

THE BREATHING OF TIME IN(TO) MUSIC

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ABSTRACT

Background. Music takes time to unfold and also modulates that time. Researchers in different fields have proposed various factors that influence our perception of musical time, but usually these factors are discussed in very general and abstract ways.

Aims. Factors that are said to have an effect on our perception of time in music include the density of information; the presence or absence of a pulse, beat, metre, and other periodicities; specific tempi and their modulation; expectation and its thwarting; and the role of memory. The current paper explores ways in which these ideas can be given concrete form, and to what extent their effect on time perception might be calculated.

Main Contribution. Atonal, unmetred, irregular- and multi-metred passages of twentieth-century and non-Western music present structures which can be appropriately examined in terms of density of activity. The degree, rate, and frequency of contrast become significant and can be considered in terms of information density, a factor influencing time perception. The role of memory, whereby a musical figure stirs a recollection of other material from the same or a different work, indicates that we often employ a non-linear listening. Another influence arises from the listener's changing focus from one temporal level of activity to another. Configurations maximizing such influences can be written into a composition and are also affected by the performance itself.

Implications. From a composer's point of view, learning how to "speed up" and "slow down" the listener's time tracking mechanism would provide a powerful shaping tool for a composition's formal structure. Musical illustrations are intended to suggest the type and variety of model which could be used for testing by psychologists wishing to examine the hypotheses presented herein.

1. INTRODUCTION

Music, often called the temporal art, not only takes time to unfold, but also modulates the time that it occupies, leaving us with a very different sense of duration than would occur in silence or while attending to mundane tasks. The questions of our perception of musical time can be (and have been) explored from a variety of perspectives, including philosophy, psychology, information theory, cognitive sciences, and musical analysis. The current paper explores these questions from the perspective of a composer speculating about specific ways of manipulating time within the context of a musical composition. It examines a variety of concepts relating to our perception of time, and speculates on how these concepts can be translated into concrete

form within musical contexts. Intuition suggests that, although it would be presumptuous to assume that everyone will listen in the same way, it should be possible to construct passages which encourage certain modes of listening.

When listeners lose track of time during a performance, the implication is that they found the music engrossing – thus, it is a compliment to the composer. More precisely, it indicates that the listener's sense of time has become so modulated by the music that the ordinary tracking mechanisms are overridden. Such an experience may be a strong motivation for attending a concert: to free oneself from the ticking clocks of ordinary life. Although psychological time is a prominent and interesting feature of our temporal perception, it should not obscure a recognition of our ability and tendency to track clock time. Most working people in contemporary urban societies, for example, find it essential to be able to align their own sense of time with clock time as much as possible while in "work" mode. We are able to calculate accurately the number of minutes required for such scenarios as getting up and dressed, eating breakfast, and arriving at work; we know what particular routines to omit if we are running five minutes late. So, although a listener may be eager to forget the clock during a performance, the time-gauging mechanisms are often difficult to turn off. Based partly on these premises, I have begun to direct my attention to compose music which will encourage different ways of experiencing time.

Although being able to "trick" the listener into overestimating duration does not seem like a valid musical objective for a composer, the ability to do so indicates a compositional skill which to me seems well worth developing. The sculpting of time is presumably as appropriate an occupation for the composer as the sculpting of sound, and is simply an extension of traditional formal and rhythmic concerns. The idea of incorporating a modulation of perceived time into the design of a composition seems a stimulating and fitting approach. This paper summarizes my reflections to date on such issues as calculating which particular combinations of factors would tend to speed up the temporal tracking mechanism, and which would slow it down. Clearly, though, considerable research with numerous subjects would be required to prove my hunches.

Given the diversity of factors, it would be impossible to determine that the musical contents of one bar will stretch perceived time by a specific percentage in relation to clock time. Therefore, I have been focussing on more general strategies: encouraging the suspension of tracking time, providing different temporal levels of activity, creating structures that encourage a change of focus from one temporal level to another, and creating optimum conditions for non-linear listening.

2. TIME AND MUSIC

2.1. Metaphors of time

A familiar metaphor equates the way in which our lives evolve with a moving forward in time. Often, our own sense of time will be measured by more or less periodic events, such as clocks and weekly job cycles, or the natural cycles of days and seasons. Sometimes, on the other hand, we appreciate the passing of time more through observation of the growth and decay of other things, beings, and phenomena evolving around us. Compared to the norm of a human life-span and activities, the growth / decay cycle of some of these aspects appear fleeting, others almost static. The contrast between these two analogies, though often subtle, can result in a difference in our perception of time. In the second, “object-oriented”, model, we observe the evolution of the object (such as a musical theme and its development) and assess the passing of time only insofar as the object reminds us of other objects whose time-frame is familiar to us. Thus, when we listen to a classical symphony or a romantic lied, we may have a sense of how long it usually lasts, in clock time. However, in another model, the musical periodicities (pulse, beat, meter) become a type of grid equivalent to the ticking of a clock (cf. Benjamin, 1983), and the tracking of time seems more prominent.

