TEXTURAL COMPOSITION: IMPLEMENTATION OF AN INTERMEDIARY AESTHETIC

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ABSTRACT

An approach to the creation of musical material, coined here as "textural composition," addresses aesthetic consequences of real-time stochastic sound mass composition. Musical texture as source material exists between sound-object (singular) and sound-objects (plural), inducing an aesthetic of the intermediary. Since sound diffusion is inextricably linked to composition, spatialization requires an approach conducive to the textural composition environment. This method of spatialization falls in an intermediary zone between point-source diffusion and the mimetic trajectory- or path-based spatialization informed by psychoacoustic principles. The aesthetic discussion is followed by the technical details of the author's work, *real-time tape music III*, a realization of textural composition.

1. INTRODUCTION

Dialectics may describe acousmatic music[1] and its use of acoustic space, i.e., its diffusion through loudspeakers. On the one hand, there are sound-objects delineated by characteristic spectromorphologies; on the opposing extreme, indistinguishable elements comprise soundscapes.[2] On one side, mimetic spatialization techniques dissimulate the loudspeakers to serve the illusion of movement and location. On the other side, point-source compositions embrace the loudspeakers as electromagnetic instrumentalists whose agency is fundamental to the composition. However, intriguing musics occur in the ambiguous mean between opposing points. If a gradient exists, intermediate elements become a third thing, as grey is neither black nor white. If the continuum is perceived categorically, then the midpoint becomes a fragile edge where substance appears to flip or flutter between extremes.

In particular, two intermediary positions, one in musical material and the other in spatialization, tender a fecund ground for development. In material, texture mediates between sound-objects and soundscape in a precarious boundary between both, suggesting a categorical perception of either. In spatialization, a gradient exists, where a third spatialization objective arises from intermediate domains: maximal mobility with minimal psychoacoustic cohesiveness of trajectory or location. The development and refinement of these intermediary aesthetics resulted in the work *real-time tape music III*, a real-time computer-generated composition. The technical implementation of this work provides an example of working within intermediate terrains.

2. TEXTURAL COMPOSITION

The qualities associated with sound-objects are metaphors from vision, taction, or corporality: volume, size, texture, mobility, etc. In fact, the very notion of a sound-object is a metaphor, however utilitarian. Metaphors intrinsically provide rich fields for continua since they often imbue ambiguity. The sound-object metaphor must be explored firstly. Then, it can be seen how the metaphor of texture can mediate sound-object(s) and soundscape. When the focus of composition centers on texture at the expense of other sonic qualities, one is no longer simply composing a texture. One is creating a textural composition, at which point the rich and varied world of musical texture may be developed. In this paper, "textural composition" is the practice of working with musical texture and subjugating other musical qualities for the express purpose of creating a sonic space on the boundary between sound-objects and soundscape.

2.1. Sound-Object – Sound Mass – Sound Monolith

The ontology of an object presupposes that it has boundaries distinguishing it from other objects. The metaphor of the sound-object exists because the qualities and gestalt behaviors of a sound's time-varying frequency spectrum distinguish it from the frequencies

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[1] The definition of acousmatic used here includes all visually sourceless electroacoustic music preoccupied with image-in-sound, sound-objects, and musical and acoustic spaces. This extends the definition beyond electroacoustic music fixed on a medium; real-time computer-generated music may be acousmatic provided it employs the same approaches to sound.

[2] Soundscape used here refers to the extreme "lo-fi" soundscape described by Murray Schafer and discussed by Simon Emmerson [2] and not the environmental compositions of the World Soundscape Project [6].

present in other objects. In other words, the qualities of a sound-object bound it away from other sound-objects in the acousmatic image.

When multiple sound-objects come together the result has been called a sound mass; the works of Xenakis come readily to mind. The qualities of a sound mass depend on the complexity and density of the constituent elements and the spectromorphology of the whole. The sound mass itself has its own boundaries. As Natasha Barrett points out in "Spatio-musical composition strategies", a sound mass exists by suggesting a "spatial occupation," or a volume of space occupied [1]. Yet, at the core of the sound mass are individual units with their own boundaries.

