TEMPORAL DISTORTIONS: A COMPOSITION FOR ORCHESTRA

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF MUSICAL ARTS

By

Robert J. Frank, B.A., B.M., M.M.
Denton, Texas
August, 1995
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*Temporal Distortions* is 18-20 minutes in length and is written for an orchestra including 2 flutes (2nd flute doubling on piccolo), 2 oboes, 2 B♭ clarinets, 2 bassoons, 2 horns, 2 trumpets, 2 trombones, timpani, 3 percussionists playing tri-toms, vibraphone, snare/tenor drum, medium suspended cymbal, Glockenspiel, bass drum, and large tam-tam; and multiple string parts for violin I a & b, violin II a & b, viola a & b, cello and double bass.

*Temporal Distortions* was inspired by the theoretical concept of "wormholes" in space, where matter is warped through distorted passages connecting distant and diverse parts of the universe.

The work is in three sections, connected without break. The first section, *Space*, emerges as a wide, expansive musical area where themes and gestures are freely presented. Gradually, these materials come into phase with one another, building to a climax. A transition follows, leading into the middle section, *Wormholes*, where the materials are frequently and suddenly transformed into other temporal elements. The third section, *Comets*, was inspired by the collision of the comet Shoemaker-Levy 9 with the planet Jupiter in July of 1993. Driving, underlying rhythms propel the thematic material through a series of statements which split into more and more sub-
statements. This leads into a turbulent, explosive section and a final wormhole which returns to the opening material.

Five basic temporal elements -- sustaining, aligned/non-repeating, aligned/repeating, non-aligned/repeating, and non-aligned/non-repeating -- are derived and demonstrated. Relationships between these elements are examined, and basic transformations are discussed. These elements serve as the basis for a theory of temporal analysis applicable to both metered and non-metered music. Chapter I presents this theory, and Chapter II discusses its application as a compositional method in *Temporal Distortions*. 
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INTRODUCTION

With each new work, composers attempt to convey or express a feeling, concept or idea which generally cannot be better expressed in any other manner. For this reason, when they are asked, "What is the piece about?", they often have trouble answering, for if they could, there would be no reason to have written the work in the first place. How, then, do composers convey that which is otherwise inexpressible?

When an aural or visual event occurs, the mind captures this information and processes it in relationship to known facts and previous experiences. This method of relating something unknown to something known is referred to by psychologist Julian Jaynes as metaphor. ¹

Many times the composer is metaphorically relating a feeling, concept or idea with a more specific, tangible item or event. The composer then constructs musical gestures which represent this item or event to the listener. Even if the metaphors of the composer are different from the metaphors realized by the listener, it is still possible for the initial concept or idea to be transferred. Take the example of a composer who as a child was frightened of descending into a dark basement. He or she writes a piece based on images of frightening darkness and imagined monsters. Someone else, listening to the resulting work, may draw upon his or her own experiences and obtain the

impression of walking slowly and fearfully past an old cemetery filled with the unknown. Although the metaphors of the composer and the listener are different, the basic concept of passing through an ominous, fearful area is, nevertheless, successfully conveyed.

*Temporal Distortions* was inspired by the concept of “wormholes” in space. A wormhole is, theoretically, a tunnel in space formed by a collapsing star. This tunnel forms a passageway that connects different locations, times, or even universes by warping and bending time and space. Although they may exist only in the realm of mathematics and science fiction, they still present an inspiring image. The concept of warping and transforming musical elements from one perceptible form to another was used in *Temporal Distortions* to create musical wormholes connecting different types of musical materials.

In the summer of 1993 it was announced that the comet Shoemaker-Levy 9 was on a direct collision course with the planet Jupiter. Images of the dramatic fragmentation of the comet and spectacular explosions upon impact (Figure 1) provided the perfect inspiration for the third movement of this work.

*Figure 1: Shoemaker-Levy 9 Comet Collision with Jupiter*
The work is in three sections connected by transitional wormhole passages. The first section, *Space*, emerges as an expansive musical area where themes and gestures are freely presented. Gradually, these materials come into phase with one another, building to a climactic moment, which then dissolves into a wormhole. This wormhole leads into the middle section, subtitled *Wormholes*. Here the listeners are led through a series of transformations, where materials are warped and distorted into various other temporal states. The third section, *Comets*, depicts the Shoemaker-Levy 9 / Jupiter collision. Driving, underlying rhythms propel the thematic material through a series of statements in which the Comet theme undergoes a process of fragmentation, resulting in a turbulent, explosive section. This section closes with the final wormhole, returning the listeners to familiar surroundings.

Themes and musical gestures embodying the character of the astronomical objects were constructed. These were not based on actual scientific data but were composed to reflect metaphorically the composer's impression of the objects. For example, the two parts of a comet (an exploding nucleus and a long tail) is depicted by a flurry of pitches followed by a sustained tail (Example 1), and the massive character of Jupiter inspired a broad, four-note theme (Example 2).
Although the metaphors of space, wormholes, comets, and other astronomical images inspired this work, there is no single, specific program or story-line. Instead, the intent was to construct musical forms and gestures that would take listeners on a voyage of the mind to whatever universes they might imagine.

Composition is both an art and a craft. The transfer of emotions, concepts, and ideas through musical metaphors reflects the artistic portion of composing. It is the craft, however, which the composer uses to implement this artistic vision. Skillful use of pitch materials is an important factor but not the only one. Regardless of the harmonic vocabularies used, the one thing that great compositions have in common is an effective and interesting use of the temporal elements of music.

