointed and fragmented recorder sounds. This technique is borrowed somewhat from Berio and his work *Gesti* of 1966. The part is notated (for four F-bass block flutes) such that the fingering and breathing are separated and disconnected, thus creating aggregates of fractured sounds (see Figure 1).

This is slowly transformed, through overlapping sections between the parts, with progressively more continuous material. While this occurs, the electronic part is moving from layers of electronically synthesised splintered sounds, made with dynamic-stochastic synthesis, which also transform from fragmented to continuous. This electronic activity occurs both in concert and in opposition to the instrumental part in a complex counterpoint until the two main streams of activity settle into a mostly continuous phase. The recorders slowly, through microtonal gestures and circular breathing, reach several seconds of a perfectly harmonious middle-G on the bass recorders. The electronic part, however, never comes completely to rest, and still occasionally bursts into activity. This excites the recorders again and they start to deviate with smooth glissando gestures, slowly gaining momentum, speed and range of gestures until they fly apart again in a frenzy of fragmented sounds and activity. The ultimate expression of this on the recorders is through flutter-tongue multiphonics.

Of course, I have been incredibly lucky to have such talented and wonderful performers who are interested in performing this music. The instrumentation for *Continuity 2* was set and inflexible, and that limitation (and opportunity) had an influence on the concept of the piece. Mostly, such restrictions are beneficial, as they give the composer some boundaries within which to work. The concept of 'continuous' with sustaining instruments is easy to

¹¹ The pieces in the series are: *Continuity 1* for electronics (1999); *Continuity 2* for recorder quartet and electronics (1999); and *Continuity 3* for percussion and electronics (2002).

Figure 1. Extract from the score of *Continuity 2*, showing the breathing and embouchure directions on the top part of each system, and fingering requirements in the bottom part. Numbers in squares indicate dynamics.

The figure displays four systems of musical notation for a recorder. Each system includes a top staff with musical notation and a bottom staff with a line graph. Above the top staff, there are symbols for breathing and embouchure directions: a 'T' for breath and a 'K' for embouchure. Below the top staff, there are numbers in squares (3, 5, 4, 6, 2) indicating dynamics. The line graphs in the bottom staves show the relationship between these dynamics and the musical notes.

imagine, and the concept of 'fragmentation' would seem to be limited only by technique and imagination. If there had been a pre-compositional phase in this work, it was when I examined the recorders and the potential sounds available from them. I worked with Ina Wieczorek, an extraordinary recorder player, to discuss the timbres available and the limits of technique on recorder (circular breathing, smooth glissando, microtones, and so on). At that stage, I did not have the most concrete concept of the piece clearly in mind, and part of that concept came from the outcomes of such sessions. Therefore, in a sense, I can see that some of the acoustic investigation of the instrument could be described as pre-compositional.

Continuity 3 explores comparable musical territory but in a different manner. The piece, specified to be for percussion and computer, needed different solutions to those appropriate for *Continuity 2*, as the concept of 'continuous' with percussion has two poles. At one extreme,

there are long, sustaining or ringing sounds, potentially unending with bowing. Fragmentation with percussion is easily imagined, but if something is struck evenly and repeatedly in rapid enough succession, it is perceived as continuous. So the continuous sounds are both singular sustained sounds and fast, short, repeated sounds, with discontinuous sounds somewhere in between. The work uses real-time signal processing on the computer to achieve the electronic part, as this makes synchronisation between the instrumental and electronic parts relatively automatic. The instrumentation chosen was a Chinese cymbal, a metal plate and a tam-tam. The Chinese cymbal has very discontinuous and non-harmonically related overtones. The metal plate was approximately 400mm in diameter and 5mm thick. It was a platter from the hard disk of the first computer of the Sonology Institute in Holland. This plate is made from duralium and has a very pure sound. The tam-tam was chosen to balance the higher frequencies of the other instruments with some lower fundamentals, and because it has a broad range of timbres and overtones, depending on how it is played. When these instruments are struck, the timbre produced depends on the distance from the centre to where the beater or stick hits, what they are struck with, and how the beater or stick is wielded. This was all carefully notated to precisely determine the sound and harmonics produced. The variety of overtones and timbres produced by these instruments is used in the electronic processing part of the piece, where they can be 'frozen' and delayed in time, shifted and spread or compressed in frequency, non-linearly manipulated and so on. To map the activity of the piece I constructed graphs of various attributes against time, such as continuity and fragmentation in general, the same for timbre, rhythm, frequency spectrum and the electronics. The section lengths were determined algorithmically by using controlled randomness, the Fibonacci series, the golden section and the like. However, I do intervene in this process and make changes during the process of composing based on the way I want it to *sound*; for me the algorithm or system is only there to help serve the composer—it is not sacrosanct. The elements overlap and interplay in a kind of counterpoint, for example, where rhythms might be more continuous but timbres or spectral elements are more fragmented and so on. These elements eventually coalesce into a section of mostly stable activity and continuity before the energy in the piece excites fracturing activity again.

