EINSTEIN'S DREAM BY CINDY MCTEE: AN ANALYSIS AND TRANSCRIPTION FOR WIND ENSEMBLE

by

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ABSTRACT

Cindy McTee's 2005 composition for strings, percussion, and computer music is an exploration in pluralism, combining newly composed music and computer-synthesized sounds with the music of Johann Sebastian Bach and Charles Ives. McTee's initial use of Bach's music comprises the complete harmonization of the chorale "Wir glauben all' an einen Gott." In later sections of the work, McTee creates entire textures from the chorale's soprano line, subjecting it to a variety of treatments including augmentation, diminution, inversion, retrograde, and retrograde inversion. In addition to the inclusion of his music, McTee reiterates the importance of Bach through composition that relies on the four-note motive formed from the letters of his name: B♭, A, C, B. The central section of *Einstein's Dream*, unlike much of the work, is devoid of any material by or related to Bach, instead being notably influenced by Charles Ives's *The Unanswered Question*. The influence of *The Unanswered Question* manifests in the characteristics of this section's texture, the individual function of its musical layers, as well as its extended melodic line, which has been constructed from the principal trumpet theme of *The Unanswered Question*. For the creation of a transcription of the work, principal challenges included the translation of idiomatic string techniques for wind instruments, as well as the aural transcription and acoustic recreation of the computer music, in order to achieve a more ideal blend with the new ensemble of winds and percussion. As such, representative examples showing the translation of certain idiomatic string techniques, as well as examples that show how the computer music was acoustically rendered occupy a portion of this document.

ACKNOWLEDGMENTS

This project would not have been possible without the guidance of my teacher and committee chair, Dr. Catherine Rand. Her unwavering, kindhearted support of me throughout this degree, and during the rendering of such a difficult and complex work has not gone unnoticed, and is a gift for which I will be forever grateful. I would also like to thank the other members of my committee, Dr. Joseph Brumbeloe, Dr. Ed Hafer, Dr. Gregory Fuller, and Dr. Travis Higa, for their intrigue, and forthright sharing of knowledge and feedback.

A special notion of gratitude is issued to Dr. Cindy McTee, for graciously allowing me to create a version of *Einstein's Dream* for wind ensemble. In the original version, Dr. McTee worked tirelessly to seamlessly blend acoustic strings with computer-synthesized sounds, and as such, the allowance of a new, completely acoustic conception required great generosity on her part.

Finally, I would like to thank my parents, Alan and Diane, and brother Justin, for their constant support of my endeavors, and pride in the fact that I am pursuing what I love. A special thank you also goes to my partner Logan, for having the patience and tenacity to cope with the demands of this degree, its long hours, and slow, steady progress.

TABLE OF CONTENTS

LIST OF MUSICAL EXAMPLES

LIST OF TABLES

CHAPTER I – ANALYSIS OF THE INCLUSION AND USE OF MATERIAL BY OR RELATED TO JOHANN SEBASTIAN BACH

Section I: Warps and Curves in the Fabric of Space and Time

The opening section of Cindy McTee's *Einstein's Dream* is marked by the inclusion of the first twelve measures of "Wir glauben all' an einen Gott," one of 371 chorales harmonized in four voices by Johann Sebastian Bach. The full harmonization in Einstein's Dream is presented in tutti strings. This is the only instance in which the full harmonization is heard, as subsequent uses of the chorale are either a single voice only or fragments thereof.

Musical Example 1 "Wir glauben all' an einen Gott"

Source: Johann Sebastian Bach, *371 Harmonized Chorales and 69 Chorale Melodies with Figured Bass*, ed. Albert Riemenschneider (New York: G. Schirmer, 1941), 31.

As can be seen in Musical Example 1, the original harmonization of "Wir glauben all' an einen Gott" is in the key of D minor. In Einstein's Dream, McTee transposes the harmonization up a major second to the key of E minor. Her change of the tonic from D to E is meant as a representation of Einstein – "[…] 'e' for Einstein."[1] Besides the transposition to the key of E minor, the only other aspects that differ between Bach's original harmonization and McTee's inclusion of it in Einstein's Dream (Musical Example 2) are minor. These differences include McTee doing away with the cadential fermatas, instead writing out prescribed rhythmic values for each cadence, adding specific dynamic levels and shaping for each phrase, as well as instrument-specific slurs in each voice. In all other aspects, the two harmonizations are identical.

Section II: Music of the Spheres

The chorale material heard in the second section of *Einstein's Dream* is comparatively pared down from the full harmonization that was presented in "Warps and Curves in the Fabric of Space and Time." In "Music of the Spheres," the only part of the chorale that is heard is the soprano voice, presented in unison violins and viola (Musical Example 3). The single line is accompanied only by a sustained tonic octave in the cellos and basses. This decision on the part of the composer to accompany the melody with only a sustained octave is intended as a representation of "cosmic harmony and unity of all that exists." The "harmonious" intervals, identified by Pythagoras and later philosophers as the perfect fourth and fifth, and the octave, were thought to be a result of the "movement of celestial bodies." This line of philosophical reasoning is represented in the section's title:

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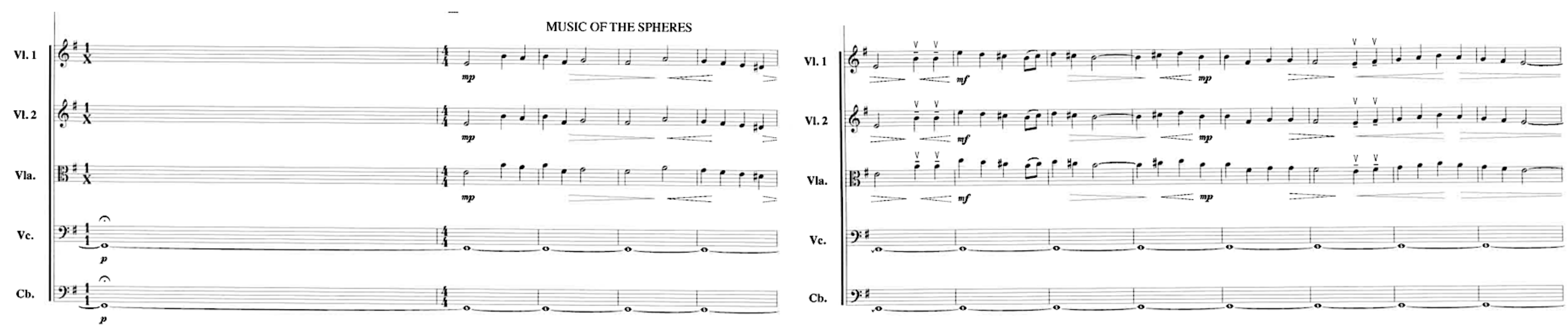
[1] Cindy McTee, *Einstein's Dream* (Dallas: Rondure Music, 2007), Program Notes.

Musical Example 2 *Einstein's Dream*, mm. 6 – 20

Source: Cindy McTee, *Einstein's Dream* (Dallas: Rondure Music, 2007), 2-3.



Musical Example 3 *Einstein's Dream*, mm. 21 – 33

Source: Ibid., 4-5.

"Music of the Spheres."[2] In addition to the octave tonic drone, other perfect intervals are produced between the drone and individual notes of the chorale melody. These perfect intervals are especially apparent at cadential points in the phrase, where authentic and half cadences respectively produce perfect octaves and fifths with the tonic drone.

Section III: Chasing After Quanta

The third large section of Einstein's Dream, "Chasing After Quanta," is characterized by a permeation of asynchronous rapid flourishes throughout an ensemble of divisi strings. The "chasing" is sonically represented not only by the rapidity of the gestures, but also by the canonic texture that they comprise. Although the gestures are dodecaphonic, they continue to establish J. S. Bach as an important component of the work. Like others who have composed with twelve-tone methods, McTee purposely employs specific intervals within these gestures. In the case of "Chasing After Quanta," it is through these intervals that the importance and presence of Bach continues.

Bach's name can be musically represented by the pitches B-flat, A, C, and B, normal order [9,T,E,0], and prime form (0,1,2,3). Each gesture of this section is comprised of repeated incarnations of this tetrachord. As such, "Chasing After Quanta" is a complete suffusion of the "B-A-C-H" motive. McTee creates a new chromatic aggregate with each series of three "B-A-C-H" motives, transposing each incarnation of the motive at a specific interval in order to render a complete aggregate. This interval of transposition is most often the major third, T_4.