As the title, Temporal Distortions, implies, this work explores the temporal aspect of musical materials. Many musical models were studied in preparation for this undertaking, among them works by Witold Lutosławski, Marek Stachowski, Krystyna Moszumańska-Nazar, Krzysztof Penderecki, Elliot Carter, Charles Ives, Luciano Berio, and Larry Austin. An appealing quality of rhythmic elasticity exists in the music of these composers.
However, searching for references regarding the perception and analysis of music which freely mixes metered and non-metered sections resulted in the discovery of a surprising lack of materials on the subject. Most existing rhythmic theories and analytical systems apply only to metered music, as do those of Maury Yeston, who at the end of *The Stratification of Musical Rhythm* adds the disclaimer that his theories are "... limited to a kind of tonal music in which the middleground rhythmic levels exhibit some regularity of motion." Others, like Jonathan Kramer's *The Time of Music*, thoroughly cover the philosophical unfolding of time within a work and the effects of tonality and pitch material on the perception of time in a work. Like Yeston, however, Kramer remains almost exclusively within the realm of metered music, providing only a passing mention of non-metered works.

The analytical ideas put forth in *Learning to Compose* by Larry Austin and Thomas Clark are more general and applicable to a much wider variety of types of music. Although these ideas are helpful in determining the rhythmic density and alignment at a detailed level, they require a great deal of time.

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2. For instance, none of the articles in recent volumes of *Musical Perception* XI/1-4 (1994) and XII/1-2 (1995) discuss temporal perception or relationships of strictly rhythmic elements. All but one dealt only with the perception of pitch or pitch-related issues.


5. In fact, the only musical example in the entire book of a non-metered excerpt is of his own composition, *Five Studies on Six Notes* (Kramer, loc. cit., 77) which still maintains a constant, common pulse between all of the parts.

and computation. For this reason, these tools are most useful only after specific areas and strata of musical material have been isolated and identified. Moreover, the results of such analysis are in the form of raw data, so that relationships and transformations must still be determined by the analyst.

So, how would one begin the temporal analysis of a work which moves freely from metered to non-metered sections? Yeston states:

"Extreme caution should be exercised in evaluating the universality of a theory. If it is too specific to a small domain of musical phenomena, a theory may mistake the unique aspects of very few compositions for general principles. On the other hand, if the theory is too general, the degree to which it may illuminate specific problems may be marginal when compared with the effort expended in arriving at general principles and solutions."\(^7\)

As the twentieth century draws to a close, it can be safely concluded that temporal flexibility is characteristic of more than a "... few compositions." In the following chapter, a compositional method which served as the fundamental basis for the composition of Temporal Distortions will be discussed. The ideas that will be presented were found useful by the composer in analyzing the temporal aspects of music which frequently and extensively mixes metered and non-metered materials and are particularly applicable to the music of many modern Polish composers. This dissertation is not intended to replace or surpass any existing theories but is offered as simply another tool for the composer and analyst to use in conjunction with

\(^{7}\) Yeston, op.cit., 148
other systems, in order to provide a deeper and more complete understanding of the temporal aspects of all types of music.
CHAPTER I
PERCEPTION OF TEMPORAL ELEMENTS IN MUSIC

When listening to music, regardless of pitch material, media, and style, the mind analyzes and organizes the sounds it hears in order to comprehend them. Acoustically, when two or more sounds of differing amplitudes and/or timbres are sounded together, an effect called masking\(^1\) causes the stronger sound to dominate, resulting in the perceived disappearance of the weaker sound. Similarly, when the listener is presented with a variety of sonic elements, the mind relegates some as being predominant and some as less dominant or background material. The mind focuses on the primary elements while background material is mentally "masked" and perceived in a subordinate role or, in some cases, not consciously perceived at all. Generally speaking, a consistent, unchanging element is perceived as being more stable and can be more easily assigned a background role in favor of new material which demands more attention to comprehend.\(^2\) Hence, material that is initially perceived as foreground material may later be perceived as background material 1) when it is repeated so many times that the mind is thoroughly familiar with it and no longer requires the same amount of attention or energy to process the information, or 2) when some new material


upsets the order of priority in the mind of the listener. This interplay of foreground and background material is one of the fundamental characteristics of Western polyphonic art music.

The following sections will attempt to define and categorize some basic types of temporal elements found in music and to discuss their various combinations.

Sustaining

The first category, sustaining, may also include silence, the sustained absence of sound. How long must a pitch/silence continue to be considered sustaining? In *Music Cognition*, W. Jay Dowling uses the term "psychological present" to refer to that temporal span of attention which we consider "now," and during which the mind processes information as a whole.\(^3\) Research has set the psychological present at about 2-4 seconds with some rare cases of up to 9 or 10 seconds.\(^4\) Events occurring within this brief period are mentally grouped into, and perceived as, single units. Therefore, pitches or silence which exceed this limit will generally be cataloged by the mind as a continuation of a previous event or, in this case, as sustaining.

\(^3\) Dowling, *op. cit.*, 179. Since the concept of psychological present is fundamental to the ideas that follow, a few clarifications need to be made. The term psychological present does not refer to the actual present which is occurring as you read this. Rather, it will be used in this paper to refer to the interval of time which defines how elements are perceived. If the material continues beyond this time-span, the mind must find a new way to deal with it, since the "buffer is full" so to speak. Beyond this limit, the mind must categorize an event as either a continuation or as a new event, thus effecting our basic perception.

