

UNIVERSITY OF CALGARY

Unheard Voices, Ancient Spaces:  
An Acousmatic Composition for Eight Channel Digital Tape and  
Eight Loudspeakers

by

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## ABSTRACT

*Unheard Voices, Ancient Spaces* is an acousmatic composition for eight-channel digital tape composed with recordings of environmental sounds from wilderness areas of Alberta and selected instrumental sounds. These recordings were digitally transformed in the studio using computer sound synthesis and processing software. The composer intends that the piece actively evoke visual associations in the mind of the listener. The movement of sounds through the listening space is an integral aspect of the composition of the work. It is divided into eight distinct sections which are characterized by unique sound sources, behaviors, instrumental and pitch development, and diffusion patterns. The development of these attributes creates a programme which alludes to the relation between the natural world and humankind throughout history. The piece exists in eight-channel and stereo re-mixed versions and it is accompanied by a graphic score and an interactive CD-ROM. The duration of the work is 18 minutes, 47 seconds.

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## I: Introduction

The title of my composition, *Unheard Voices, Ancient Spaces*, refers to the creation of new and unique *spaces* which exist in sound. I was primarily concerned with evoking characterized spaces associated with natural areas of Southern Alberta, both through the selection of raw compositional materials, and by the evocations arising from my compositional decisions. This is a work which is presented in concert where there are no performers or instruments in the usual sense, and where there is an absence of the expected visual performance component in traditional concert music. Instead, the listener is confronted with sounds projected using loudspeakers, actively implying highly characterized visual responses in the minds of the listeners. Normandeau has referred to this musical aesthetic as *cinema for the ear*<sup>1</sup> and it is widely used to describe *acousmatic composition*. Bayle defines acousmatic music as that in which “one may recognize the sound sources, but one also notices that they are out of their usual context. In the acousmatic approach, the listener is expected to reconstruct an explanation for a series of sound events, even if this explanation is provisional.”<sup>2</sup>

Acousmatic music composition owes much to the tradition of *musique concrète*, which originated in Paris in 1948. Working in the studios of Radiodiffusion Télévision Française (RTF), Pierre Schaeffer began composing with *objets sonore*, recordings of preexisting sound sources, both naturally occurring and man-made. The aim was to use collections of sounds subjected to relatively simple transformations to create musical gestures and larger forms. In the 1970s in France, and the 1980s in Quebec, *musique concrète* was reinvested with far greater transformational possibilities, largely due to technological developments in analog and computer-based sound synthesis. Conceptually, this new approach differed from the classic *musique concrète* tradition because a greater emphasis was placed on the new contextual roles, behaviors, and functions of the transformed and arranged materials. Composers who embraced and explored the new acousmatic aesthetic included François Bayle, Francis Dhomont, and Robert Normandeau.

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<sup>1</sup> Robert Normandeau, *Tangram*, CD booklet, Diffusion iMedia IMED-9419/20-CD (1994): 16.

<sup>2</sup> Sandra Desantos, “Acoustic Morphology: An Interview with François Bayle,” *Computer Music Journal* 21:3 (1997): 17.

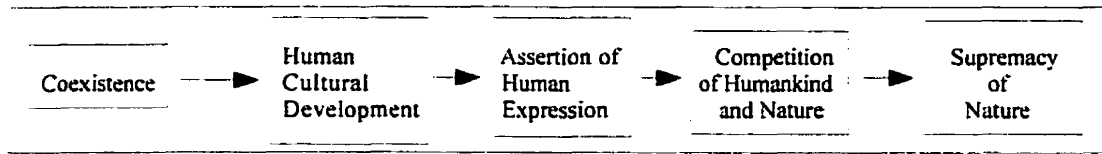
More recently, a school of acousmatic music has arisen in the United Kingdom. Denis Smalley, Andrew Lewis, and Jonty Harrison are particularly active in this area.

Aesthetically, *Unheard Voices*, *Ancient Spaces* also draws upon the traditions of *acoustic ecology* and *environmental soundscape* music. Canadian composer R. Murray Schafer was instrumental in creating the World Soundscape Project in 1971 at Simon Fraser University. Other composers including Hildegard Westerkampf, Barry Truax, and Claude Schryer have more recently founded the World Forum for Acoustic Ecology and have done much in the development of this genre. Composers and sound artists working in these areas are concerned with the preservation of unique sound environments, primarily those which are threatened by increasing levels of human activity. The sound ecologist documents and archives sounds which are threatened by the destruction of wilderness areas and the expanding noise pollution within our cities. Composers have integrated this concern in their music by making recordings of chosen sounds and preserving them in compositions and by creating works which reflect personal philosophies regarding these matters.

I have a deep awareness of the central role that the natural world, particularly wilderness areas, has played in my creative and spiritual life. With *Unheard Voices*, *Ancient Spaces* I wanted to try to express this dimension of my experience with nature within the composition in an integral manner. To accomplish this, I made recordings of naturally occurring sounds in a number of wilderness areas of southern Alberta. These sounds became the primary source of musical materials in the piece. The use of a selection of instrumental sounds was also necessary to suggest a human presence. The suggested evocations, the particular treatments of instrumental sounds, and the composition's formal structures create a programme (Figure 1) which suggests my own personal perspective on the interaction between the natural world and humanity through history, presented in a unique and engaging "virtual world" of sound spaces.



**Figure 1. Programmatic form of *Unheard Voices, Ancient Spaces***



At the highest formal level, *Unheard Voices, Ancient Spaces* alludes to the coexistence of nature and humankind in pre-technological times, a gradual increase in the degree of human cultural assertion and subsequent competition with nature, and finally, what I see as a likely outcome of the increasing strains and destruction due to this competition, the eventual reassertion of nature over humankind, through some unknown means.

The perception of sounds moving through space is an integral and innovative component of the aesthetic within my composition. The spaces that I created are largely defined through the creation of dynamic *moving* sound materials. In addition to the traditional concerns with the perception of the timbral properties, pitch, rhythm, dramatic development, and structure of the musical materials within the composition, I created a work in which the movement of sound literally through the listener's spatial environment was of equal importance. This concern was central to the creation and perception of the evocations in the composition and influenced the processes of my work.

Bayle writes that acousmatic music is a "wandering that tries to extract from sound matter the energetic shapes that transcend the 'here and now' of cultural experience and expand their roots in the depth of our ontological experience".<sup>3</sup> He suggests that the evocations produced by acousmatic works arise from the activation within the listener of the shared archetypes of the human species.<sup>4</sup> I believe that the re-contextualization of real-world sounds evokes images in the imagination of the listener that *can* be representations of archetypes but which are ultimately dependent upon the listener's

<sup>3</sup> Stéphane Roy, "Functional and Implicative Analysis of *Ombres Blanches*," *Journal of New Music Research* 27(1998): 173 – 4.

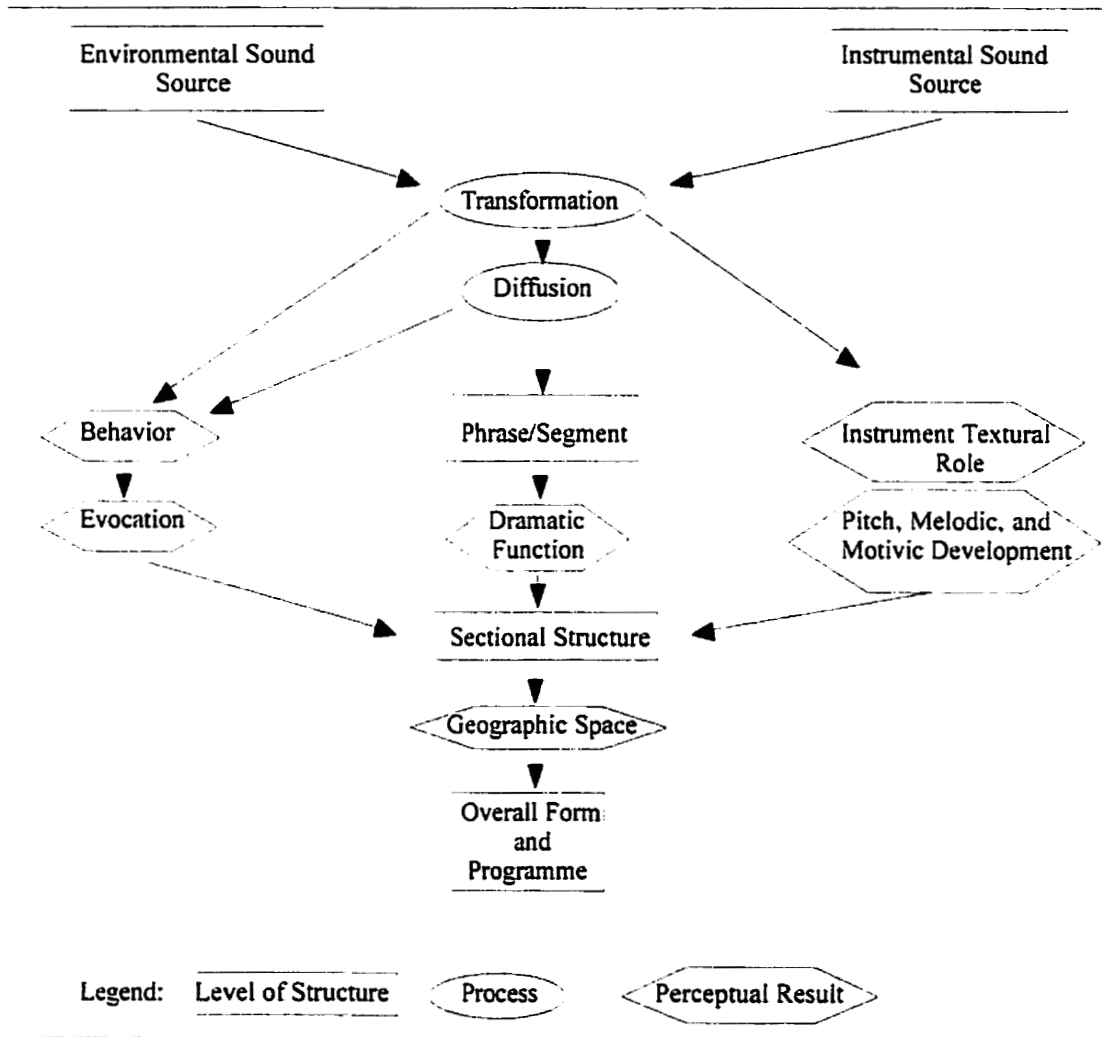
<sup>4</sup> François Bayle, *Musique Acousmatique: Propositions... ..Positions* (Paris: INA, 1993), p. 76.

own cultural and previous life experience. The following essay will perform the following:

1. Identify the materials which act as the most basic building blocks for these evocations
2. Discuss the transformations, diffusion, and resulting behaviors of the sound source materials
3. Describe the phrasing and the main dramatic musical functions of the materials within the composition such as announcement, introductory, and motivic devices
4. Describe the development of instrumental timbre and pitched materials in the piece

I will show how these factors and the processes of working with my source materials produce and relate to the resulting musical structures and programmatic form. Figure 2 provides an overview of these aspects. Reference to the listening score in Appendix A and the specified examples in the recording will aid the reader in the understanding of this “wandering”.

**Figure 2. Process and hierarchal structure**



## II: Source Material and Geographic Space

The smallest structural units in *Unheard Voices, Ancient Spaces* consist of the sounds which I have recorded in their naturally occurring environmental contexts and the instrumental sounds. The sectional form of the piece is defined by the organization of these sounds, transformed and arranged in the studio. A description and classification of sound sources is therefore important in understanding the basic structure. The distinction between naturally occurring and instrumental sounds is crucial to the key programmatic

development in the piece. Instrumental sounds represent a human presence, and the transformation of these sounds in relation to the naturally occurring sounds is the direct means by which the progression from coexistence to competition is implied. This ranges from the textural integration of instrumental sounds and environmental sounds to the creation of instrumental melodic motives (see V: Development of Instrumental Timbre and Pitch).

**Figure 3. Classification of natural sound sources**

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<b>Naturally occurring sounds</b>	
1. Alpine trees	Gently moving and creaking trees
2. Mountain squirrels	Individual chirps and extended calls
3. Rapidly moving water	Water rushing down a creek bed, recorded in several successive locations downstream
4. "Creek clutter"	An assortment of fly, frog, cracking ice, and shifting tree foliage sounds
5. Lake environment	Bird calls, ducks, wave motion, moose calls
5. Bees and black flies	
6. Dragonflies	
7. Cricket buzz	
8. Cricket chirp	
9. Slowly moving water and surrounding ambience	
10. Solo birdsong	
11. Long grass moving in the wind	

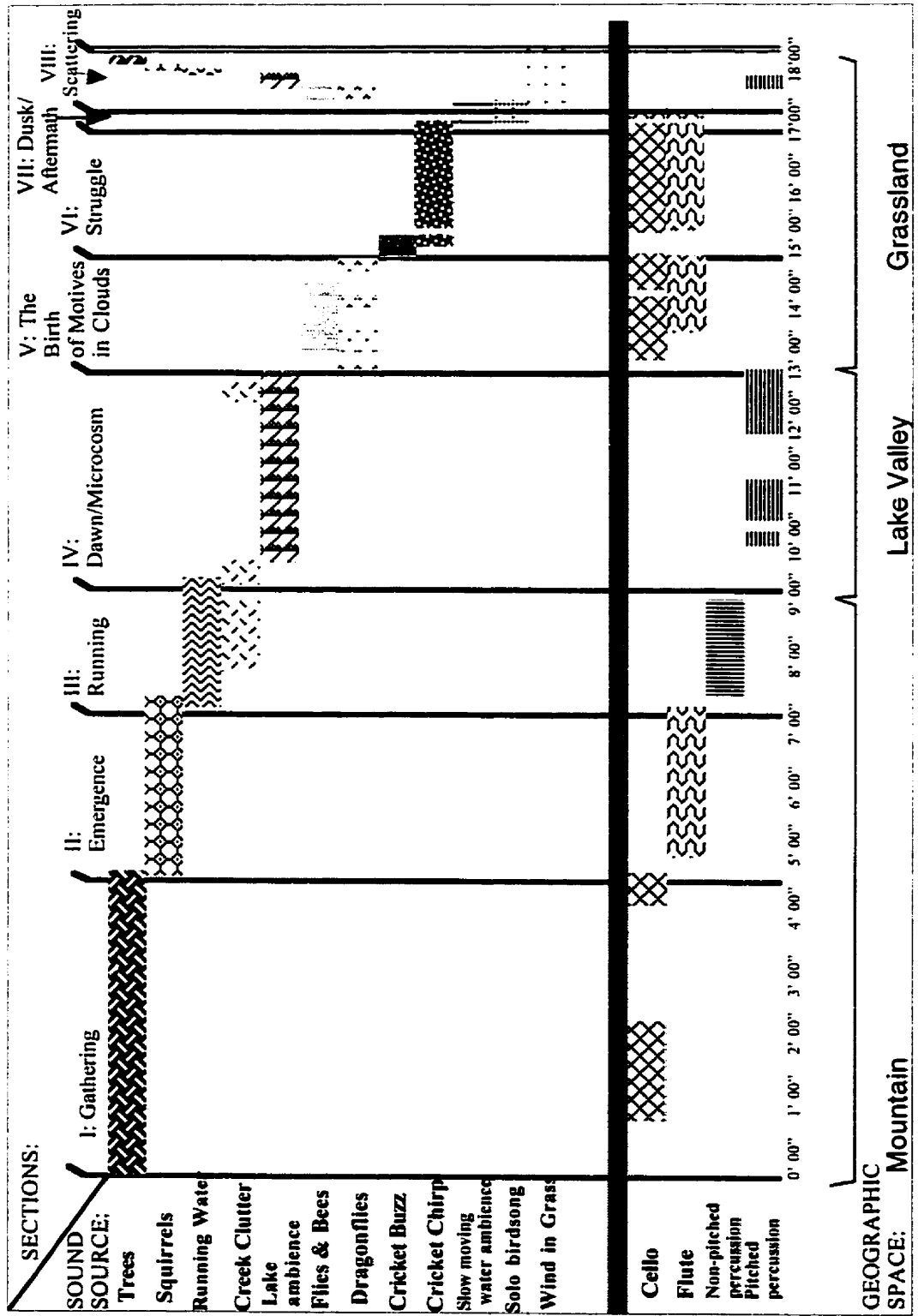
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**Figure 4. Classification of instrumental sound sources**

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<b>Instrumental sounds</b>	
1. Violoncello	Pizzicato, bowed, and ponticello articulations
2. Flute	
3. Non-pitched percussion	Snare drum, timpani, and cymbal
4. Pitched percussion	Gongs and various metallophones

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**Figure 5. Sectional structure as a function of sound source groupings**

The overall sectional form of the piece is clear from the grouping of sound sources (Figure 5). Each of the eight sections is clearly distinguished by a particular grouping of natural sound source and musical instrument. These groupings are one of several factors which create the distinctive character of each section. Related to the structure derived from the grouping of sound sources is the idea of geographic space. Hierarchically, the organization of sound source materials reflects the actual regional spaces in which the recordings were made. The journey of the listener is defined at this larger level as moving from mountain regions, to a lake environment and finally to grassland areas. Within each region the listener experiences individually defined sound sources, behaviors, and evocations.

