

Drama and Temporality of the Electroacoustics in Roger Reynolds' *The Angel of Death*

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Introduction

Roger Reynolds subtitled his composition *Odyssey* (1989-93) "an opera in the mind". However, form, time, and space are present in his works to such extent, that the "opera in the mind" epithet could be applied to all his compositions. Although this dramatic aspect can be expressed in an outward form onstage (for example *JUSTICE*, 1999), it is nevertheless more an inner affair than an outer one. The music of Reynolds is less concerned with communication than with offering the listener a new sensory and intellectual experience. In his own words, the composer's goal is to "to reveal something not previously known, to put forward occasions for unfamiliar experience to any listener, even one who shares little in common with him".¹

For this reason, we will approach the electroacoustics in *The Angel of Death* via its use of drama and time. Drama here is used in its original sense, meaning action. The term drama in a musical piece can be defined as that which requires action, acting, movement, rhetoric, discussion, etc. Analyzing a work from the dramatic standpoint means assessing not only the aesthetic power of the musical events, but also examining their expressive force and their formal role within the entire work. Reynolds never uses electroacoustics in a composition without good reason. The electroacoustics are never there for purposes of sweeping musical dust under the carpet, nor are they some sort of outgrowth. They are not there to beef up the harmony and the timbre, or reinforce the instrumental section. Their use is always justified by expressive and formal needs. They are essential to the drama of the work. In fact, they often are the main actor.

The term "temporality"² in the present context is taken in the phenomenological sense of time consciousness. Paul Ricœur defines temporality as "the temporal aspect of a virtual experience of the being in a world proposed by the text".³ Therefore we may define the temporality of a musical composition as the experience of time that comes into being through the tension between the self and the various time scales of the work. In Reynolds' music, the electroacoustics are always deeply involved with the formal conception and the time consciousness of the work. Whether by means of modification techniques and the restructuring of the perception of time, or by stretching time out, the electroacoustics modulate, constrain or transform the way the listener experiences time.

1. The Role of Electroacoustics in the Dramatic Aspects of Some Works by Reynolds

In the sixties, Roger Reynolds began to incorporate electronic elements in some of his compositions, either sound recorded on magnetic tape (*A Portrait of Vanzetti*, 1962-63), or live electronics processing (*Traces*, 1968) or a combination of various techniques as in *Ping* (1968). The electroacoustic music cycle *VOICESPACE* (1975-86) was the starting point for some profound soul-searching on the role of space in sound. Roger Reynolds' electroacoustic output may be divided into three main periods (see Appendix), which sometimes overlap, depending on the technologies employed:

- The first period used live electronic processing and/or analog synthesis. This period starts

¹ Roger Reynolds, A perspective on form and experience, *Contemporary Music Review*, 2(1), London, Harwood Academic Publishers, 1987, p. 280.

² In this text, temporality is taken in the sense of time structure. [Translator's note]

³ Paul Ricœur, *Temps et récit II, Le temps raconté*, Paris, Seuil, 1985, p. 151.

with *Ping* (1968) and ends with *Sketchbook* (1985).

- The second period is characterized by the use of digital synthesis. It begins with *...the serpent-snapping eye* (1978) and goes all the way to *The Angel of Death* (2001). In most of the cases, the electroacoustic component was made up of instrumental sounds that had been recorded and digitally processed.
- From the compositions *Watershed III* and *IV*, Reynolds began to use computer-controlled real-time spatialization. In several recent compositions, *JUSTICE*, (1999) *....brain ablaze... she howled aloud* (2000), *Process and Passion* (2002), this technology was to be increasingly present, along with computer-generated sound.

Whatever the technology used, the electroacoustics in these compositions became an integral part of the drama, in the words of the composer, when speaking of the *VOICESPACE* cycle: "a theater through the mind's ear."⁴ Several examples illustrate this dramatic aspect.

Traces (1968) was composed for piano, flute, cello, live electronics and six-track magnetic tape (three stereo recordings, each played over its own sound system). The title of the composition refers to the idea of a vestige (a sign, a mark, a line, etc.) of something that belongs to the past. It also evokes the traces that are left in memory and that bring back, to a greater or lesser degree of precision, events, images and sounds of past perceptions. In this composition the flute, the cello, and the recording correspond to the traces left by the piano part. The latter is made up of nine virtuoso propositions⁵ that structure the piece into three groups each having three short sections. The "traces" left by the acoustic instruments and by the sounds on tape are not of the same type. Whereas the flute and cello are a direct extension of the pianistic material, the sounds on tape are a distant reflection of the traces of those instruments. The combinations of synthesized pictures are distributed over six independent tracks, and make up a rich and complex texture. In addition to the sounds recorded on tape, the piano and cello sounds are processed by a ring modulator (as in *Ping*, 1968 and *...between...* 1968). This treatment gives the piece its spectral and harmonic richness as well as an orchestral dimension. The most extended "traces" between certain movements generate a feeling of stretching out of the formal and temporal dynamic.

The "traces" that extend the fourth and seventh propositions by overlapping the following movements suggest that time in its very essence is not simply a succession of separate moments. It may also be the superimposition of traces of the past, of forgone resonance, of scraps of memory combined with "the reality" of the present moment.

Two compositions for solo instruments accompanied by four-track magnetic tape, inspired by Herman Melville's famous *Moby Dick*, rely heavily on the electronic element. The titles of the compositions are drawn from phrases in Chapter 36, *The Quarterdeck*, in which Ahab tries to incite the crew to hunt the white whale, a hunt that will lead them ineluctably to their tragic end. In the composition *... from behind the unreasoning mask...* (1975), magnetic tape symbolizes the mask (mentioned in the title), a mask behind which the two soloists — trombone and percussion — perform. The sounds on the tape (a compilation of often very violent transient attacks on varied objects performed and recorded by the composer) give the impression of an "irrational" monolithic force, and the musicians have to interact with it. As the composition moves forward, the music on the magnetic tape increases in density and intensity. The mask becomes more and more opaque. *... the serpent-snapping eye* (1979), for trumpet, percussion, piano, and four-track magnetic tape was the first composition in which Reynolds used sound

⁴ Roger Reynolds, Liner notes for the CD *Voicespace*, Lovely Music LCD 1801.

⁵ The piece was composed for the composer and pianist Yuji Takahashi.

generated by frequency-modulation digital synthesis.⁶ Three models were used in the creation of these synthesized sounds, and were also used in setting up the structure. Thus the three models can be said to determine the instrumental behavior of the soloists. In the first section, the instrumental part has to submit to and support the electroacoustic sounds. In the second section, the synthesized sounds are sparser, allowing the instruments greater independence. In the last section, the behavior of the instruments is both complementary to and independent of the electroacoustic component.

