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Impressionistic techniques applied in sound art & design

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IMPRESSIONISTIC TECHNIQUES APPLIED IN SOUND ART & DESIGN

by

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ABSTRACT

Sound art and design collectively refer to the process of specifying, acquiring, manipulating or generating sonic elements to evoke emotion and environment. Sound is used to convey the intentions, emotions, spirit or aura of a story, performance, or sonic installation. Sound connects unique aural environments, creating an immersive experience via mood and atmosphere. Impressionistic techniques such as Impasto, Pointillism, Sgraffito, Stippling introduced by 19th century painters captured the essence of their subject in more vivid compositions, exuding authentic movements and atmosphere. This thesis applied impressionistic techniques using sound art and design to project specific mood and atmosphere responses among listeners. Four unique sound textures, each representing a technique from Impressionism, and a fifth composite sound texture were created for this project. All five sound textures were validated as representative of their respective Impressionistic technique. Only sonic Pointillism, matched its emotive intent. This outcome supports the research question that sound art and design can be used to direct listeners' mood and atmosphere responses. Partnering Impressionistic principles with sound art and design offers a deeper palette to sonically deliver more robust, holistic soundscapes for amplifying an audience's listening experience. This project provides a foundation for future explorations and studies in applying cross-disciplinary artistic techniques with sound art and design or other artistic endeavors.

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INTRODUCTION BACKGROUND AND PURPOSE

In sound art and design, sound is used to convey the intentions, emotions, spirit or aura of a story, performance, or sonic installation. Sound can provide emotional context, augment or guide the listening audience, causing them to push deeper into their seat when a blood curdling scream is heard, to lean forward in the darkness of a silent moment, or to startle when a door is slammed shut behind them. Sound adds depth and dimension to the experience. Sound creates and connects unique aural environments, creating an immersive experience via mood and atmosphere.

The Impressionist Movement similarly provides immersive experiences in the visual arts. Nineteenth Century painters rejected traditional art forms to capture more spontaneity in modern life. “Impressionist painters preferred to record their initial sensory reactions rather than idealizing a subject” (Samu, 2004). The techniques use effects of light and color theory on hastened dots, dashes, and scratches to authentically capture mood and atmosphere reflecting actual life experiences.

Impressionism influenced music during this same period. Deviating from the intense emotional arcs of the Romantic period, composer Claude Debussy inserted non-traditional sustained chords in inharmonic staccato rhythms and emphasized each instrument’s tonal color characteristics to portray atmospheric ambiences in his compositions. Debussy’s arrangements are tonally unique in that they “convey moods and emotions aroused (actively) in the subject rather than a detailed (passive) tone-picture” (Rutherford-Johnson, Kennedy, & Kennedy, n.d.). Impressionist methods in music create an atmospheric ambience for expression and interpretation rather than a narrated sonic story. These practices allow for creative emotion-centric exploration.

The purpose of this creative, exploratory investigation is to apply Impressionist theories and techniques using contemporary sound methods to construct a broader blanket of immersive auditory sensational experiences.

BACKGROUND DEFINITIONS AND SUPPORTING LITERATURE

In this section, the physics of sound and sound expression are reviewed. Sound moves through air in a sinusoidal rhythm (or sound wave), serially compressing and decompressing air particles (Figure 1). In the compression phase, air particles are densely packed. In decompression (rarefaction), a vacuum is created where air particles seek less densely-populated pockets. Amplitude is the oscillating magnitude of sound waves. Subsequently, higher fluctuations and displacements from equilibrium result in larger amplitudes, therefore, louder sounds. This loudness (volume) is defined as strength "of auditory sensation produced." (The Editors of Encyclopaedia Britannica, 2018a) Frequency refers to the speed of sound waves moving through air. Frequency is measured in cycles per second. The differences in the rate of frequency and caliber of sound dictate pitch. Low-frequency sounds are slower in rate and spread omnidirectionally (a widespread radius of dispersion), bellowing into the given space as low churning rumbles. Conversely, as the frequency and pitch of sound increases, the dispersion narrows, piercing the air with greater directionality into the given space as a shrill whistle. The sonic power behind those bellowing low frequencies and piercing higher frequencies defines the intensity of sound. Variances in these sonic characteristics paint the air creating mood and atmosphere.

