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Electroacoustic Composition

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A folio of creative work and dissertation
submitted for the degree of
Doctor of Philosophy

Department of Music
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June 1999

To my parents

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Declaration

This dissertation is entirely the result of my own work and includes nothing which is the result of work done in collaboration. Any reference to the work of other researchers is clearly indicated in the text. This thesis has not been submitted in whole or in part for any other degree or qualification at this University or any other Institute of Learning.

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June 16th, 1999

Ambrose Edmund Field

Summary

The aesthetics of composing electroacoustic music that includes both environmental and digitally processed sounds were studied. This was accomplished by practical means, resulting in a folio of creative work. Compositional methods and techniques relating to the interaction between environmental and processed sounds are detailed in this written dissertation.

The dissertation also explores compositional applications for theories derived from the discipline of *acoustic ecology*. The context a sound might exist in, as well as the timbral characteristics of the sound itself, are shown to be vital in developing a coherent compositional approach for the integration of natural sounds into complex musical hierarchies. Simulated sonic environments are identified as being effective in this aim, as it is possible for the composer to exert considerable control over the development of their individual sounding elements. The characteristics that define simulation, and the interaction between sound sources and spaces were analysed. The notion of *context bonding* was introduced, which aims to link Smalley's concept of *surrogacy*[1] to a sound's extrinsic connotations.

Discovery strategy is a practical methodology that was developed whilst composing the creative work that accompanies this dissertation. By using a set of structural devices called steering processes, it aims to assist first-time listeners in decoding the structural characteristics of a work. Steering processes couple simple and easily recognisable rhetorical codes of communication to a clear underlying sub-structure. Discovery strategy techniques do not attempt to simplify works for easy listening. Moreover, they allow the potential for more listeners to access the inner structural details of a piece. As the creative folio demonstrates, this can result in a musical surface that is highly distinctive and energetic.

KEYWORDS: *Acousmatic composition, Acoustic ecology, Discovery strategy, Post-modernism, Sonic communication, Sonic landscapes, Spectromorphology.*

[1] Smalley (1986:82)

Chapter One

Introduction

1.1 Research objectives

The aim of the research presented in this dissertation was to investigate relationships between sounds recorded from real environments and more abstract, processed timbres. The main research objectives can be summarised as follows:

- The structural and timbral interaction between environmental and abstract sound is investigated by means of a folio of original creative work.
- Existing models for the compositional usage of environmental sound are evaluated with reference to the creative work.
- Extensions to existing compositional theory are proposed, with the aim of addressing the problems of creating non-real and hyper-real electroacoustic environments.
- A new compositional method is presented. Called *discovery strategy*, this method exploits qualities intrinsic to environmental sound. The purpose of discovery strategy is to permit better integration of real and abstract sounding materials, and allow the potential for a work to be more accessible for listeners without compromising the structural integrity of the music.

1.2 The creative work

The creative component of this submission comprises a folio of large-scale electroacoustic compositions, upon which the new theories and compositional methods described within this dissertation are based. These works were composed between 1993 and 1996, and were realised at the electroacoustic studios of the University of East Anglia, Norwich, and later at the studios of City University, London.

The works are presented on an accompanying compact disc. The track times, and a complete listing of the creative work can be found in table 1.1 on page 152. The musical examples referred to in the text of this dissertation are presented on an additional *audio examples disc.* An index to these can be found in table 1.2 on page 153.

Appendix C contains diffusion scores, which facilitate live performance of these works.

1.3 Essential terminology

As this dissertation seeks to demonstrate methods for the smooth integration of natural outdoor sounds with those that are processed or simulated, it is useful to define some terminology for this purpose.

Environmental refers to sounds not processed in any way which would prevent a listener from identifying the recording as being 'real'. The source of these sounds may be easily identifiable. For the purposes of this dissertation, sounds recorded directly from natural or man-made environments will be classified as 'environmental sounds'.

Abstract-timbral refers to sounds with no audible connection to natural or man-made real-world environments. It is often difficult to identify the source of abstract-timbral sounds. For the purposes of this dissertation, synthesised or highly processed sounds will be classified as 'abstract-timbral sounds'.

1.4 Purpose of this dissertation

The creative component of this research follows an *acousmatic*[1] approach to electroacoustic composition. In practice, sounds are selected, processed and combined into larger events according to the composer's aural judgement. The compositional process adopted within the creative work also includes a systematic and structured approach towards the organisation of those events. This approach is process-based (rather than algorithmic), and it is the purpose of this dissertation to demonstrate the origins and applications of these processes.

Acousmatic is a highly controversial term in electroacoustic aesthetics. A traditional view, here exemplified by Dhomont, allies acousmatic music and the wide palette

[1]This term is attributed to Pythagoras, and is taken to mean sound sources that are hidden from view – see Nattiez (1990:91). Dhomont (1996:24) notes that Jérôme Peignot was the first to use the term in a musical context to mean a sound with a hidden source.

of sounds this genre potentially includes to the aesthetic practices of P. Schaeffer (1966):

> ... the term 'acousmatic', as well as the notion it represents, find their origins in France; they are founded on Schaefferian phenomenological concepts, extend musique concrète, and symbolise the aesthetic views of composers either belonging to, or following the tradition of France's Groupe de Recherches Musicales de Paris ...
>
> ... The Montréal composers do not put the art to the test, do not engage in the removal or subversion of its idiosyncrasies, rather, they follow the great Schaefferian tradition, using certain key works of the repertoire as their models.
>
> (Dhomont, 1996:25-26)

This dissertation demonstrates a type of acousmatic music that has followed a different line of development. Chapters Two and Three outline the central components of discovery strategy, demonstrating that when acoustic ecology is mixed with contemporary philosophy concerned with the portrayal of reality, a powerful compositional approach can be generated. This synthesis is presented in Chapter Four.

Chapter Two

Real sonic environments

2.1 Introduction

Acoustic ecology theories were used as a basis for the acousmatic compositional approach employed within the creative work. In this chapter, R.M. Schafer's ideas regarding the correspondence between functional and musical aspects of the soundscape are evaluated, with a view to extracting compositionally useful parameters. The defining features of an environmental soundscape are explored and set against compositional models for the relationship between sound sources and their immediate extrinsic contexts. This discussion is illustrated in a final section concerned with the compositional significance of sounds caused by human activity within a recorded soundscape.

2.2 Acoustic ecology

Schafer (1978) extended John Cage's philosophy of regarding the acoustic environment as a large-scale composition[1], creating a new discipline of *acoustic ecology*. Occupying a central position within Schafer's acoustic ecology theory was the belief that the extramusical information carried by a sound was essential in establishing the unique qualities of a particular soundscape. Schafer illustrates the diversity and communal importance of this information in his account of the firing of the *nine o'clock gun* in Vancouver:

> In addition to marking time, it has also opened War Bond drives, inaugurated Vancouver's Diamond Jubilee, marked Remembrance Day services, New Year's celebrations... It is even used as a weather beacon:

[1] documented by Pritchett (1996).

> some old-timers claim that a hollow ring to the sound forecasts a rainy day ahead.
>
> (Schafer, 1978:37)

Schafer's philosophy on composing soundscapes[2], although not concerned with spectral compositional methods, included an integral consideration of the timbral qualities of the sounds themselves. This approach, coupling extrinsic meaning with sonic morphology, inspired many of Schafer's colleagues to explore the timbral diversity of outdoor soundscapes. Perhaps the most notable of these exponents is Barry Truax, who has devised granular sound treatment methods with the specific aim of unravelling the timbres of the outside acoustic environment (Truax, 1994). By using this method to the exclusion of other more potentially destructive studio techniques, Truax's initial aim was to magnify the timescale of the recorded sonic environment. He was thus able to retain extramusical characteristics, such as 'naturalness', that were normally associated with real sonic environments, rather than presenting an abstracted view of his original recordings:

> These [granulation] techniques seem to provide an alternative to the industrial approach of processing 'raw' sounds into the commodity of sound effects. It also seems to open up a language of discourse based on associations, metaphors, and symbols...which is intellectually satisfying as abstract manipulation, yet more accessible in engaging an audience.
>
> (Truax, 1996:15)

Even when Truax does not use environmental recordings as the source material for his electroacoustic compositions, morphologies and constructional principles derived from the natural environment are highly pervasive. Truax's programme notes for *Riverrun* (1986) state that the structural design of the work is modelled on the progress of a river: starting with the agglomeration of a few discrete grains, and ending in a highly dense *sounding flow*[3]. The environmental allusion is supported by Truax's granular synthesis method. This is particularly adept at producing 'natural' sounding massed textures, exploiting the fact that natural sounds, such as rain, also have their origin in similar particulate behaviour. Although Truax uses abstract-timbral sounds within his own environmentally-inspired compositions, he perceives a considerable gap between acousmatic compositional methodology and soundscape composition:

> The distinction in the two disciplines manifests itself right from the initial recording practice (isolating sounds acoustically from their context

[2]As set out in his chapter on acoustic design, Schafer (1977:237-246).

[3]I have borrowed this term from Ten Hoopen, (1994:62).

> versus recording them *in situ*) through to the final product (an art of sounds fixed on a support medium versus an art of sounds whose communicative role entwines the listener's participation and hence is not fixé in any absolute sense).
>
> (Truax, 1996:14)

As detailed in section 1.1, it is one of the main aims of the creative work in this dissertation to unite both approaches into a single compositional method. In the works presented, recorded environments sit alongside abstracted and processed sounds, linked by structural and extramusical devices.

2.3 Functionality and timbre

Schafer's acoustic ecology theories rest on the nature of the interaction between the sonic environment and humans:

> What is the relationship between man and the sounds of his environment, and what happens when these sounds change? Is the soundscape of the world an indeterminate composition over which we have no control or are we its composers and performers, responsible for giving it form and beauty?
>
> (Schafer, 1973:3)

Crucially, Schafer does not separate extramusical and musical aspects of the soundscape. In fact, it is of central importance to his approach that these two aspects remain locked together. It can be seen that this is a very different approach to that proposed by the GRM school of acousmatic composition. Also, Schafer does not explicitly require a particular listening strategy to be adopted in order to understand the musical structure of the soundscape. To examine this view, it is necessary to understand Schafer's motivation in conducting his soundscape research. Schafer (1973:4) recounts two Greek myths about the origin of music. The first myth concerns music as a creator of human emotion and the second offers a structural and morphological view of music. Schafer defines his study as one which is exclusively concerned with the latter. Here lies an important distinction. It is easy to think of extramusical content conveyed by a sound as relating to a listener's basic emotional responses or a sound's narrative qualities.[4] After all, Romantic programme music has established this particular linkage as a genre in acoustic composition. Nattiez illustrates one of the main problems created by anecdotal material:

[4] Ferrari (1996) terms these sounds *anecdotal sounds.*

> Hearing Till Eulenspiegel, I can (aided by the title) recognize that it deals with the life and death of an individual. I hear how he runs, jumps...but what exactly, is he doing? I cannot know.
>
> (Nattiez, 1990:128)

However, in electroacoustic music, a sound's *indicative*[5] qualities may be generated by basic emotional responses, the listener's imagination or by straightforward recall of reality itself. Electroacoustic music is unique in being able to assist a listener in creating indicative networks in a guided way: this can be accomplished by the inclusion of sounding materials derived directly from the real world of human experience. The extramusical components of an environmental sound may convey very specific information, for example: geographic location, the time that the recording was made and the spatial characteristics of the location. This extrinsic information, carried by the environmental sound and interpreted by the listener, is a very different form of contextual information to that carried by acoustic music such as *Till Eulenspiegel.* The important factor here is a sound's immediate context: i.e. how a sound relates to others that occupy the same sound-field. Schafer underlines the importance of this type of contextual information, suggesting a theory that listeners have the ability to use contextual cues to assess the constructional and morphological characteristics of the soundscape which they are currently perceiving (Schafer 1977:16). Timbre alone, he states, cannot provide this information. Schafer is not commenting specifically on the cause of the sounds, but the process that is responsible for the cause. This depth of meaning can be bypassed by electroacoustic aesthetics: it is easy to treat the process that was responsible for setting up a cause as being secondary to the causal qualities of the sound itself. If, as Schafer suggests, the morphological qualities of a sound can in some cases be determined from its *causal preparation*[6], then a method exists to enable a compositional unity between that sound's gestural and behavioural indicative fields. This idea is introduced as part of *discovery strategy* in Chapter Four.

Perhaps this relegation of causal preparation explains some aesthetic problems encountered when attempting to reconcile extramusical information and timbral sophistication: the contextual information regarding how a sound came into being may not be embedded in the cause, but in the environmental conditions that gave rise to that cause. Crucially, this is not an issue in Schafer's work, as Schafer adopts an approach in which context and a sound's abstract morphology work *together* to produce a soundscape.

---

[5]Smalley's term (1992b:521) denoting the process of indication of extramusical implication by a sound. Smalley defines nine indicative fields of possible *linkage* between the perceptual experience of sounds that correspond with a typology of extramusical experience.

[6]My terminology. A *causal preparation* is a process that provided the conditions to enable a cause to exist. This process may or may not be evident in the auditory causal qualities of a sound.

2.4 Mythology

Commonly occurring natural sounds have an inescapable mythology[7] that should be acknowledged before attempting to integrate those sounds within compositions where their extrinsic connotations are important. This section seeks to show that mythological concerns are not necessarily incompatible with the principles on which discovery strategy theory rests.[8] In Barthes' (1957:15-25) terms, such sounds have meanings that do not need decoding, as their meaning has become ingrained within the communication process itself. Schafer recognises the role of mythology within the soundscape as one where listeners actively generate their own meanings from the mythic quality of the sounds. Schafer (1977:27) classifies several sounds that have 'mythological' qualities. For example, he cites sounds that are particularly 'apocalyptic'.

Apocalyptic sounds is Schafer's term for a class of sounding materials portraying the full force of nature. This is of particular relevance to the creative works presented with this dissertation. For example, it was important in *Still Water* and *Till* to create spaces that allude to extremely powerful natural forces. Since it is not possible to know what the sound of the end or the creation of the universe is like, this mythological domain traditionally provides great freedom of interpretation. Sound that has not yet been encountered has the potential to be 'apocalyptic'. Here lies one of the most prevalent problems concerning the integration of well known sounds within electroacoustic music works: it is necessary not to inscribe false mythologies on an audience. As Chapter Four demonstrates, this can be avoided by building appropriate contexts for the interpretation of sounds. Within discovery strategy, the mythological aspects of a sound are used as a technique to enable a work to become personalised by the listener. It is Barthes' definition of a mythology that provides a useful starting point for the theories described in section 4.1:

> Mythical speech is made of a material which has *already* been worked on so as to make it suitable for communication: it is because all the materials of myth (whether pictorial or written) presuppose a signifying consciousness, that one can reason about them while discounting their substance. This substance is not unimportant: pictures, to be sure, are more imperative than writing, they impose meaning at one stroke, without analysing or diluting it.
>
> (Barthes, 1957:110)

It is this aspect of material which is already suited for communication that forms

[7] In the form of ingrained meaning.

[8] The impact of myth on music will not be covered here. For a preliminary discussion relating to electroacoustic music see Wishart (1986), together with Lévi Strauss' text (1970).

a 'way in' to the compositional design of extramusical signification. Furthermore, Barthes' definition hints that it is not fully possible to ally the treatment of mythology within electroacoustic music to that within acoustic music. This is due to the unique way that extrinsic meanings can be constructed in electroacoustic music. Lévi-Strauss demonstrates that acoustic music can only generate extrinsic meaning from high-level structural constructs:

> To paraphrase Lévi-Strauss's words, if there is meaning to be found in music [myth] it cannot [sic] reside in the isolated elements which enter into its composition, but only in the way those elements are combined.
>
> (Shepherd and Wicke, 1997:45)

Unique in being able to control timbre and guide extramusical implication, the moment-to-moment level within the structural hierarchy of an electroacoustic composition is extremely important. This is the timescale on which we perceive timbre, and at a similar level it is possible for a listener to imagine many extramusical meanings from a single sounding moment. This is a considerable advantage for the electroacoustic composer, as it is possible to generate extrinsic meanings on a wide variety of structural levels.

2.5 Scope of the environmental soundscape

Many of the pieces presented in this dissertation utilise sounds recorded directly from the outside environment. Increasing industrialisation has meant that boundaries between urban and countryside soundscapes have become blurred (Schafer, 1977:71-86). Schafer states that latterly, increased personal mobility has meant that many non-urban soundscapes contain sounds formerly associated with the town.

However, the changing nature of that soundscape has required a flexible approach towards the use of environmental sounds. For example, the work *Still Water* requires the soundscape to possess very few human traits, in an environment that is as 'natural' as possible. Most of the natural sound recordings have needed extensive cleaning up; not to remove technical noises (such as hiss generated by the equipment itself), but to remove sounds that would detract from establishing natural sounding environmental contexts.[9]

[9]The process used to accomplish this is closely related to that described in Appendix A.

2.5.1 Portability of the soundscape

Schizophonia (Schafer, 1977:90) is the separation between an original sound and its electroacoustic representation. As such, schizophonia forms the first of Emmerson's *acousmatic dislocations* explored in section 2.7. The idea of schizophonia is important within the works presented, as re-capturing a sense of geographical place is a compositional aim utilised by the discovery strategy techniques developed in section 4.8.5 on page 75.

In the work *Pyrotechnic!* a sense of place is systematically removed and is gradually replaced by sounds with noticeably synthetic timbres. This idea of sonic originality is of vital importance in creating believable acoustic environments. A prime component of this process is controlled by what can be referred to as source-cause recognition.

It is easy for an audience to view electroacoustic media as a substitute original sound source.[10] This can only become increasingly likely as storage and distribution methods based on computer or studio technology become more sophisticated. These methods offer a vast possibility for transforming sounds. Importantly, Schafer does not make this distinction: for him, the role of electroacoustic technology enables sound spaces to be portable. Although sounds in the spaces are simulated by loudspeakers, the soundscape created references the original environment where it was captured:

> Most recently, the quadraphonic sound system has made possible a 360 degree soundscape of moving and stationary sound events which allows any sound environment to be simulated in time and space. This provides for the complete portability of acoustic space. Any sonic environment can now become any other sonic environment.
>
> (Schafer, 1973:15)

Although Schafer was probably over-estimating the ability of the quadraphonic sound system to simulate real environments,[11] his argument demonstrates the possibility for re-creating, rather than re-producing, acoustic spaces. Indeed, Schafer implies that the simulated or reproducible environments which he describes are projected to the audience in their most perfect state.

---

[10] As identified by Ten Hoopen (1994:62).

[11] Malham and Myatt (1995:58) demonstrate more recent technical methods.

2.5.2 Sound signals

An important issue within the work of the acoustic ecologist is that of ***sound signals*** (Schafer, 1973:19): this is due in part to their disappearance. Unfortunately, for composers who wish to use sounds with community-wide implications, suitable materials are becoming increasingly scarce. For example, it is all too easy to pick up traffic ambience on any electroacoustic work that takes its source material from a city soundscape.

Sound signals have a metaphorical function within the remit of electroacoustic composition, and constitute an important part of the rhetorical systems described in section 3.6.2. Since the listening public will associate certain sounds directly with physical actions, sound signals can be used to provide linkage between the physical (non-sounding) experience of the acoustic environment and the musical substance of the work itself. This idea is developed further on page 69, as a compositional method within discovery strategy.

Schafer illustrates the physical implications of a sound signal:

> Two such sounds, for instance, are sirens and church bells. Each must be loud enough to emerge clearly out of the ambient noise of the community; each has an important social function. The messages, however, are different. The siren broadcasts distress; it is a centrifugal sound designed to scatter people in its path. The church bell, on the other hand is centripetal; it attracts and unifies the community.
>
> (Schafer, 1973:19)

Schafer's allocation of behavioural types to the sound demonstrate that certain morphological constructs may have ingrained social resonances.

2.5.3 Source recognition

It is often perceived, or indeed expected, that compositions which adopt an extensively timbral language will cause confusion for listeners attempting to locate an apparent cause of the sound that they are perceiving:

> Since the late 1940s it has become increasingly evident that some branches of contemporary music may exhibit source ambiguity for listeners.
>
> (Ten Hoopen, 1994:61)

As Schafer (1977) has demonstrated, the soundscape of our society is growing in timbral diversity. This is reflected in the unification and standardisation of public alert signals, and other commonplace soundscape elements that Schafer describes. It is important to re-examine the aesthetic impact of the source and cause of sounds, as there is a possibility that sources and causes have less perceptual relevance within the contemporary sonic environment. Ten Hoopen summarises current thinking on the relationship between sounds and their causes:

> We are naturally inclined (like animals) to relate sounds we perceive to what might have caused them, especially with sounds unfamiliar to us or when sounds occur in unexpected circumstances.
>
> (Ten Hoopen, 1994:61)

In a natural environment, this linkage forms part of an important perceptual mechanism:

> Indeed, for real animals the establishment of connections between cause and effect are fundamental to learning environments and to survival ... We must judge ... if a breaking twig signals friend or foe.
>
> (Emmerson, 1994:96)

When considering the modern outdoor soundscape, it is necessary to ask ourselves if we still employ a perceptual mechanism dating from primitive cultures to each new sound that we perceive? Has our society become conditioned by a more limited set of rhetorical soundscape codes?

Contemporary society has adopted standard signals for particular messages: for example, siren = danger. As interpreters of these codes, we no longer need to evaluate the specific cause of the sounds – we simply need to take action. Rhetorical communication shares much with Barthes' definitions of mythology (Barthes 1957:109-159), as the raw elements for communication have been worked upon to enable efficient and direct communication. Barthes argues that society has learned to trust information that others have provided without questioning its origins. This is a major social change: 'survival' strategies are less socially important now. If this linkage is followed through to a logical conclusion, perhaps the acceptance (and creation) of timbral music by the listening public has been accelerated due to the decreasing social requirements to carry out source-cause analysis in our everyday world. As technology has progressed, society has evolved and we can now accurately codify our behavioural responses to danger.[12] Increasing industrial noise in the soundscape has resulted in this situation of causal insignificance being amplified. For example,

[12]See McLuhan and Fiore, (1997:36-37).

the noise from industrial machines is similar the world over, and we do not have to undertake too much aural enquiry to decode the physical nature of the sound. With so many similar sounds in the soundscape, it is possible that their source-causes are becoming less relevant socially. Due to the advancement of cheaper and more sophisticated technology, coupled with a public that is becoming increasingly media-aware, 'new sounds' are no longer a domain solely exploited by the electroacoustic composer. Ten Hoopen summarises the issues regarding source-cause perception within contemporary electroacoustic aesthetics:

> Is a *source* the source used by the composer? Is a *source* what the composer hopes or intends that the listeners will think of as the source? Or should we consider a *source* dependent on the listener *only* - whatever the listener *thinks* or *imagines* the source of a sound might be? This question should be related to the fact that the production (composing data) and perception (sense data) often appear to be far apart in electroacoustic music.
>
> (Ten Hoopen, 1994:62)

This attitude towards defining a source might be crucially dependent on the assumption that it matters to listeners what the source actually is.[13]

Perhaps causal listening should be regarded as a primitive listening strategy that shares many attributes with *technological listening* (Smalley 1992b:551). Historically, acousmatic music has evolved from the premise that sources and causes of sounds are hidden from the audience. Pythagoras is credited with having delivered his lectures from behind a curtain, forcing his students to concentrate on the message, rather than the medium.[14] Live acoustic music has visual cues and instrument paradigms. These factors alone would be sufficient to account for why audiences do not necessarily adopt a listening strategy based on causal analysis. Moreover, it is the fact that the structural logic of acoustic music does not exist on a causal level. There is thus no need to listen to exact causal information in a concert listening situation.[15] Why then is the situation so different for electroacoustic music, and why is causality[16] so important? Having discounted the relevance of the provision or lack of visual cues, or instrument paradigms, it is necessary to explore the dynamics of causality. Let us return to Pythagoras.

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[13]It is also worthwhile noting the polar distinction between composer and listener in Ten Hoopen's argument. The creative work in this dissertation attempts to resolve this polarity. It is discussed in section 4.2 on page 56.

[14]Source: Nattiez (1990:91).

[15]In acoustic music, Smalley views this as "a kind of self-deception, encouraged perhaps by notation" (Smalley (1999)).

[16]As highlighted by Ten Hoopen (1991).

Emmerson notes:

> Hanging a curtain between speaker (Pythagoras) and listener may have lead [sic] to the term 'acousmatic' but is strangely misleading. We recognise the cause of speech, of all things, through much distortion. If anything the curtain had a different function, essentially iconoclastic. Emphasising the idea – the word – over its speaker and author. Pythagoras hence prefigures Barthes.
>
> (Emmerson, 1994:95)

Perhaps this concentration on the message, or the text of the communication, obscures a subtlety in Barthes' argument. Read in a postmodern light, Barthes' argument as presented in his essay *Death of the Author* (1977) exposes a new dimension in Pythagoras' technique. Perhaps Pythagoras was attempting to enable his students to author the text *themselves* by encouraging them to construct their own individual meanings from it. The listener therefore, becomes the author. Paradoxically, it is this aspect of authorship that encapsulates a major dilemma for the listeners to acousmatic music, as the construction of individual meaning relies on the existence of reference points and formal norms. How, for example, can audience members know if the meaning they are constructing is the one intended by the composer?

Discovery strategy points out that there is no such 'correct' meaning, and no single decoding of the text. The fact that individual readings of the text would probably vary slightly, depending on individual experience, is not of consequence when weighed against the increased potential for allowing an audience to personalise a musical work. Source-cause insignificance receives visual comment in an untitled painting by Sherrie Levine which is described by Newman:

> This comprised a framed reproduction of German Expressionist Franz Marc's painting Red Roe Deer II together with a statement. Included were the words "we know that a picture is but a space in which a variety of images, none of them original, blend and clash....A painting's meaning lies not in its origin, but in its destination"[17]
>
> (Newman, 1990:114)

Therefore, if we are manipulating materials that are not truly original (for example, any recorded environmental sound) can we really expect listeners to be interested in actively decoding sources or causes? From Barthes' point of view, the act of representing non-original objects locks their significance into the text alone. If this

[17]This text itself is adapted from Barthes' essay.

is the case then electroacoustic listeners are freed from having to define the source-causes for non-original sounds, and can concentrate on developing their own new, original meanings. This expansion of Barthes' argument into the electroacoustic domain results in a familiar conflict. If abstract timbres are 'original', then the idea of the perceiver as ultimate author/constructionist breaks down. This is because the act of being an author implies a knowledge of the constructional principles of the text concerned. This fact may also account for why listeners to timbral music search for its constructional roots as opposed to depending on survival instincts to identify source-causes.

Increasingly, works of art are created in which perceivers are given a degree of formal control over final product (see Buck, 1997). Interactive works, installations requiring user input to function and works relying on exclusively transcontextual processes all require users to search actively for, and assemble meaning from, the objects presented to them. Harrison's electroacoustic work *Unsound Objects* (Harrison, 1996a) demonstrates this technique. This piece encourages the audience to enter a highly interactive relationship with the musical substance in order to decode the multiple levels of meaning presented. Not only are transcontextual meanings built from relationships between presentations of environmental sounding material, but the timbral and formal qualities of the work often require causal enquiry based listening methods to be deployed at the same time. Harrison writes:

> One of the main criteria in Schaeffer's definition of the 'sound object' was that through the process of 'reduced listening', one should hear sound material purely as sound, divorced from any associations with its physical origins. Despite this idea, a rich repertoire of music has been created since the 1950s which plays precisely on the ambiguities evoked when recognition and contextualisation of sound material rub shoulders with more abstracted (and abstract) musical structures. But as these structures should themselves be organically related to the peculiarities of individual sound objects within them, the ambiguity is compounded: interconnections and multiple levels of meaning proliferate.
>
> (Harrison, in Leopoldseder and Schöpf, 1997:206)

It is the nature of this collision between abstract-timbral materials and highly recognisable environmental sounds that forms the backbone of the creative enquiry within the works presented in this dissertation.

2.6 Authenticity and source sounds

Issues of authenticity are fundamental in defining the importance of source-causes within the creative work presented. Emmerson illustrates how issues of authenticity and artistry typically co-exist:

> Perhaps all artists are in the end practitioners of *trompe l'oeille*. Art is about suggestion (even, on occasion, deception).
>
> (Emmerson, 1994:96)

If we were to rotate Emmerson's argument, and label art 'original', art would disappear because we would be presented with reality. In this guise, it would be hard to view reality as the product of human creativity. Ironically, labelling art a 'fake' experience in this sense serves to re-affirm the ultimate originality of the artistic endeavour, as perceivers may need to know that what they are perceiving is in fact the product of human artistry. Unfortunately, this legitimation for human creative endeavour creates considerable aesthetic problems for artists using hyper-real environments within their work. The question 'if the simulation of reality is perfect, can it also be artistic?', is highly pertinent in this case. Baudrillard demonstrates that human originality is always ultimately imprinted on the objects that it has created:

> The fascination of handicraft derives from an object's having passed through the hands of someone the marks of whose labour are still inscribed there upon: we are fascinated by what has been created, and is therefore unique, because the moment of creation can not be reproduced.
>
> (Baudrillard, 1968:76)

Here, much importance is placed on the *moment* of creation. According to Baudrillard, if we look for originality, this is where we are truly able to find it. His argument has considerable implications for listeners attempting to assess the causal validity of the sounds which they are hearing. A listener's search for causal qualities within sounds may be a result of this desire to find a link with an authentic human creative process, rather than a specific desire to identify the sounds *per se*.

To further this argument, it is necessary to look closely at the anatomy of a source-cause. Smalley (1992b:535) proposes the concept of *agency* to delineate sources that produce sound independently, and those which require a physical initiation to come into being. It is tempting to use this distinction to delineate sounds that are produced in real environments (such as a recording of natural sounds) from those that are the product of simulation (for example, the manipulation of an abstract-timbral sound). Therefore, it is important to retain a sense of perspective when applying

these distinctions to sounds that are unfamiliar: if we can not detect an agency aurally, it does not necessarily follow that a sound is simulated. Parmegiani's *De Natura Sonorum* (1975) uses this process as part of the formal identity of the work. In his music, Parmegiani appears to have acknowledged the perceptual problem of listeners questing to identify the physical agency responsible for producing the sounds. He has accomplished this by making particularly abstract sonic juxtapositions. In the first movement, 'natural' sound morphologies are set alongside their highly processed counterparts. Emmerson demonstrates this:

> The best acousmatic music is often a play of real and apparent cause: Parmegiani's *De Natura Sonorum* or *Dedans Dehors* spell this out perhaps a little too simply: the clearly identifiable cause/effect – though of course we might have been fooled! – stands alongside its electronic surrogate which imitates its topology and sometimes its morphology. The move into the computer domain has allowed greater control of this real/imaginary axis...
>
> (Emmerson, 1994:97)

In addition to a lack of appropriate transformational tools, Parmegiani's transformations are also simple because he does not invite listeners to compare reality with imagination: he only requests that we compare reality with *simulation*. This relationship demands knowledge of only one set of sounding materials in order to perceive differences between it, and the other sounds in the work. If Parmegiani were expecting the audience to hear relationships between real and imaginary objects in a manner similar to that employed by Wishart (1986:41-60), then the audience would be required to place the whole piece within an imaginary landscape where they would be able to add the missing contextual information necessary in order to link their imaginary constructions to Parmegiani's original sounds. The importance of this dynamic between real and simulated cause is explored within the works *Breaking Spaces* and *Still Water*, and is discussed in section 4.8.4 on page 74.

2.7 Acousmatic dislocation

This term, coined by Emmerson (1994:95), expresses the means by which a sonic reality can be captured and re-positioned at a different point in space or time. He defines three important dislocations: temporal, spatial and mechanical causality, stressing that they may interact and overlap. Acousmatic dislocation is essential to all recorded art; if we can not perceive any acousmatic dislocations then we are probably listening to live art. The following section proposes a theory that links the idea of this compositionally essential dislocation to a cyclic system of source-causes.

2.7.1 Media bonding

Where a sound does not reference the real world in any way,[18] the sound may be perceived as being its own reality. A circular relationship between surrogacy and acousmatic dislocation can be observed. For example, adding increasingly stronger acousmatic dislocations to a sound will result in that sound becoming a higher-order surrogate. Stronger acousmatic dislocation is where a greater amount of space, time, or intervening mechanical causality is placed between the original recording of the sound and its reproduction or transformation. This process can be repeated, but after a point the sound will begin to take on a new reality of its own, rather than appear to the listener as a transformed version of the original. This point of change occurs when the treated sound conforms to Smalley's definition of remote surrogacy. Applying further transformations to a remote surrogate will eventually result in the creation of another 'original' source sound. This process can be continued ad-infinitum.

From a poietic viewpoint, it can be observed that each time the cycle repeats, a new sound source is formed that has no spectral, dynamic or contextual relationship to the original. The sound created by this cycle is increasingly bonded to the medium performing the transformation.[19] I shall call this idea *media bonding*. As the cycle repeats, each successive acousmatic dislocation produces a new reality.[20]

This cycle of media bonding is of crucial importance when the sound selected for transformation contains contextual information. Excessive transformation of such material will result in a sound that is extensively media bonded. In such an extreme case, the original contextual information is substituted by that provided by the medium. To give a practical example, instead of listeners apprehending a highly abstract virtual environment within an electroacoustic piece, all they may hear is the sound of 'GRM tools'.[21] It is proposed that repeated cycles of dislocation may finally result in the condition famously documented by McLuhan (McLuhan and Fiore, 1996) where the medium *becomes* the content.

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[18] An environmental sound might have undergone a very radical sound transformation, rendering the original recording of that sound unrecognisable by comparison. Smalley's term for the nature of this linkage between the treated sound and the original is *surrogacy* (Smalley, 1986:82).

[19] In this case, the medium is electroacoustic technology.

[20] Perhaps this is why the television medium is so effective in projecting the idea of reality even though what the public sees has undergone several 'acousmatic' dislocations. See Baudrillard (1991).

[21] Commercial software dating from the early 1980s, currently distributed by the Groupe de Recherches Musicales, Paris. When used without extreme caution this package is particularly effective at replacing the detailed spectral characteristics of original sounds with a limited set of its own timbres.

2.7.2 Bridging acousmatic dislocations

Acousmatic dislocation is essential to the existence of electroacoustic music. However, there is one environment where it is necessary to reduce the impact of acousmatic dislocations: that is the one that exists at performance time between the art work and the real surrounding environment itself. This can be accomplished by reducing the perceived dislocation between the space inhabited by the artwork and that observed by the audience. It is essential that the impact of this dislocation is reduced, so that listeners hear the pieces being performed and not the production technology or the loudspeakers. In his installation of sump oil in London's Satchi gallery entitled *20:50*, Richard Wilson demonstrates this point visually. This is described by Buck, who comments that it forms:

> a surface so disorientatingly reflective that it is almost impossible to judge where the reflection stops and where the surface begins.
>
> (Buck, 1997:64)

Apart from the notion of creating a performance (which relates to instrument paradigms), sound diffusion[22] functions in this way. Effectively, sound diffusion installs a work around an audience thereby reducing one of the most prominent acousmatic dislocations. The audience must hear the work as a 'new reality' and not as a recording fixed on a tape.

2.8 The environmental sound field

A crude starting point for the analysis of any environmental sound field is to divide it into two distinct zones: proximate and background. This binary distinction is often used *per se* by recording engineers with the specific aim of creating a 'realistic' performance. Usually, a recording engineer will attempt to localise the sound that is most interesting to the audience towards the front of the spatial image, whilst adding just enough ambience to set the appropriate scene – be it concert hall, church or vocal dub studio.[23]

This professional recording approach actually demands a highly focussed listening strategy. This proximity/ambience distinction also serves to highlight the causal qualities of the sound, when used as a listening strategy. In many of today's recordings of acoustic music, it is not uncommon to hear the artist's keyboard squeaking, bow noises or key clicks. The attempt to capture the most realistic performance on

[22] In the multi-speaker form, exemplified in the U.K. by Smalley and Harrison.
[23] See Revill (1987).

tape demands that listeners are also highly aware of differences between the source sound and ambient sounds. It is clear that both studio equipment and commercial production methods are derived from an understanding of this distinction. This production methodology has some similarities with Schaefferian reduced listening. Both methods rely on aural analysis of the fine detail of the sound source. Environmental sounds occupying the ambience are of secondary importance in this case. In situations where there is a wide variety of sound sources with complex extrinsic interrelationships, and where there is no live performer present on a stage, both methods fail as effective listening strategies. Until the advent of digital spectral analysis, electroacoustic composers had few tools that could be used to de-contextualise sounds accurately, and they were forced to carry out transformations of ambient material in a studio environment more suited to maximising a particular source sound.[24] With computer technology, the potential for using specific features of a sound's ambience no longer needs to be ignored.

2.8.1 Replacements for the proximity/ambience model

In the previous section, it was suggested that there was much cross-fertilization between the commercially based proximity/ambience recording production model and aspects of Schaeffer's research. Ferrington proposes a three-tier model based upon his work with the World Forum for Acoustic Ecology. His model includes foreground, background and contextual levels of sound. Ferrington gives the following practical example of how a contextual sound may support the perception of a foreground sound:

> Contextual sounds are those taking place in the vicinity of the foreground sound. Given the sound of the fire siren, one may also hear related sounds such as shouting, crackling fire, and the chaos of great commotion. This additional layer of sound supports and makes more urgent the message being presented by the siren.
>
> (Ferrington, 1994:4)

With some development, such a model may be helpful as a starting point for the practical construction of electroacoustic soundscapes based on environmental concerns. Although somewhat generalist, Ferrington's model is significant here as it permits the integration of acousmatic materials with sounds that possess obvious causes and contextual relationships. Ferrington's model is perhaps of most direct use to the composers of narrative radiophonic music. His ideas regarding the zonal

[24] For example, most analogue devices require the ratio of 'noise' to source sound to be heavily weighted towards the source, due to technical limitations in their electronics.

delineation of different types of sounds would lend support to a voiced narrative, since contextual sounds can be segregated clearly from the main auditory focus of the work. This limitation can be mitigated by using foreground and contextual sounds that are as diverse in timbre and extramusical impact as possible. Such a situation is not always acceptable for electroacoustic composers, where the musical dialogue is carried by timbre. For example, it was a compositional aim in the first movement of *Breaking Spaces* to make the audience aware of a slow transformation from a sound emerging from a background ambience, and finally occupying a distinctive position at the front of the sound-stage.[25] Ferrington's three-field approach assumes that the boundaries between the zones can be easily defined. For listeners, these boundaries may be hard to delineate. For example, when does a foreground sound become a contextual sound? As such, this model can only be applied to compositional practice, and can not be used to analyse complex environmental soundscapes.

A more flexible soundscape model is required. The model that was used within the creative works accompanying this dissertation is presented in figure 2.1 on page 159. This model sets out to integrate sources and spaces, and relies on three interrelated parallel continua rather than a zonal approach. The idea of *immediacy*[26] is introduced to define a situation where a sound commands a listener's complete attention. In an extreme situation of immediacy, the sound appears to be physically close to the listener. Acoustic parameters such as decreasing air resistance contribute to a sense of brightness as sounding objects approach the listener (Winckel, 1967:170). In these conditions, the ability to identify the source of the sound is enhanced. Importantly, Ferrington's concept of 'contextual sounds' is missing from this model. As a sound becomes less immediate, it becomes increasingly difficult for listeners to apprehend specific contextual cues. For composers attempting to build environmental scenes, the parallel continuum model proposed suggests some important constraints. For example, to simulate a decrease in immediacy, more sound sources will be required within the soundfield. These sources will require careful spatial placement, so that they remain as discrete as possible. This aim can be easily accomplished for inside spaces by reverberation processes; scattering one sound source into many diverging paths of reflections. As it is harder to simulate an outdoor environment, it may be more practical to import a background ambience *en masse*, subsequently adding other materials. As shown in section 4.8.4, this approach was adopted for the opening of *Still Water*. As sounds become more immediate, it becomes more likely that they were the result of human agency.

According to Truax (1984:94), it was possible to hear natural sounds in pre-industrial soundscapes on a background level, due to the low degree of noise pollution. This arrangement of human in the foreground and nature in the background parallels the

[25] This process is described in section 4.8.5 on page 75.
[26] Inspired by Slawson (1985).

traditional listening situation in Western classical music, where the sounds which human performers make occupy the acoustic foreground and natural sounds create an ambience in the background. Nowadays however, soundscapes contain background sounds that are the result of human agency, and natural sounds can often only be perceived clearly from a foreground perspective. Industrialisation has changed the way we listen. So why do audiences adopt apparently pre-industrial listening strategies in the concert hall? To understand how listening strategies can change with composer intervention, it is first necessary to analyse Emmerson's spatially sophisticated *local/field* model for evidence of a practical segregation between the physical cause of a sound and its context.