Personae (1990), a concerto for solo violin, chamber orchestra and computer-generated stereo or quadraphonic sound, carries strongly psychological and dramatic electroacoustic components. This composition is the third of a series of *concerti* begun in 1984: *Transfigured Wind II* (1984), for flute, instrumental ensemble, and quadraphonic computer-processed sound, and *The Dream of the Infinite Rooms* (1986) for cello, instrumental ensemble, and quadraphonic computer-processed sound and *Personae*. In these compositions, the role of the soloists goes well beyond that of mere concerto playing. The soloist material completely determines its own environment, not only in terms of pitch and rhythmic material, which becomes transformed into the music for the other instruments as well as for the computer, but also in terms of dramatics. The initial idea of *Personae* was to evoke a kind of imaginary theater in which there are four contrasting characters: the *Conjurer*, the *Dancer*, the *Mediator*, and the *Advocate*. These characters are depicted not only in their outer aspects but also at deeper, inner levels.⁷ The four occurrences of the soloists represent the four characters, with the last character restating certain attributes of the three other characters. Each solo section is "followed" by a response from the orchestra, which in turn is followed by a "temporal echo" from the electroacoustic part. The responses and "echoes" are intended to evoke the deeper layers of the personality. Whereas the first series of soloists/responses/echoes possesses a conventional character, the following series go further and further afield. Thus the second solo overlaps the first "echo", the second "echo" comes before the second response, and the third echo comes before the third solo and the third response. This formal structure gives greater thickness to the psychological aspects of this shadow theater, by introducing an unconscious level that in some ways is akin to premonition.

Thus for example, the fourth violin passage is preceded slightly by its own electronic echo. The latter is made up of a long line of elements in perpetual metamorphosis gathering together several references to the first three solo passages. Here, the electroacoustic materials embody anticipation as well as remembrance.

The electronic parts of the string quartet *Ariadne's Thread* (1994) fulfill a particularly important role from both sonic and dramatic standpoints. It was created using the UPIC⁸ system developed by Iannis Xenakis in 1977. The UPIC system allows the user to create musical textures from lines drawn on a large graphics tablet. The piece should therefore be thought of as a study of lines, in which all the various waveforms, electronic textures, and melodic material are derived "in a direct line" from graphic elements. Reynolds chose as his graphic sources seven drawings from artists as diverse as Rembrandt, Klee, Matisse, Pollock, and Jasper Johns. For example the drawing by Johns, made up of a series of strokes possessing contradictory angles and segments, was modeled in such a way as to generate a series of sliding textures that have to be played by the

⁶ *Eclipse* (*Voicespace III*, 1979) is Reynolds' second composition created using this technique, which was developed by J. Chowning. The composition is dedicated to the pioneer of digital synthesis Max Mathews.

⁷ Each character is depicted not only by classes of pitches, rhythms and temporal proportions, but also by a kind of code of behavior that shapes the nature of the musical material and determines how it is performed. Thus the magician's solo is eccentric and extroverted, climbing up to great heights in pitch.

⁸ Unité Polyagogique Informatique at the CEMAMu founded in 1965 by Xenakis.

quartet and by the electroacoustic component. The title of the piece of course refers to the thread that Ariadne gave to Theseus to help him find his way out of the labyrinth after having conquered the Minotaur. This myth serves as the source for the global structure of the composition. It is made up of three layers. The first layer represents the thread, most particularly the seven-stage path through the labyrinth.⁹ It is continuous and is musically carried by the quartet (as a specific entity). Theseus' journey through and out of the labyrinth is represented metaphorically by the main melodic line, which retrogrades from the fourth section onwards, this section representing the center of the labyrinth. The second layer is made up of four solo parts intended to reflect the psychological makeup of the main characters.¹⁰ None of the solo parts is used in the fourth section. The third layer is made up of sparser electroacoustic passages. It is intended to evoke the effect that the labyrinth has on the mind. The electroacoustics here fulfill several roles, from accompanying the instrumental part to outright contradiction of it. The second section of the electroacoustic part, the main role of which is to color the spectrum and intensify the feeling of "pressure", remains relatively withdrawn. By contrast the fourth section intervenes brutally, making its presence powerfully felt in the quartet by the weight and the density of the sliding textures. The sixth passage in the electroacoustic part, at the end of the sixth section, sets up a question-and-answer relationship, on an equal footing with the quartet. In each and every case, Reynolds was able to take advantage of the strengths and weaknesses of the computer, bending them to his expressive requirements. The glissandi and the massive sounds of the UPIC system — which might easily have allowed Xenakis' strong creative personality to shine through — are in fact totally integrated into Reynolds' aesthetic and into the composition's dramatic aspects.

In Reynolds' music the use of electroacoustics is not there to set the music off, or as a cover-up. Its presence is always justified structurally, temporally, harmonically and/or timbrally. It always plays a major role in the dramatics of the work. In this theater for the ear, the electroacoustic part constitutes a character, a persona in its own right, that lives, moves and has its being on its own terms, expressing itself with its own voice, never ceasing to forge strong links with the other characters, who are carried by the instrumental section. It lends weight to both the musical and the psychological dimensions. Let's examine the role of the electroacoustic component in the dramatic workings of *The Angel of Death*.

2. Electroacoustics: A Key Persona in the Dramatics of the Work

The poetic element in *The Angel of Death* is built on two contradictory ideas —*fate*¹¹ and *respite* (or fate being held in abeyance). These ideas play a large part in the aesthetic and technical choices that are made during the creation of the computer layer. In his sketchbook, Reynolds refers to the Etruscan civilization with regard to the notion of fate, and to the myth of Asklepios with regard to the notion of respite, or that of a second chance, an alternative way. [Lien vers article OTHER(S), pp. 4-5] Fate signifies the inevitable future, notably death, but it is in a manner of speaking countered by the possibility of respite. From this standpoint, the Angel in *The Angel of Death* symbolizes both fate and the guardian Angel, the protecting Angel, the one who extends life or even gives it. The Angel in *The Angel of Death* is not the mover of stars

⁹ The seven sections are: I "Finding the path", II "Pressing inwards", III "Animated line", IV "Extremity", V "Exuberant line", VI "Desperate line", VII "Line desire".

¹⁰ In order of appearance: second violin "The memory of Ariadne", cello "The intention of Theseus", viola "The anguish of the Minotaur", first violin "The anticipation of Dionysus".