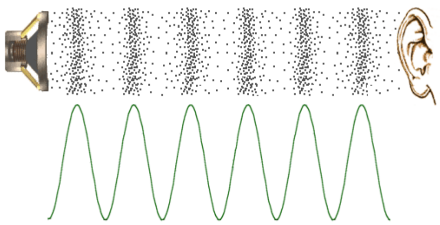


Figure SEQ Figure * ARABIC 1 Variations in Air Pressure and Corresponding Waveform Available via: http://www.mediacollege.com/audio/01/sound-waves.html

Mood is "a prevailing emotional tone or general attitude; a state of feeling at a particular time" (The Editors of Encyclopaedia Britannica, 2018b) Mood establishes a state of mind which permeates the individual's emotions, serving as an instinctual sense that gauges environment reaction. It gathers evidence via human sensory experiences and communicates with the brain to assess and interpret the information. Once interpreted, the person is alerted how to proceed in their environment. Mood establishes a common understanding or interpretation of communal experiences.

Atmosphere is a "surrounding or pervading mood, tone, or influence (The Editors of Encyclopaedia Britannica, 2018a) Atmosphere is an intuitive sense that sets the permeating tone of the listening experience. It facilitates comprehension within emotional and social conditions. Furthermore, it expresses proper emotion within a presented environment. Atmosphere registers human emotional radiation analogous to a Geiger counter.

Mood and atmosphere may seem similar, but each is distinct from the other. In 1912, J.E. Patterson differentiated mood and atmosphere by describing mood as an ephemeral phenomenon, born from emotion that translates into atmosphere, or "in giving mood that form, that similarity to substance, in which only can it be sensed by another person" (J Patterson, 1912). To clarify, mood is the initial sensation perceived in reaction to the sound experience; atmosphere sustains the experiences as the context emerges.

Sonic techniques purvey mood and atmosphere via varying frequency characteristics. Low frequency sounds steady and ground the listening experience. Elements of low frequency sounds occupy space beyond the human hearing range, which are interpreted viscerally and evoke movement within a soundscape – such as a deep, soulful whale call. In contrast, fluctuating mid to high frequency sounds evoke an unnerving sensation. When the fluctuations are chaotic and staccato, great anxiety results, evidenced by increased heart rate. Fluxes that are intentional evoke palpable suspense, i.e. creaking wooden doors slowly opening in darkened spaces. Dynamic shifts in volume (loud or soft), intensity, and amplitude emit tension and drama. These shifts, often occurring in crescendos, accentuate movement, augmenting the visceral response associated with the lower frequencies, e.g. bowing on a waterphone. These, and other variations in sonic textures, construct mood and atmosphere.

IMPRESSIONISM

In this section, the history, techniques, and principles of the Impressionist Movement are reviewed with application made cross-disciplinary from the visual arts to music. Impressionism is described as the period in which visual artists transitioned from dull and realistic portraits to more vivid, sketch-like compositions that depict modern life. The painted techniques employ impasto (short, thick strokes of paint [that] capture the essence of the object rather than the subject's details ("Impasto," n.d.)), "pure unblended colors, and an emphasis on the effects of light (Samu, 2004)." Later techniques such as stippling (Marking (a surface) with numerous small dots or specks), sgraffito (scratching into layered paint to reveal contrasting vibrant colors), and pointillism (painting using tiny dots of various pure colors, which become blended in by the viewer's eye) increase the brilliance of color. The artists believed that painting their experiences were genuine. These techniques and practices led to capturing moments of nuanced life, exuding authentic atmospheric tones rather than explicitly staged locations and actions. Consider a first-time viewer's close-up look at *A Sunday Afternoon on the Island of La Grande Jatte* by George Seurat. (See Figure A Lower right corner). The viewer's eyes are immediately overloaded with millions of precise dots and dashes, but once their eyes adjust, taking in the larger optically-blended colors and forms, they can view the cumulative tranquil impression of life as intended by the artist.

Figure A Sunday Afternoon on the Island of La Grande

Similarly, music experienced a stylistic shift characteristic of impressionism, using sonic manipulations of harmony, chords, melody and silence. Composer Claude Debussy developed a style in which "atmosphere and mood take the place of strong emotion, or of the story in program music" (Swinkin, 2012). Inspired by the brushwork and Impressionistic principles, Impressionism in music included "…an avoidance of traditional musical form, static harmony (a single chord, most often the tonic of the dominant, and the prolongation of this chord), emphasis on instrumental timbres that create a shimmering interplay of "colours" [like staccato notes contrasting a sustained chord], [and] melodies that lack directed motion" (The Editors of Encyclopaedia Britannica, 2017). The result is a holistic aural environment immersed in emotion.