2.8.2 Emmerson's local/field model

Emmerson (1996:10) has defined a model for live performance that sets out methods by which musicians working with electroacoustic technology can create 'mixed'[27] works that exhibit a greater degree of immediacy. He states that the need for this process lies in a decreasingly obvious relationship between a sound's source and cause, particularly where computer based processing has taken place. Emmerson here cites the acousmatic dislocations (Emmerson 1994:95) as being problematic in this respect:

> The aim is to be clear that in abandoning any reference to these 'links of causality' the composer of electroacoustic music – especially that involving live resources – creates a confusion (even a contradiction) and loses an essential tool for perspective and engagement between the forces at work.
>
> (Emmerson, 1996:10)

Emmerson has created two zones (local and field) that encompass a performance environment.[28] With local controls, he reaffirms the importance of audible human agency in creating music with a high degree of immediacy. The field zone appears to be the prime collector of contextual information:

> ... the *field* as defined above *can contain other agencies* i.e. it is not merely a 'reverberant field' in the crude sense but a stage on which the entire panoply of pre-composed electroacoustic music may be found.
>
> (Emmerson, 1996:10)

[27] Works involving both electroacoustic and acoustic sounds.

[28] This includes all aspects of the performance: performer, tape (if any), live processing techniques and sound diffusion.

Crucially, this model does not relegate the field zone to a background function, and as such it should not be mistaken for the traditional proximity/ambience model described above. In making this local/field distinction, Emmerson's theory also reaffirms the notion that contextual information is to be found in the environment, rather than in the sounds of the performer. Indeed, this situation would add clarity to live works, where the composer is concerned with timbral interactions between live performers and real-time computational methods. It is possible for live performers to include environmental materials that are intrinsically rich in contextual information. The creation of a sense of immediacy in these situations need not be dependent on the causal qualities of the sounds themselves. According to the continuum model proposed here, a sense of perspective can be achieved by manipulating the degree of contextual information present in the source sound, provided that the listener can identify the source.

To give a simple example, it would be possible to construct a live performance situation where the 'local' performer plays via a controller, triggering a succession of highly anecdotal[29] environments. For instance, the performer could be manipulating a recording of waves breaking on a beach. These sounds might possess few of the characteristics indicative of human agency. Another performer may be working with highly abstract timbres, again with no obvious human agency responsible for their cause. Yet, there could be a great sense of acoustic distance between these sound events. In this example, it is not the fact that one sees the performers 'playing' environmental sounds, but the conflict between the spectral types of the sounds and their associated contexts that could prevent the environmental materials from being incorporated successfully into the live performance environment.[30] If discrete sounds within a sounding flow are perceived to have similar and persistent causal qualities, then the immediacy of the live performance is enhanced. This is naturally the case with much performed acoustic music. Unless a soloist changes instruments, the cause of the sounds created will persist for the work's duration.

The idea of *cause coherence* can now be introduced, to account for the rate of change in the causal qualities of a sounding flow. Cause coherence is high where there is no perceived change in the causal qualities of a sounding flow, and low where there are many changes in apparent cause. High cause coherence plays a vital role in our perception of instrumentality, as we do not expect the causal conditions of the sounds produced to change during a performance. In terms of the local/field model, it appears that the local controls as described by Emmerson would require a high degree of cause coherence in the source sound to enable meaningful interactive relationships to exist with field elements. In live performances where local sounds exhibit low cause coherence, a situation much like tape acousmatic music is created. This similarity between low cause coherence live musics and the acousmatic tape

[29] After Ferrari (1996).

[30] Note that Emmerson's model would suggest that this example is not truly live, but *real-time*.

genre, supports Emmerson's theory that it is not only the presence of performers that can make a work truly live.

In works which seek to manipulate environmental materials, cause coherence can be low, due to the variation in the nature and type of agency responsible for producing the sounds. In these instances, the local/field model is no longer appropriate due to the lack of consistent causal information available to the listener. This thesis suggests the idea that immediacy rests not with source-causes, but with a perceived distance between the relative types of contextual information provided by a sound. In this way, sounding flows with low cause coherence can be accommodated into a musical discourse without compromising the listener's sense of perspective. As contextual information can include causes, this theory does not conflict with local/field methods. Instead, it is perhaps an extension of local/field thinking to accommodate acousmatic tape works.

In *Mambo Vinco*, Javier Alvarez (1997) illustrates this discussion well. In this work, the binding function of high cause coherence serving to unite instrument and tape in a local/field model is exchanged for a simple narrative structure to which both forces contribute. Mechanical sounds of a truck starting up rebound against a rhythmic trombone part. Both the pitch elements of the trombone and the environmental sounds of the truck are defined from, and bound to the narrative. Alvarez's programme note recounts a journey in which he hitches a lift from a long distance truck driver who listens continuously to Mambo music on his radio. Alvarez has enabled this narrative to become apparent acoustically, by interweaving snippets of Mambo music (sounding as if they were recorded from the radio) into the tape part. Crucially, both parts contribute important contextual information about the piece. Although cause coherence is low in this example, both parts contribute to establishing an extrinsic context for the whole work. In this simple example, local/field concerns have become blurred[31] due to both the environment and the local performer contributing contextual information. As this situation is common in acousmatic music derived from recordings of natural sounds, it is necessary to analyse types of interaction that could provoke an exchange of contextual cues between local and field concerns.

2.8.3 Environment/human interaction

Smalley (1992b:536) has generated a comprehensive typology of environmental sounding models. A major factor in the successful compositional integration of sounding materials recorded from the natural environment is the relationship between sounds of explicitly natural origin and those that are connected with the human world. Causal qualities are paramount in establishing a structural link between

[31] Emmerson (1996:10) does account for this in his text.

abstract-timbral sounds and natural environmental sounds. During the sound design stage of the works presented with this dissertation, it was found that transformations between abstract-timbral sounds with no detectable cause and environmental sounds with highly detectable causes were less successful and harder to prepare than those between two abstract-timbral sounds with highly defined causes. After subsequent analysis, the elliptical relationship shown in figure 2.2 (on page 159) emerged.

The fact that the transformations described above were hard to effect is due to gestural incompatibilities between the two sound-types involved. Transformations between no cause/abstract-timbral and human agency/environment pairs face particular problems. In *Undercurrents*, the solution to this potentially high degree of transformational incompatibility was to effect the transformation in stages. This process occurs between 2'46" and 6'42". Two discrete developmental techniques were required to perform this transformation.

Phase one (2'46" to 4'34") concerned mapping the sound of the train onto the gestural profile of the sea.[32] Both sounds required considerable dynamic smoothing. Spectral filtering was used to match the timbres, and as both sounds involved had similar noise based spectra, the transformation was successful. Stage two (4'34" to 6'42"),[33] transforming the sea (natural agency) into an abstract-timbral (no agency) sound proved problematic, and demanded a new technique. In this case, standard phase vocoder treatments failed to produce the result desired, since the two sounds were of differing spectral types. One sound was a noise-based texture, the other a spectrally-limited drone. Phase vocoder interpolation did not satisfactorily dissolve the causal features of the first sound, but merely blended them with the target sound. The end result of this process was a poorly filtered sea sound.

The gestural activity of the sea still provided an aural cue to the natural cause of the sound and needed to be dissolved. This was accomplished by tracking the long-term gestural motion of the live sea recordings and applying the resulting data to a set of spectral tracking filters.[34] These filters were adjusted to focus slowly on the harmonics of the final drone, resulting in a smooth, long term transformation between human agency/environmental sounds and a no agency/abstract-timbral drone. As indicated by the elliptical model described above, the timescale necessary to accommodate this type of transformation is long: nearly three minutes of sonic development take place within *Undercurrents*.

[32] Audio example CD: track 1, index 1.
[33] Audio example CD: track 1, index 2.
[34] Realised with Penrose's program *twarp* (Penrose, 1994), custom modified by the author.

2.8.4 Nature of human interaction

Windsor (1994) provides an important development in source-cause thinking. It is easy to perceive human/environment interaction from a viewpoint where contextual information is primarily recovered from the sound caused by human agency. By introducing Gibson's ideas of 'affordance', Windsor demonstrates that meaning is recovered from a sound's causal qualities due to the interaction between that cause and its surrounding environment. This is an important development, as it allows the classical definition of reduced listening (Schaeffer, 1966:116) to be extended to encompass contextual information derived from environmental sounds. It is now necessary to examine the relationships between the concept of agency and environmental sounds, as the creative work submitted with this dissertation presents a systematic approach toward integrating sounds produced by the intervention of an agent, with those that have autonomous causal characteristics.

2.8.5 Ambiguous human presence

A subtle way of suggesting a human presence is to employ sounds that could be interpreted ambiguously by the listener. For example, the rustling of leaves on a forest floor could be interpreted as being indicative of the action of an invisible human agent, or as a result of the wind.[35]

Still Water employs footstep sounds in this way during transitions between adjacent sections, thereby capitalising on their metaphorical qualities to suggest the idea of travelling from one section of a work to another.[36] Also, these sounds can allude to a human presence within a soundscape without explicitly revealing a human source. This is a powerful process for establishing ambiguities and uncertainty in the mind of a listener, and as such can easily be over-used. However, *Still Water* uses this technique to augment the sense of scale in the sonic landscapes that precede and follow the introduction of the footsteps. Table 2.1, on page 154, shows the functional relationships between environmental sounds in *Still Water*. The footstep sounds give the audience a yardstick with which they may gauge the size of the rest of the sonic environment.

The footstep sounds that precede Climax 1 at 7'23" are suddenly withdrawn, revealing a shifting texture that has been derived from an agglomeration of impacts formed from the granular sounds of insect activity (at 03'20"). The aim of this process is to enable the further magnification of the spaces available for Climax 1, as these insect sounds also grow to inhabit the acoustic space occupied by the

[35] *Exercisme III* by Parmegiani (1986) provides good examples of such contextual ambiguity, as does *La Disparition* by Calon (1988).

[36] Audio example CD: track 2.

footsteps.[37] This texture itself expands and disintegrates into a spectrally sparse and bleak landscape, where the only identifiable sound is that of a seagull cry that has been grossly transformed.[38] As this sound has a highly distinctive gestural profile, it is recognisable as the same seagull sound that was extracted from its original real-world context of a beach in the first section of the work. Thus the human presence in the landscape was systematically alluded to, diminished in scale and finally replaced altogether.[39]

2.8.6 Human/animal soundscape interaction

My aim in *Till* (1996) was to subvert the notion set up in *Still Water* that footstep sounds might imply a human presence within a landscape. Creating a situation in which this might be possible proved to be a difficult task, due in part to the requirement to preserve the illusion that some agency had initially created the footstep sounds. Interpolative transformations between human and more abstract-timbral sounds were first attempted. These were not successful in creating the desired subversion, as footsteps fading into a broadband noise texture still left the impression that human agency was at work. In order for this aim to succeed, it was necessary to create a transformation that did not change the sounds, so much as the agent responsible for them. It was imperative to maintain the audience's belief that a recognisable electroacoustic transformation had not occurred, and that the human sounding footsteps had, in fact, always been the result of pigs foraging in the forest undergrowth! This necessitated a short timescale for the transformation, and so a multi-stage transformation approach was used on this occasion. Figure 2.3, on page 160, shows an analysis of this transformation of agency.[40] It was realised with the following procedure.

Footsteps first emerge from a highly processed and resonant environmental scene. Rather than attempting to linearly interpolate towards the footstep sounds, the resonant ambience spectrally collapses and focuses gradually on the timbral qualities of the footsteps whilst retaining its own gestural profile. This is important as it is only the agency responsible for the steps which needs to be changed. For the transformation to attain its desired effect, it was necessary to arrive at the unprocessed recordings of the pigs. This was accomplished by introducing real ambience at the same rate at which the resonant ambience was collapsing. An impression of increasing environmental reality is set up, culminating in an ambience burst centred around the footstep spectra. It is then followed by a complete edit to the live pig

[37] Audio example CD: track 3.

[38] See figure 4.6 on page 167 for a full structural overview of *Still Water*.

[39] The magnification of non-human environmental activity and spaces in *Still Water* was inspired by moments within Smalley's *Valley Flow* (1992a).

[40] Audio example CD: track 4.

recordings. The function of the ambience burst is to prepare the listener for this edit, attempting to dull the impact of this major change. Note that between 6'20" and 6'35" this is the only event taking place on the musical surface. Therefore, the audience's attention is steered towards this transformation. Once accomplished, a return to the underlying processes of timbral development is instigated. The real world ambience is spectrally focussed towards the rain sounds, which then dissolve into a synthetic sound which exhibits similar gestural qualities.

2.9 Contextual listening

Perversely, when listening methods based on Western acoustic music (i.e. the aural identification of pitch relationships and structures) are combined with aspects of Schaefferian thought such as reduced listening, a habit arises whereby the listener is unable to gain a good structural insight into electroacoustic music. Truax shows how this might happen, noting also how he views the acousmatic tradition as entirely separate from Schafer's soundscape work:

> When one captures what is sometimes called 'raw' sound on tape and subjects it to studio processing, whether for mundane sound effects or the abstract material of the acousmatic approach, this manufacturing process with its industrial overtones suggests that one is composing 'with' sound... The soundscape composition typically reverses this process... The distinction is subtle because it involves a difference in musical process that conventional analysis of the end product (e.g., form, materials, structural organisation) may not reveal.
>
> (Truax, 1996:60)

Essentially, Truax states that conventional analysis (using both aural and paper methods) does not expose contextual information. If acousmatic approaches and soundscape methods are entirely exclusive in this way, it would imply that the listening public was insufficiently equipped to understand any type of music that carries contextual information in addition to timbre, form and structure. Recent studies in reception theory (Smalley 1992b) have clearly identified that modes of listening which were once considered separate,[41] actually operate interactively. It is on this understanding that the central aim of this dissertation rests: discovery strategy methods such as those defined in Chapter Four rely on fine-tuning aspects of the interaction between soundscape methodology and acousmatic composition. As Clarke (1997) points out, the popular music industry has recently adopted such a cohesive attitude towards listening, with good commercial gain. He gives an example

[41] Such as the Schaefferian modes, or Truax's levels of listening.

from the artist Tricky, where musical signifieds[42] are in good agreement with those generated from environmental sound sources:

> In the track *Struggle*, we struggle to pick up what the sounds specify. we struggle to hear the linguistic content of Tricky's voice. Within the domain of the sounds themselves, uncertainty or struggle are specified directly in the instabilities and ambiguities of the sound objects at their most physical level.
>
> (Clarke, 1997)

According to Clarke, Tricky appears to have adopted an approach towards composing with environmental sound that has some similarities with that contained within the acousmatic works of this dissertation. In both cases, sounds are used for both contextual and sonic purposes simultaneously.

2.10 Summary

This chapter has demonstrated that the soundscape theories of R.M. Schafer have great relevance to contemporary acousmatic composition. Furthermore, as it is possible for composers to extract sounds from their recorded contexts and place them in new composed environments, it is vital that we understand the nature of the interaction between a sound source, its cause and the sonic characteristics of the surrounding environment from which it was taken. In this chapter it was proposed that the link between a sound's source and cause is not necessarily the most important factor in assessing whether that sound is real or synthetic. This perception is vital to the compositional success of simulated sonic landscapes. These soundscapes are considered in the next chapter, where a new theory called *context bonding* is introduced.

The term *media bonding* was used to describe how sounds can become increasingly connected to the medium that carries them with each subsequent sound transformation. This is a useful distinction, as the notion of media bonding may assist composers who are aiming to produce realistic sounding environments within their compositions. In this case, only sounds that are not media bonded are suitable.

The compositional interaction between humans and the environment was analysed with reference to the musical works submitted. It was seen that the nature of this interaction can be harnessed and compositionally controlled. It is this interaction between sound sources and their contexts that enables the possibility for composers

[42] A semiotic term, roughly corresponding to 'extrinsic meaning'. See Nattiez (1990).

to steer listeners towards the structural or the extrinsic features of the music. This premise forms the core of *discovery strategy* presented in Chapter Four.

Chapter Three

Simulated sonic environments

3.1 Introduction

In this chapter the compositional uses of simulated sonic environments are explored. Simulated environments can offer acousmatic composers considerable freedom in manipulating the contextual implications of sounds. This is due to the fact that when a sonic landscape is pre-constructed, it is often possible to perform effective sound transformations on the individual elements that constitute it. This type of process is difficult to accomplish for a recorded real environment, as it often requires the use of sophisticated spectral extraction techniques to isolate the sonic details of the discrete sound events within the recording.

This chapter seeks to assess the compositional possibilities afforded by hyper-real environments, where it is not possible for the listener to tell the difference between reality and simulation. The mechanics for creating a convincing hyper-real environment are addressed, and the soundscape theories set out in Chapter Two are combined with contemporary philosophy to demonstrate the electroacoustic implications of hyper-real environments.[1] Wishart's definitions of real spaces and objects (Wishart 1986:42-43) are analysed and extended to account for hyper-real environments.

As realistic sounding environments can be pre-constructed, it is possible to construct events within a landscape that communicate in a highly personal, direct way. The second part of this chapter includes a discussion of how this technique can be applied. A rhetorical communication system of soundscape codes is proposed, demonstrating the possibility that simulated sonic environments can assist composers in controlling the listener's extramusical interpretation of the musical surface. Crucially, this is the foundation for the compositional methodology developed in Chapter Four, which permits a piece to have many extrinsic interpretations that are in good agreement

[1] See Baudrillard (1981) for an introduction to hyper-reality.

with a structural decoding of the work.

3.2 The changing nature of media space

Contemporary society exhibits a growing trend towards the personalisation of media space.[2] As Baudrillard (1981:29) puts it "You no longer watch TV, it is TV that watches you". He proceeds to identify the emergence of new fly-on-the-wall television documentary styles and a demand for increasingly interactive media services. Electroacoustic tape music can miss out on this new form of media interaction. Yet electroacoustic music can make use of materials that are extremely personal in nature, ranging from recordings of children (for example, Lewis's *Scherzo* (1993)) to the use of sounding materials taken from our surrounding environment. Why is it then, that such electroacoustic pieces can fail to gain an interaction with the audience on a personal level? One major factor lies in an awkward paradox: in order for others to recognise the cause of sonic materials, there is a need to select quite general sound types. The sounds of passing cars, bird-song and environmental ambience are so common that it is difficult to assign them to particular times or places. Works featuring the noises of cities are particularly problematic. The sound of traffic, train doors closing or crowd scenes retain little location specificity. Pieces that use environmental materials that attempt to allude to a specific time or place often resort to using a few *keynote* (Schafer 1977:272) sounds to link diverse ambiences and contexts together.[3] Without resorting to a radiophonic style of presentation and perhaps utilising a narrative voice-over, it is difficult to introduce audience interactivity on such a direct level. However, it is possible to introduce a level of interactivity that is directly supported by the medium itself. This issue will be addressed further in the course of this chapter.

Processed, transformed and synthesized sounds are all in keeping with the technology used to present them to an audience. However, a glaring gap between the sound sources and their technical presentation exists where composers have chosen to represent real-life sounds and sources. The contexts and extramusical connotations of those sounds would not have been manipulated by technology in the real-world, unless the audience received them first via the media. Listeners to an electroacoustic concert where the sounds were taken from everyday life may be particularly prone

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[2]What I have termed *media space* occurs where a communications medium is listened to, or watched by an individual member of an audience.

[3]In moments of Norman's (1996) *London* it is difficult to be sure that the city concerned is actually London. The initial street ambiences (at 0'42"-1'23") are particularly generic. It is only materials that possess linguistic contextual information such as the market scene (at 13'15") where Cockney accents are exposed that it is possible to identify the work with London's East End. To solve this problem, Norman has linked the sections of the work together by using easily recognisable sounds: for example, the sound of a tube train (at 7'22").

to accept the presentation of recorded environments as an actual reality. To integrate processed and transformed sound within such an environment is awkward, as there is a risk that the audience will be reminded of the technological nature of the medium. This would lessen the impact of any extramusical threads presented. Baudrillard (1981:20) states that the ultimate domain of hyper-reality is the "indifferentiation between active and passive". In a real-world soundscape, there is no constructional manipulation of audio events. With hyper-reality, composers can actively insert sounds that depend on listeners applying passive listening processes, such as Truax's background listening (Truax, 1984:21). Presenting environmental scenes is much like the process that lies behind 'TV verité'. Any media presentation of reality will inevitably contain some form of manipulation, even if this lies at a basic level of structure and available resources. After all, timescale is one of the first parameters to be used in any composition.

3.3 Creating simulated environments

The electroacoustic genre is well suited to the creation of simulated sounding environments. Using computer technology such as that demonstrated in Appendix A, it is possible to abstract individual sounds from complex recordings. However, it is easy to create what Wishart terms 'sur-real' environments, with sounds that have been abstracted from a variety of different contexts and spaces. This method will be examined in section 3.5.2, but first it is necessary to gain an understanding of the powerful role of reality itself within a recorded soundscape. It will be proposed that sur-real environments can have very little to do with reality, and as such offer little beyond an abstraction of reality coupled with new composed events. It is the aim of this chapter to explore the compositional possibilities of simulated, real-sounding environments, where it is not possible for the audience to tell the difference between simulation and reality itself. If such environments can be set up, then many new powerful developmental techniques can be utilised to transform contexts, as well as the sounds themselves. In order to see how this might be the case, it is necessary to start by determining the differences between simulation of a real event and reality itself. This is illustrated concisely by J. Baudrillard (1981:19-22): he invites the reader to organise a fake bank robbery as realistically as possible. Baudrillard notes that there is no existing punishment for fake hold-ups. They will be either punished as a real event or as an offense, such as wasting police time, but *never* as a simulation. From this he concludes that reality has a natural tendency to try and establish itself where possible. It is due to this fact that we are not constantly wondering if what we are perceiving is real.

Following Baudrillard's thesis, we can can see that the characteristics of a good simulation include the following:

- A simulated reality must offer all the gestures and signs of the real.
- A good simulation will have the same semiotic consequences as the real.
- It is impossible to 'prove' reality.
- The longer we perceive an environment, the more likely it is to be accepted as real.

This last requirement provides an interesting limitation on the types of long-term structure that can be used to create realistic sonic landscapes. If a landscape takes time to establish, then the structure of a work needs to be carefully considered so that the surrounding materials do not appear out of context. Conversely, composers who wish to set up the illusion of an imaginary landscape are faced with a 'reality problem'. How can they convince their audience that what they are listening to is actually a sonic landscape, rather than an arbitrary collection of sounds? This question is examined in section 3.5, although the principles behind this technique are quite simple:

> Disneyland is presented as imaginary in order to make us believe that the rest is real ...
> (Baudrillard, 1981:12)

Baudrillard shows that the presentation of imaginary events is often necessary in order to uphold the perception that the surrounding materials are actually real. This principle is extremely powerful, as it is elemental in maintaining listeners' belief in the existence (real or otherwise) of the environment that they are hearing. So, how can this belief be maintained for simulated 'real' (hyper-real) environments? To answer this question, it is necessary to observe the nature of communication between the music and the medium on which it is carried.

3.4 Medium, form and simulation

Marshall McLuhan famously argued that *content* can become neutralised when the medium dictates the form of communication (McLuhan and Fiore, 1996). By this rule, any sound transformation accomplished by technological aims may invalidate the 'content' being presented. Of course this may be a creative aim, but when extended, McLuhan's argument exposes the fragility of the link between a sound's apparent source or cause and the links that the sound may have had with the original context in which it was recorded. This section examines what 'context' might

mean for electroacoustic sounds, leading to the introduction of a new, tightly defined notion of the relationship between a sound's context and the transformation procedures used to create the sound itself. For example, if that content is an environmental sound, then McLuhan is correct. His argument demonstrates that the listening process commonly associated with assessing the physical reality of a sound by identifying its source-causes has, in fact, little to do with sources or causes but with the intervention of the medium itself. Following McLuhan to a logical conclusion, it is not important what the sources or causes of a sound are, as these can not be solely responsible for creating an illusion of reality. Sources and causes only provide an *indication* of what a sound actually is. What binds sounds to reality is the lack of media intervention in the presentation of their sources.

This hypothesis is easy to demonstrate. Consider the output of a physical modelling synthesis process. In order to create a sound, a user must first instruct the model regarding the nature of the surrounding physical environment. A physical model program such as TAO, or MOSAIC[4] will then simulate the causal qualities of the sound. In the resulting sound, the causal qualities are clear but technological intervention has resulted in less than a perfectly accurate sound. More importantly, it is also possible to identify the source as being that of a particular instrument, even though this is a simulation. It is tiny differences between a good simulation and reality itself that disconnect our perception of reality. This is why compositional strategies that use imaginary environments in conjunction with real ones are so powerful – the realism of a simulated environment is measured by the audience as the *difference* from reality. This can be a problem for electroacoustic composers, as the medium itself might encourage audience listening strategies that are incompatible with the materials being presented. Wishart has identified that it might be the medium that is the problem, rather than the sounds themselves:

> The dis-orientation experienced by listeners new to electroacoustic music is not because they can not imagine the source, but because they can not decode the medium of presentation. Providing information regarding source-sounds in programme notes really does little more than engage a passing interest.
>
> (Wishart, 1996:139)

Although Wishart is underlining a common concert situation, he highlights the apparent dislocation of source and cause from the perceptual processes used by an audience to identify everyday reality. However, according to Baudrillard there is a more serious issue at stake, one which McLuhan did not consider:

[4]These software packages are reviewed in Pearson (1998).

> Beyond this neutralization of all content, one could still expect to manipulate the medium in its form and to transform the real by using the impact of the medium as form.
>
> (Baudrillard, 1981:82)

Baudrillard sees this as a two-stage process. Firstly, the idea of 'message' is imploded into the medium. Secondly, the logical conclusion of this process is the implosion of the medium into reality. Thus, it would appear that reality can be manipulated by a content-less medium, purely by its form. We shall see that this is consistent with the application of electroacoustic technology to environmental sound.

3.5 Composing with reality

3.5.1 Sonic landscapes

The term *Sonic Landscape* originates with Wishart (1986:41). The use and construction of a sonic landscape implies a set of constraints, concerned with defining the nature of the interaction between the landscape and the listener. Many of these concern the uneasy juxtaposition between real elements of a sonic landscape and those that are imaginary. Wishart states that, in order for a landscape to be formed, we must recognise the source of a sound:

> Let us place these various characteristics of the sound experience related to our recognition of the source of the sounds under the general heading 'Landscape'.
>
> (Wishart, 1996:130)

Wishart re-affirms that we perceive reality due to source recognition processes. It will be demonstrated that such a definition can actually limit the production of landscapes to cases where the landscape is, as far as the listener is concerned, obviously simulated.

3.5.2 Reality and imaginary spaces

For Wishart, the space which a landscape inhabits is a crucial part of what defines it:

> The nature of the acoustic space can not be separated from our perception of the sounds within it. (Wishart, 1996:140)

However, such an approach segregates reality and imagination.[5] In summary, Wishart is proposing that sonic landscapes can be viewed as an interaction between a virtual, recorded space, a real performance space and a perceptual space created by the imagination. Wishart is particularly skilled at effecting transformations between these domains, where the real and the imaginary never truly exist in the same space. In this environment, it is clearly not possible to generate hyper-real situations, due to the fact that imaginary and real sonic environments are not available to the listener concurrently. This segregation should not be confused with the sur-real type of imaginary landscape that Wishart is referring to. Indeed, it will be argued that this segregation of aspects of reality and imagination are a necessary part of a virtual soundscape.

This approach creates many problems. For example, Wishart (1996:136-137) describes the problem of performers engaging in a performance of a live work, that is listened to over loudspeakers. Interestingly, he does not find a suitable solution within his definition of *landscape* to integrate the different types of space created by both imaginary and real objects. Instead, he sidesteps the issue by suggesting that virtual spaces can easily be combined with those that are real, so producing acceptably realistic results. He argues that this is legitimate because studio techniques such as reverberation use overlay processes by default. He also includes information on how to re-create virtual landscapes by the process of convolution, noting that:

> Sound recording and the presentation of recorded material, has, however brought with it a number of acoustic spaces which are conventions of a mode of presentation. We shall refer to these as formalised spaces, so as to distinguish them from 'real' acoustic spaces.
>
> (Wishart, 1996:142)

What is *formalised* about these spaces is perhaps the parameters and the mathematical models that created them, and not the resulting landscape. From a perceptual point of view, listeners to popular music will expect this virtual/real space duality as a necessary part of the music. It is perceived as an effect, not a formalised space. This distinction is particularly critical in understanding how the real and the virtual can be made inseparable in the domain of hyper-reality. Wishart's virtual landscapes are perhaps the 'reduced listening' equivalent of real soundscapes. Note that he has not, at any stage, violated the Schaefferian tradition in considering extramusical information, such as the explicit contexts of the sounds in a landscape. After all, this *reduced soundscape listening*[6] is positively essential if abstract-timbral

[5] This is practically demonstrated in Wishart's own compositions, such as the *Vox Cycle* (Wishart, 1990).

[6] *Reduced soundscape listening* is my term for a process whereby the listener abstracts individual sounds from a soundscape, without considering the contextual relationships between those sounds.

sounds are to be used within a landscape. Wishart then applies his construct of a formalised landscape:

> A typical formalised landscape might be that of a disk jockey presentation of rock music. We are not meant here to recreate an image of a person sitting in a studio and speaking into a microphone and putting records on turntables (in fact, in many Californian rock stations this has now been entirely replaced by automated synchronised tape recordings).
> (Wishart, 1996:145)

Nowadays, many of those automated stations include disk jockey talk as part of the broadcast.[7] The unfortunate fact is that if the *reality* of the radio event is not preserved along with its seemingly personal nature, customers will not tune in. By defining this as a formalised landscape, Wishart has avoided the intrusion of reality by confining it as a small parameter in a larger formal package. He supports his theory by defining the relationship between a sound object and its surrounding space. It is this split between object and space that is essentially responsible for the distinction (both compositional and perceived) between abstraction and reality. Wishart defines three classes of interaction:

- Un-real objects/real spaces
- Real objects/un-real spaces
- Real objects/real spaces

Enforcing the distinction between imaginary and real does not allow for a composed hyper-real situation, because of how these definitions are reflected in practical compositional methodology. In order to understand why this might be so, it is necessary to introduce the idea of contextual labelling.

3.5.3 Contextual labels

A *contextual label* can not be removed from a sound or a space. Take for example, the recorded sound of a casserole dish being struck with the lid of another. This recording could have a contextual label that contains ambient information pertaining to the closeness and clarity of the recording. Alternatively, the label may point to 'a famous electroacoustic work', rather than a 'kitchen environment'.[8] Spaces can

[7] For example, even the new music station KPFA-fm, Berkeley, USA employs such methods.

[8] *Klang* by Harrison (1996b) has altered the contextual labels of recorded casserole dishes for practised electroacoustic composers and listeners.

also possess contextual labels. Again, available ambient information is an important factor in generating the label. For example, an environment with a broad-band noise texture with few acoustic reflections may suggest other sounds that might occupy an outdoor space. Sound spaces can only exist if there are sounds, so these particular ambience cues are a result of sounds naturally occurring within a given space. These can include reverberation or additional ambient sounds such as insect activity. We can see that if a real casserole dish were to be imposed upon a real outdoor space, the result would be far from real. The case of the 'real sound/real space' requires much further investigation as the contextual labels and semiotic interpretants generated by this process can be highly unpredictable and inconsistent.

3.5.4 Abstraction and surrealism

Let us review Wishart's definition of the real object/real spaces case, noting that the result is an *imaginary* landscape:

> We have a landscape in which the sound sources are real and the perceived space is real, yet the relationship between the sound images is impossible. This bringing together of normally un-related objects in the virtual space created by loudspeakers is closely parallel to the technique of bringing together unrelated visual objects in the space defined by a painting, a technique known as surrealism, and I therefore propose is to call this type of imaginary landscape (real objects/real space) surrealist.
>
> (Wishart 1996:146)

Such an analogy with surrealist art again implies that a process of abstraction has been at work, negating the true compositional potential of combining real objects with real spaces. Furthermore, this theory of space and object-type does not account for situations where a composer might be able to simulate reality itself, by building environments where the contextual labels of both the spaces and the sources are in total agreement. Spaces do not have to contain objects, although this is often how they are perceived. However, with concentrated listening it is possible to perceive first the space, then the sound contained within it. Wishart does not consider the real object/real spaces case to include plausibly real situations where the contextual information carried by both object and space are matched. Paradoxically, he uses his definition of the results from combining real objects with real spaces to construct abstract sonic environments. It is important that we ask why this abstraction can occur when real objects and real spaces are combined, as logic dictates that the result should be realistic in some way. However, the level of abstraction that results is a direct product of the space and sounds not possessing consistent contextual

labelling information.[9] Perhaps this class of space/sound should be re-defined as:

> objects abstracted from reality/spaces abstracted from reality.

Red Bird (Wishart, 1977) contains many instances of this process. Wishart writes:

> In another situation I wished to create the aural image of a machine... In this particular instance it was necessary to construct a convincing aural image of a machine, but using as the sound components the syllabic constituents of a certain phrase.
>
> (Wishart, 1996:153)

He attempted to filter and re-process each vocal sound separately, yet:

> ... given all of these factors, it was necessary to use further contextualising cues before the aural percept 'machine' was received by the listener.
>
> (Wishart, 1996:153)

In the end, real factory ambience and other real factory sounds mixed in at a low level, were used for this task. In order to make the contextual labelling consistent, Wishart had to rely on 'contextualising cues' when attempting to combine two real space/real object sounds. As these spaces include objects that are not normally heard together, these contextualising cues are essential to increase the *reality credibility*[10] of the sonic landscape in question. In order to enable better integration of contextualising cues and abstract sound environments, reality credibility can be enhanced by adopting a methodology based on spectromorphological concerns, rather than those that are exclusively contextual. This may appear to be a rather perverse idea at first sight. However, it is the spectromorphological aspects of the contextual label which often hinder successful integration of transformed and natural sounds, even where appropriate extramusical contexts can be set up.

For maximum reality credibility, the contextual labels exposed by all sounds within a particular sonic landscape must match. In such a situation, it is clear to see that if a sound possesses an odd timbre, even though its gestural and contextual information are consistent with the space, the whole soundscape can no longer be trusted to be an authentic representation of reality. This requirement can be illustrated by the

[9]The goal of achieving consistent contextual labels across all sounds in an environment is irrelevant for the other space/object combinations mentioned by Wishart, because the result will always possess a certain degree of abstraction due to the types of source sound selected.

[10]I use this term to indicate a measure of the apparent authenticity of a soundscape.

following hypothetical situation. Imagine a recording of an urban traffic soundscape. With careful editing and spectral extraction, the sound of one car is removed, filtered with a simple all-pass filter, and re-combined with the original at the same time position from which it was extracted. Here, the car's spectral characteristics do not match those of others which contain similar gestural and extrinsic information and therefore lend the scene a low reality credibility.

3.5.5 Landscape morphology

Just as in Geomorphology, a *landscape morphology* concerns the most important structural trends contained within a landscape. There are five main categories of landscape morphology:[11]

1. Hyper-real
2. Real
3. Abstraction/Surreal
4. Virtual
5. Non-Real

The hierarchical ordering of these definitions is important, reflecting a specifically compositional viewpoint and offering an insight into the sounds/spaces paradigm discussed earlier. This view of landscape morphology is potentially more useful than a sound/spaces approach as it defines the landscape in terms of the aural product of the sounds contained within it, rather than being a description of the constituent parts. Abstract, imaginary landscapes will not be covered in any great detail here.[12] Real landscapes were examined in Chapter Two, and hyper-real, virtual and non-real landscapes can be defined as follows:

- Hyper-real

  This is a situation where a reality is carefully composed, but is indistinguishable from the real in any way. Contextual labels match up closely between the sounds concerned and the space. Ferrari was one of the first pioneers of composing with hyper-real landscapes:

[11] These can include both 'live' and recorded sounds.

[12] See Wishart (1996) for further information.

> I thought it had to be possible to retain absolutely the structural qualities of the old musique concrète without throwing away the content of the reality of the material which it had originally.
>
> (Ferrari, in Wishart 1996:129)

The key word here is structure. By adopting the structures of music concrète, rather than those of reality, a distinction is made which technically should place Ferrari's landscapes within the virtual category.[13] We are convinced that these are real recordings, but due to the extensive timescale manipulation that is involved there are cues that may give the audience the impression that these events could not be taking place in reality.

- Virtual

  In fact, virtual reality has little to do with reality, or indeed, abstraction. Virtual landscapes are those where all aspects of the landscape are perceivably simulated, yet the landscape retains a high degree of reference to real sounds and spaces. For example, it might be possible to create an environment that has the gestural qualities of falling rain and a wide open space. The result is an environment that has great proximity to one that is real, yet the listener knows it not to be so.

  Virtual environments can account for what is colloquially termed 'ambiguity' in much French-Canadian electroacoustic music.[14] Such environments are not themselves ambiguous, as they have been carefully constructed to provide the features and cues of reality without reality itself. Although this may clearly leave an ambiguity in the mind of the listener, the compositional construct is far from ambiguous.

- Non-real

  These are environments that are not surreal, nor are they identifiable as real in any way. For example, a non-real environment could consist of highly processed textural sounds that are remote surrogates of their original recordings.

3.5.6 De-contextualising sounds

John Young (1996) has identified that contemporary electroacoustic composers, with the exception of Ferrari, do not appear to be very interested in composing with reality directly. Young cites Wishart as an example:

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[13]This is apparent in Ferrari's *Presque Rien no.1* as a compression of timescale. (See Emmerson 1986:19).

[14]See Calon's programme notes for *Portrait d'un visiteur*, in Calon (1988).

> ... firstly, the use of the medium as a virtual sonic world in which recognisably realistic sounds with different contextual associations can be combined to create 'surreal' environments and, secondly, the potential to create distinctions between apparent 'Reality'[sic] and 'abstraction'.
>
> (Young, 1996:73)

Young also cites Schaeffer to support his argument:

> Schaeffer's analysis of listening modes points to the way we can instinctively shift the psychological context we give the same sound, and to the ways such shifts may be useful as a compositional strategy in electroacoustic music.
>
> (Young, 1996:74)

For transformed sounds to be recognised as being 'de-contextualised', they must retain some characteristics that remind the listener of what the original sound was before any transformation took place. Otherwise, the fact that a de-contextualisation process has taken place will not be obvious to the listener. This may not be of importance in many cases, where the sound is to be used purely as part of a timbral development process. However, the process of removing contextual cues so that the sound may be subjected to timbral transformation is an interesting compositional process that can have considerable aural impact. The success of a de-contextualising process can be measured in relation to the surrogacy level of the resulting sonic materials. Table 3.1, on page 155, shows the relationship between surrogacy level and context in the seagull transformation at the start of *Still Water*[15], from a poietic viewpoint. Here I wished to experiment with the process of de-contextualising a sound, and attempt to show how such a process can be integrated into a larger compositional hierarchy. The sea-gull sounds in this example become progressively less *context-bonded.*[16] Treating sounds to remove contextual information requires great care, as it is possible that any electroacoustic technique that modifies time or spectrum can cause this process to happen.[17]

3.5.7 Sonic reality and source recognition

This section examines how a sense of sonic reality can be created. As we have seen, source recognition is only part of the process that enables listeners to have faith

[15] Audio example CD: track 5, index 1–3.

[16] The extent to which the existing context of a sound is linked to the context in which that sound was first created.

[17] Section 4.8.4 on page 70 explores the possibilities of de-contextualising sound materials in a new class of sound transformation: the *contextual steering transformation.*

that what they are hearing is real in some way. If we do not recognise the source of the sound, is it still possible that the sound could have a high degree of contextual credibility?

Although source recognition is undoubtedly a key parameter as Young describes, we do not necessarily have to recognise the source *per se*. After all, sources can still have a high degree of contextual credibility regardless of their mimetic qualities, or surrogacy level. For example, the opening moments of *Still Water* contains sounds that are characterized by their impulsive, granular nature. They are in fact recordings of twigs breaking, which were recorded in an outdoor environment. It is difficult to identify the causes of these sounds. However, they do not stand out from their new composed environment because they possess similar spectral characteristics to other sounds in the same scene, which were recorded in a different, real acoustic environment. These breaking twig sounds do not have a mechanical origin and so do not conflict with the other natural sounds in the environment. Furthermore, the ambient component of their contextual labels are in agreement with those of the background scene, as both sets of sounds are identifiable as being part of a natural environment. To make sure that the contextual labels matched, the twigs were recorded at a distance of 3m from the microphone. Thus we have seen that the reality credibility of a sound can have as much to do with the spectral characteristics of the sound concerned as it does with source-cause recognition. Young hints at the importance of spectral listening in establishing a convincing sense of reality:

> Within the category of object 'door', the sound itself indicates something of the probable physical nature of the source (such as its size and weight) which in turn suggest different contexts: is it a seemingly heavy door in a vastly reverberant space, or a door which opens from a resonant interior on to an external space ...
>
> (Young, 1996:77)

According to this concept, the main mechanism behind the perception of sounding contexts again must result from examining the nature of the source sound itself. Young (1996:77) continues "A realistic context is therefore one in which we are able to recognise objects by their sounds". However, the process of reality credibility assumes that spatial and extrinsic environmental characteristics are perceptually analysed *at the same time* as the spectral nature of the sound. This distinction avoids the concept of listeners having first to channel sounds through a perceptually restrictive reduced listening process. The spatial characteristics of the environment are an important part of this process. A simple demonstration of this theory is to select any recording of an outside space, and run it through a reverberation process. It will still be possible to recognise and correctly decode the sounds, yet the environment itself is far from realistic.

