Textural Composition and its Space

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Abstract – The aesthetic implications of real-time stochastic sound mass composition call for a new approach to musical material and spatialization. One possibility is found in the fertile ground of musical texture. Texture exists between notions of the singular sound object and the plurality of a sound mass or lo-fi soundscape. Textural composition is the practice of elevating and exploring the intermediary position between the single and the plural while denying other musical attributes. The consequences of this aesthetic principle require a similarly intermediary spatialization conducive to textural listening. This spatialization exists between point-source diffusion and mimetic spatialization. Ultimately, the ramifications of textural composition affect both the space in the sound and the sound in space. This paper introduces the intermediary aesthetics of textural composition focusing on its spaces. It then describes an implementation in the author's work, *real-time tape music III*.

I. Introduction

Xenakis developed stochastic operations to create sound masses [1]. Since his work, composers have been exhausting computer methods for generating stochastic models. However, new development must continue in the application and aesthetics of stochastic methods, and not simply in the methods themselves.

Sound objects, Truax's "space in sound" (timbre), and "sound in space" (diffusion) [2] dominate the aesthetics of acousmatic music. Despite the generally, accepted fixed-medium definition, acousmatic music does not necessarily exclude real-time compositional practices [3]. Therefore, acousmatic music includes real-time computer-generated music provided it is preoccupied with sound objects, spatialization, and the sound image engendered by both.

The *real-time tape music* series evolved from stochastic sound mass composition contextualized by acousmatic principles of sound objects and space into something perceptually different: textural composition.

Textural composition resides in the intermediary regions between dialectical poles identified in electroacoustic, specifically acousmatic, composition. By subjugating gesture, primarily, and other musical attributes, secondarily, textural composition occupies the spaces between dialectics.

Dialectics in acousmatic music exist both in sound material and its spatialization. The single sound object opposes the lo-fi soundscape first described by Murray Schafer [4]. In spatialization, mimetic practices dissimulate the loudspeakers, while point-source compositions embed musical agency within the loudspeakers.

Spaces between dialectics can be experienced two ways. If gradient stages exist, an intermediary position can be a grey between black and white. If the dialectics are categorical, the intermediary position is marked by a fragile boundary where something can oscillate between each category. Music existing in the grey areas or on fragile boundaries begets intermediary aesthetics.

In acousmatic music, texture is poised on the delicate edge between the categorical singularity of the sound object and the ambiguous plurality of the soundscape. Spatialization in acousmatic music can exist in a shade of grey where mimetic aesthetics merge with the democracy of point-source diffusion. This intermingling creates immersive spatial motion in all perspectives without necessarily engendering psychoacoustically cohesive trajectories of sound in space.

First, this paper briefly contextualizes textural composition within acousmatic practice, then addresses the nature of texture itself in its duality with gesture. The focus on texture comes to the first dialectic: the sound object versus the soundscape. It proposes a sound meta-object, an intermediary between this dialectic.

The sound meta-object carries with it ramifications for both the space of the meta-object and the meta-object in space. This paper discusses space and the meta-object in terms of scale, movement, physicality of the listener, and perspective, arriving at the second dialectic: mimetic spatialization versus point-source diffusion.

Finally, a description of an implementation of textural composition, *real-time tape music III*, examining the stochastic and random processes used concludes the paper.

II. Arriving at Textural Composition

The aesthetic foundations for the sound-mass compositions leading to textural composition form the basis for the discussion of textural composition and the spaces it incurs. Therefore, a brief survey of the aesthetic questions contextualizes textural composition and aids in defining it.

The underlying purpose for the *real-time tape music* series grew from the need to dissolve popular distinctions in electroacoustic music. The aim was to pursue typically acousmatic objectives using traditional tape techniques while capitalizing on real-time computer-generated controls (e.g., stochastic processes) to create "live" acousmatic works.

One of the fundamental acousmatic concerns that contextualizes *real-time tape music* is its focus on space. Smalley states that "acousmatic music is the only sonic medium that concentrates on space and spatial experience as aesthetically central," even though he concedes that his ideas can be applied to "other electroacoustic music

genres which possess an acousmatic component" including live and interactive genres [5].