At several formal divisions in the piece the conclusion of one section overlaps with the beginning portion of the next. For example, to create a smooth transition between sections *II: Emerging* and *III: Running*, there is an elision of approximately ten seconds duration. In contrast, between sections *IV: Dawn/Microcosm* and *V: The Birth of Motives in Clouds*, there is no actual elision, although the long decrescendo concluding section *IV* does lessen the impression of an abrupt change in materials. In the final section, *VIII: Scattering*, each region is revisited in a fragmented form, creating a sense of traditional recapitulation in an acousmatic context. The title of each section was chosen to reflect the overall impression, or suggested evocation, created by the combined characteristics of source materials, behavior, spatial pattern, and motivic development. This will be addressed in the conclusion of the essay.

### **III: Transformation and Behavior**

The transformation and manipulation of the recorded sound sources was essential to the creation of musical materials which exhibited individual gestures or *behaviors*, a crucial component of the evocations central to acousmatic music. I applied selected transformations, often in a series of combinations, to shape the material into new contexts. A continuum of the degree of transformation exists, ranging from completely

unaltered “pure” material to heavily processed and manipulated material which is hardly recognizable. The transformations which I applied in *Unheard Voices*, *Ancient Spaces* included timbre modifications of a sound (spectrum, pitch, or amplitude), manipulations of a sound’s temporal qualities (stretching or looping<sup>5</sup>), convolution<sup>6</sup> of the timbral properties of one sound with those of another, synthesis of new sounds using previously existing sounds as raw materials, and the rapid juxtaposition of a collection of differing sounds or sections of a continuous sound (Figure 6). Transformation and manipulation of the sounds was done using a number of computer-based sound synthesis and processing tools in the *C-Sound* graphical programming environment called *Cecilia* (Appendix B: CSound and Cecilia).

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<sup>5</sup> Looping lengthens the duration of recorded sound samples by seamlessly repeating the playback of a selected contiguous section of the sound for a specified time. This produces either a sustained effect or a rhythmic pulsation.

<sup>6</sup> Convolution imposes the amplitude or pitch characteristics of one sound onto another. The resulting sound exhibits characteristics of both ‘parent’ sounds, but does not necessarily resemble one or the other.

**Figure 6. Main categories of transformation used**


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<b>1. Transformation of timbre</b>	(the main characteristics of the sound source are still perceivable)
A.	Spectrum (static and dynamic transformations)
i.	Filtering (selected frequencies are attenuated)
B.	Pitch (static and dynamic transformations)
i.	Transposition
ii.	Harmonization
C.	Amplitude enveloping
<b>2. Transformation of temporal properties</b>	(the main characteristics of the sound are less perceivable)
A.	Stretching sound (pitch unaffected, duration increased)
B.	Augmentation of event through the use of reverb or delay/echo
C.	Looping (the creation of pulse or rhythm)
<b>3. Convolution</b>	
A.	Cross-synthesis (imposing the amplitude characteristics of one sound onto another)
B.	Ultra vocoder (as above but with the excitation of resonant tones)
<b>4. Textural synthesis</b>	(using sound source as raw material for the creation of new textures)
A.	Granular synthesis/"brassage" (creating rich streams of sound from very short samples or "grains" of sound)
B.	Granular synthesis/"agglomeration" (creating increasing and decreasing sound masses of grains)
<b>5. Rapid juxtaposition of materials</b>	
A.	Numerous different materials are superimposed or juxtaposed
B.	Rhythmic modulation of continuous material, creating a "juddery effect"
<b>6. None</b>	Unaltered environmental or instrumental sound

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From the acousmatic perspective, it is ultimately most important to consider the effect of the transformations upon the listener rather than the cause. This requires identifying within each section the characteristic behaviors which are a result of the applied transformations and re-contextualizations. Aside from incidences of strict repetition of material, each instance of a particular behavior is distinct. It is, however, still possible to characterize generally the principal ones found within *Unheard Voices. Ancient Spaces* (Figure 7). Each section exhibits one or more primary behaviors, often simultaneously, as well as others which are of secondary importance (Figures 8 – 10). Diffusion is also an important factor in the creation of unique behaviors for each section. This topic is discussed separately in VI: Diffusion.

**Figure 7. Primary behavior classifications of transformed material**

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<b>Pitch related</b>	<b>Space related</b>
Sustained tones/drone	Reflections (echo)
Glissandi	Spatial allusion (reverb)
Melodic sequence	
Motive	
Doppler effect	
<b>Rhythm related</b>	<b>Texture related</b>
Mechanical rhythmic pulse	“Agglomeration” increase/decrease
Natural rhythmic pulse	Chorus/mass of single sound type
	Bursts/eruptions of sound
	Rich textural stream
	Fragmentation
	Interaction (chase, conflict, evolution)
<b>Motion related</b>	<b>Diffusion related</b>
Convulsive movement	The movement of sound through
Doppler effect	the listener’s surrounding space
Rapid juxtaposition	

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**Figure 8. Analysis of characteristic sectional behaviors**

<b>SECTION</b>	<b>BEHAVIOR</b>	<b>EXAMPLE</b>
<i>I: Gathering</i>	Primary:	Agglomeration 0:00 – 1:00
		Drone 2:36 – 3:54
		Chorus/mass of single sound type 2:34 – 3:54
		Bursts of sound 3:54 – 4:40
	Secondary:	Reflection (echo) 2:20 – 2:37
		Natural rhythmic pulse 3:57 – 4:40
<i>II: Emerging</i>	Primary:	Glissandi 6:27 – 7:20
		Mechanical pulse 4:55 – 5:15
		Sustained tones/Melodic sequence 5:30 – 6:10
<i>III: Running</i>	Primary:	Convulsive movement 9:20 – 9:33
		Natural rhythmic pulse 7:43 – 8:17
		Rapid juxtaposition 9:18 – 9:32
<i>IV: Dawn/Microcosm</i>	Primary:	Drone 10:02 – 10:50
		Rich textural stream 12:17 – 12:55
		Melodic sequence 11:35 – 12:30
	Secondary:	Fragmentation 11:30 – 12:30
		Spatial allusion (reverb) 11:35 – 12:30
		Natural rhythmic pulse 10:19 – 10:45
<i>V: The Birth of Motives in Clouds</i>	Primary:	Rich textural stream 13:20 – 13:40
		Melodic motive 14:40 – 15:12
	Secondary:	Doppler effect 14:20 – 14:30
<i>VI: Struggle</i>	Primary:	Melodic motive 15:32 – 17:12
		“Chase” interaction 15:32 – 17:15
	Secondary:	Rich textural stream 15:32 – 17:12
		Pulse 15:12 – 15:30
		Fragmentation 15:15 – 15:25
<i>VII: Dusk/Aftermath</i>	Primary:	Melodic motive 17:16 – 17:42
		Fragmentation 17:17 – 17:31
<i>VIII: Scattering</i>	Primary:	Fragmentation 17:34 – 18:47

The predominant behavior evident in *I: Gathering* is the agglomeration texture. This occurs when a collection of short attack-like sound events increases or decreases in density. It is a recurrent feature of this section, including the large-scale accumulation of creaks (0:00 – 1:00), subsequent diminishing density (1:00 – 1:50), and several shorter bursts of agglomerations (for example, 1:50). Instances of reflection, or echo, are common, suggesting large spatial expanses (2:20 – 2:40). The creation of building choruses of creaking trees (2:35 – 3:50), ringing drones based upon these choruses, and sudden and violent bursts of creaking and droning trees (3:55 – 4:40) are also characteristic of this section.

*II: Emerging* is characterized by the use of glissandi and mechanical rhythmic pulses. Similar to the first section's dominance by a large-scale behavior, *Emerging* is dominated a single large-scale glissando (6:25 – 7:00), and several smaller glissandi events in preparation (5:15 – 5:30) and response (7:10 – 7:20). Sustained tones in this section create pitch centres and harmonic structures (5:30 – 6:40). Transformed material was looped to create several different looping pulses (4:58 – 6:00) which are related by the use of similar source materials (noise-like or pitched) and the suggestion of regular pulse. Although rich textural streams were not produced explicitly in this section, the overall density of materials creates a similar textural mass in places, but without the rich variety of granular synthesis streams.

The use of recordings of fast moving streams in *III: Running* naturally provoked the inclusion of convulsive behaviors. The extremely rapid juxtaposition of similar (water sounds) and dissimilar (creek clutter: flies, logs, etc.) materials created a great deal of movement in the section. This contrasts with brief sections of relative stillness (8:33 – 8:35). Percussive water sounds (7:46 – 8:15) were looped to create pulsing rhythmic sound events. The behavior in section *IV: Dawn/Microcosm* is characterized by the presence of droning tones with wave-like pitch fluctuations (10:02 – 10:44), rich textural streams of sounds (12:17 – 13:12), two melodic sequences (10:48 – 11:30 and 11:37 – 12:32), and rhythmic loops of waves (10:19 – 10:48) and percussive material (12:40 – 13:01).

Section *V: The Birth of Motives in Clouds* distinguishes the remainder of the composition from the preceding sections through the introduction of instrumental melodic motives. The motives are presented as straining to escape from dense clouds of insect sounds. The large-scale behavior of this “birthing” process is presented in three elided sequences (13:18 – 13:59, 13:42 – 14:28, and 14:25 – 15:11). Each of these sequences consists of: (1) the release of two clouds of sound, each containing proto-motivic material; (2) the movement and collision of the clouds; and (3) the release of the motive. The release behavior is accentuated by the development of Doppler<sup>7</sup> behaviors.

Motivic material and rich textural streams are also used in section *VI: Struggle*. Here, however, the material is developed to suggest behaviors of chase and interaction between the cricket material (nature) and motivic material (humankind). This is achieved through the application of dynamic pitch transpositions and diffusion patterns. The final overtaking of the motivic instrumental material by the processed cricket sounds, for example, is distinguished by the use of a glissando (17:07 – 17:15) in the upper extreme frequency range.

The final two sections of the piece, *VII: Dusk/Aftermath* and *VIII: Scattering*, contain melodic/motivic material (17:16 – 17:42) and fragmentation behaviors (17:46 – 18:30). Fragmentation of materials taken from the preceding sections of the piece plays a role of recapitulation, but more importantly resolves the tension of the composition’s dramatic development. The melodic/motivic material also contributes to the creation of a conclusion by revealing for the first time the source of the pitch material used in the piece, in its original birdsong context, which up to this point had remained hidden.

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<sup>7</sup> Doppler Effect: “a change in pitch that results when the source and the listener are moving relative to each other.” For example, the change in pitch of a train whistle as it passes the listener. John Chowning first incorporated the Doppler shift in computer music in 1971. Curtis Roads, *The Computer Music Tutorial* (Cambridge: The MIT Press, 1996), p. 464.

#### IV: Dramatic Function and Phrasing

While much of the material in *Unheard Voices, Ancient Spaces* can be described in terms of a multi-layered network of sound events, certain units of sound stand out as having important functional characteristics in the dramatic development of the work. Figures 9 and 10 provide an analysis of function and phrasing. Material can be identified in the piece which performs specific functions in the experience of listening, similar to the use of the dominant V7 chord in cadential settings in conventional tonal music. A system of functional classifications has been proposed for acousmatic music by Stéphane Roy.<sup>8</sup> Those most important in describing the dramatic devices in the piece include *affirmation*, *trigger*, *announcement and reminder*, *introduction and conclusion*, *pedal*, *reiteration*, and *sign*. These functional roles are played by both single and multiple behaviors.

*Affirmation* occurs to signify that the last point in a process of repetition has been reached. After a series of iterations of the same sound, the sound is dramatically re-articulated to reinforce the apex of the repetition.<sup>9</sup> A clear instance of this occurs at 1:00 when a very strong tree creak marks the end of the building agglomeration of tree creak attacks.

The *trigger* function occurs regularly throughout the piece and it is used to suddenly and abruptly introduce a new event, a phrase, or a new section.<sup>10</sup> Instances of *trigger* as a signal marking new sections are found at the beginning of sections *II: Emerging* (4:54), *IV: Dawn/Microcosm* (9:48), and *V: The Birth of Motives in Clouds* (13:12).

*Announcement and reminder* are similar to the idea of *leitmotif*. They occur when a predominant theme, behavior, or character of a section is first announced, and later restated and developed in the section.<sup>11</sup> As with *leitmotif*, the material stated by the

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<sup>8</sup> Roy, p. 165 – 184.

<sup>9</sup> Ibid., p. 182.

<sup>10</sup> Ibid., p. 181.

<sup>11</sup> Ibid., p. 182.

announcers and reminders defines the character and dramatic context of a section. Incidences of *announcement* and *reminder* include the shortened glissandi (5:14 – 5:30) which prepare or foreshadow the large-scale glissandi which later dominate the same section (6:11 – 7:42).

The same material is often used repeatedly with varying functional roles in each instance. The *trigger* material at 4:54 is restated at several points throughout *II: Emerging* (7:02 and 7:40). At these later times it is clear that the material is not functioning in a *trigger* capacity, but refers back to its initial iteration, in a *reminder* capacity. This is also true of the *trigger* material at 13:12 which can also be interpreted as an instance of *announcement*. This results from companion *reminder* events which occur later (14:50).

*Introduction* and *conclusion* material are common functional attributes of material in the piece. *Introduction* occurs where there is a progressively developed behavior using a dynamic crescendo, increase in tension, or increase in density. This may be followed by *conclusion* material which clearly closes a phrase or sectional unit.<sup>12</sup> The gradual increase in amplitude of the water sounds at the beginning of *III: Running* (7:40 – 8:00) introduces the remaining dominant material in the section. *Conclusion* material which is also dependent on amplitude includes the sectional fade outs of *IV: Dawn/Microcosm* (13:00 – 13:12), and *V: The Birth of Motives in Clouds* (14:59 – 15:12). At the phrase level, the agglomeration increase and decrease pairing in *I: Gathering* (0:00 – 2:00) and the glissandi up/down pairings in *II: Emerging* (6:11 – 6:42) also function as *introduction* and *conclusion* material.

*Pedal* function refers to material which establishes perceptible ostinato pulses,<sup>13</sup> both natural and mechanical-like. These include the looped materials in *II: Emerging* (4:58 – 7:01), the percussive ostinati in *III: Running* (7:46 – 8:15), and the low frequency cricket pulsations in *VI: Struggle* (15:12 – 15:21). *Pedal* is also manifested through the pulses of the repeating motivic arrangements in *V: The Birth of Motives in Clouds* and the timings of the repeated melodic sequences in *II: Emerging* (5:30 – 6:04) and *IV:*

<sup>12</sup> *Ibid.*, p. 181.

<sup>13</sup> *Ibid.*, p. 183.

*Dawn/Microcosm* (10:48 – 11:30 and 11:37 – 12:32).

*Reiteration* intensifies the effectiveness of an event by repeating it within the confines of a phrase.<sup>14</sup> The multiple instances of smaller agglomerations (1:20 – 2:00) extend the effect of the larger opening agglomeration (0:00 – 1:00) by functioning as if they were “aftershocks” of the initial event. Similarly, in *VI: Struggle*, the low frequency percussive reverberations (for example, 15:37 and 15:50) are reiterated throughout the section, and are also “aftershocks” of the opening pulsations (15:12 – 15:25).

Material which directly refers to its environmental or instrumental sound source has a *sign* function.<sup>15</sup> The instances of this in *Unheard Voices, Ancient Spaces* include the frog and water sounds in *III: Running* (9:41 – 9:48), the cricket chirps in *VI: Struggle* (15:21 – 15:31), the birdsong in *VII: Dusk/Aftermath* (17:16 – 17:42), and the grass/wind sounds in *VIII: Scattering* (17:34 – 18:47).

Related to the functional characteristics of the transformed and arranged material in the piece are the phrasing characteristics which I created in the studio. The phrasing of the material determines the *rate of flow* which is perceivable by the listener. Phrase units contain single large or small-scale behaviors or multiple groupings of sequential or simultaneous behaviors. Frequently, a phrase unit can also be analyzed by its functional components. For example, the large-scale agglomeration increase (0:00 – 1:00) and decrease (1:00 – 2:00) in *I: Gathering* creates two large phrase units, which function as *introduction* and *conclusion*. Other phrase units are related to melodic sequences (5:30 – 6:04 and 10:44 – 11:30), glissandi events (17:07 – 17:16), or the pacing of highly active segments against material in repose (throughout 7:40 – 9:32). An important characteristic of the piece is the elision or simultaneity of multiple phrases. This is due to the stratified textures of sound events found throughout the composition.

