

Predetermined Systems, Cognition and Aesthetics

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The orientation towards predetermined systems in certain lineages of twentieth century music reflects a shift in aesthetics, a key aspect of which is a desire to avoid well-established musical tendencies, including both those relating to musical practice in general and those relating to self-expression and personal preference. In fact, such an aversion is achieved by moving compositional decision-making out of an explore-audition scenario and onto predetermined plans. Since the resulting music is not organised around perceived preferences, it often seems to come from beyond the intuitions of the particular composer, and can sound unlike any other style of music. In this way, predetermined systems are capable of generating a music that might seem to be stylistically disconnected from the past, and it is equally this sense of discovery that many composers find so attractive. Of course, the disconnection is only figurative; it is specifically the affective qualities of music that are disengaged from the past. Historically, the fact remains that Process music did occur and continues to do so.

The significance of an emphasis on predetermined systems in contemporary music is deeper than just a shift in aesthetics. It has real consequences for the ability of a listener to understand the music, and ultimately leads to fundamental questions as to the nature of music itself. Considerable evidence to support these claims is provided by existent and ongoing research in the field of cognitive science in general, and music cognition in particular. What follows is merely a brief overview of that research, but my feeling is that it is adequate to illustrate that reliance on 'the ear', that is, the explore-audition scenario, during the act of composition inevitably leads to a music that is strongly rooted in well-established tendencies.

Cognition and Musical Acculturation

The study of music cognition aims to explain how music is perceived, and more precisely, how that perception gives rise to musical understanding, or meaning. Perception has traditionally been divided, although perhaps somewhat superficially, into physiological and psychological layers.¹ The physiological layers involve the reception of a stimulus by the physical mechanisms of hearing—the auditory system—the structure of which determines important dimensions of our hearing potential, such as frequency response ranges, loudness curves, masking effects and the critical bandwidth surrounding each particular frequency. Psychological layers relate to the mental interpretation of a stimulus once it has passed the physical auditory system. Inevitably, both physiological and psychological layers are at work when listening to music, and we might summarise perception by saying that the physiological layer supplies the brain with raw data while the psychological layer attempts to interpret that data into a meaningful musical experience (Raffman, 1993). Studies in the field of music cognition provide an interesting understanding of what it is that listeners find preferable in particular pieces of music, and more generally, why people like music at all. Such research is important to any discourse on composition, but is particularly relevant to a discussion of processes because, as will be argued in the next section, the predetermined nature of decision-making in music that involves processes challenges contemporary cognitive theories in significant ways.

In his influential book *Emotion and Meaning in Music* (1956), Leonard Meyer investigates the nature of music perception from a psychological perspective. Meyer states that a stimulus has *embodied meaning* when, on the basis of past experience, it makes us expect a consequent musical event. For Meyer, meaning is firmly attached to expectation, of which there are two types: conscious and unconscious. Conscious expectations are intellectual experiences where the listener

¹ I say ‘superficially’ because the psychological layers surely have a physiological basis.

has a conscious understanding of the musical structures and relationships contained in a piece, and a conscious awareness of the expectation itself. Such conscious understanding relies on an intellectual rationalisation of perceived information, which is made in the context of a body of explicit knowledge that is based on long-term memory and acquired through the intentional and conscious study or deliberation on a subject or stimulus (Dienes & Perner, 1999). For example, a listener may appreciate a canonic piece because of the ingenuity applied to the composition of the canon itself. Such appreciation is often achievable through analysis of the score alone, without ever hearing the canon as manifested in sound. Undoubtedly, appreciation of this sort is conceivable only because the listener has some experience with, and explicit memory of, canonic composition, at least to the extent that it is possible to recognise the particular canon in question as being unique and interesting in some way. Importantly, in such circumstances, the listener is aware of the reasons behind the sense of appreciation felt; the understanding is conscious.

At the centre of Meyer's argument, however, is the idea that listeners maintain a specialised, unconscious understanding of music, whereby meaning is contained within the structurally important units themselves: the harmonies, phrases, melodies, and so on.²

We are continually behaving in an intelligent way, comprehending meaning and acting upon our perceptions, cognitions, and evaluations without ever making the meanings themselves the objects of our scrutiny—without even becoming self-conscious about what experience means (p.38).