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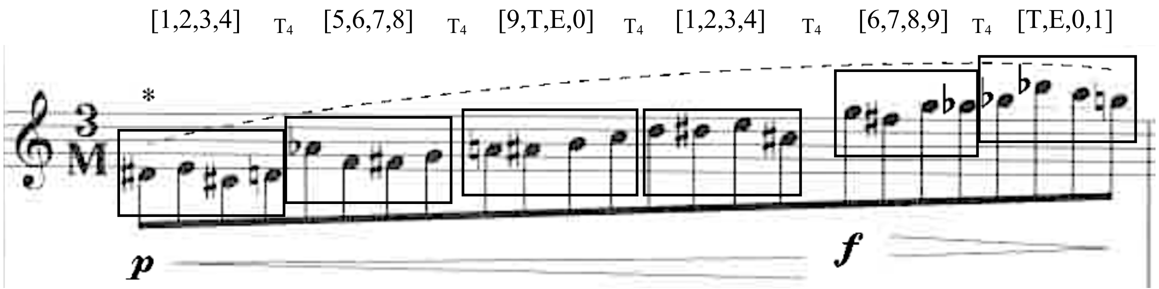
[2] McTee, *Einstein's Dream*, Program Notes.



Musical Example 4 Violin 2, m. 38 from *Einstein's Dream*

Source: McTee*, Einstein's Dream,* 8.

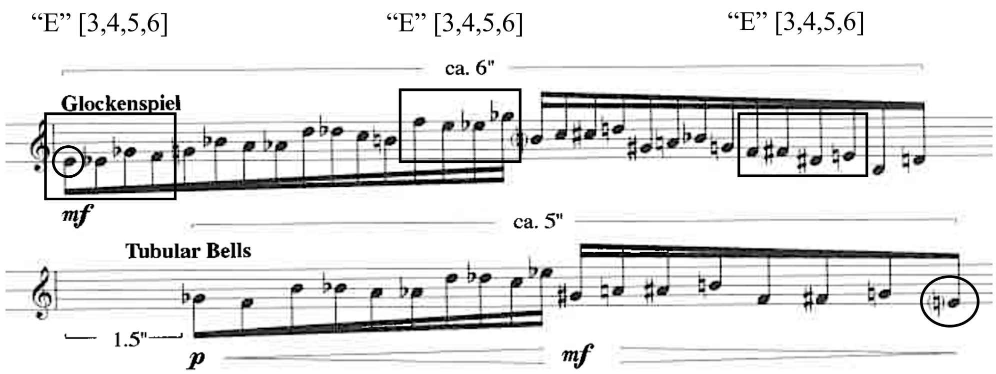
Prior to the suffuse texture of the strings, McTee briefly introduces what is to come in a much more transparent duet of glockenspiel and tubular bells. This short event also serves as a link between the preceding chorale, grounded in the tonality of E minor, and the following dodecaphony. While, as a pair, the glockenspiel and tubular bell gestures mimic the texture that is to follow, and are themselves also dodecaphonic, a pitch centricity of E relates them to the preceding tonality. This pitch centricity is established through the event both beginning and concluding on E, as well as possessing a number of instances of the "B-A-C-H" motive that have been transposed from B-flat to E.

B♭, A, C, B	T_6	E, E♭, F♯, F
[9,T,E,0]		[3,4,5,6]
(0,1,2,3)		(0,1,2,3)

Table 1 Transposition of "B-A-C-H" motive to "E"

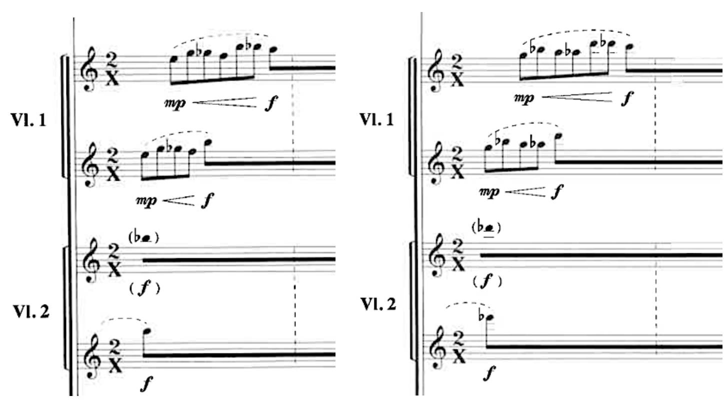
Note: This table shows the pitch names, normal orders, and prime forms for both sets, as well as the transpositional operator that separates them.

In "Chasing After Quanta," there are a total of two suffuse canonic textures that occur in the strings. Each texture concludes with dissonant, sustained harmony in the violins alone. Dissection of these harmonies reveals that they are vertical stackings of the "B-A-C-H" motive, the first "at pitch" as [9,T,E,0], and the second, a transposition of the motive by three semitones to [0,1,2,3] (Musical Example 6). Despite a lack of tonality throughout "Chasing After Quanta," harmonic "arrivals" on the "B-A-C-H" motive nevertheless seem fitting at the conclusion of textures that are almost wholly comprised of it.



Musical Example 5 *Einstein's Dream*, m. 37

Source: McTee, *Einstein's Dream*, 7.



Musical Example 6 *Einstein's Dream*, mm. 40 & 42

Source: Ibid., 9-10.

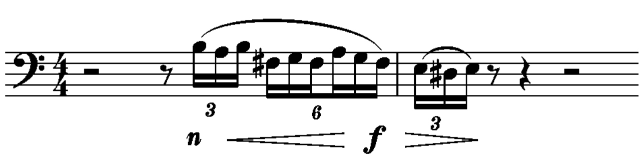
Section V: The Frantic Dance of Subatomic Particles

The fifth large section of *Einstein's Dream* is, like the opening "Warps and Curves in the Fabric of Space and Time" and "Music of the Spheres," built using material from the chorale "Wir glauben all an' einen Gott." Unlike either of the aforementioned sections, the chorale material used in Section V is very difficult to recognize aurally. This is because, in order to create a "Frantic Dance of Subatomic Particles," McTee modifies the chorale material by casting it in very short, successive rhythmic values. She also chooses to cast this section in a quick tempo, one that is twice as fast as the tempo at which the opening chorale is heard.

As with "Music of the Spheres," chorale material in "The Frantic Dance of Subatomic Particles" is taken from the soprano voice only. To create each gesture in the "Frantic Dance," McTee uses the notes of the soprano voice in the first phrase of the chorale only, beginning with the second note:

Musical Example 7 *Einstein's Dream*, mm. 6 – 11

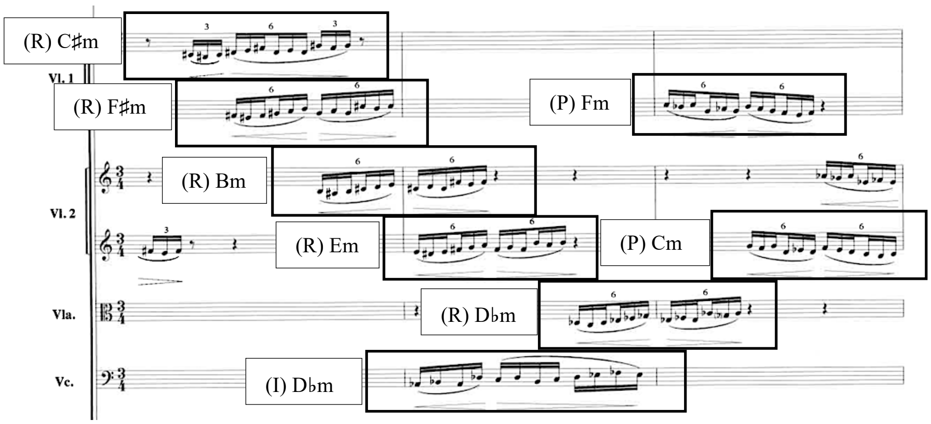
Source: McTee, *Einstein's Dream*, 2.



Musical Example 8 Violoncello, mm. 106 – 7 from *Einstein's Dream*

Note: This example illustrates how McTee modifies the chorale's soprano line for use in "The Frantic Dance of Subatomic Particles."

Throughout the "Frantic Dance," the chorale material is set not only as it is heard in the first and second sections of the work (as illustrated in Musical Example 8), but is also set in retrograde, inversion, and retrograde inversion. The material (in all transformations) is also transposed to each of the twelve minor keys. Additionally, these gestures are present in six separate string parts, and are constantly occurring throughout the "Frantic Dance," creating a scurrying, complex, and pointillistic texture. The combination of tempo, transformation, transposition, and complex texture of six separate strata is what makes aural recognition of the chorale tune very difficult and unlikely.



Musical Example 9 *Einstein's Dream*, mm. 148 – 50

Note: (R) = retrograde, (I) = inversion, (P) = prime form

Source: McTee*, Einstein's Dream,* 34.