The timing of these phrase units creates rates of flow for the material and also

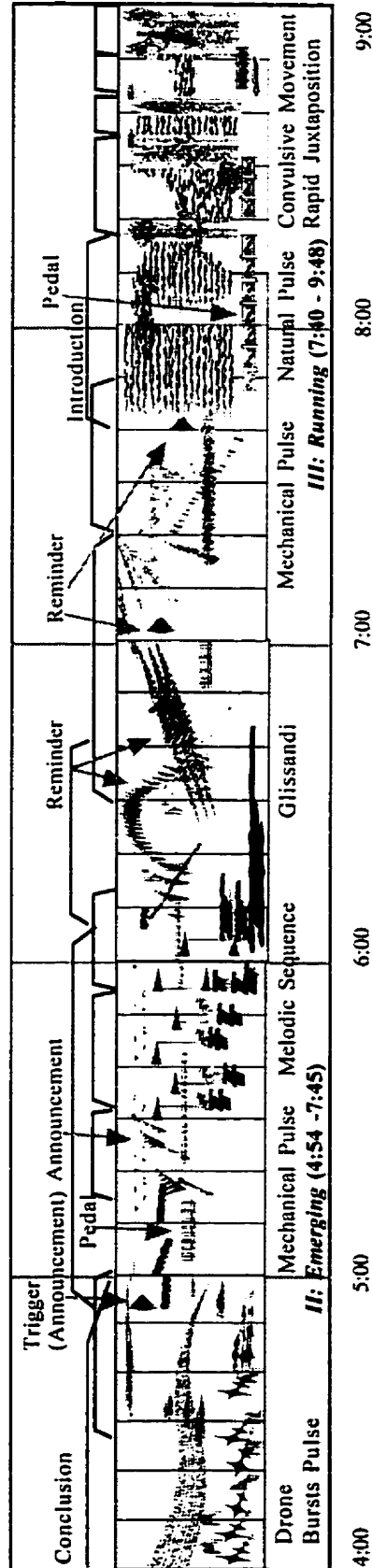
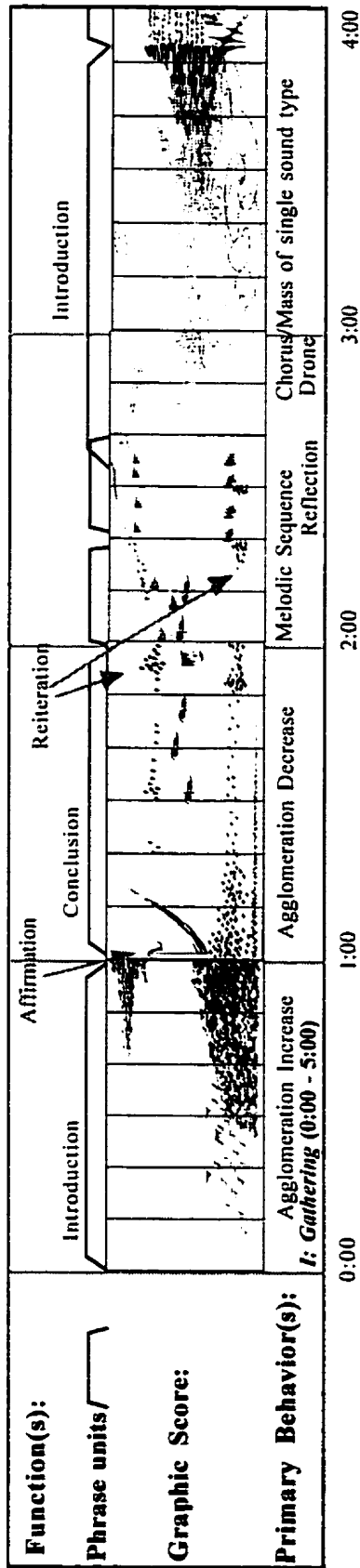
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<sup>14</sup> Ibid.

<sup>15</sup> Ibid.

contributes to the development of tension, relaxation, and resolution in the piece. Tension in *Unheard Voices, Ancient Spaces*, is a product of the phrasing, degrees of density, overall amplitude, and behaviors of the material within each section (Figure 11). The use of an upwards glissando (6:57 – 7:40 and 17:07 – 17:15), for example, creates a climactic effect, while the fragmentation of material into less dense settings reduces the level of tension and creates a sense of resolution (11:29 – 12:20 and 17:17 – 18:46).





**Figure 9. Analysis of function and phrasing (0:00 - 9:00)**

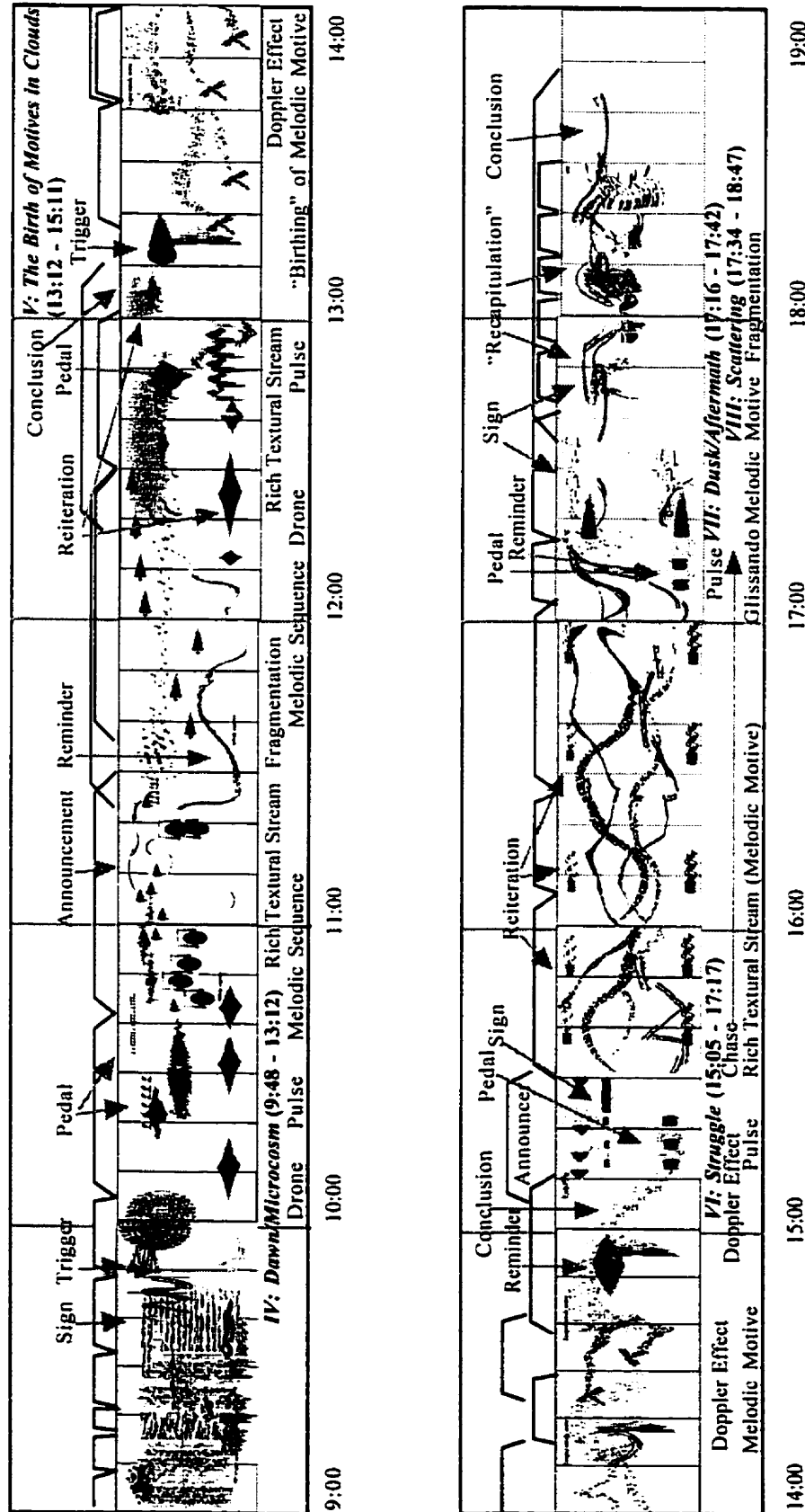
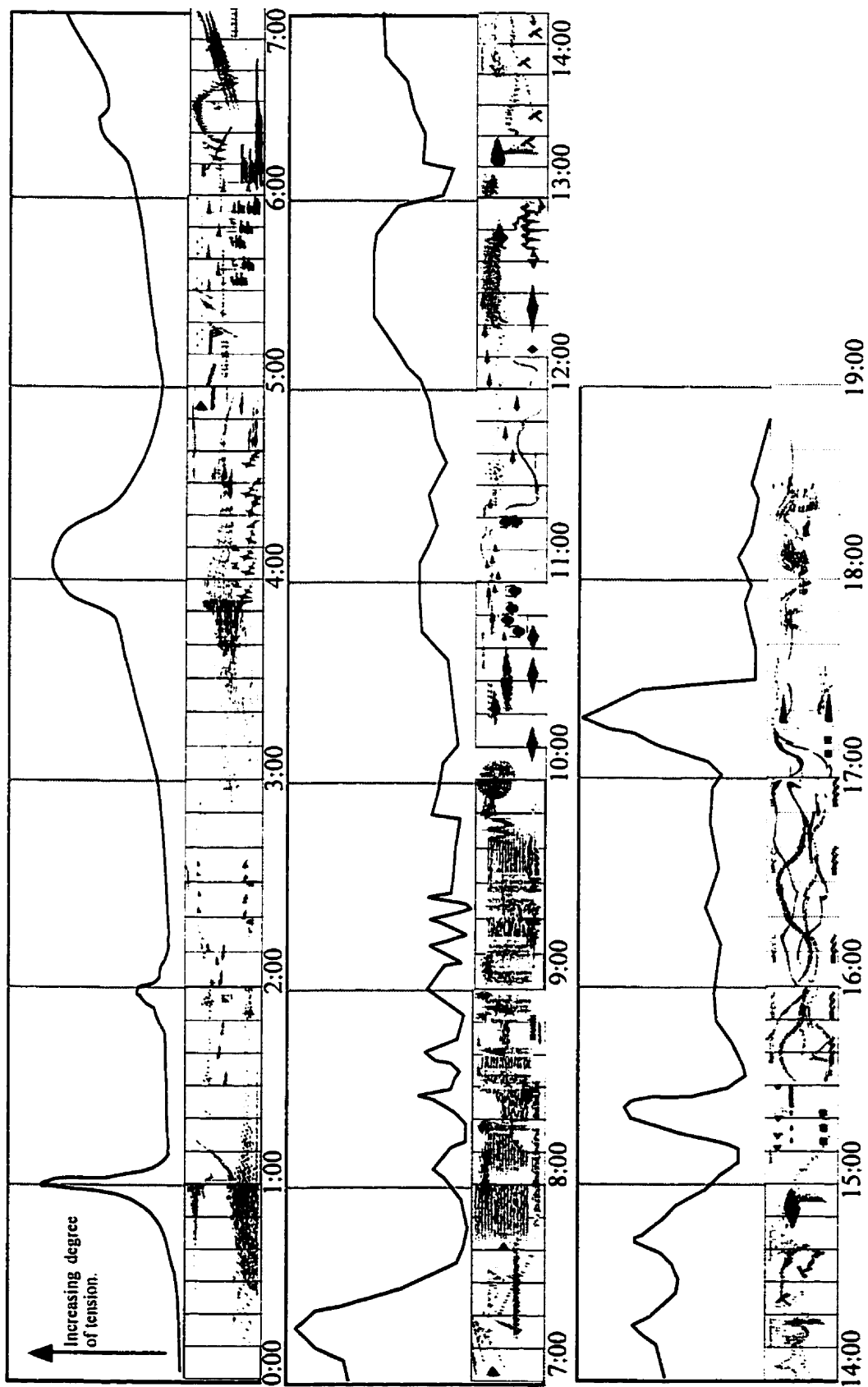


Figure 10. Analysis of function and phrasing (9:00 - 18:47)



**Figure 11. Analysis of tension**

## V: Development of Instrumental Timbre and Pitch

The development of pitch centres, the emergence of melodic motives, and the treatment of instrumental timbres further characterize each section of the piece and largely define the overall programmatic form. Through the course of *Unheard Voices*, *Ancient Spaces*, instrumental timbres are developed in increasingly traditional performance contexts. Within *I: Gathering* and *II: Emerging*, the instrumental sounds are texturally integrated with the transformed natural sounds. The cello sounds (1:00 – 1:52) in *Gathering* mirror the building agglomeration of creaking trees (0:00 – 1:00), but with a diminishing behavior. This releases the tension created by the “gathering” trees and is subsequently reiterated (1:52 – 2:01 and 2:14 – 2:33) on a smaller scale. The ringing drones of creaking trees throughout this section are also matched by the sustained cello notes, transformed by time-stretching processes (0:55 – 1:00 and 4:25 – 5:00). The flute sounds used throughout *II: Emerging* are also integrated in a textural manner with the squirrel sounds. Extensive transformations of the flute recordings renders them unrecognizable as flute sounds, especially when combined with the transformed squirrel sounds.

In sections *III: Running* and *IV: Dawn/Microcosm* there are contexts in which natural sounds mimic man-made rhythmic material and where textures derived from percussive instrumental sounds mimic natural textures. This creates a two-way integration of materials. In *Running*, the non-pitched percussive instruments are integrated to reinforce the percussive qualities of the moving water. Rolling snares (7:54 – 8:20), timpani (8:25 – 8:31), and cymbal crashes (8:33) respond to and interact with transformed water sounds of a similar nature. Looped water sounds create rhythmic ostinati (7:46 – 8:15), increasing the development of the percussive nature of this section. *IV: Dawn/Microcosm* can be seen as transitional regarding the development of instrumental sounds from heavily transformed and integrated contexts into real-world contexts. This is evident in the use of both the tolling bell (gong) sequence (10:48 – 11:30) and the passage combining metallophones with natural sounds in dense granular synthesis streams of sound (12:17 – 13:12).

In sections *V: The Birth of Motives in Clouds* and *VI: Struggle*, the cello and flute sounds return, presented largely as identifiable real-world sounds. Techniques of transformation such as transposition and time-stretching are applied to create desired behaviors (including Doppler effects and chase-like movements), but the main function of the instruments in these sections is to create melodic motives. The final transformations evident in sections *VII: Dusk/Aftermath* and *VIII: Scattering* return the instruments to textural contexts. This completes the progression of instrumental timbre development within *Unheard Voices, Ancient Spaces* and contributes to the overall programmatic development in the piece (Figure 12).

**Figure 12. Instrumental timbre transformation, pitch development, and programme**

I: Gathering II: Emerging III: Running IV: Dawn/Microcosm					V: Birth VI: Struggle		VII VIII
Textural Integration		Real-World Instrumental Sound			Texture		
Pitch Centre	Harmonic Structure	Melodic Sequence		Melodic Motive		Fragment	
Coexistence		Human		Assertion of		Supremacy	
		Cultural		Human		Competition	
		Development		Expression		of Nature	

Related to the development and programme of instrumental transformation is the increasing importance of pitch. All of the chosen pitch centres, melodic sequences, and motives in the piece are based upon arrangements of a robin's birdsong. Recordings of this birdsong were transposed several octaves down so that individual pitches could be discerned. Pitches which did not precisely conform to the tempered 12-note scale were

rounded to the nearest semi-tone (Figure 13). I was quite free with my interpretation of the more complex and unstable pitch material. In some cases I chose to include harmonic overtones present within the recording, in others I decided to simplify the pitch to a single dominant pitch centre.

**Figure 13. Birdsong transcription and associated pitch material**

TRANSCRIPTION:

SECTION:	PITCH USE	MATERIAL
I: Gathering	Pitch Centres	Cello
II: Emerging	Harmonic Sequences (each repeated)	Flute and Squirrel (Unstable pitches)
IV: Dawn/Microcosm	Melodic Sequences	Gongs
		'Spectrally Modified Duck'

The birdsong melody, essentially the underlying motivic theme of the piece, is continually drawn on throughout the work. It provides the pitch centres evident in *I: Gathering*, the harmonic structures in *II: Emerging*, the melodic sequences in *IV: Dawn/Microcosm* (Figure 13), and the motivic arrangements in *V: The Birth of Motives in Clouds* and *VI: Struggle* (Figure 14). In some instances the pitches are assigned to instrumental sounds (for example, the bell/gong sequence in *Dawn/Microcosm* (10:48 – 11:30)) and at other times, to transformed sounds from nature (for example, the squirrel sequence (5:30 – 6:04) in *Emerging* and the spectrally modified duck-call sequence (11:37 – 12:32) in *Dawn/Microcosm*). By applying multiple transformations to the pitched materials in the piece, unstable fluctuations around a given pitch centre were introduced, along with the creation of harmonic overtones (often the perfect fifth) and other timbral related transformations. The real-world source of the pitch material, the birdsong itself, is finally revealed in *VII: Dusk/Aftermath*, in its original octave, as well as transposed several

octaves below (17:16 – 17:42). The song is also hidden in highly transformed contexts, including the granular synthesis streams (12:17 – 13:12) in *IV: Dawn/Microcosm*. The progression from pitch centre, to harmonic structure and finally to the emergence of motive also contributes to the programme of the piece (Figure 12).