3.5.8 Spatial cues

We have seen that spatial cues are responsible for the perception of audio reality, as distinct from source identification. For example, the process concerning the genesis of an outdoor reality involved the creation of many simulated spatial cues that were necessary to build a realistic environment. Two of the most important spatial concerns in creating an environment with high reality credibility are set out below. These parameters were arrived at through a systematic exploration of the spatial processes used to create the opening moments of the work *Breaking Spaces*.

- Size of environment ambience in relation to source-sound scale.

  The size of an acoustic environment is a complex parameter which can be used for compositional manipulation. It is not simply the physical width and breadth of a space that contributes to the perception of the size of a space. The sounds within a space are used to measure the correctness of the scale of the environmental ambience. This process can be seen in action in *Still Water* at 0'15", where a human voice is introduced at a low level, towards the background of the mix.[18] The environment thus appears considerably magnified.

- A natural dispersion of the sound sources must be observed within the simulated acoustic environment.

  When constructing simulated environments, it is vital to correct sound sources so that their *orientation* is as consistent as possible with their known behaviour in reality. Orienting sources correctly can make large differences to the believability of the soundscape. Not all sounds within a landscape will be pointing towards the listener. The output of some sound sources may first encounter a reflective or absorbent surface, before being transmitted to the listener.

A simple concern for directionality can be used as a compositional means to increase the reality credibility of a sound. In the opening of *Still Water*, directionality was accomplished by careful filtering and binaural sound placement. With the technology available to construct this work, it was necessary to generate more than one listening position, instead of generating multiple sound placement positions. Using this technique, it was possible to gain an illusion of depth in the soundscape by using the same source samples. Figure 3.1, on page 161, demonstrates the spatial results of this method. All sources for a simulated real environment must be recorded at distances that concur with their presentation in reality. If this is not possible, that spatial position needs to be simulated.[19]

[18] Audio example CD: track 6.

[19] Appendix B shows the CMIX script used to create binaural environments. However, it is not necessary to listen to the work on headphones to hear these environments.

3.5.9 Reality and sound transformation techniques

Risset has specialised in the creation of realistic recorded sonic environments. In contrast to those methods deployed by Wishart, Risset aimed to re-create an impression of reality by combining disparate materials. As such, this represents a step towards the development of hyper-real composition.

Risset (1996) introduces the work of the psychologist Gibson, recounting the theory (Gibson 1966) that perception has evolved to provide useful information regarding our environment, to which the physical characteristics of the sound (timbre, loudness, duration) are of secondary importance. Gibson's theory is in good agreement with the analysis presented earlier, showing that source-causes are not of primary importance in the aural decoding process which identifies sounds as being real. However, Risset proposes that, as stated by Wishart, 'mechanical causality' is again a primary concern in identifying sound sources as possessing realistic attributes.[20] The perceived primacy of the source-cause, which Risset identifies as a listening strategy (Risset, 1996:30), is adapted to servicing Risset's personal compositional quest of creative cross-synthesis and filtering. In 1988, when *Sud* was produced, it was a technological masterpiece.[21] Risset even remarks of his current research aims:

> A major research goal in my team of the Informatique Musicale at the Laboratoire the Mecanique et d'Acoustique in Marseilles is to gain the ability to process sounds with a ductility approaching that afforded by synthesis.
>
> (Risset, 1996:30)

In works such as *Sud*, reality serves to lead the listener into hearing these interesting techniques. Unfortunately, this is where this process stops. As listeners, we can do little more than focus on the audio effects of cross-synthesis. Like Wishart, Risset constructs musical textures around these techniques. Structural discontinuities, introduced by using cross-synthesis as the means to mediate between reality and abstraction, are numerous. The process of cross-synthesis can only be regarded as a tool in creating hyper-real environments, as by exchanging the characteristics of one sound with another, the reality of either is not substantially removed or enhanced.

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[20] Windsor (1994) does not agree with Risset, suggesting an alternative role for environmental cues in source recognition.

[21] *Sud* was composed at the GRM, Paris in the Digital Studio (Studio 123).

3.6 Rhetorical soundscape communication

3.6.1 Metaphor

The metaphorical qualities of sound can aid the creation of simulated environments. In order to understand this process, it is necessary to examine the mechanisms by which sounding metaphors are constructed in acousmatic electroacoustic works. Generating a sonic metaphor is a multi-stage process. Because of the contextual and compositional manipulation that must occur before the metaphorical sound can be integrated into a simulated environmental context, the chance of a listener perceiving that sound as an intrusion must be minimised. The timescale on which a sonic metaphor operates is important, with a requirement for events within the immediate temporal context of the metaphor to possess matching contextual labels. Because of these limitations, composers frequently employ other types of allegory. Some examples will be given in the following text to illustrate the use of allegories as a device to undermine/re-enforce the reality.

A sonic metaphor exists where sounds with clear extramusical contexts suggest musical functions or processes. F. Bayle's (1978) *Erosphère* contains many good sonic metaphors. One such instance is the sound of closing doors (Transit 1: 0'02"), followed by the sounds of a lift descending. Here, it is unlikely that Bayle was attempting to create any vision of 'reality'. The sound of the lift may be real, but the use of metaphor in this way sets up a quasi-reduced listening situation for the listener. This type of reduced listening is one where the contextual and timbral implications of the sound are ignored. We are required to construct a new reality in our imagination and apply it to our perception of other events in the piece. Bayle does not develop further the timbral aspects of this incident. This indicates that Bayle included the lift sounds for contextual reasons: the lift doors close off the outside reality, and we descend into a new world of subterranean sounds. How did our perception know to interpret the sound of the lift as indicating a descent into the work, instead of as a timbral event? This type of question is central to much acousmatic composition, where real world sounds are interjected with abstract-timbral sounds.

This process is often the result of listeners expecting a perceived link between two associated contexts. Walker and Chaplin point out that this construct is used extensively in film; note the use of similar expressive parameters:

> In the final moments of Hitchcock's North by North West (1959) the hero and heroine are about to consummate their marriage in a train couchette. Hitchcock does not show their sexual union directly, instead he cuts from the train's interior to an exterior shot showing the train entering a tunnel.

(Walker and Chaplin, 1997:120)

Thus the metaphorical communication of ideas is clearly a useful device as it allows us to communicate aspects of reality by use of non-explicit source materials. However, Walker and Chaplin's example shows some of the dangers of this technique. Used in this way, metaphor can become a euphemism. In the English language, the problem with euphemisms is that there are a small number of them, compared to other expressive phrases. Perhaps if there were more euphemisms, the reality alluded to would become harder to codify. In electroacoustic music, the over-use of metaphor can have the same effect. For example, we frequently observe footstep sounds as a metaphor for travelling, doors opening and closing for entering and leaving sections of a piece. Over-use is inevitable, particularly because of an unfortunate co-incidence that the palette of materials recorded from the environment has a high probability of containing these metaphorical sounds. Used sparingly, metaphorical sounds can provide a strong link between hyper-real and virtual environments. Examples of this process can be seen in *Till*. See section 3.6.7 for details.

Metaphor is a rhetorical construct, or a 'figure of speech'. As such, the codes of communication that are exchanged when rhetoric is used have to be fairly general in order to convey their apparent meanings:

> Rhetoric is an ancient type of speech designed to move audiences and to persuade them to accept certain ideas. Today, politicians, advertisers, and pressure groups are the main producers of rhetoric. To engage the interest of the public, rhetoricians use language in a non-literal manner.
>
> (Walker and Chaplin, 1997:119)

It is clearly an essential part of rhetoric that those ideas are not analysed too closely. It is hardly surprising then, to find that rhetorical sounds within electroacoustic music are not often exposed to timbral development, particularly within a short timescale of their occurrence. The above example from Bayle illustrates this well. As Walker and Chaplin note, rhetoric is a good device for selling commodities, due to the fact that an instant emotional response is often generated within the human apprehending the message. Their discussion (1997:120-122) can be usefully extended from the bounds of visual culture into sonic art with the aim of clarifying some misunderstandings behind the application of environmental sounds, and compositional strategies concerned with the manipulation of real and imaginary contexts. Although Wishart views metaphor as a compositional end in its own right (Wishart, 1996:165-167), he concedes that the process of establishing a metaphor is multi-layered and context dependent. He mentions Stockhausen's *Gesang der Jünglinge* as an example:

> It is interesting to note, however, that even in this case the metaphorical interpretation depends on the existence of a transformation.
>
> (Wishart, 1996:165)

As we have seen, by viewing this process the other way round (i.e. where contexts give rise to transformations), this dependence on contextual cues is essential to the establishment of a direct channel of communication with the listener.

3.6.2 Simile

A sonic simile gives a new meaning to an existing sound by juxtaposing it with new material. For example, in *Vox V* (Wishart, 1990) vocal sounds appear within a landscape populated by wild birds, gurgling water, horses and other natural phenomena. Yet the vocal sounds are never explicitly those of language. The simile created here gives the highly abstract vocal material a placement within a 'natural' and somewhat primordially powerful landscape. As this example demonstrates, simile is a powerful compositional process that can be used to add a recognisable context to abstract material. However, it is important to recognise that simile is a process that can be applied in a linear manner, and not simply as a vertical super-imposition of original contexts. The most direct example of a simile used as pure rhetoric can be found within the same work in the now classic voice – bees – voice transformation (Wishart, 1990, time:2'14"). In the programme notes for this piece, Wishart even remarks: "My voice is like a swarm of bees". Ambiguity is an important component of a linear simile. Without it, this type of simile would not be possible.

I will use the term *context loading* to describe the process that combines a sonic simile with the creation of ambiguous relationships between the resulting contexts.[22] Context loading occurs where a listener is being directed by the composer to follow a simile and forced to make an aural comparison between timbre and metaphor. In the above example from *Vox V*, it is important to note that there are no other materials surrounding this transformation, and it is exposed to the listener as a linear strand. A technique similar to this is used in my work *Breaking Spaces*, to create highly directive links between different zones of the piece. A link was required between a scene featuring gritty and granular sounds (3'17")[23] and one where an environmental scene of rain and thunder occurs (4'13")[24]. It was necessary to set up a simile so that the transition could be made smoothly, and so an interpolative transformation between the impacts of the pebbles and the sound of falling rain

[22] One context is loaded onto another, creating an aural ambiguity. As there is no cohesive combination between the two materials, this process differs from transcontextuality.

[23] Audio example CD: track 7, index 1.

[24] Audio example CD: track 7, index 2.

was manufactured. The resulting pebbles/thunder ambiguity that occurs half way through this transformation[25] is a by-product of this developmental process.

3.6.3 Hyperbole

Frequently, it is necessary to overstate the case to get a message across.

> In television commercials, cars are shown falling from tall buildings and landing undamaged.
>
> (Walker and Chaplin, 121:1997)

In electroacoustic art, hyperbole plays just as important a role as in visual culture. A sonic hyperbole is a sound that possesses deliberately overstated extramusical connotations. For example, in Calon's *La disparition* (1988), the jungle scene (at 4'17") contains not only the sound of insects or tropical birds, but a Tarzan-like vocal sample that appears to swing through some imaginary trees. For anyone exposed to Walt Disney in childhood, stereotypical jungles will probably include some kind of swinging Tarzan-like figure. This audio hyperbole is effective in two different ways. Firstly, as far as any listener is concerned this is a *tropical* jungle. This allusion is just as well, as the sounds of the surrounding wildlife are not particularly convincing in themselves. The second function of this pseudo human utterance is to indicate that this landscape may be compositionally interfered with.[26] Such exaggeration of a monkey's call into this Tarzan-like utterance is not meant to be taken literally, and thus conforms well to the classical literary definition of rhetorical hyperbole stated above.

3.6.4 Personification

In sonic terms, personification is where a sound has highly personal and human extramusical connotations. At first sight, personification would appear to have little use to composers due to the fact that it only possible to represent people directly by following a narrative or radiophonic format. However, personification can also be a powerful tool for composers wishing to utilise environmental sounds. In this guise it can be used to create a point of contact with the audience. A new generation of works is emerging which often take this principle to extremes. Andrew Lewis' *Scherzo* (1993) features sounds gathered from his children. These are subject to many radical sound treatments where the original materials are transformed into

[25] Audio example CD: track 7, index 3.

[26] A subsequent transformation between aeroplane and bass drone texture occurs at 6'12".

remote surrogates. However, at 6'47" these transformations dissolve into the sound of a child's voice playfully crying 'daddy'. The playful interplay between materials occurring earlier in the work is summarised in a readily accessible human form.

As a rhetorical method of creating human contact, personification can be invaluable in other situations where more abstract materials are being manipulated. *Still Water* sets up vast, shifting sonic landscapes. It was my wish to make these landscapes more involving for the listener. To attract attention, a small burst of human laughter is added to the initial landscape at 0'15". The audience has a brief point of contact within a sonic world devoid of other recognisably human links. As such, the rhetorical process of personification has a serious role to play in establishing an interactive dialogue between the listener and the work, and is an important element of discovery strategy, as detailed in Chapter Four.

3.6.5 Synecdoche

A sonic synecdoche exists where only partial aural cues are given to an extramusical context. Listeners must generate their own extramusical meanings from deliberately ambiguous sonic information. If enough aural information is presented, a listener can fill in the details. Because synecdoche provokes interactivity on the part of the decoder, the scene can become personalised instantly.

The idea of sonic synecdoche resolves an interesting dichotomy in electroacoustic music. Picture an audience member having read the programme notes for a piece and possibly asking the familiar question: 'Are the composer's intentions supposed to be compatible with my decoding of the work?'.

This difference in opinion between composer and listener is entirely acceptable. Indeed, the strength of synecdoche as a rhetorical device rests on this distinction. As will be shown in section 4.5, *double encoding* processes actively invite the audience to tease out their own (possibly conflicting) meanings from the work. This interactivity is achieved as the audience is required to fill in gaps in the aural information presented to them by the composer. Wishart refers to this process as *masking*. Wishart presents masking as a process whereby extrinsic information masks the identity of a particular sound, noting that:

> The brain is capable of reconstructing a message from partial information, even when the remainder of the message is not present.
>
> (Wishart, 1996:153)

So, masking can aid composers in creating realistic environments because the brain will fill in detail that the composer has not provided. Whilst this is undoubtedly true,

the positive benefits of synecdoche are easy to overlook. The fundamental principle in making this process work with materials that have extramusical implications is the careful selection of materials which provoke an active and thoughtful decoding. In this case, the 'message' is crucially complete, and *not* actually masked by anything. With synecdoche-based processes, there is no alternative information or materials serving to hinder the perception of the original material. Thus a sonic synecdoche concerns the act of suggestion, rather than detection.

3.6.6 Rhetoric in action

Because the formal nature of rhetoric is widely understood, it can be used creatively to solve the dilemma for audience members attempting to decide at a particular point in time whether to listen to a sound's timbral qualities or decode its extrinsic meanings. In short, rhetorical codes communicate directly and can therefore be used to direct an audience's listening and perception. I put this theory to the test in a Composers' Workshop at the Royal College of Music (London: 12 March, 1996). The audience of 50 musicians was asked to jot down any aural images formed during the performance of *Undercurrents*. Crucially, most of the audience who volunteered an answer had identified the sounds of the train (track and whistle), but still felt confused when told that the piece was not about trains. This answer demonstrated that they had known how to decode the individual train sounds (by contextual listening), but also showed their unwillingness to unpack the spectral logic of the train sounds developed in the surrounding textures. At a timbral level, the opening of *Undercurrents* is almost exclusively developed from these sounds, drawing on the pulsed nature of the train sounds. However, the audience had become personally involved on a direct level. Their response was not one of questioning whether they were supposed to listen to the timbre or the extramusical meaning. They instinctively knew what to listen for, due to the rhetorical nature of the communication process involved.

Because rhetorical codes can be easily decoded, they also carry timescale implications for the events surrounding the rhetorical code. For example, the train hooter at 0'45" in *Undercurrents* is surrounded by sounds with no clearly definable extramusical meaning. There is also a large amount of activity occurring over a short length of time in this section, due to the shortness of the constituent sounds themselves. Likewise, when the whistle enters at 0'12" it is only in existence for 0.8 of a second. This is hardly long enough for an audience to begin thinking of compatible extramusical narratives, or to start analysing the timbres involved. They have no choice but to listen rhetorically, via direct methods of communication. I have also attempted to remove any possible audience speculation regarding future developments of this sound, by following it with an explosive attack of sculpted white noise. This attack is succeeded by a section containing low-level textures that

requires careful listening. By using rhetoric as a starting point, I have attempted to steer the audience between the two poles of timbral analysis and the recognition of extramusical features.[27]

3.6.7 Transcontextuality as rhetoric

According to Walker and Chaplin transcontextuality can be used as a rhetorical device in its own right, as contemporary audiences are equipped to decode transcontextual materials easily:

> Contemporary popular movies such as *Independence Day* (1996) are generally full of borrowings and references to other films belonging to the same genre, in this case science fiction. Intertextuality increases audiences' enjoyment by mobilising their existing knowledge by treating them as sophisticated viewers.
>
> (Walker and Chaplin, 1997:124)

It is worthwhile noting that this process is self re-inforcing. As works within a genre borrow more from each other, the the audience will feel more comfortable with those works. This situation has obvious limitations. In Walker and Chaplin's own visual example above, viewers have only actually been exposed to a limited amount of transcontextual references by virtue of the fact that they must come from the same genre. This could encourage a *genre dependence*[28]. This method can also back-fire, as borrowing techniques that are too sophisticated, particularly those that demand knowledge of the *consequence* of actions resulting from a particular scene, may not succeed. Sooner or later, the net of meanings will become tangled and self-referential. Composers should take care to avoid this situation, as this drawback is due to the limited number of common codes of communication available. We must ask ourselves whether it is really necessary to hear Parmegiani's *Dedans/Dehors* in every electroacoustic work which uses closing/opening door sounds.[29]

Given these limitations, I set out to create a work (*Till*) that draws on an audience's pre-existing knowledge of electroacoustic music. Crucially, none of this knowledge is mobilised by borrowing actual materials, but situations are set up whereby skilled listeners could feel 'at home' with the work. The sounding materials and structural

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[27] This process assumes that listeners are capable of timbral analysis and extramusical recognition simultaneously.

[28] My term for a contemporary media audience that becomes so locked into the rhetorical codes of a particular genre to the extent that apprehending other genres becomes particularly challenging.

[29] Also, due to the intrinsic simplicity of rhetorical communication codes, it is possible to construct new works that inadvertently specifically reference existing ones.

design of *Till* were forged to reflect many well known electroacoustic works. In this instance, I wished to use transcontextuality in a mode similar to that suggested by Walker and Chaplin. Table 3.2, on page 155, shows an synopsis of the extrinsic references in *Till.*

3.7 Summary of rhetoric

The success of these rhetorical processes, and their ability to provoke a correct decoding (or one that is within the bounds of acceptable parameters) can be critically allied to a system of semiotics used by Barthes. Unlike the semiotics of Saussure and Pierce,[30] Barthes' central assumption was that the process of decoding meaning from rhetorical codes was not active or passive, but automatic.

It was demonstrated that rhetorical soundscape communication can bring several creative benefits. The reality credibility of soundscapes can be enhanced, and a level of audience interactivity can be introduced within a work.

3.8 Summary

Simulated, hyper-real sonic landscapes were proposed as a new domain for acousmatic compositional exploration. As hyper-real environments present the listener with what appears to be reality itself, the composer is free to make intricate contextual and timbral manipulations to the sounds which constitute that landscape. This chapter proposes this technique as being potentially more powerful and subtle than one based on extracting discrete sounds from a recorded, real environment. However, it was shown that such extraction techniques can be used to generate new hyper-real environments that are undetectable as being a synthesis of many existing soundscapes. The criteria which define the existence of hyper-real landscapes were set out, and it was noted that for a simulation to become hyper-real then there should be no *observable* differences between it and reality.

This class of hyper-real thinking called for the re-evaluation of existing models regarding the relationship between sound sources, and the spaces in which they exist. Wishart's model of sources and spaces was refined, with a new definition for the real-sounds/real-spaces class. Importantly, it was demonstrated that the combination of real sounds and real spaces does not necessarily lead to audio surrealism and abstraction.

The chapter concluded with a discussion of communication methods that can assist in stimulating consistent extrinsic audience responses. It was shown that simple

[30]See Nattiez (1990) for a summary.

rhetorical codes can be placed on the surface of the music to help the audience generate their own extrinsic meanings. The choice of rhetorical codes (i.e. a tightly defined and well known communication system) enables a greater possibility of agreement between a listener's personal responses to a work and the composer's underlying structural design. The following chapter describes a system that can be used to integrate these two domains.

Chapter Four

Discovery strategy

4.1 Introduction

Discovery strategy is a new compositional methodology employed within the works presented with this dissertation. It was derived from the practical application of the artistic aesthetics described in the previous chapters, and has two main aims. Firstly, discovery strategy methods enable environmental sound materials to be incorporated within compositions that are overtly concerned with timbre, in a way which allows the possibility for listeners to be more certain of how they are to perceive and interpret those materials. Secondly, discovery strategy attempts to encourage an audience to adopt fresh listening strategies when they return to a work. This aspect of discovery strategy is particularly important for acousmatic works that remain fixed on tape. It achieves these aims by employing a set of steering processes: compositional methods that aim to direct a listener's attention between timbres, extramusical elements and large scale structural concerns.

Discovery strategy is varied in construction. It draws together ideas from various modes of communication, listening and hearing strategies, and notions of listening competence. This chapter connects these with semiotic and perceptual factors.

4.2 Electroacoustic communication

Systems of musical communication are documented extensively in Nattiez (1990). He cites processes whereby the poietic thoughts and intentions of the composer are communicated by means of a text, and decoded by the esthesic processes of the listener.[1] This classical approach to sonic communication poses particular problems, as Nattiez demonstrates by quoting Schaeffer:

[1]Poiesis refers to creative processes and esthesis refers to the reception processes. See Nattiez (1990) for details.

> ... the work is no longer an object that will respond to any and all questions: the relationship between subject and object is already inscribed within it. The work expects the listener to accept this relationship. If he or she moves outside, directs his or her attention to the sound qualities other than those the composer has dealt with as values, the structure will escape; only chaos will be perceived ...
>
> (Schaeffer, in Nattiez, 1990:97)

Nattiez shows that Schaeffer expects a form of communication that is universal. Schaeffer would like the audience to know precise details regarding the sounds used in the work, so that the poietic and esthesic domains correspond. In the example above, Schaeffer implies that reduced listening processes must be used to decode the work. The point of these processes is to enable the listener to perceive timbre, and that is perhaps one of the most universal forms of musical communication. However, communication in the electroacoustic arts is rarely a simple linear process where poietic intention is translated into esthesic perception. This aspect of the communication process has been documented extensively by Emmerson (1989), showing that new compositional strategies need to be carefully researched before any linkage between poiesis and esthesis can even be assumed. As many of the compositional methods suggested within discovery strategy involve predicting the response of the listener in some way, the nature of the relationship between poiesis and esthesis on which the works are based will now be set out.

Discovery strategy techniques assume that the 'flow of communication'[2] is controlled by both listeners and composers. Additionally, discovery strategy techniques do not assume that there is one single communicational flow. The communicational model developed for discovery strategy techniques is a synthesis of ideas drawn from the work of Nattiez (1990), Truax (1984), Smalley (1992b) and McLuhan (1996). Using the model, communication is broken down into three core elements: *controllers*, *strategies* and *responses*.

Controllers are the part of the system that actively steer the communication process, selecting the strategy to adopt for encoding or decoding musical meaning. The controllers are shown in table 4.1.[3]

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[2]This is a term borrowed from Nattiez (1990:16).

[3]Note that the controllers are divided into two groups. Secondary controllers can be viewed as a subset of the primary group, but they are equally important in selecting systems of encoding or decoding, such as those based on the ideas of *preference* or *relevance* discussed in section 4.5.

Coding strategies concern the type of the material to be encoded or decoded.[4] *Contextual coding* attempts to give primacy to contextual ideas within the message, rather than the specific content. For example, contextual information is encoded in most real-world sounds. Contextual coding strategies attempt to highlight this occurrence, both at a compositional stage and within the listener's decoding of the work via an appropriate steering process. *Narrative coding* structures are not employed within the musical works *per se*. However, Nattiez's idea of the 'Narrative Impulse' is prevalent in the works because discovery strategy techniques give the audience an incitement 'to make a narrative, to comment, to analyse' (Nattiez, 1990:127).

It was mentioned above that composers and listeners may select independent coding strategies. For example, the composer may select a contextual encoding strategy, and the listener may select one that is narrative or timbral. It is the role of the steering processes, as described in section 4.8, to help listeners select a decoding system that matches that intended by the composer.

4.3 Electroacoustic listening

In addition to adopting a flexible methodology for sonic communication at the compositional stage, discovery strategy methods are based on perceptual premises formed from analysis of differing types of listening. Principles adapted from Truax, Schaeffer and Smalley are integrated with contemporary models of ideal and non-ideal audiences.

Truax (1984:19-24) identifies *listening in search*, *listening in readiness* and *background listening* as the three main states[5] of auditory perception employed by all humans. Truax's description concentrates on aspects of information flow between the environment and the listener, and accounts for stored human knowledge that can be mobilised by contextual cues encapsulated within environmental sounds. For example, Truax describes listening in readiness as depending:

> ... on associations being built up over time, so that the sounds are familiar and can be readily identified even by 'background' processing in the brain.
>
> (Truax, 1994:19)

[4] Again, this definition applies to the methodology employed at composition time within the works of this dissertation. This model may not be valid if it is retrospectively applied to other works for analytical purposes, as it contains the assumption that principles from discovery strategy (such as steering processes) are integrated into the structural design of a work.

[5] Truax refers to them as 'levels'.

Truax's theories imply that listening states can themselves be directed by the sounds being perceived. He cites an example of a mother being awakened by her baby's cry, but not by road traffic (Truax, 1994:19). In this example, the existence of a certain sound has directed listening processes from being ready to evaluate all sounds within the environment, to a highly analytical state concentrating on just one particular sound. Truax avoids indicating that a change of listening level has occurred by suggesting that this new analytical state is a *feature* of his listening in readiness level:

> Subtle differences in familiar sounds convey information that is more important in judging the sound than simple identification. Even when a sound is unfamiliar or unexpected, this type of listening is ready to treat it as new information and evaluate its potential significance.
>
> (Truax, 1994:19)

However, in Truax's original example, distinct perceptual shifts have occurred. The listener, once decoding the significance of the traffic sounds and deciding to take no action, has now to analyse the timbres of the child's cry to extract the relevant information. The process has shifted from source identification to spectromorphological listening, but in both cases the emphasis is on extracting extramusical information regarding the current state of the environment.

The listener's ability to select listening strategies in response to particular types of sound event is central to discovery strategy. If it is possible to place such a process under compositional control, listeners can be directed to hear particular textures in a manner required by the composer. For example, these textures could be environmental sounds that the composer requires the listener to hear in such a way as to make their extramusical meanings relevant to a more abstract structural discourse within the work. Alternatively, these could be sounds that are introduced with the specific intention of directing a listener's attention towards the timbral features of the music, which could be useful following an environmental scene laden with extramusical meanings. Discovery strategy steering processes operate in a similar way to Truax's listening levels, in that they never require the listener to make a radical change of listening context. In particular, discovery strategy steering processes are not used within these works to direct the listener between totally disconnected materials. These processes, and the mechanisms by which they operate, are explained in section 4.8.

Truax is careful not to name his levels 'processes'. This is significant, as time and the exact nature of the interaction between the different levels are not part of his definitions. Furthermore, such a static, level-based approach can not account explicitly for differences in the changing nature of the relationship between the

subject of the perception (the listener) and the object under perceptual examination (in Truax's case, the environment). For this distinction, we need to look to the work of Schaeffer, and latterly, Smalley.

Smalley (1992b:519) has proposed a synthesis of Schaeffer's listening modes (Schaeffer, 1966:116) based on his own research and that of the psychologist Ernest Schachtel. Several techniques within discovery strategy are built upon a compositional application of this work. Of particular interest is Smalley's definition of the *reflexive relationship* as a situation where a sounding flow does not carry its own identity, outside that given to it by the listener's own emotions. This is perhaps not a situation that would be welcomed by composers concerned exclusively with timbre! However, discovery strategy methods attempt to capitalise on the pervasiveness of the reflexive relationship (Smalley, 1992b:520) and its often exclusively one-way communication path. If it were possible to exploit the fact that the initial interpretation of a particular sound would result in an emotional response, and not an analytical inquiry, then it might be possible to gain access to a listener's analytical perceptive mechanisms, by deploying and developing sounds that are selected to give very definite types of emotional response.

This type of response, as we have seen in section 3.6, can be elucidated successfully by using strict rhetorical codes of communication. Discovery strategy methods use Smalley's reflexive relationship as their central core. They attempt to steer listeners away from listening exclusively in an autocentric manner by providing sounds and structures that need inquiry, in close proximity to the sound provoking the emotional response. Crucially, the type of inquiry required to unravel the structural qualities of these sounds (be they tiny timbral details or longer term structures) in this case have their root in the initial emotional response. Section 4.7 describes this process.

Smalley's *interactive relationship* is adopted within discovery strategy to provide compositional methods that are used to create and control materials, ranging from background structural trends to abstract timbres on the surface of the music. It is a principal aim of discovery strategy to engage the listener in an analytical, interactive relationship with the piece. Central to Smalley's definition (1992b:520) is a *combination* of methods used to decode structure. Importantly, Smalley includes Schaeffer's reduced listening, together with structural hearing and other types of analytical listening.

However, discovery strategy methods contain the assumption that listeners must never be expected to adopt reduced listening as their first response to un-processed recordings of environmental materials. This is largely because the extramusical meaning of these sounds has been preserved with the specific intention of elucidating a reflexive, emotional response. If this were to be avoided by a listener whose reaction to environmental sounds was to perceive them with reduced listening techniques, then the steering processes based upon the unfolding and mapping

of extramusical meaning onto musical structures would not take effect. Discovery strategy methods attempt to secure a consistent perception of the structure, regardless of the structural level on which the piece is examined. Should listeners choose not to engage in a reflexive relationship with the piece, it would not be too detrimental to the recovery of significant structural detail from the work. Discovery strategy techniques assist listeners in decoding structural information such as gestural patterning and timbral information, from environmental sounds. An *interactive* listening relationship with these materials can therefore be stimulated.

4.4 Scope of discovery strategy

Discovery strategy methods aim to direct a listener's attention towards features of the music that the composer has identified as being of primary importance. Within the works of this dissertation, these features are parameters such as long-term structural organisation, and the consistency of timbral manipulation with these structures. Due to the fact that this directed listening is built into the composition, the listener does not need a full knowledge of all the codes of communication used by this music in order to apprehend the most structural features of it. This is due to a certain amount of redundancy which is built into the structuring principles of the work, and through use of easily understood rhetorical methods of communication.

A criticism often levelled at electroacoustic music, which discovery strategy aims to address, is that it is too difficult for the average listener[6] to understand. Landy (1991:97) has identified this trait within experimental music audiences. He highlights the importance of music education, giving emphasis to the opinion that music education is necessary in order that experimental music can be regarded not as experimental, but as a natural music that is simply an acquired taste taken up by adults. Later, he suggests that composers are not to blame for writing music that is too demanding for the listener. This he argues, results in a situation where most listeners can not appreciate the structures and aesthetics of a work without prior education:

> What is unfortunately still avant-garde is that too few musicians can handle these works. Is it all the fault of 'poor' quality or 'impossible to understand' composition techniques? This writer believes that the fault can *also* be found elsewhere. [my italics]
>
> (Landy, 1991:176)

For Landy, the equation is clearly two-sided. He acknowledges that some compositional techniques may be difficult to understand, but also demands that listeners

[6]The notion of the average electroacoustic listener is examined later in section 4.5.

and performers experience adequate education in new music. Discovery strategy techniques aim to enhance this vision, enabling the musical work itself to take on a greater role in training listeners. There is a danger that this could be seen as counter-productive. Paynter (1992:5) clearly demonstrates that it is not acceptable for listeners to blame composers for creating music that is too 'difficult', whilst also pointing out that many processes used by composers can be easily adapted to educational situations. By citing Henri Pousseur, he shows that it is precisely the complexity of avant garde musics that stimulates new directions in music education. If the only advantage of using discovery strategy methods was to make music more accessible, there is a risk that there would be little cerebral or lasting value within the works created using them.

Discovery strategy systems do attempt to enable electroacoustic works to become more accessible, particularly to first time listeners. However, this is accomplished in an integrated and systematic manner, with the intent of avoiding a compromise in the structural sophistication of the work. The 'difficultly' spoken of by both Landy and Paynter is retained within discovery strategy works, in the form of structural schemes and timbral working. Yet a musical surface is presented that enables inexperienced listeners to apprehend more of these details.

Discovery strategy does not aim to replace aspects of music education, nor will it substitute for a detailed knowledge of electroacoustic aesthetics resulting from practised listening and composing. However, it does assist listeners by attempting to unite extramusical connotations and intrinsic musical structures. As such, it is a system that can only be practically applied to electroacoustic works that use a mix of sounds recorded from cultural and environmental activity, together with more abstract timbres.

4.5 An average electroacoustic audience?

For discovery strategy techniques to succeed, traditional views of an audience as a mass entity need to be considered. As discovery strategy relies on the assumption that an audience can recover a particular meaning or extrinsic emphasis from the music, it is essential to arrive at an understanding of the audience which allows for individuality within a framework of group responses.

The predicted response of an audience needs to be carefully considered. Turner (1990:122) documents the pitfalls of not considering the audience as a mass entity within works that aim to create individual decodings. He analyses various analytical responses to studies of the audience of the 1980s BBC television news programme *Nationwide*. Some crucial lessons for compositional strategies can be drawn from this study. Turner also demonstrates that it is dangerous to build an analytical

process that accounts for an audience's mass behaviour, whilst still accepting the preferred meanings offered by programme creators:

> ... individual readings will be framed by shared cultural formations and practices pre-existent to the individual... Such a view may resist the idea of a 'mass', undifferentiated audience, but it also resists the temptation to individuate each audience member completely.
>
> (Turner, 1990:123)

It is this view of an audience on which the compositional systems within discovery strategy are based. Discovery strategy techniques used within the works presented do assume certain cultural norms. There is a pre-requisite that the audience has been exposed to Western culture.[7] However, it is essential that discovery strategy methods allow for differences in individual decodings of a work as it is this process that enables individuals to internalise a work more effectively.

Using sounding materials drawn from cultural activity implies that an audience has certain abilities to store, understand and make links with events occurring within their environment. Barry Truax introduces the idea of *soundscape competence* (1984:50), analogous to the notion of *musical competence* as defined by Otto Laske (1975). Soundscape competence refers to the degree of accumulated knowledge which a person has about his or her surrounding acoustic environment:

> ... our lifelong exposure to environmental sound gives us a complex body of knowledge about how to recognize and interpret the structure of environmental sound in order to obtain information that we can use. Soundscape competence permits us to understand environmental sound as meaningful. Like musical competence, it is knowledge that can be neglected or fostered, and therefore there is a social responsibility involved in its education.
>
> (Truax, 1984:50)

Turner (1984:152) remarks that "We do not spend our lives as members of an audience". The notion of soundscape competence might appear contradictory to this statement. Truax, following the work of Schafer, believes that we should listen closely to our sonic environment instead of relegating it to the background of our attention. However, the sounding materials used within discovery strategy techniques have such a powerful, and personal effect, precisely because we are not simply a

[7]There is no pre-requisite for discovery strategy systems to rely on Western cultures. The creative work simply uses transcontextual references located within the bounds of Western culture.

passive audience. Instead, we are humans for whom there is an action repertoire[8] associated with many sounds found within our environment.

Crucial to Truax's definition of soundscape competence is the idea that listeners must be able to understand the structure of the sounds, in order to extract meaningful information. It is on this definition that some techniques within discovery strategy rest. A sound's structure can be used as a structural analogy to give the listener greater access to foundation levels of a work. The technique is described in section 4.6. This principle of associating personal actions within a frame of selected cultural norms has been capitalised on extensively by the media as a creative feature. Hobson points out that programme makers can manipulate the content of their programme, exclusively with the aim of encouraging viewers to construct a narrative of their own. Her study concerned the level of audience interactivity with the 1970s ITV drama, *Crossroads*:

> ... the contribution which the audience makes to *Crossroads* is as important as the message which the program-makers [sic] put into the program. In this sense, what the *Crossroads* audience has revealed is that there can be as many interpretations of the program as the individual viewers bring to it. There is no overall intrinsic message or meaning in the work, but it comes alive and communicates when the viewers add their own interpretations of a program.
>
> (Hobson, in Turner, 1990:133)

This is clearly Barthes' *Death of the Author* (1977) writ large. The poietic role of the programme makers includes creating a text[9] that provokes creative and individual decodings. Hobson notes that the logical conclusion of this argument is that if an audience can exert such control over the text concerned, then it is possible for them to feel as if they owned the text themselves. It is this sense of ownership that is important in discovery strategy. The audience is never permitted to possess full control over the musical text in the case of the electroacoustic works presented with this dissertation, by virtue of the inclusion of non-narrative and abstract compositional structures. However, it is the principal aim of certain discovery strategy systems, such as that of *handles*, to increase the sense of ownership within a work. This is done with the specific aim of encouraging the listener to return to a work at a later date, on the consumerist premise that an audience is more likely to do so if they feel that they own the 'product' concerned.

There is a potential solution to the apparent conflict regarding the allocation of aesthetic primacy between the text and the audience. Fiske (in Turner, 1992:138)

[8] Action repertoire is defined by Emmerson (1989:137).

[9] *Text* is used here in the same sense as Nattiez's *neutral level* (Nattiez, 1990:11-12).

describes an audience model in which primacy is still given to the text, whilst retaining the idea that an audience can take part in a creative and interactive relationship with the text. This has important musical implications. Fiske relates the traditional communicational model of encoding and decoding (as described in Nattiez, 1990) to the idea of audience preference, proposing that an audience will only engage with a text on an interactive level if it is *relevant* to them:

> The preferred reading theory still grants precedence to the text, although it allows the viewer considerable scope to negotiate with or oppose it according to his or her position in the social formation. Preference is a textual concept. Relevance, however, is a social one: the viewer makes meanings and pleasures from television that are relevant to his or her social allegiances at the moment of viewing; the criteria for relevance precede the viewing moment.
>
> (Fiske, in Turner, 1992:138)

The idea of textual *relevance* is important within discovery strategy. Instead of offering relevance in terms of social activities as described in Fiske's model of television audiences, relevance is used in the form of sounds drawn from the environment, providing a contextual basis with which a wide variety of listeners will be already familiar. As Fiske notes, criteria for relevance are not necessarily connected to the work itself. This is a crucial separation. If sounding materials are relevant to the listener, it does not necessarily follow that the meanings the listener draws from them will interfere with those gained from a more allocentric understanding of the text, even if these meanings are contradictory. It is under these conditions that it is possible to introduce highly anecdotal sounds into a composition concerned with timbral manipulation. As Fiske states, the inevitable anecdotal decoding of such materials need not interfere with other seemingly conflicting meanings drawn from the text, because viewers are perfectly able to decode a work on both textual and personal levels simultaneously. As discovery strategy seeks to combine the often contradictory audience decodings of environmental sounds with a unified view of the musical structure, it is necessary to find a system whereby the basic nature of the decoding can be systematically controlled. Wolfgang Iser[10] has identified a process used by media authors to enable this type of double encoding, by formulating the idea of the *textual invitation.*

A textual invitation is a covert element of a text that has been specifically chosen to invite readers to accept a particular idea, or to add to the work information from their own cultural background. The reader does not necessarily have to agree with the author's point-of-view, or that of other readers. What has happened is that

[10]In Turner (1992:142-143).

the author has been able to elicit a response at a crucial point within the structure of the work, enabling the reader to participate in an interactive relationship with the text. Although the meanings generated may be different, the way in which meaning is recovered by the reader is controlled and systematic. Discovery strategy employs Iser's idea to enable the integration of environmental sound materials within a timbral work. As Iser demonstrates, there is nothing wrong with the audience generating extrinsic meanings that are contradictory to those encoded by the composer, because the way in which they have been provoked has been carefully manipulated and made to be consistent with the underlying structures of the work. Turner (1992:115) notes that a by-product of a work created using Iser's double-encoding principles is a textual surface that is rich in immediacy. This is certainly the case within *Undercurrents*. In attempting to engage the audience in decoding extramusical information, the musical surface of *Undercurrents* is packed with a multitude of vivid environmental sounds.