Harrison makes a similar statement in comparison to instrumental music. Space can play a more defining role in electroacoustic music than instrumental music. However, Harrison emphasizes that this true in electroacoustic music especially "in which the cause of the sounds is not seen or necessarily implied [6]."

Therefore, the acousmatic sound sources (i.e., the veiled sound source) coupled with the central focus on space firmly situate *real-time tape music* as an acousmatic endeavor. Yet, Harrison's own definition of acousmatic music ("predominantly 'tape' music, music 'on a fixed medium' … descended from *musique concrète*") problematizes this context [6].

Harrison more profoundly segregates aesthetic approaches based on a much older distinction: that the remnants of the dispute between *musique concrète* and *elektronische Musik* could be found in what he classifies as "organic" and "architectonic" music. In architectonic music, structures depend on "quantifiable distances *between* musical events (in all parameters)." Organic music "explores the qualitative evolution" of musical events. And, all parameters include the spatialization of the events themselves [6].

Harrison explicitly defines sound diffusion as the "realtime (usually manual) control of the relative levels and spatial deployment *during performance*." And, he argues that the explicit structures of architectonic music requiring sounds to be at specific distances to each other at specific times do not lend themselves to such diffusion. On the other hand, live diffusion not only suits but supports the qualitative evolution of organic music [6].

Harrison's definition severely narrows the domain of spatialization. But even Smalley includes a similar definition as one aspect of what sound diffusion can mean: as "'sonorizing' the acoustic space and the enhancing of sound-shapes and structure in order to create a rewarding listening experience [7]."

Therefore, *real-time tape music* not only had to focus on space as its central issue, but it had to address real-time sound diffusion as well. Stochastic processes controlled the sampling and playback of sound files to create sound objects in real-time. These sound objects were then diffused in real-time using similar processes in order to suit the qualitative environment wrought by the objects.

The stochastic processes, however, embodied another aesthetic: the sound mass. Promptly, sound material and diffusion thickened until sound objects became sound masses. Powerful personal computing allowed for more layers of processes, objects, and spatialization. The result of this aggregation could only be heard as something significantly different than sound mass or sound objects. The work, *real-time tape music III*, explores this new domain, coined by Hagan in [8] as "textural composition."

III. Gesture and Texture

Many composers have identified a gesture/texture duality but often with different perspectives. Two perspectives, one by Murray Schafer and one by Smalley, offer a starting point for addressing the difference between textural composition and material that is textural.

Murray Schafer distinguishes gesture from texture in terms of number and attention. For Schafer, gesture indicates a unique event. Texture, on the other hand, consists of innumerable events. More important to this distinction is the perception of these polarities: gesture is the "noticeable," while texture can only be perceived "in masses or cluster formations [4]."

Smalley contributes another quality that divides gesture from texture: "The energy-motion trajectory of gesture is… not only the history of an individual event, but can also be an approach to the psychology of time [9]." Therefore, the real and subjunctive passage of time plays a fundamental part in whether material is gestural or textural.

Time as a function of music becomes forward motion or linearity. Smalley distinguishes gesture from texture in terms of this directionality. He states, "A music which is primarily textural, then, concentrates on internal activity at the expense of forward impetus [9]."

Murray Schafer and Smalley pinpoint the fundamental aspects of music that ultimately beget textural composition: number and its apperception, and a modified approach to time. These aspects lead to a dialectical investigation of the acousmatic sound image. And, it is in the boundaries between dialectics that textural composition lies.

IV. Sound object versus Lo-Fi Soundscape – Number and its Apperception

Descriptions of the metaphorical sound object are also metaphors of vision, taction, or corporality: volume, size, texture, mobility, etc. The intrinsic ambiguity of metaphors creates rich intermediary positions. The metaphor of texture offers a particularly fecund continuum. Textural composition is the practice of working within musical texture to subjugate other metaphorical qualities for the express purpose of creating a sonic space on the boundary between sound objects and the lo-fi soundscape defined by Murray Schafer [4].

A distinctive sound object exists because its spectromorphology distinguishes it from other sounds. Sound objects have sonic boundaries drawn by the time-varying frequency spectrum and gestalt behavior. In other words, the qualities of a sound object bound it away from other sound objects in the acousmatic image.