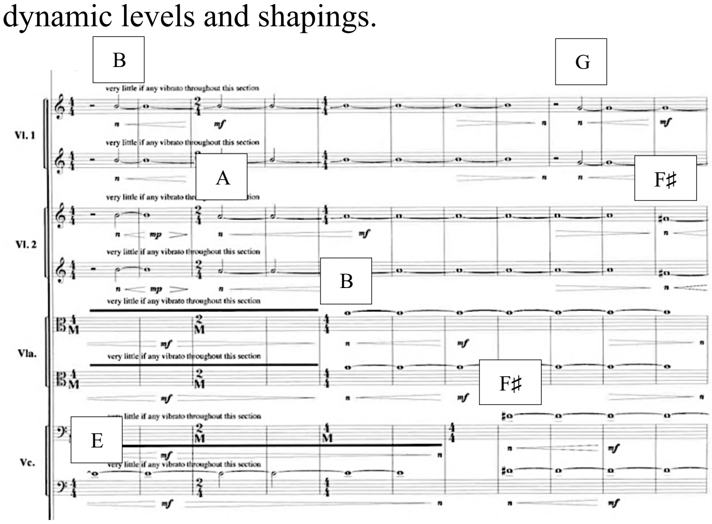
Section VII: Wondering at the Secrets

McTee describes the final section of *Einstein's Dream* in the following manner:

> In composing *Einstein's Dream*, and in thinking about new temporal experiences, I became very interested in the perceptual effect of time-stretching […]. Time-stretching is perhaps loosely analogous to the way in which Einstein's equations of relativity predict that gravity, or the curvature of space-time by matter, not only stretches or shrinks distances, but also appears to slow down or dilate the flow of time. Concepts of before and after merge. What most intrigued me about musical time-stretching was its ability to shift the listener's attention toward the inner components of the sound – the harmonics and the overlapping resonant regions – as if inviting a kind of meditation to wonder at the secrets.[3]

[3] McTee, *Einstein's Dream*, Program Notes.

The material used for the “temporal experience” present in Section VII is again the chorale tune from the soprano voice of “Wir glauben all an’ einen Gott.”[4] In order to achieve a “perceptual effect of time-stretching,” McTee’s treatment of the chorale tune is multifaceted.[5] At the most basic level, McTee elongates each note of the chorale tune to a length greater than twenty beats in most cases. In addition to the extreme stretching of rhythmic values, notes do not occur one-at-a-time, as they do in the original chorale tune. Because each note is sustained for a long period, successive notes of the chorale tune sound well before individual notes are finished. This layering of notes that were purely successive in the original chorale tune is what facilitates the merging of “concepts of before and after,” as melodic notes are merged harmonically.[6] Finally, the progression and contour of the notes of the chorale tune are heard not necessarily by their successive sounding, but rather as they come in and out of focus through the specific assignment of dynamic levels and shapings.



Musical Example 10 *Einstein’s Dream*, mm. 179 – 89

Source: McTee, *Einstein’s Dream,* 42.

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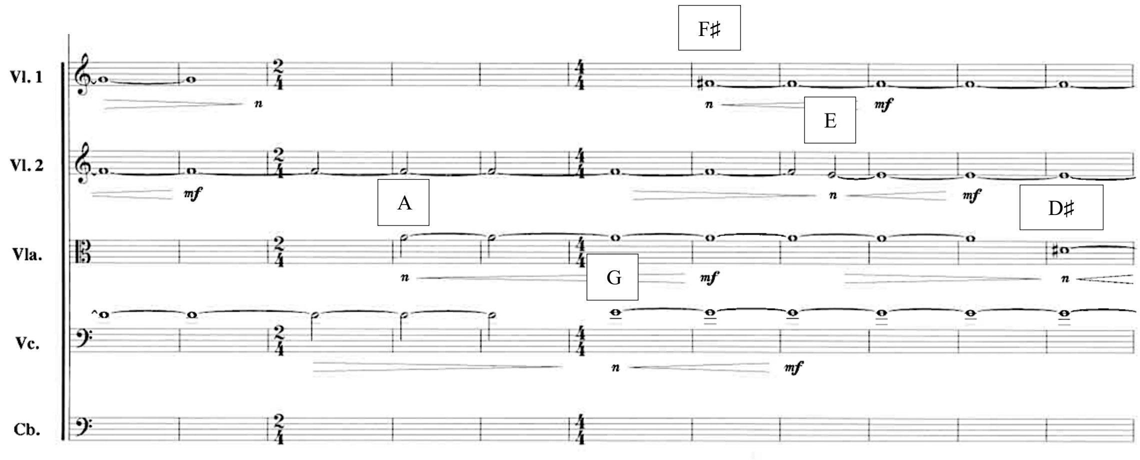
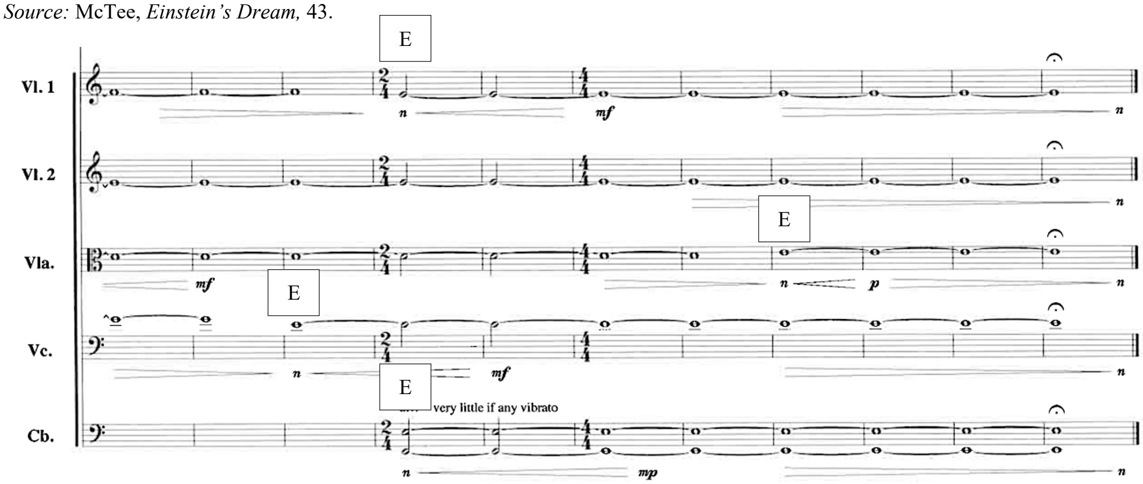
[4] Ibid.
[5] McTee, *Einstein’s Dream*, Program Notes.
[6] Ibid.



Musical Example 11 *Einstein's Dream*, mm. 190 – 200

Source: McTee, *Einstein's Dream,* 43.



Musical Example 12 *Einstein's Dream*, mm. 201 – 11

Source: Ibid., 44.

CHAPTER II – ANALYSIS OF THE INCLUSION AND USE OF MATERIAL BY OR RELATED TO CHARLES IVES

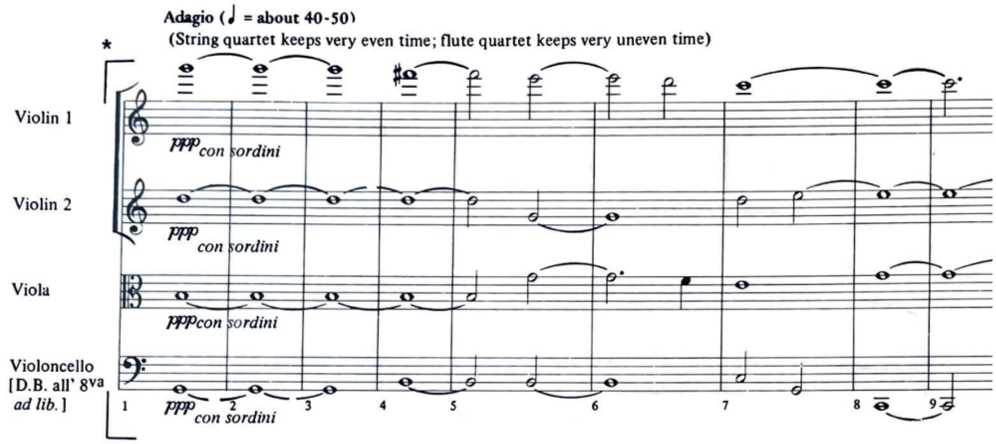
Section IV: Pondering the Behavior of Light

The fourth large section of *Einstein's Dream* is a great textural contrast to "Chasing After Quanta," consisting solely of one extended melody surrounded by long sustains and gestures from the rest of the strings, the percussion, and the computer music. Much of the musical material present in this section is related to Charles Ives's 1906 composition for trumpet, flute quartet, and strings: *The Unanswered Question*. Additionally, the inherent texture of "Pondering the Behavior of Light" is similar to the texture that Ives employs in *The Unanswered Question*. As in "Pondering the Behavior of Light," the texture of *The Unanswered Question* includes long, sustained harmonies in the strings, as well as considerably distinct layers of music that are occurring simultaneously, but which seem to function independently from the other layers around them. These similarities in texture give *The Unanswered Question* and "Pondering the Behavior of Light" a comparable sound that is likely not coincidental.