4.6 Structural hierarchy

For analytical purposes it is often necessary to visualise music as consisting of a hierarchical system of structural levels. This concept of structure is linked to the timescale on which auditory perception can be focussed. If a particular trend or feature is perceived over a short time period, then that feature can be said to be part of the musical surface. It is a natural tendency for listeners to focus their perception on this level of the musical structure (Sloboda 1985:172). If it is necessary to listen to the whole work before a feature becomes apparent, then that feature can be described as being part of the background structure. Furthermore, it may require many repeated listenings to reveal components of a work that are embedded in a background structure.

Lerdahl and Jackendoff (1983) propose that it is possible for listeners to assimilate such a hierarchical view of music's structure. Lerdahl (in Smoliar, 1995) later advances this argument, proposing that hierarchical elements of musical structure are heard, and subsequently committed to memory, via a set of reductive processes. These processes search for patterns in a flow of information and are reduced by a mental parser[11], which compares these patterns to those previously existing in a listener's memory. However, Smoliar points out that the views held by Lerdahl and Jackendoff regarding this process of perceptual reduction may be invalid, due to the fact that they construct musical structure retroactively from a static viewpoint:

> Ultimately, Jackendoff runs into trouble in trying to make parsing an op-

[11]The term *parser* is derived from the discipline of computer science where it refers to a pattern analysis system that compares input with a set of previously existing rules, producing a more tightly structured version of the input as the output.

> erative metaphor. Parsing assumes that the mind is building structures and holding them in a static repository similar to a computer memory. However, biological evidence is mounting that human memory does not involve any static repository ...
>
> (Smoliar, 1995:27)

The idea of this reductive perceptual process is used within discovery strategy to build a compositional technique that could provoke the listener into hearing specific parts of the musical structure on repeated listenings. Meyer (1973:80-105) has shown that on re-listening, listeners will find that different aspects of the musical hierarchy will attract their perceptual attention. Within discovery strategy, the *steering processes* concerned with re-listening attempt to exercise some degree of compositional control over the details which a listener selects on subsequent listening. This relationship will now be addressed.

4.7 Structural relationships within environmental sound

We have seen that Truax believes that an audience should have an innate knowledge of the structure of environmental sound, by virtue of it surrounding the average listener.[12] This view mitigates the problem of the perceived inaccessibility of electroacoustic music, as discussed earlier, by permitting the use of familiar sounding materials in a context that does not require any formal training to decode. Writing about this problem in acoustic music, Nicholas Cook (1990) identifies that traditionally there are two sorts of listener: those that possess specific formal knowledge of music and those who derive their enjoyment of a work without possessing this knowledge. He argues however, that in contemporary culture it is less likely that a knowledge of the formal parameters and norms of music relate to the listener's ability to derive aesthetic (allocentric) pleasure from a work. Cook cites a change in listening habits whereby listeners would previously expect to compare a particular piece to others that were contemporary to it. However, modern listeners tend to accept each work on its own merits:

> But how important is knowledge such as this [concerning form and genre] in relation to the listener's ability to derive aesthetic enjoyment from music? As regards genres, Dahlhaus has pointed out that these no longer have the importance for musical perception that they did in the eighteenth century and before; as I said earlier, we tend nowadays to hear works as individuals rather than as exemplars of a type ...
>
> (Cook, 1990:147)

[12] Discussed in Chapter Two.

This reduction in the importance of genre, as perceived by Cook, is beneficial in creating an environment where composers may have to use similar materials and structures if they are composing with environmental sounds.

4.8 Steering processes

4.8.1 Gesture linkage

Discovery strategy uses gestural information to establish links between sounds occurring within environmental and timbral contexts. In an earlier paper (Field, 1996), I described the compositional possibilities which arise when an environmental sound is linked to an abstract sound, by mapping the morphology of one gesture onto the shape of another without exchanging spectral information. The primary aim of this process within discovery strategy is to embed causal information into abstract timbres, in order to give the aural impression that the sound was perhaps of environmental origin.

After extracting the envelope of the environmental sound and modulating the other sound accordingly,[13] it is essential to the success of gesture linkage that the resulting sound is placed in a context where an environmental cause can be suspected. This technique is used to steer the listener through a sounding flow that progresses from environmental sounds towards more abstract timbres, using the gesturally-linked sound as a bridge. Figure 4.1, on page 162, shows an application of this principle within *Undercurrents*. In order for this steering process to be effective, the contextual labels of the surrounding sonic material must agree. Therefore, I have referred to this process as a linkage, rather than a mapping. At 05'20"[14] in *Undercurrents*, a highly processed sound, which was derived from the recording of the sea, is given the morphological characteristics of an earlier train sound.[15] The compositional intent was to build a bridge in the reverse direction to the one mentioned above - from the abstract domain to a natural soundscape. This reversal of the process exposes a crucial caveat: for gestural linkage to succeed between an abstract sound and an environmental sound, the listener must first be *primed* with the type of sound (environmental/abstract) that the transformation will resolve into. Unfortunately, in this instance there is no such gestural primer, and the listening imagination is free to interpret the transformation in a variety of new ways. The result of this transformation sounds very much like a passing car (*Undercurrents* at 6'29").[16] When combined with the descending pitch trajectory of the abstract sound, the bell-shaped amplitude envelope and spatial placement characteristics that were recovered from

[13] The details of this procedure are well documented: see Endrich (1994).
[14] See diffusion score, page 95.
[15] Audio example CD: track 8, index 1.
[16] Audio example CD: track 8, index 2.

the earlier train sounds resemble a classical Doppler shift. Table 4.2. on page 157. shows the results of this process.

In summary, two rules appear to aid gesture linkage. Firstly, the steering processes enabled by gestural linkage operate on a local timescale. Secondly, the musical events involved within the transformation must lie adjacent to each other in the sounding flow of the piece.

4.8.2 Mimesis

In Field (1996), I introduced the idea of transcontextual spectromorphological logic. Transcontextual material must have the same spectral logic in both old and new contexts to enable a smooth transformation between an environmental sound and one that is abstract/timbral. This transcontextual logic is in essence an application of the idea of *mimesis*. Emmerson has written extensively on mimesis which he defines as:

> ... the imitation not only of nature but also of aspects of human culture not usually associated directly with musical material... There are two types of mimesis: 'timbral' mimesis is a direct imitation of the timbre ('colour') of the natural sound, while 'syntactic' mimesis may imitate the relationships between natural events ...
>
> (Emmerson, 1986:17-18)

It is the second category, syntactic mimesis, that discovery strategy utilises in creating abstract contexts in which sounds may exist whilst maintaining their transcontextual logic. In Emmerson's terminology, a gestural linkage transformation between an abstract and an environmental sound moves from timbral mimesis towards syntactic mimesis.

4.8.3 Structural analogy

The processes of gesture linkage introduced above can be extended and applied to a work's long-term structural design. Gestural linkages are exclusively linear: each event has a direct impact on the next in the sounding flow. Although it is not possible to map gestures directly on to long-term musical structures in a physical sense, it is possible to design the longer-term structural characteristics of a work so that they might be analogous to a particular gestural shape. Such an analogy can be based on the morphology (envelope dynamics) of a sound, rather than spectral concerns.

Structural analogy is a core technique in discovery strategy, uniting immediate surface features with longer term structural trends. For the integration of abstract and anecdotal materials to be compositionally consistent, the underlying organisational principles of both spectra and structure should not be too distant. Furthermore, structural analogy is necessary to enable the steering processes mentioned above. For example, for first-time listeners to progress from identifying that a train sound has a pulsed morphology, to being able to realise that similar relationships exist on a longer time-scale, requires a high degree of structural consistency in the music. Figure 4.4, on page 165, shows this linkage within *Undercurrents*. The structural morphology of the work is linked to the gestural contours of a sound on the surface. In practice, rather than being linked to a specific instance of a sound, the structural analogy is based on a generalised view of the sounds that make up the surface of the work. This is largely a practical concern which enables compositional decisions concerning the sculpting of the detail musical surface to be made in accordance with aural judgment, rather than a rigid algorithmic plan. Figure 4.4 also demonstrates how sounds within two groups, pulses and waves, contribute to the background structure of the work. The criteria for structural linkage which are required by discovery strategy will be satisfied, provided that the overall morphology of the background structure of the work has similarities with the morphology of local events.

4.8.4 The contextual steering transformation

Steering processes within discovery strategy aim to lead the listener between environmental and more abstract contexts. Linear transformational processes, such as spectral interpolation, are particularly adept at transforming the timbre of sound materials. This section shows how these processes can be adapted to perform transformations between contexts, rather than between sounds themselves. To this end, a new type of transformation, the *contextual steering transformation*, will be defined.

The main aim of a contextual steering transformation is to bridge the gap between abstract and real contexts. Timbral manipulation is a necessary part of this transformation, though it is of secondary importance to the listener. In order that the timbral transformation does not claim the listener's full attention, a set of criteria need to be considered before a contextual steering transformations can be applied.

The usage and nature of sound transformation processes is documented by Smalley (1993:295). Of particular importance to this discussion is the recognition that sound transformation processes will introduce goal-directed structures within a linear flow of events. It is this strong sense of goal orientation that the contextual steering transformation shares with Smalley's *revelatory transformation*:

> This is a case of specific direction starting from an implied or freed state ... which will be at some distance from the base, distant enough so that the identity of the base is not apparent at the outset of the process. The focus of the transformation is on its termination in relation to which the previous context is perceived as subordinate. We can call this a *revelatory transformation.*
>
> (Smalley, 1993:289)

In the above citation, Smalley uses the term *base-identity*[17] to refer to the source-cause of the sound that is revealed during the transformation process. In the case of the revelatory transformation, the primary goal is this exposure of the base-identity. However, unlike a revelatory transformation, the contextual steering transformation does not attempt to subvert the perceived identity of the original sound. The goal in this case is an exchange of contextual information, rather than timbral development. The term *contextual identity* will be introduced to account for contextual information, in a way analogous to Smalley's concept of base-identity. The steering transformation process can be divided into two phases: the local phase and the remote phase.

Local phase

This first stage of the contextual steering transformation has the specific intent of transforming sounds which have extramusical contextual implications into those that do not, without the listener becoming distracted by the change in sounding materials. It can be used on its own or, preferably, as a precursor to the remote steering transformation described below. At this first stage, spectral detail local to each sound is used to effect the transformation. The source-cause of the sound under transformation appears to change as the local phase progresses. Importantly, the spectral characteristics of both sounds should remain similar. Local transformations of this type can be accomplished by using procedures such as linear spectral interpolation.[18] In theory, the result of this process is a gradual transformation between sound one and sound two. The idea known as 'morphing' (Miranda, 1998:54) is commonly mis-used in reference to this type of transformation. Spectral interpolation does not 'morph' sounds in the manner that is now commonplace in television commercials. To illustrate the difference between morphing and spectral interpolation, a hypothetical video morphing transformation will be considered.

[17]Smalley (1993:285) suggests that the base identity for a sound may lie beyond the scope of the work. For clarity, this discussion will restrict the scope of the base identity to sources that lie within the bounds of the work.

[18]Software such as VOCINTE (Endrich, 1994) can be used to perform this type of transformation. This program computes an FFT analysis of the source and target sounds, progressively *exchanging* similar phase and amplitude information under user-controlled trajectories.

In a video morph, we may see the face of one person being transformed into that of another. Both faces are the same size, but the first person's ears are slightly larger than those of the second. The visual 'morph' is accomplished by gradually increasing the size of the ears by a fractional amount for each frame of the film.

Interpolative sound transformation does transform sound one into sound two, but this is accomplished by calculating a trajectory between the sounds that is based only on the spectral qualities *common* to both sounds. It *does not* generate any new timbral information to assist with the transformation. If the processes used within interpolative sound transformation could be applied to our fictitious visual image, the ears of person one would simply fade out whilst those of person two faded in leaving the common facial components unchanged.

In the audio domain, the result of a linear spectral interpolation is more like an evolving hybrid of two sounds, rather than the spectromorphology of one sound being stretched or moulded to fit that of another. This is a fortunate distinction as far as contextual steering processes are concerned, as a requirement of this transformation is that the two base identities remain distinct, even though there has been a transformation between them. The spectral interpolation process described above thus provides an ideal means to accomplish this type of transformation. Both the source and destination sounds can be heard as distinct formal entities, whilst a link can be created between them. This process is used frequently in the works presented within this dissertation, to aid the forward flow of a series of local events.

Between 1'10" and 1'36" in *Undercurrents*[19] a transformation of this type is introduced to prepare the listener for the introduction of low-level train sounds and associated environmental ambience at 1'36"[20]. Short, low-level reverberant impulses with no discernible environmental cause, transform gradually into the sound of a rain-laden environmental ambience.[21] Without this preparation, the textures at 1'47" could appear out of place in such a spectrally sparse, abstract-timbral environment.

There are potential problems with this technique. When accomplished using phase-vocoder software such as VOCINTE, spectral interpolation can result in a sound transformation where the timbre of sound one develops for a length of time, only to dramatically flip to that of sound two at an arbitrary point in time. This unfortunate side-effect of some interpolative transformations has been documented by Wishart (1989). If an interpolative transformation is unsuccessful in this way, the local steering process that depends on it would fail. As stated above, it is an essential requirement of this process that the listener is not aware of any distracting changes in the sonic flow as one context is transformed into another. Such a perceptual flip

[19] Audio example CD: track 9, index 1.
[20] Audio example CD: track 9, index 2.
[21] Audio example CD: track 9, index 3.

may cause the listener to evaluate the transformed sound as a completely new event, instead of one connected to a previous structure.

Two rules appear to govern the success of the local steering processes as used in the compositions within this dissertation. They are:

1. The frequency spectra of both sounds involved in the steering process should be similarly distributed. This requirement is both timbral and practical. Firstly, because this type of transformation is concerned with changing contexts, it would not be successful if radically different sound-types were used, as the listener's attention could be drawn away from the contextual implications set up by the steering process. Secondly, the spectra of both sounds are required to be broadly similar for spectral interpolation algorithms to produce good results. As described above, the transformation does not operate effectively where there are no common spectral components.

2. The spectral logic of the resulting sound within the transformation should be transcontextual.[22] That is to say, if the transformation was reversed, the way in which the spectromorphology of an individual sound interacts with those around it should remain constant. Consider the following hypothetical situation. An environmental sound is to be transformed into one that is abstract-timbral. Imagine that in this case the original recording was the sound of several stones sliding down a slope and collecting at the base of a cliff. If that sound is transformed into one that is a remote surrogate, it would have transcontextual spectral logic if that surrogate were to be part of a flocking or agglomeration process. This requirement is necessary to allow a listener to follow the structure of a transformation, as this steering process has the potential to provide a 'window' through which more fundamental organisational aspects can be heard.[23]

The cubist artist Georges Braque used similar transcontextual techniques. He writes about his work *Atelier VIII* (1952):

> No object can be tied down to any one sort of reality; a stone may be part of a wall, a piece of sculpture, a lethal weapon, a pebble on a beach, or anything else you like, just as this file in my hand can be metamorphosed into a shoe-horn, or a spoon, according to the way I use it.
>
> (Braque, in Tucker, 1992:38)

[22]This requirement is similar to that for a successful gesture linkage. See section 4.8.1.

[23]For this to be true, the work must obey the discovery strategy pre-requisite for structural consistency. This was set out in section 4.6.

Transcontextual formal logic allows Braque's objects to fit into place in many different environments. An object possesses the same formal qualities regardless of differences in the surrounding context, even though the functions of the object can be completely different. If the conditions mentioned above are satisfied, then the contextual steering transformation can progress to the second, *remote* phase.

Remote phase

The remote phase of the contextual steering transformation aims to adjust the listening strategy employed by the listener over an extended timescale. Typically, this is used to effect a transition between autocentric modes of perception and analytical timbral listening. Rather than utilising specific detail local to a particular sound, the remote phase is the product of a contextual separation process. The remote phase concerns the removal of a sound's original contextual label, in such a way that the base identity of that sound is still preserved. Within *Still Water*, this is accomplished by systematically isolating the sound of sea gulls, breaking twigs and aeroplanes from the general sea-side ambience.[24] When the remote phase of this transformation is complete, the contextual identity of these isolated sounds is no longer related to that of the original recordings, even though the sounds are still recognisable as sea-gulls, breaking twigs and aeroplanes. Figure 4.5 on page 166 shows this transformation. Compositional techniques such as the interpolative transformation are not suitable for effecting this type of transformation, as they require the use of two distinct sounds. The primary aim of remote steering transformations is to change the contextual label of a sound without effecting its source-cause characteristics. A spectral extraction process was devised to effect this transformation, the procedural details of which are given in Appendix A.

This type of steering process is explored in *Pyrotechnic!*, the third movement of *Breaking Spaces*. *Pyrotechnic!* is a non-narrative piece of programme music. The work manipulates the relative contexts of two distinctive, easily recognisable source sounds derived from a single recording of a communal fireworks display:

> At first, the electroacoustic transformations appear to be concerned with manipulating the acoustic impacts caused by the exploding fireworks. These materials are cleanly extracted from their original context and given their own space. While the listener concentrates on the dynamic energy of these textures, the role of the crowd changes subtly. By the end of the work the spectators react to the colours and impacts of totally abstract electroacoustic sounds.
>
> (Field, in Leopoldseder and Schöpf, 1997:211)

[24] Audio example CD: track 10.

Pyrotechnic! is structured in five main phases. As table 4.3 on page 158 shows, the role of the crowd within the work adapts from being fixed within the soundscape of the original firework recording, to reacting against and apparently participating in the musical argument set out by the developing flow of synthetic timbres. Inspired by Parmegiani's *De Natura Sonorum* (1975), *Pyrotechnic!* contrasts notions of the natural and the artificial,[25] by changing the contextual role of the crowd. Between 7'30" and 11'23" this process is revealed on the musical surface, in the form of a constant stream of transformations between real and non-real spaces.[26] In this example, discovery strategy techniques are directly responsible for the structural basis of the work itself. *Pyrotechnic!* is essentially a study in remote contextual transformation.

A contextual steering transformation has two contextual identities and one base-identity. The contextual identities can both be remote or local, and are intrinsically linked to the transformation process. An extreme remote contextual identity concerns sounds that enable a listener to deploy an autocentric listening strategy in order to gain personal extramusical information. A local contextual identity can be defined as a context containing very specific extrinsic information that is responsible for articulating the transformation between two different contexts. An example of a local contextual identity would occur during a transformation between an environmental recording of rain and a grainy synthetic timbre. What is local to *both* identities in this transformation is the sense of granularity within both sounds. It is this that enables the transformation.

Figure 4.2 on page 163 shows an example from the second movement of *Breaking Spaces*, where this type of contextual transformation is combined with a revelatory transformation.[27] An environmental context slowly emerges from one which is exclusively abstract timbral. The thin, granular texture at 05'00" slowly expands and mechanical rhythms suggesting human activity emerge. The squeal of a brakes from a lorry enter the texture at 05'09", deprived of the traffic ambience that surrounded them in the original recording. Footstep sounds are introduced, whilst the granular texture continues to expand and fuse with street ambience. Once this process is complete, the sound of a bus pulling away from a stop closes the transformation at 05'22".

4.8.5 Spatial transformation

It was my aim to investigate whether a type of smooth transformation, similar to those common in the spectral domain, could be achieved between spaces rather than

[25] See Chion (1983) for a detailed analysis of *De Natura Sonorum*.
[26] Audio example CD: track 11, index 1-5.
[27] Audio example CD: track 12.

sounds. The primary aim of the work *Breaking Spaces* was to explore this possibility.

This work exhibits direct seamless transformations between unrelated spaces. The first movement aims to bring a sound indoors from a distant outdoor ambience, wrap it around the listener, and give the illusion that the sound is being projected somewhere inside the listener's head. This process involves many different types of spatial interaction. Recorded perspective must be translated into physical spatial location, and physical spaces need to be transformed into imaginary spaces. A single sound is used as a carrier for this transformation, as the contextual labels associated with any further materials might offer the listener a choice of spatial interpretations. Crucially, the sound chosen is devoid of any easily discernible causal information. This was essential, as the sound was to be moved between a variety of spatial contexts. This sound was designed to carry sufficient timbral interest (the timbre of this sound develops considerably throughout its duration), be malleable by the psychoacoustic techniques used to locate it in physical space and be innocuous enough to be able to emerge from a background ambiance. The resulting spatial transformation from 0'00" to 2'18" can be analysed in six stages.[28]

1. 0'00". The aim of this first stage was to create a believable outside ambience which included the sound to be transformed. It was to appear to casual listeners that the transforming sound was an inseparable part of the soundscape: a result perhaps of a distant machine, or a type of traffic noise. After conducting various recordings of environmental ambience, a layering technique was employed to combine these sounds. This technique was similar to that used to create the hyper-real soundscape at the beginning of *Still Water*. However, due to extreme difficulties in matching the timbral qualities of the transforming sound with the physical depth of field in the ambience recording,[29] new methods had to be developed to ensure a convincing transformation. After much experimentation, a solution was devised whereby the transforming sound was replayed on a single outside loudspeaker mounted at a distance in the ambient field. Successive advancements of the loudspeaker were necessary to obtain a set of spatial samples, from which it was possible to calculate a moving sound trajectory. The first five seconds of the transformation were created in this manner, resulting in the transforming sound appearing smoothly from ambient noise, and dominating progressively more of the sound field as it approaches the listener.

2. 0'38". As a preparation for bringing the sound inside, the sound is spatially mirrored, expanding its perceived position within the stereo image. As a result

[28] Audio example CD: track 13, index 1–6.

[29] Employing standard psychoacoustic techniques, such as lowering the high frequency content to give an impression of distance, simply compromised the audio quality of the transformation. See Winckel (1967).

of this expansion, the outside environment appears to decrease in size.

3. 1'03". Extensive psychoacoustic processing[30] was used to locate the sound outside the traditional stereo image. It is at this point that the transition between recorded perspective and physical actuality commences. as gradually sound appears to become located within the listener's own room.

4. 1'40". Whilst the transforming sound is panned behind the listener, the outside environment is reduced in size by manipulation of the stereo image. At this stage, the contextual label of the ambience conflicts with the cramped nature of the space it is reproduced with. The environmental credibility of the ambience breaks down, allowing it to be faded out.

5. 1'56". The gap in the image caused by the removal of the ambience recording is subsequently filled by sounds of an aggressively clean, bright timbre. Due to their spectral qualities, these sounds appear to be quite proximate to the listener.

6. 2'10". Finally, the transforming sound folds towards the centre of the listening space, and the transformation ends.

This transformation is shown in figure 4.3 on page 164.

4.8.6 Signposting

As Cook (1990:146) has remarked, contemporary audiences have little in the way of formal norms to which they can reference the structural qualities of a new musical work. Boulez offers an analysis of this situation, and proposes that the lack of formal references in contemporary music is because:

> ... Western European music, with its strong pre-established hierarchy underlying every actual composition, had elaborated a skillful system of markers, or reference points, within an initially given form ...
>
> (Boulez, 1986:93)

Boulez concludes that from the listener's perspective, many contemporary works construct their form in real time as the music is performed, and it is only after the event that the listener can begin to deduce their formal characteristics. Discovery strategy attempts to re-instate some of those formal markers that both Boulez and Cook find lacking in contemporary music. However, it does not use pre-established

[30]The method is described in Appendix B.

hierarchies or elaborate systems of repetition. Figure 4.6, on page 167, shows the formal structure of *Still Water*. Note that there are many reference points within the work. Here, formal markers are provided by re-using structural processes with different sonic materials. This technique is shown in figure 4.7, demonstrating structural control on a local level within *Still Water*.

4.8.7 Steering processes enabling re-listening

Integral to discovery strategy is the idea that a listener should be actively encouraged to return to a work at a later date. This section introduces the idea of a *handle*: a compositional device with the specific function of enabling a work to become more memorable.

Research into the interaction between memory and audience return to a work has been conducted by Landy (1994). Landy proposes that there is often little that audiences find memorable in contemporary music, stating that composers of complex timbral music should consider simplifying their works. With reference to the works of Ligeti, Landy argues that this should not be accomplished by reducing complexity itself, but by organising complex parameters in such a way that a detectable patterning can be identified by the listener:

> ... a good look at any of Gyorgy Ligeti's scores from the 1960s demonstrates a certain level of complexity. Yet, he was very careful in those years to profile register and density through his cluster writing as two parameters that could be easily followed. In other words, he offered his listeners something to hold on to.
>
> (Landy, 1994:50)

This idea of grouping complexity at a structural level is not one that is specifically used in discovery strategy. Discovery strategy does not aim to simplify the music in any way. Rather, it attempts to provide additional information that the listener may use to find a 'way in' to the sub-structure of the work.

Landy recommends that electroacoustic composers should consider using homogeneous textures and timbral movements (1994:53), whilst avoiding textures that exceed four sound types at once. Here lies an important difference between Landy's "something to hold on to factor" and a discovery strategy handle. Moments where limitations need be imposed on textures or sound types are rare, again due to the action of steering processes in directing listening towards the structural complexity of the work. This process is analysed in detail below. Finally, Landy (1994b:55) demonstrates that listeners should have a sonic frame of reference that is within

their own experience. This, he says, could be accomplished by using sounds with which the audience is directly familiar such as the voice, sounds recorded from the natural environment, or older music which has been recycled.

It is this single point which is the basis for the idea of discovery strategy handles. A handle can be defined as a sound that has been inserted within a composition with the specific intent of being memorable. In order to fulfill this criterion, the sound should be one with which the audience is already familiar. It is important that the handle also has an integrated structural role within the work, so that it does not appear out of place in a sounding flow. For example, at 00'45" in *Undercurrents*, the sound of a train whistle punctuates the surrounding textures. This closely recorded sound dominates the foreground of the musical surface, exhibiting a high volume level and sharp attack transients. There are no other sounds within the entire work that fully occupy the spectral or dynamic space in the same way as this sound. From a sonic perspective alone, the hooter makes an immediate aural impact.[31] The train hooter is also significant from an extramusical perspective, in that this is the first time that the idea of trains is explicitly exposed within the work. This is not without preparation however. A mechanical repeating texture emerges at 00'24" and gradually dissolves into the subtle clinking sounds of the train wheels crossing gaps in the rails. Also included in this texture is a low level whistling sound, reminiscent of brakes being applied.[32] These sounds occupy a low position in the dynamics of the mix and are easily overlooked on a first hearing of the work.

As a handle is effectively a memory aid, it is essential that the sound chosen is of short duration. A short duration ensures that it simply remains part of the musical surface. Rösing demonstrates the notion of the psychological present, showing that short term structures are easily memorised if they do not exceed certain clearly defined durational limits:

> 'The psychological present' has been assigned values of between five and seven seconds; even a trained expert musician will scarcely be able to extend it beyond nine seconds ... if anything fall short of the five – seven second time-span, so that motifs can be brought home all the more strongly to the listener as concise, easily grasped shapes.
>
> (Rösing, 1984:130)

As was previously mentioned, handles should be integrated into a work in such a way that the recall of a handle is connected to a design feature of the work itself. The listener must not simply remember the extrinsic meaning of the sound concerned; the sound must be made to be representative of the piece in some way. This may appear

[31] Audio example CD: track 14.
[32] Audio example CD: track 15.

to be a tall order when the sound chosen may already posses a strong extramusical meaning. The solution lies in the compositional linking of the handle with a local structural context. In the above example, the handle of the train hooter can be connected to the piece *Undercurrents*, in that it has the potential to signify notions of trains, environmental sounds and loud transient attacks. As shown above, all of these contexts were carefully set up in advance of the handle being used.

Rather than being a tool to make a work accessible whilst it is being performed, a handle is a label for a piece that can be used to aid a listener in recalling a work from memory. Born (1995:128) has identified a need for music which can be categorised easily. In her study of non-research personnel at IRCAM, she demonstrates that listeners who are not part of the musical elite are particularly prone to collecting and categorising music. In such a situation, the fact that a work possesses a memorable handle might mean that it can be more readily categorised, and as Born demonstrates, more readily accepted.

4.9 Summary

This chapter presented a synthesis of the ideas presented in previous chapters. The result is the practical compositional methodology of discovery strategy. By enabling environmental and abstract-timbral sounds to be integrated, discovery strategy methods aim to assist composers in making electroacoustic works more accessible for first-time listeners. A communication model of controllers, strategies and responses was put forward to account for how listeners' responses can be steered by the composer. It was shown that, by framing personal responses to music within a set of established cultural norms, it is possible for listeners to have their own extramusical interpretations of a work that are not necessarily contradictory to those intended by the composer. By stressing the importance of a unified approach to musical structure, these responses can be used to assist listeners in discovering the underlying structural details of a work. In practice, this can be accomplished by steering processes – compositional devices that can be used to direct listening. The most important of these is the contextual steering transformation; a process that enables the transformation of contextual relationships rather than sounds themselves. Finally, it was shown that discovery strategy methods can help listeners returning to a work to uncover new aspects of the piece in a systematic and controlled manner. Although discovery strategy aims to assist listeners, it does not attempt to simplify the music. Instead, discovery strategy seeks to help listeners uncover more details of the music for themselves.

Chapter Five

Conclusion

5.1 Concluding remarks

The work presented in this dissertation was undertaken to investigate the relationship between unprocessed environmental sounds and those that have been digitally treated. The folio of creative work demonstrates this interaction in a practical form, and this written dissertation has set out the aesthetic considerations that are particularly important for electroacoustic composers. Through analysis of sound in natural and simulated environments, a compositional strategy was drawn up which enables environmental and abstract sounds to be mixed in a way that is advantageous to the listener. Discovery strategy is a set of compositional methods that can be applied to assist listeners uncover the musical substance of a work. It does so without prescribing that each listener should have the same extramusical interpretation of the piece.

5.2 Suggestions for further work

Two suggestions for future work arise directly from this dissertation. One is aesthetic, the other technological.

- This dissertation has introduced models that concern extramusical and contextual relationships between sounds. These could be expanded and brought within the remit of spectromorphological theory itself.
- Technological tools that enable composers to perform transformations of contexts and spaces are currently in short supply. Developers should be encouraged to include these important parameters in their software. In particular, code that can separate-out different spaces within a recording would facilitate many of the creative aims described within this dissertation.

Appendix A

Spectral extraction

This section documents a two-stage practical methodology for performing spectral extraction. Using this procedure, it is possible to separate the complete spectrum of a desired sound from surrounding events. The process works for sounds at any dynamic level: sounds that were originally masked by louder sounds can be extracted using this process. The stages are as follows:

1. Spectral filtering

   Very precise filtering methods must first be used to generate a soundfile containing a spectral approximation of the sound to be separated from the others. The desired sound can be referred to as the target sound. Software such as *Ceres*[1] or *Audiosculpt*[2] can be used to perform this stage of the transformation process. Ceres is shown in plate 1. Both of these packages allow the composer to 'paint' filters onto a spectral display of a soundfile, in a fashion reminiscent of graphic drawing software. Unlike conventional time domain filters, these spectral filters are ultra-precise: the area specified for treatment is the only part of the sound to be affected by the filter.[3] Gain is then applied to areas of the frequency spectrum that the composer has identified as belonging to the target sound. It is important to the success of this process that the composer successfully identifies all partials within the target sound, and not simply those that are most easily visible on the spectral display. For sounds with harmonic spectra, both software packages allow a pitch grid to be superimposed upon the spectral display to aid correct identification of the upper partials. Once the identification of the target sound's spectrum has been completed, all sounds except the sound traced with the filter tool are to be excluded from re-synthesis. A soundfile containing the spectral estimation

[1] See Notam's web site, http://www.notam.uio.no for this code.

[2] See IRCAM's web site: http://www.ircam.fr for the latest version.

[3] Time domain FIR and IIR filters spread their activity around a central resonance peak.

of the target sound is then written to disk. This soundfile is unlikely to be usable in itself, as only the *spectral* characteristics of the target sound have been isolated. Other sounds may still be included within this sound, as they may be present at differing dynamic levels within the spectrum that has been isolated. In extreme cases, the target sound may be masked by louder sounds occurring at the same frequency.

2. Spectral-dynamic windowing

This process is responsible for separating the target sound from any other sounds that occupy different positions within the dynamic space surrounding it.

Firstly, it is necessary to find the dynamic level on which the sound to be extracted occurs. This is a complex process, as the dynamic profile of the sound to be extracted will not be constant over the entire frequency range. With real-word sounds, lower partials are typically louder, and higher partials contain less energy. The composer must first supply an approximation of the dynamic zone in which the target sound occurs. This range is then warped by the software to account for variations in dynamics across an approximation of the target spectra. In this way, a spectral-dynamic model of the target sound can be built up. The software is then set to extract this model from the source recording used in stage one of the extraction process.

At the time when these pieces were created (1995-1996) it was necessary to build custom software to perform this operation. Chris Penrose's spectral window filtering programs *turpentine* and *furious* were adapted to read dynamic profiles based on user-supplied soundfiles. The results formed the basis for the code *Isd*, shown in plate 2 on page 170. Recently, Paul Koonce at Princeton University has released an efficient public domain code (Koonce, 1998) that performs this spectral dynamic filtering process with a high degree of reliability.[4] The custom code used to perform spectral window filtering used within the pieces of this dissertation did not posses this attribute, and is consequently not included in this submission.[5] Once the program has obtained a reliable estimate of the spectral and dynamic profiles of the target sound, the isolation process can occur.

[4]Koonce's filters are also apparently derived from Penrose's work

[5]It is however, available for research purposes with permission from the author.

Appendix B

Soundscape simulation

The following simple CMIX[1] script was used to generate realistic outdoor spatialisation effects. Sounds can be assigned a position within a virtual space. A virtual recording can be made at a distance from the source by a pair of simulated microphones. This simulation of the microphone array was essential in generating natural sounding simulated spaces that could easily be mixed with real world ambiences.

```
/*CMIX*/

/*    Select input and create output soundfiles */

input ("input.snd")
system ("sfcreate -r 44100 -i -c 2 output.snd")
output ("output.snd")

/*   Define the microphone type, and capture angle  */
/*   120 is wide angle, 1 selects hypercardioids    */

mikes(120, 1)

/* Set the size of the space: all distances in feet.

        space (dist_to_front, dist_to_right, -dist_to_back,
-dist_to_left, height,
        absorbtion_characteristics, rvbtime)
*/

space  (50, 100, -50, -100, 70,
```

[1]CMIX can be obtained from ftp://ftp.princeton.edu

```
        0.25, 0.001)

/*  Place the sound in the space

place (input_start_in_sec,input_end_in_sec,duration,
amplitude, distance_to_sound, angle_of_sound,
distance_between_mics, gain)
*/

place  (0, 0, dur(0),1, 30, 10,
         1, 1.0)

/*end*/
```

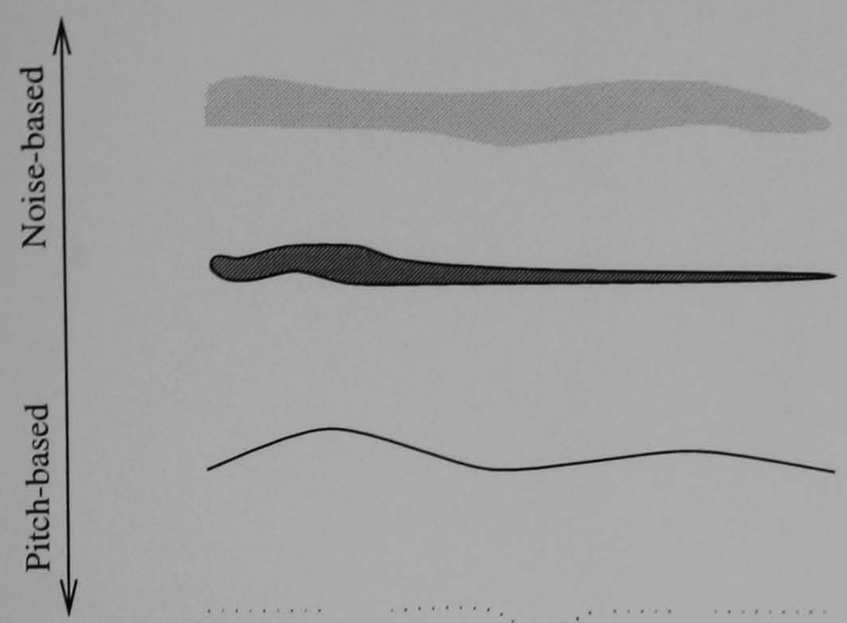
Appendix C

Diffusion scores

The graphic scores presented within this appendix should facilitate live performance of the creative work. The notation adopted conforms to guidelines set out in Helmuth (1996) and aims to show clearly the most important gestural, dynamic and spectral components of the music. Spectral and dynamic plots have been extracted directly from the works presented on the compact disc. The notation used for the graphic score is intentionally general in nature: it shows overall trends and is not a scientifically parametric representation. However, similar morphologies are represented by consistent symbols, allowing the main structural and sonic characteristics of the music to be identified. Some examples of the graphic notation are given overleaf. The exact spatial positions of the individual sounds is left open to interpretation by the diffusion artist.

Please note: these works may require extensive rehearsal in order to obtain a convincing sound diffusion.