According to Meyer, as we listen to music, expectations regarding the probability of future events are continually being generated at various levels of the music's

² According to Meyer, there are two attitudes towards musical meaning. Absolutists are those who believe that meaning is contained in the relationships within the work itself. Referentialists are those who believe that meaning is found in references to the extramusical world (Meyer, 1956). Embodied meaning is associated with absolutism, while designative meaning is associated with referentialism. This discussion takes an absolutist position, unless specified otherwise.

structure. Expectations remain unconscious so long as the course of events satisfies them. They only become conscious when the probable outcome is either delayed or replaced with an unexpected consequent. Of particular importance to this discussion, these expectations are the product of each individual listener's cumulative experience with a musical style.

Expectation...is the product of the habit responses developed in connection with particular musical styles and of the modes of human perception, cognition and response—the psychological laws of mental life (p.30).

Expectations are, in fact, simply the manifestations of the embodied meaning described earlier. Meyer goes on to state one of the basic hypotheses of his writing: that emotional or affective responses are aroused in situations where expectations are temporarily delayed or permanently denied.

The sort of unconscious understanding that is central to Meyer's argument is not specific to the perception of music. In fact, it is widely discussed across many areas of cognitive science, including linguistics (Chomsky, 1980), visual perception (Kosslyn et al., 1990) and social cognition (Carlston & Smith, 1996), to mention just a few. From a cognitive perspective, perception relies on unconscious frameworks of knowledge, referred to as schemata.³ In a discussion of mental imagery, Nigel Thomas (1999) provides a complete and accurate definition of a schema:

Schema... refers to a data structure, implemented in the brain, that functions to govern perceptual exploration of the world so that appropriate perceptual tests are applied at appropriate times and places, and that is continuously modified or updated by the results returned by those tests so as to be able to govern perceptual exploration in the future (p.1).

Literature in cognitive science portrays perception as a bi-directional system. Interpretation of a stimulus is made in response to the relationship between the

³ In cognitive science literature *schema* is used to denote the singular, whereas *schemata* is used to denote the plural.

stimulus and the individual's schemata, which are acquired passively through repeated experience with the activity concerned. At the same time, a representation of that stimulus is added to the listener's acquired knowledge, so as to contribute to future interpretations.

The exact nature of schema-based knowledge is an issue of considerable debate, and there are two leading theories that attempt to explain it at a neurological level. The Classical view (eg. Fodor, 1975; Newell & Simon, 1976) maintains that information is stored in the brain as symbolic representations, much like a computer stores digital data on a hard disk. Accordingly, interpretation involves comparing a representation of the perceived input with those similar representations stored in the brain from past experiences. Connectionist theory (eg. Bharucha, 1987; McCulloch & Pitts, 1943; Rumelhart & McClelland, 1986; Rumelhart, 1989; Smolensky, 1988) argues that as we listen to music a network of highly interconnected neurones is activated, and the stronger the connection the greater is the level of excitement. Furthermore, the excitement of each particular neurone has the effect of strengthening its physical connections to other neurones. These connection strengths are the key to connectionist theory because it is in the relative weights of the nodes that musical knowledge is stored. It may be argued that these two theories are actually not in contrast, but instead provide a single explanation of perception. Simply put, the representations of the classical view may be nothing more than patterns of stimulation across a neural network. There are, however, some important differences between the two theories, but a proper investigation is beyond the scope of this writing.

Schema-based theories of perception have naturally been applied to music, perhaps most notably by Fred Lerdahl and Ray Jackendoff in their book *A Generative Theory of Tonal Music* (1983). According to Lerdahl and Jackendoff, the perception of music is similar to that of language, involving the unconscious construction of abstract structures (representations), of which the events of the musical surface are the only audible part. These abstract structures, which are formed from schema-based knowledge, are what account for a listener's understanding of music. The theory proposes various hierarchical descriptions of

musical structures that are reminiscent of Schenkerian analysis. Ultimately, it goes further to present a grammar that defines the abstract structures relating to tonal music that an experienced listener must possess, and relates those structures to musical surfaces in the tonal style by way of various well-formedness, preference and transformation rules.