¹¹ When Reynolds began to compose *The Angel of Death*, he would certainly still have been feeling the effects of the death of his friend Toru Takemitsu a year earlier (1996). Earlier deaths, that of Feldman (1987) and of Cage (1992), as well as the illness of Xenakis would no doubt also have added to the gloominess of his thoughts.

according to the Aristotelian idea, nor is it the fallen Angel, Satan, nor is it the announcer of the Apocalypse. Rather it is a messenger, a representative of a higher will that may decide whether life is to be extended for a while.

The metaphor of the Angel belongs to the electroacoustic part of the work not only from the standpoint of its position in time but also of its content. The piece is made up of two halves: *Sectional* and *Domain*, which can be presented in either order according to the version used. Whether the version is S-D or D-S, the electroacoustic part always appears in the second half of the piece. The electronic sounds come down and stretch out, like a shadow or a cloud, over the instrumental parts. In *The Angel of Death*, the same stages (containing the same material) are gone through twice: the first time in a separate and divided manner, the second time in an organic and continuous way. This constitutes the very essence of the piece: the opportunity to begin again, to reassess an experience, like the serpent Asklepios appearing in a dream (another metaphor that belongs to the electronic element) for the purposes of giving life. So fatality can at least be pushed back if not conquered. Whether an angel of death or a guardian angel, whether fatality or respite, *The Angel of Death* shows the same being or the same state of being from two different angles — *Sectional/Domain*, like Janus, the god of change and transition, but also the god of vigilance. This notion is reflected in the idea of an attentive audience, a god who at once looks before and behind, left and right, down and up, inwards and outwards, and who weighs up the pros and the cons.

Reynolds above all wanted to create an electroacoustic layer that would be perceptually very distinct from the instrumental parts. The ghostly world of the electroacoustic part constitutes an extra current that cohabits alongside the real world of the instrumental music, but does not become one with it. Thus the electroacoustic part creates a counterweight to the instrumental part, a parallel world, sometimes submerged, at other times distinct, sometimes even dominating the instrumental ensemble. And yet, this parallel world is not totally independent. The electroacoustic part weaves numerous links with the instrumental parts. The links between these two worlds are of varying and very different forms. They are based not only on the timbre, on the writing, on the way time is laid out, on the themes, but also on the performance.

As in most of Reynolds' mixed compositions, the electronic sounds in *The Angel of Death* are created exclusively from instrumental parts recorded by the performers.¹² Thus the thematic material is carried over to the computer-processed sound layer. This creates a distorting mirror relationship between the computer layer and the orchestra, which could open up an abyss between the performer and what is performed. The composer processes not only the sound, but also how the performers play. Computer processing takes on a new dimension, it becomes a reinterpretation of the gestures made by the players, creating new ways of handling time and timbre. As Reynolds himself stresses: "The performer's interpretive contribution can now become a composer's resource".¹³

This is a new form of variation that we could call "performer modulation". Preserving a common base between the live sounds and those played over the loudspeakers is a way of preserving unity while at the same time playing on the ambiguity of the sound streams, of the

¹² It is very striking that technological musical development in the 20th century shows a constant back and forth movement between the studio and the instrument, a symbol of the double need to process sound in-depth and preserve the life of instrumental sound. It is from this standpoint that Roger Reynolds approaches the problem of mixed compositions. While taking advantage of the stability of sound images stored on magnetic tape or computer disk, he also incorporates the interpretive quality of instrumental playing, and while using the power of computer processing.

¹³ Reynolds, Roger, "A Perspective on Form and Experience", *op. cit.*, p. 286.

timbres, of the transformations and the positions in space.

Thus the sources of the electroacoustics of *The Angel of Death* are drawn from recordings of instrumental sections, to be more precise, recordings of the thematic materials (the five "themes").¹⁴ Some of the themes were recorded by instrumental family (woodwinds, brass, percussion instruments, and strings). The core of each theme was also recorded separately, and then all the samples were processed via their spectral and temporal components, and finally edited and mixed (Reynolds calls the results "images"). After this they were stored on hard disk and triggered from the control room in the theater by a technical assistant during the concert. The electronic material was played over an "orchestra" of six loudspeakers:

- two frontal speakers (1, 4),
- two additional but more distant frontal speakers (2, 3)
- two rear speakers (6, 5).

Thus if we move in a clockwise direction from the front left loudspeaker (1, 2, 3, 4, 5, 6) a circular trajectory is created. [lien vers graphique spatialisation article Roger] Each image in the electronic layer consists of a prepared mono sources that is spatialized in a particular. Some of the images contain many layers (S7, for example, contains 30 simultaneous layers). These are reproduced over six independent channels.

So it can be said that the electroacoustics have an interdependent relationship with the instrumental part. The fact that they are projected in separate layers affords them a certain freedom in space and time while nevertheless maintaining audible separation of the sound streams. They are related to the instrumental part by virtue of the source material, of the writing processes and the various transformations, and this makes it possible for the electroacoustics to weave a network of relationships of anticipatory play and mnemonic elements. The composer has an advanced degree of control over this network of relationships thanks to a formal concept that is set up before a single note ever gets written.

3. The Role of the Electroacoustic Layer in the Formal Concept

We will not describe here the formal design of *The Angel of Death*. Suffice it to say briefly that the composition has two halves — *Sectional* (S) and *Domain* (D)— and that these two halves have themes in common, themselves in fact being formal units each made up of several sections — as well as certain non-thematic elements, processed differently. The first degree of transformation between S and D is concerned with instrumentation. The instrumental ensemble in D plays the themes that are played by the solo pianist in S and vice versa. A second level of transformation is concerned with the kind of writing that is applied to the two halves. Whereas in S the boundaries are clearly marked and circumscribed, in D their identity is challenged on several levels. It is as if each half is viewed through the same camera lens, but with a different adjustment, so that what is sharply focused in one place may be fuzzy elsewhere. The writing in S is more homogeneous, more purposeful, whereas in D it has greater variety, allowing the various types of material to fuse together. Only the core elements of each of the themes are identical in the way they are written (the instrumentation is different).

The electronic part is made up of 10 independent sections,¹⁵ distributed in a sequential way in the formal plan. Each image is described precisely, with drawings concerning the processing, the text or the movement in space. Various techniques of *sound processing* are also used, such as time expansion and compression, transposition, algorithm modification and

¹⁴ The thematic material was recorded in the ensemble version by the Sonor Ensemble and then in the piano version by Jean-Marie Cottet.