Sound art and design collectively refer to the process of specifying, acquiring, manipulating or generating sonic elements to evoke emotion has a rich and long history in theatre. Early sound effects ranged from simple bells, whistles and horns cued from off-stage to elaborate mechanical sound-making contraptions. With the advent of "the breakdown of tonality as a referential system" (Döbereiner, L., 2011) and invention of phonographs at the turn of the twentieth century, practices emerged as precursors to contemporary sound production techniques. For example, "...etching grooves into phonograph records…[forms] a compositional synesthesia in which image, sound notation and the physical sonic phenomenon are [conjoined]...[in] the composition process" (Döbereiner, L., 2011).

In the mid-20th century, recorded analog sounds advanced sound art and design, enabling composers to manually paint soundscapes. They did so by setting "every single sound at the oscillator and cutting it to the right length of tape with a pair of scissors" (Koenig, G., n.d.). These manual manipulations of recordings allowed for a constructed aural experience, adding sharp depth to sensory experiences, progressing sound art and design and affording designers more artistic agency to create and synthesize sound. More traditional, or standard sound synthesis techniques expanded to include "non-standard synthesis [...aiming…] at the composition *of* sound instead of *with* sound" (Döbereiner, L., 2011). Standard synthesis is based in the scientific principles of "physics, acoustics, and psychoacoustics" (Döbereiner, L., 2011). Whereas, "non-standard sound synthesis" (Döbereiner, L., 2011) is situated in more "compositional ideas of sound and musical organization" (Döbereiner, L., 2011).

Sound art and design progressed as technology advanced. "The development of punch-tape control, voltage control, and, finally, the introduction of the computer have made the programmatic aspect of…sound production increasingly clear" ("The Use of Computer Programmes in Creating Music," n.d.). Computer-generated sound synthesis allows for the creation of immersive sound environments: "the computer acts as a sound-generating instrument *sui generis*, not imitating mechanical instruments or theoretical acoustic models" (Koenig 1980 in (Döbereiner, L., 2011)). Software programs-emerging from the 1970s, such as Iannis Xenakis's GENDYN, Gottfried Michael Koenig's SSP, and Herbert Brün's SAWDUST (Döbereiner, L., 2011) and "MUSIC V software" (Di Scipio, 2000) from the 1980s, permits designer-composers to explore specificity in actual structures of sound in their creative compositions. In deconstructing sound to its base elements, the relationship between "sound as a physical phenomenon and sound as a perceptual phenomenon" (Döbereiner, L., 2011) inspires designers/composers to focus on sound's structural and timbral qualities, and reimagine content as unique and original, emphasizing the fact that sound art and design is "something made, something composed" (Döbereiner, L., 2011): more than an imitation of the elements.

The generated compositional methods access the fundamentals of sonic construction and manipulation, to explore the nuanced relationships between pitch, timbre, amplitude and its resultant composition. *Contours* by Jean-Claude Risset, exemplifies the methodologies of sonically-adapted Impressionism. Risset's techniques are described as "synthetic sounds…carefully shaped as to become a tapestry of a rather impressionistic kind…[with] a constructivist attitude [that] hides behind what at first may sound as a pure interplay of fascinating sound colors" (Di Scipio, 2000)

Permitting "the composer to think of sounds in terms of the frequency spectra…[Risset's techniques were]…classic methods such as *waveshaping* (or nonlinear distortion, DNL), *frequency modulation* (FM), and various methods of *additive synthesis*" (Di Scipio, 2000). *Waveshaping (or nonlinear distortion, DNL)* is defined as "a popular synthesis-and-transformation technique that turns simple sounds into complex sounds. [One] can take a pure tone, like a sine wave, and transform it into a harmonically rich sound by changing its shape" (Burk, Polansky, Repetto, Roberts, & Rockmore, n.d.). *Frequency modulation (FM)* is defined as using "one wave to rapidly increase or decrease (modulate) the frequency of another, which creates entirely new frequencies that aren't part of the first two" (Rise, n.d.). Lastly, *additive synthesis* is defined as "a sound synthesis based on the idea that complex tones can be created by the *summation,* or addition, of simpler tones, usually in the forms of sine waves" (Burk et al., n.d.). Thusly, "Risset roots his design possibilities into a frequency-domain representation of sound, whose minimal elements are oscillations of prescribed frequency and amplitude" (Di Scipio, 2000).

Advancements of the algorithmic principles, complexities, and technologies into the 21st century allow for more facile, in-depth, and complex sonic compositions in sound art and design.