When a critical mass of sound objects comes together, the result can be the lo-fi soundscape, where objects are blurred into each other, or a sound mass, where objects are distinctive, but amount and behave together.

A multiplicity of sound objects without boundaries results in a lo-fi soundscape. In extreme cases, as Murray Schafer describes it, "individual acoustic signals are obscured in an overdense population of sounds. The

pellucid sound—a footstep in the snow, a church bell across the valley or an animal scurrying in the brush—is masked by broad-band noise [4].” The notion of a soundscape still implies that, though indistinct, multiple sound objects exist.

The sound mass can be seen as an intermediary. It consists of individual objects, but takes on essential sonic boundaries much like the single sound object. Yet, at the core of the sound mass are individual units with their own boundaries.

Textural composition provides an alternative to the sound mass intermediary. One sound object expands to occupy the entire musical space, and its boundaries exist beyond the acousmatic image. Without boundaries or gestalt behaviors, it is not a sound mass. Though this could become a lo-fi soundscape, it is not. The imagination perceives the whole as one thing, not amalgamated multiple things. The sound object is magnified into a sound meta-object, and its musical attributes advance to the level of compositional material.

A sound meta-object requires substantive space, both in terms of the space in the meta-object and the meta-object in space. More importantly, it is crucial that the space facilitates texture’s dominance as the central musical material while diminishing the influence of other attributes.

V. Space in the Sound Meta-Object

Texture cannot exist alone; texture is a quality of some material. The rough grit of sandpaper requires the substratum of paper. Furthermore, the elements yielding the texture cannot be separated into individuated items without destroying the texture itself. To see or feel the individual grains of sand on sandpaper is to necessarily lose the “rough grit” experienced at normative perspectives. Yet, to discuss the texture of the sandpaper and nothing else means to frame only that aspect. One can say, “Feel the grittiness of this sandpaper,” and the attention is drawn to texture.

Drawing one’s attention to the texture of the sandpaper sacrifices the other qualities to which one can attend: e.g., the shape of the paper (is it a sheet or designed for a belt sander?), the color (e.g., is it emery or aluminum oxide?), or the flexibility (e.g., is it cloth or fiber sandpaper?).

Likewise, textural composition requires a shift in attention that diminishes other musical parameters. The sound meta-object serves this purpose. Several factors conduce to spawn a sound meta-object with sufficient space to carry texture: singularity, volume, and time.

First, the meta-object is a single unit. The edge between a unit object and multiple objects where the meta-object resides is categorical and requires a delicate balance of multiple factors. The tenuous existence of the singular sound meta-object depends on, among other things, the component parts’ mutual compatibility - that they appear to belong to one ideational thing. The grain of the texture must not stand out as single sound objects. Furthermore, these component parts must maintain an overall, unchanging, average spectromorphology to further enforce the singular.

Second, the volume of the meta-object must extend beyond the periphery of the acoustic “view” and subsume the listener, negating any potential for the whole to act as a sound mass.

Barrett identifies density, texture, and amplitude as key contributing factors to “implied spatial occupation [10].” Truax notes that spectral richness, duration, and asynchronicity collude to affect perceived volume [2]. On the one hand, Barrett is characterizing sound masses, while Truax is discussing a single, complex sound. But, both formulas apply to the sound meta-object.

However, these qualities of cyclopean volume contravene the characteristics of the singular meta-object. Therefore, textural composition exists on a categorical, fragile edge between the magnitudinous singularity and the multitudinous mass, an intermediary aesthetic [8].

Time becomes a factor as a result of the gesture/texture duality. As gesture is the opposite of texture, the temporal aspect of the meta-object must stretch to become the entire piece, providing no basis for the interaction of sound objects, linearity, or directionality. Therefore, gesture is neutralized, and time is subverted.

Smalley suggests that “high sustained, continuant morphologies” can suggest “space itself rather than anything which moves in it, something possibly atemporal, as if time is becalmed [5].” However, continuant morphologies typically have softer, if any, textures. On the other hand, the subjunctive space of the sound meta-object combined with its consistent overall spectromorphology tends to perform the same role after sufficient inculcation.