Although schemata are individual to each of us, the degree to which we collectively engage in the same, or similar, experiences will result in a corresponding degree of similarity in our individual schemata. Such a consequence is indeed necessary for the development of a musical language. Cognitively speaking, musical language can be thought of in terms of the collectively shared schemata within a particular group of people, which exists by the fact that those in the group have had similar musical experiences to a sufficient extent that similar structures have formed in each individual. While it is difficult to define the boundaries of collective schemata, it is possible to be fairly confident that listeners will be familiar with many structures. Just as a person who does not know the meaning of the word 'house' can not be said to know the English language, equally in music, a person who does not understand, albeit unconsciously, the meaning of a V-I chord progression can not be said to know the language of Western tonality. We can refer to *musical acculturation* as the method in which the collectively shared schemata of a particular society are instilled in a person over time (Frances, 1988). Anyone who has listened to the music of a remote culture has most likely observed the importance that acculturation has on musical preference. Such experiences often give rise to a sense of confusion and even frustration, presumably due to a lack of understanding of the musical language. Regardless of whether such contact with exotic music is deemed to be enjoyable, it seems clear that the experience of the outsider is much different from the experience of the listener who has grown up in that culture, having listened to the music extensively and acquired the necessary schemata to interpret and properly understand it.

To summarise, research in cognitive science, particularly in the area of music cognition, provides us with an interesting and useful insight into the perception of music. The cognitive view of music perception is that a stimulus is interpreted

simultaneously on both conscious and unconscious levels. At the same time, the unconscious aspects contribute to schemata and the conscious aspects contribute to the listener's framework of explicit knowledge. What is important in the context of this writing is that the perception of music is a matter of comparing what is heard to what has been learned through past experience, and the relationship that the perceived music has to these internal schemata will determine the listener's preference for the music. More specifically, in such comparisons it is the similarities that are important because they provide meaning to what is perceived, either conscious or unconscious. Accordingly, it is through similarity that expectations are delayed or denied. Since composers of music are at the same time listeners, and often so at decision-making moments during the act of composing, this understanding of music perception has significant consequences with respect to certain approaches towards composition and the nature of the decision-making involved.

Perceptual and Conceptual Intuition in Composition Activity

At the outset of *A Generative Theory of Tonal Music* (1983), Lerdahl and Jackendoff state that the goal of their theory is to provide "...a formal description of the musical intuitions of a listener who is experienced in a musical idiom" (p.1). Musical intuition, in the context of its usage above, is simply another way of referring to a listener's response to a stimulus whose interpretation is formed in the context of that listener's acquired schemata. Such responses are intrinsically tied to the listener's preferences and an instinctive sense of what 'sounds right' when listening to music. Since the composer is also a listener, intuition of this sort certainly plays a role in the act of composition, but the difficulty with such a description is that it only accounts for decisions that are made through audition. That is, it only accounts for those situations where the composer sounds out a musical idea, either preconceived or arrived at through exploration, so as to listen to it and decide whether it sounds appropriate. In practice, many of the governing forces

present during the act of composition are the result of decisions made outside this explore-audition scenario, and in fact are often made before a single sound event is composed. Surely those decisions also involve intuition in the sense of some idea as to what the result will sound like. Intuition of this latter sort is fundamentally different, relying on a framework of explicit knowledge that is consciously accessible. We can distinguish between these two modes of intuition by referring to *perceptual intuition* as that mode which relies on unconscious, schema-based knowledge, and *conceptual intuition* as that mode which relies on a body of explicit, memory-based knowledge. The composer exercises both modes of intuition during the act of composition by way of two different types of decision-making, referred to as *perceptual decision-making* and *conceptual decision-making*, accordingly.

Perceptual Decision-making

Perceptual decision-making leads to the determination of some characteristics of the music in accordance with implications that arise from earlier events in the piece. Such decisions are made from moment-to-moment ‘by ear’, in the context of an explore-audition scenario, and presumably in relation to preferences of the composer. Assuming that preferences are formed in relation to schemata, it might be said that perceptual intuition looks to the past for guidance—both the immediate past, the events in a particular piece, as well as the experiential past, the events in the composer’s lifelong musical development. As a consequence, reliance on perceptual intuition results in a music that is firmly connected with music of the past and one would expect it to be abundant with well-established musical tendencies, as manifested in similarities of behaviour, relationship or function at various levels.