A multiplicity of sound-objects without boundaries results in a soundscape. In extreme cases, the boundaries of the objects are blurred. But, the notion of a soundscape still implies that, though possibly indistinct, multiple sound-objects exist.

Imagine, however, an alternative where only one sound-object expands to fill the entire musical space, and its qualities become the focus of attention. It denies the existence of other objects, as it occludes the acousmatic image. Its boundaries exist outside the "view" of the listener. It is not a sound mass, since it is too large for perceptible boundaries or gestalt behaviors. It is not a soundscape, because the imagination perceives the whole as one thing. At this magnification, the qualities of the sound-object advance to the level of compositional material. It is a sound-monolith, a sound meta-object, that carries details of sonic information that do not stand alone as objects themselves. A particularly rich trait at this magnification is texture.

2.1.1.   *Texture as Intermediary*

Texture does not exist in a vacuum. Rather, it qualifies a substratum. Texture characterizes the grain in a wood plank, the weft of cloth, or the silkiness of fur. And, it cannot be separated into constituent parts at a normative perspective. Where do the ridges begin and the valleys end in wood grain? Can we detect the individual threads in cloth or hairs in fur? Though it is possible to magnify an object, where cells, threads, and hairs achieve ipseity, they lose their identities as textures.

Musically, the challenge lies in magnifying the sound-object sufficiently, where texture exists as a sonic quality of a sound meta-object, but its engendering components are not perceived. The boundaries of its parts, if any, are blurred and belong to the same substratum. In other words, the components of a texture must correlate to each other, amalgamating as a result of mutual affinity.

In this sense, texture is an intermediary, existing in the continuum circumscribed by sound-object and soundscape. It neither exists in and of itself, but it is not a variegated compendium of unrelated sonic events.

2.2. The Ascendancy of Texture

The reception of texture as the compelling focus of listening demands that other musical attributes are subjugated or diminished in both function and attention. In "Spectromorphology: explaining sound-shapes," Denis Smalley asserts "a music that is primarily textural … concentrates on internal activity at the expense of forward impetus." Smalley's detailed descriptions of texture and its possibilities assume that texture is a complement of gesture [4].

However, for music that *is* texture and not merely textural, more than gesture must be sacrificed. The volume of the sound object must stretch beyond the imagined periphery of the space, negating the effect of the object's boundaries. The component sounds must correlate to each other so that their distinguishing features do not overwhelm and shift focus from the whole. The average spectromorphology of a given texture must remain static.

Furthermore, for texture to dominate musical listening, it must be developed and given compelling properties. In particular, dynamic textures (as opposed to static textures) more clamantly demand attention. Textural flux is a function of time and has a rate of change. As music occurs only in time, it stands to reason that dynamism figures as a potent factor in the ascendancy of texture as the central musical material.

On the spectrum from independent sound-objects to soundscape, engendering the monolithic substratum on which texture occurs is challenging. There is a fragile distinction between autonomous sound-objects and either a sound mass or a soundscape. Although one can incrementally increase sound events, there appears to be categorical perceptual distinctions between "few," "many," and "too many to individuate." Textural composition balances precariously between "many" and "too many to individuate."

3.   SPATIALIZATION

The composition of sound and its musical space is inseparably and reciprocally linked to its diffusion in acoustic space. In textural composition, the consequences are twofold. First, the size of the acoustic space must correspond to the size of the sound meta-object. Second, the mobility of the sounds must complement the dynamism of the texture.

Like the sound meta-object, space must appear to be limitless, where any boundaries are too distant to be perceived. Prospective space, as Smalley defines it, distinguishes forward from backward [5]. The frontal perspective focuses attention on the image laid before the listener. What occurs behind signifies only as it relates to the front. Prospective space inhibits the perception of a sound meta-object since the distinctions between forward and backward bound the meta-object spatially. Regardless of orientation, a listener must perceive that there is no true frontal perspective, what

Smalley calls *immersive space* [5]. All frames of reference must conflate so no boundaries exist in perspective. Density, activity, movement, etc., must homogeneously encircle the acoustic space and appear to continue beyond the acoustic space.