Though the meta-object subverts the time of the piece at a formal level, texture must still dominate at the local level. For texture to fully ascend to the role of main compositional material, texture itself must be developed. Music is a temporal art. Therefore, temporal aspects of texture must figure prominently to elevate texture’s status to the central musical material, even if the sound meta-object is timeless. Texture in a textural composition must be dynamic in order for it to be compelling.

VI. Sound Meta-Object in Space

Sound and its musical space is inextricably linked with its acoustic diffusion. The space of a sound meta-object carries with it implications for its existence in space through diffusion. In textural composition, this means that diffusion must correspond to the size and extension of the sound meta-object. And, the diffusion must complement the dynamism of the texture.

Additionally, the metaphor of texture in music derives from physical experiences of texture in vision and touch. Therefore, the spatiality of texture is predicated on the physicality of the human body. Any philosophical approach to spatialization needs to contend with space in relation to the listener.

A. Volume and Scale

The most concrete aspect of spatializing a sound meta-object applies to its perceived volume and scale. First of all, according to Truax, “Uncorrelated signals will increase the apparent volume of a sound provided there is

a basis for perceptual fusion of these components into a single, possibly complex auditory image [2]."

Smalley argues that the distribution of spectral space contributes to volume and scale, as well. "I can create a more vivid sense of the physical volume of space by creating what I shall call *circumspectral spaces*, where the spectral space of what is perceived as a coherent or unified morphology is split and distributed spatially [5]."

In effect, assuming that (psychologically if not psychoacoustically) the sound meta-object is perceived as a unified morphology, then the components of the meta-object must be *uncorrelated* and *distributed* spatially. However, the components themselves are complex sounds. Therefore, creating uncorrelated copies of the constituent sounds and diffusing them throughout the space will increase the volume further still.

B. Dynamism and Motility

Spatial stasis does not crucially impact the perception of a dynamic texture, but motion does enhance a dynamic texture. As Smalley says, "The motion must be implicit in the sound itself or the texture itself or the context itself [7]." Since the texture of the sound meta-object changes in time, static diffusion of the texture seems incongruent or dissonant.

Mimetic spatialization fabricates a subjunctive space through psychoacoustically illusive or allusive localization and motion. The interaction of sound objects in a mimetic subjunctive space is called "objects-motion-environment" by Simon Emmerson [11], and it is a significant musical trope in acousmatic music.

However, if the spatial motion coheres elements of the texture into distinct sound objects through identifiable trajectories in space, the fragile meta-object is splintered into multiple sound objects. Therefore, diffusion needs to occur between stasis and mimetic spatialization.

C. Human Agent

On the most abstract level, perception of scale, motility, and mimetic trajectorial spatialization convolve in the human observer and ultimately rely on the physicality of the perception and the human perspective.

Texture is a physical quality, perceived through vision and touch. Smalley asserts that, as such, texture (among other things) has space because vision, touch, and sound "embody underlying spatial attributes." More importantly, perception has physical roots in the body, "which is always at the focal centre of perception – as utterer, initiator and gestural agent, peripatetic participant, observer and auditor." The importance of the human-centered perception means that musical perspective is always related to the human scale, what Smalley calls the "egocentric space [5]."

But, Smalley also suggests that gestures operate within the human scale because "if gestures are weak, if they become too stretched out in time, or if they become too slowly evolving, we lose the human physicality. We seem to cross a blurred border between events on a human scale and events on a more worldly, environmental scale [9]."

Since texture is the opposite of gesture, then textural composition, by its very nature, operates outside the human scale. This relationship to egocentric space only serves to strengthen the impression of volume, scale, and timelessness the meta-object strives to achieve. However, the spatialization of the meta-object cannot rely on the environmental qualities alone to elevate texture to textural composition. The perspective of the listener must be addressed.

D. Perspective

Perhaps the most useful discussion of perspective and the listener in the case of textural composition comes from Smalley's space-form approach because it "places time at the service of space [5]." Since time is subjugated in the textural composition, the analysis should focus on aspects of space outside of time. For this reason, Smalley's other writings on texture motion and gesture [9] have less relevance.