**Figure 14. Birdsong transcription and motivic arrangements**

**TRANSCRIPTION:**



**ARRANGEMENTS:**



**Arrangement 1:** Motive B and C  
Two Cello's  
(V: 13:42 – 13:59)



**Arrangement 2:** Motive D and A  
Flute and Cello  
(V: 14:14 – 14:28)



**Arrangement 3:** Motive B and D  
Flute and Cello (V:14:41 – 15:11,  
source for VI: 15:31 – 17:15, and  
fragmented in VII and VIII)

I created the motivic arrangements (Figure 14) of the birdsong by separating the song into smaller motivic units, freely applying octave displacement to selected pitches, disregarding some repeating pitches, and applying new rhythmic settings to the material. By combining and repeating two motives at a time I was able to create highly characterized arrangements. The repetition of Arrangement 2 resulted in continuously synchronized material while Arrangements 1 and 3 created phasing rhythmic variations. Each arrangement was further distinguished by the instrument choices. The application of Doppler effects to the motivic material in *V: The Birth of Motives in Clouds* resulted in transformations similar to traditional sequencing treatments, while extreme processing and time-stretching greatly animated and distorted Arrangement 3 in *VI: Struggle*.

## VI: Diffusion

The final process contributing to the distinctiveness of each section involved the diffusion<sup>16</sup> of the piece (Figure 15). The movement of sounds through space was a central concern in the composition of *Unheard Voices*, *Ancient Spaces* and became a performance attribute of the work's concert presentation. Historically, the diffusion of musical sounds has been a concern for many composers. Giovanni Gabrieli, for example, employed the technique of *cori spezzati* in works such as *Sacrae symphoniae* (1597) where two choirs were placed on opposite sides of the church.<sup>17</sup> Berlioz incorporated solo instruments placed offstage in several compositions, including the shepherd's pipe in *Symphonie fantastique*.<sup>18</sup> Greater experimentation with diffusion techniques, however, only began with the rise of electronic music in the twentieth century. Stockhausen and Xenakis each used multiple speaker configurations for the presentation, or interpretation, of their electronic works in the 1950s.<sup>19</sup> Varèse's musique concrète composition *Poème Electronique* was designed for presentation in concert using 425 loudspeakers and was

<sup>16</sup> The term *diffusion* refers to the process of locating and dynamically moving sounds through a spatial field, as well as the resulting perceptual characteristics of a composition's spatial movements.

<sup>17</sup> Denis Arnold, "Cori spezzati," *The New Grove Dictionary of Music and Musicians*, ed. Stanley Sadie (London: MacMillan Press Ltd., 1980), vol. 4, p. 776 – 7.

<sup>18</sup> Hugh MacDonald, "Berlioz, Hector," *The New Grove Dictionary of Music and Musicians*, ed. Stanley Sadie (London: MacMillan Press Ltd., 1980), vol. 2, p. 600.

<sup>19</sup> Roads, p. 453.



composed specifically for the space within the Philip's Pavilion, designed by Le Corbusier, at the Brussels World's Fair in 1958.<sup>20</sup>

In *musique concrète* composition, Schaeffer experimented with the spatial control of sounds in real-time as early as 1951, using the *potentiometre d'espace*, developed by Jacques Poullin.<sup>21</sup> More recent innovations in the real-time diffusion of sound have been used by Boulez and Berio.<sup>22</sup> Normandeau and Dhomont have also presented acousmatic works in concert where the movement of sounds in multiple speaker environments is integral to the composition and creates a dynamic perceptual experience for the listener.

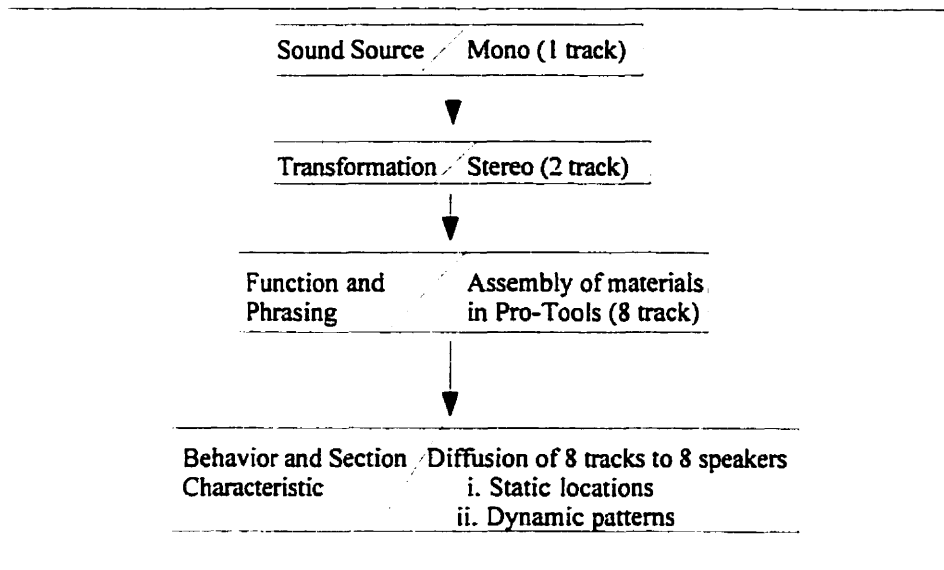
*Unheard Voices, Ancient Spaces* was composed using an 8-track digital audio editor called Pro-Tools (Appendix C: Pro-Tools). This allowed me to compositionally organize my transformed materials in eight independent tracks. The amplitude, speaker placement (balance), and equalization of each track was preserved independently from the others. Because each behavior within a section of the piece was confined to a given number of tracks (mono or stereo), I was able to enhance it further by creating an associated spatial position or movement for each chosen track. This approach differs dramatically from the tradition of diffusion as an interpretation of a finished stereo tape composition through multiple speakers. In my work, spatial motion is a parameter of sound and music comparable to pitch, timbre, duration, and amplitude. It is integral to the compositional process.

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<sup>20</sup> Ibid.

<sup>21</sup> Peter Manning, *Electronic and Computer Music* (Oxford: Clarendon Press, 1995), p. 27.

<sup>22</sup> Roads, p. 453

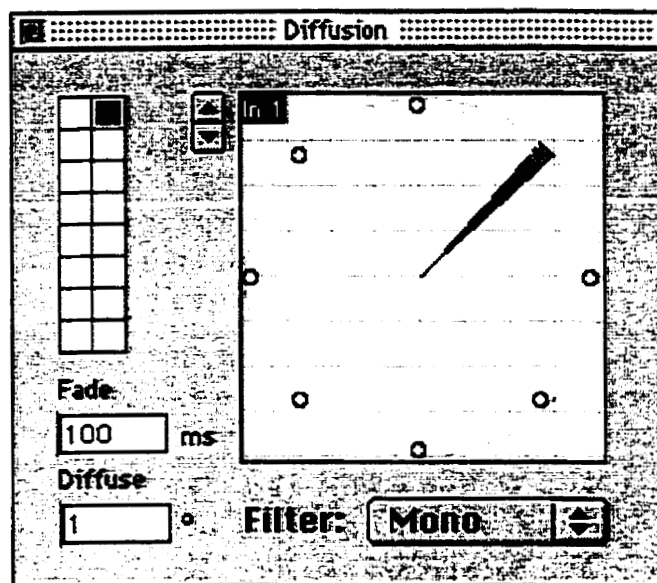
**Figure 15. Diffusion process**

By using a real-time 8-channel/8-speaker digital mixing matrix called the Richmond Audio Box<sup>23</sup> and the ABControl<sup>24</sup> software interface, I was able to *diffuse* each track of sound material to any given location or create dynamic spatial patterns, all within a 360° perimeter of eight speakers. I isolated each stereo pair of sound tracks, and then designated its location within the circle of speakers at specific time cues, according to what I felt best suited the behavior of the sounds. When the piece was played back through the Audio Box, these locations and trajectories would take effect at each specified cue time. The positions in space were designated by using a vector based graphical interface (Figure 16). The cue times of each position were recorded in a separate cue list.

<sup>23</sup> Created by Charlie Richmond at Richmond Sound Design Ltd., 205-11780 River Road, Richmond, BC, Canada.

<sup>24</sup> Developed by Chris Rolfe of Third Monk Software, <http://www.thirdmonk.com/>.

**Figure 16. ABControl diffusion vector console**

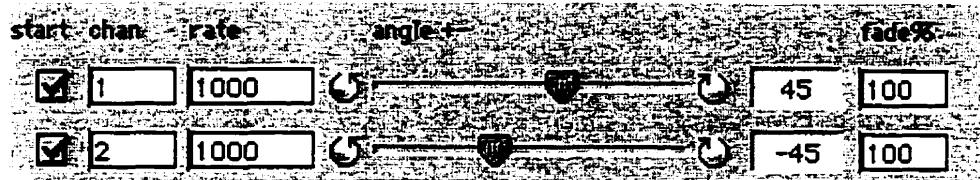


Each small sphere on the circle represents one speaker location.

The darkened indicator shows the current spatial location of Track 1 which can be moved by using the mouse in ABControl.

Dynamic movements could be researched, rehearsed, and recorded in real-time while listening to the sound material by either using the computer mouse to move the vector through the spatial field in the vector console, or by creating and recording preset spatial patterns using diffusion generators (Figure 17). I could hear the sounds move in response through the space surrounding me and the corresponding vector parameters of these dynamic movements were concurrently recorded into the cue list with the associated cue times. The creation of these movements was a direct response to the behaviors which I had created with the transformed sound materials and resulted in unique spatial characteristics for each section (Figures 18 and 19). Diffusion also enabled denser materials to be separated and for the characteristics of each track of material to be more clearly discerned.

Figure 17. ABControl diffusion generator



The rate, transitional fade, and direction of each rotational pattern was predetermined using these parameters. In multiple combinations, these patterns resulted in highly complex movements.

Figure 18. Selected characteristic spatial patterns and behaviors (Sections I – IV)

SECTION AND DIFFUSION	BEHAVIOR	EXAMPLE (time)
<i>I: Gathering</i>		
Rapid and scattered diffusion covering entire sound area in semi-random manner	Agglomerations increasing and decreasing	0:00 – 2:00
Slowly circling rotational patterns	Slowly building choruses of voices	2:40 – 3:40
<i>II: Emerging</i>		
Single speaker point of origin and slow spread	Glissandi	6:30 – 7:00
180° separation of paired sequential events	Call and response melodic sequence	5:30 – 6:05
<i>III: Running</i>		
Sudden and rapid shifts in location	Convulsive juxtaposition of materials	8:18
Slow 180° panning timed to behavior pulse	Rhythmic pulse	7:45 – 8:30
<i>IV: Dawn/Microcosm</i>		
Wide panning and separation of materials	Gong and spectrally modified duck melodic sequences	10:48 – 11:30 and 11:37 – 12:32
Sweeping pans timed to behavior	Pitch fluctuations of drones and rich textural streams	11:05 – 11:25

**Figure 19. Selected characteristic spatial patterns and behaviors (Sections V - VIII)**

SECTION AND DIFFUSION	BEHAVIOR	EXAMPLE (time)
<i>V: The Birth of Motives in Clouds</i>		
Separated movements of streams of sound and subsequent collision of clouds	Clouds of trapped instrumental motives and “birthing” process	13:18 – 13:41
Panning of material timed to Doppler effect	Doppler effect of passing freed instrumental motives	13:42 – 13:59
<i>VI: Struggle</i>		
Sudden and rapid movements timed to the behavior characteristics	Chase and interaction of cricket material and instrumental motives	15:12 – 17:15
<i>VII: Dusk/Aftermath</i>		
No movement, but material separated spatially	Calm	17:16 – 17:42
<i>VIII: Scattering</i>		
Rapid movement in response to wind gusts	Fragmentation of material, scattered by the wind	17:46 – 18:30

## VII: Conclusion

The creation of sections with distinct evocations for the listener is dependent upon the source materials, behaviors, diffusion, and development of pitch and instrumental timbres in each. I chose titles for each section which I felt best described the combined results of these characteristics. *Gathering* refers to the agglomerating textures and droning choruses of creaking trees. The scattered and circling diffusion patterns and the use of instrumental textures to reinforce the natural sounds suggested to me a gathering of “voices of the forest”. In the second section, the diffusion pattern is of voices emerging in one speaker and gradually spreading to the others. The first appearance of melodic/harmonic sequences in this section and the creation of new voices of material

through the intensive integration of flute and squirrel sounds was also consistent with the idea of an *emerging* voice.

*Running* was chosen as an obvious description of moving water. The convulsive nature of the sound sources also led to rapid diffusion movements and rolling snare and timpani textures. I intended to evoke a vivid cascade of images and sounds as if the listener were rushing down a mountainside. *Dawn/Microcosm* refers to the sudden stillness of drone-like behaviors which appear, as well as the rich biodiversity one encounters in a lake environment, presented in the form of rich textural streams of sound. The first appearance of instrumental timbres in a clearly recognizable and traditional presentation also suggested the development of new interaction between the natural world and humanity. The title *The Birth of Motives in Clouds* is directly related to the intended evocations of the material in the section — the evolution or birthing of melodic motives in the midst of dense clouds of insect sounds and the advent of a developed human cultural expression. This is also true of *Struggle*, where I intended, largely through dynamic diffusion movements and extreme temporal distortions of the motivic material, to create a sense of conflict between nature and humankind. The titles *Dusk/Aftermath* and *Scattering* are both related to the development of a conclusion for the piece and the sections' diffusion patterns. The release of tension, the revealing of the birdsong, and the recapitulation of earlier materials creates the sense of conclusion.

The musical materials developed in *Unheard Voices*, *Ancient Spaces* show similarities to traditional instrumental composition in the development of gestures, functions, phrases, and formal structures. The transformation of materials also had parallels in instrumental music, including the transposition of pitch, the orchestration of color, the creation of tempo, and the control of time. Where the music takes on innovative properties is in the source of compositional materials and the movement of sounds through space. Together, all of these components enabled me to create a unique listening journey for the listener through invented, immersive, and dynamic environments. I was able to both give voice to a deeply felt personal experience of nature and create evocations which draw the listeners inwards into their own imagined spaces.

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## Appendix A: Listening Score

Composers and analysts of electronic, musique concrète, and acousmatic music frequently create graphic scores for these compositions. They consist of visual representations of the music displayed over a horizontal time-line. Images, symbols, and analytical data, and poetic inscriptions are often used to offer further interpretation of the music. György Ligeti's *Artikulation* and Karlheinz Stockhausen's *Kontakte* are two well known works for which graphic scores were created. R. Murray Schafer created graphic scores for compositions for instruments and electronics which have been displayed in art galleries, independent of the performance of the music.

After completing the composition of *Unheard Voices, Ancient Spaces*, I created a listening score. I based the symbols and images in the score upon what I heard in the music. Often, the attributes of a particular gesture or behavior immediately suggested a corresponding graphic image or shape (Figures 20 and 21).