Next, a constantly mutable texture suffers from static spatialization; the sounds are incongruously immobile. Though not crucial to the perception of a dynamic texture, spatial movement enhances the texture. However, if the volitant sounds cohere into psychoacoustically mimetic trajectories, the paths individuate the sound-objects and distinguish them from the whole.

3.1. Mimetic and Point-Source Spatialization

Mimetic spatialization relies on what is known from psychoacoustics. The illusory or allusive juxtaposition of sound-objects in location, movement, or displacement evokes a subjunctive acoustic arena. In "Aural Landscape: musical space," Simon Emmerson calls this interaction "objects-motion-environment" [2]. This subjunctive space lies at the heart of the acousmatic image.

Mimetic spatialization places sound-objects around the acoustic space, some with motion, some without. The apparent physicality of mimetic spatialization provokes liminal responses to directionality and location: does this approach me? Does it recede? Is it dangerous? Must I move? Mimetic spatialization is as much about the human receiver as it is about the sounds themselves, on the threshold between psychological and physiological response by *subject* to *object*. Smalley refers to this relationship as a function of egocentric space [5].

In point-source spatialization, each loudspeaker embodies a musical presence. These electronic performers may be disposed in space in a fashion unimaginable for human performers. Still, they are static, immobile sources of sound. Material may pass from one source to another, but this motility recalls musical figures passing through an orchestra, e.g., from the first violins to the cellos.

The point-source loudspeaker democracy encourages omnidirectional, immersive space. For example, one can readily imagine a texture made of rain-like sounds, where each loudspeaker "performs" its material. However, it suggests stasis. Even if one imagines undulating intensities of rain passing through the space, the texture lacks horizontal movement on the microlevel (i.e., each drop of rain). This is not to say that point-source spatialization is necessarily static, nor does this address different approaches to point-source spatialization. Rather, this is a perspectival starting point.

3.2. Intermediary Aesthetic of Spatialization

In the subjunctive space of mimetic spatialization, space is bounded by the sound-objects in it. In the arena of point-source spatialization, the sounds belong to fixed points in the acoustic space, but each loudspeaker enjoys equivalent status. Textural composition requires a space between these approaches. An intermediary stance, incohesive mobility diffused equally around the listener, carves a relief between contrasting approaches to spatialization: the mimetic, trajectory-based practice and the point-source aesthetic.

Textural composition requires equality among loudspeakers (point-source) as well as in between loudspeakers (mimetic). Dynamic textures prosper in motile environments (mimetic) and subject-object inapplicability (point-source). Textural composition elicits an intermediary aesthetic of spatialization.

4. IMPLEMENTATION

The constraints expressed here for textural composition are: irrelevancy of the sound-object through voided attributes (e.g., illimitable space, static spectromorphology); the correlation between sonic components through density, blurred boundaries, and affinity; and the ascendancy of texture through dynamism. These prerogatives prescribe a process more suited to mass production of sounds with minimal localized interference on the composer's part. For this reason, one obvious solution presents itself in the use of stochastic and random methods[3]. Random and stochastic processes can control large quantities of changing sonic events with only a few manageable parameters, creating dynamic musical textures while negating other qualities. The random processes and their parameters have identifying characteristics, so there is a unity of events. And, random or stochastic processes operating at the structural level work independently of the sound sources, enabling the composer to choose sources for their capacity to correlate.

Random and stochastic processes generate *real-time tape music III* at micro- and mid-levels. Gaussian distribution random generators dictate individual sonic events at the micro-level. Markovian stochastic processes manage textures at the mid-level. Uniform distribution random generators control spatialization. The form is pre-determined in time. The piece is implemented in Pd-0.40-2 on a 3GHz 8-core Mac.