\(^4\) Dowling, *op. cit.*, 180. Although the psychological present may vary slightly from person to person and event to event, it differs from Jonathan Kramer's concept of "moment time" (Jonathan D. Kramer, *The Time of Music*. [New York: Schirmer Books, 1988], 50-55.) in that it is a real time during which events are perceived as opposed to Kramer's term referring to the perceived passage of time during events.
Repeating

Similarly, patterns which occur within the psychological present and then continue repeating beyond that span of attention will be grouped into a unit perceived as a continuation of the pattern. Pitch also plays a determining role in the perception of repetition.\(^5\) Similarity of contour may be sufficient cause for a pattern to be perceived as repeating, but to a lesser extent than an exact repetition. Therefore, repeating elements in this text will be defined as patterns which repeat with identical rhythmic and pitch values. Events which repeat with the same rhythm but with only similar pitch contours or different transpositions will be considered a weaker sub-category of this element.

Studies have shown that the human mind reacts to the occurrence of a sonic event and then projects forward in time an expectation of what is to come.\(^6\) As long as an event continues according to what the mind expects, there is little mental attention required. When something unexpected occurs, such as a change in the pattern, there is a biological reaction signaling that "something has gone wrong." New events will also elicit this signal. Both reactions will bring about psychological conditions which shift the mind's attention to the new or different event, while continuing events will elicit less and less of a reaction.

A common application of this principle is found in the use of the "Alberti Bass" and other repeating accompanimental patterns. With these figures,


composers can sustain rhythmic interest and direction without distracting from the melodic material. In the twentieth century, "minimalist" composers have taken advantage of this phenomenon by introducing subtle changes to repeating elements just often enough to keep the listener balanced between the perception of the element as foreground or background.

**Aligned**

Another factor to be considered is alignment to a common pulse. When an event or combination of events is aligned to a common, recurring interval of time, a pulse emerges. Extended to a higher level, regularly accented patterns of pulses form related groups, commonly referred to as *meter*. As there are a great number of works on this subject, there is no need for a detailed discussion of this topic. However, alignment does have a great impact on our perception of music. In this paper, aligned events will refer simply to events that are coordinated to a common, recurring interval of time. Although metered events are a narrower interpretation of this factor, they will not be a requirement of the definition.

**Five Basic Temporal Elements**

When a sound, silence, or series of sounds occurs within the period of the psychological present, it will be referred to in this paper as an *event*. In the following discussion, let us define an *element* as an event or series of events continuing beyond the psychological present.

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Sustaining elements by nature provide no opportunity for repetition or alignment beyond the initial attack and, as such, are unique. Within non-sustaining elements, however, the factors of repetition and alignment to a common pulse each have an effect on the perception of the resulting material. Therefore, all combinations of these two factors will result in perceptually different elements. These combinations result in the formation of five basic temporal elements: sustaining, aligned/repeating, aligned/non-repeating, non-aligned/repeating and non-aligned/non-repeating.

1. Sustaining

A simple example of a sustaining element is a long fermata. The technique of "pedal point" is another example of this type of element. Example 3, on the following page, shows Penderecki's use of only sustaining elements, introducing changes in the sound to maintain interest.

2. Aligned /Repeating

In this type of element, events repeat to a coordinated regular pulse. It is what we commonly associate with minimalist or "pattern music" composers such as Philip Glass, Steve Reich and Terry Riley but is also used in many types of music as an accompanimental figure (Example 4).


3. Aligned /Non-Repeating

Unison passages, homogenous chorales, and metered music with distinctly independent lines are all examples of aligned/non-repeating
elements. Although this type of element may contain recurring motifs and patterns, it does not contain regular, periodic repetitions like aligned/repeating elements.

Example 5. Bach, Two-Part Invention No. 8 in F Major, mm. 1-3.

4. Non-Aligned/Repeating

In this genre there is no coordinating temporal pulse. Each sub-element proceeds independently of the others but contains within itself repeating events. This element is used frequently in contemporary music and is a prominent feature in the music of the Polish composer Witold Lutosławski (Example 6).
5. Non-Aligned/Non-Repeating

This genre has no coordinating pulse, no continuously repeating figures, and individuality of sub-elements. Non-aligned/non-repeating elements are used in common practice cadenzas and many twentieth-century solo works. Luciano Berio's Sequentia V for trombone solo (Example 7) uses this type of element in an alternate notation devoid of precise metric connotations.
Combination of Temporal Elements

Temporal elements can, of course, exist singularly, as shown in Example 7, or in combination with other elements. When combined, they may be in some specific and intentional relationship to one another.

In a phased relationship, two or more elements exist in related tempos or consistent subdivisions of the beat that result in points of coordination. The opening of Elliott Carter's *String Quartet No. 3* (Example 8) demonstrates this relationship on both levels. First, there are two metered elements at different tempos (Duo I and Duo II), but the tempos are chosen to provide a common eighth-note pulse. Secondly, within Duo II the violin II proceeds consistently in three subdivisions of the beat, while the viola proceeds consistently in five subdivisions of the beat. When Duo II is combined with Duo I (which proceeds in two and four subdivisions of the beat) there are effectively three aligned/non-repeating elements in a phased relationship.

In other cases, two or more temporal elements may exist together, independent of one another. When these non-related elements begin simultaneously, the result can be a swirling, "jangling" sound collage, as in the example by Larry Austin (Example 9).

Another effect is achieved by the gradual layering of elements. Consider the opening of Lutosławski's *Symphony No. 3* in Example 10. The opening four-note event in the brass begins with the sustaining elements in the strings. After this opening event, repeated elements are gradually added over the sustaining elements in the strings. By choosing different temporal elements and adding them one by one, he achieves a heightened sense of foreground and background, since the mind is forced to reconcile non-compatible elements via the concept of *separation*. In this case, each of the three types of temporal elements are heard as separate entities.