**Figure 20. Selected listening score examples I**

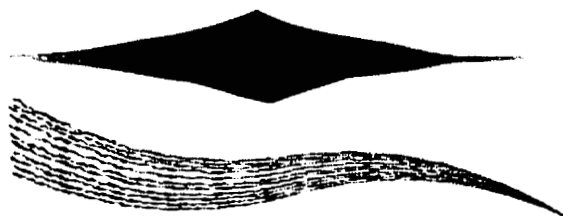
Glissandi:



Rich textural stream:

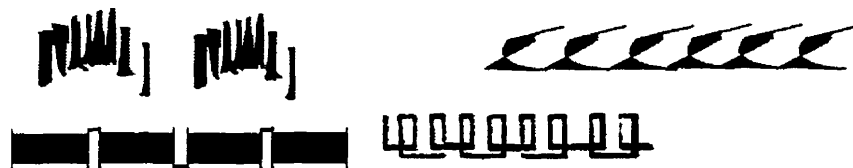


Drones:

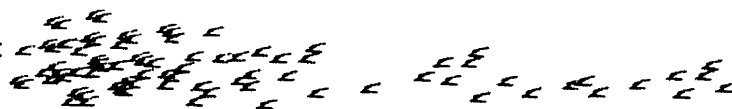


**Figure 21. Selected listening score examples II**

Ostinati pulses:

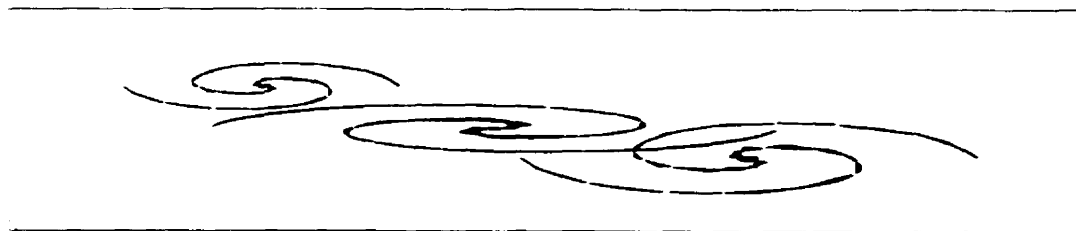


Fragmentation:



In other instances I created interpretive images which were a visual response to the evocations I experienced from the music.

In general, the vertical axis in the score represents frequency, ranging from lower frequencies in the bottom to higher frequencies in the top. The darkness, or contrast, of the material reflects the amplitude. In both cases, these representations are relative to the immediately surrounding material. I deliberately avoided a strictly measured analytical approach within the score, opting instead for a liberal artistic interpretation and representation of the music. In several places, the diffusion of the sounds is also represented in the symbols and images. For example, the circling diffusion patterns (2:40 – 3:40) of the chorus of tree creaks were reflected in the use of images which suggested such movement (Figure 22).

**Figure 22. Circling diffusion representation in the listening score**

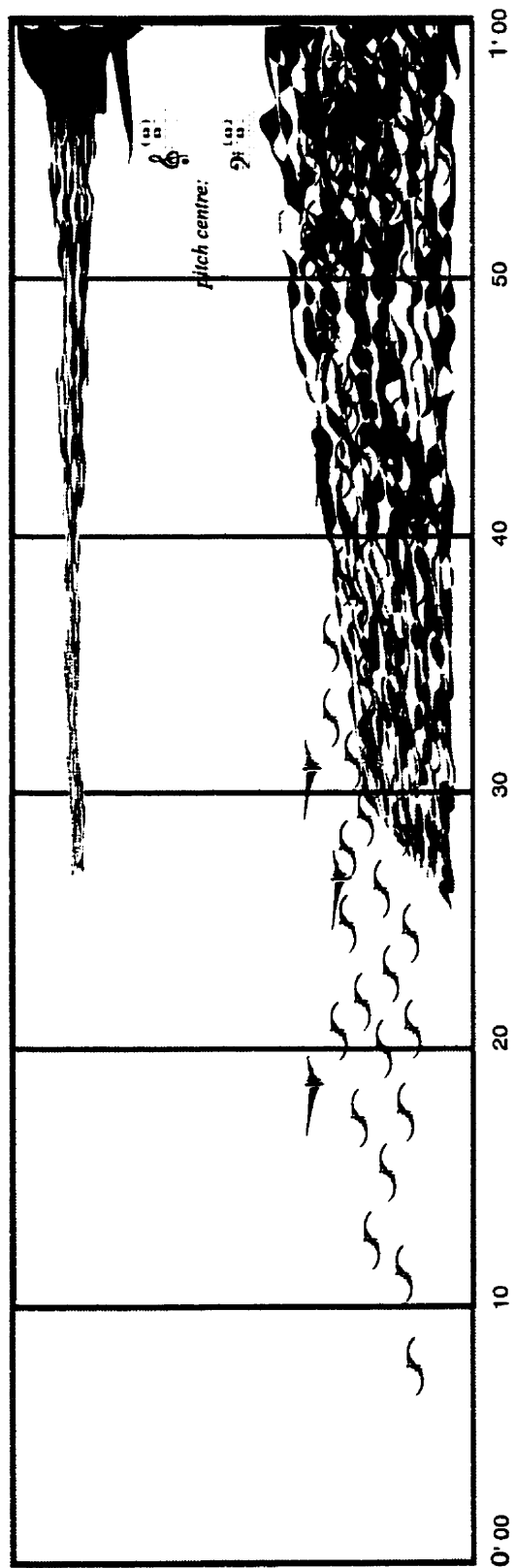
In *V: The Birth of Motives in Clouds* and *VI: Struggle*, placement of the images within the score reflects the diffusion and movement of the sound to a greater degree than the frequency and amplitude. The movement and collision of the textural clouds in space during the “birthing” process of the melodic motives, for example, is graphically represented in the score (Figure 23).

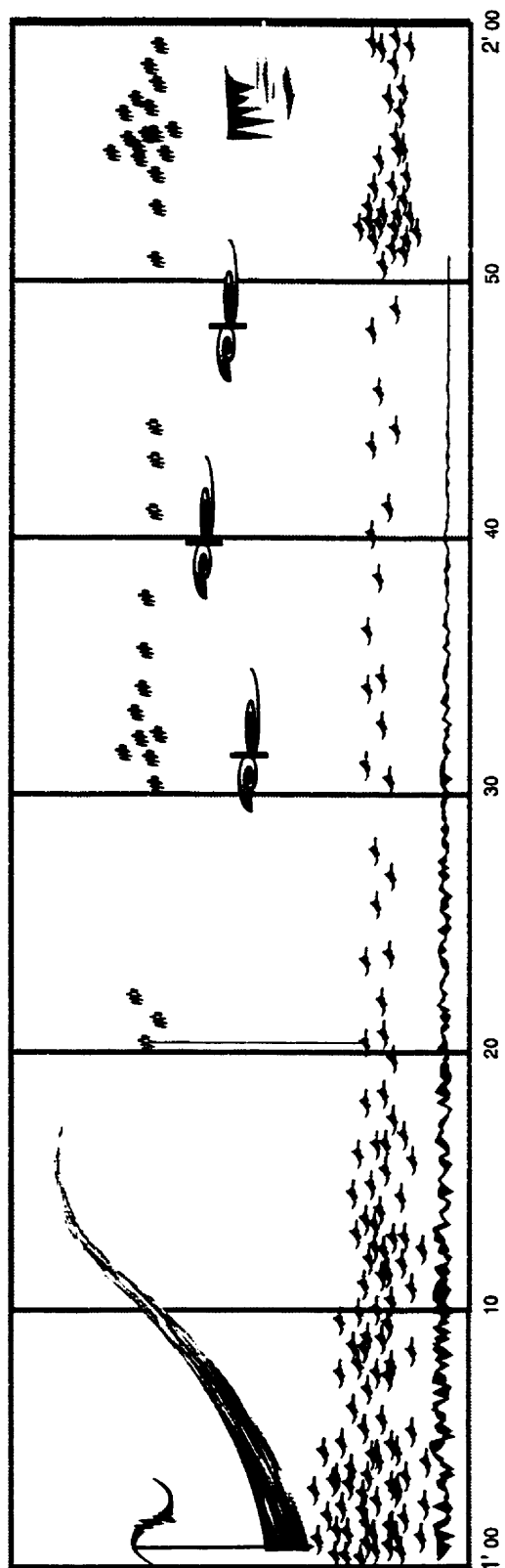
**Figure 23. Textural clouds collision in the listening score**

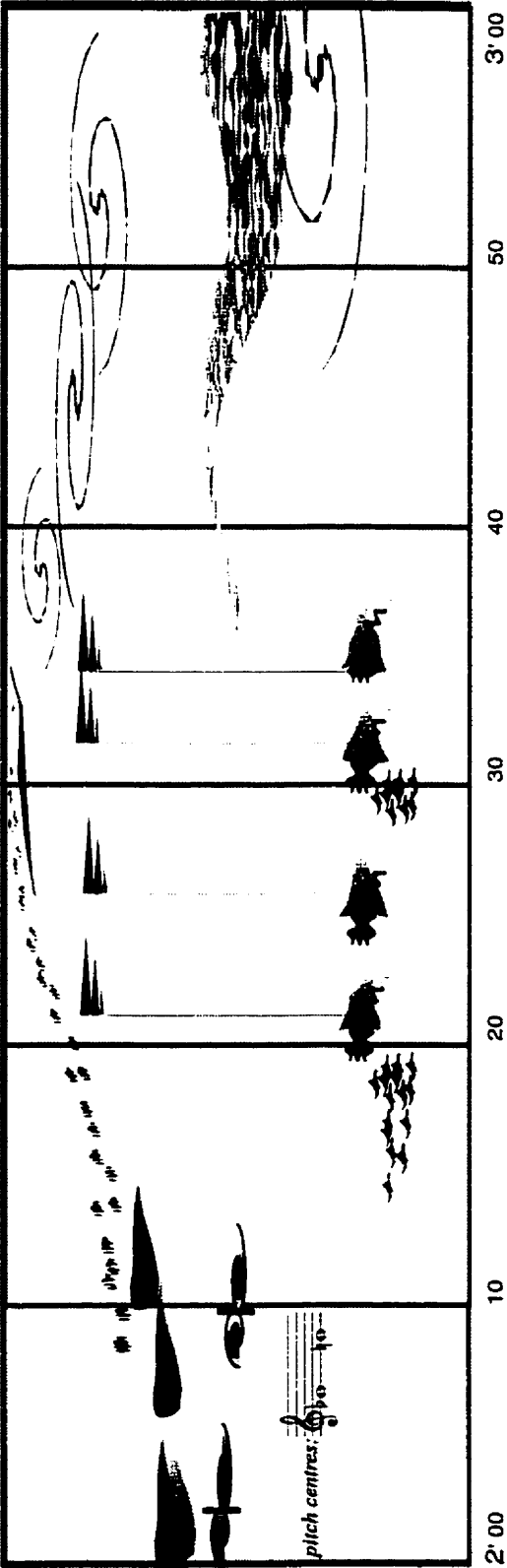


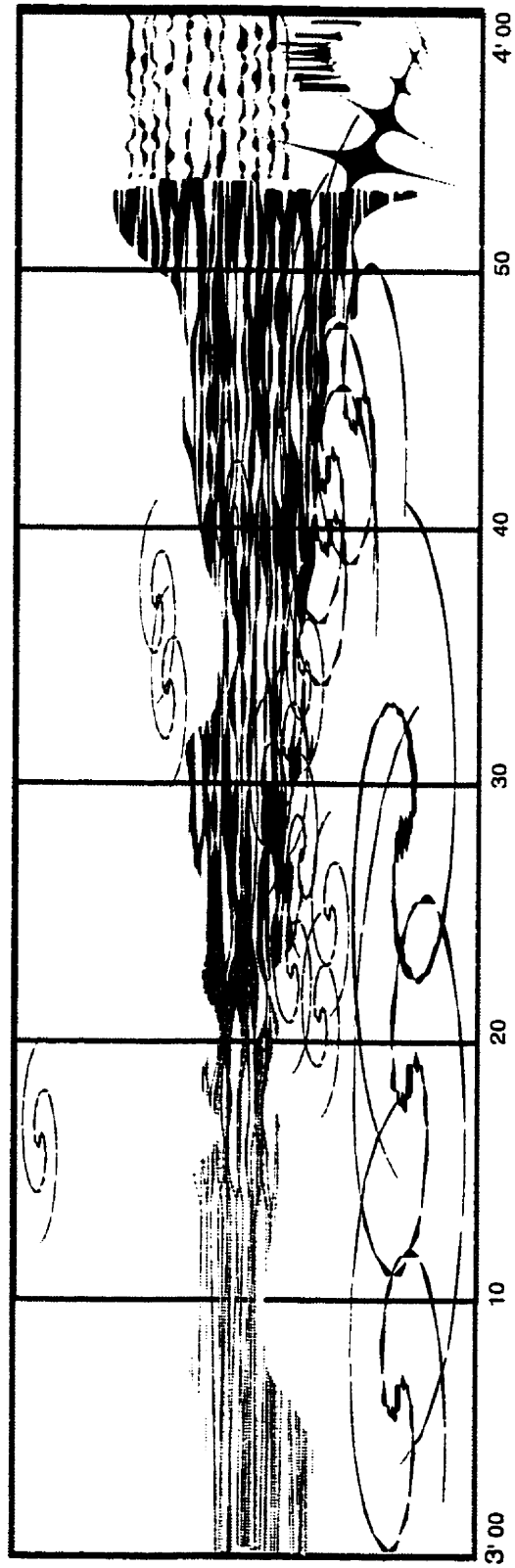
I also included traditional musical notation to indicate where the pitch material derived from the birdsong was used to create pitch centres, melodic sequences, and motives. Section titles and times are also included. The listening score was created using Adobe Acrobat Illustrator 8.0, a graphics design and drawing software tool. It can also be viewed in the Macromedia Director Movies titled UVAS-MOVIE1 and UVAS-MOVIE2 on the accompanying CD-ROM (see Appendix D: CD-ROM).

I: Gathering 0' 00" - 5' 00"