Psychological time, although often contrasted with clock time, is perhaps more closely related to that model than to the “object” model insofar as it is a modulation of clock time by inner feelings which alter our perception. Schubert lieder seem appropriate musical examples of psychological time, as there is generally a single, forward flow, but the rate of flow is uneven, just as in our lives the days appear uneven in length according to the significance of the experiences and events therein. Much of the 20th-century repertoire, on the other hand, is more closely related to the growth/decay of objects model, where independent coexisting musical ideas wax and wane.

Sometimes, a composition may seem analogous to a living organism whose growth (and decay) is the focus of the musical work. The establishment of metric regularity may then serve to provide a grid against which the varying contours, tempo, and intensity of the music appear like the changes in significance of one day to another. The effect of a change in the meter depends not only on the type but also the rate of change. If the metric regularity is modulated by a very slight *rallentando*, we may feel that the grid is staying the same but that our perspective is changing – a “zooming in” on detail, for example. If the instruments articulating the meter stop playing, then in many cases we will continue to maintain the regularity in our heads – at least until a more suitable replacement arrives. However, if two or three conflicting suggestions of regularity are presented, then some listeners might feel bewildered, and in an effort to sort out what they are hearing, the increase of attention and information density is likely to derail the tracking mechanism. Others may focus in on a particular level or rate of regularity, and therefore their perception of the material will depend on the specific rate they are following.

My wish to “breathe life into” a musical composition, or to make a composition appear to “breathe”, is a reflection on the way in which I approach composition generally: cerebrally-conceived designs in sound and time. Patterns and structures

are considerably more motivating for me than the expression of personal emotion. I do find natural patterns more attractive than perfect geometric ones, and am beginning to acknowledge that, since we are animate beings ourselves, we are particularly sensitive to the little fluctuations that distinguish the static from the living. Apart from the two ways mentioned above -- designing a modulated linearity which mimics human perception, or by portraying coexisting quasi-animate structures -- one can also make the music “breathe” by designing the composition so that the listener is encouraged to experience time in different ways depending on how s/he listens. In some cases, combinations of two or even all three of these modes might be desirable.

One of the most common methods of achieving the illusion of “life” is through the counterpoint of the non-periodic aspects against any perceived or expected regularity. The fluctuations in the perceived regularity, whether consciously perceived or not, will also contribute to a great extent. For example, in the case of a regular grid, the good performer can breathe considerable life into the image by the use of *microrubato*, the term used to describe the extremely subtle deviations from the written score in the performance of musical rhythm. A different type of subtlety, visible upon analysis of the musical score, is that of extension or elision, where an established regularity creates expectations in the mind of the listener against which the extensions or elisions of a phrase pattern or gesture provide the contrast.

2.2. Linear and non-linear listening

It is usually assumed, probably for the sake of simplicity, that we listen to music in a linear fashion: that we hear the piece in the order in which it is played. By tracking the periodicities of the music and by understanding relationships between melodic notes, chords, phrases, etc., we can keep the various elements in order and connect them mentally through their arrangement on the metric grid. As predominant as this form of listening must be, such a perspective ignores memory and anticipation, which operates on many levels. I have already suggested elsewhere (Mountain, 1993, 2001a) how our listening in a complex multi-strata work like Stravinsky’s *Rite of Spring* or Ligeti’s *Chamber Concerto* may resemble the phenomenon of click migration, as the linear construction of superimposed layers seems to override our awareness of “vertical” sonorities. On the other end of the spectrum, we may have reminiscences of years past triggered by a favourite theme. Most commonly, a piece with any recurrence of recognizable musical material assumes that the second or third iteration will recall something of the first.

It seems likely that such retrospection would increase the impression of duration, since the contemplation of a previous musical event, though almost instantaneous, includes memory of events that occupy time. At the very least, it creates interruptions in the sense of the forward-flowing of time, leaving certain ambiguities. A related but slightly more complex effect happens when the listener already knows the piece, and anticipates future occurrences of a theme, for example, on hearing the first presentation. In this case, the listener is obliged to “step back” from the evolving time of the moment in order to project (usually a large) part of the work in imagination. A knowledge of the historical/stylistic context of the work, especially of a conscious analytical type, will doubtless heighten the possibilities of such a listening strategy.