The string accompaniment in *The Unanswered Question* is said by Ives to "represent 'The Silences of the Druids – who Know, See and Hear Nothing.'"[7] As such, the strings possess a music that proceeds independently from both the trumpet and flute quartet, and which is essentially unchanging over the course of the piece. The harmonies of the strings are diatonic and consonant throughout *The Unanswered Question*,

[7] Charles Ives, *The Unanswered Question*, ed. Paul C. Echols and Noel Zahler (New York: Peer International, 1984), 10.

"establishing G-major tonality with occasional intimations of C major."[8] The consonance, slow harmonic rhythm, and independence of this string music are what make it noticeably similar to that which is played by the cellos and contrabasses throughout "Pondering the Behavior of Light."



Musical Example 13 Opening of *The Unanswered Question*

Source: Charles Ives, *The Unanswered Question,* ed. Paul C. Echols and Noel Zahler (New York: Peer International, 1984), 2.

Note: This example illustrates the qualities of the string music in *The Unanswered Question.*

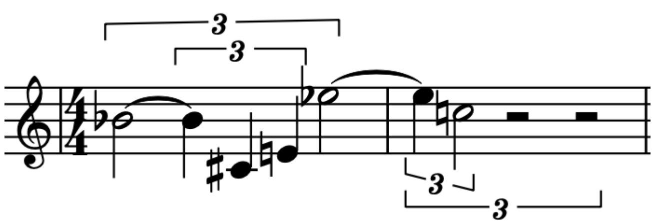
While the cellos and contrabasses in "Pondering the Behavior of Light" do, like the strings in *The Unanswered Question*, play consonant harmonies that change slowly, their harmonies differ in that they are not diatonic. Instead, they are a series of triads that "fall in major and minor thirds to complete a 12-tone row."[9] Despite the fact that these harmonies collectively form a 12-tone row, and thus a layer of atonality, there nevertheless seems to be two conscious decisions by the composer to create both symbolism and an instance of polarity. In line with previous tonal and pitch centers of E, the cellos and contrabasses likely begin and end their group of triads on E major in order

[8] Matthew McDonald, "Silent Narration? Elements of Narrative in Ives's *The Unanswered Question,*" *Nineteenth Century Music* 27, no. 3 (Spring 2004): 269, http://lynx.lib.usm.edu/scholarly-journals/silent-narration-elements-narrative-ivess/docview/200272531/se-2.
[9] McTee, *Einstein's Dream*, Program Notes.

to symbolize Einstein. Additionally, as stated by the composer, these triads do move by third, and thus there is no tonal polarity through the majority of them. McTee does break this pattern near the end of the set, however, placing B major before a final move by fourth to E major. This change of pattern is possibly in an effort to create a momentary tonic and dominant relationship, in order to make the arrival back on E major sound closing.

Musical Example 14 Reduction of consonant triads in cellos and contrabasses, mm. 46 – 102 from *Einstein's Dream*

The extended melody (in solo violin) that is present for the entirety of "Pondering the Behavior of Light" uses, as its germinal motive, the trumpet theme from *The* Unanswered Question:



Musical Example 15 Trumpet theme from *The Unanswered Question*

This trumpet theme is represented by normal order [T,0,1,3,4] and prime form (0,1,3,4,6), and is characterized by irregular rhythm, and pitches that, collectively, do not belong to a tonal center. The adjacency interval series of the set, <2,1,2,1>, however, reveals that Ives's trumpet theme does belong instead to an octatonic collection. McTee capitalizes on this quality by allowing octatonicism to permeate not only the extended melody, but also the harmonic layer occupied by the violins and violas. Unlike the harmonic layer of the cellos and contrabasses, the layer played by the violins and violas does support the solo violin. Despite being harmonically supportive of the solo, however, a slightly offset harmonic rhythm does grant this layer some sense of independence. The harmonies played by the violins and violas are an array of diminished triads and fully-diminished seventh chords, all of which fit within an octatonic collection.

Musical Example 16 *Einstein's Dream*, mm. 85 – 6

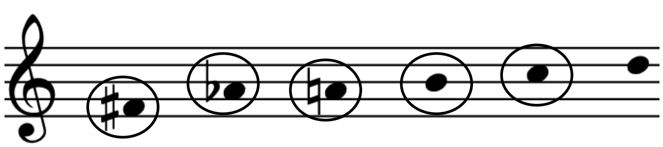
Source: McTee*, Einstein's Dream,* 18.

Note: This example shows the violin and viola harmonies present in measures 85 & 6, as well as the difference in harmonic rhythm between that group and the solo violin.

The complete trumpet theme appears in the extended violin solo six times in total, beginning in measure 59:

Musical Example 17 *Einstein's Dream*, mm. 59 – 61

McTee continually transposes the trumpet theme so that each statement begins on a different pitch, unlike the unchanging B♭ from *The Unanswered Question*. Additionally, none of the statements are a direct copy of Ives's trumpet theme, as not one of them begins on B♭. McTee also seems to have carefully chosen which pitches each of her themes begins with, as these first pitches, as a group, are also a subset of an octatonic collection. Interestingly, five of the six pitches form the five notes of the solo violin's original statement of the trumpet theme:



Musical Example 18 Starting pitches of trumpet themes within solo violin melody

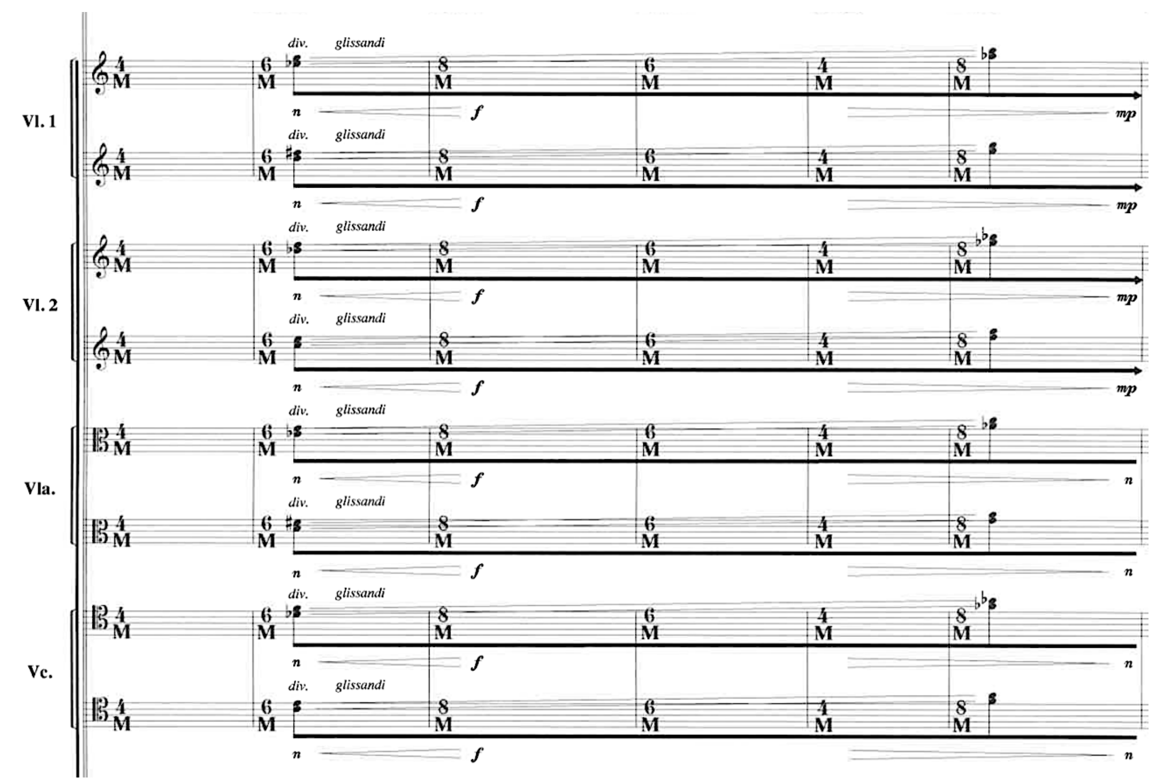
Note: This group of pitches is represented by normal order [6,8,9,E,0,2] and prime form (0,2,3,5,6,8). Pitches that form the solo violin's original trumpet theme statement are circled.

In addition to the six complete statements, Ives's trumpet theme is ever-present throughout the violin solo, with partial statements ranging from two to four of the five notes occurring regularly. Finally, McTee's frequent use of tuplets (particularly triplets) in the violin solo is likely taken from Ives's notably similar rhythmic treatment of the trumpet theme.