Texture types



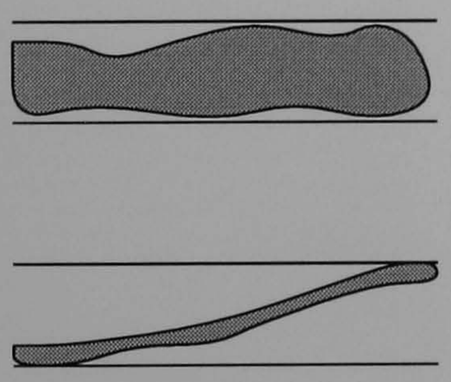
Coarse-grained, loosely packed texture

Fine-grained, high density texture

Thin, undulating line

Thin, granular line with temporal discontinuities

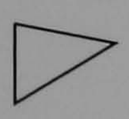
Spectral trajectory



Texture filling spectral space

Texture evolving from bass sounds
to occupy upper frequency range

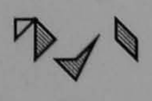
Impacts & attacks



Impulsive attack, smooth decay



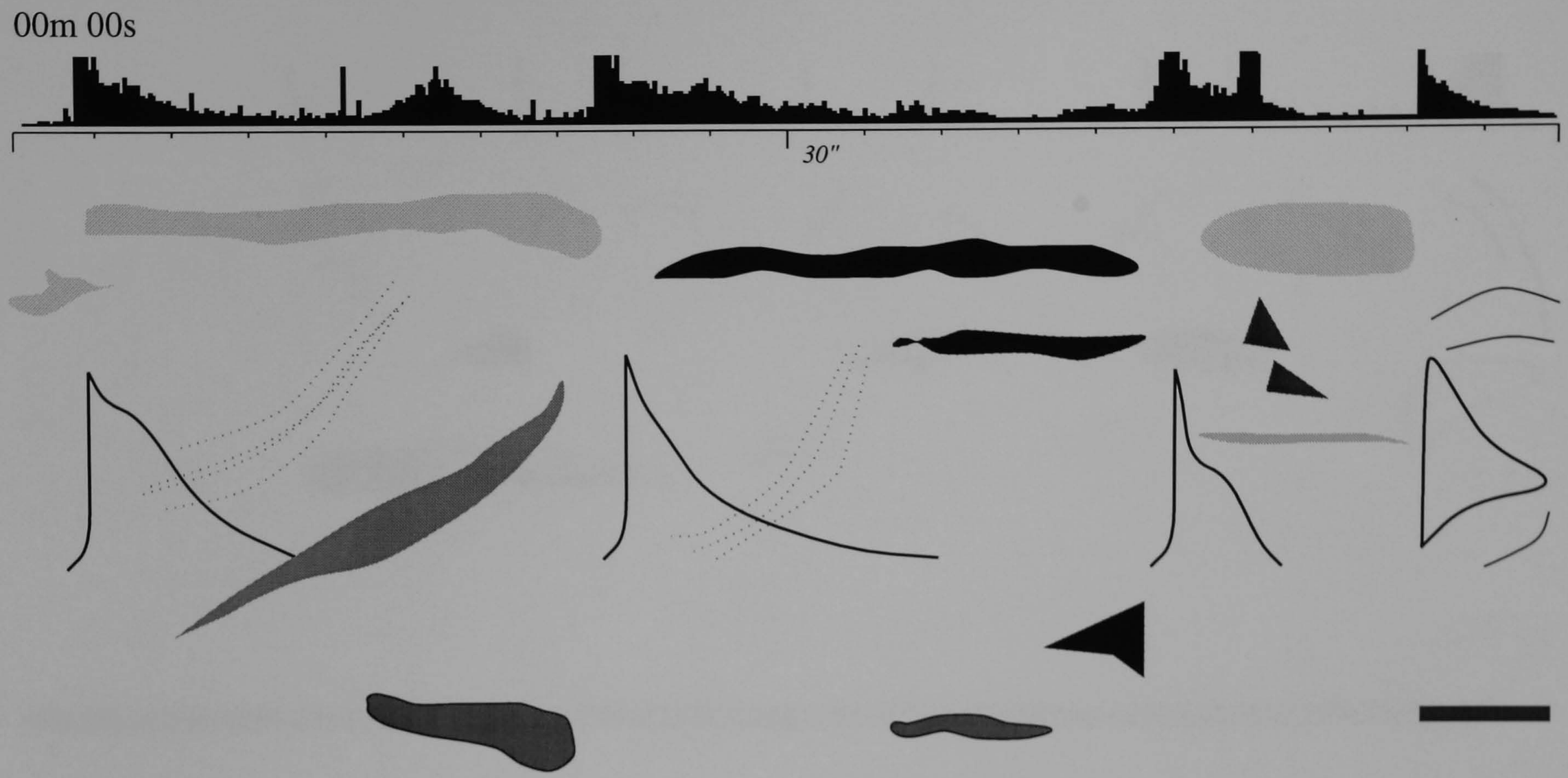
Smooth onset, elongated decay



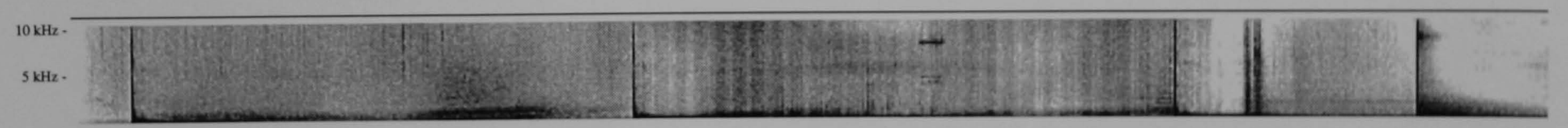
Cluster of momentary impacts

Key: Examples of graphic notation used in the diffusion scores

Undercurrents
Diffusion Score



Graphic Score



Spectral Plot

Undercurrents
Diffusion Score

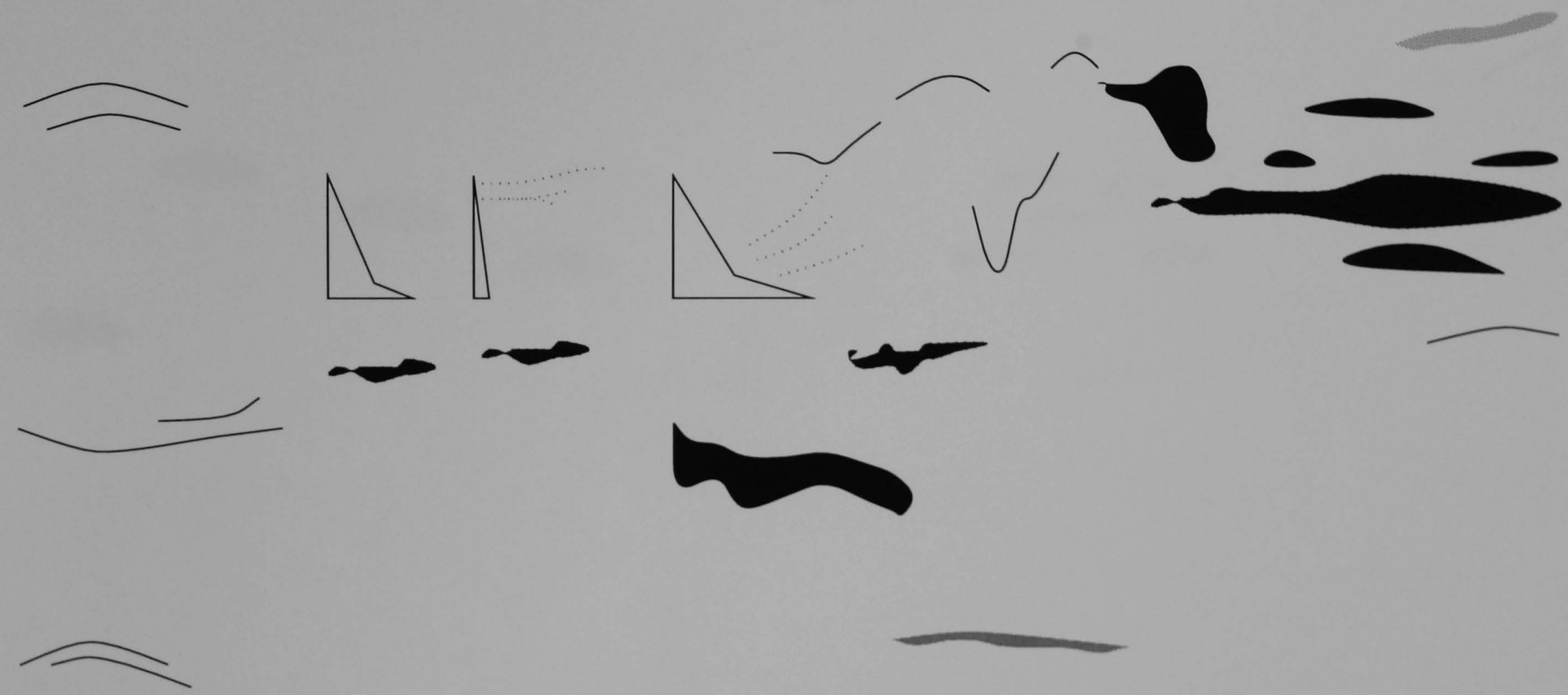


Undercurrents
Diffusion Score

02m 00s

Dynamics

30"