If only for completeness, it should be mentioned that there are likely to be strong similarities between many musically preferred sonic gestures or phrase structures and sound events that are experienced outside of the scope of music. Indeed, sounds that are frequently encountered in everyday life also contribute to

schemata and it is possible that musical preference may be in response to these rather than schemata formed from previous musical experience. One example of such an extra-musical influence is found in the relationship between the harmonic spectrum of naturally occurring pitched sounds and the evolution of Western tonality, which not only divides the frequency continuum into specific pitches that correspond to the overtones on a given fundamental, but also places the importance of each scale degree in close relation to the prominence of its relative position in the natural harmonic series. To be specific, aside from the fundamental frequency and its octave equivalents, the 5th and 3rd harmonics are the more perceptible in the natural harmonic series and their corresponding pitches possess a comparable importance in Western tonal theory, as the fifth and third scale degrees respectively. Harry Partch (1949) lends more weight to the argument by claiming that these three “...are the most important scale degrees in nearly every musical system worthy of the name that the world has ever known” (p.87). Hermann von Helmholtz (1863) was perhaps the first to propose that before the development of tonal music people would have been familiar with these harmonies because of their prevalence in naturally occurring pitched sound, including those of the human voice. It is no surprise, then, that people would have been attracted to these intervals when music began to be concerned with harmonic relationships. A proper investigation of the use of everyday sounds in music would need to account for whether the same schemata are engaged when listening to music as when listening in non-musical contexts. It may be that particular schemata are activated or their interpretive role heightened when an individual decides that he/she is listening to music, and as a result, normal listening may be different than musical listening in fundamental ways.

Reliance on perceptual intuition during composition provides significant benefits to the resulting music. Foremost, it conforms to the predominant understanding of what it is that we like about music—that we like it when it ‘sounds right.’ A reliance on perception directs composition towards structures that are meaningful to the composer, and because that composer is a member of a social group and shares in the collective schemata of that group, one would expect that other listeners would also find those structures meaningful. Pursuing this line of

argument one might presume that it is important for composers relying on perceptual intuition to remain 'in-tune' with the collective schemata of their population, which is accomplished by remaining familiar with music trends. On the other hand, however important collective schemata might seem to be, in reality they represent only the most common aspects of musical language. Returning to Meyer, it is largely the breaking of expectations that causes an emotional response to music. It may be more accurate to say that the collectively shared language provides a common set of expectations that can be broken, and the particular way in which they are broken is what identifies individuality amongst composers. At any rate, if musical preference is dependant on acquired musical language, then a strong argument can be made that working within the context of a musical language should be the aim of music composition, and the essence of music itself. In fact, to argue to the contrary one must be willing to accept music on fundamentally different terms.

Conceptual Decision-making

Conceptual decision-making refers to the predetermination of some characteristics of the music outside explore-audition activity. These decisions can take the form of rational processes or other conscious, intentional plans that influence the organisation of musical materials. In contrast to perceptual decisions, conceptual decision-making is not performed in response to a stimulus, but rather requires the ability to imagine a situation and anticipate its needs. Accordingly, such decisions are not dependent on schemata, but instead rely on explicit knowledge that is rooted in the intentional study or deliberation on a subject and brought into consciousness during this imaginative planning stage. Conceptual decisions generally have implications for the role that perceptual intuition will play during the act of composition. This interaction is largely one-way, simply because the predetermined nature of conceptual decisions means that they are made before

arriving at the explore-audition activity.⁴ Conceptual decisions can be applied to a wide range of musical parameters and the nature of such decisions varies greatly. This being the case, it is useful to further divide conceptual decisions into three primary categories:

1. Environmental decisions
2. Developmental decisions
3. Deterministic systems

Environmental decisions relate to the general setting in which a composition is to be formed, defining holistic parameters such as instrumentation, musical style or duration, to name just a few. These decisions create the boundaries within which a piece exists, and inevitably affect the role of perceptual intuition in composition by acting to guide, or limit, exploration from moment-to-moment. This guiding/limiting effect can be made clear through the use of a hypothetical example. Imagine that a composer sets out to create a three-minute piece of tonal music for string quartet, and that the piece is to be composed ‘by ear’ within the context of an explore-audition scenario. Although the composer will rely largely on perceptual intuition during the composition activity, a number of environmental decisions have been made that will limit and guide exploration. The sound world will be limited to those sounds capable of being produced by the specific stringed instruments making up the quartet. Having decided that the piece is to be in a tonal style, the range of musical sounds is largely restricted to twelve-tone equal tempered pitches, and presumably those seven contributing to a specific tonality. Because a string quartet consists of four players, some limit is also placed on the density, or number of different parts, that the musical texture can contain. Finally, the decision that the piece is to be limited to three minutes is likely to have durational implications for the composition of sub-structural entities such as melodies, phrases and sections. During the act of composition the composer may explore various musical ideas, for example by

⁴ It is possible that moment-to-moment decision-making in one portion of a piece can influence conceptual decisions applying to later portions. For the sake of simplicity, this discussion is limited to the interaction between both modes of intuition when they concern the same portion of a piece.

sounding them out on a piano or other instrument. However, this exploration is guided, and in significant ways limited, by the environmental decisions made at the outset.