Layered elements do not have to be contrasting in order to be effective. Charles Ives was one of the first to experiment with the layering of similar elements in contrasting temporal relationships. In Example 11 we find several aligned/non-repeating elements layered in different tempos.

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Example 10. Lutosławski, Symphony No. 3, beginning.

1. There are long silences only in oboes and horns.
2. The phrases with the repeat marks (|||) are to be repeated until the next single bar (q).
Example 11. Ives, The Unanswered Question, mm. 43-49.

Juxtaposition of Elements

Sometimes, different temporal elements are juxtaposed one after the other for temporal, as opposed to textural, contrast. This is often used to help define formal sections in a work, as in the first movement of the Lutosławski Double Concerto (Example 12).
Example 12. Lutosławski, Double Concerto.
Transformations of Elements

Twentieth-century Polish composers have made some of the greatest strides in developing transformations between temporal elements, but they were by no means the first to do so. Brief alternation between two temporal elements is often used as a transitional device. Consider Example 13, where Bach transforms a sustaining element into an aligned/non-repeating element. The sustaining pedal point at the beginning becomes momentarily unstable in measure 7. Following a brief return to generally sustaining elements in measures 8-10, the bass line takes on the full rhythmic pace and identity of an aligned/non-repeating element. By briefly alternating between the original sustaining element and the aligned/non-repeating element, the change is made less abrupt.

Lutosławski made frequent use of a wide variety of temporal elements in his music. In Example 14 the woodwind parts transform elements from non-aligned/non-repeating to non-aligned/repeating forms. This transformation is one of the simplest, accomplished by the gradual introduction of repeating elements. Performers proceed individually, without break, from the non-repeating passage into the repeated figures. He accomplishes this transformation gradually by staggering the woodwinds' transitional points. In the violins, the degree of repetition is much higher in the material before the repeated phrase, which makes their transition even less noticeable.
Another type of transformation is demonstrated in Example 15. Here, Lutosławski "bends" the sustaining elements at specific rates, creating a sense of rhythmic motion without the addition of new attack points (with the exception of necessary bowing changes). In the measure before rehearsal
number 81, he begins articulated rhythmic motion, which becomes a non-aligned/non-repeating element at rehearsal number 81. Then, by slowing the tempo, decreasing rhythmic density, and varying lengths of the phrases, he transforms this element back into a sustaining element. By gradually changing only certain characteristics of an element, he creates hybrid elements which he uses as transitional devices.

Example 15. Lutosławski, Symphony No. 3.
Many composers have used various combinations of temporal elements, but nowhere does the use of frequent and rapid transformations seem to be more prevalent than in the recent works of two Cracow composers: Marek Stachowski and Krystyna Moszumanska-Nazar. Example 16 is from Moszumanska-Nazar's *3 Moments Musicaux* for double bass solo. In the first line we find a transformation from stable, aligned/non-repeating material to unstable, aligned/non-repeating material. The trill is used as a transitional element between the previous material and the sustaining element which follows. In the second line, the sustaining element is transformed into a non-aligned/non-repeating element by use of a *glissando* combined with a *tremolo*. This new element then slows and becomes an aligned/non-repeating element at the end of the second line.


Within the confines of a meter, Stachowski still manages to make use of a full range of elements by offsetting events and using conflicting subdivisions of the beat. In the following example, he begins at measure 40 with low-level, aligned/repeating elements, each offset by an eighth-rest. These lead directly into pure aligned/repeating elements, which briefly cadence on pivotal sustaining elements. The combination of an irregular rhythm and the use of
closely, but differently, valued subdivisions of the beat in the succeeding measures create four, slightly out-of-phase, aligned/non-repeating elements.

Example 17. Stachowski, String Quartet No. 3, mm. 39-47.
One of the most flexible and fluid transformations of temporal elements may be found in the 2nd String Quartet of Moszumańska-Nazar (Example 18). By gently changing the rhythmic pace of each line, she is able to transform the material from a stable combination of sustaining and aligned/non-repeating elements in the first line into less stable elements. In the second measure of the second line, aligned/non-repeating (waved lines indicate repetition of the notes in any order) material in the second violin and cello parts is added to the first violin and viola elements. The first violin and viola are coordinated to the same pulse, but they are made unstable by use of conflicting subdivision of the beat and a low alignment factor. This technique of destabilization is applied to all of the parts in the third line, where there is a transformation into a flurry of non-repeated/non-aligned elements. Thus, she has combined the techniques of varying the rhythmic pace and alternating between two types of elements to transform material from the stable, sustaining elements into unstable, non-aligned/non-repeating elements, bringing the phrase to its zenith.
Conclusion

The preceding definitions, relationships, and transformations were used to analyze passages of many works including, but not limited to, those cited. Through analysis of these works, a better understanding of the temporal aspects of music was obtained, thereby accomplishing the goal stated at the end of the introduction. The principles outlined in this chapter were then applied in the composition of Temporal Distortions.

While labeling temporal elements and identifying transformations between them may not provide detailed data that would result from other forms of analysis, these processes provide give an overview of the structures
and techniques used in temporally flexible works or passages. These principles were found helpful in determining the relative temporal stability of passages of music that were studied in preparation for the composition of *Temporal Distortions*. Used as a first-level analytical tool, this method helped to isolate areas of particular temporal interest and aided in determining which other analytical tools might be appropriate for further in-depth study. Perhaps the greatest personal benefit of deriving these principles was gaining a greater sensitivity to the factors that affect the unfolding, temporal flow of a work. It is hoped that this method might also assist others in recognizing and appreciating the large-scale counterpoint of elements inherent in music of all periods, including the often neglected and misunderstood music of our own time.
CHAPTER II
USES OF TEMPORAL ELEMENTS IN TEMPORAL DISTORTIONS

Construction of Themes

In order to create a greater contrast between various thematic materials, a different type of temporal element was featured in each theme or motif. Although contrasting harmonic material was also chosen for each theme, the pitch-set formed by the interval stack +1+6 \(^1\) was used as a common set for the construction of most material.