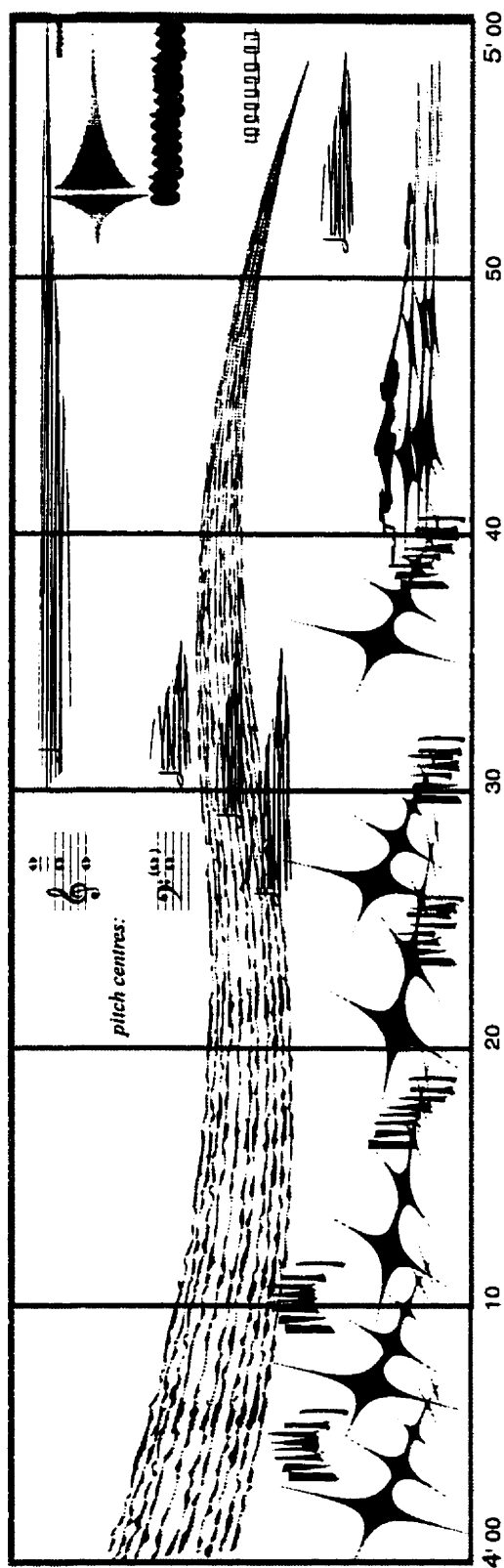




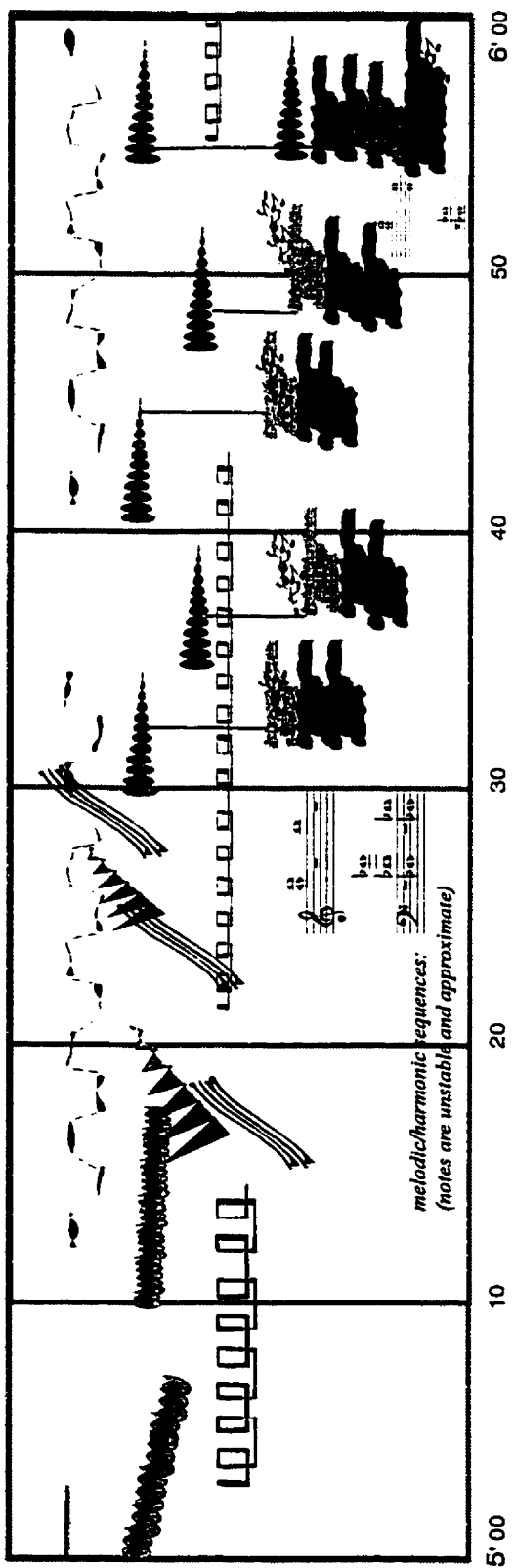


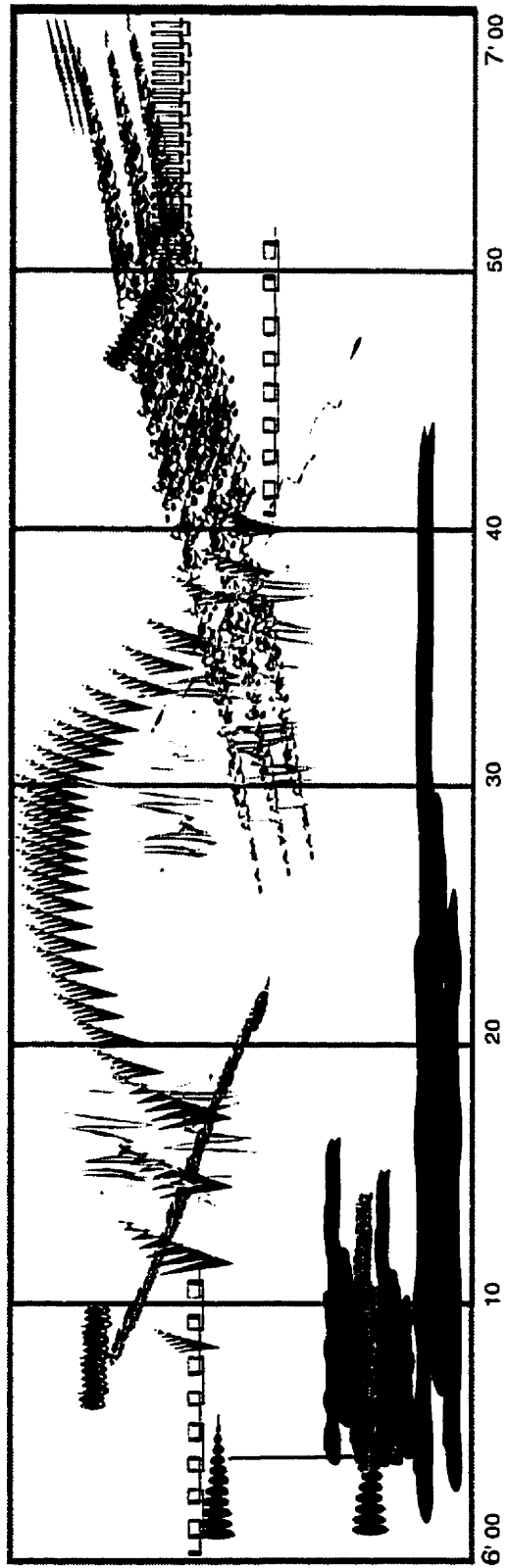


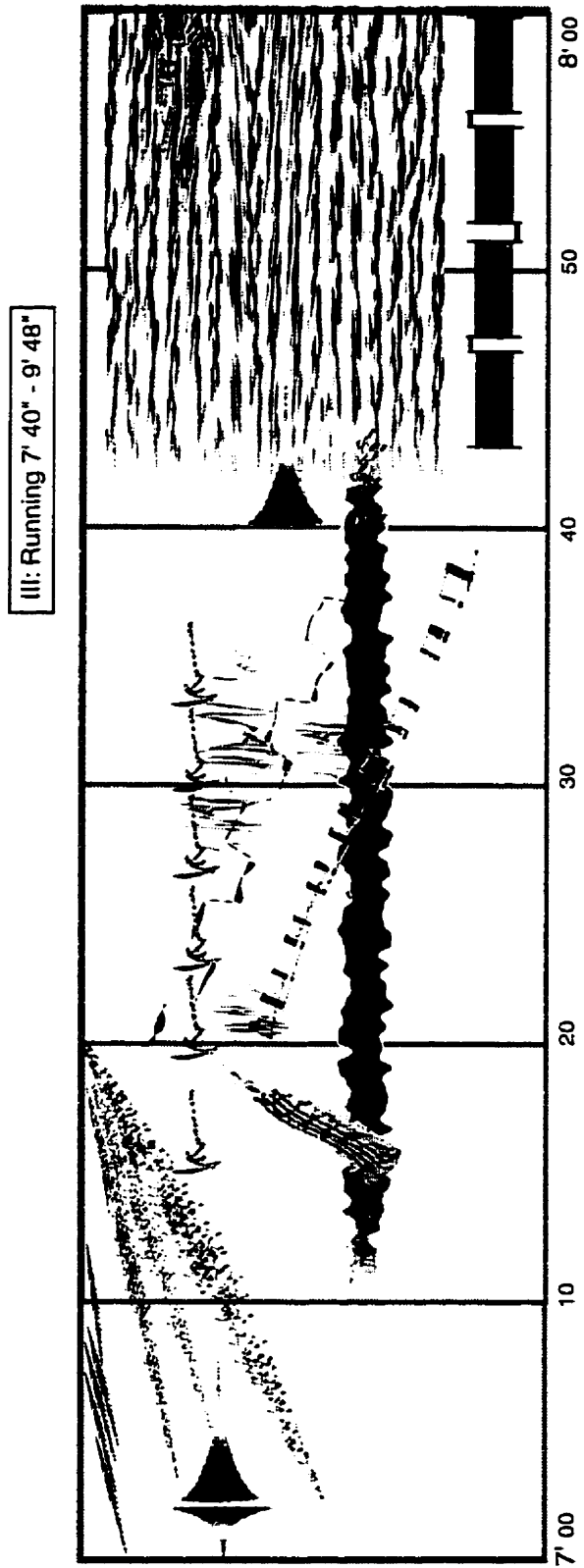
II: Emerging 4' 54" - 7' 45"