4.1. Form

Two contiguous movements form *real-time tape music III*. The first movement serves a didactic purpose, inculcating textural listening through gradual accumulation of sound-objects and slower formal changes. The first movement ends with a crescendo immediately followed by a transitional section that rebuilds a new texture leading to the main section. The main section comprises the majority of the work and

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[3] In this paper, random process means any probability operation, in general, while stochastic is reserved specifically for goal-oriented processes, e.g., processes with an equilibrium state.
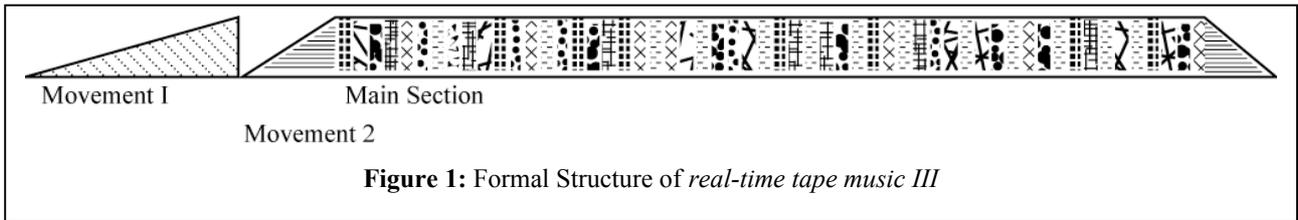
Figure 1: Formal Structure of *real-time tape music III*

constitutes the textural composition. The piece ends with a pre-determined texture.

4.2. Musical Material

The source material for *real-time tape music III* comes from recordings of acoustic instruments and environmental sounds stored in ten separate soundfiles. Spectral and temporal features of the sounds determined their selection for the work, chosen for a balance between mutual congruity and diversity. Each soundfile contains multiple sounds from the sources including silence.

Soundfile	Source
Soundfile 1	Close-mic'd elastic band
Soundfile 2	Close-mic'd carbonation bubbles in aluminum can
Soundfile 3	Cello passage
Soundfile 4	Cello and percussion passage
Soundfile 5	Orchestral attacks
Soundfile 6	Aluminum tab, plucked
Soundfile 7	Processed violin passage
Soundfile 8	Processed violin crunch bowing
Soundfile 9	Processed violin harmonics
Soundfile 10	Woodwind passage

Table 1: Soundfile contents

4.2.1.   Random Sampling

The soundfiles are sampled at regular temporal intervals. Gaussian distributions determine the mean and deviation of the starting point, duration, pitch/speed, and loudness of each sample from a soundfile. Sampling techniques only utilize procedures available in tape techniques, i.e., cutting, splicing, slowing, speeding; hence, the title "real-time tape music."