In *Continuity 3* I also engaged in a phase of acoustical investigation of the potential instruments and the techniques of the percussionist (in this case, Timothy Philips). However, as the concept for the piece was already fixed in my mind I do not consider this activity as pre-compositional. If there is an element of pre-composition in this piece it is that I used a tool, Paul Berg's *Algorithmic Composition Toolbox* (hereafter *Toolbox*), to create a palette of rhythmic patterns for use in notating the piece. After the map of activity had been created, I entered equations in *Toolbox* to generate rhythms from continuous to fragmented (as previously described for percussion), and generated many bars of rhythms along this continuum. I then used these as a catalogue of rhythms to be used when I was notating the instrumental part from the map of activity. The electronic part was constructed interactively by building and tuning the signal processing algorithms, using samples of the sounds, until the desired results were achieved. The use of *Toolbox* to create the palette of rhythms occurred with total regard for the pace and timing of the piece, but it was somehow still out-of-time, so it could be regarded as pre-composition, even though it occurred well after the piece had been conceived—it was used to generate the details. However, I also used *Toolbox* to generate information determining

the section lengths, and I do not consider this pre-composition as it was integral to both the compositional concept and process. It was also very much 'in time' activity as it was important for the timing of the piece.

Figure 2. Extract from *Continuity* 3. The three top lines are for cymbal, plate and tam-tam. Below this is a direction indicating where to play on each instrument, the bottom being the edge of the instrument. Numbers in triangles indicate a change in the computer processing.



In the piece *Piano Piano* (2003) I took a different approach. The piece is not primarily about continuity and fragmentation, although these concepts play a part. *Piano Piano* is for concert grand piano and electronics. It is concerned both with displaying elements of the piano that are normally the province of the performer (those elements hidden from the audience), and with overcoming various limitations of the piano, such as glissando and microtones. Because I take the approach of composing with sound itself and the resonances of the strings, the piece requires the use of a concert grand piano, and will not work on upright, electronic, or smaller models. The piece is divided into sections, each of which explores various aspects. The opposed dualism of chaos and order might be one way of examining most of the sections. The sections are not pre-defined lengths, but come from the natural flow of the processes involved, and the performer is given quite some latitude in the performance timing (but not with the dynamics). The first section, for example, starts with block clusters played *p* to *ppppp* moving up the keyboard. The harmonics of these clusters are picked out by the computer program and played back with progressively less order, but the range of the harmonics and the highest frequencies stay about the same so there is a degree of frequency compression. The performance dynamics and range of notes determine the harmonics produced as lower notes produce more overtones than upper notes, and the harder a note is struck the more harmonics are produced. The notes are performed with precisely specified dynamics on the piano, amplified and processed by the computer, thus fusing the electronic part to the acoustic part.

Before composing this piece I thought I should review the twentieth-century piano repertoire; piano music has such a rich history that anything I write will necessarily invite comparison. To facilitate this I read the books and scores, and listened to as much twentieth-century piano music as possible. To complete my research, I also re-read the history of the piano and I read books about the acoustics of the piano, eventually sitting at a concert grand and playing notes at various dynamics to listen carefully to the sounds produced. It was only then that I started to conceive of the work. I decided that I should forget everything that I had listened to or read, to pretend I had never heard any music at all, and approach this piece as if I were writing the first piece of music ever and thus could be original. I thought that this would give me the best chance of writing a successful piece. All of the research component

could be considered part of the composition process proper, but some people would consider it pre-composition. I know that Koenig, at least, and likely others of the composers mentioned earlier, would consider this to be part of the composition process, as would, say, checking the possible fingerings on an instrument before writing something for that instrument. As the research was used to inform the compositional process, I lean towards the view that this is part of the compositional process, rather than pre-composition, but there are arguments both ways, and I can understand that others might describe such research as pre-compositional. To me, the difference is how the composer feels that such activity informs the composition process that makes it part of that process, or somehow separated, and thus a precursor to that process.