To summarize: Smalley defines perspectival space as the "relations of position, movement and scale among spectromorphologies, viewed from the listener's vantage point." Perspectival space includes the shifting perspectives of prospective space, panoramic space, and circumspace. Prospectival space and panoramic space contend with the frontal, forward view of the acousmatic image, while circumspace "encompasses the listener, with the possibility of approaching or passing over egocentric space from all directions [5].

Smalley tends to work primarily with the frontal image, since he works in more orthodox acousmatic methods [7]. However, his preference for the prospective space cannot serve the purposes of textural composition. Prospective space favors the 'forward' space; sounds occurring behind the observer are only significant in relation to the front. This perspective bounds the acoustic space. A sound meta-object cannot be bounded or limited, so prospective space cannot support it.

However, Smalley also defines a space with no favored orientation. He calls this immersive space, a kind of circumspace, "where the spectral and perspectival space is amply filled, surrounding egocentric space, where the pull of any one direction does not dominate too much, and where the listener gains from adopting, and is encouraged to adopt, different vantage points [5]."

Hence, textural composition must achieve immersive space, where the sound meta-object not only becomes greater in the perceived volume and scale due to its sonic characteristics, but also greater than the egocentric space and unlimited in its range around the listener.

More importantly, textural composition must take on what Smalley calls environmental dimensions because it implies spaces beyond the listening space [5]. Music that uses environmental sounds and causes them to interact in environmental dimensions dissolve boundaries because of the listener's experience with the environment. Textural composition, however, does not enjoy the advantages of being environmental in this way. However, proper spatialization can recreate an environment, however fantastic, that the listener can experience.

In Murray Shafer's lo-fi soundscape, all perspective is lost and there is only presence. "The modern lo-fi soundscape possesses no perspective; rather, sounds massage the listener with continual presence. As the population of sounds in the world increases, soloistic gestures are replaced by aggregate textures. Textures and crowds are correlatives [4]."

At first glance, this appears to be the state to which textural composition must assay: no perspective, only presence. However, as Smalley points out: "high density is the enemy of low-level detail," and "a packed density of full spectral range … creates a solid wall" around the listener [9]. This perceptual wall around the listener will, at any distance, bound the space.

So textural composition must have some amount of perspective, if only to suggest that all perspectives – in all directions and at all distances – are completely included in the sound meta-object. Textural composition must have superperspective. In this instance, textural composition requires an intermediary aesthetic of spatialization.

E. Mimetic and Point-Source Spatialization

Mimetic spatialization dissimulates the loudspeaker to create a perception of space between speakers. However, most composers interested in imitating reality do so in order to simulate motion in space, or objects in a trajectory.

The trajectory-based aesthetic of mimetic spatialization enforces an orientation and perspective that undermines the creation of the immersive space required for the sound meta-object, since sound trajectories are more effective in the frontal image. The objects-motion-environment relationship of mimetic spatialization debilitates the sound meta-object, shattering it into disparate elements.

An alternative, point-source spatialization, empowers each loudspeaker with its own musical presence. Different methods of point-source spatialization still allow the loudspeakers to retain their agency as musical performers, as Burns discovered in several of his works [12]. The democracy of the point-source method ensures that no one perspective is favored.

Yet these electromechanical performers are static. Any material that passes between speakers moves much like material would within an orchestra. The motion is only approximate.

Textural composition requires plenary motion, typically associated with trajectory-based mimetic spatial aesthetics, while employing an application that favors no singular perspective. The spectrum between mimetic and point-source spatialization is a gradient, so there are many degrees to which something may be more or less trajectorial, or more or less point-source. In this sense, textural composition occupies only one possibility within an intermediary aesthetic.

VII. Aesthetic Conclusions

Given the context of "live" acousmatic music, textural composition requires real-time generation of material diffused in space. Space, both space in the sound and the spatialization of sound, needs to figure prominently in the compositional method.