Since the soundfiles contain multiple sonic events from each source, the parameters of the Gaussian distributions controlling sample playback determine the characteristic results. For example, narrowing the deviation of the distribution limits the diversity of sounds. Choosing a mean starting point earlier in a soundfile creates different results than a mean starting point later in a soundfile. The silence in the soundfiles ensures that, despite the regular sample triggers, resultant sounds do not conform to a pulse. The individual samples are layered and sent as a single signal stream to the spatializing patch.
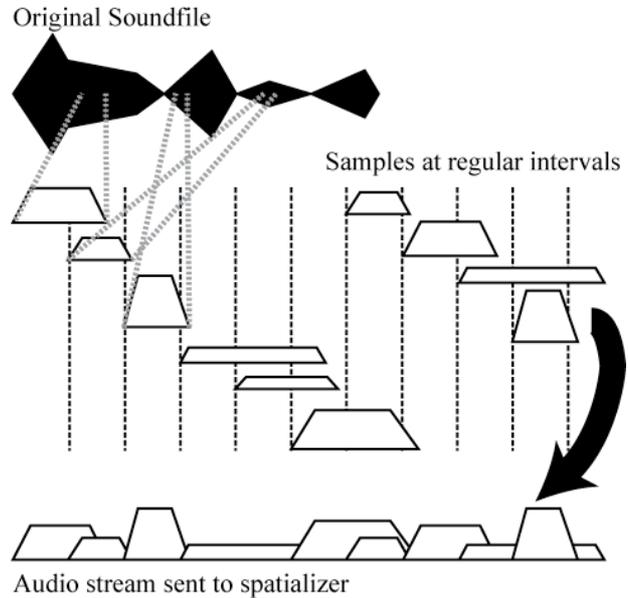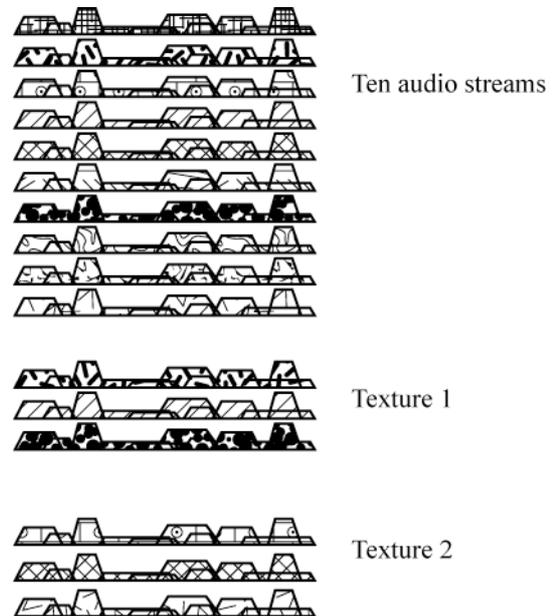

Figure 2: Random sampling of soundfiles

Figure 3: Example textures

4.2.2.   Stochastic Form in Texture

A texture depends on two factors: the combination of the soundfiles being sampled and the parameters of the Gaussian random generators sampling the soundfiles. Eight textures comprise the main section of the work. The eight textures are a pre-determined combination of audio streams from soundfiles. Over the course of the

main section, the Gaussian parameters for each soundfile change slowly. The rate of change allows the eight textures to maintain their identities; however, the larger overarching change creates formal level interest.

A Markovian matrix first used by Iannis Xenakis in *Analogique A + B* [7] determines the order in which the eight textures appear and reappear, changing every 500 msec. The nature of the matrix guarantees an equilibrium state where the probabilities of the eight textures do not change from stage to stage. Throughout the main section, the system is "seeded" with a single texture which, due to the Markovian probabilities, returns to equilibrium. This procedure occurs in real-time, utilizing a portion of a patch created for the analysis of *Analogique B* [3].

4.3. Spatialization

The random sampling and stochastic form is computationally expensive. Therefore, spatialization must be achieved using minimal resources. Loudspeaker amplitude, interaural time delays, and artificial reverberation fabricate a motile environment that does not rely on spatializing each individual sample.

The environment is mapped as a circle; each audio stream is sent in a path along the circle (Figure 4, A). A copy of the audio stream passes through a variable delay line that oscillates in and out of phase with the original signal. The phased copy of the audio stream traces a path 180 degrees opposite the original stream. The phased copy acts as an interaural time delay, creating the impression that sounds are moving across the circle as well as around (Figure 4, B).

A random number generator determines the strength of the signal to send to the reverberation patch. The output of the reverberation patch is statically assigned to four locations in the circle. The relative amounts of reverberation act as variable direct-to-reverberation levels, giving the impression that the sounds are sporadically moving outside the circle (Figure 4, C).

At any given moment, at least three independently controlled audio streams are moving through the circle. The multiple audio streams, random spatialization, phased copies, and reverberation result in the impression of exaggerated, incohesive movement in the space (Figure 5).