Predetermined decisions may be made that prescribe developmental plans, such as how a piece, or a section of a piece, will unfold over time. *Developmental decisions* also limit or direct perceptual intuition in much the same way as environmental decisions. However, environmental decisions are global and static, meaning that the influence that they have on exploration remains constant over the entirety of the piece. In contrast, developmental decisions can be applied to sub-structures of a piece, and more importantly, the fact that they describe development suggests that the implication that they have on perceptual decision-making is dynamic; the particular effect may change according to the stage of development. Again, the governing consequences of such decisions are best illustrated by way of example. Let us suppose that a composer makes the decision that a particular textural section will increase in intensity and that such growth will be achieved through the combined effect of a steady increase in activity, a parallel increase in dynamics and a gradual transition from consonant to dissonant harmonies. Again, the specific sequence of events may be composed within an explore-audition scenario, but if the conceptual plan for development is followed then a number of restrictive rules must be applied. Firstly, the average density of events will need to increase over time. Secondly, at any given point in the development the pitch material will be restricted to a set of intervals that occupies some range on the continuum from consonance to dissonance, and that range will shift from being more consonant to more dissonant as the development progresses. Lastly, the decision that the section is to increase gradually in volume has implication for the sounds that can be chosen for each stage of the development. For instance, sounds that are naturally soft would be less suitable for later stages, and vice versa.

The conceptual decisions discussed so far have had the effect of guiding or limiting moment-to-moment exploration during the act of composition. It is possible however, to incorporate a system that determines a specific sequence of events, thereby taking the place of moment-to-moment decision-making all together. The

distinguishing feature of *deterministic systems* is that they organise musical parameters according to data which itself has been determined by forces outside of perceptual, moment-to-moment exploration. Such a system can be implemented as a data-generating algorithm, or may already be in the form of a collection of data that can be mapped to specific musical parameters. In the absence of perceptual decision-making, the composer's intentions are restricted to those that are conceptual, and these intentions are reflected directly in the design of the system. This inevitably results in a heightened compositional emphasis on formal and conceptual concerns. Furthermore, by abandoning reliance on the ear, deterministic systems can create a kind of disconnect from the music of the past, leading to relationships that are outside any conventional musical language, a characteristic which might be seen as both their finest achievement and their most obvious point of criticism.

The idea of composing music that intentionally avoids reliance on perceptual intuition has been met with considerable opposition by listeners and composers alike, primarily because it contradicts common notions regarding the nature of music itself. A piece that manages to disconnect itself from the past and from any known musical language may be understood and appreciated in a cerebral sense, but is likely to be meaningless in terms of schema-based understanding. Consequently, it may not create the same sort of affective response that perceptually composed music is capable of producing. This being the case, conceptual intentions cannot be evaluated fairly in terms of perceptual intuition, but rather must be judged using other criteria that are more aligned with the nature of the decision-making involved. This is not to say that perception does not play a part in evaluating deterministic music; music is inherently a perceptual activity. However, where conceptual intentions are concerned it may be that the function of perception is not to produce an affective response, but rather to act as a channel over which the concepts in a piece are communicated. The desire, then, is to create a system in which the concept is most clearly perceived, and an evaluation of the music should take clarity of compositional intent into account. At this point it is instructive to examine some of the motivations for emphasising predetermined systems in composition.