Textural composition is a practice of intermediary aesthetics, lying between dialectical poles. In sound material, a textural composition exists on the fragile categorical boundary between sound object(s) and the lo-fi soundscape. It exists in a sound meta-object, a massive, singular sound object that extends beyond the periphery, both imaginatively and in spatial diffusion. Furthermore, texture must ascend in dominance over other musical traits, and temporal flux of texture secures that position.

Likewise, the spatialization of textural composition must support the delicate existence of the sound meta-object. It must augment the volume and scale, it must not dissolve the meta-object into multiple sound objects, and it must match the dynamism of the texture with correlative motility. These qualities suggest an intermediary spatialization in a gradient between mimetic, trajectory-based aesthetics and the immersive space suggested by point-source aesthetics.

VIII. Compositional Implementation

In this paper, a stochastic process is a goal-oriented random process that has an equilibrium state as originally defined by Xenakis [1]. A random process is any probabilistic operation. Textural composition arose from developing stochastic and random techniques for the generation of sound masses using Pure Data (Pd) by Miller Puckette.

Random and stochastic processes only require a moderate number of parameters to affect drastic changes in sonic output, a great advantage in creating musical textures. Processes that control actions on the structural level provide the composer with the freedom to choose sounds sources that work together in a texture.

The author's work, *real-time tape music III*, moves away from previous sound mass composition and utilizes real-time random and stochastic processes at micro- and mid-levels to create a textural composition. Gaussian processes sample sound files and apply common tape-based manipulations to generate individual sonic events. Markovian stochastic processes determine the overall textural shifts. Uniform random processes control spatialization. The macro-structure, i.e., form, is pre-determined.

A. Form

The piece consists of two contiguous movements. The first movement initiates the listener to textural listening through a didactic accumulation of sound objects. A crescendo finishes the first movement after approximately five minutes. The opening of the second movement rebuilds the texture for approximately one minute, leading to the main section of the second movement.

The main section comprises the majority of the piece, lasting approximately ten minutes. It is within the main section that the piece truly exhibits textural composition. The final thirty seconds of the piece is a slow diminution to silence.

B. Random and Stochastic Processes in Texture

Processes originally created for *real-time tape music I* and *II* generate individual texture streams from ten separate soundfiles. Gaussian random number generators take in mean and variance values for the playback speed, loudness, duration of the sample, and onset time within the soundfile. A sample is triggered in uniformly random increments of time. The samples are layered to create a single audio stream of an individual texture.

The parameters are set at the beginning of the first movement. Then, they change at the beginning of the second movement. Through out the duration of the second movement, the parameters ramp to new values by the middle of the second movement, returning to the initial second movement values by the end. This creates a subtle textural trend over the course of the main section.

The sound sources were chosen for their ability to ally with each other to create a meta-object, but with enough distinguishing features to create rich and diverse textures. Sources include a close-mic'd elastic band, close-mic'd carbonation bubbles in an aluminum can, a solo cello musical passage, a musical passage for cello and percussion, orchestral attacks, a plucked aluminum tab, a digitally processed musical passage for violin solo, processed samples of violin crunch bowing and harmonics, and a musical passage for woodwinds.

Each soundfile creates a single texture stream (see Fig. 1). Eight combinations of individual texture streams were chosen for their textural interest (see Fig. 2).

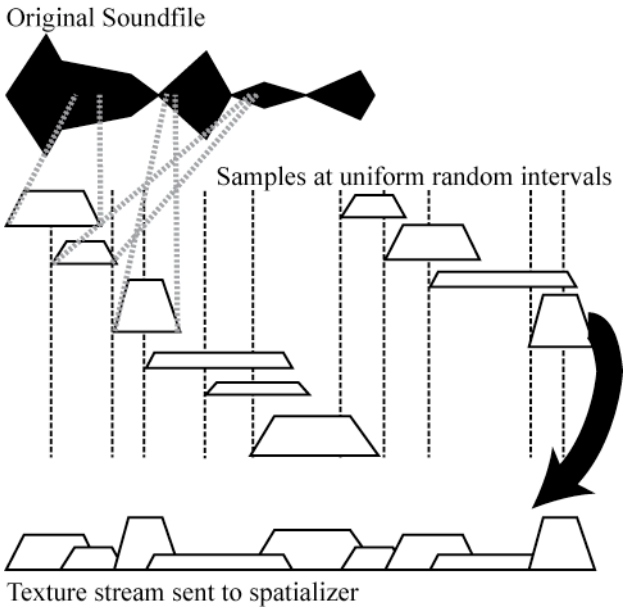

Fig. 1. Sampling files for Texture Streams[8]