4.3.1. *Loudspeaker Amplitude*

The amplitude of a signal in a loudspeaker is determined by the virtual angle on the circle of the signal, the actual angle where the loudspeaker is located, and the "skirt" or the arc length of a signal. Since these variables are adjustable, the spatialization patch will work with any azimuth speaker configuration. The signal skirt must be adjusted for the number of speakers available. If the skirt is not wide enough for configurations with fewer speakers, the signal will disappear in the spaces between speakers. (This is an interesting effect, but not the desired one for these purposes.)
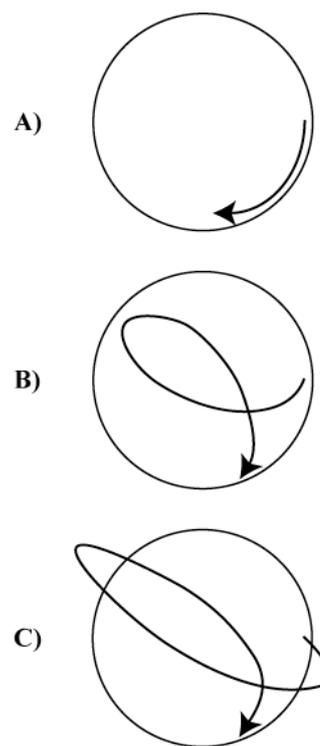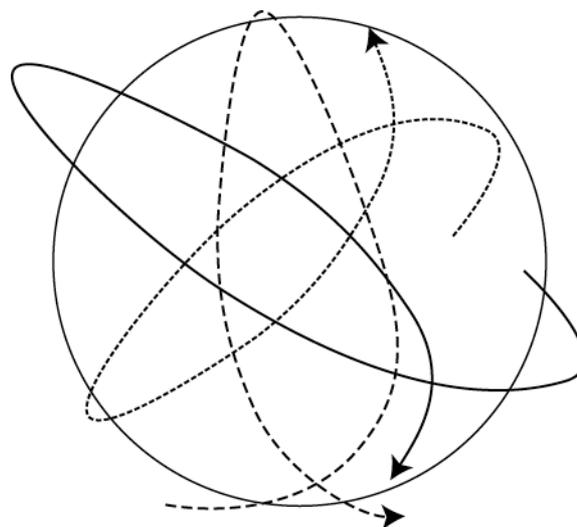

Figure 4: The accumulated effects of spatialization.

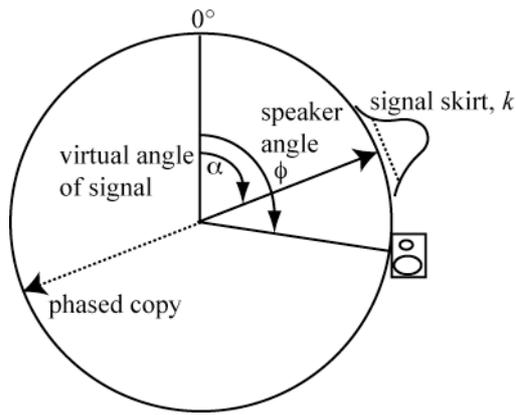**Figure 5:** Result of multiple, independent audio streams

Figure 6: Spatialization variables

Given that the speaker angle is within the arc of the signal skirt, the amplitude of the signal in a speaker is determined by a cosine weighting:

$$\text{amplitude of signal} = \cos(\frac{\pi|\alpha - \phi|}{2k}) \qquad (1)$$

5. CONCLUSION

Stochastic and random processes with appropriate parameters and sound sources engender textural composition, where neither sound-object nor soundscape dominates the work. Conjointly, spatialization spanning both mimetic and point-source principles strengthens the delicate balance between sound-object and soundscape. These medial approaches to sound and space define an intermediary aesthetic.

The author's work, *real-time tape music III*, demonstrates textural composition in a real-time computer-generated work. Uniform and Gaussian random number generators control micro-level events, while Markovian stochastic generators control structural events. These musical materials constitute the detailed texture of a sound meta-object. Loudspeaker amplitude, interaural time differences, and direct-to-reverberation ratios give the impression of plenary motion with little psychoacoustic cohesion into trajectories or paths.

6. REFERENCES

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