Part of the question posed to me about pre-composition was 'Is it audible?' My answer to this is, unequivocally, yes! However much of my practice may be considered pre-composition, there is no question that activity at the earliest stages of the composition process is clearly audible in the piece that results. Decisions and selections made at the outset will be manifest in both the sounds and the form of the composition. One reason for this is the way conceptual or formal parameters are mapped to musical elements. In algorithmic composition, there is always a time when whatever parameters one has been working with as abstractions for the form and concept of the piece must be connected to sonic parameters and sounds in some way. This connecting of conceptual elements to actual musical or sonic elements is what I term 'mapping.' While this may have been a relatively simple one-to-one linear mapping in times past, there is a wider range of possibilities now. Composers such as Barrett, Pape and Dench are now more likely to use much more complex mappings in order to more clearly delineate or express a musical concept, such as those which occur at the outset of a composition. I will adjust the mapping of conceptual and formal elements to musical elements if I believe that the concept is not clearly enough expressed. Such adjustments might be altering the scale of the mapping or using a non-linear process such as exponential or logarithmic mapping, such that the concepts and features in the input data (shapes, relationships, densities and so on) are audible in the sounds as output. Thus significant concepts in the piece, even those from the earliest phases of the work, will be audible at the end product.

Pre-composition may not be a significant feature of the practice of algorithmic composers or of electroacoustic music composers. Some of the reasons for this lack of significance may be related to those that I have outlined above for my own practice. However, there are other reasons that may help to explain the diminished role of pre-composition in electronic music. For electronic music of all sorts, the act of composing sounds is not significantly different from the act of composing a piece of music, so for composers of electroacoustic music there is often little pre-composition practice. Composing the sounds may be considered as working in the microform. In addition, some of the discussion surrounding pre-composition discourse could be due to confusion between music theory and composition practice and perhaps also because there is no clear delineation when the pre-composition phase ends and composition itself begins. Musical theory is, by and large, not useful for, or part of, modern composition practice. The kinds of activity are quite opposed, musical theory being largely a reductive activity and composition practice being largely an expansive activity. Attempts to use music theory as a basis for composition typically leads to results that are aesthetically non-compelling. I find imagining a piece of music is the key to composing it; composing I see as the act of realising the ideas behind it and the sounds I can hear in my imagination. I tend to

see the whole process as composition, as it all stems from the ideas and concepts that are the foundation of the piece. Works of art that I find powerful and profound tend to have several characteristics in common:

- great effort is involved in the creation of the work;
- significant and masterful technique is required to produce it;
- it contains strong coherence in its concept, expression and execution;
- it is interesting and intellectually challenging; and
- it is an act of love (because someone who hates humanity cannot have a creative and artistic reaction to the world).

If pre-composition is useful for a composer to achieve such goals, or whatever their goals may be, then so be it. As such, it is of course an individual's choice how they work. Ultimately, any work of music must stand or fall in the act of listening to the work—that is all that is important. All of this discussion about composition technique, structures and my work reminds me of the words of Richard Barrett, who several years ago wrote about some of his work in his diary (and subsequently published it in the *Leonardo Music Journal*): 'I may not have much material, but I have learned how to fuck it up. It isn't much to be proud of but it's home.'¹² This still makes me laugh today, and I don't think I could paraphrase it without losing the essential humour and meaning—but the whole discussion of pre-composition brought Richard's words back to me very powerfully when I reflected and thought, 'I don't do much *pre-composition* ... whatever the hell *that* is.' Nevertheless, the reflection on the question has been useful in that it has brought to the fore aspects of my practice that I had not previously considered in such a light. It does seem to me that pre-composition is unnecessary when using algorithmic composition techniques, when composing with the infinite set of possibilities that one has when dealing with sound itself, or when one has a more unified composition practice. I still do not think that I engage in pre-composition, if it exists. The progress of the phases of the work of composition seems more intertwined and overlapping, rather than clearly demarcated in any way.

Postscript

After this article was completed, I was lucky enough, several nights later, to have had several hours of after-concert discussion with Bernard Parmegiani, courtesy of the Liquid Architecture festival in Melbourne. Bernard said that pre-composition for electronic music (acousmatic) composers was learning the tools—in the current time the software tools—used to create the music. It is an interesting thought and not without merit, although I see this (learning the tools) more as part of the compositional technique for this kind of music. Nevertheless, by saying this Bernard did imply that all of the real composition activity (everything after learning the tools) was unified and this would be the same attitude as many other composers mentioned here and I think this was what he meant.¹³

¹² Richard Barrett, 'not necessarily anything to do with Karlheinz Stockhausen,' *Leonardo Music Journal* 8 (1998): 17–19.

¹³ Conversation with the author, 13 July 2003.

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