Certain musical configurations are clearly more favourable to retrospection. Generally, these can be identified as having two elements: a reduction in the density of information in the currently-audible passage, and some quality of the passage and/or the preceding material which makes retrospection an attractive activity. Thus, the reiteration of a simple theme will at once encourage reflection on its previous occurrence (and possibly the intervening material as a change in context), while not overloading the listener with new information. Even new material may be determined to be less significant to a global understanding of the work and thus permit reflection on other aspects. On the other hand, a slow-moving melody presented on a single instrument, even though it may seem to present data at a slow rate, may strike the listener as so beautiful in all its detail that it precludes any lapse of attention. This is the kind of phenomenon where an exquisite performance enhances the composer's idea, maintaining the absorption level of the listener. Such a performance is likely to emphasize microrubato and timbral modulation, thus focussing the listener's attention on the foreground level.

On the whole, music which has a single prominent metric or beat structure reinforces linear listening, and encourages a tracking of clock time – though the awareness of the correlation between the clock time and the musical speeds will likely be grasped only subconsciously through internal tracking by the body. Pulse and meter are intimately connected with limb movement (and sometimes, in quieter passages, respiration), and our tendency to perceive mood and intensity is at least partially linked to the imagined amount of energy to maintain a corresponding overt pulse. Although most obvious in the context of dancing to music, where for example a suspension in the melody will cause the momentary halting of a rhythmic alternation of steps, with one foot suspended in air waiting for the resumption of the beat, the effect is almost as perceptible if the listener is imagining such a movement, unconscious though it might be. (A simple example is drawn from the author's composition *Underground Streams* [1992]). [\[SOUND SUSPENSION.WAV\]](#) Likewise, tempo fluctuations such as those achieved through rubato are intimately analogous with a speeding up or slowing down of such movements, and thus evoke a psychological inflection of clock time.

2.3. Suspension of time

The sense of suspended time can be quite easily achieved, and has been known for millenia. It can be stimulated by two seemingly opposite means: continuous regular pulse, or lack of pulse. As the continuous regular pulse usually lacks a higher-level grouping pulse, and the pitch material, timbre, and dynamics are relatively unchanging, the sense of linear progression of time is thwarted. This is typical in trance-inducing music, whether African medicine chants or popular electronic trance music. The lack of pulse is typical of music such as certain parts of Gregorian chant, and shakuhachi music. In both types, the music has to stay in the same rhythm for a considerable period of time for a real "erasure" of temporal tracking. However, even a few measures at a very slow beat can create a similar feeling if there is no beat at faster levels to join them. Periodicities of around 36-40 per minute are perceptible, yet difficult to track. On the other hand, they are

usually sufficiently calming – even soporific – that the listener may feel inclined to notice other rhythms and configurations. My recent electroacoustic piece, *Eddies in the River of Memory* (2001), articulates a very slow movement throughout with the use of bells, while the somewhat faster elements are sufficiently repetitive to contribute to the same suspended sense of time. [\[SOUND EDDIES.WAV\]](#) [\[IMAGE EDDIES.GIF\]](#)

A different scenario, more common in music of other cultures and only occasionally found in 20th-century Western music, is the sensation that "time is standing still". This can be compared to walking into a room and seeing there static objects; the sensation is usually created by the presentation of sonic "objects" where the only change is in the listener's focus. In terms of the previous analogies, the objects are not displaying any growth by which we might infer the passing of time. Webern was one of the first Western composers whose music attracted this comment, due to the presence of audible retrograde passages and absence of tonal progressions, traditionally used to indicate forward movement. (Stockhausen later developed the related concept of "Moment Music" which he applied in some of his own works.)

2.4. Different temporal levels

The existence of different temporal levels of activity is of course also a standard aspect of most music, though often not discussed in such terms. These can be manifest in sequential order or simultaneously – or both. Until the twentieth century in Western music, the simultaneous coexistence of different levels of activity were normally related in a simple arithmetic relationship. Thus, a melody moving in quarter notes might be filled in with delicate sixteenth-note patterns, and played in counterpoint with a slower-moving bass line in half-note durations. In the twentieth century, composers from Nancarrow to Carter and Ligeti, Messiaen, Stockhausen and Xenakis began creating multiple-strata works where different layers of music coexist each with their own pulse and sometimes even independent metric hierarchies. In non-Western music, as in jazz, the flourishing of heterophony also creates intricate relationships between the rhythms of different melodic lines.