Predetermined Systems and Musical Aesthetics

The orientation towards predetermined systems in certain lineages of contemporary music reflects a shift in aesthetics, which can be broadly characterised as consisting of three primary concerns:

1. Logical experimentation
2. Objectivity
3. Discovery

Logical Experimentation

Humans have an inherent propensity for logic, and it is not surprising that such inclinations should find their way into the creative arts. An interest in the application of rule-based systems to music is not a twentieth century phenomenon. However, the importance placed on the listener's awareness of those systems in Process music is a notable development. As James Tenney once commented, "...then the composer isn't privy to anything" (cited from Reich, 1968: p.1). Steve Reich describes his thoughts on perceptible systems in *Music as a Gradual Process* (1968):

I am interested in perceptible processes. I want to be able to hear the process happening throughout the sounding music. To facilitate closely detailed listening a musical process should happen extremely gradually. Performing and listening to a musical process resembles:

pulling back a swing, releasing it, and observing it gradually come to rest;
turning an hour glass and watching the sand slowly run through to the bottom;
placing your feet in the sand by the ocean's edge and watching, feeling, and listening to the waves gradually bury them.

...I don't know any secrets of structure that you can't hear. We all listen to the process together since it's quite audible, and one of the reasons it's quite audible is, because it's happening extremely gradually... Even when all the cards are on the table and everyone hears what is gradually happening in a musical process, there are still enough mysteries to satisfy all. These mysteries are the impersonal, unintended, psycho-acoustic by-products of the intended process. These might include sub-melodies heard within repeated melodic patterns, stereophonic effects due to listener location, slight irregularities in performance, harmonics, difference tones, etc. Listening to an extremely gradual process opens my ears to it, but it always extends farther than I can hear, and that makes it interesting to listen to that musical process again (p.1).

Process enthusiasts, whether composers, performers or listeners, usually maintain both affective and cerebral interests in music, while the degree to which they orient themselves towards one or the other varies. One might argue that music is an audible art form, and therefore its audible qualities should be a composer's primary concern. Accordingly, the implementation of any system is aimed at creating a sonic outcome that is preferable in the context of a schema-based interpretation, and if that does not result then such composers are inclined to either change the system, modify the outcome or discard the idea all together. Other composers maintain a more strict, experimental philosophy, and thus resist being overly concerned with the outcome. This latter attitude is largely rooted in John Cage's consideration of experimental music "...not as descriptive of an act to be later judged in terms of success or failure, but simply as an act the outcome of which is unknown" (Cage, 1961: p.13). Influenced by Cage, experimentalists often approach the use of predetermined systems as an experiment in which an intellectually attractive idea is translated into sound. As with any experiment, one first develops a hypothesis—a reason to believe that such an experiment may produce an interesting sonic result. Along with an orientation towards experimentation comes an acceptance that not all experiments are successful. Christian Wolff once compared the situation to that of a baseball game, explaining that we attend with the hope of witnessing a good game, but many times the game is

lousy. This, however, does not diminish our general enthusiasm for attending baseball games (Wolff, personal communication, 1999). Moreover, an experiment can result in various levels of success. Although a piece may not be deemed successful as a whole, it may contain wonderful moments, or prove to be inspirational in specific ways. It is entirely possible that one might find interest in a piece of music, yet never wish to hear it again. On the issue of acceptance, Steve Reich (1968) writes:

Musical processes can give one a direct contact with the impersonal and also a kind of complete control, and one doesn't always think of the impersonal and complete control going together. By a "kind" of complete control I mean that by running this material through this process I completely control all that results, but also that I accept all the results, without changes (p.1).

Objectivity

Perhaps the most overt avoidance of previous tendencies in much contemporary music is found in its rejection of self-expression. In the article *New and Electronic Music* (1958), Christian Wolff makes the following observations:

One finds a concern for a kind of objectivity, almost anonymity... For at least some of these composers, then, the final intention is to be free of artistry or taste. But this need not make their work 'abstract', for nothing, in the end, is denied. It is simply that personal expression, drama, psychology, and the like are not part of the composer's initial calculation: they are at best gratuitous (p.24).

By restricting compositional decision-making to the design of a process, which then generates the music, one senses that there is less of a focus on individual expression. It is not, however, that the music expresses nothing, but rather that the concepts and relationships that are expressed are external to the composer; they seem to have been discovered rather than expressed.

While performing and listening to gradual musical processes one can participate in a particular liberating and impersonal kind of ritual. Focusing in on the musical process makes possible that shift of attention away from he and she and you and me outwards towards it (Reich, 1968: p.2).