CHAPTER III – REPRESENTATIVE EXAMPLES OF TRANSCRIPTION METHODS FOR IDIOMATIC STRING TECHNIQUES AND COMPUTER-SYNTHESIZED SOUNDS

Transcription of Idiomatic String Techniques

One technique that is befitting of string instruments is the continuous, uninterrupted glissando. While this specific technique is achievable on certain wind instruments like the trombone, it is much more difficult to execute on others due to the physical "break" between half-step chromatic fingerings. There have been extended techniques developed for some wind instruments that achieve a glissando-like effect, but these are difficult to execute effectively, especially as longer gestures at slower tempos.



Musical Example 19 *Einstein's Dream*, mm. 168 – 72

Source: McTee, *Einstein's Dream,* 39.

The sixth large section of *Einstein's Dream*, "Celestial Bells," contains three extended glissandos for the strings. The second of these, shown in Musical Example 19, spans four measures and lasts a duration of approximately thirty-two seconds. Because extended glissandos are not idiomatic for the majority of wind instruments, recreating this event for an ensemble of winds requires the creation of a texture that does not prescribe glissando en masse, but rather which combines glissando with other techniques (Musical Example 21). The resultant sound is one that closely resembles the original.

The first step in recreating an ensemble string glissando for winds is to have the wind instruments that can execute a true glissando do so. In the wind ensemble, the only standard instrument that is able to execute a true glissando is the trombone. Because of this fact, it was decided that four trombones would be called for in the transcription to satisfy two requirements of recreating the ensemble string glissandos. The first requirement satisfied was the coverage of the tetrachord in divisi cellos, and the second was that true glissandos being executed by four trombones would greatly help to blend the "quasi-glissando" techniques being executed by the other wind instruments, and create a composite ensemble sound reminiscent of true glissando.

The "quasi-glissando" techniques of the other wind instruments take the form of quarter-tone scales. The quarter-tone scales are assigned to a quartet of flutes, a quartet of B-flat clarinets, and a quartet of saxophones, in order to cover the tetrachords that are present throughout the strings. The technique of quarter-tone scales was chosen because, although there is a distance between a pair of quarter tones, this distance is considerably smaller than the distance between two notes of the chromatic scale. Quarter-tone scales are able to be played on woodwind instruments because the fingerings employed are "weak," out-of-tune modifications of standard chromatic fingerings, that alter the pitch in such a way as to fill the space between two notes of the chromatic scale.

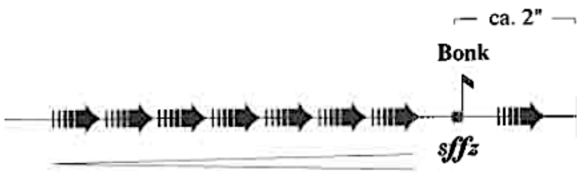
Transcription of Computer-Synthesized Sounds

Computer-synthesized sounds form a large and very integral component of *Einstein's Dream.* The majority of these sounds are notated in the score with arrows only, which indicate merely that such sounds are occurring at a given moment in the piece. Notation of rhythmic content is rare, and notation of pitch content is absent entirely. Occasionally, the composer will include dynamic indications or worded descriptions on the computer music staff, which serve as a more complete visual representation of the sounds. These more detailed notations serve largely as aural markers, to be used by the conductor as an aid in aligning the live music with the computer-synthesized sounds, as the sounds are recorded on compact disc, and the piece does not utilize timing devices, click-tracks, or software for its performance.

Correspondence with the composer resulted in the decision that the original computer music would be acoustically recreated in the wind ensemble transcription. Dr. McTee stated regarding the computer music: "I put enormous time and energy into colorizing and blending the instrumental parts to accompany the electronic music, I therefore have a hard time imagining another instrumentation [to accompany the electronic music]."[10] Because of this, she suggested that "a wind and percussion version [be created that] replac[es] both the string and electronic sounds [...] to avoid issues

[10] Cindy McTee, email message to author, June 29, 2023.

around blending instrumental sounds with the existing pre-recorded electronic music."[11] As such, in an effort toward achieving an ideal ensemble blend with setting music for a new medium, it was agreed that the computer music would be acoustically recreated with instruments inherent to the wind ensemble medium.

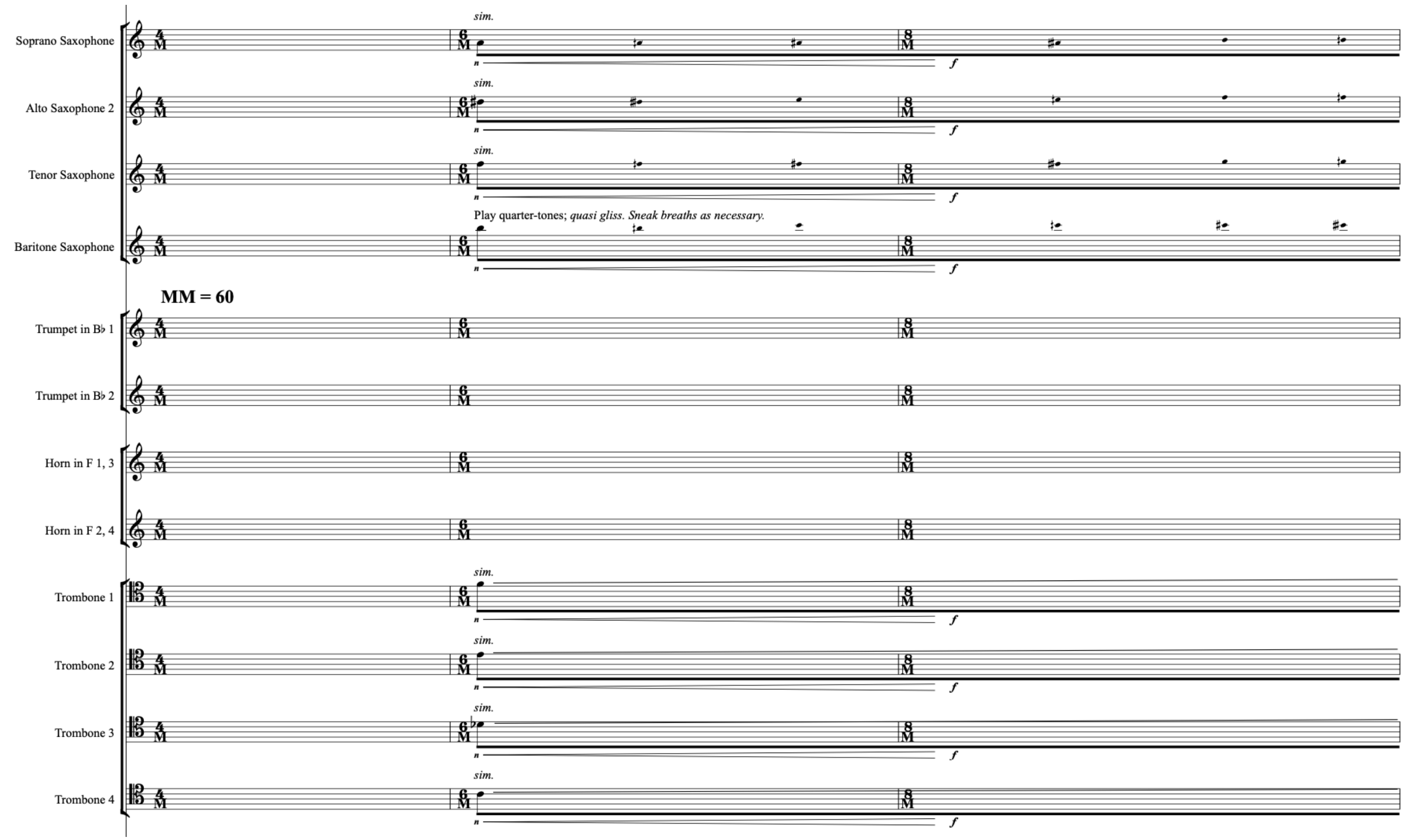


Musical Example 20 Computer music, m. 37 from *Einstein's Dream*

Source: McTee, *Einstein's Dream,* 7.

Because the notation of the computer music in the score is minimal, due to its purpose as a guide for the conductor, transcription of the sounds for acoustic rendering had to be completed largely by ear. One of the principal tasks that had to be completed for each computer music event was that an instrument needed to be chosen that could recreate a given timbre, register, and/or pitch. Much of the computer music was recreated with percussion instruments for two primary reasons: the nature of timbres presented in the computer music, and the wealth of timbral possibilities available from the modern percussion arsenal. Another principal task in recreating the computer music was understanding the amount of time (in seconds) that each event occupied, and then either convert that timing into conventional rhythmic notation that fit into a meter, or notate the sound as a timed event in seconds. Other musical aspects that had to be aurally dictated include dynamic levels, dynamic shapings, and articulations.

[11] McTee, email message to author.