¹⁵ Originally, there were 11 images. Image S3 — *Staggered Convergences* — was discarded.

filtering.¹⁶ The computer part maintains the separation between S and D. The 10 images are divided into six D images totaling 11'36" and 4 S images totaling 4'42". Thus the D sections make use of time expansion more often than S, and all in all, they are more stretched out than the S images. In this way they emulate the behavior of D in which the material spreads out to a considerable degree, making the sections overlap. In the D2 image, there is a fragment of the first theme, played by the piano that progressively slows down. Towards the middle part of the image, the orchestral version of this theme fragment is played backwards, progressively accelerated and given a circular movement in space.

Most of the D images are set out in layers. Image D9 for example, comprises two independent layers giving the impression of drifting, floating masses. Conversely, the S images are often made up of succeeding or alternating fragments borrowed from the theme materials. For example, S11 is an irregular back-and-forth movement between the piano and the instrumental ensemble, starting out from parallel segments, as well as continuity breaks generated by unexpected octave jumps (8/16^{va} or *bassa*). S4 is a mosaic of brief instrumental gestures (runs, chords and melodic lines) that spring up unexpectedly. The alternation between homogeneity and heterogeneity, which constitutes one of the ways that S and D may be distinguished, is also to be found in the S and D computer images, but applied differently. Whereas most of the S images contain fragments from various themes, the D images draw their material from more concentrated sources. D10 and S7, which respectively begin and end the electroacoustic part, provide an example and are respectively the images with the highest degree of homogeneity and heterogeneity. The table below shows the name, the duration and the source material of each image (the images are listed in their order of appearance in the composition).

Table 1. The 10 electronic images. [Lien vers fichiers sons]

Number	Name	Duration	Source material (theme.subsection)
D10	<u>Ghostly Expansion</u>	2.10'	T3.2
D6	<u>Dematerialization</u>	2.10'	T5.1
D5	<u>Formulation/reformulation</u>	1.40'	T5.1
D1	<u>Other</u>	2.41'	Other (non-thematic material)
D2	<u>Reality Mirror</u>	1.15'	T1.6
S11	<u>Sudden Displacement</u>	1.05'	T3.1, T3.2, T5.4, T3.3, T3.4
S4	<u>Iconic Gesture</u>	1.10'	T2, T4
S8	<u>Centrifugal Explosion</u>	0.47'	T1.3, T1.2, T2.6, T4.1, T4.5
D9	<u>Drifting Masses</u>	1.40'	T.5.5
S7	<u>Vertiginous Continuity</u>	1.40'	T2.4, T3.3, T2.2, T2.4, T2.5, T2.6, T1.9, T4.5/6, T1.1/3, T4.1, T4.7

In deciding the order of the images, the composer took into account the relationship between the thematic materials included in them and the material played by the instrumental section with which they co-exist. The first image group (D10/D6/D5) comprises relatively long images, with a fairly calm atmosphere. The source material comes from Themes 3 and 5. At this juncture, the computer fulfills the role of initiator, by giving a forewarning before the appearance of each of these two themes in the second half of the piece. Then comes the D1 image, *Other*,

¹⁶ The following sound processing software was used: *Audio Sculpt*, *SVP*, *Sound Hack* and Ircam's *Spat*. F. Voisin created a program in Lisp specifically for certain kinds of filtering. The editing was done using the ProTools audio processing and mixing software.

which is sealed off from the rest of the images, being preceded by a pause and played "a cappella". All these factors, taken together with the strong identity that this passage possesses, create a powerfully evocative effect. The familiarity profile levels observed in the audience during the real-time concert experiments go up drastically in this passage, showing that listeners recognized it clearly. [Lien vers expériences temps réel, SM]. The computer version of *Other* is followed by a group of three short images (D2/S11/S4). Although they differ in atmosphere, they possess a common acceleration/deceleration characteristic. The richness and variety of the source material, the computer processing (stretching, transposing, filtering, etc.) as well as the spatializing effects (circular movements) give this passage a definite psychological tension, a feeling of irrepressible forward movement, which leads it toward Theme 4. Analysis of the emotional force and familiarity profiles show that this passage is perceived as being rather unfamiliar (probably because of the transformation undergone by the material), but that it nevertheless produces strong emotions. [Lien vers expériences temps réel, SM]. Accumulating *ostinati*, possessed in common with image S8 and *RepStrat*, create calmness in the *Interlude*. Image D9, which unfolds together with Theme 5, also contributes to a quiet and ethereal atmosphere. Since the source material of D9 is drawn from the core element of Theme 5 (T5.5) it is as if the image were conceived both as an anticipation and a reminder of the "chorale" element. The emotional profile is one of the lowest in the entire composition, due to the extreme smoothness of this passage.

The last image S7 is heard in the raw without instruments. It is made up of 10 segments, whose source material is drawn from Themes 1-4, and its function is obviously a summarizing one. Curiously enough, the familiarity profile is neither particularly high nor particularly low. The emotional profile shows a clear increase as the image unfolds. This would seem to indicate that because of the transformation and fragmenting that it had undergone, the listeners only began to recognize the thematic material towards the end of the image. Then the meaning of the image becomes apparent to the listener — like one's life passing before one's eyes at the moment of death. This resulted in a very strong jump in the observed emotional profile.

Perhaps, however, the electroacoustic component makes itself felt most when it comes to time and space. The composition unfolds through three temporal layers: the piano, the ensemble and the computer. The additional electroacoustic layer — often divided into independent superimposed strata — possesses its own specific temporal quality. This can either be stretched out (as in the D images), or very concentrated (as in the S images). Consequently the overall texture can be modified, can be enriched, or can be blurred to a lesser or greater degree. The S4 image is an interesting example of the effect that electroacoustics can have on the overall texture of a passage, and how perception of the passage can be altered. S4 appears in the last third of the TR2/4 transition region that leads to Theme 4, continuing until the end of the theme. In the S-D version, the passage on which S4 is superimposed is built almost entirely on the piano part, the ensemble only coming in with the start of the T4 core element. This gives the impression of a kind of solo cadenza that flows out of the previous passage. The writing is so fluid that the change at T4 is almost imperceptible. In the D-S version, the texture in the parallel passage is much denser because both the instrumental ensemble and the piano are present, at least until the entry of Theme 4, when the piano falls silent. The source material of S4 is made up of eleven brief gestures (chords and runs) drawn from Theme 2 (8) and Theme 4 (3). Some of the gestures are played by the piano, others by the ensemble and still others are played by both. The sounds were subjected to several types of processing (SPIRLZ, transposition, stretching). Each gesture is played several times according to a numerical series (3, 4, 7, 11). Figure 1 shows how the items are distributed in the image, lasting 70.5 seconds (each line represents a gesture, and the vertical

lines represent the start of the gesture).

Figure 1. Distribution of source materials in computer image S4.