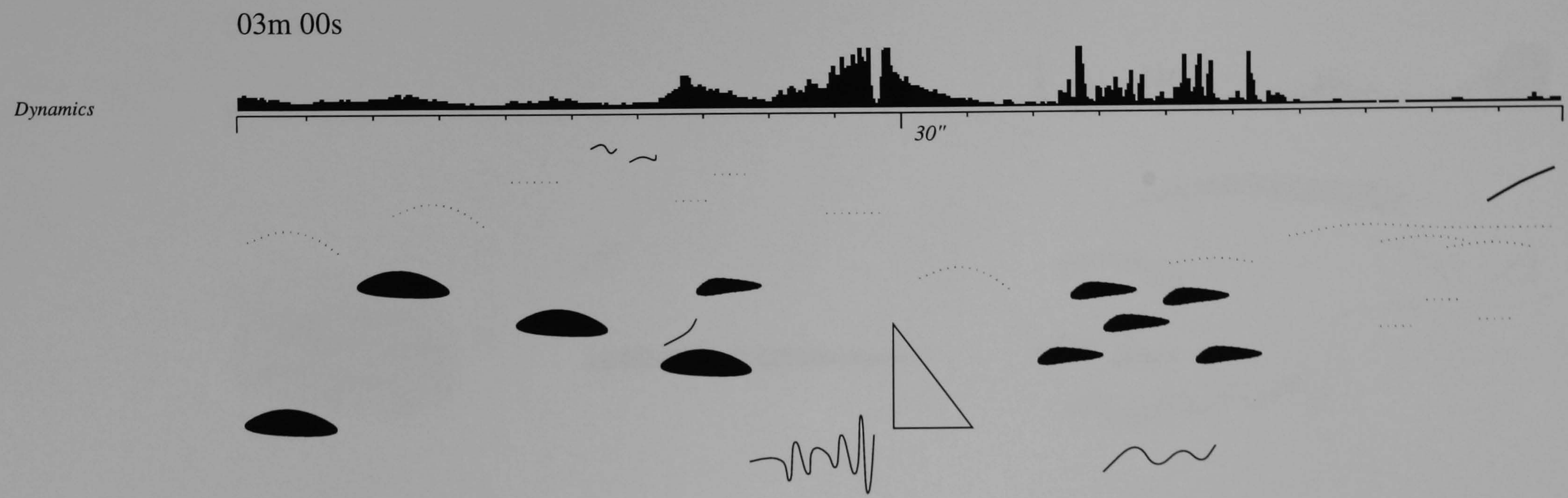
Graphic Score

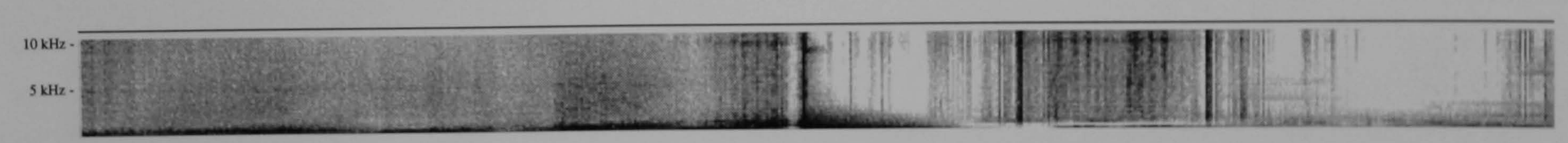
10 kHz -

5 kHz -

Spectral Plot

Undercurrents
Diffusion Score





Undercurrents
Diffusion Score



Undercurrents
Diffusion Score



Undercurrents
Diffusion Score

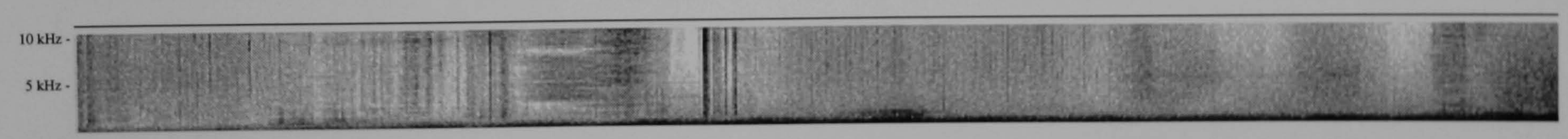
06m 00s

Dynamics

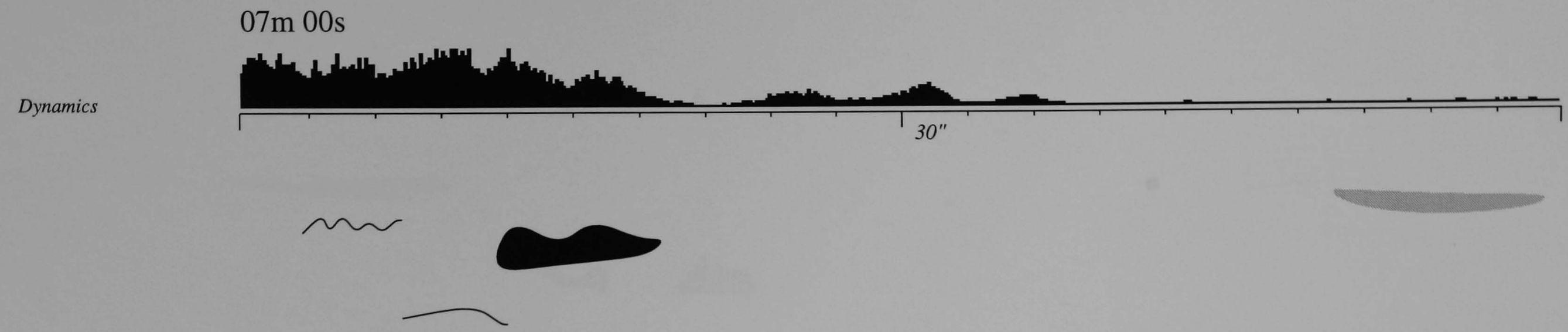


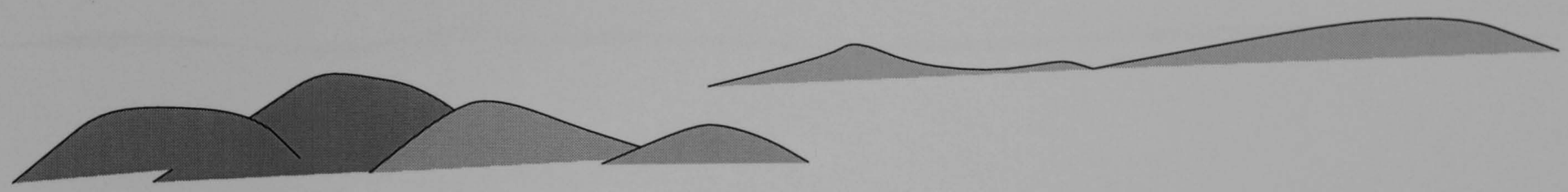
Graphic Score

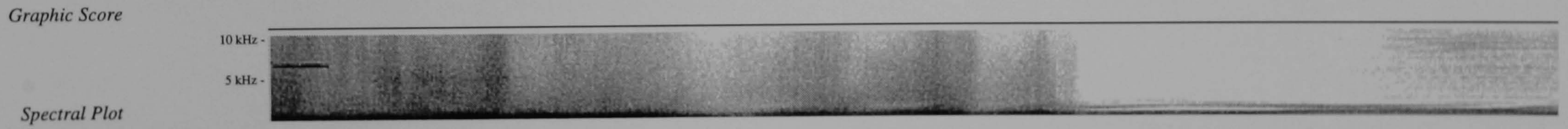
Spectral Plot



Undercurrents
Diffusion Score



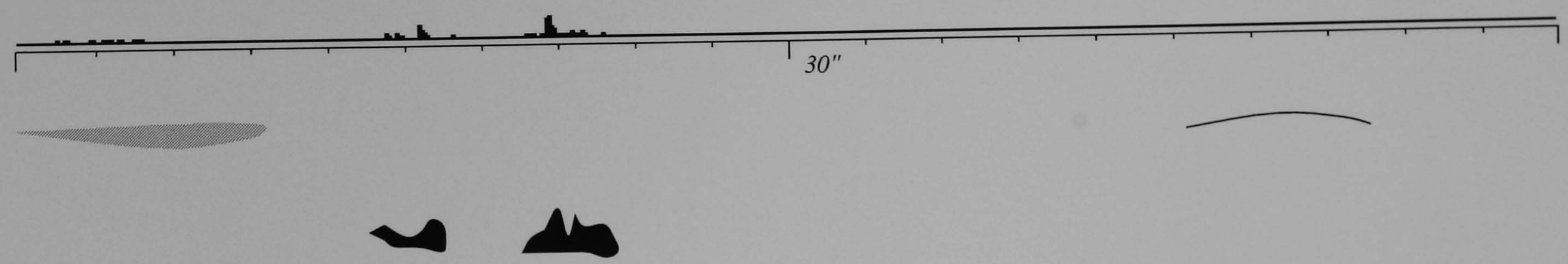


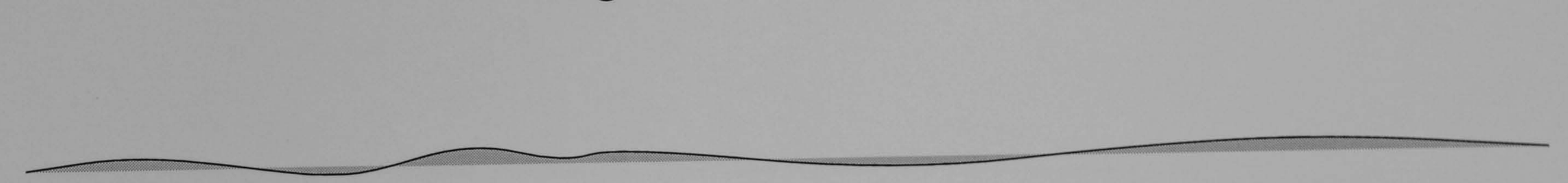


Undercurrents
Diffusion Score

08m 00s

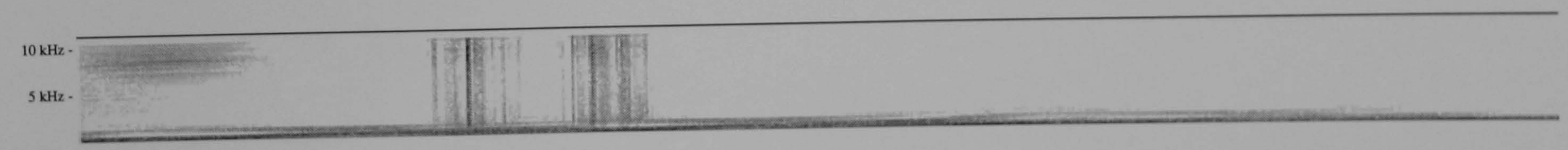
Dynamics





Graphic Score

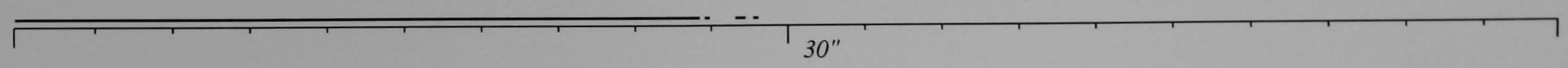
Spectral Plot



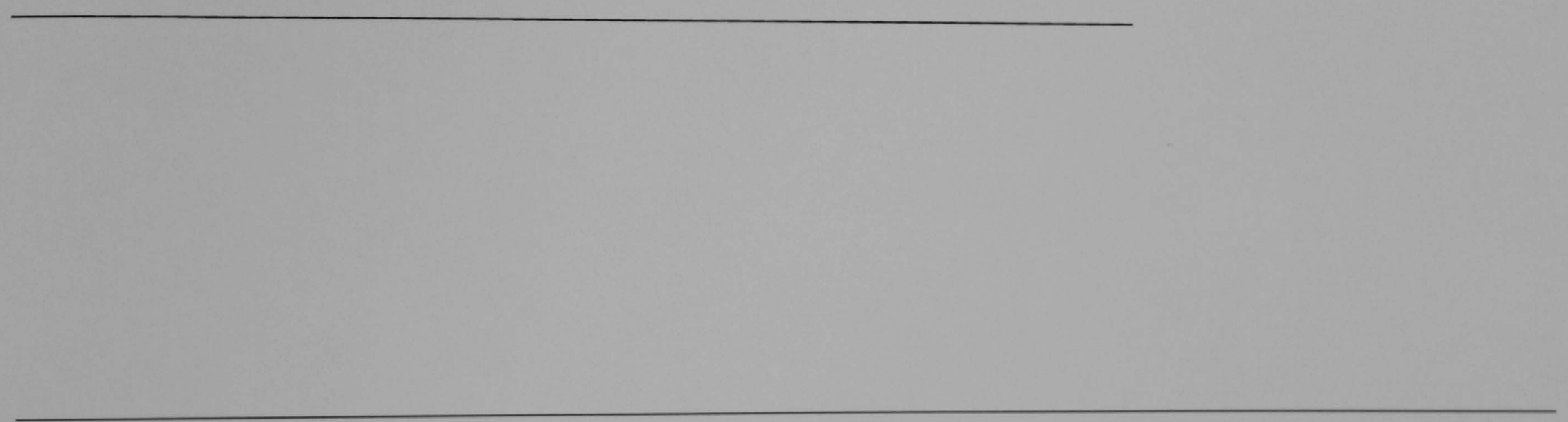
Undercurrents
Diffusion Score

09m 00s

Dynamics

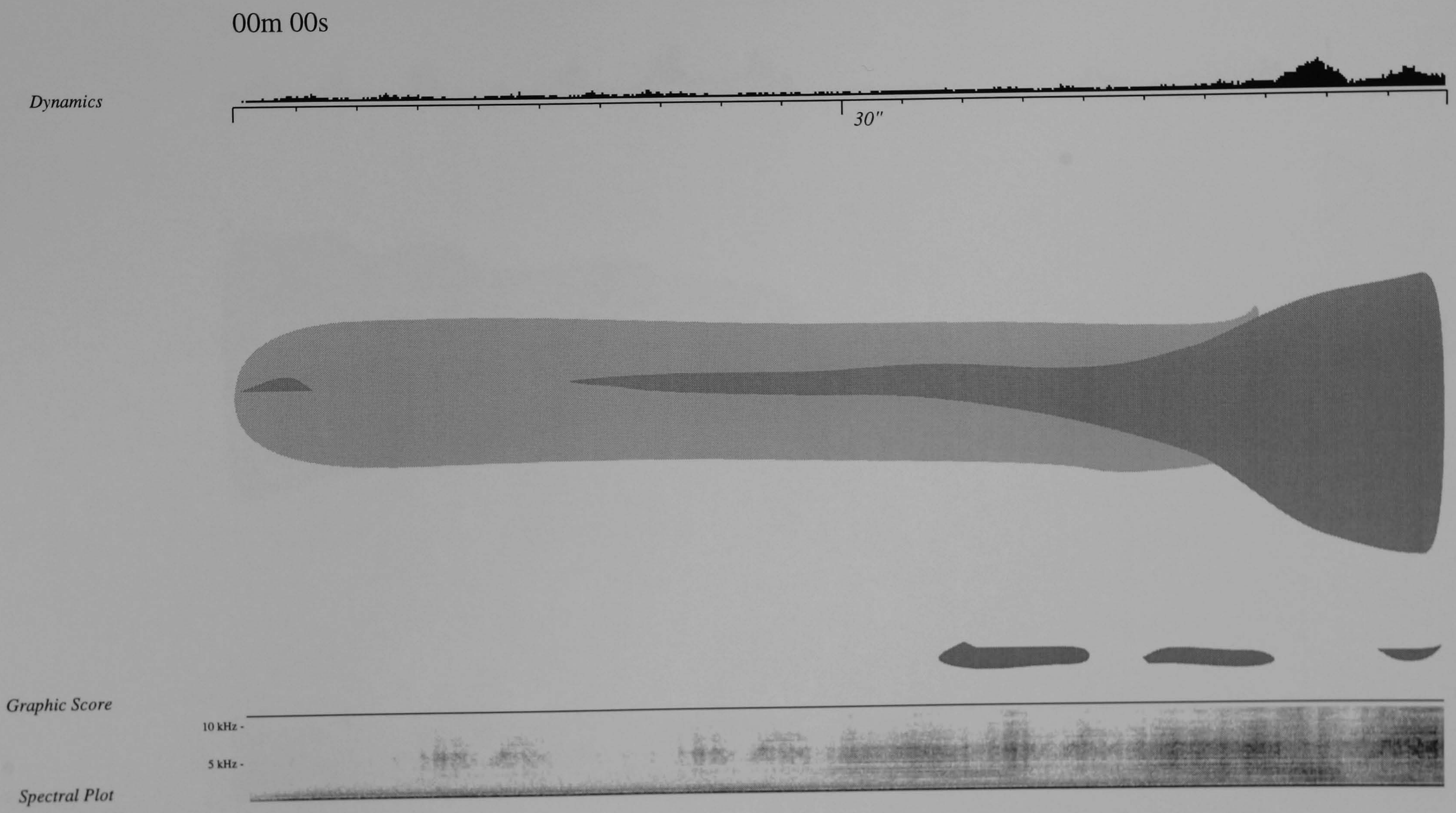


Graphic Score



Spectral Plot

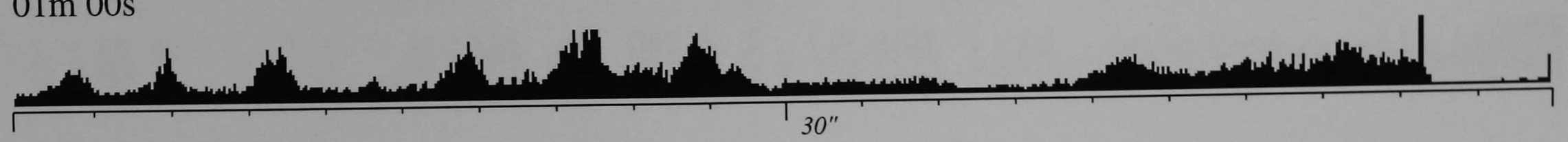
Breaking Spaces
Diffusion Score

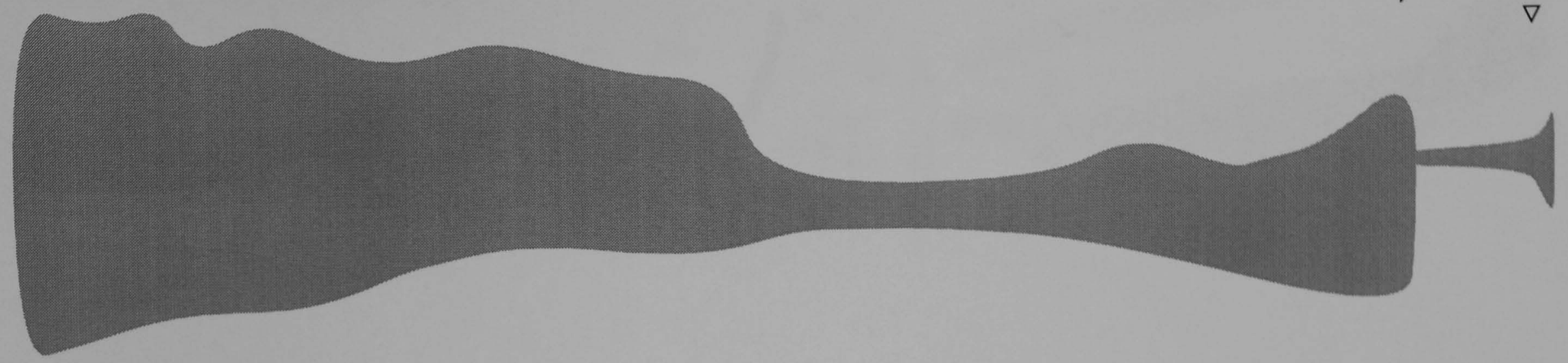


Breaking Spaces
Diffusion Score

01m 00s

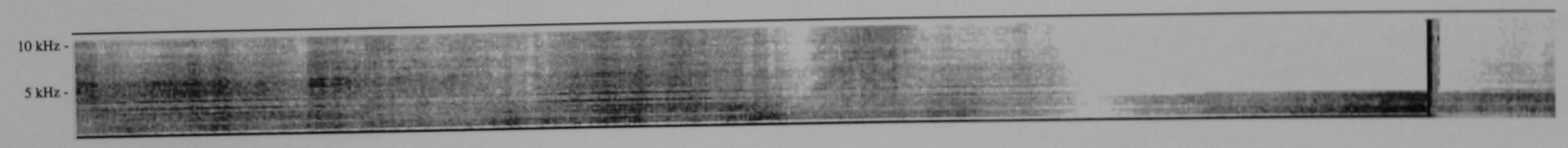
Dynamics



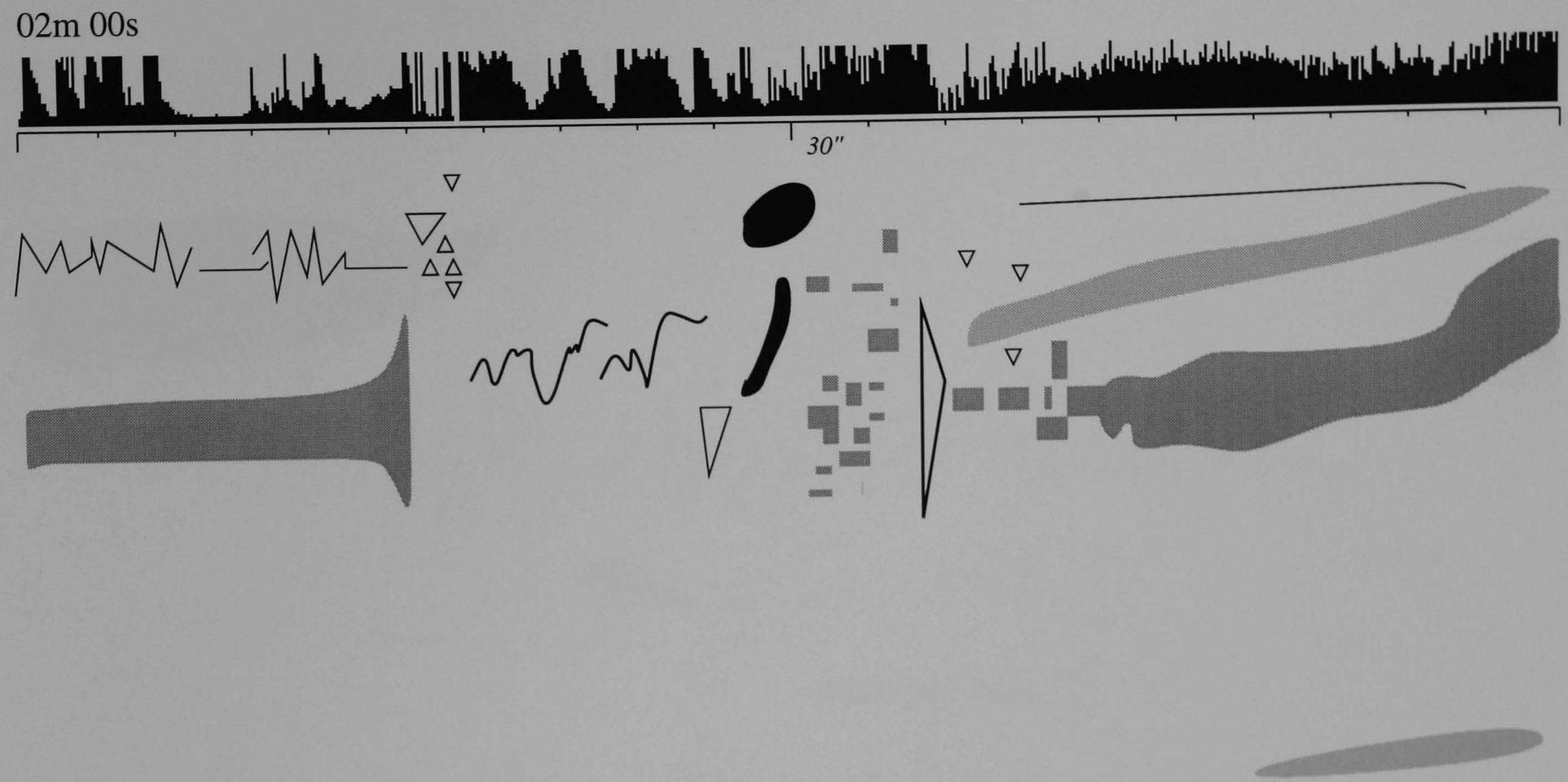


Graphic Score

Spectral Plot



Breaking Spaces
Diffusion Score



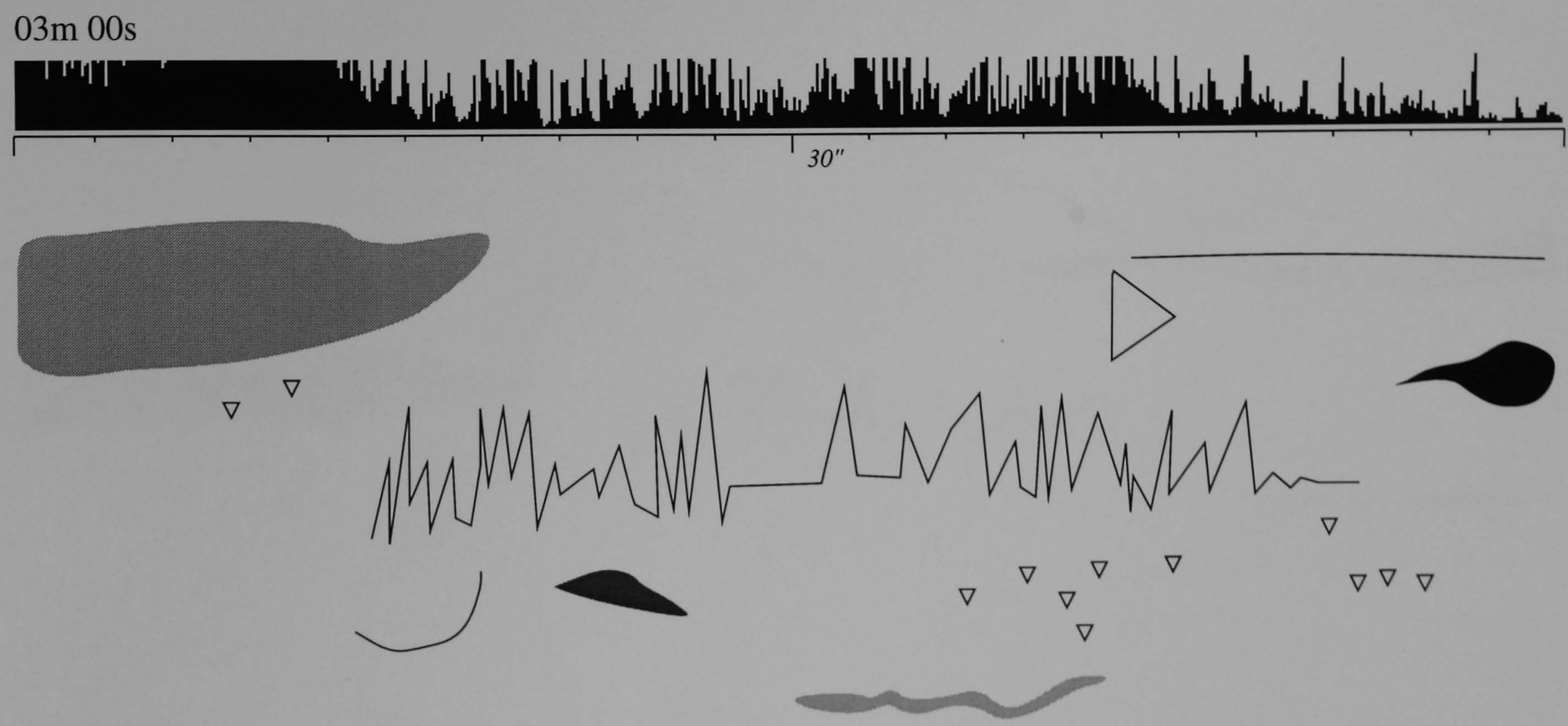
Dynamics



Graphic Score

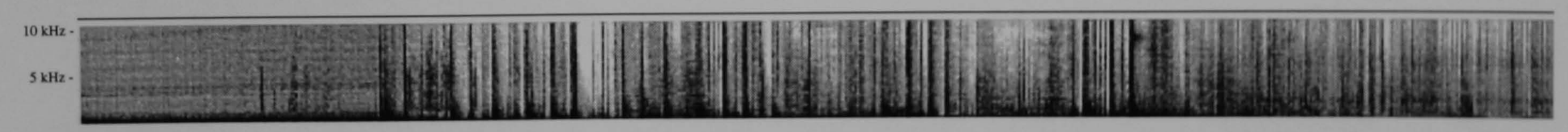
Spectral Plot

Breaking Spaces
Diffusion Score

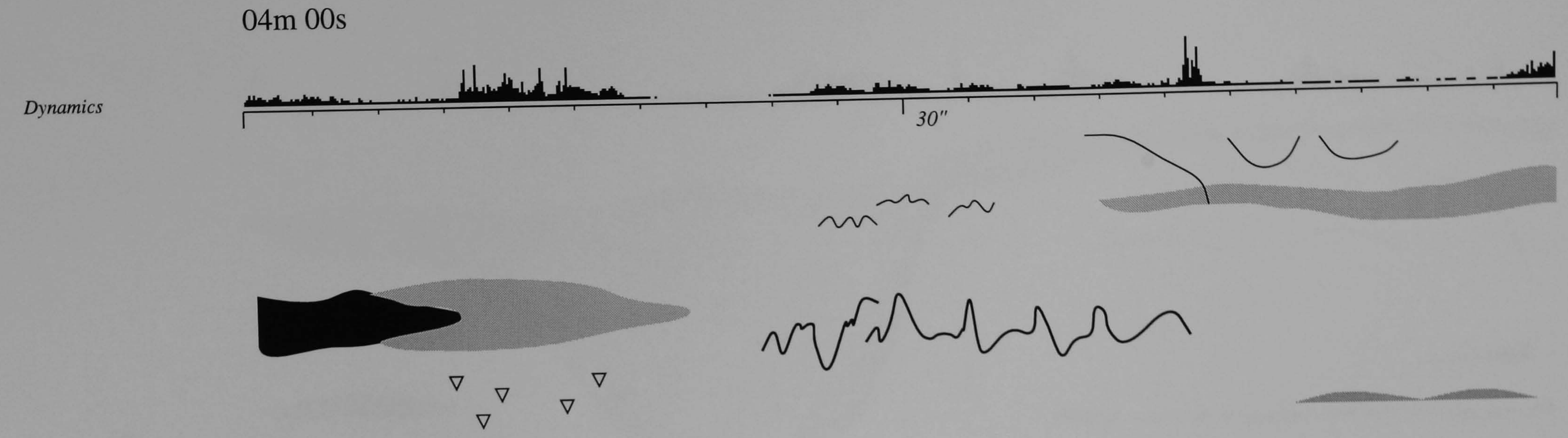


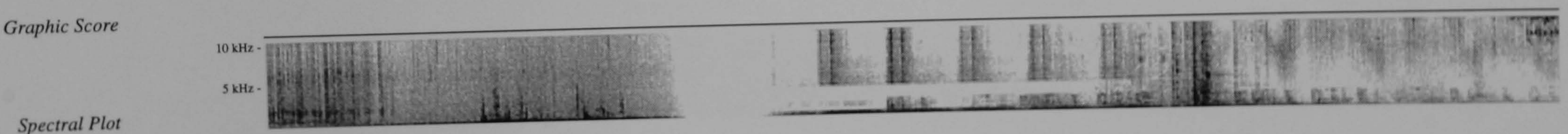
Graphic Score

Spectral Plot



Breaking Spaces
Diffusion Score





Breaking Spaces
Diffusion Score



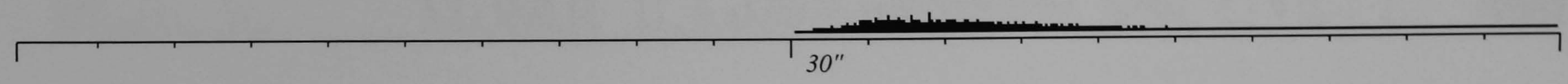
Breaking Spaces
Diffusion Score

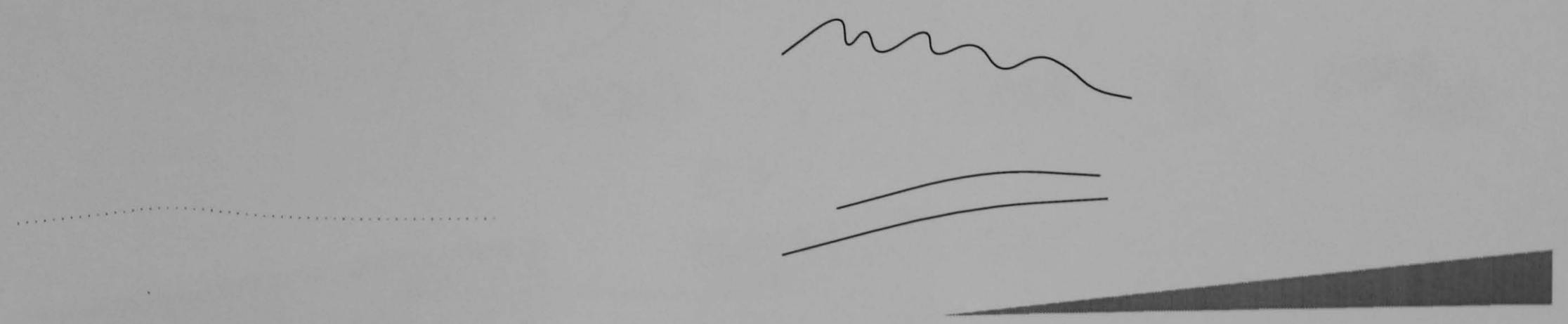


Breaking Spaces
Diffusion Score

07m 00s

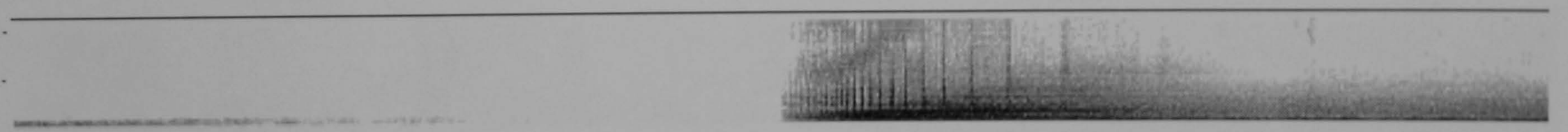
Dynamics





Graphic Score

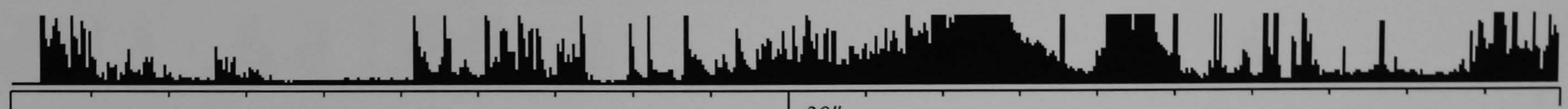
Spectral Plot

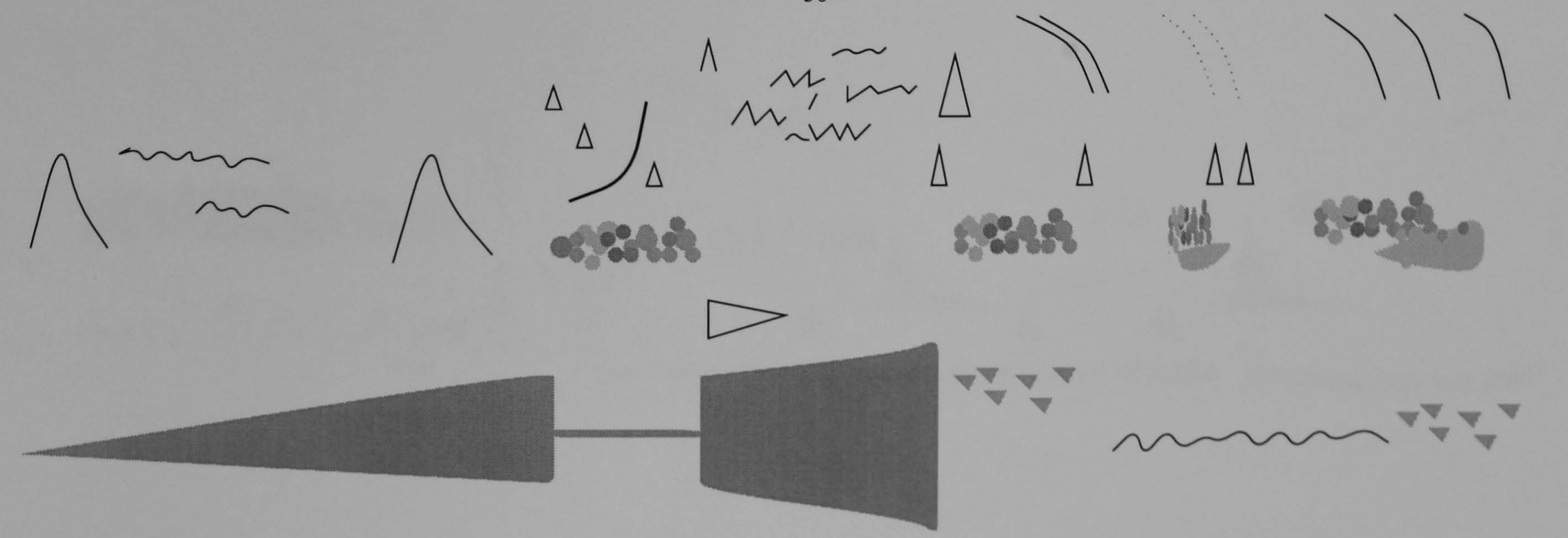


Breaking Spaces
Diffusion Score

08m 00s

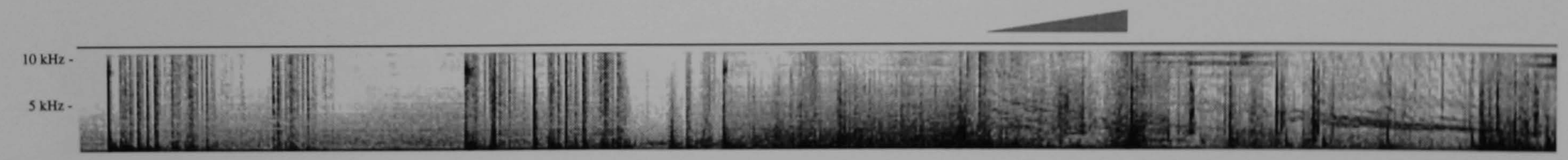
Dynamics





Graphic Score

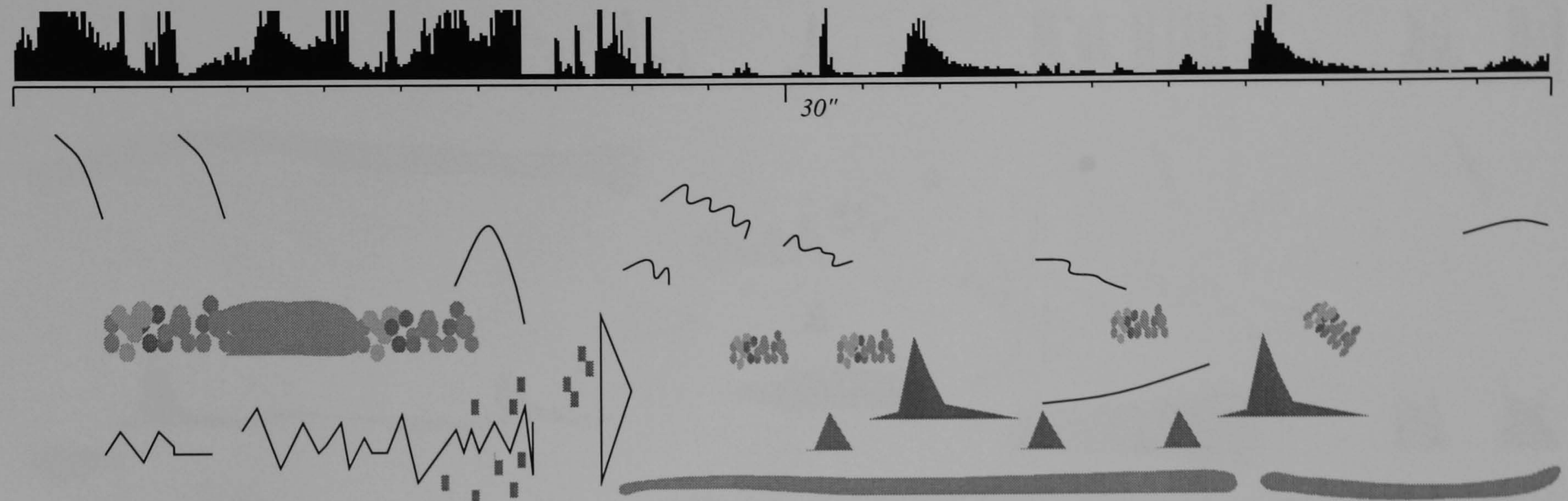
Spectral Plot



Breaking Spaces
Diffusion Score

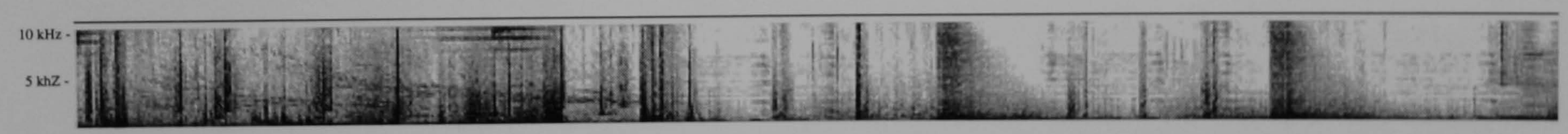
09m 00s

Dynamics



Graphic Score

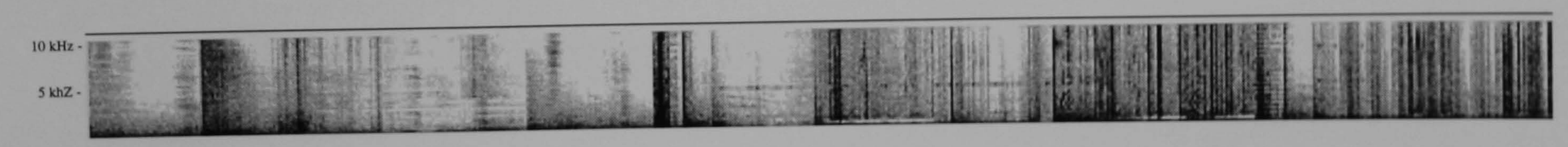
Spectral Plot



Breaking Spaces
Diffusion Score



Dynamics



Graphic Score

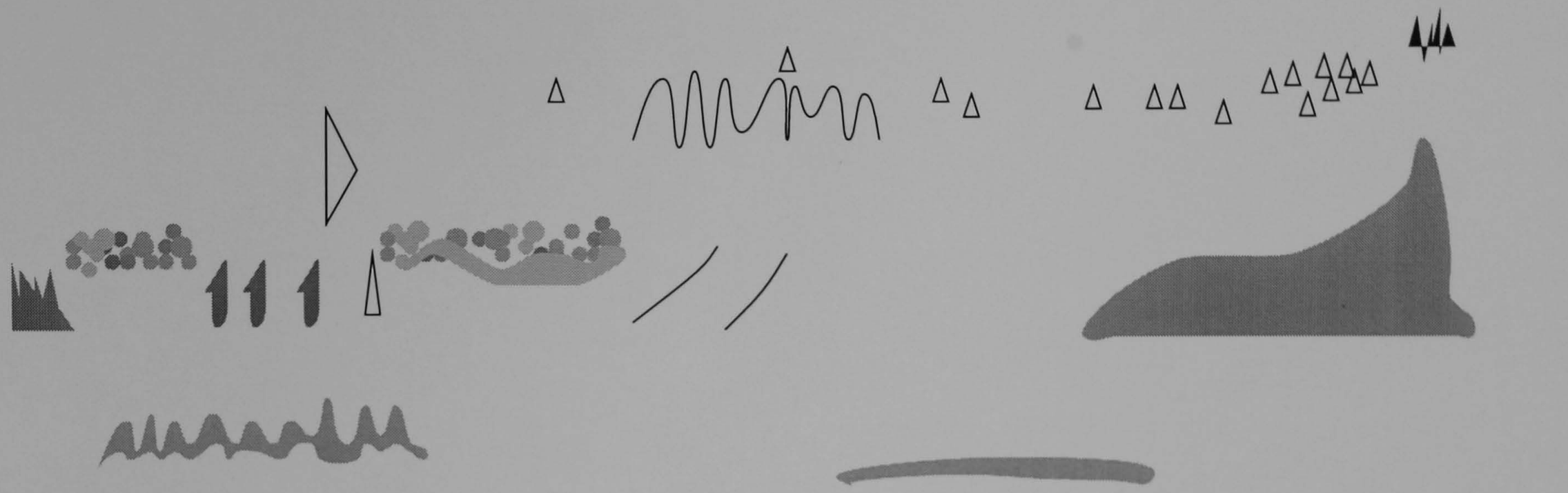
Spectral Plot

Breaking Spaces
Diffusion Score

11m 00s

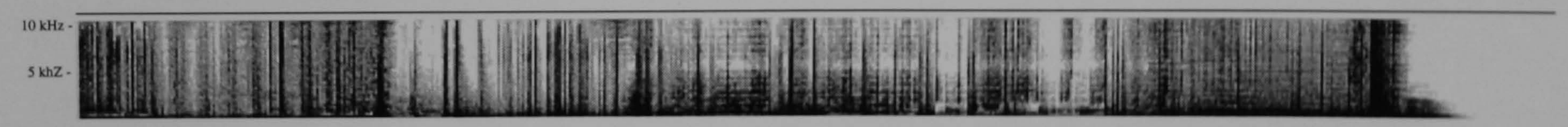
Dynamics





Graphic Score

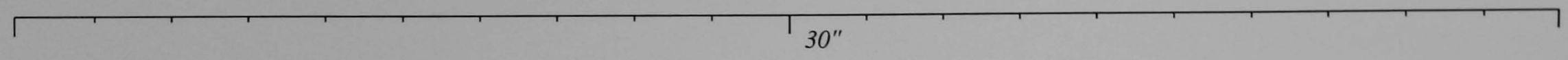
Spectral Plot



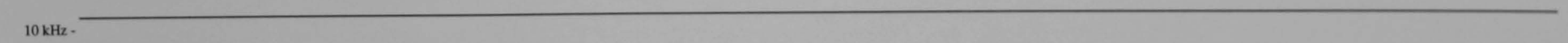
Breaking Spaces
Diffusion Score

12m 00s

Dynamics



Graphic Score

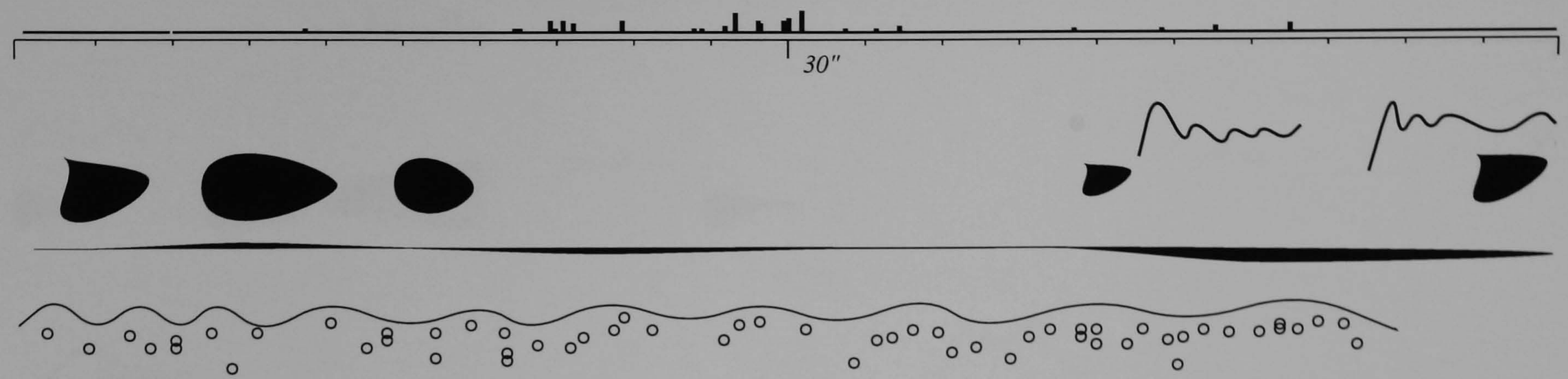


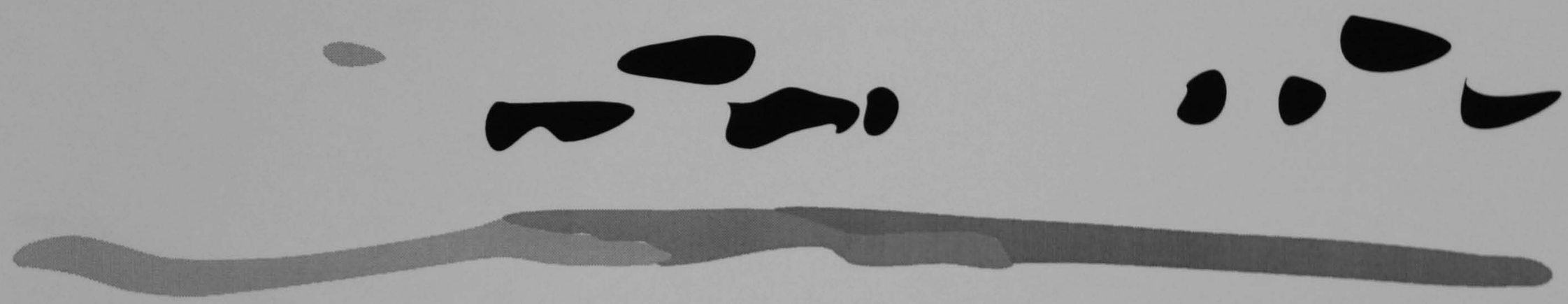
Spectral Plot

Still Water
Diffusion Score

00m 00s

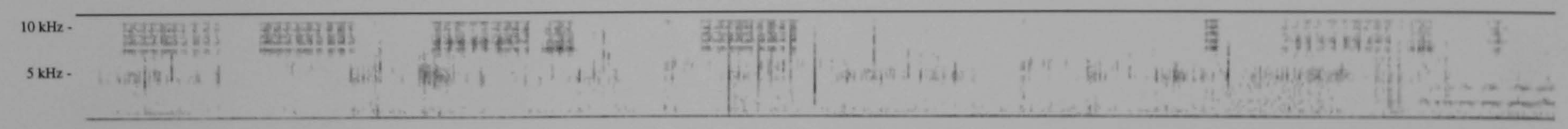
Dynamics





Graphic Score

Spectral Plot



Still Water
Diffusion Score

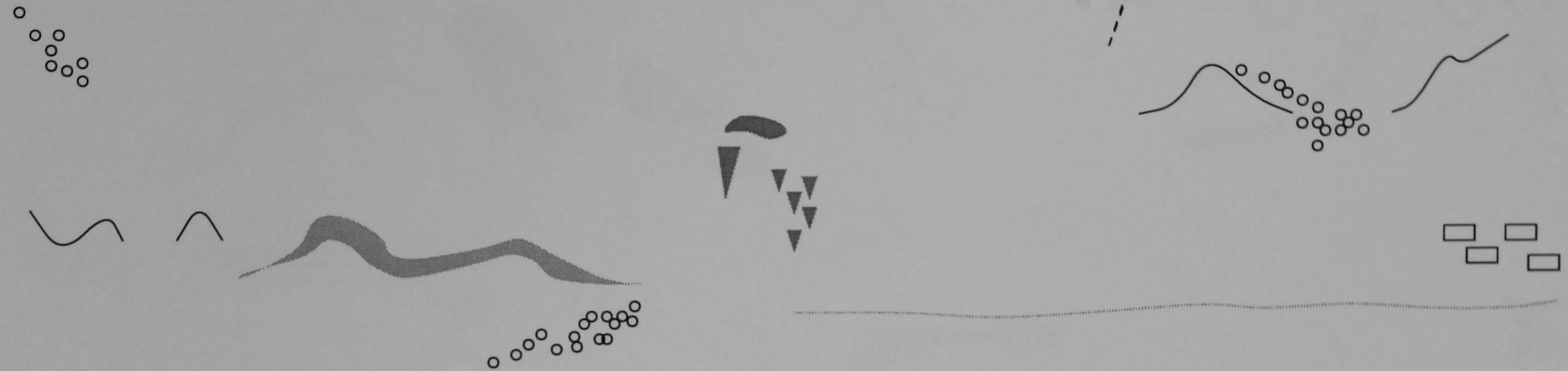


Still Water
Diffusion Score

02m 00s

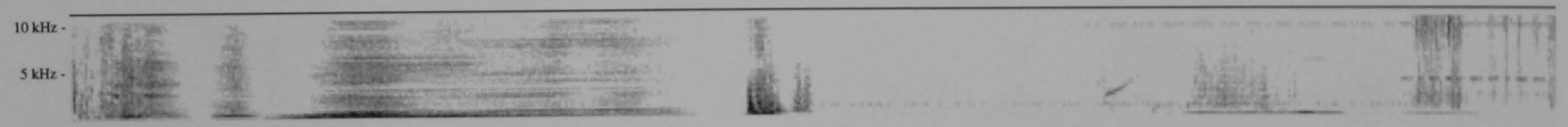
Dynamics

30"



Graphic Score

Spectral Plot



Still Water
Diffusion Score

03m 00s

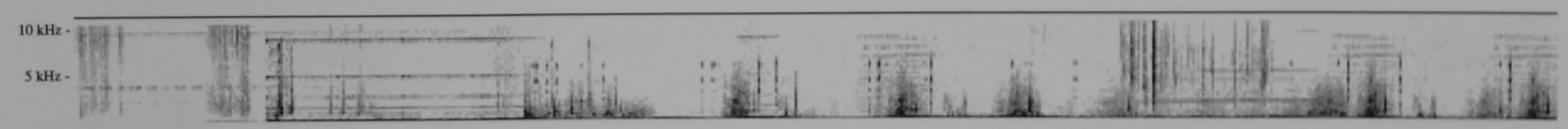
Dynamics

30"



Graphic Score

Spectral Plot



Still Water
Diffusion Score

04m 00s

Dynamics





Graphic Score

Spectral Plot



Still Water
Diffusion Score

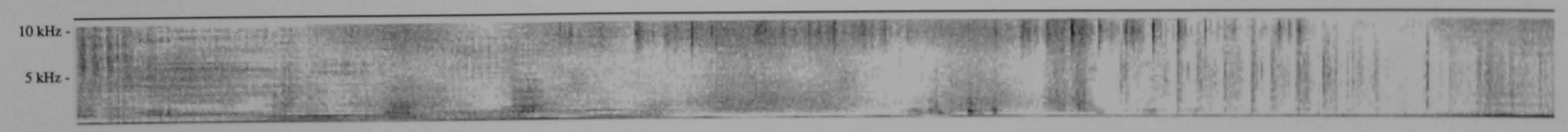
05m 00s

Dynamics



Graphic Score

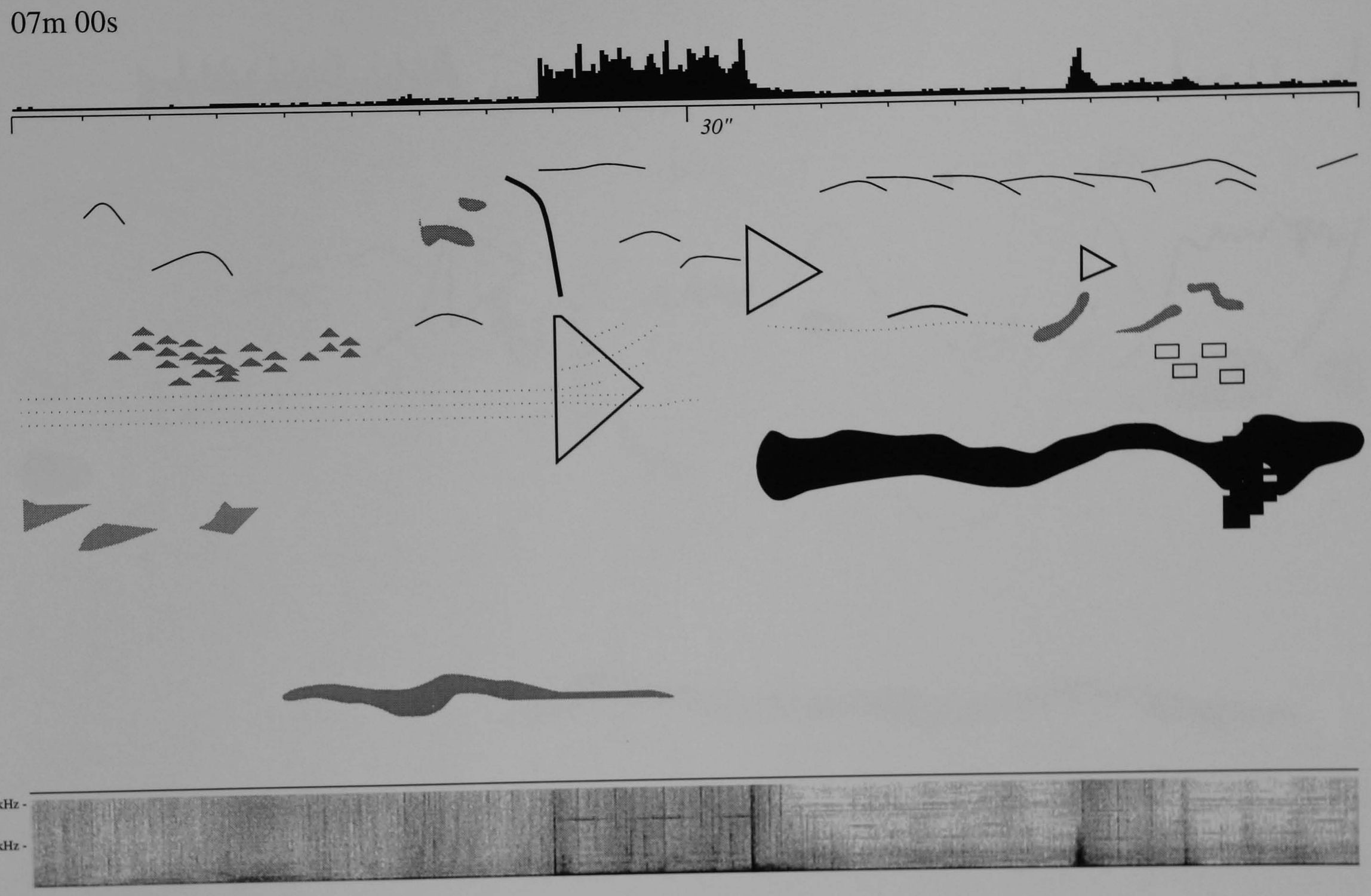
Spectral Plot



Still Water
Diffusion Score



Still Water
Diffusion Score



Still Water
Diffusion Score

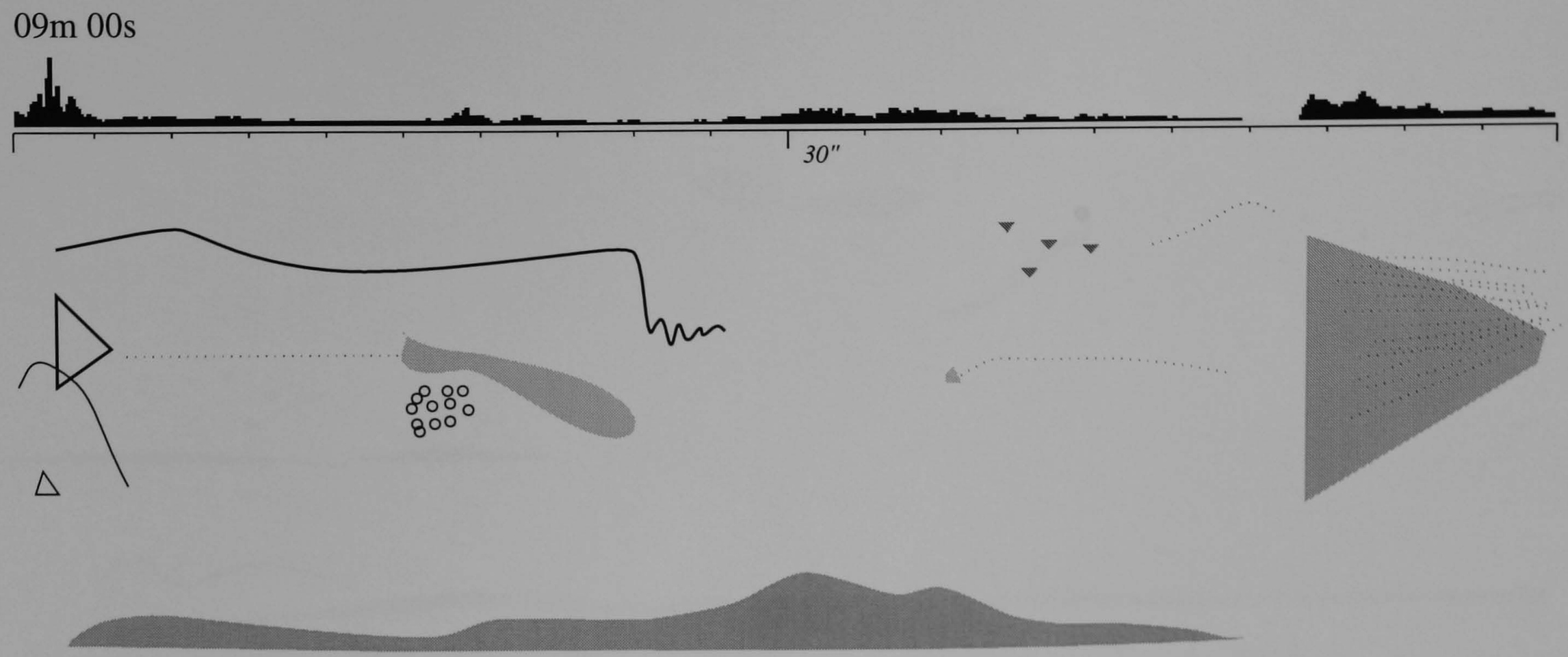


Dynamics

Graphic Score

Spectral Plot

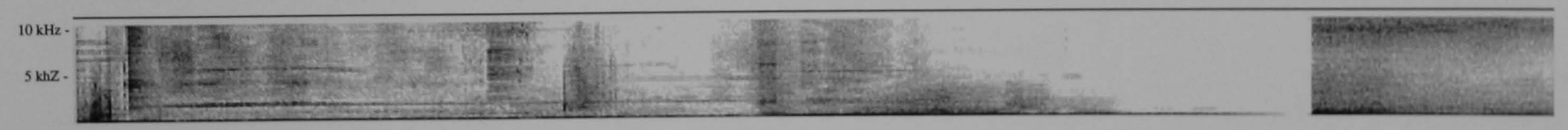
Still Water
Diffusion Score





Graphic Score

Spectral Plot



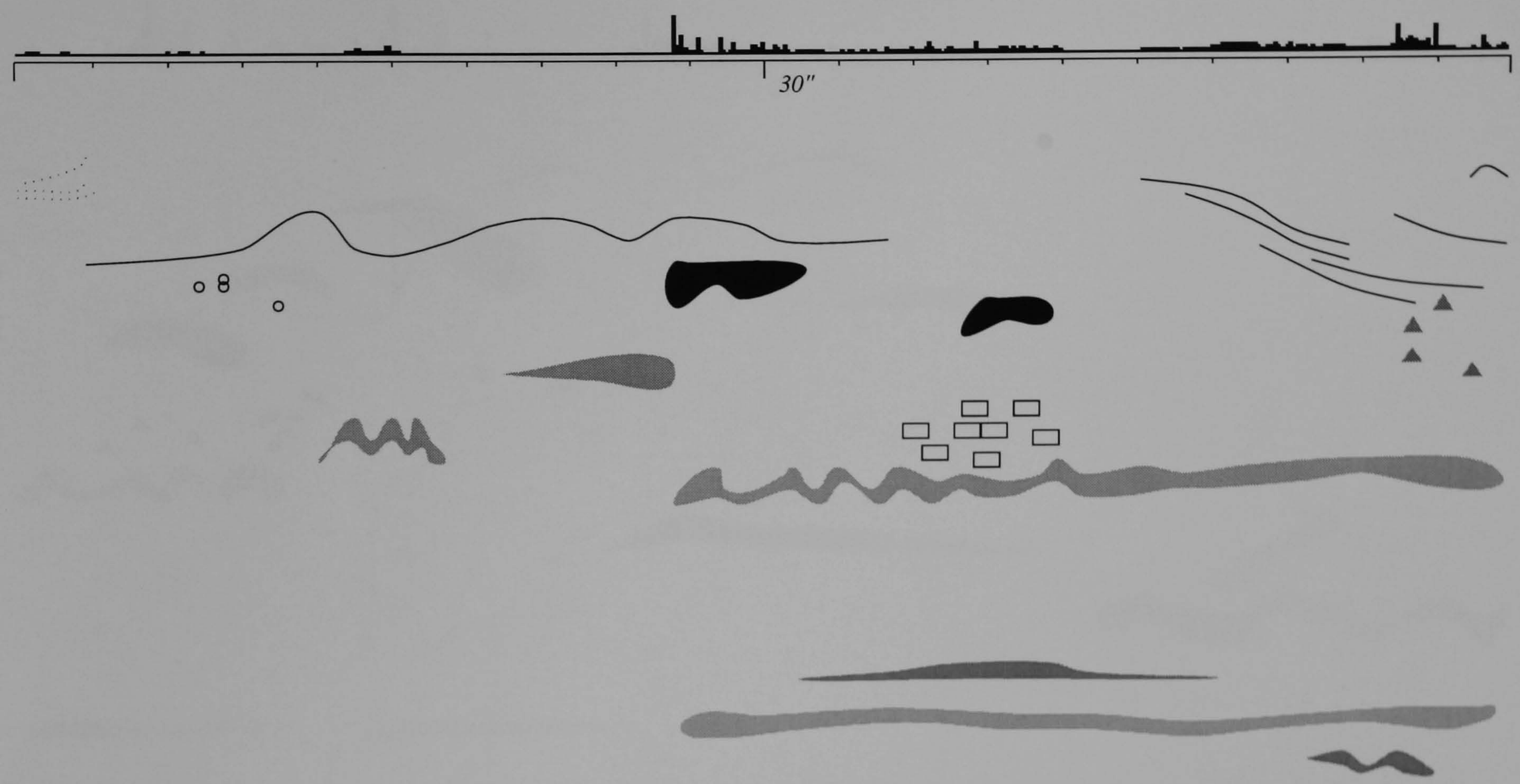
Still Water
Diffusion Score



Still Water
Diffusion Score

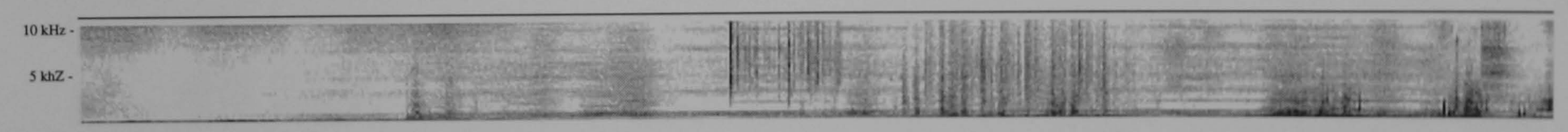
11m 00s

Dynamics



Graphic Score

Spectral Plot



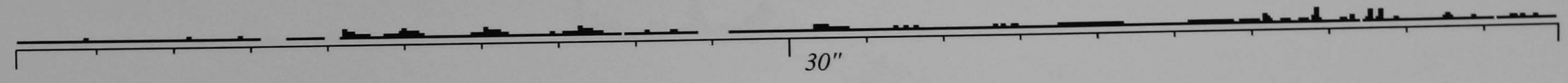
Still Water
Diffusion Score

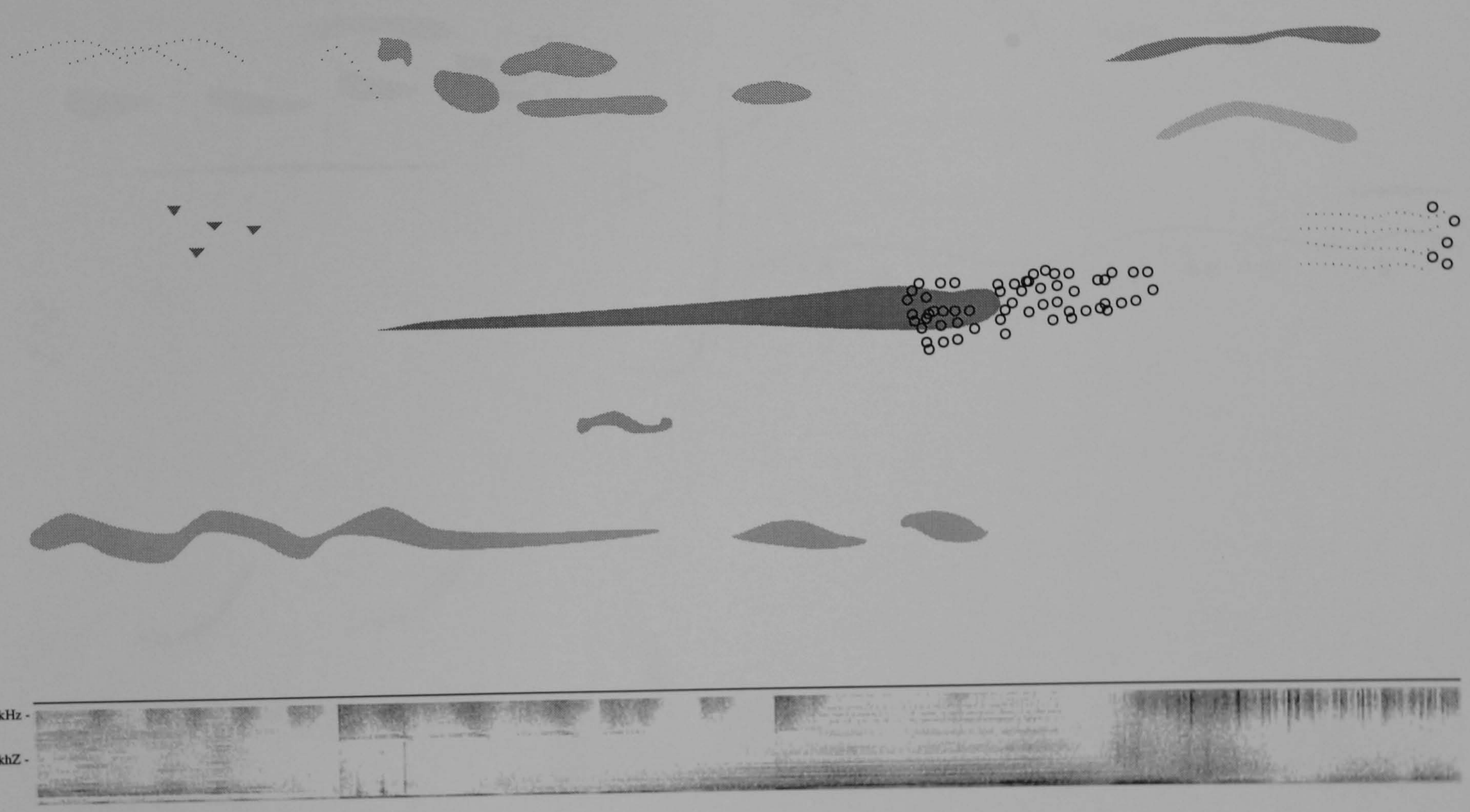


Still Water
Diffusion Score

13m 00s

Dynamics





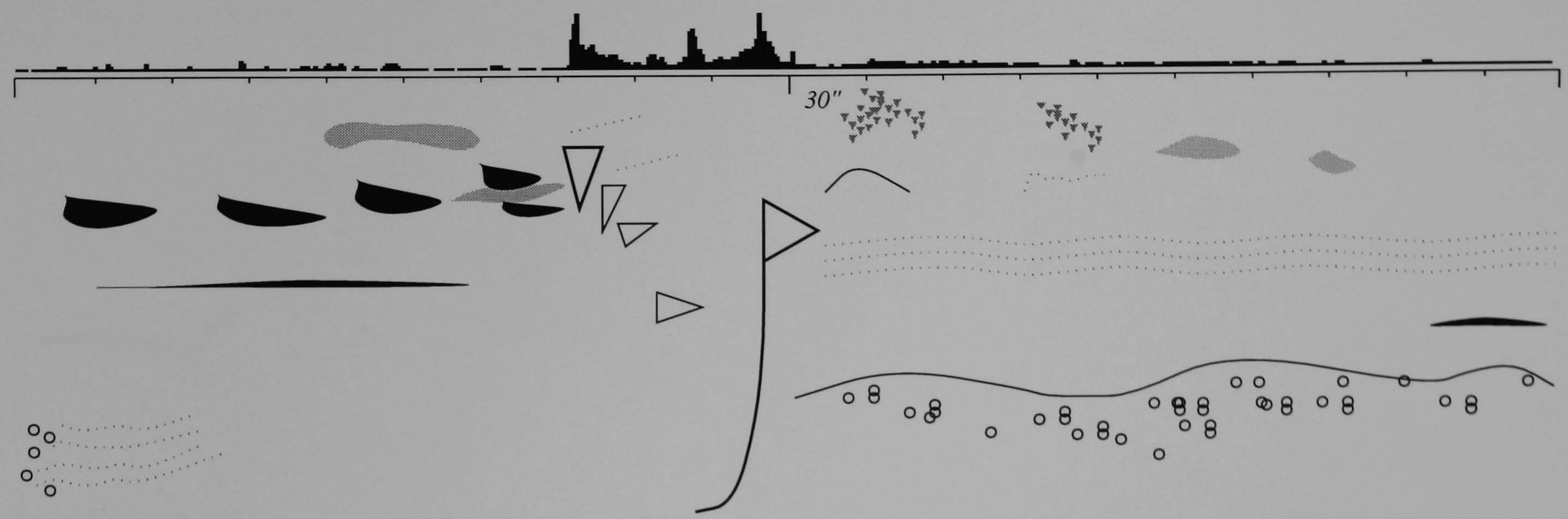
Graphic Score

Spectral Plot

Still Water
Diffusion Score

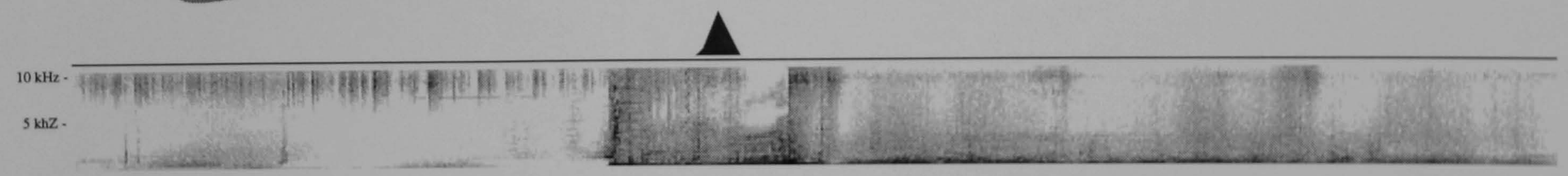
14m 00s

Dynamics





Graphic Score



Spectral Plot

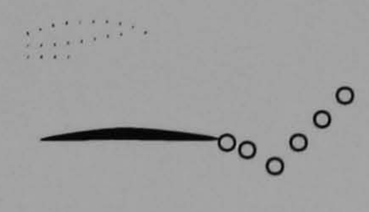
Still Water
Diffusion Score

15m 00s

Dynamics

-

30"