This avoidance of self-expression also helps to explain the acceptance of any outcome that is associated with Cagean experimentalists. To the extent that the composer imposes judgement on the outcome of a deterministic system, that composer is expressing personal preferences. After hearing the result of a musical process it may be that the composer decides to modify the system in order to enhance the perceived structure of the process. However, if one is to avoid 'self', in as much as that is possible, then the aim should be to restrict any judgements and modifications of the system to those that contribute to a greater expression of the system itself—to those that illuminate the intrinsic qualities of the process.

Discovery

Deterministic systems effectively take the place of moment-to-moment decision-making, thereby diminishing the role that perceptual intuition plays in governing the organisation of events in a piece. This not only evades tendencies of the individual, but in more extreme cases can also create a disconnection with the music of the past, in the sense that the resulting music may be difficult to categorise in terms of language or style. Deterministic systems are likely to produce musical relationships that would not have emerged as a result of perceptual exploration, and it is this sense of discovery—of venturing into uncharted territories—that many composers find most interesting about them. The resulting music can be as surprising to the composer as it is to a listener with no knowledge of the piece.

The extent to which predetermined systems create a music that is disconnected from the past varies depending on the rules of the system and the nature of the source material. The music of Steve Reich provides an example of a moderate disconnection, where processes operate on phrases and tend to control

aspects of the large-scale development. Significantly, the source material in Reich's music is almost always tonal and composed by ear. As a consequence, the music retains a sense of familiarity, even if the manner in which it develops is innovative. A greater disconnection is created when predetermined systems either operate on less familiar source material, or on individual elements of a source set. In the case of the former, it is clear that if the material itself is unconventional, then it is less likely that any organisational process will render it familiar. In the latter case, unfamiliarity comes from the fact that no perceptually intuitive decisions are retained in the organisational process. The sequence that is generated is determined entirely by the process at the event level. When processes are used in this way, the result is likely to be a music that does not resemble any known musical style or language, which can pose challenges for the listener. Such systems demand a modification of one's listening strategy, or at least of the criterion by which the music is judged. Rather than considering the music from a purely schema-based, affective interpretation, greater attention should be given to the compositional intention, the character of the process and the structure of its development.

Conclusion

The aim of this chapter has been to examine some of the motivating factors behind the use of predetermined systems in contemporary music, and to consider the significance of such an aesthetic shift in terms of cognition. Music has long been concerned with both affective and cerebral human propensities. One significant development in contemporary music has been the shift towards conceptual concerns and the degree to which composers have attempted to elude their own musical preferences, turning moment-to-moment decision-making over to predetermined systems or plans. The willingness of composers to abandon a reliance on perceptual intuition reflects more than just a shift in aesthetics. When viewed in terms of cognition, it suggests that the very essence of what music is and why people enjoy listening to it is being questioned, and more importantly, altered. It is this challenge

to the fundamental nature of music that makes such an emphasis on predetermined systems one of the most significant musical developments of our time.

At this point it is worthwhile explaining how the original pieces discussed in this writing relate to the view of predetermined systems that has been outlined thus far. To begin with, these pieces do not represent Process music in any pure sense. Although they take inspiration from process composers, two factors prevent them from being typical examples of Process music. Firstly, there is not the same concern for unity at the formal level as there is in Process music. Unity is compromised in order to make sectional forms a possibility. However, the desire for unity is often retained at the process level, as this contributes to clarity of compositional intent, which is a high priority. Secondly, many of the predetermined systems used in these pieces are not deterministic, but instead are developmental, intended to guide or influence perceptually intuitive decision-making. While there is a deliberate effort to evade personal tendencies, that does not necessarily equate to a desire to avoid personal preferences. This music is intended to be affectively appealing and I rely on my own perceptual intuition for judgements. In the context of developmental processes, there is no commitment to the logic, so when the results are not appealing the system is modified or abandoned altogether.

The primary concerns with predetermined systems in these pieces are threefold. The first can be described as a desire for clarity of compositional intent, and it is maintained that such clarity can be achieved in complex forms through the combination of simple, clearly defined structures. The second is to explore the ways in which processes can lead to musical relationships that are beyond my own perceptual intuitions, that is, ideas that would not have arisen through explore-audition activity. This not only produces interesting music, but also adds a sense of surprise and excitement to the composition process itself. It is important to me that the act of making music is rewarding, and not just concerned with reaching the final product. Finally, predetermined systems are used to create musical surfaces with clearly defined structures that are capable of contributing to large-scale musical forms. In this respect, then, the predetermined system is merely a means to end, and not the end in itself.