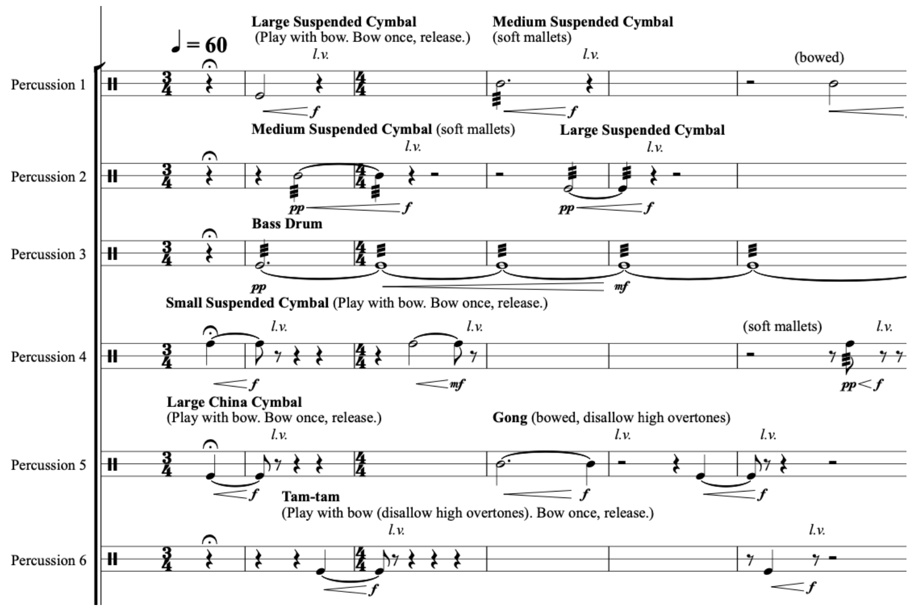


Musical Example 21 *Einstein's Dream* project transcription, mm. 167 – 9

Note: This example shows the pairing of glissando in Trombones 1 – 4, and "quasi-glissando" by way of quarter-tone scales, in soprano, alto, tenor, and baritone saxophones.

Section I: Warps and Curves in the Fabric of Space and Time

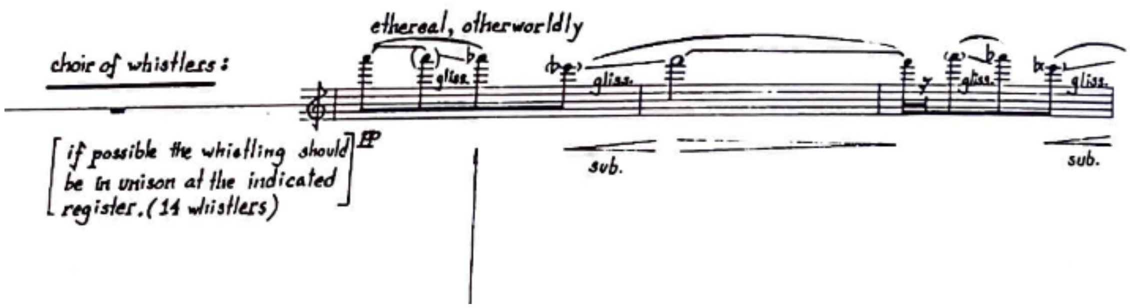
The computer-synthesized sounds that set the stage for and accompany the complete harmonization of “Wir glauben all an’ einen Gott” have a timbre that closely resembles bowed cymbals, gongs, and tam-tam



Musical Example 22 *Einstein’s Dream* project transcription, mm. 1 – 5

The expansive array of instruments employed in this section is primarily to cover the considerable number of variations in pitch of the bowed sounds present in the computer music. Additionally, instructing those players that are bowing gong and tam-tam to “disallow high overtones” is also in an effort to achieve the goal of discernible pitch differentiation from the bowed percussion. If successfully executed, the lower fundamental of these larger instruments is able to be heard more easily.

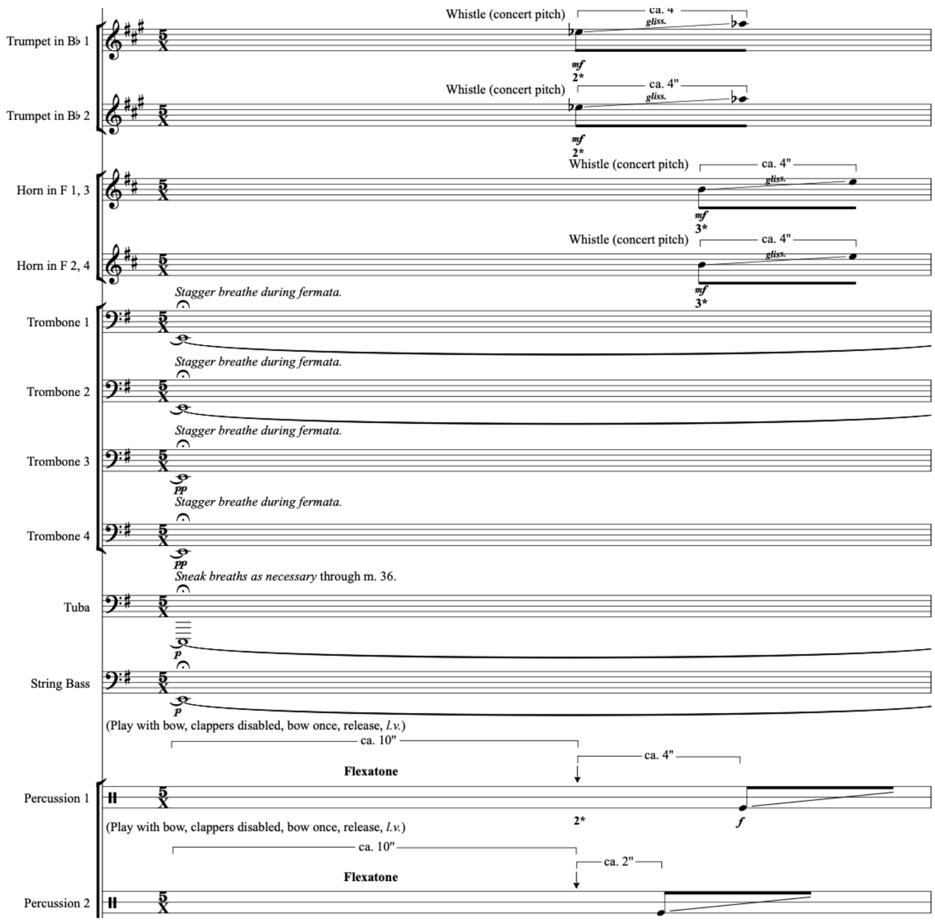
The final measure of “Warps and Curves in the Fabric of Space and Time” presents a pair of high-pitched glissandos from the computer music, alongside bowed glissandos from a pair of flexatones. The composer states: "I put enormous time and energy into colorizing and blending the instrumental parts to accompany the electronic music."[12] By extension, it is the composer's intent that the acoustic instrumental parts be at times aurally indistinguishable from the computer-synthesized sounds. As such, in the aforementioned measure, the composer likely intended for the high-pitched glissandos from the computer music to blend seamlessly with the acoustic glissandos from the bowed flexatones. In an effort to preserve the composer's intent and recreate the desired texture, players are asked to whistle in place of the synthesized glissandos. The success of employing this unconventional technique can be seen, for example, in the wind ensemble scores of Joseph Schwantner. These instances served as another inspiration for this choice.



Musical Example 23 *From a Dark Millennium*, mm. 26 – 9

Source: Joseph Schwantner, *From a Dark Millennium* (New York: Schott Helicon Music, 1981), 4.

[12] Cindy McTee, email message to author, June 29, 2023.