Graphic Score

10 kHz -

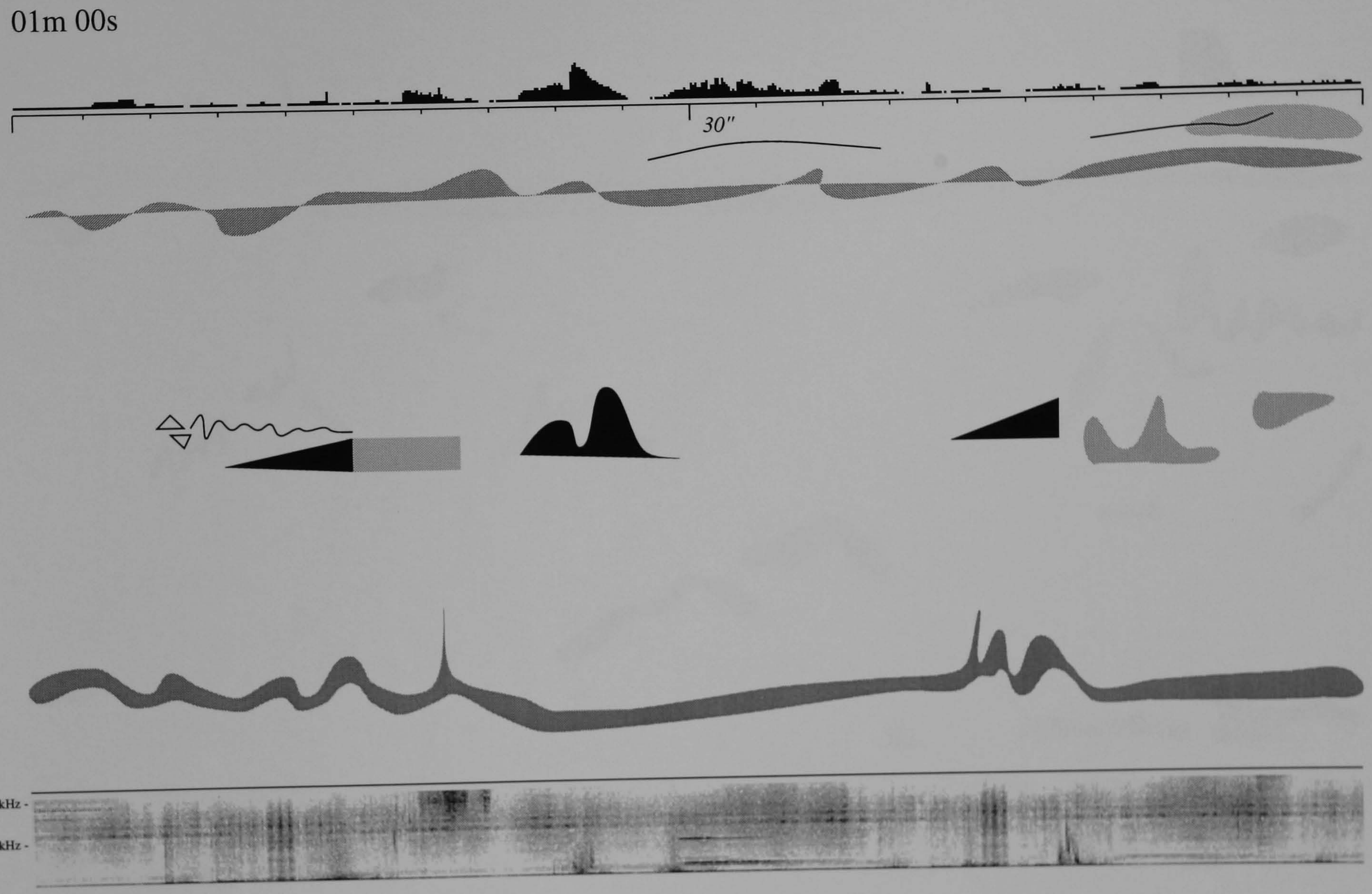
5 khZ -

Spectral Plot

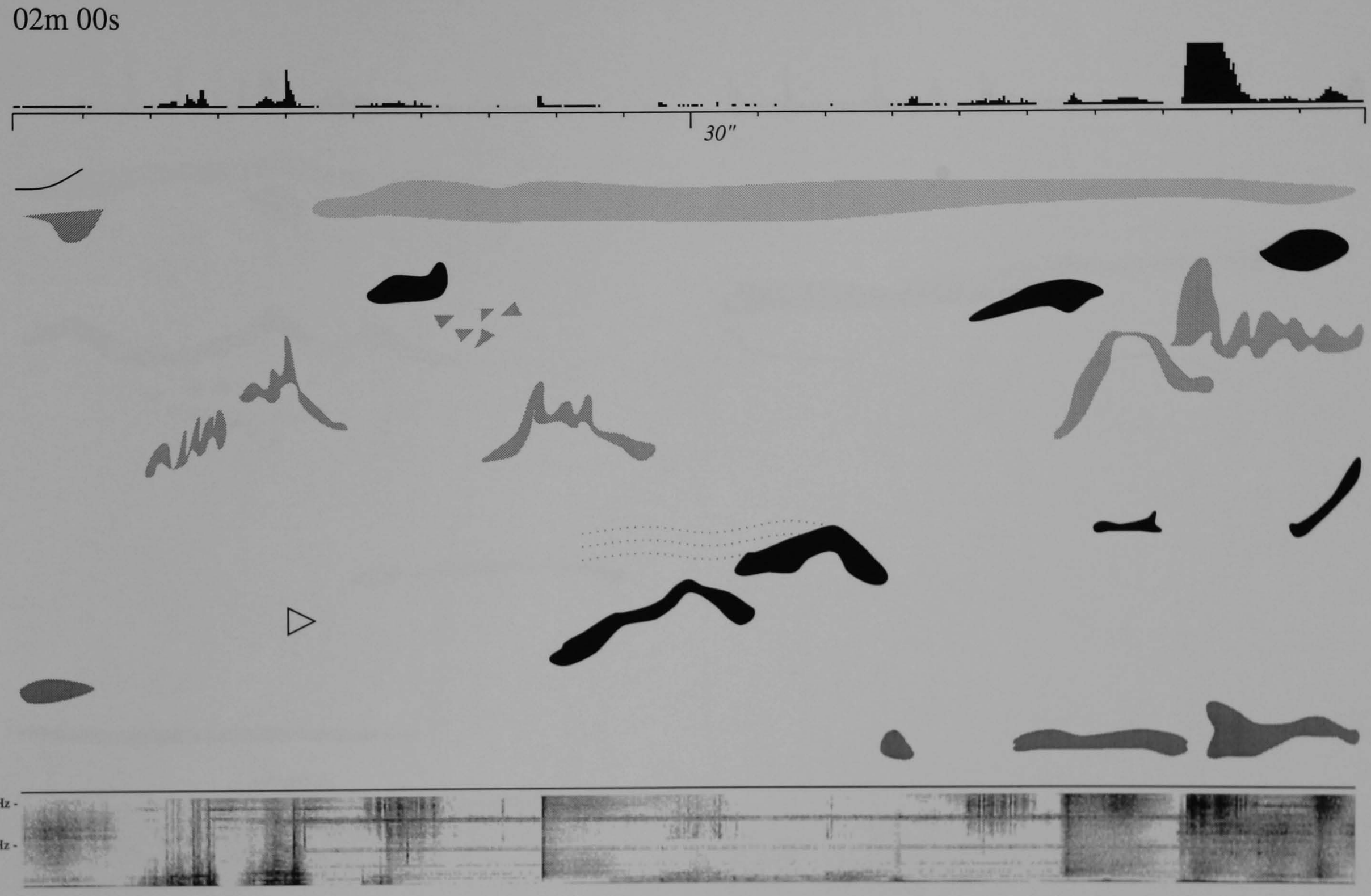
Till
Diffusion Score



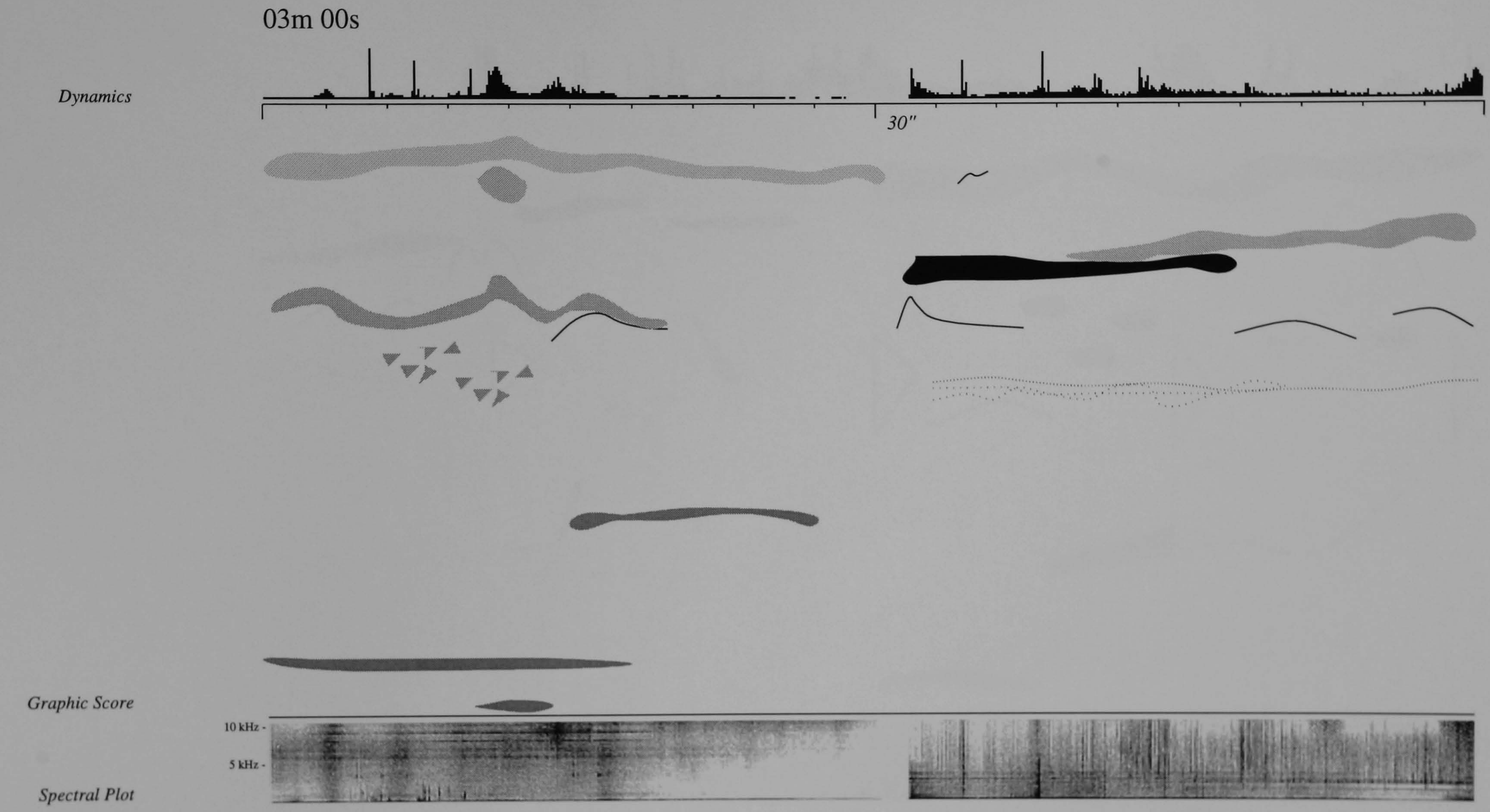
Till
Diffusion Score



Till
Diffusion Score



Till
Diffusion Score



Till
Diffusion Score

04m 00s

Dynamics

30"

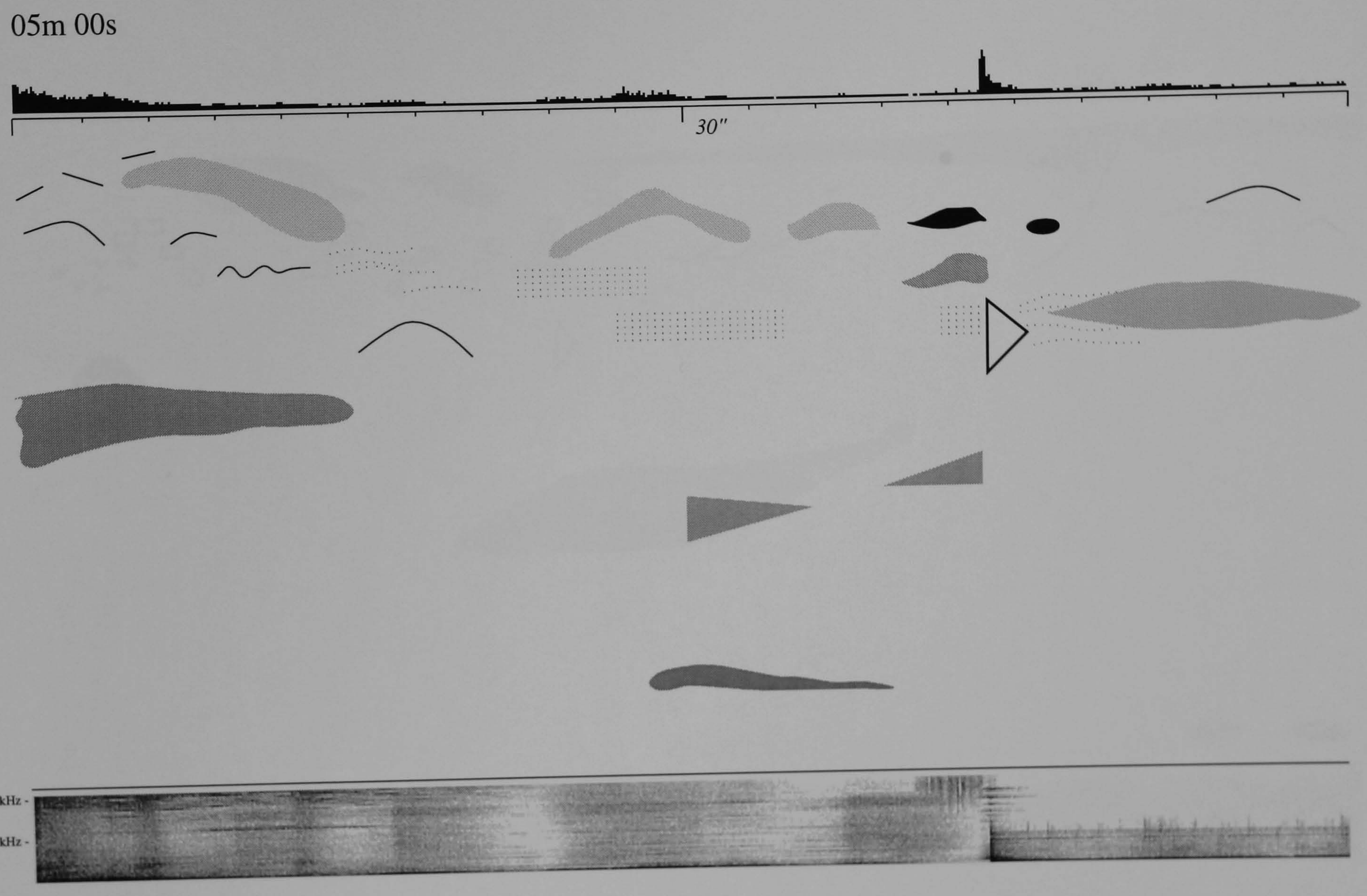
Graphic Score

Spectral Plot

10 kHz -

5 kHz -

Till
Diffusion Score



Till
Diffusion Score

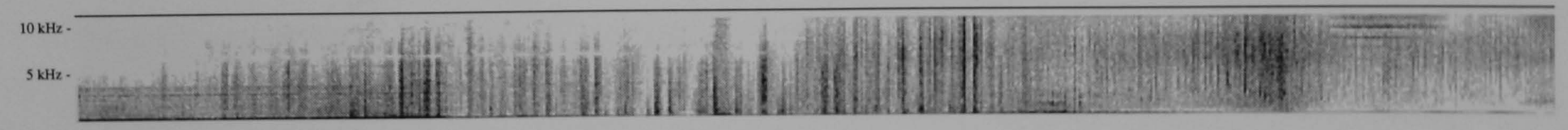
06m 00s

Dynamics



Graphic Score

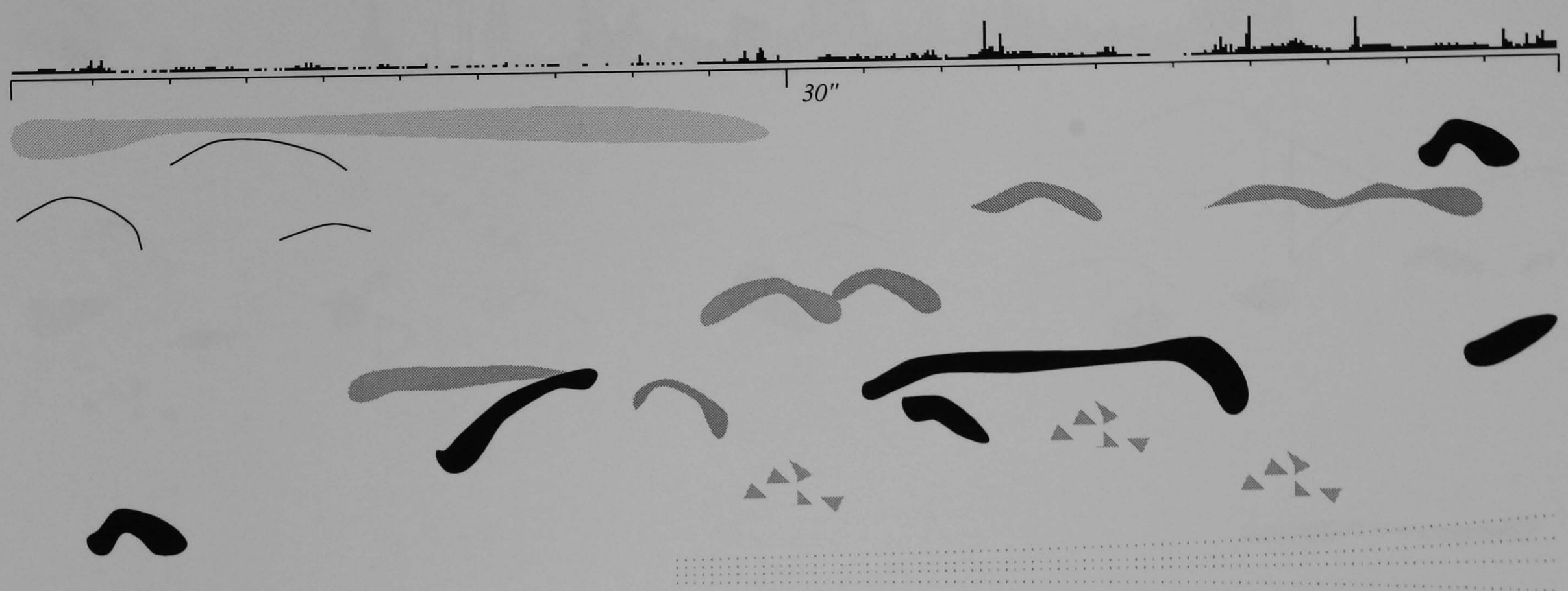
Spectral Plot



Till
Diffusion Score

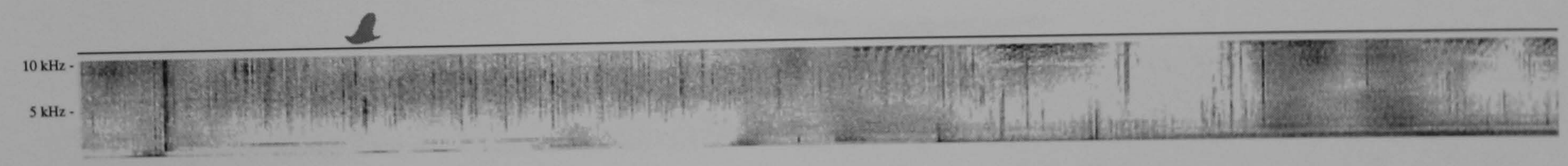
07m 00s

Dynamics



Graphic Score

Spectral Plot

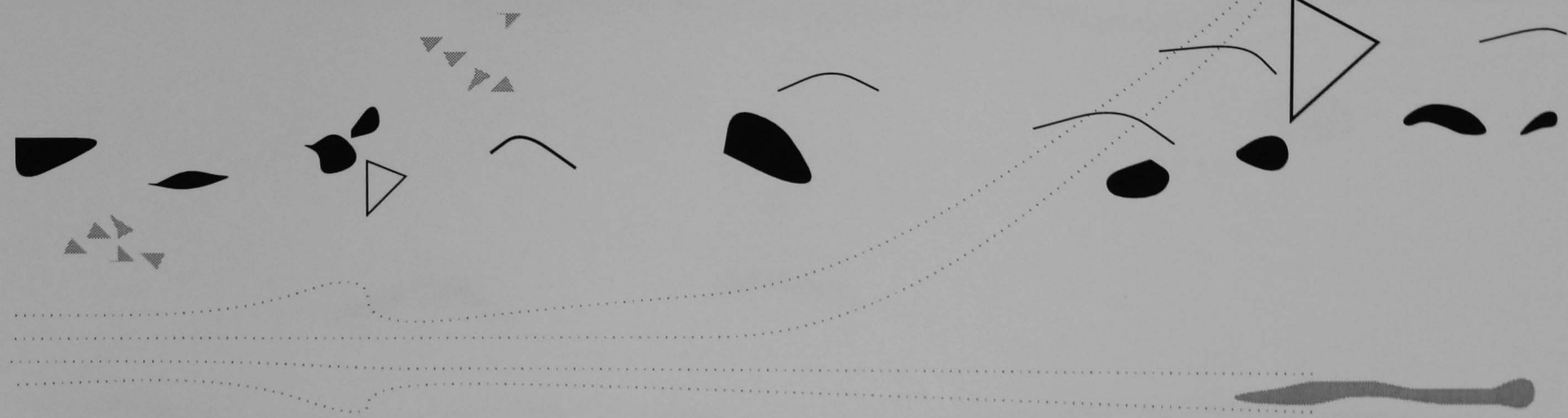


Till
Diffusion Score

08m 00s

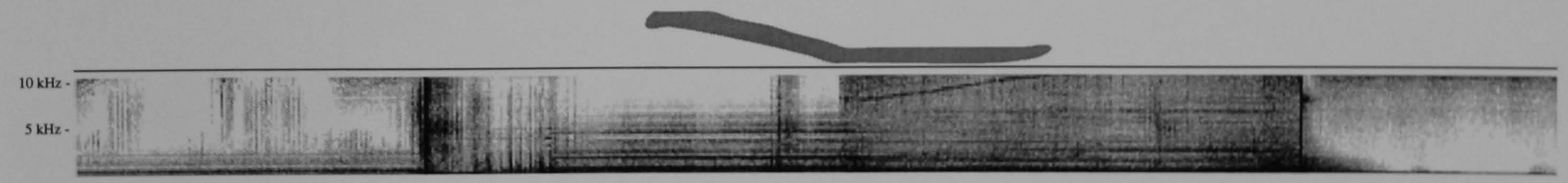
Dynamics

30"



Graphic Score

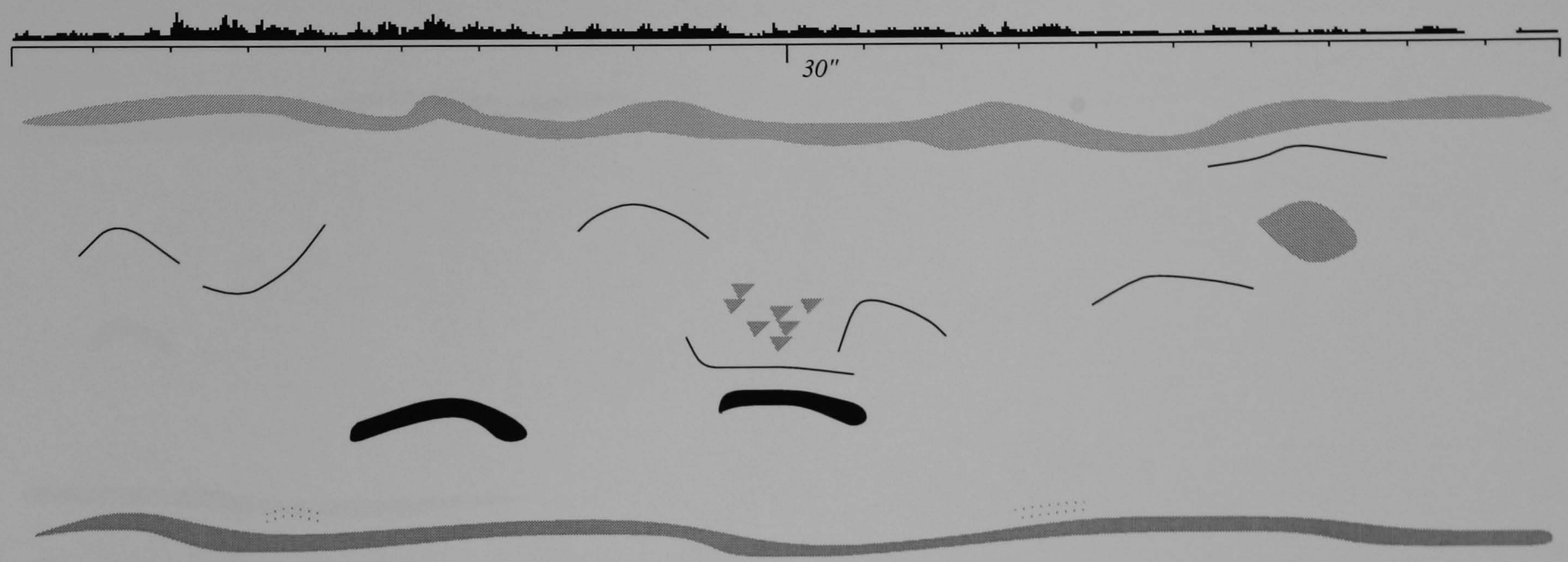
Spectral Plot



Till
Diffusion Score

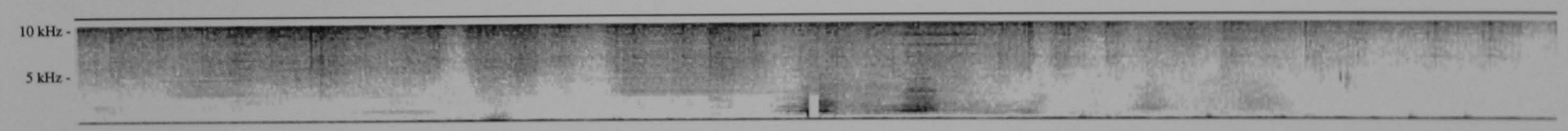
09m 00s

Dynamics



Graphic Score

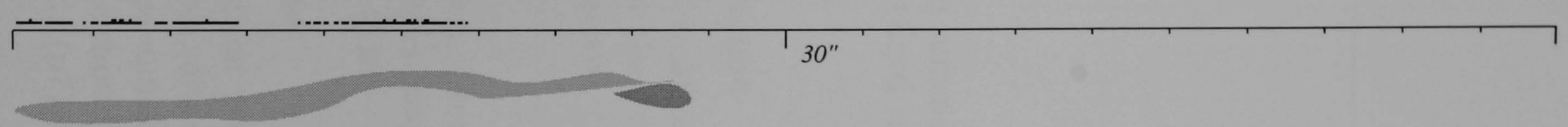
Spectral Plot



Till
Diffusion Score

10m 00s

Dynamics







Graphic Score



Spectral Plot

Appendix D

Glossary

This glossary provides a summary of new terminology introduced in this dissertation. These terms are also defined in the main text where they are first mentioned.

- *Agency transformation*

  An agency transformation is a process that changes the agent which appears to be responsible for the cause of the sounds involved, rather than transforming the sounds themselves. (p27)

- *Causal enquiry*

  Causal enquiry is a listening strategy where listeners search for the causes of sounds. *Technological listening* (Smalley 1992b:551) is an example of a causal enquiry process. (p15)

- *Causal preparation*

  A causal preparation provides the conditions that enable a source-cause to exist. For example, although the sound of twigs breaking may be caused by human agency, the sound still retains a sense of belonging to a natural out-door environment. The causal preparation of the out-door environment is ingrained in the twig sound. (p7)

- *Cause coherence*

  Cause coherence is a measure of the homogeneity of the causal qualities of sounds which constitute a sounding flow. Cause coherence is high where there is no perceived change in the causal qualities of a sounding flow, and low where there are many changes. (p23)

- *Context bonding*

  Context bonding is a measure of the extent to which the existing context of a sound is linked to the context in which that sound was first created. Essentially, context bonding is a form of *surrogacy* (Smalley (1986:82)) that can be applied to contextual relationships. (p43)

- *Context loading*

  Context loading occurs where contextual materials have been included within a work with the specific aim of directing the listening processes employed by the audience. (p49)

- *Contextual label*

  A contextual label refers to details within a sound's ambience which give acoustic cues to that sound's causal preparation. The semiotic interpretants derived from the label may not necessarily point to the causal preparation. See section 3.5.3 for examples. (p38)

- *Contextual steering transformation*

  A contextual steering transformation is a process that creates transitions between contexts, rather than between the sounds themselves. (p70)

- *Discovery strategy*

  Discovery strategy is a compositional methodology which aims to permit better integration of real and abstract sounding materials. It does this by using a system of *steering processes* and *handles*. (p82)

- *Genre dependence*

  Genre dependence occurs where an audience has become locked into the rhetorical codes of a particular genre to the extent that apprehending other genres becomes increasingly difficult. (p53)

- *Handles*

  A handle can be defined as a sound that has been inserted within a composition with the specific intent of being memorable. In order to fulfill this criterion, the sound should be one with which the audience is already familiar. (p78)

- *Immediacy*

  Inspired by Slawson (1985), the idea of immediacy is introduced to define a situation where a sound commands a listener's complete attention. In an extreme case, the sound may appear to be physically close to the listener. (p21)

- *Landscape morphology*

  Sonic landscapes can be divided into many types according to their reality credibility. These can include hyper-real, real, abstract, virtual and non-real. (p41)

- *Media bonding*

  Media bonding concerns the degree to which timbral or extramusical aspects of a sound have been influenced by the medium by which they are carried. (p18)

- *Media space*

  Media space occurs where a communications medium is listened to, or watched by an individual audience member. (p32)

- *Reality credibility*

  Reality credibility is a measure of how authentic a soundscape appears to be. Reality credibility is highest in real-world, 'live' soundscapes. (p40)

- *Reduced soundscape listening*

  This is a listening process, where the listener abstracts individual sounds from a soundscape without considering any contextual relationships that might exist between those sounds. (p37)

- *Sonic rhetoric*

  Sonic rhetoric is a system of commonly understood codes that can be used by the composer to provoke a known and predictable response (decoding) from the audience. (p47)

- *Steering process*

  A steering process is a compositional device that enables the manipulation of the listening strategy chosen by an audience. (p68)

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Tables

CD Track	CD Index Point	Title	Date	Time
1		*Still Water*	1995	15'09"
2		*Undercurrents*	1993–1994	9'42"
3		*Breaking Spaces*	1995	12'00"
	1	movement 1		
	2	movement 2		
	3	movement 3 *Pyrotechnic!*		
4		*Till*	1996	10'23"
				Total Time 47'21"

Table 1.1: Creative work: Compact Disc track index

CD Track	CD Index Point	Work	Time in Work	Section	Page
1	1	*Undercurrents*	2'46"	2.8.3	25
	2		4'34"	2.8.3	25
2		*Still Water*	5'37"	2.8.5	26
3		*Still Water*	2'51"	2.8.5	27
4		*Till*	6'09"	2.8.6	27
5	1	*Still Water*	0'43"	3.5.6	43
	2		0'53"	3.5.6	43
	3		9'12"	3.5.6	43
6		*Still Water*	0'15"	3.5.8	45
7	1	*Breaking Spaces*	3'17"	3.6.2	49
	2		4'13"	3.6.2	49
	3		3'52"	3.6.2	50
8	1	*Undercurrents*	5'20"	4.8.1	68
	2		6'29"	4.8.1	68
9	1	*Undercurrents*	1'10"	4.8.4	72
	2		1'36"	4.8.4	72
	3		1'47"	4.8.4	72
10		*Still Water*	0'00"	4.8.4	74
11	1	*Pyrotechnic!*	7'30"	4.8.4	75
	2		8'37"	4.8.4	75
	3		9'23"	4.8.4	75
	4		10'25"	4.8.4	75
	5		11'23"	4.8.4	75
12		*Breaking Spaces*	5'00"	4.8.4	75
13	1	*Breaking Spaces*	0'00"	4.8.5	76
	2		0'38"	4.8.5	77
	3		1'03"	4.8.5	77
	4		1'40"	4.8.5	77
	5		1'56"	4.8.5	77
	6		2'10"	4.8.5	77
14		*Undercurrents*	0'45"	4.8.7	79
15		*Undercurrents*	0'25"	4.8.7	79

Table 1.2: Audio examples: Compact Disc track index

Sounds	Time	Agency	Function
Insect sounds	0'00"	Animal	Thin sonic lines
Twigs breaking	3'06"	Animal/human	Points
Footsteps	4'09"	Ambiguous	Human presence
Granular decompostion of insect, twig and footstep sounds.	7'23"	None	Texture with extreme spectral range unites previous materials.

Table 2.1: Environmental sound and structural function in *Still Water*

Time	Surrogacy level	Context
0'43"	Original sound	Environmental scene
0'53"	Second order	Abstracted scene
7'39"	Remote	Timbral dialogue

Table 3.1: Surrogacy levels and context in *Still Water*. **Audio example CD: track 5,** index 1,2,3

Time	Reference
0'00"	Smalley: *Névé*
3'30"	Dhomont: *Points de fuite*
5'28"	Risset: *Sud*

Table 3.2: Extrinsic, non-explicit references in *Till*

Primary controllers	Composer Listener Media
Secondary controllers	Style, Genre Education Compositional tools and techniques
Coding strategies	Contextual Narrative Timbral
Responses	Allocentric Autocentric

Table 4.1: Sonic communication methods in discovery strategy

Original Sound	Processed Sound	Outcome
Spatial panning	No movement	Left-right spatial pan
Noise based spectrum	Pitched spectrum	Noise based spectrum
No pitch contour	Descending pitch trajectory	Descending pitch trajectory

Table 4.2: Gestural linkage: sound transformation results

Section	Time	Comments
1	7'30"	Introduction: Abstract-timbral drone slowly unfolds and synthetic impacts are introduced.
	8'22"	Introduction of outdoor spaces that include real fireworks.
2	8'37"	Real crowd now react to synthesised impacts. Glissandi from real firework 'screamers' appended to synthetic impacts.
	8'43"	Previous crowd noises and glissandi are now transformed, but articulated in a real space.
	8'51"	Transformation: real space – real crowd – synthetic crowd – synthetic space.
3	9'23"	Undulating drone replaces synthetic ambience.
	9'28"	Short gestures from the crowd ("hurray!", applause) interact within the resonance of time-expanded firework impacts.
4	10'25"	Small-scale granular activity within large reverberated ambiences replaces the original ambience of the crowd recordings.
	10'55"	Synthetic attacks begin to take on dynamic morphology of real fireworks.
5	11'23"	Real firework impacts, but in a seemingly empty space (no crowd).

Table 4.3: Structure in *Pyrotechnic!*. Track 11 on the audio example CD has index points set at section boundaries.