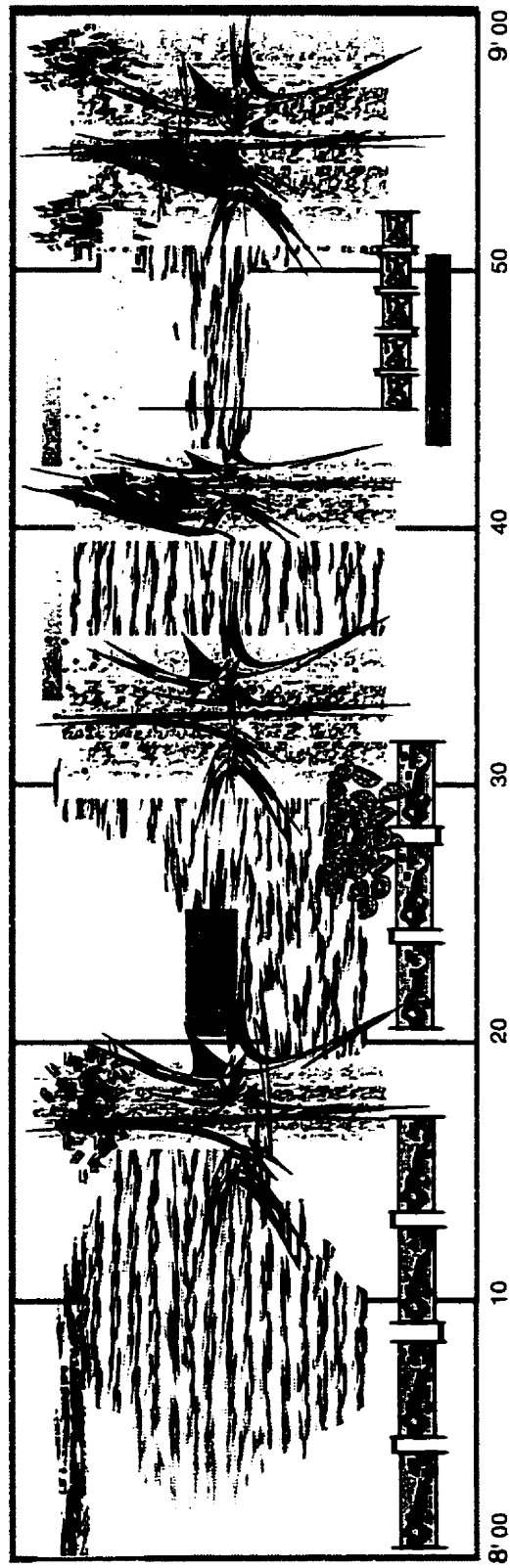




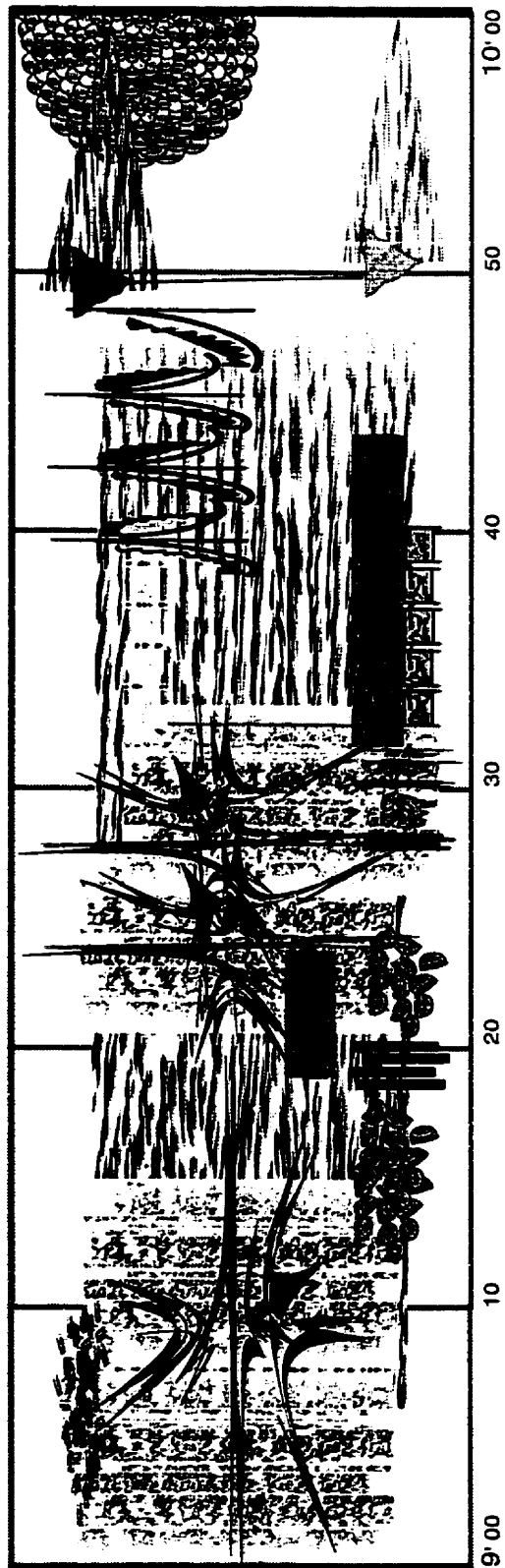


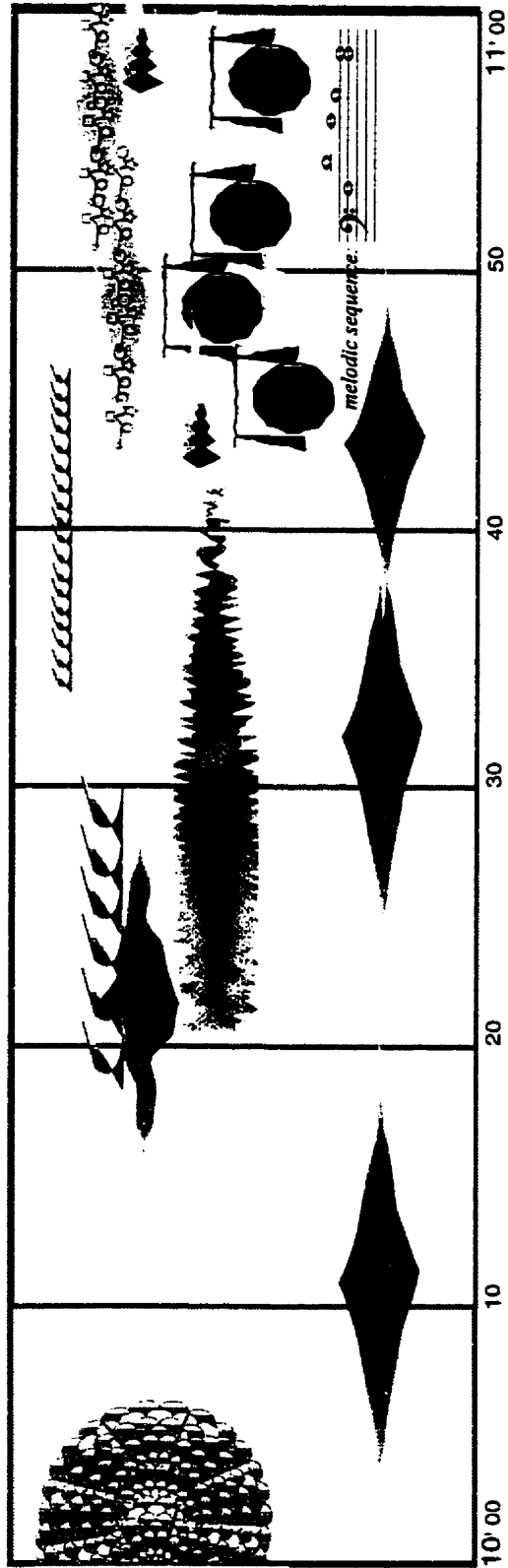


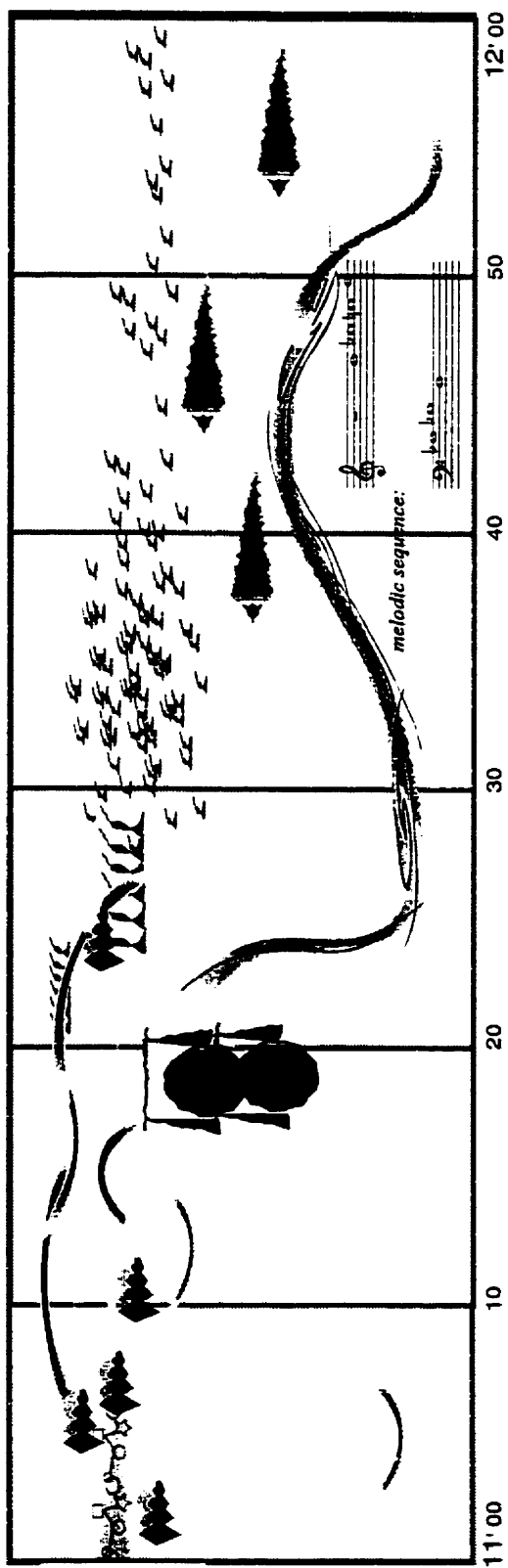


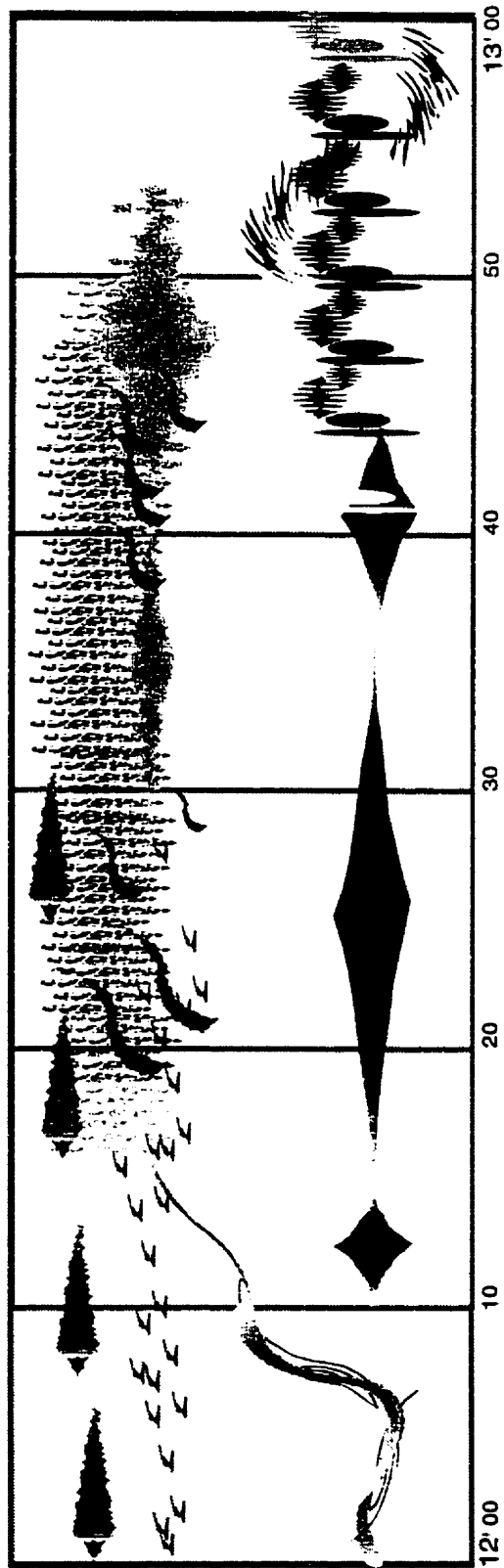


IV: Dawn/Microcosm  
9:48 - 13:12



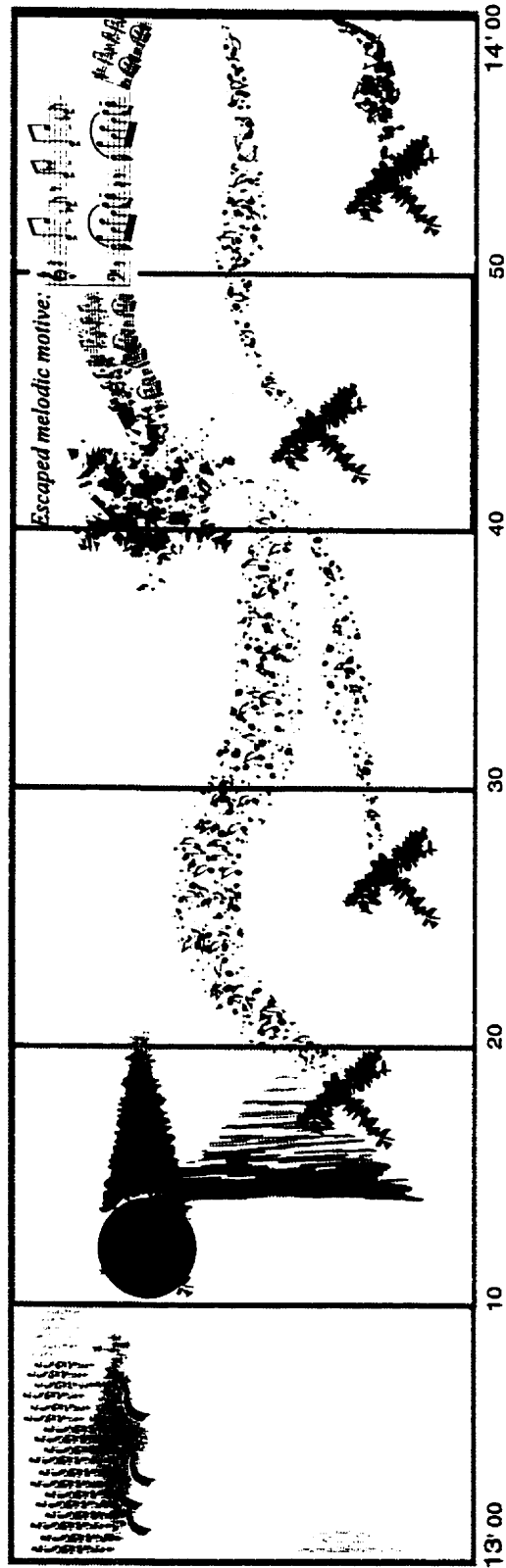


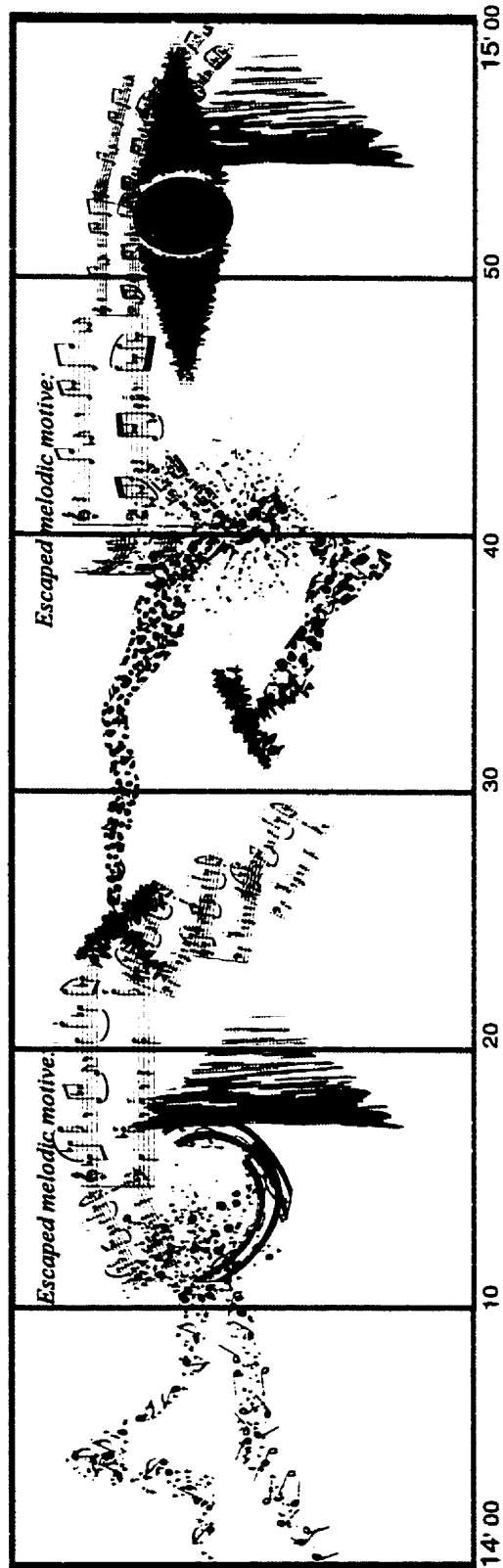


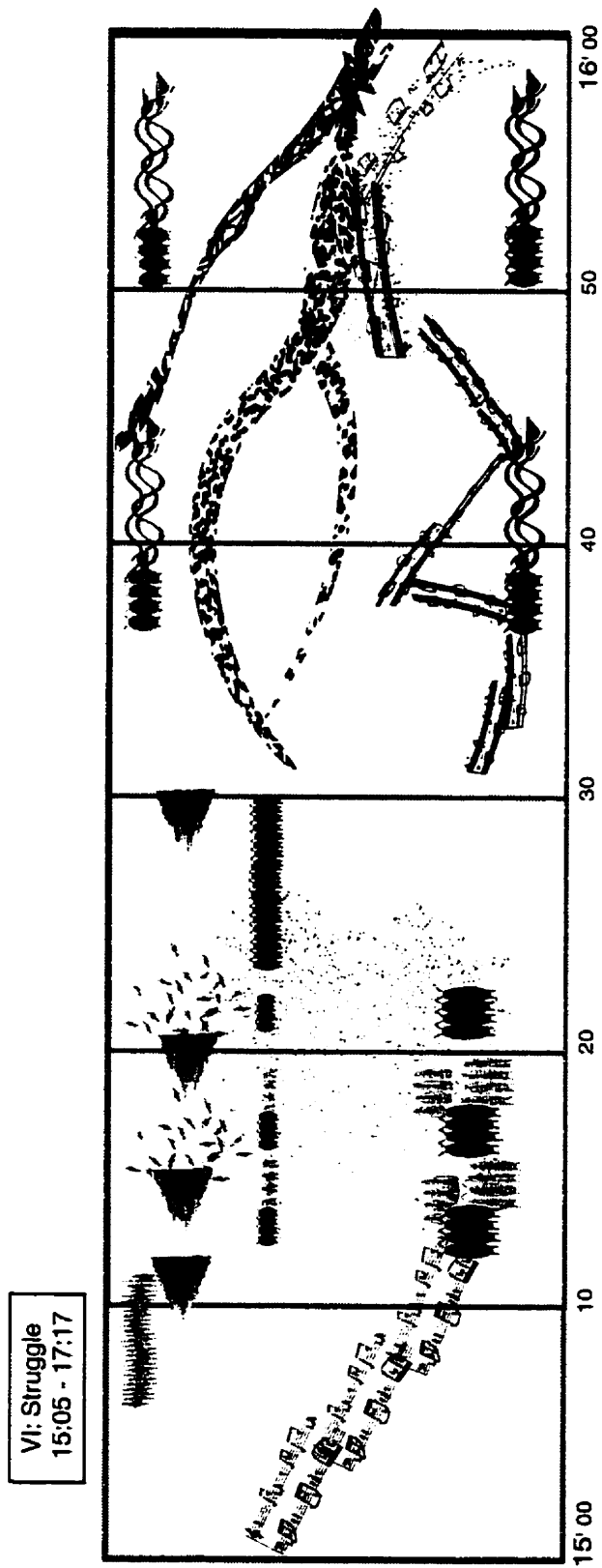


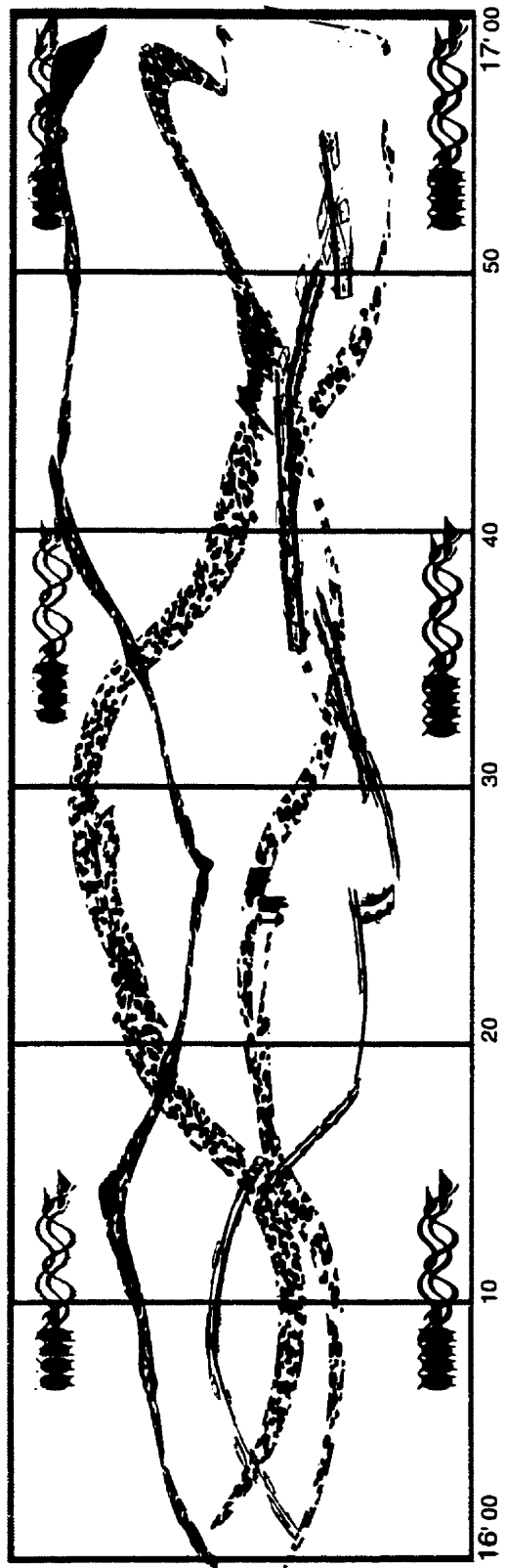


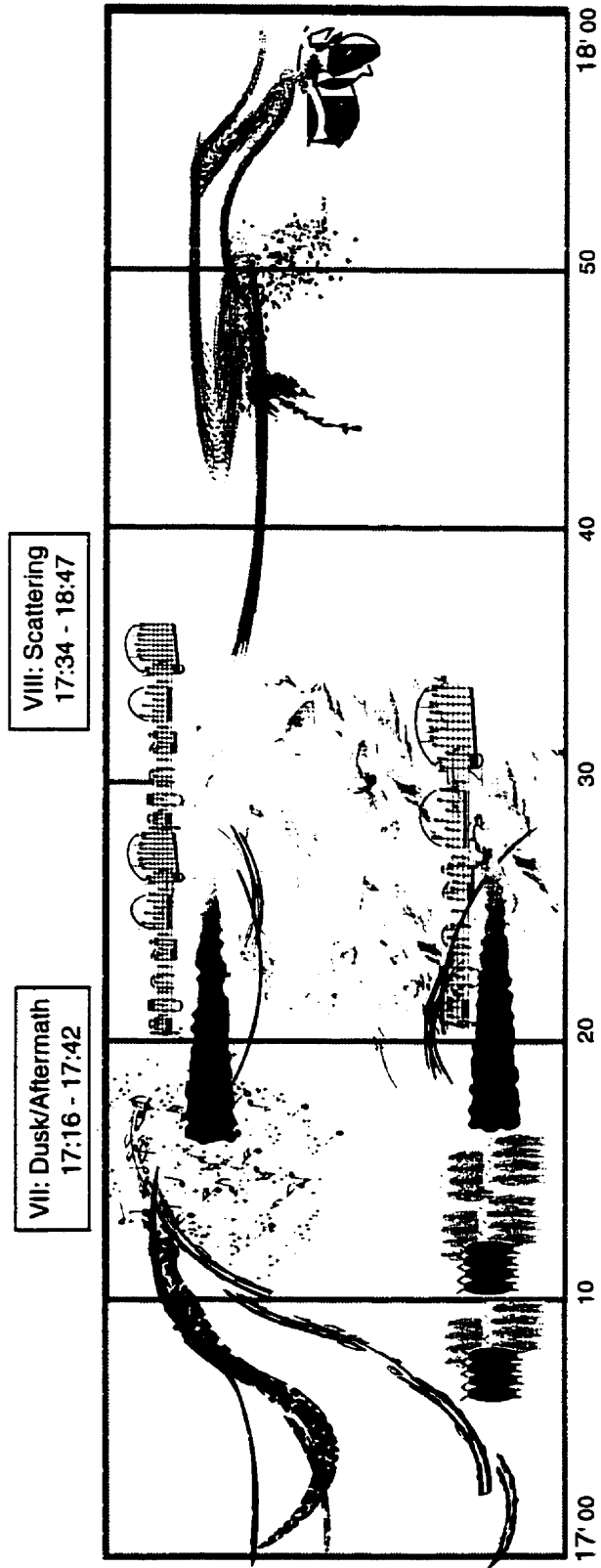
V: The Birth of Motives in Clouds  
13:12 - 15:11