This distribution gives the impression of a very unpredictable mosaic of events. We can observe a strong concentration of events just before and after 20 seconds, with events becoming sparser between 40 and 60 seconds (from the start of Theme 4 up to its core element). This shows how much the composer wished to heighten the tension by building up the concentration of events at the end of the transition, and then to relax the tension when Theme 4 appears. This strategy is reinforced by the spatialization, with a rapid projection of each gesture (we might even say extremely rapid) from one loudspeaker to the other on circular and diagonal trajectories. Reynolds speaks of the image as a kind of scherzo [Lien vers le fichier son, S4 seul] of the instrumental gestures (in the pitch domain) and of the spatial gestures (in acoustic space). The thematic effect afforded by S4 is very different according to whether the S-D or D-S version is chosen. In the S-D version, [Lien vers le fichier son, S4 in version S-D from audio CD] the electroacoustics give the impression of being a heterogeneous — and sometimes rather disruptive — entity that goes skimming over the piano in an independent stream. The computer and instrumental sounds appear to oppose each other, or contradict or even avoid each other. In the D-S version [Lien vers le fichier son, S4 in version D-S from audio CD] even though it has the same image content, the effect is totally different. The overall texture here is extremely dense and the quality of the timbre is extremely rich. The electroacoustic part and instrumental parts are totally fused into each other, and they interact. This interaction between the electronically transformed gestures and the "natural" instrumental gestures is so developed that it creates startling sonic illusions. At times the listener has the impression that it is the instrumental sounds — and not the electronic ones — that are being spatialized. This passage in *The Angel of Death* shows the extent to which the relationship between electroacoustics and instruments, whether in terms of fusion or of segregation, makes it possible to obtain results that are totally different aesthetically. It shows that both versions are nevertheless aesthetically satisfying and that they start out from the same reality. It shows how much this relationship can influence the dramatics of the composition.

When the electroacoustics make their entry in the second part of the composition, the consequences are felt on several levels. The stretching out and the stratification of the D images are played off against the relative shortness and alternating patterns typical of the S images. Together with the unity or with the multiplicity — as the case may be — of the source materials, they build up a play of contrasts between homogeneity and heterogeneity. This play of contrasts takes on a very different meaning according to which version of the composition was chosen.

The 10 images are laid out and distributed in such a way as to reinforce and intensify the dramatics of the piece. The network of thematic relationships becomes much richer, and leaves room for a greater number of performing possibilities. Electronic processing injects ambiguity into the identity of the thematic elements. The play between anticipatory elements and "recall" elements plays with auditory memory in different ways, even though the elements in question have been fragmented and transformed.

The increase of density in a texture sometimes makes it hard for the listener to differentiate between the various thematic elements, but it is precisely this multi-stratification in space and in time that gives *The Angel of Death* its richness. Finally, the relationship between the electroacoustics and instruments can produce very differing results according to the version being used, and can bring about a considerable modification of the way time and space are perceived.

The use of the electroacoustics provokes fundamental changes in other dimensions as well. Processing through transposition, filtering, time stretching or time restructuring transform the music in a way that goes beyond the simple piano/orchestra dialog, and also changes the way the music is written for the instruments. In the following pages, we will examine how the sound is processed by “cut-up” and phase-vocoder techniques.

4. Cut-up Techniques: Time Restructuring

In 1920, at a Surrealist meeting, Tristan Tzara offered to write a poem by pulling words at random out of a hat. In the Fifties, the painter and writer B. Gysin had the idea of mixing up words and texts from cutouts and collages. The “cut-up” technique was born. It became famous when William Burroughs used it to create a literary form in its own right. Not only did Burroughs take narrative conventions inherited from traditional literature and blow them apart by systematically destroying the established order, but in addition cut-up became an instrument for the social critique of the American "air-conditioned nightmare". Fragments stolen from reality (extracts of press articles, of cheap novels, of books popularizing science, etc.), by breaking down language structures, made it possible to challenge the power of words and images as used by the establishment. John Cage from the Fifties onwards developed the musical equivalent of this procedure. Thus *William Mix* (1952) was created as a collage of 600 pieces of magnetic tape containing urban, natural, electronic and other sounds. The material for *Fontana Mix* (1958) came from fragments of tape salvaged from the Milan studio. *Fontana Mix* can be performed alone or together with compositions such as *Concert for Piano and Orchestra*, *Aria*, *Solo for Voice 2*, or *Song Books*. Cage composed other pieces using material from *Fontana Mix*: *Water Walk*, *Sounds of Venice*, *Theatre Piece*, and *WBAI*. Today this practice has become common in popular music and has lost its subversive character. Techno music commonly uses salvaged material, hybrid mixing, and "hijacked" elements. Although they do not use aleatoric techniques, today's DJs have taken over cut-up and musical fragmentation techniques, thanks to mixing and sampling technology.

The cut-up technique as used by Reynolds from the Eighties on, makes a very different impact. The first difference in comparison to the collages of Cage is on the material level. Reynolds does not recycle musical styles. The cut-up techniques are only carried out using material that belongs to the composition itself. Therefore, this is not a collage technique in the Surrealist sense of the word. The second difference is on the technological level. In analog technology, cutting up bits of magnetic tape and sticking them together already represented an extreme form of utilization. But in the case of digital technology, cutting and pasting became much more versatile. As Reynolds himself states: "In the digital domain, however, segments may overlap, be multiplied, be kept in their original state, or the duration of the segments used may be modified; it is possible to create networks of a hitherto unknown — but nevertheless relevant — perceptual complexity in which sounds recall themselves or other sounds."¹⁷

The third difference lies in Reynolds' refusal of aleatoric techniques. Although certain of his compositions in the Sixties do occasionally leave some freedom for the performer, Reynolds prefers to maintain firm control over his writing. And although it is true that certain extreme forms of transformation may create elements that resemble random effects, the procedures for generating them are perfectly quantified and controlled by digital technology. In this regard, cut-

¹⁷ Roger Reynolds, “Réaliser une expérience musicale“ in *Quoi ? Quand ? Comment ? La recherche musicale*, Tod Machover, ed., Paris, Christian Bourgois Editeur/IRCAM, 1985, p. 252.

up techniques as used by Reynolds are closer to the mathematics of Oulipo¹⁸ than to the poetry of William Burroughs.