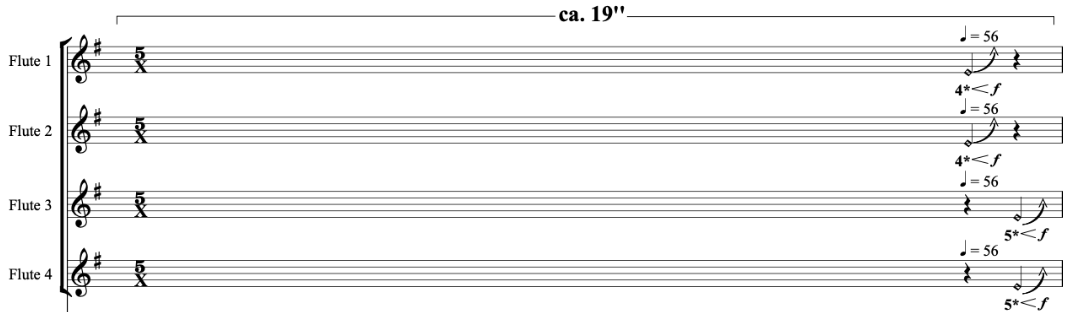
Musical Example 24 *Einstein's Dream* project transcription, m. 21

"Warps and Curves in the Fabric of Space and Time" culminates with a pair of computer music sounds that the composer describes in the score as "whooshes."[13] These sounds emulate a sudden and quick movement of a high volume of air. Their timbre is also somewhat metallic and mechanical. Additionally, there is a notable difference in pitch between the two sounds, the first being higher than the second. In order to recreate the timbre and difference in pitch, scraped China cymbal is followed by scraped tam-tam, and combined with a pair of jet-whistle effects in the flutes, each of which is notated with a slightly different pitch contour. Composer Frank Ticheli's description of the jet-whistle

[13] McTee, *Einstein's Dream*, 4.

effect makes it seem an appropriate solution in recreating these whooshing computer music sounds:

> The jet-whistle effect is achieved by covering the blow-hole of the flute entirely with the lips and blowing as hard and violently as possible into the instrument, as though you are trying to blow out a hundred candles with one short and powerful burst of air. The resulting sound should resemble something like the sudden release of steam from a powerful engine. If players find themselves taking a full second or several seconds to release all the air from their lungs, they are not blowing with the proper force. The effect will only last a fraction of a second if done properly. There should be no attempt to sound any specific pitch.[14]



Musical Example 25 *Einstein's Dream* project transcription, m. 21

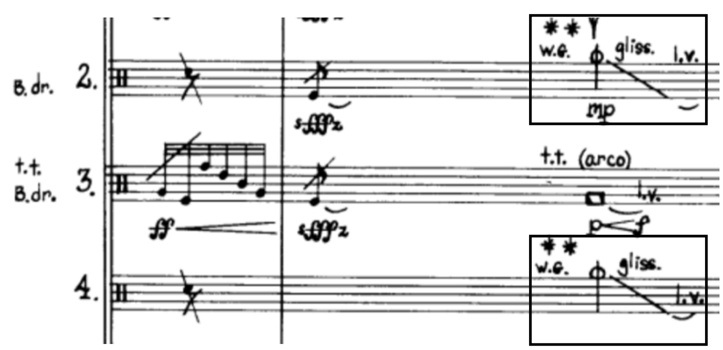
Note: This example illustrates the notation for the pair of jet-whistle effects.

Section II: Music of the Spheres

As with "Warps and Curves in the Fabric of Space and Time," computer-synthesized glissandos also appear in "Music of the Spheres." Those in "Music of the Spheres" possess a very different sound, however. The timbre of these sounds is not unlike the timbre of pitched gongs. As such, it seemed logical that these sounds should be recreated with gongs of some type. The logic of utilizing gongs was reaffirmed by the fact that the glissandos are of two distinct pitches, and this pitch difference could be rendered acoustically by using two gongs of different sizes.

[14] Frank Ticheli, *Angels in the Architecture* (Brooklyn: Manhattan Beach Music, 2009), Rehearsal Notes.

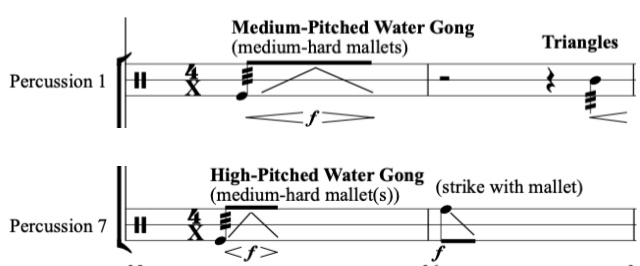
Achieving the inherent glissandos that are part of the gong-like sounds requires an unconventional playing technique whereby a gong is struck and then submerged in a tub of water. As the instrument is lowered into the water, a downward glissando is produced. Conversely, an upward glissando is produced as the instrument is raised out of the water. Because of the dampening of sound that naturally occurs as the instrument is submerged, some upward glissandos require the instrument to be rolled instead of struck so that vibration of the instrument is maintained while it is submerged. The necessity of rolling a gong to achieve an upward glissando is largely dependent on the size of the instrument being used. The use of "water gongs" in large ensemble contexts is evidenced again by the works of Joseph Schwantner:



Musical Example 26 *…and the mountains rising nowhere*, m. 1

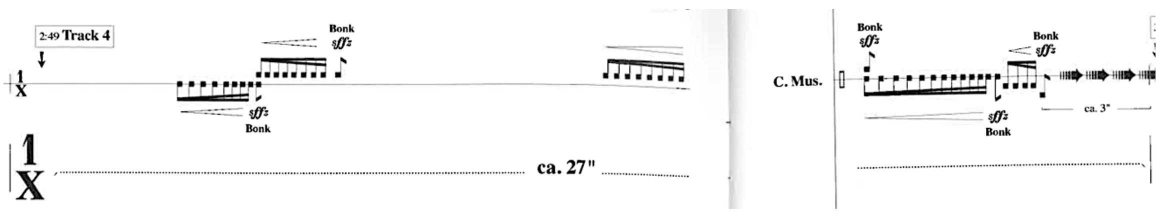
Source: Joseph Schwantner, *…and the mountains rising nowhere* (Valley Forge, PA: European American Music, 1977), 1.

Note: The water gong gestures are boxed.



Musical Example 27 *Einstein's Dream* project transcription, mm. 25 – 6

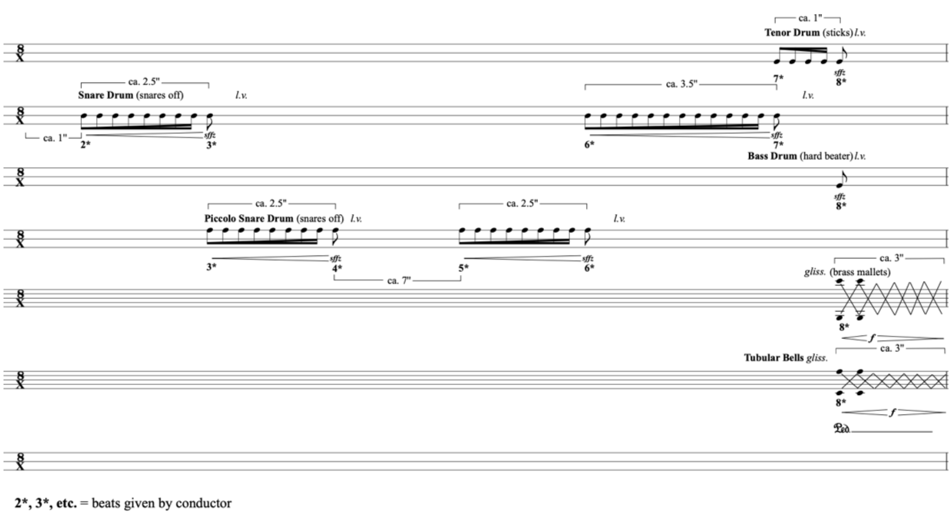
“Music of the Spheres” concludes with an extended measure of computer music that is characterized by accelerating rhythms. Because the original measure is a single gesture set in seconds, the notation of the recreated sounds was done as partitions of the measure’s total time amount. The sounds themselves mimic the timbre of membranophones. Similar to what McTee has done with much of the computer music that comes before, the sounds in this extended measure comprise three distinct pitches. For this reason, three membranophones were employed in order to display the differences of pitch.



Musical Example 28 *Einstein’s Dream*, m. 36

Source: McTee, *Einstein’s Dream,* 4-5.

Note: This example shows the measure from McTee’s original score – a single gesture of approximately twenty-seven seconds.



Musical Example 29 *Einstein’s Dream* project transcription, m. 36

Note: This example illustrates how the measure was partitioned to total approximately twenty-seven seconds. This was facilitated by a modification of the meter to include eight beats from the conductor.

Section III: Chasing After Quanta

One computer music sound that is first heard in "Chasing After Quanta" is what the composer describes as "Granulated Speech Sounds."[15] In the preface to the score, McTee provides further information regarding these specific sounds: "a palette of computer music sonorities derived from a recording of DSO Artistic Administrator, Victor Marshall, reading, 'I require the clear constructions of Bach.' Using granular synthesis software, the words are broken up into a myriad [of] particles and rearranged to create a texture in which the words cannot be understood."[16] The words have been reduced to sound "grains," and the sound event is characterized by saturating its texture with an innumerable amount of these grains. The grains themselves are lightning-fast and razor-sharp.

To reproduce this texture, certain instruments and playing techniques were chosen that would have crystalline articulation, as well as timbres that were very dry and direct. The chosen complement includes a combination of multiple cabasas, as well as suspended cymbals and timpani heads being struck with wire brushes. Because the sound event possesses a clear contour of rising and falling in pitch, the suspended cymbal and timpani parts are notated purposely in a way to reproduce this contour, by having the players use three suspended cymbals of different sizes as well as five timpani, respectively. Because later occurrences of this sound event are modified slightly by the composer, it was decided to augment these later occurrences with guiro and snare drum also struck with wire brushes.