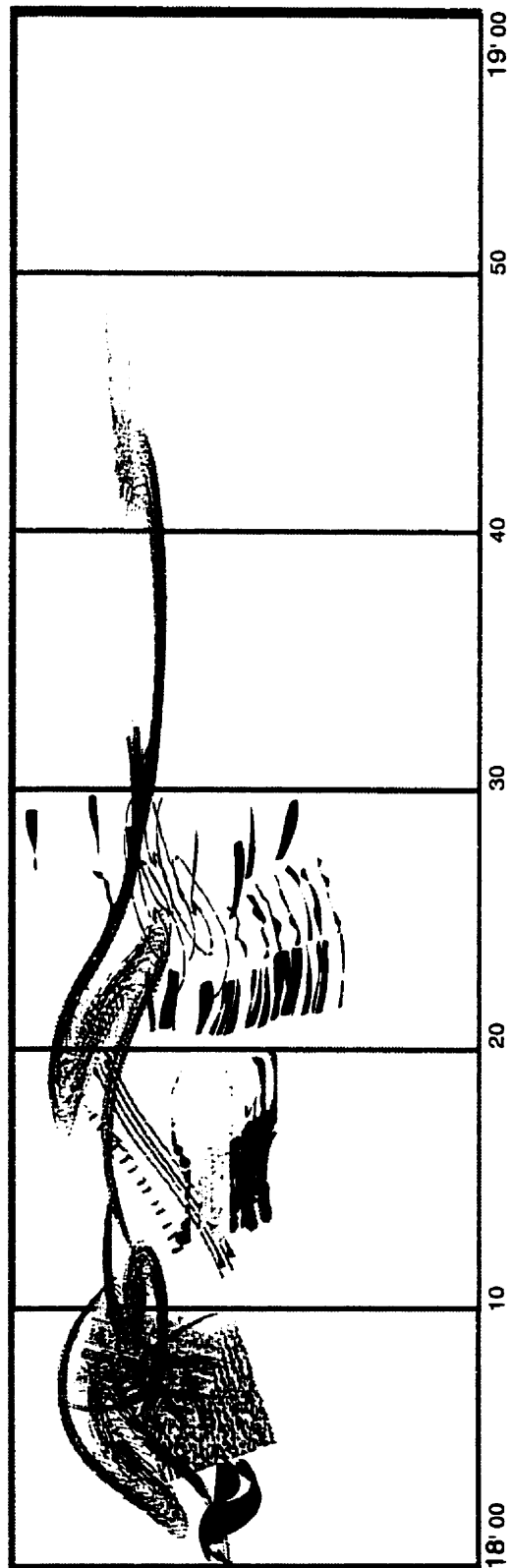












## Appendix B: CSound and Cecilia

The processing and manipulation of recorded sound materials was done using *CSound*, a computer-based software synthesis and processing language first developed in 1986 by Barry Vercoe at MIT. A wide range of pitch, time, and spectral analysis transformational and synthesis techniques are available with *CSound*. In depth information on *CSound* can be found in *The CSound Book* by Richard Boulanger (Cambridge: The MIT Press, 2000).

A graphical programming interface for *CSound* called *Cecilia* was used to set the parameters for my transformations. *Cecilia* was developed by J. Piche and A. Burton at l'Universite de Montreal. It is freely available for Windows, Macintosh, and Unix operating systems and can be downloaded by FTP from:

**<ftp://ftp.musique.umontreal.ca/pub/>**.

Using *Cecilia*, I was able to make visually based decisions regarding the particular transformation I was applying. A number of individual *modules* are available for carrying out specific transformations, each oriented to the given transformation. *Band Pass Filter*, *Resonant Filter*, *Spectral Filter*, *Ultra-Vocoder*, *Stereo Reverb*, *Multi-Tap Delay*, *Brassage*, *Transposer*, *Warper*, *Convoluter*, and *Stretcher* were Cecilia modules used for transforming the material in *Unheard Voices*, *Ancient Spaces*. Each module allows the user to set synthesis or processing parameters through the manipulation of plotted points on an x/y axis. Figures 24 – 26 contain examples of *Cecilia*'s work environment and modules.

Figure 24. Cecilia module "Band-Pass Filter"

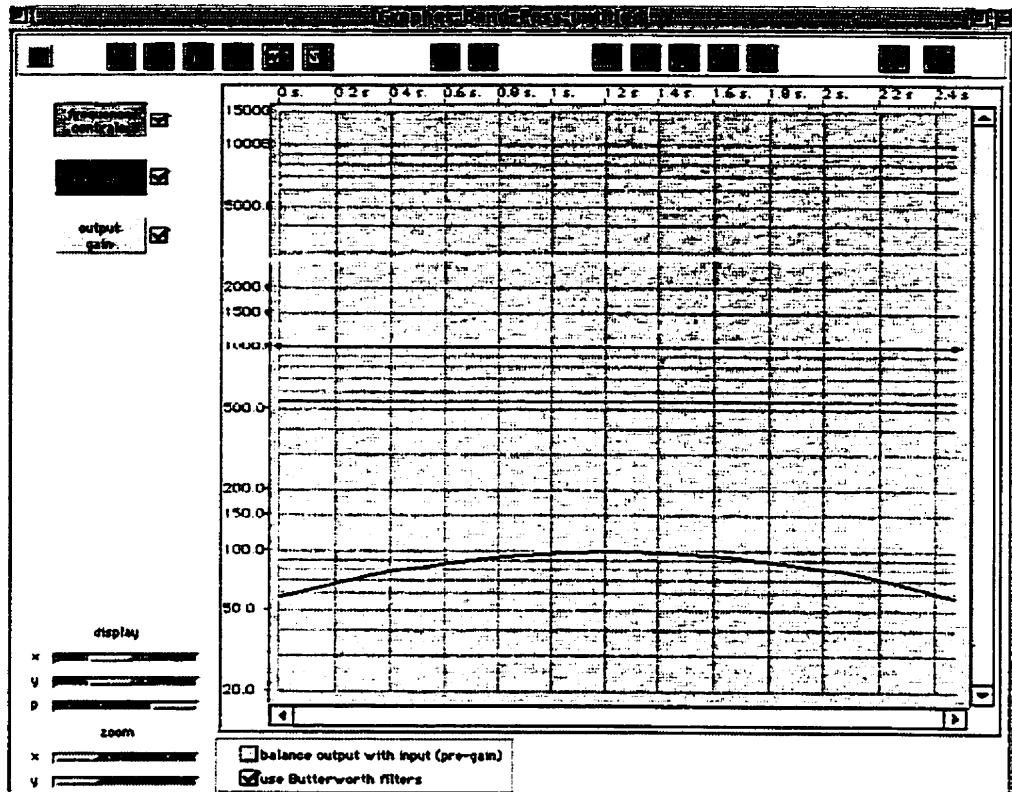


Figure 25. Cecilia module "Brassage"

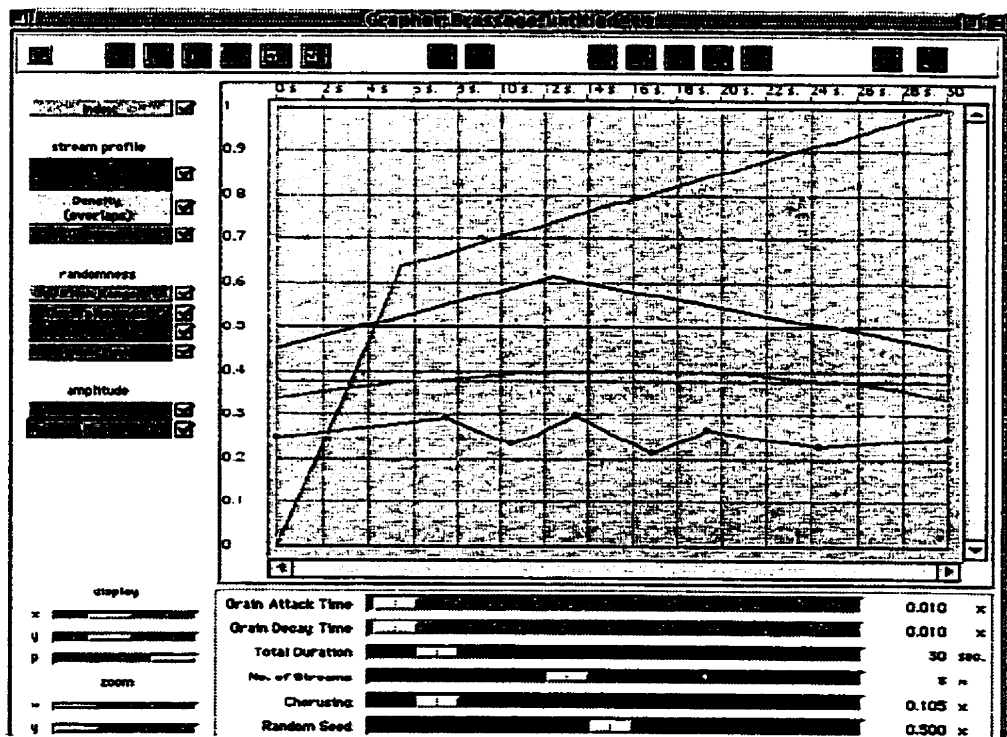
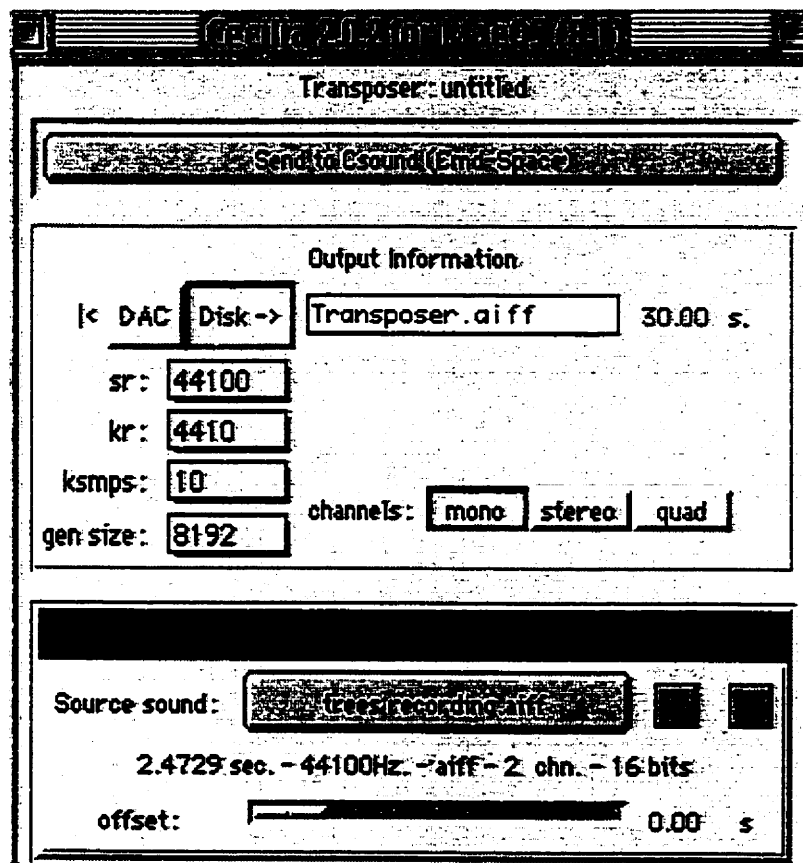


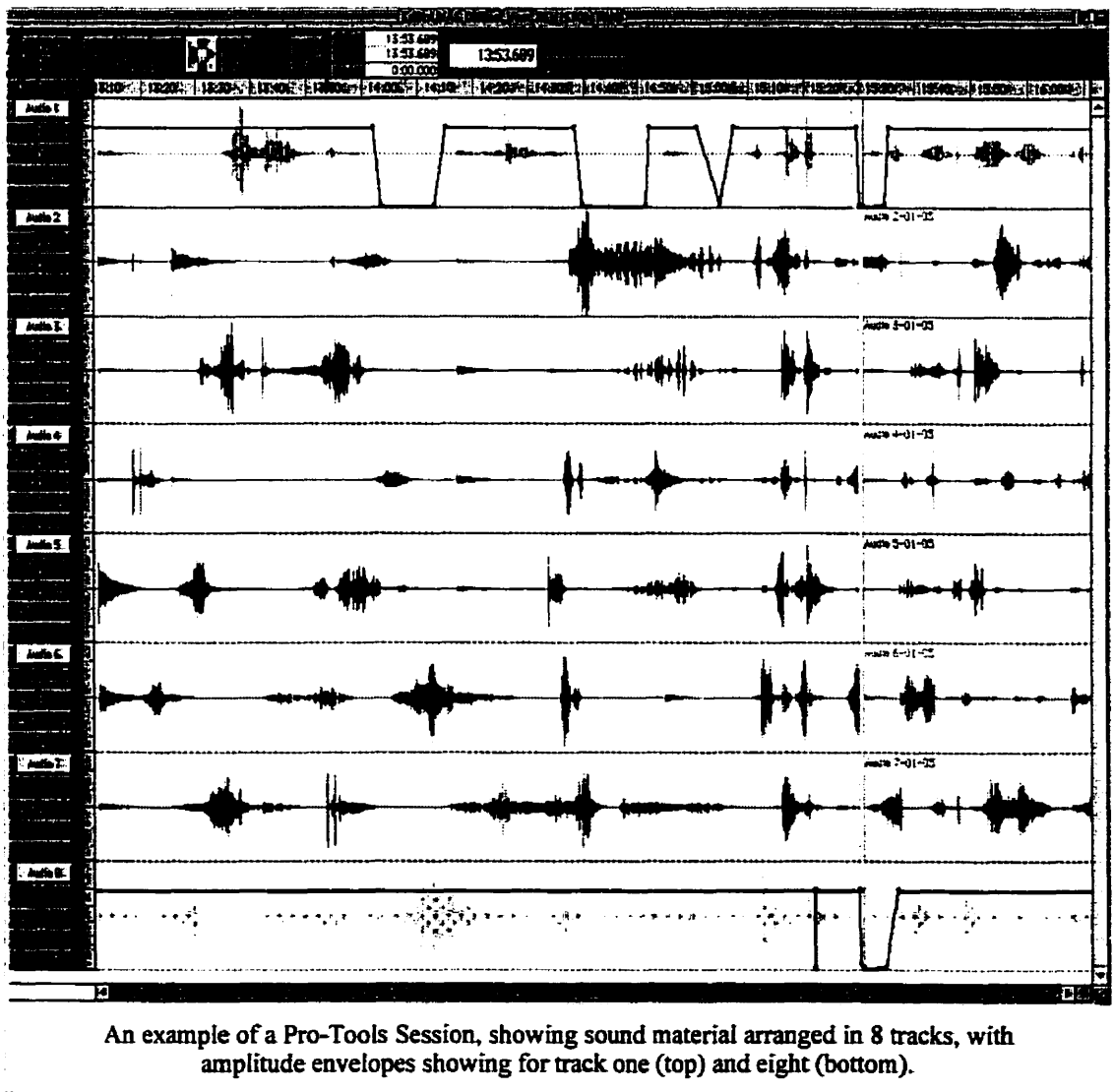


Figure 26. Main *Cecilia/CSound* interface window

## Appendix C: Pro-Tools

Pro-Tools is a leading multi-track digital audio editing software application created by Digidesign. It allowed me to arrange my transformed materials in eight tracks and apply further manipulations. These included the control of amplitude, the ability to copy and paste portions of a sound, and stereo panning settings. Once completed, the material was transferred to an eight-track digital audio tape for use with the Richmond Audio Box. Additional Pro-Tools information is available at <http://www.digidesign.com>.

**Figure 27. Pro-Tools session work environment**



## Appendix D: CD-ROM

The accompanying mixed format CD-ROM contains a re-mixed stereo version of the original eight channel diffusion of *Unheard Voices, Ancient Spaces*, playable on any standard audio CD player. In order to best experience the diffusion attributes of the piece, listening through high fidelity speakers placed four to five feet apart, or through high quality headphones, is recommended.

A *Macromedia Director Movie* is also included, titled UVAS-MOVIE1 and UVAS-MOVIE2. UVAS-MOVIE1 is the preferred version to use and may be run by double clicking on its icon. On systems with smaller monitors (14 or 15 inch) or low resolution, it may be necessary to run UVAS-MOVIE2, which plays in a smaller window, viewable on all monitors. The Movie is playable using a Macintosh (OS 8 or higher recommended) operating system (suggested minimum requirements: 6100 or G3 processor and 60 MB RAM). *Quicktime* and an internet browser (*Netscape Navigator* or *Internet Explorer*) should be installed on the computer. The movie features an interactive environment for the playback of the piece and synchronized display of the full color score. It is recommended that high quality speakers are connected to the audio output of the computer, or that a good pair of headphones attached to the computer headphone jack are employed. This essay is also readable from within the movie.