In Reynolds' music, time restructuring is carried out using "editorial" algorithms: SPIRLZ and SPLITZ.¹⁹ These may be applied to instrumental fragments (*Vertigo*, 1985) or they may be used on vocal fragments (*The Vanity of Words*, 1986). These two algorithms make it possible not only to cut the source up into separate segments and reorder them in time, but also to apply temporal envelopes to them.²⁰ The goal of this kind of processing is to broaden the way the composer uses time, to attain a new ideal level of formal control in structuring the original source material. The end result might be considered as a structural modulation of musical time. So the goal of an editorial algorithm is to make the material proliferate, to reconstruct the way it is laid out in time, in response to certain artistic requirements. The edited results will be longer than the original, and can bring about structural change with a very high degree of control. The structure of the original material and the structure of the editorial algorithms interact with each other. However, even though the algorithm's structure has a tendency to dominate the material, Reynolds strives to maintain a certain balance between the two, so that the original identity of the material will not be lost.

The SPIRLZ algorithm treats the material as a series of equal adjoining segments. It rearranges the segments in time, by beginning somewhere in the middle and then progressively stringing together segments taken alternatively before and after those that have already been used. This operation is carried out in several cycles by the algorithm. The composer sees this operation as being a kind of spiral restatement of the original material. The size of the segments being rearranged may be changed at each cycle in order to give the impression of acceleration (convergence, granulation of the material) or of deceleration (divergence, reconstitution of the material). The output consists of a single stream, the segments being placed end to end.

Figure 2. Transformation process by the SPIRLZ algorithm.

The S8 *Centrifugal Explosion* image is an example of the SPIRLZ algorithm. The image occurs in the *RepStrat* region. The latter acts as a transition between T4 and T5, as well as carrying out the dramatic function of a "distracting influence" so as to create an effect of surprise. It begins after the 9-second silence following T4, and then suddenly stops, giving way to the calm atmosphere of *Interlude*. No direct link exists between this passage and the thematic material, apart from the pitch resources themselves. *RepStrat*'s main texture is made up of repeated notes in rhythmical patterns. The main impression given by this passage is one of rapidity, velocity and discontinuity. When *RepStrat* returns during the second part of the composition, the impression of rapidity and above all of acceleration is vigorously reinforced by the S8 computer image. Five layers are built up in S8, each layer possessing its own source material (T2.6 + T4.1 + T4.5 + T1.1 + T1.2). [Lien vers fichier son S8 seul] The resulting spinning and speeding up, created by SPIRLZ, as well as the accumulation process, brings about a dramatic intensification of the *RepStrat* region, itself the result of an accumulation of ostinati.

¹⁸ L'Ouvroir de la Littérature Potentielle [*The Workroom for Potential Literature*] was founded in 1960 by Raymond Queneau et F. Le Lyonnais.

¹⁹ These algorithms were first developed at Ircam with the help of David Wessel and then at the Computer Audio Research Laboratory at the Center for Music Experiment of the University of California at San Diego with Mark Dolson. They were tested for the first time in *Archipelago* [1982-83], a composition for ensemble and computer-generated sounds, at Ircam.

²⁰ The SPLITZ algorithm makes it possible to modify the envelopes of even and odd segments independently.

Figure 3. Plan of the S8 computer image (sketch)

The SPLITZ algorithm breaks up the original extract in a rather different way, by cutting it up into a series of segments (whose proportions are defined according to a specified “proportional series”) processed in two contrapuntal layers. Even and odd segments are separated in space (i.e., left and right channels). The odd segments are played in chronological order alternating with lengthening silences. The even pairs are played in reverse order, alternating with ever shortening silences. Various amplitude envelopes can be applied to the even and odd segments. The result is a mosaic made up of two layers of discrete fragments, spread out in time as far as the composer could ever wish. According to how the algorithm is set, and the way it changes the cumulative duration of the source material²¹, this can produce a powerful impression of being in a hall of mirrors.

Figure 4. Transformation process by the SPLITZ algorithm.

SPLITZ was used in the D5 *Formulation/Reformulation* image, the basic material of which is made up by the first line of Theme 5 *Interior Line*. The intention is to create a kind of double interpolation, of the timbre and the texture, between a simple piano line and an orchestral chord. D5 is made up of an introductory section created by algorithmic processing, followed by a line morphing into a chord. After it has been processed several times by the SPLITZ algorithm, the initial line begins to break up to an ever-increasing degree, until the sound becomes completely granular (as in granular synthesis). The grains then run together to make up a single sound. The sound is transformed into a chord, using cross synthesis, fusing with an orchestral sound played backwards and stretched out, so that the image ends with the chord attack.

The SPIRLZ and SPLITZ algorithms represent two paradigms typical of Reynolds' music. SPIRLZ corresponds to the paradigm of the spiral: an original line is reorganized into cycles of equal segments that either grow shorter and shorter, or longer and longer. This gives rise to a proliferation of material starting from a center, in a cyclic and iterative fashion. Here the musical time is continuous and directional. SPLITZ on the other hand corresponds to the paradigm of the mosaic (or labyrinth): an original line is reorganized into proportional fragments that alternate with silence. This produces two fragmented sequences starting out from the two extremities (beginning and end) and then crossing each other. Here, musical time is discontinuous and non-directional. Table 2 summarizes the respective characteristics of the two algorithms.

Table 2. Complementarity between SPIRLZ and SPLITZ.²²

SPIRLZ	SPLITZ
Paradigm of the spiral	Paradigm of the mosaic
Continuous, directional	Discontinuous, non-directional
Re-segmentation of the original line into equal segments, within cycles that become longer and longer or shorter and shorter.	Re-segmentation of the original line into segments of different lengths (according to a proportional series)

²¹ There is no temporal stretching of the segments, and increased duration is achieved as a result of the interposed silences.

²² Adapted from Roger Reynolds, *Musical production and related issues at CARL*, Proceedings of the 1986 International Computer Music Conference, San Francisco, Computer Music Association, 1986, pp. 387-391.

Starts in the middle of the original line and progresses cyclically to the extremities of the initial segment	Starts at the extremities and moves in two opposing directions
Cyclical, iterative	Contrapuntal, sparse
Single voice	Polyphonic

5. The Phase Vocoder: A Resource for Expression

The electronic part of *The Angel of Death* is not merely there to amplify or to reinforce the instrumental part. It is conceived rather as a character in its own right that will profoundly affect the drama of the work. It also invokes the notion of other worlds, nonhuman worlds. The ethereal sounds created by the computer create a dreamlike feeling, one of hallucinations, of the irrational, of the unreal. Many of the sounds were obtained through phase-vocoder techniques, much used in sound time stretching, as well as for transposition and filtering via FFT techniques. We will examine some of the computer images from *The Angel of Death*, from a technical and dramatic standpoint.