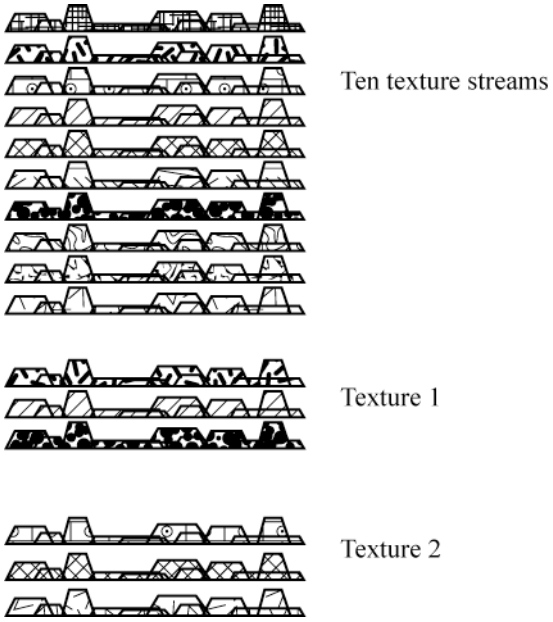

Fig. 2. Textures created from Texture Streams[8]

A Markovian stochastic process first invented by Xenakis for *Analogique A* and *B* determines the order and choice of texture. A portion of the patch used to analyze *Analogique B* is used for the selection of textures in real-time [13]. The pertinent quality of the Markovian process is that it is stochastic, i.e., it has an equilibrium state. At specific times in the second movement, the system is "seeded" with one texture for thirty half-second cycles, or fifteen seconds. The system then nears its equilibrium state with each fifteen-second cycle.

C. Spatialization

The processes controlling the random sampling and texture choices are computationally expensive. Therefore, the spatialization must rely on minimal resources. Loudspeaker amplitudes, interaural time differences, and artificial reverberation with uniform random variables create the motile environment without spatializing each sample.

Spatialization is mapped in the space as a circle. Each individual texture stream is given a constantly changing virtual angle that moves around the circle at varying speeds.

A simple equation calculates the relative amplitude of the texture stream based on the angle of the speaker in the circle and the virtual angle of the stream. This sends the texture stream in a path around the circle (Fig. 3 A).

A copy of the texture stream is placed 180° across the space. The copy is slowly oscillated in and out of phase with the original stream by virtue of a variable delay. The result of this creates the perception that the stream is crossing the space as well circling it. This also creates an uncorrelated copy of the stream, which increases perceived volume, as well (Fig. 3 B).

Finally, the stream is sent to a reverberation patch, and the amount of reverberation constantly varies, controlled by a uniform random number generator. This variable reverberation fabricates a more environmental feel, extending the volume of the sounds into larger imagined spaces (Fig. 3 C).

Since the individual texture streams are being spatialized independently, any given texture can have up to three separate spatialized streams. Consequently, an expanse is created where no single psychoacoustic trajectory sweeps the space, but rather the impression of frantic, turbulent motion pervades the space (Fig. 4).

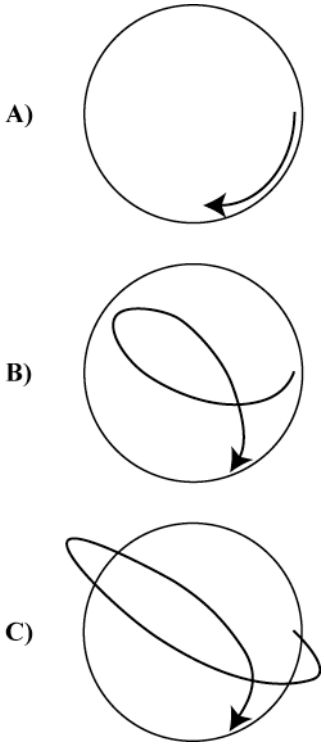

Fig. 3. Effects of Spatialization [8]