Figures

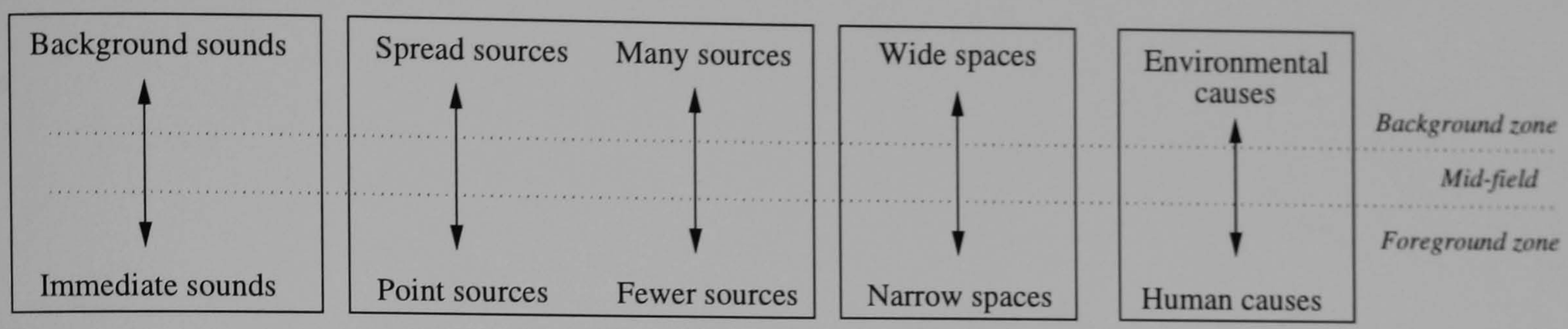


Figure 2.1: Relationships between spaces, source types and causal agency

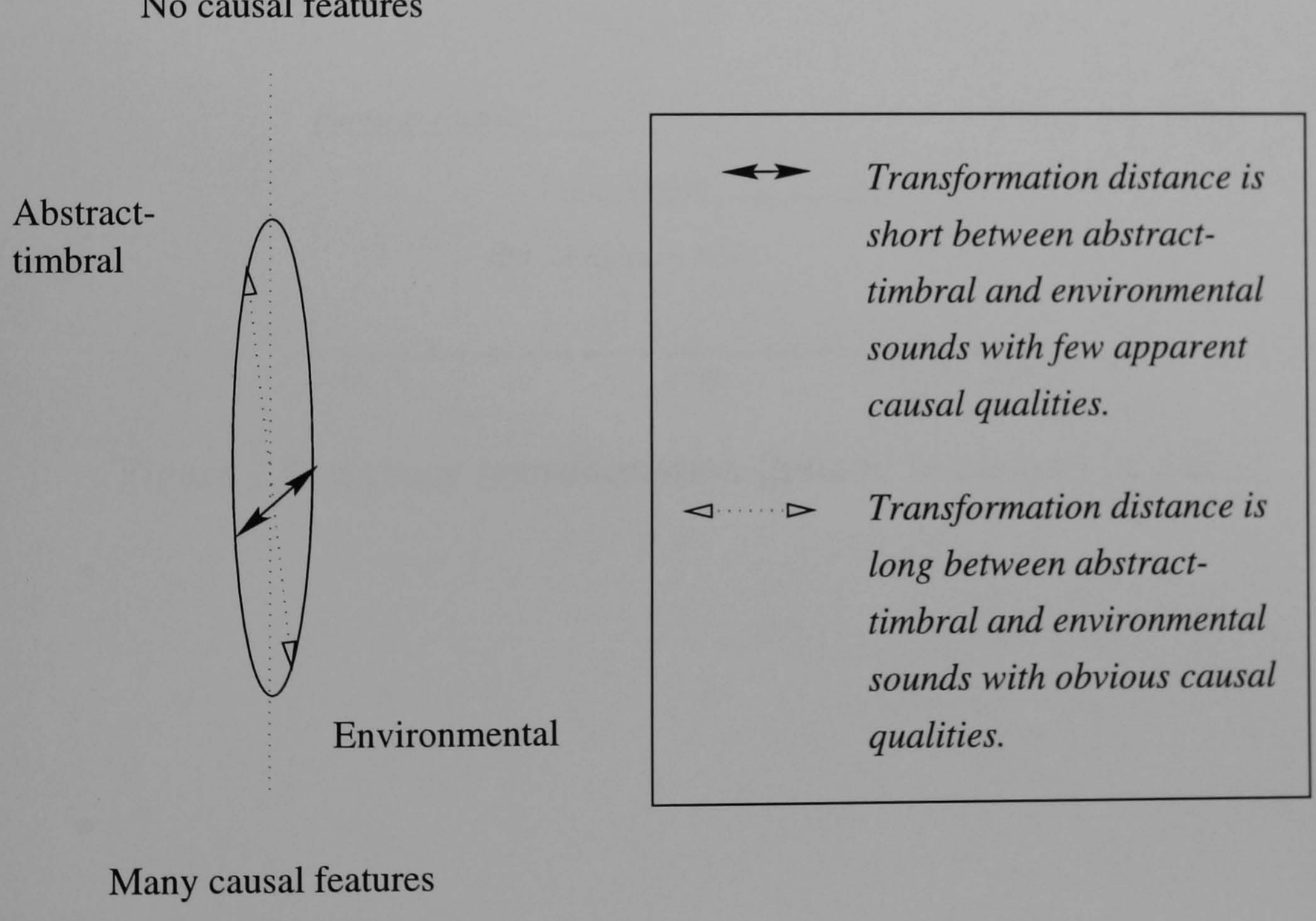


Figure 2.2: Transformation distances between abstract-timbral and environmental sounds

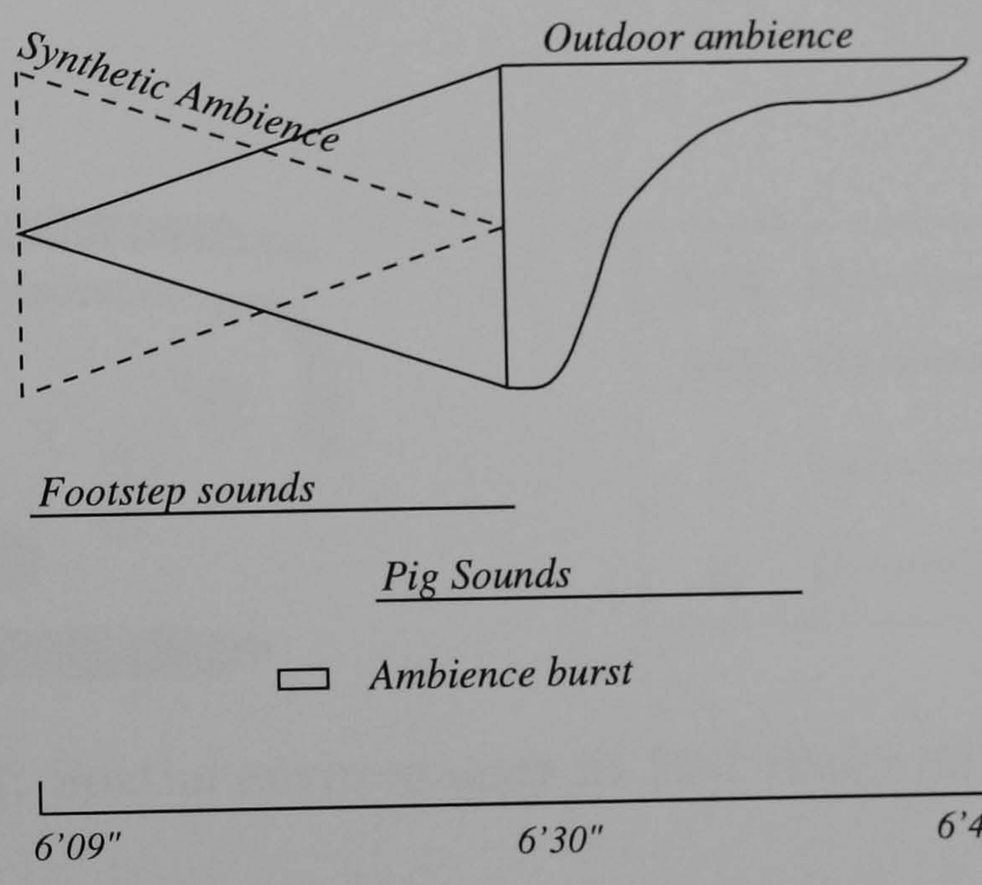


Figure 2.3: Agency transformation (human to animal) in *Till*

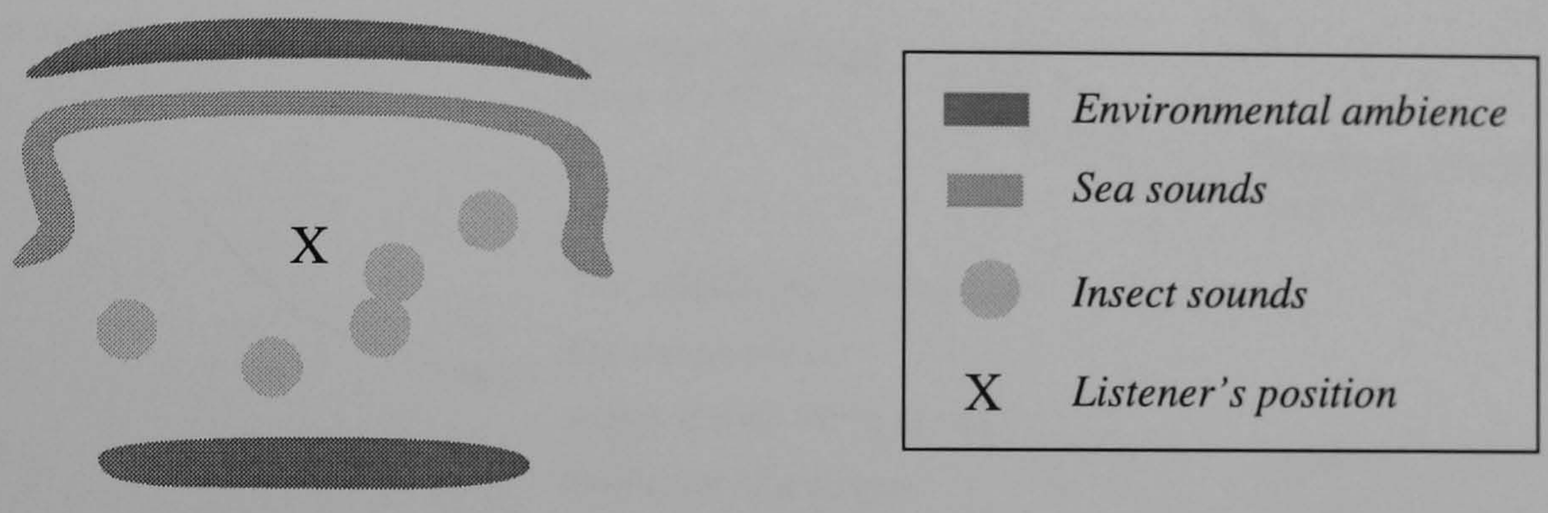


Figure 3.1: Spatial environments in *Still Water*: 0'00" to 0'58"

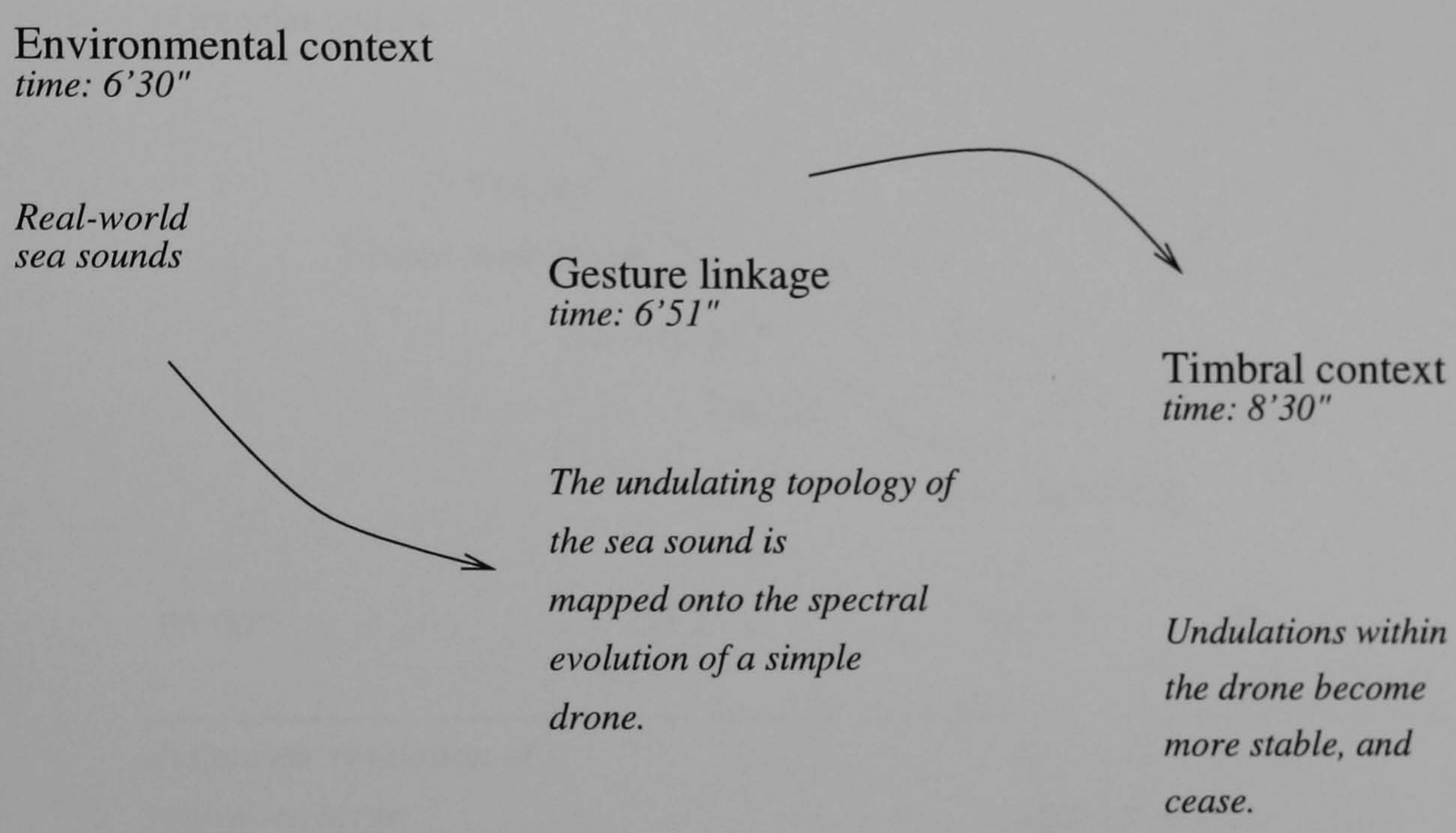


Figure 4.1: Gesture linkage between environmental and abstract timbres in *Undercurrents*

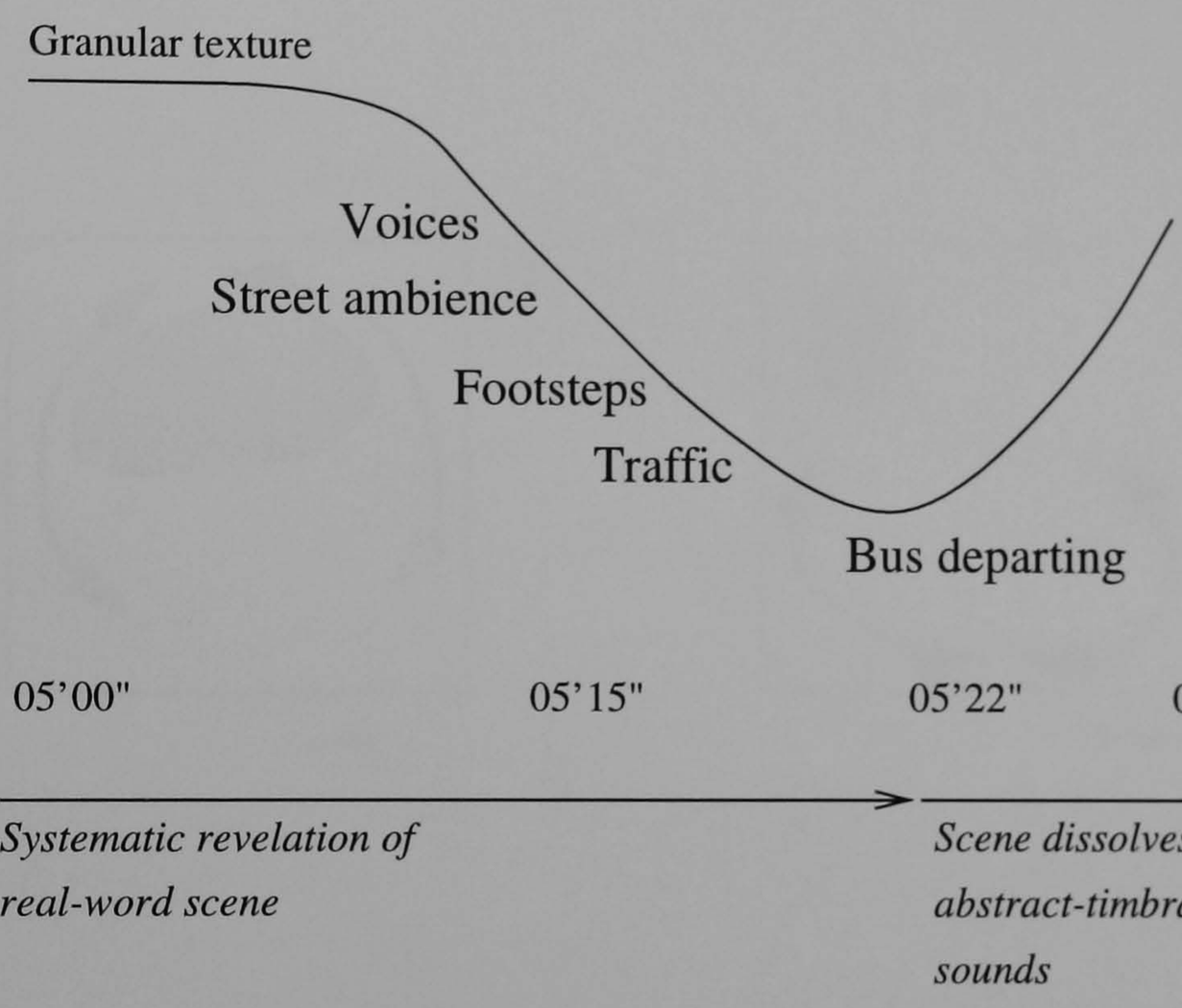
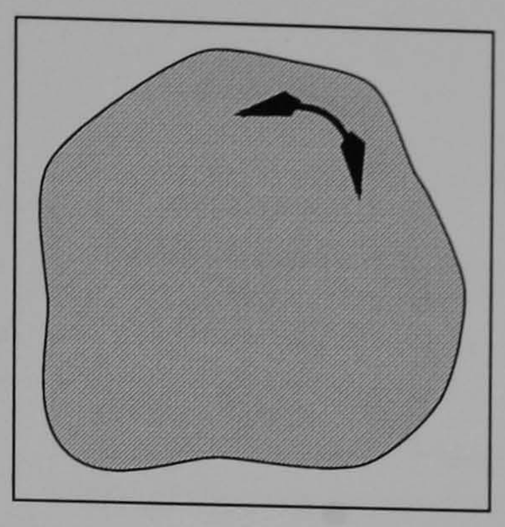
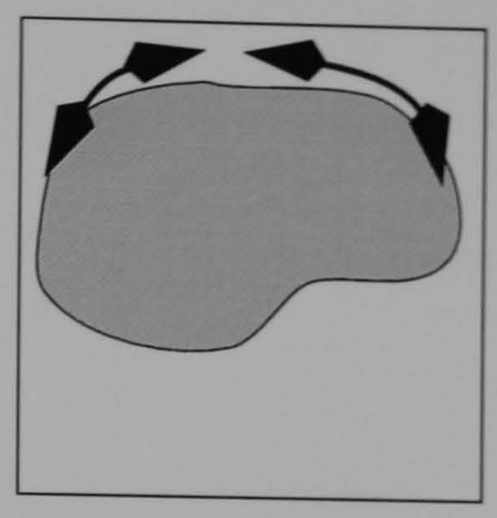


Figure 4.2: Contextual revelatory transformation in *Breaking Spaces*, mvt.2



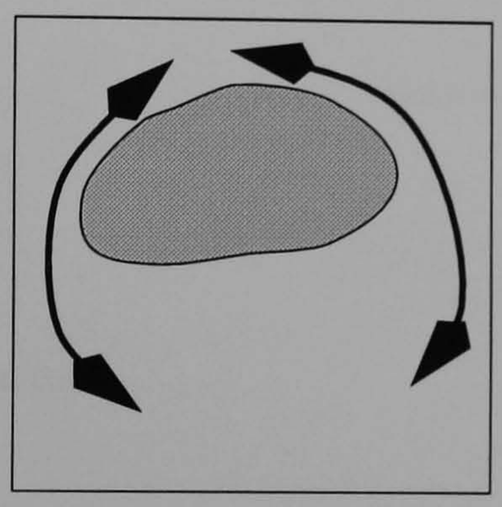
1

00'00''



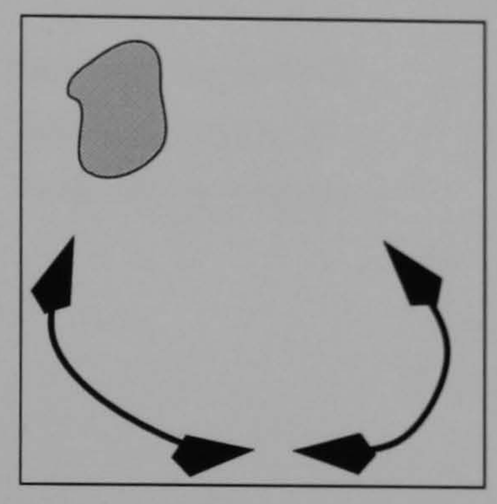
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00'38''



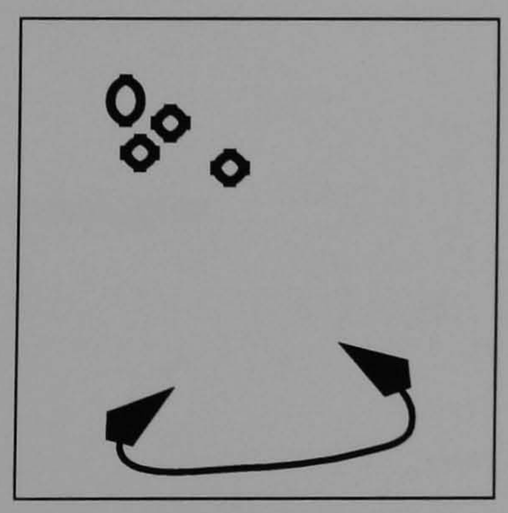
3

01'03''



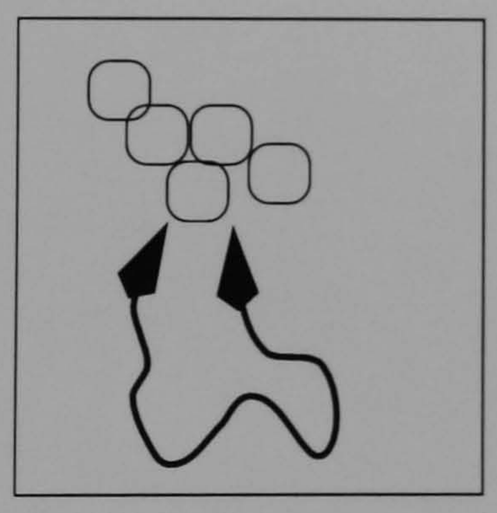
4

01'40''



5

01'56''



6

02'10''

Figure 4.3: Six-stage spatial transformation in *Breaking Spaces*, mvt.1. This figure has been adapted from Field (1997)

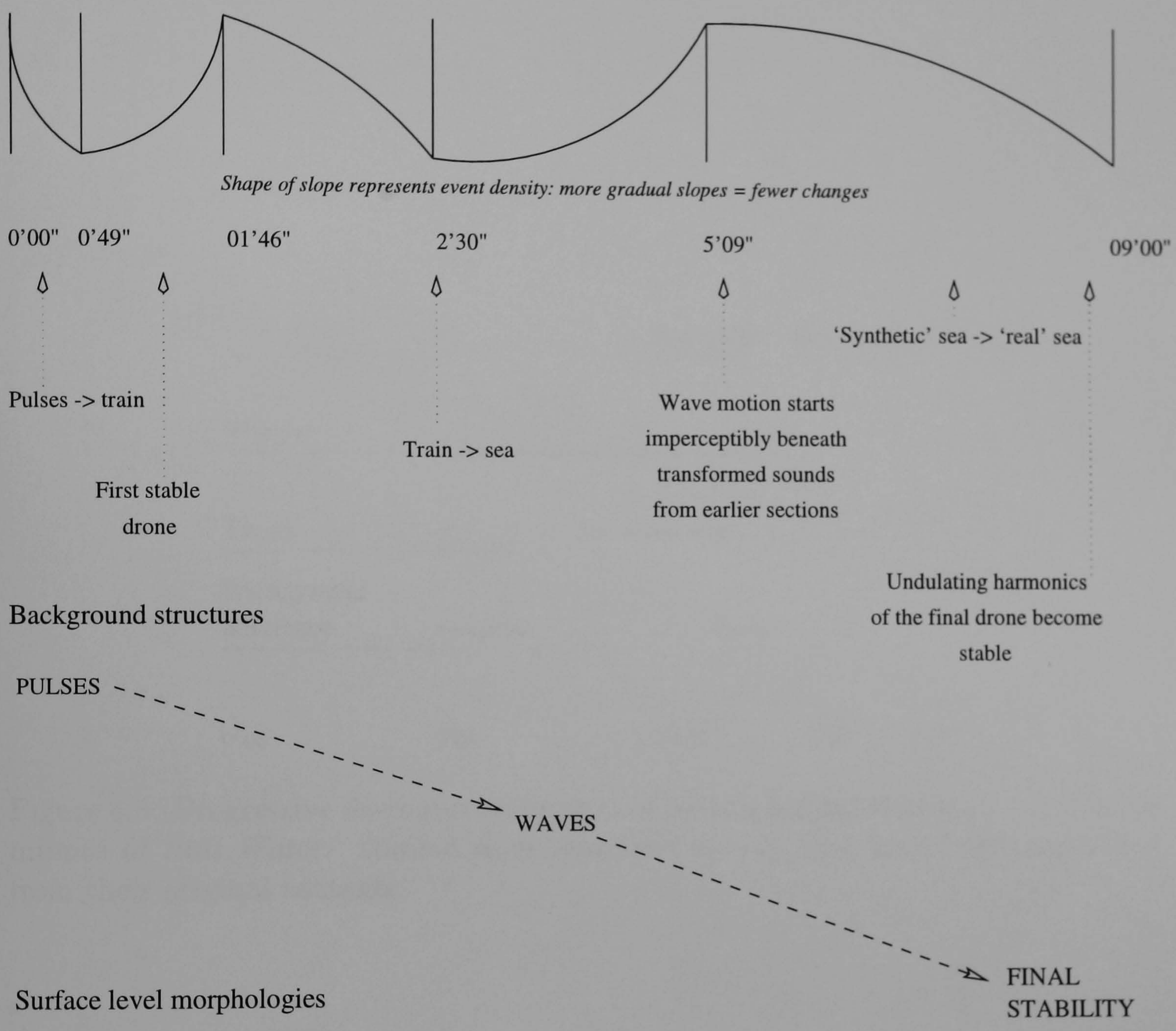


Figure 4.4: Structural consistency in *Undercurrents*. This figure has been adapted from Field (1996)

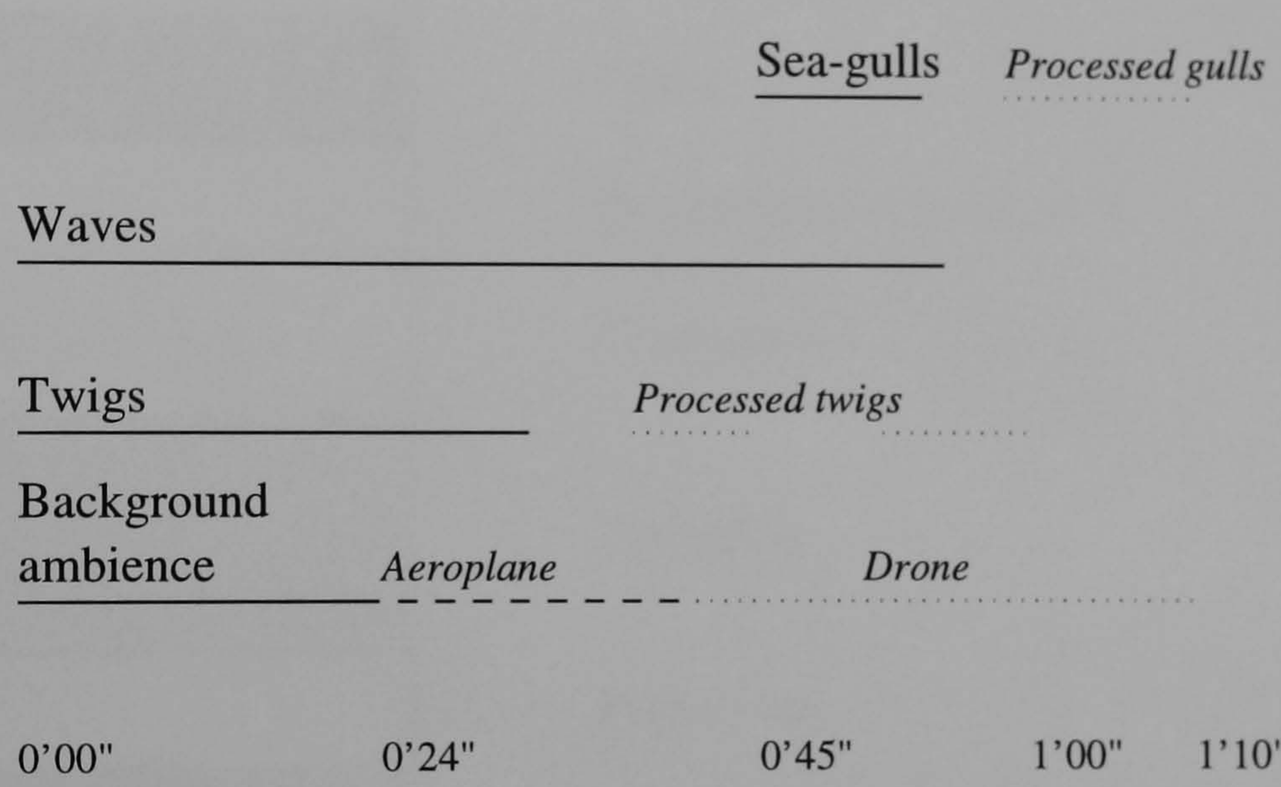


Figure 4.5: Progressive de-contextualisation of environmental sounds in the opening minute of *Still Water*. Dashed lines represent sounds that have been abstracted from their original contexts.

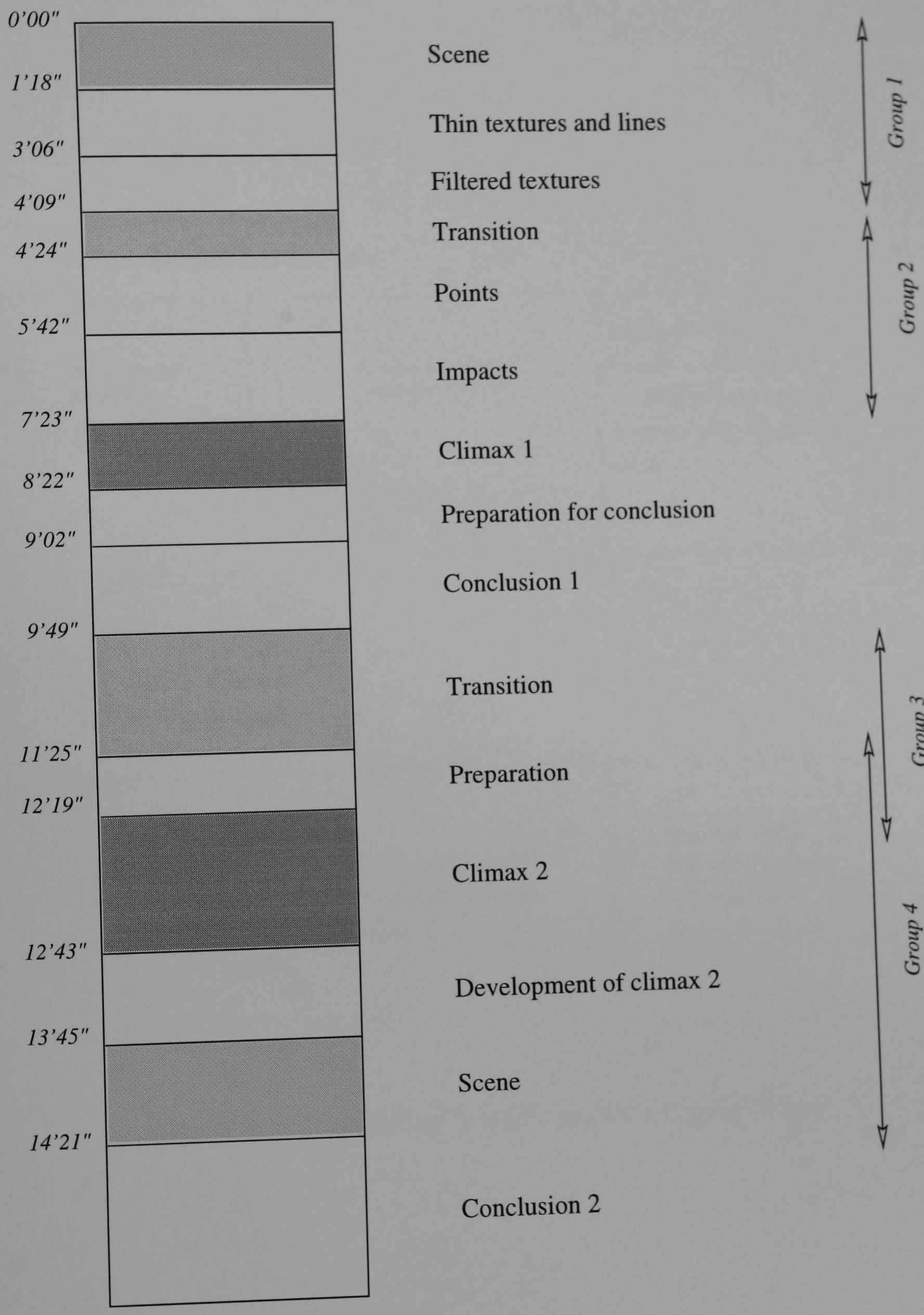


Figure 4.6: *Still Water*: structure

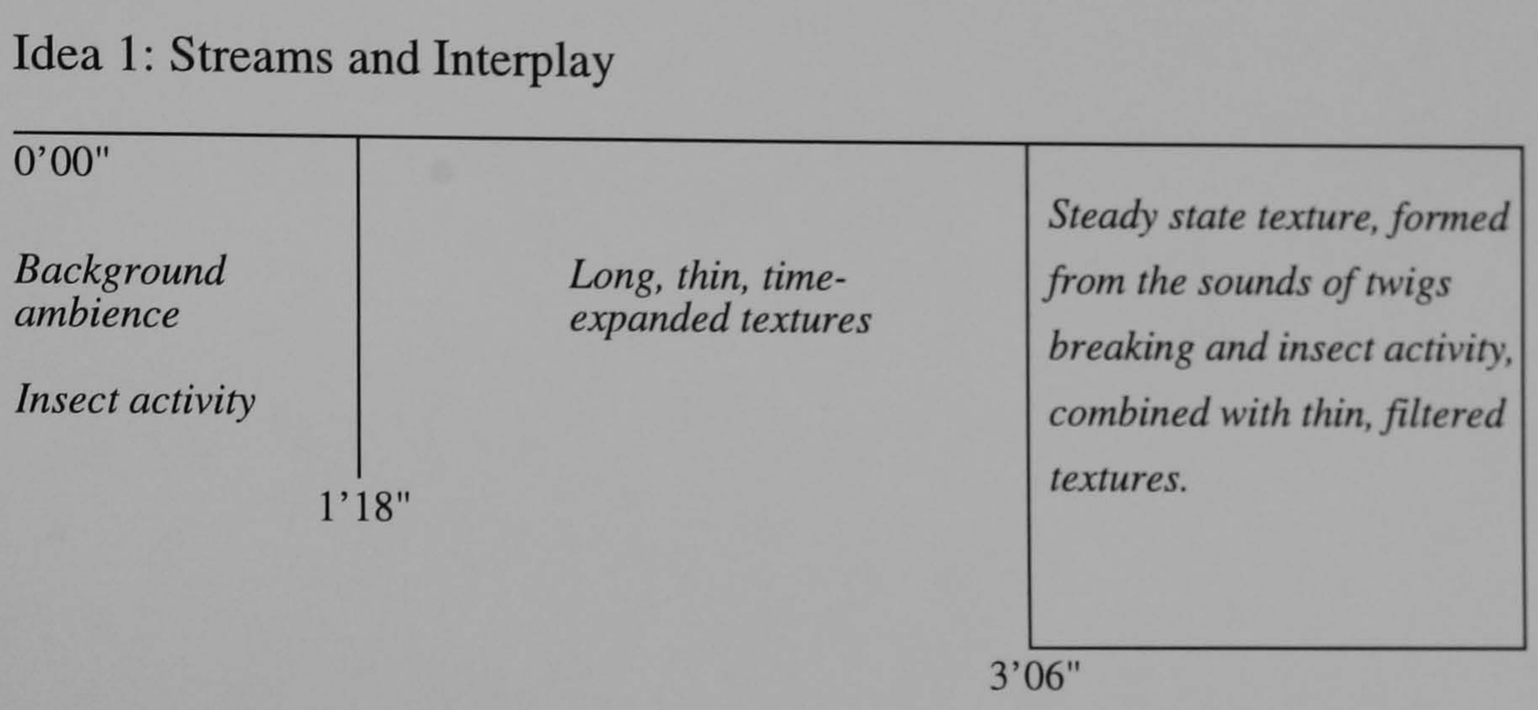


Figure 4.7: Three-stage transformations in *Still Water*

Plates

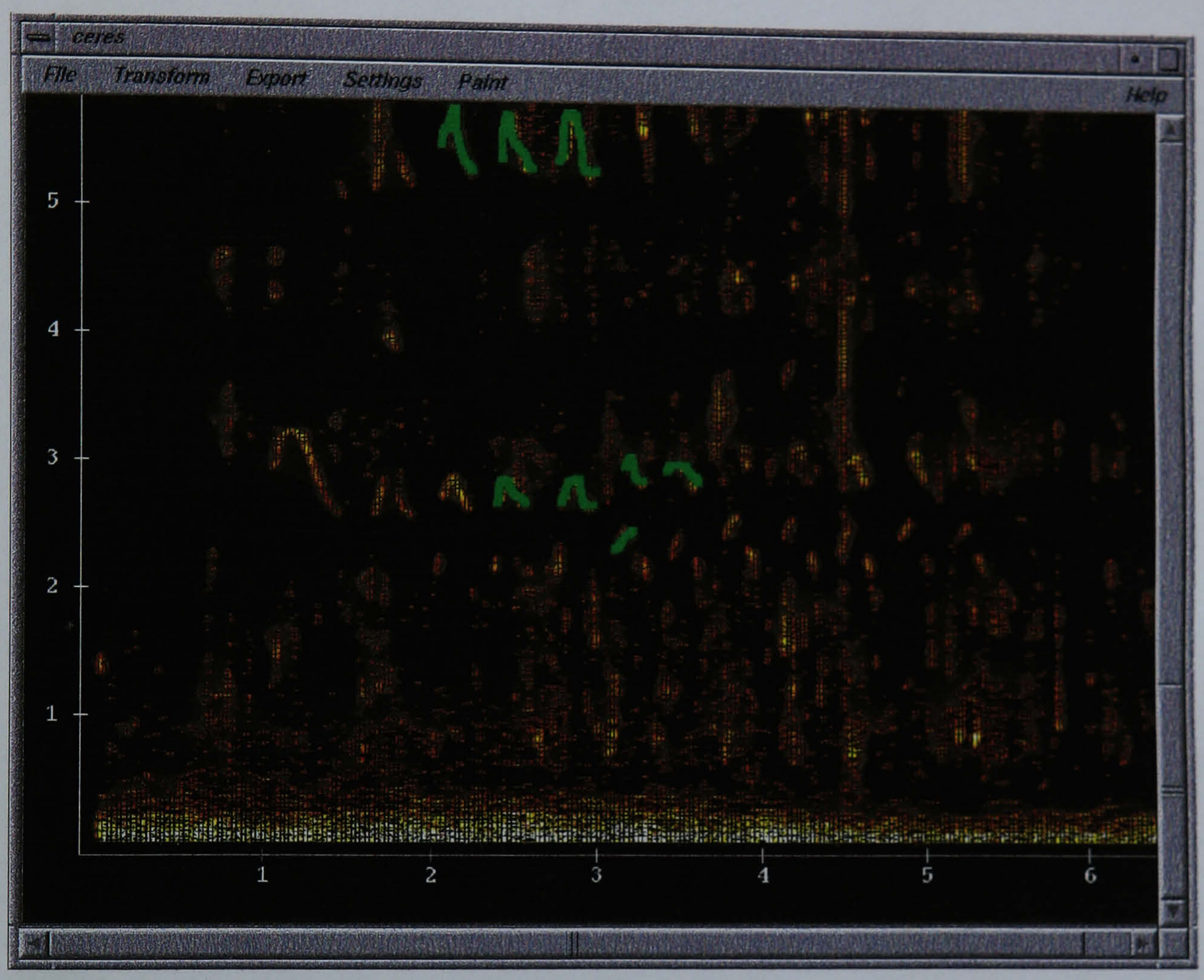


Plate 1: Spectral isolation in *Ceres*.
To isolate the sea-gull sounds from the surrounding ambience, spectral filters were painted onto the sonograph display. These areas are shaded green. Note how broad-band noise textures (shaded red and orange) surround the selected areas. These must be removed subsequently from the filtered sounds, by a spectral-dynamics process.

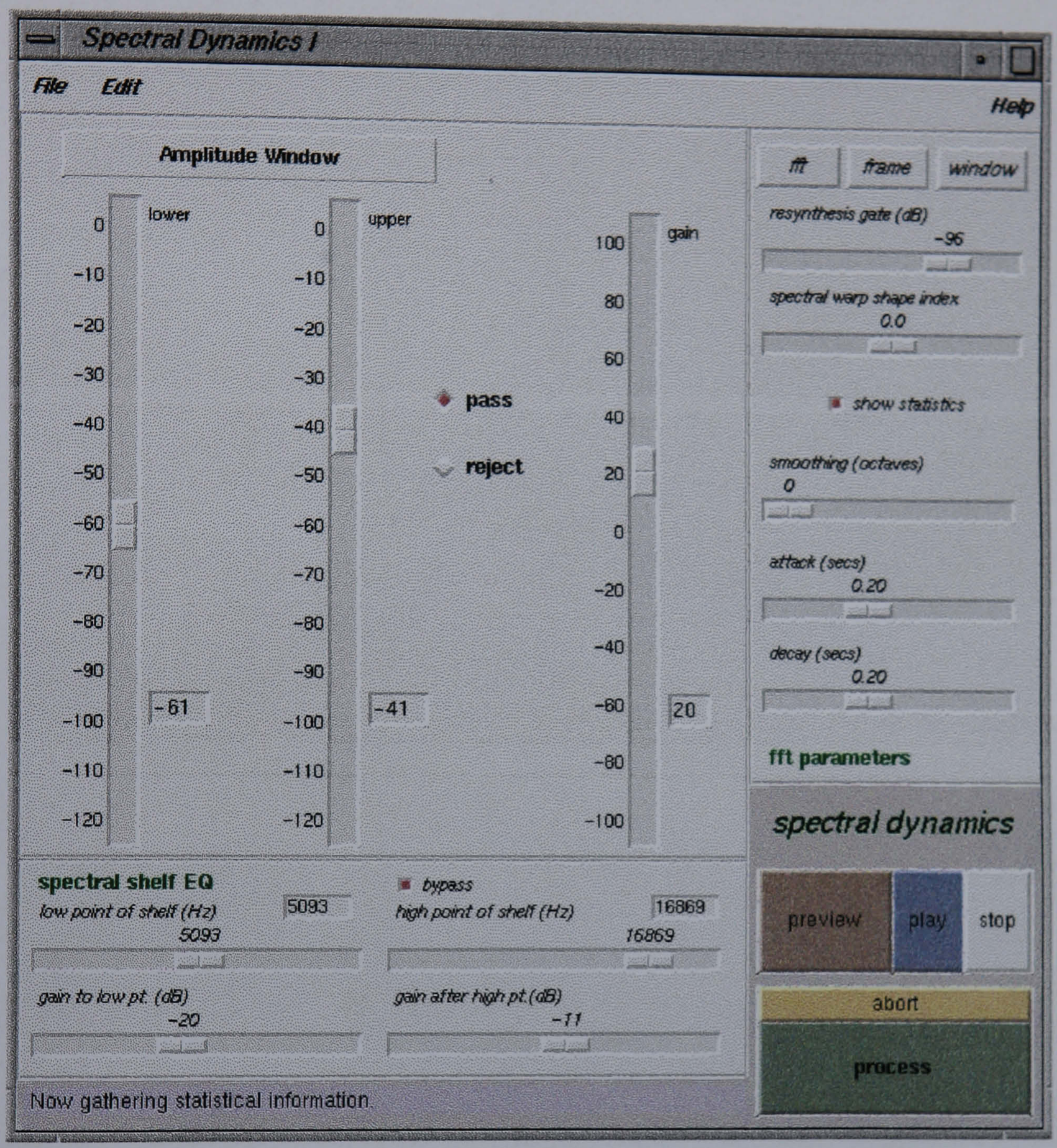


Plate 2: Spectral-dynamic isolation in the author's program *Isd*.
In this example, only sounds that have a dynamic level of between -60dB and -40dB are retained. Unlike a noise gate, the processing is spectrally dependent. This allows sounds to be exposed that were previously masked by others in different spectral zones.

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