I greatly appreciated Tenney's (1988) clarification of the concept of temporal focus, and his advice that we should learn how to adjust it. The idea of tracking the eighth-note activity of a piece, and then the whole-note movement, becomes considerably more complex when one has different layers of musical material. This could be expressed in terms of a highway, with several different "lanes" of time, where each lane moves at a different speed. Depending on which lane one is tracking, the sense of time will seem a bit different. Most importantly, though, is that if musical activity encourages "lane changes", then the experience of time becomes more modulated.

3. CHANGE IN INFORMATION DENSITY

Sequential contrast in temporal levels of activity can be achieved as simply as following a "fast" movement with a "slow" one, or more subtly with an increase or decrease of information. If we accept that our perception of time depends on the amount of information received, then if we ordinarily process x amount of

information / minute, $(x+I)$ will imply that more than a minute has passed. Researchers in psychology and philosophy have suggested that the amount of mental processing is crucial to our perception of duration. In musical terms, this is manifest in many ways. In the case of an increase of information, the rate of increase is crucial; a steady gradual increase enables the listener to anticipate the introduction of new data and prepare for it. A sudden burst of higher density, on the other hand, will compound the input rate, as the unexpectedness also contributes information. This type of information can be greatly reduced by subsequent hearings, even to the detriment of appreciating a pleasant surprise. Although what is considered “information” is highly dependent on the listener’s training and expectations, the listeners who come to concerts of contemporary music usually possess some combination of training and curiosity that puts most of them in a roughly similar grouping. Also, even if the amount of information is rated differently by different members of the group, often the change in amount is more relevant.

The rate and intensity of change in general -- whether it be a change of durational values, timbre, note density, amplitude fluctuations, or even style characteristics -- all contribute to the amount of information which has to be processed and thus to the sense of time. Stockhausen, Clarke and Tenney have all stressed the importance of change in musical parameters as contributing to the amount of information. In post-tonal music, the formal structure is often recognized primarily through such changes, with a section delineation being characterized by a shift in activity or density levels.

A low level of information, even with a periodic structure, should create optimum conditions for redirecting the attention. In temporal perception in general, opposite conditions often produce identical results: both too little and too much information can lead to a sense that a piece is taking too long, whether from boredom or information overload. So, a lack of change in musical parameters can conceivably produce a sensation of extended time: if after considerably activity there is suddenly a lull – a held chord, for example – then there may be a feeling of suspension that causes all time-tracking to stop. The listener enters into a different state, and when the beat / movement begins again, there may be a consciousness that some indetermined amount of time has elapsed. However, the difference between boredom and overload may well influence the listener’s choice of how to react: if the information level is low for a short period of time, then it may well serve as a resting place to absorb high information of an immediately previous section, and/or to be eager for the next burst of information. Overload, on the other hand, may create a sense of frustration and the listener will “turn off”. It was this reflection that prompted me to insert long chords between very fast passages, to encourage a retrospective listening; the listener can potentially re-create in echoic memory the passage which has just occurred, even if it was too fast on the initial “real” listening to be heard. An example is taken from the opening of the author’s piano piece *Spring Thaw* (1996). [\[SOUND SPRINGTHAW.WAV\]](#) [\[IMAGE SPRINGTHAW.GIF\]](#)

4. POLYFORMS

The simultaneous portrayal of two or more sonic images, melodies, “objects”, etc. can create fascinating structures. To extend Benjamin’s analogy, the resulting polyrhythms present two or more “clocks,” thereby confusing the sense of “real time” if their relationship is not easily grasped. In works with several “layers” of activity, such as ones by Stravinsky, Varèse, Messiaen, Ligeti, Nancarrow, etc., the “ticking clocks” may be far less obvious but the sense of time still very affected. The listener will tend to focus on one texture or layer more than another at any given point, but may shift attention from one layer to another over time. In such a case, considerable mental activity becomes involved, especially if each layer is sufficiently interesting to merit full attention and thus prompt shifting attention. If the listener changes focus from foreground to middleground and back to foreground again, the change of focus will produce a change in the referent clock unit, from pulse to super-pulse, for example. (See Mountain, 2001b.) Repeated listenings to such structures will permit different paths through the music, as the listener can focus on different strands each time. The composition will then be most truly “animate”, presenting a slightly different face each time it is met.

4. REFERENCES

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