The "Space" motif, beginning at rehearsal number \(^2\) is primarily a five-octave (G1 - G6) sustaining element. Later, aligned/repeating, phase-related elements are added.

The "Jupiter" theme is a four-note, aligned/non-repeating figure. In each of its appearances, it is fully aligned in the most stable form of this genre, a unison statement, to convey metaphorically the size and stability of the giant planet. The pitch material forms a major-7th chord, expanding and inverting the +6+1 set to +1+7 in its opening gesture.

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1 Sets will be represented in this paper as successive intervals between pitches, as presented in Learning to Compose (Larry Austin and Thomas Clark. Learning to Compose. [Dubuque, Iowa: Wm. C. Brown Publishers, 1989], 144-149.) The set +6+1 is equivalent to the unnormalized set \{0,6,7\} as defined by Allen Forte (Allen Forte. The Structure of Atonal Music. [New Haven: Yale University Press, 1973]).

2 Due to the shifting metered and non-metered nature of this work, examples in the score will be referred to by rehearsal numbers, indicated by bold, underlined numbers (i.e. 2).
Example 19. Jupiter Theme.

The four-note "Sub-comet" motif (Example 20) is an aligned/repeating element. Its contour was chosen to match that of the Jupiter theme and its $+1+6+1$ set forms an interlocking, mirrored combination of the $+6+1$ set and its inversion $+1+6$.

Example 20 Sub-Comet Motif.

The "Comet" theme appears in two forms: as a non-aligned/non-repeating element in the first section and as an aligned/non-repeating and sustaining element concatenation (Example 21) in the third section. It is composed of various chromatic embellishments and inversions of the $+6+1$ set. This theme also contains all twelve pitch classes. Although it is rhythmically the most active theme, it also contains the least active (sustaining) element. This duality reflects the two part nature of a comet, with its nucleus of exploding material followed by a long, thin tail that grows longer the closer it gets to the sun. Similarly, as the third section progresses, the sustaining "tail" of this theme grows longer and longer.
Materials in the wormhole section of the work apply non-aligned/repeating elements (Example 22) or various other transformations to the themes. Most of the wormhole sections are constructed of non-aligned elements which progress to various levels of instability. Pitch material was generally chosen to reflect the material being transformed, including the commonly used half-step sub-set $\pm 1$.

Example 22. Wormhole Material.

Form

The composition is essentially cast in a three-part palindromic form (A: unstable to stable; B: unstable/fluctuating; C: stable to unstable) with an introduction and coda (Figure 2). It is also cyclic, since the opening material returns at the end. This form was chosen to provide a sense of traveling to many different areas, then returning to the starting point. It also bears similarity to a sonata form, with material presented, developed, and restated at the end. The essential concept of the work was that of developing transitions and transformations between temporal elements.
Introduction

The work opens with a six-measure long wormhole which unfolds in several different ways. The introduction begins with a five octave range which rapidly closes to just over two octaves within two measures, then expands back to five octaves by the end of the sixth measure. The woodwinds progress from less stable, aligned/non-repeating to more stable, aligned/repeating material, while the strings change from aligned/non-repeating to non-aligned/repeating material. Thematically, materials are also in turmoil. The woodwinds have fragments of the comet theme, the first trumpet has the comet theme in augmentation, and the lower strings outline the Jupiter theme's pitch set. Meanwhile, the upper strings (and eventually all strings) present wormhole material. This is designed to create a turbulent blur that propels the listeners into the first section, *Space.*
I. Space

The central concept of Space is that of a wide expanse through which musical elements pass at different levels. As more and more elements are added, they gradually come together to form a living, pulsing universe. It also serves as the expository section for thematic material. The entire movement is a progression from instability to stability. For this reason, non-aligned elements based on the comet theme are used at rehearsal number 8. The offset, echo statements of the Sub-comet motif in the muted trumpets at 2 make use of the acoustic effect of reverberation and echo to depict distance. To summarize this effect, sounds which are farther away have a primary tone and are followed by a reflected, softer echo tone. When the interval between the primary tone and the echo tone is shorter, the perceived size of the sounding area, and thus, the perceived distances will be smaller. In smaller rooms, this interval of time between primary and echo tones is so brief that two separate tones are not heard, but rather only one "blurred" sound. When the distances are greater (for instance, in the Grand Canyon) the interval between the primary and echo tones can easily exceed several seconds. This concept was used throughout Temporal Distortions to create a metaphoric, three-dimensional relationship between materials.

When the first consistent tempo begins at 13, it conflicts with the tempo of the repeating element in the vibraphone, serving to destabilize the meter until 35. Within this section there are two events related to the comet theme. The first one at 23 begins by simulating a non-aligned/non-repeating element

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by means of conflicting subdivisions of the beat. As the event unfolds, the alignment factor increases until the final four notes form a unison passage. When combined with a crescendo in the woodwinds, brass, and percussion, this gesture simulates the decreasing reverberation and increasing amplitude of an approaching sound source. The second event at 28 uses a different effect, beginning with reverberation-like tones at the same pitch level and becoming more independent as the gesture progresses. In this case, the lack of change in the amplitude was used to create a sense of lateral motion. The non-aligned/repeating elements in the bassoons extend this gesture until the next brass statement at 34-35. Now the echo-tones are only offset by one-third of a beat, as compared to the half-beat distance before. This idea of bringing the sound object closer is carried further at 50-51, where the offset is reduced to one-quarter of a beat.