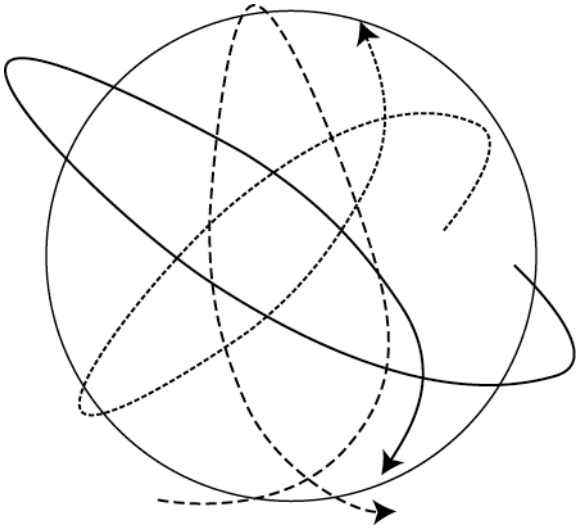

Fig. 4. Spatialization Results[8]

IX. Conclusion

Experimentation with stochastic and random processes creating sound mass compositions led to a new approach to conceiving a work, especially within the aesthetics of acousmatic music.

Textural composition, an intermediary aesthetic between sound object(s) and soundscape, wrestles with questions of gesture, number, volume, scale, and time in the instantiation of a sound meta-object. Congruent spatialization mediating between mimetic aesthetics and point-source principles augment the sense of the sound meta-object through extensive mobility, the physicality of space, and superperspective.

One realization of textural composition is *real-time tape music III*, a real-time computer-generated work. This piece utilizes Gaussian and uniform random variable generators for micro-level events and spatialization, while Markovian stochastic processes control structural events.

Due to the computation required for the random processes, an efficacious spatialization environment is created using loudspeaker amplitudes, interaural time differences, and direct-to-reverberant sound ratios to create plenary motion with little psychoacoustic coherence into trajectories.

References

[1] Xenakis, I., *Formalized Music: Thought and Mathematics in Composition*. Revised ed. Harmonologia Series No. 6. 1992, Stuyvesant, NY: Pendragon Press.

[2] Truax, B., *Composition and diffusion: space in sound in space.* Organised Sound, 1998. **3**(2): p. 141-6.

[3] Wishart, T., *Audible Design: A Plain and Easy Introduction to Practical Sound Composition*. 1994: Orpheus the Pantomime.

[4] Murray Schafer, R., *Our Sonic Environment and the Soundscape: the Tuning of the World.* 1994, Rochester, Vermont: Destiny Books.

[5] Smalley, D., *Space-form and the acousmatic image.* Organised Sound, 2007. **12**(1): p. 35-58.

[6] Harrison, J., *Sound, space, sculpture: some thoughts on the 'what', 'how' and 'why' of sound diffusion.* Organised Sound, 1998. **3**(2): p. 117-27.

[7] Austin, L., *Sound Diffusion in Composition and Performance: An Interview with Denis Smalley.* Computer Music Journal, 2000. **24**(2): p. 10-21.

[8] Hagan, K. *Textural Composition: Implementation of an Intermediary Aesthetic*. in *International Computer Music Conference*. 2008. Belfast, Ireland.

[9] Smalley, D., *Spectromorphology: explaining sound-shapes.* Organised Sound, 1997. **2**(2): p. 107-126.

[10] Barrett, N., *Spatio-musical composition strategies.* Organised Sound, 2002. **7**(3): p. 313-323.

[11] Emmerson, S., *Aural landscape: musical space.* Organised Sound, 1998. **3**(2): p. 135-40.

[12] Burns, C. *Compositional Strategies for Point-Source Spatialization*. eContact! **8**, 2, http://cec.concordia.ca/econtact/8_3/burns.html

[13] Hagan, K., *Genetic Analysis of Xenakis' Analogique B*, in *Electroacoustic Music Society*. 2005: Montreal, Canada. http://www.ems-network.org/spip.php?article150