The D10 image *Ghostly Expansion* (2'10") is the first image, it comes in at the end of the first part after the core element of T5. Along with images S7 and D1, it is the only electronic part to be heard more or less without instruments. The source material for D10 comes from the core element of T3 (chromatic contrary movement) in its piano and orchestral versions. [Lien vers fichier son, T3 piano]

Figure 5. Core element of Theme 3, piano version.

In the first instance, the phase vocoder was used to separate the rising voice from the descending voice, both for the piano and the ensemble versions. Following that, the descending voice was transposed upwards by one or two octaves, with a corresponding symmetrical transposition downwards for the ascending voice. Then the transposed versions were stretched out so that they would overlap and fuse together to give the impression of a long continuous descent combined with an almost parallel upward movement. The mix of transposed and stretched timbres produces a choral effect (the time stretching generates amplitude pulsing, somewhat like human vibrato). This effect is reinforced by reverberation. As the sonogram in Figure 4 very effectively illustrates, this image creates an auditory illusion. [Lien vers fichier son, D10 seul] The paradoxical character of the sound gives the impression of a continuous fall as with the "Sheppard-tone" effect in Jean-Claude Risset's composition *Computer Suite from Little Boy* (1968). Interestingly, the D10 image is also, especially spatially, an illustration of the spiral paradigm (even though it does not use the SPIRLZ algorithm): it unfolds in a musical time that is directional and continuous.

Figure 6. Sonogram of the D10 computer image

However, that is not the most important aspect. The D10 image, which is a metaphor for the appearance of the angel of death, acquires meaning and expressive power because of its central position. In opening the second part of the work, it marks a change in direction, or even a reversal of the situation. Like any dramatic turn of events, or *coup de théâtre*, it has a profound effect on the action, and is a sign that the change is irreversible. This was clearly felt by the

listeners — at this point in the composition, whatever the version, the emotional force profiles were very high. [Lien vers article Steve expériences temps réel, SM] From D10 onwards the electroacoustics makes its presence felt, and profoundly changes the way we perceive the new thematic and non-thematic elements that we encounter.

The D1 image, the computer version of *Other*, is an example of filtering with frequency and time shifting techniques. The texture of the piano part is created through the use of 7 asynchronous ostinati and 11 rapid runs intertwined. [Lien vers fichier son, Other]. The dynamic level, which is as calm as it could possibly be, remaining identical from start to finish in *Other*, as well as the fact that the piano pedal is held down throughout, combine to create the dreamy floating feeling that is so characteristic of this passage. In order to diminish the effect of repetition when *Other* is played a second time²³, Reynolds decided to have it played entirely by the electroacoustic layer. With this type of writing, it is not easy to know what kind of electronic processing should be used in order to maintain identity while nevertheless continuing to generate musical interest. In *Other*, processes modifying the spectral and temporal content of the piano part intensify the feeling of strangeness. Firstly, a digital filter was used in order to separate the source into two complementary (positive and negative) sub-images. The two sub-images are then put back together, but with a very slight time delay, a micro delay which alters in cycles. Secondly, frequency shifting was used to create very small wave-like transpositions.²⁴ [Liens vers texte de Roger] Figure 7 shows how this processing was applied.²⁵ A palindromic structure divides the music into six symmetric sections and peaks. The peaks represent the point at which the time and spectral phase shifting are at their greatest. Here, the digital treatment creates the auditory equivalent of focusing and unfocusing, sometimes rendering the sound sharp, at other times fuzzy.

Figure 7. Sketch of the filtering plan of *Other* for the D1 computer image.

Eleven phantom elements — instrumental gestures that come from other themes, notably the rapid runs that echo the piano part — streak across the misty landscape of *Other*, intensifying the impression of nebulosity and dreaminess. [Lien vers fichier son, D1] The influence that the electroacoustics have on the way the listeners perceive D1, when the image reappears in the second part of the piece, are shown by the familiarity profiles. [Lien vers article SM] It can be observed that the familiarity profiles, during the first appearance, are continually moving upwards (and this applies to both S-D and D-S versions) because of the generally static and repetitive nature of D1. By contrast, when it appears for a second time — played by the computer layer — D1's familiarity profiles tend to go down. This would indicate that the surface elements were immediately recognized, but that the modifications in the temporal and spectral structures of the sound brought with them a genuine increase in newness.

The D6 image *Dematerialization* (2'10") borrows an idea from *Transfigured Wind II* (1984) in which a unison theme is divided into groups of partials. Each subgroup can be stretched differently. From a structural standpoint, D6 can be described as a canon in eight layers, made up

²³ During the performance of the second part, whatever order of parts is chosen.

²⁴ Contrary to the *harmonizer*, which works by simple transposition, the *frequency shifter* acts by adding, by multiplying or by dividing each component of the spectrum by the same frequency. Where addition is applied, the spectrum processed by *frequency shifting* becomes inharmonic, and where multiplication is applied, it remains harmonic.

²⁵ The upper part of the graph shows the frequency shifting trend, the lower part shows the filtering and the time shifting [from 0 to 100 milliseconds]

of groups of partials taken from the orchestral version of the fourth subsection of Theme 5. This is how Reynolds describes the image: "a line pulls away, divides up, slows down, and then undergoes stratification in time and space; what was united has now become a web of independent strands."²⁶ The even and odd partials of each stratum of the orchestral version (woodwind, brass, percussion instruments, and strings) were separated out, time-stretched and put back together in such a way that the first subsection is composed of asynchronous elements. The second is composed of elements that are somewhat more synchronous, and the third subsection is quite synchronous. This processing creates an image that has undergone very extreme time stretching, to such an extent that the theme is practically unrecognizable. [Lien vers le fichier son, D6 seul] Thus, D6 no longer has a thematic role, but rather, is there to provide a background of floating sound. As with D2, S11 or D9, the role of this image is not to intensify or to contradict the instrumental parts, but, in the words of Reynolds, to make them "transparent".

The S7 image *Vertiginous Continuity* (1'40") is always the last image. As with D10, its beginning runs simultaneously with the end of Theme 5. But whereas D10 only contains source material from T3.2 (all the D images are homogeneous), S7 is created in the spirit of a recapitulating stretto. Eleven segments of Themes 1-4, all in their piano and ensemble versions (T2.4, T3.3, T2.2, T2.4, T2.5, T2.6, T1.9, T4.5-6, T1.1-3, T4.1, and T4.7) follow in quick succession. Recapitulation is also applied to the computer processing. All the signal processing techniques used in the foregoing images are used again in S7: algorithmic editing, time compression/stretching, transposition, cross synthesis, filtering, etc. Another recapitulating element is embodied in the 11 gestures used throughout D1 (although they are not the same extracts), the 10 electronic images that run through the second half of the piece (originally there were 11) and finally the 11 thematic and non-thematic elements that make up the entire composition.²⁷ Reynolds' aim was to obtain "continuity using the most improbable levels of internal discontinuity"²⁸. Starting out from a maximum degree of local unpredictability, the composer sought to arrive at an overall predictability: a "vertiginous continuity". This can be said to be the sum of the spiral and the mosaic paradigms.