The pulsing Space material in the strings has more and more aligned/repeating, phase-related elements added to it until 52. From 52-72 the elements come together into a common pulse while building to a climactic fff. This unification is foreshadowed by the change in the vibraphone from non-aligned/repeating to aligned/repeating elements. As more instruments enter, the parts gradually switch from differing subdivisions of the measure to an aligned, half-note pulse. Finally, at 72, the entire orchestra joins in a unison statement of the Jupiter theme. After this dramatic moment of total alignment, the ensemble proceeds with aligned/repeating quarter-note figures before individually leaving the texture.

At 87 (Example 23) the material begins to break down from the very stable, aligned/repeating elements into highly unstable elements in a
wormhole section. The transformation was accomplished by first converting the aligned/repeating elements into aligned/non-repeating elements in the same tempo as the preceding metered section. Although the aligned/non-repeating elements sound like a continuation of the previous material, the new notation allows the performers to continue individually from this passage to the next. Since the performers are proceeding individually from one passage to the next, the transition points will be offset from one another, and the transition will be more subtly accomplished, as in the Lutosławski example in Chapter One (Example 14). Destabilizing figures are distributed evenly among the parts over four-beat groupings, so that as performers individually complete the repeated quarter-note figure and continue to the following passage, more and more destabilizing figures will gradually enter until everyone is playing non-aligned/repeating elements of varying lengths. The resulting perception is that of a complete disappearance of the pulse.
Example 23. Frank, Temporal Distortions, 87-97.
At 94, the sustaining elements in the highest and lowest strings converge, transforming from a sustaining element to a non-aligned/non-repeating element by the introduction of a tremolo. A glissando in the brass was added to heighten the sense of "bending" and "warping" through this wormhole passage connecting the first and second movements.

II. Wormholes

The second movement is essentially a development section based on a palindromic rondo form of A-B-C-B-C-B-A. However, it differs from a traditional rondo form in that no section repeats literally. Rather, the material returns each time in an altered form, often with only similar characteristics and/or gestures. The A-material consists mostly of non-aligned/repeating elements. The B-material is a mixture of several elements, and the C-material is primarily made up of metered, aligned/non-repeating elements. This results in an alternating degree of stability/instability.

After emerging from the closing wormhole of the first movement at 100, the second movement opens with two successive statements consisting of transformations from non-aligned/repeating to sustaining elements. The method of transformation is simple, since both elements contain the same pitches, and one can fade into the other. In the second statement, the sustaining element is transformed into a non-aligned/repeating element in the cello at 102.

At 106, there is a wormhole which transforms material from non-aligned/non-repeating to non-aligned/repeating to aligned/non-repeating (Example 24). The first transformation is accomplished by a brief
introduction of repeating patterns that gradually settle into the pattern of the repeated element. The second transformation reduces the tempo of the first clarinet's figure to a point where it can be combined in alignment with other parts.


The material at 114-122 initially uses sustaining, aligned/non-repeating and non-aligned/repeating elements in layers, then sustaining and non-aligned/repeating in juxtaposition. The rapid glissando figure is introduced in
the strings. This B section serves as a transition between the non-aligned material in the A section and the aligned material in the C section.

At 123, the previous sustaining and non-aligned/repeated figures in the woodwinds are transcribed into metered notation. The durations are gradually increased to simulate independent reductions in tempo. This is in contrast to the layer of non-slowing, aligned/repeating elements in the double basses.

Section C at 123-138 consists of an overall progression from stable to unstable within an aligned, metered context. This section presents aligned/non-repeating material in the brass which is layered over an aligned/repeating bass line in the double basses and aligned/non-repeating material in the remaining strings. The string material slowly changes from stable to unstable by a reduction of alignment, decreased use of repetition, and increased use of differing subdivisions of the beat, all of which transform the aligned/non-repeating elements into the non-aligned/non-repeating elements at 138.

The brass at 123-127 extend the Jupiter theme into sustaining elements, which at 128 are joined to the end of the Comet theme in the woodwinds. This leads, in turn, to wormhole material consisting of aligned/repeated, offset material in the flutes. At 136-138, transformation of the non-aligned/non-repeating element into various sustaining elements is accomplished by overlapping each new attack in another instrument with a sustaining element.

At 139, the shifting, unstable B-material returns. The same process of overlapping the attack points with sustaining elements is used. Since the
process this time occurs over a time scale which greatly exceeds the psychological present, the resulting materials will be perceived as sustaining elements rather than aligned/non-repeating elements, as they were in the previous statement at 136-138. The pitches for this passage were derived from a twelve-tone row, which is an inversion of the row used in the Glockenspiel part from 13-46 of the first movement. The row is also used in an inverted, retrograde form at 140 to form the release points of the sustaining elements and to begin the next event in the cellos and double basses at 142. This new figure in the low strings consists of a non-repeating/non-aligned version of the row in the middle of two sustaining elements. The final part of the figure reintroduces the *glissando* figure of the B-section. The *glissando* figures are elongated in the strings, while the same transformational material that led into the first B section in Example 22 returns in the woodwinds. In this instance, the passage functions as a transitional wormhole leading into an aligned, metered section.