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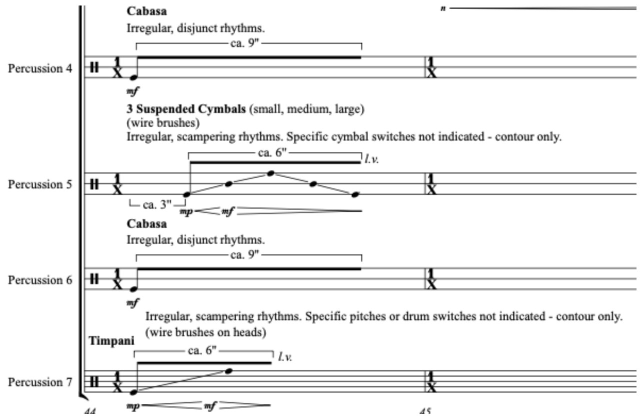
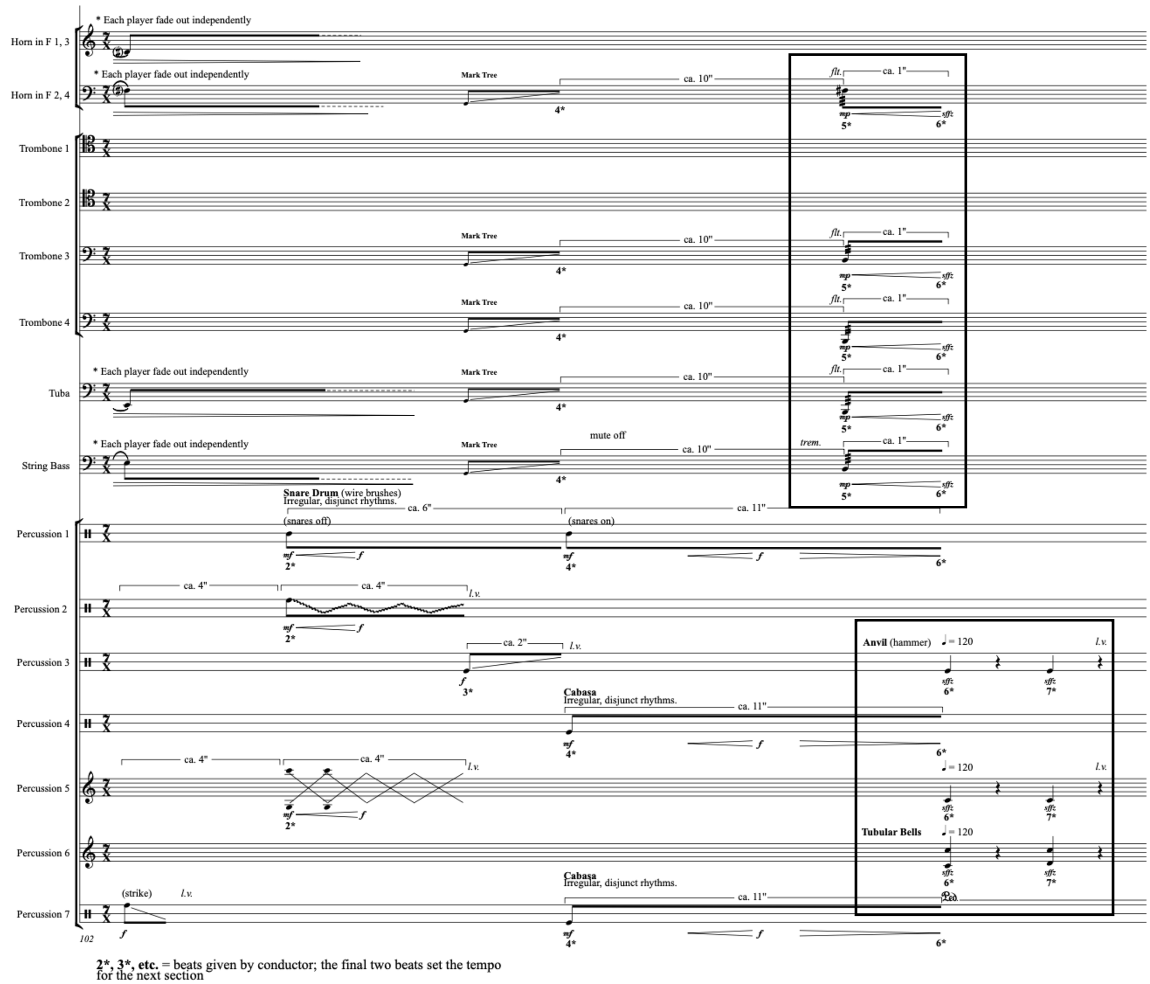
[15] McTee, *Einstein's Dream*, 11.
[16] Ibid., Program Notes.



Musical Example 30 *Einstein's Dream* project transcription, mm. 44 – 5

Section IV: Pondering the Behavior of Light

Shown in Musical Example 31, the final measure of "Pondering the Behavior of Light" introduces a new computer-synthesized sound that resembles a high-performance engine being revved. The event is brief, lasting for approximately a second from beginning to end. It is characterized by a guttural timbre, and a rapid increase in energy and volume. Each time the sound occurs, its sudden release is marked by the ringing of bells. Additionally, the sound always possesses a definite pitch. Because of the guttural timbre, the instruments chosen to reproduce this sound are the brass and string bass, who are instructed either to flutter tongue or perform a rapid tremolo on a single pitch. The ensuing bells, on the other hand, are recreated in their various guises through an amalgam of metallic percussion: a pair of triangles, anvil, crotales, glockenspiel, and tubular bells. These "bells" also always possess a definite fundamental pitch, assigned to the pitched instruments among the amalgam of metallics.

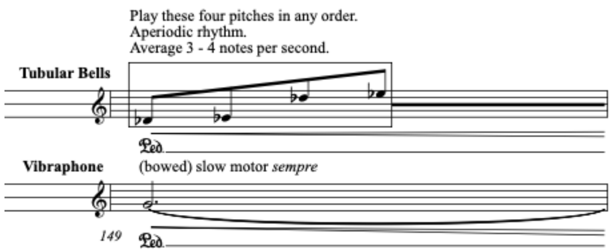


Musical Example 31 *Einstein's Dream* project transcription, m. 102

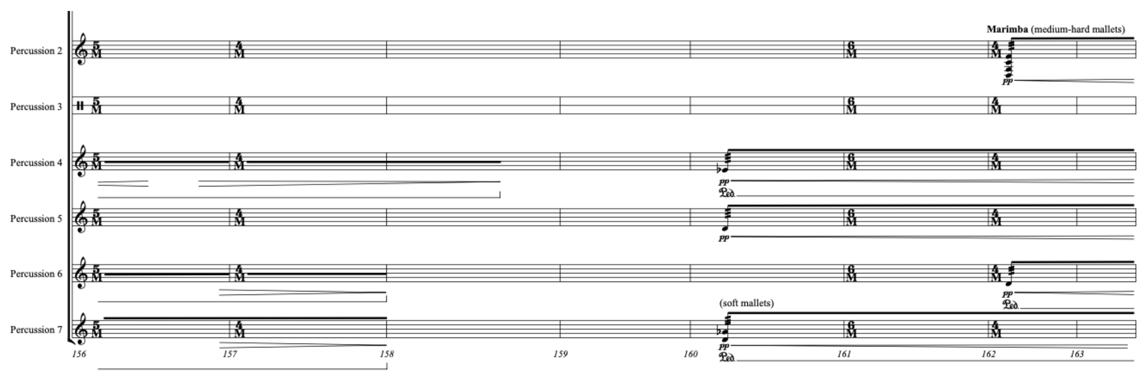
Note: The "revving" sound and ensuing "bells" are boxed. This example also illustrates how a timed measure is partitioned into multiple sound events.

Section VI: Celestial Bells

As the title of this section of music implies, the computer music is replete with sounds that emulate bells. The many bell-like sounds in this section are distinguished from one another by their respective timbres as well as pitch. Due to the need to recreate definite pitches, pitched percussion instruments were used exclusively. A number of these bell-like sounds were indistinguishable from the timbre of tubular bells. Additionally, multiple layers of this timbre at times occurred simultaneously, requiring two racks of tubular bells for their reproduction. The selection of other instruments was largely dictated by the register of each pitch in question, as well as by the number of audible overtones present in a given sound. For example, bright, higher-pitched sounds with many audible overtones could be reproduced with glockenspiel. Conversely, duller, lower-pitched sounds with less audible overtones could be reproduced with marimba.



Musical Example 32 *Einstein's Dream* project transcription, m. 149



Musical Example 33 *Einstein's Dream* project transcription, mm. 153 – 63

Note: Pitched percussion instruments shown (from top to bottom of the score) are marimba, glockenspiel, two racks of tubular bells, and vibraphone.

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