Figure 8. Plan of the S7 computer image (sketch) [Lien vers fichier son, S7]

From the standpoint of drama, this image is a summing up of everything that went before — in the same way that a person about to die sees the history of his own life in a few seconds — giving way to a brief *Epilog* by the soloist. An overall trajectory — which may also be called a kind of descending spiral as in D10, although somewhat more spatial and time based than spectral — pulls us away from auditory hallucinations and brings us back to reality. Thus, starting out from elements that have undergone considerable computer processing (and are therefore less easily identifiable), the image ends with the last section of Theme 4 as played by the piano. Reverberation and spatialization are the sole electronic treatments, and the passage then moves directly to the *Epilog*, played live by the pianist. Here too, the expressive power of the electroacoustics is shown by the emotional force profiles that are constantly on the rise throughout S7. [Lien vers article Steve, expériences en temps réel, SM]

²⁶ Sketchbook

²⁷ The five themes, TR1→3 and TR2→4 transition regions, COMB2/4 combination region, *Other*, *RepStrat* and *Interlude/Epilog*.

²⁸ Unpublished interview with S. McAdams on 20 September 2000 at Ircam.

Conclusion

If we take the overall time scale into consideration, the most important single dramatic factor in *The Angel of Death* is the moment at which the computer layer begins. This is a veritable reversal of the situation that contains not only an element of surprise, but above all changes our entire perspective on the piece.²⁹ The emotional force measurements show that this is the moment that the spectators feel to be the most crucial. The emotional force profile is at its highest when the image D10 begins. In this theater for the ear, the electroacoustics constitute a character in their own right, playing a predominant role in the drama of the piece. The electroacoustic part is a metaphor representing the angel, bringing with it a ghostly, unreal, inhuman world. Nevertheless, this parallel world, which possesses its own strata, weaves numerous links with the real world of instruments.

The electronic images are put together in a way that maintains the distinction between the S and D parts of the piece: the S images are made up of heterogeneous material. They function on the basis of sequential alternation and temporal concentration, whereas the D images are made up of homogeneous material and exploit time stretching and stratification. The relationship between the electroacoustics and the instruments may take place on the level of fusion or of segregation, of domination or submission, and of intensification or of disruption. Whatever the case, the electroacoustics act as a prism to the instruments and can change the way we perceive a given passage, according to which version of the piece is chosen (S-D or D-S). When the electroacoustic part begins, the network of thematic relationships becomes much denser and gives rise to a greater number of possible interpretations. Some elements are “anticipatory” while others play a “recall” role, giving rise to mnemonic processes that either prime the ear or that refresh it, [Lien vers article SV2] even though the elements in question may be fragmented and transformed.

Processing through transposition, filtering, time stretching, time compression, and time restructuring bring an added degree of transformation, one that goes beyond a mere piano/orchestra dialogue. Two paradigms that are typical of the Reynolds aesthetic — the spiral and the mosaic — afford us a window, throughout each image, into the dramatic inner workings of the piece. Above all, technology is used as a resource to enrich expression, be it via time restructuring carried out by means of the two processing algorithms SPIRLZ and SPLITZ, or be it via time stretching, time compression, transposition and filtering carried out using phase vocoder techniques. The electroacoustic layer is indeed the main actor in the dramatic workings of *The Angel of Death*, the one that decides which way the action is going, the actor that has the profoundest effect on the way the listener will experience time³⁰.

APPENDIX

		ES.	CP.	LE.	RT.
<i>A Portrait of Vanzetti</i>	1962/1963	*			
<i>...between...</i>	1968/1969				*
<i>Ping</i>	1968	*			*
<i>Traces</i>	1968	*			*
<i>I/O A Ritual for 23 Performers</i>	1970				*

²⁹ There is a similar process to be found in the series of pieces for percussion entitled *Watershed* (1995) in which the writing changes direction in the central passage called the *Watershed Divide*.

³⁰ The author would warmly thank M. Battier, S. McAdams and Roger Reynolds for their attentive proofreading of my four articles, and R. Reynolds for his very helpful explanations.

<i>Again</i>	1970		*
<i>Compass</i>	1972/1973	*	*
<i>...from behind the unreasoning mask</i>	1974/1975	*	
<i>Still [VOICESPACE I]</i>	1975	*	
<i>A Merciful Coincidence [VOICESPACE II]</i>	1976	*	
<i>...the serpent-snapping eye</i>	1978		*
<i>Less than Two</i>	1978		*
<i>Eclipse [VOICESPACE III]</i>	1979		* *
<i>The Palace [VOICESPACE IV]</i>	1978/1980		*
<i>The Tempest</i>	1980	*	
<i>Archipelago</i>	1982/1983		*
<i>Summer Island</i>	1984		*
<i>Transfigured Wind II - III - IV</i>	1984		*
<i>Sketchbook (for the Unbearable Lightness of Being)</i>	1985		*
<i>Vertigo</i>	1985		*
<i>The Vanity of Words [VOICESPACE V]</i>	1986		*
<i>The Dream of the Infinite Rooms</i>	1986		*
<i>Symphony [Vertigo]</i>	1987		*
<i>Not Only Night</i>	1988		*
<i>Versions/Stages I-V</i>	1988/1991		*
<i>Personae</i>	1990		*
<i>The Ivanov Suite</i>	1991		*
<i>Odyssey</i>	1989/1993		*
<i>last things, I think, to think about</i>	1994		*
<i>Ariadne's Thread</i>	1994		*
<i>Watershed III - IV</i>	1995		*
<i>Two Voices — an allegory</i>	1996		*
<i>The Red Act Arias</i>	1997		*
<i>On the Balance of Things</i>	1996/1998		*
<i>The Red Act Arias Suite</i>	1997-2001		*
<i>JUSTICE</i>	1999		* *
<i>...brain ablaze...she howled aloud</i>	2000		* *
<i>The Angel of Death</i>	2001		*
<i>Process and Passion</i>	2002		* *
<i>Sanctuary (II. Oracle)</i>	2004		*
<i>"22"</i>	2005		* *
ES. = Electroacoustic Sound, CP = Computer Processed Sound			
LE. = Live Electronic Processing, RT. = Real-time Computer Spatialization			