Section C, from 158-162, uses layers of materials reminiscent of the first movement. The woodwinds present aligned/repeating, phase-related elements similar to the chromatic comet-like fragments at 28. The violins, cellos and double basses expand the sustaining elements of the Space theme into a broad, C-major chord. In the midst of this, the violas present the twelve-tone row in the form of a lyrical, aligned/non-repeating element. As the violas finish the element at 158, the Jupiter theme is presented in the brass, beginning in an aligned/non-repeating form which, again, extends into sustaining elements.
When the next B section returns at 162, it differs from its counterpart at 112-123. At 162 the woodwinds continue with the previous aligned/repeating, phase-related material instead of the non-aligned/repeating figures of the original. Also, the first and second parts of this section are structurally reversed, with juxtaposed elements appearing first and the layered elements following. The strings at 166 contain material reminiscent of the C section at 123. Non-aligned/non-repeating Col legno figures in the second violins are used to foreshadow ideas of the upcoming movement, allowing the listeners to, as it were, glimpse the other end of the wormhole.

The final A section from 171-179 forms a wormhole connecting the second and third movements. The timpani continues the constant pulse, while the low strings switch to non-aligned elements. Each performer proceeds independently, blurring the transition. Coordinating points are located at 177 and 179 to help the conductor regulate the pace of this passage. All of the figures are gently reduced to a low, sustaining octave which leads quietly and without pause into the final movement.

III. Comets

In the previous sections, metered, aligned/repeating sections were presented at slower tempos and contained materials with reduced rhythmic motion. The third movement, Comets, also contains metered, aligned/repeating material but with a much higher rhythmic energy level. The comet theme is split into more and more offset fragments each time it returns. The form of the movement is shown on the following page in Figure 3. Each comet section and its corresponding transitional section becomes
shorter, faster and more overlapping until the demarcation between sections is obliterated. This leads into the climactic "collision" section which opens up into the same wormhole heard at the very beginning of the piece. This wormhole connects the third movement with the coda.

The first jeté figure in the violins (Example 25) is a hybrid temporal element consisting of an aligned/repeating attack point with a non-aligned/non-repeating continuation. The brevity of the event, less than 1 second, places it within the psychological present so that it will be perceived as a single event containing both stable and unstable tendencies. At 221, when the Comet theme begins, the violins change to a more stable aligned/repeating form.

Example 25. Jeté Figures

The vibraphone in the first three comet sections (see Example 26) recalls the three-dimensional echo-tone effect of the first movement. In these passages the performer uses a different mallet in each hand to simulate a primary (hard right mallet) and echo tone (softer left mallet).

<table>
<thead>
<tr>
<th>Section</th>
<th>Characteristics</th>
<th>Beginning at</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>stabilizing</td>
<td>180</td>
</tr>
<tr>
<td>Comet #1</td>
<td>unison</td>
<td>221</td>
</tr>
<tr>
<td>Transition #1</td>
<td>modulatory</td>
<td>237</td>
</tr>
<tr>
<td>Comet #2</td>
<td>split into 2 elements</td>
<td>265</td>
</tr>
<tr>
<td>Transition #2</td>
<td>increased tempo, metric modulation</td>
<td>281</td>
</tr>
<tr>
<td>Comet #3</td>
<td>split into 3 elements</td>
<td>303</td>
</tr>
<tr>
<td>Transition #3</td>
<td>modulatory</td>
<td>318 ca</td>
</tr>
<tr>
<td>Comet #4</td>
<td>split into 4 elements</td>
<td>328</td>
</tr>
<tr>
<td>Transition #4</td>
<td>modulatory</td>
<td>337</td>
</tr>
<tr>
<td>Comet #5</td>
<td>split into 5 elements</td>
<td>340</td>
</tr>
<tr>
<td>Transition #5</td>
<td>modulatory</td>
<td>347</td>
</tr>
<tr>
<td>Comet #6</td>
<td>fragmented into multiple bits</td>
<td>348</td>
</tr>
<tr>
<td>(Transition #6)</td>
<td>Jupiter theme in trpts. &amp; trmbs.</td>
<td>352</td>
</tr>
<tr>
<td>Collision</td>
<td>turbulence, fragmentation, destabilization.</td>
<td>359</td>
</tr>
<tr>
<td>Final Wormhole</td>
<td>transition to coda</td>
<td>366</td>
</tr>
</tbody>
</table>

Figure 3: Form of Movement III. Comets
Most of the transitional areas in this section serve as modulatory bridges between the pitch centers of the various comet sections. The second transitional section, however, accomplishes a temporal modulation as well. Until 276, the tempo is $J = 128$, beginning over a half-note pulse in the bass line in the first comet section and progressing into a two-beat quarter-note pattern in the second comet section. By 281, the tempo has increased to $J = 144$ and the triplet subdivision has been introduced, increasing the tempo without increasing the number of attacks per second (8.5 sixteenth-note attacks per second at $J = 128$ versus 7.2 triplet-note attacks per second at $J = 144$). At 303, the number of attacks per second remains constant, but the pulse shifts to four eighth-note subdivisions of the beat, resulting in a new tempo of $J = 108$ ($144 \times 3 \div 4 = 108$). This change is supported by a sudden compression of the range, a shift from dissonant to triadic pitch material, and a drop in the dynamics. All of these changes are necessary to allow the following comet sections to become progressively faster, louder, and more exciting, without exceeding the practical performance abilities of the performers.

The collision section at 359 introduces the first changing meter figures in the entire movement, disrupting the stable, even pulse. Chromatic fragments of the Comet theme in the strings and woodwinds lead into explosive figures in the brass and percussion over varying phrase lengths, further reducing metric stability. As the materials become more fragmented and less stable, they lead into the wormhole passage at 366, which is identical to the introduction of the work. Its length of 5-6 seconds creates an event that only
slightly exceeds the psychological present. This duration allows the listeners enough time to recognize the returning material but not enough time to begin consciously analyzing it, so that they can experience the expected resolution without losing the excitement of the anticipation leading up to it. Thus, the enigma of the opening few seconds of the work is resolved: the opening material has returned, and the journey is complete.

**Coda**

Cyclic forms have been used in many popular, large-scale orchestral works, including Beethoven’s *Symphony No. 5*, Brahms’ *Symphony No. 3* and Mahler’s *Symphony No. 2*. With the return of the opening material, the listeners are given a sense of completion after having an experience that, hopefully, leaves them better off than when they began.

In *Temporal Distortions*, when the listeners emerge from the wormhole at the end of the *Comet* section, they are returned to the same initial material as the first movement. Here, however, the remaining materials are abbreviated to function more as a remembrance than a recapitulation.

To create an effective dénouement, the strings begin with stable, aligned/repeating quarter-notes and progress to less stable, non-aligned/repeating material that finally diminishes into silence. As the various themes of the first movement are recalled, they, too, quietly fade away, leaving only the empty Space motif. The last two measures consist only of a quiet, incomplete statement of the Jupiter theme followed by a shooting star-like gesture in the suspended cymbal.
SUMMARY AND CONCLUSIONS

The preceding chapter could have been omitted in favor of a colorful description of the metaphor of traveling through space: first to an expansive, living, pulsing universe; next through a series of smaller, shifting parallel universes; and finally on a trip inside a disintegrating comet during a fiery collision with the planet Jupiter. To many listeners, this method of describing the work would most likely provide the greatest enjoyment, since it focuses on explaining the metaphors and artistic images of the work. However, as stated earlier, composition is both an art and a craft. The process of formalizing compositional styles and methods, in this case, led the composer to a deeper exploration and development of a method that defines relationships between temporal elements. This resulted in the creation of a work which extends and develops these techniques. Through further application and development, it is hoped that these ideas might develop into a theory that would encourage the exploration of the less charted waters of post-metric music and might also serve as a tool enabling younger composers to think "beyond the bar line."

In the same spirit, Temporal Distortions does not end with a firm closing statement that provides the last word in the matter. Rather, the open-ended statement is intended to invite and lead the listeners to continue their own voyages of the imagination, on to whatever metaphoric universes they may discover.
Instrumentation

Flute 1 & 2 (Piccolo)
Oboe 1 & 2
Bb Clarinet 1 & 2
Bassoon 1 & 2

French Horn 1 & 2
C Trumpet 1 & 2
Trombone 1 (Tenor)
Trombone 2 (Bass)

Timpani (4)
Percussion 1:
   Tri-Toms, Vibraphone, Snare/Tenor Drum
Percussion 2:
   Medium Suspended Cymbal, Glockenspiel
Percussion 3:
   Bass Drum, Large Tam-Tam, Suspended Cymbal

Strings (multiple performers each part)
Violin Ia
Violin Ib
Violin IIA
Violin IIb
Viola a
Viola b
Violoncello (div)
Double Bass

All parts sound as written, with the exception of the piccolo which sounds an octave higher and the double bass which sounds an octave lower.

Duration: 18-20 minutes.
Performance Notes

In non-metered phrases, accidentals apply only to the note they precede or throughout the beamed group in which they occur.

The term independently is used throughout the score to indicate that each individual performers should play their material independently of the others. The tempo should be very fast unless otherwise specified.

Glissando figures should begin immediately after the attack and should continue throughout the entire duration of the note. A glissando with no ending pitch (i.e. before rehearsal number 112) should continue to as high or as low as the instrument allow.

in all "wormhole" phrases, the ensemble should strive to make the transitions as smoothly and as gradually as possible.

Notation:

\[ \text{\begin{music}
\note c \note d \note e \note f \\
\end{music}} \]
gradual, independent increase in tempo

\[ \text{\begin{music}
\note c \note d \note e \note f \\
\end{music}} \]
gradual, independent decrease in tempo

Repeated figures continue as specified (individually or not) for the duration of the solid line. If the line ends in the middle of a bar, the performer should individually fade out before the end of that bar. A solid line ending on a barline indicate that the performer should end his or her material at the end of the measure. When new material (either repeated or not) immediately follows the solid line, the performer should continue into the new material without a break.

Boxed glissando figures indicate that the strings should complete the glissando while fingering the pattern as rapidly as possible, resulting in a rapid, chromatic blur.
BIBLIOGRAPHY


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Temporal Distortions

Robert J. Frank

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I. Space

Trp. 2
S.Cym.

independently
change to Flute
repeat rapidly and independently
Vibraphone. Med.
Rotor L  I
Glock. Medium Mallets

stagger bowings
sub pp
yff
stagger bowings
sub pp

Glock. Medium Mallets

Opus 1

Temp.

Tri-Tom

V. Bl

V. Bb

V. Hn

V. Tuba

V. Fg

V. Fg

Corps de Cuivre

Timpani

Score

5-10 seconds

Independent

Choral: Haydn's New Year's Carol
J remains constant and at the previous tempo.

Continue to 194) 5-10 seconds after everyone is repeating the final figure.

Adagio \( \text{\#52 sec} \)
Begin 3-4 sec./note & acc.!
* The figures should move against, on the beat, then trail off independently. The number of bounces is not specific. Wooden pencils or chopsticks may be used in place of bows.
Hrp. 1
S.Cym.
independently
r？s change to flute
independently
/Ts Vibraphone, Med. Rotor
repeat rapidly and independently
Adagio
stagger bowings

JJJ
stagger bowings

JJ
stagger bowings
I straight mate
0 i
harmon mute-no stem