RESEARCH QUESTIONS

Sound developed using sonic impressionistic techniques provides more immersive, sensory- rich listening experiences. A sound designer's traditional creative palette, augmented by 21st Century technologies, suggests potential for more enhanced and eclectic sound production methods, resulting in elaborate moods and atmospheres. The purpose of this exploratory investigation is to apply contemporary sonically-adapted Impressionistic synthesis techniques to four base sounds, carefully composing immersive aural experiences for listening audiences. More specifically, will juxtaposing four unique sounds result in a holistic soundscape such that the listener experiences an intended mood designed from the Impressionistic sound textures?

Conducting this exploration contributes to the ongoing discussion of how to advance sound art and design; bridging two artistic expressions for future collaborative installations. Lastly, implementing an enhanced sonic palette would broaden the artistic approach one could deploy to overcome design challenges, allowing greater artistic agency.

METHODS

DESIGN

This exploratory project examined individual participant's mood and atmosphere responses captured in reaction to four (4) unique sound textures and a fifth, composite sound texture. Sound textures were constructed using Impressionistic principles and techniques translated from painted art to sound art and design.

SUBJECTS

In the first half of the 2018 spring semester volunteers from the Boston University School of Theatre and greater Boston University were invited to participate in this project. Potential individuals were notified of this project via printed and electronic communications, e.g., posted flyers and internal email correspondences, respectively. Invitations to participant were extended during the period beginning in January through February of 2018. Adult students, i.e., age 18 or over, willing to listen to up to 5 sound textures, were invited to participate. All data were collected in Boston University School of Theatre Sound Studio.

PROCEDURES

SOUND TEXTURES

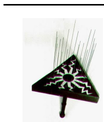
Four (4) unique sound textures and a composite texture were constructed and recorded. Sonic adaptations reflective of painted impressionistic techniques guided the construction of each sound textures. In their recording, sound-making vessels were secured to a 22 in. x 48 in. plywood sheet and the recording microphone was placed and secured at a 60-degree downward angle to the vessel. Sound textures were recorded using Zoom Handy H5 Recorder with Condenser Microphone; processing and manipulations were performed using Cubase (*Cubase Music Production System*, n.d.). Table 1 describes the sound textures and matches each to its respective impressionistic technique. The technical construction of the sound textures is detailed in Appendix 1.

TABLE 1 IMPRESSIONISTIC PAINTING TECHNIQUES MATCHED WITH IMPRESSIONISTIC SOUND SYNTHESIS TECHNIQUES

Impressionistic Painting Technique	**Sonically-Adapted Impressionistic Technique**	**Sound-Making Materials and Recording Patterns**	**Intended Mood and Atmosphere Response**
Impasto	Low frequency steady pulsations (60-125Hz)	Wooden bowl and spoon Churning metal, e.g., nuts, bolts, etc	Soulful, hypnotically grounding
Pointillism	Intentional mid to high frequency staccato fluxes in dynamic shifts of amplitude, intensity, and volume	Triolin[1] Consistent rapid tapping on surfaces of the shortest to mid- length metal rods	Anxious; slightly overwhelming energy
Sgraffito (scratching)	Mid to low dynamic shifts in intensity, amplitude and volume	Triolin Strums punctuated with taps on mid to long-length metal rods	Suspenseful; tensing
Stippling	Chaotic staccato rhythmic patterns	Glass bowl and manual eggbeater; viscous veggie oil containing pebbles shells Variable-speed beating	Panic-y; hyper; anxious; bubbling energy (picture shaking chihuahua)

VALIDATION OF IMPRESSIONISM IN SOUND TEXTURES

Four sound design subject matter experts were consulted to validate the sound textures and their intended emotive responses. The expert panel was comprised of four (4) experts recruited from the faculty and graduate student body in the Department of Sound Design at Boston University. The sound textures were presented individually in an isolated sound studio through a 2.1 playback stereo sound system connected to a CD player. Experts sat squarely in front of the sound system, approximately 2 ft away. The CD player contained five (5) separate constructed tracks. Sound textures were 30 seconds to 45 seconds in length. Experts listened to each sound texture three times. Experts evaluated the representation of selected impressionistic painting

[1] Triolin  – Originally crafted by Hal Rammel. Building materials: varying gauge metal rods inserted into a wooden triangular resonant chamber w/ handle attached to base; Resonates very similar to a waterphone

techniques in the given sound texture. Definitions for each visual painting Impressionistic technique and for each sonically adapted Impressionistic technique were provided, along with the intended mood & atmosphere descriptions for each sound texture. Sound Textures 1, 2, 3 and 5 recorded one hundred percent agreement among experts regarding the intended affective experience. Three of the four experts agreed with the intended affective experience for Sound Texture 4. Experts recommended additional manipulations to Sound Texture 4 after which all there was one hundred percent agreement among experts regarding the intended affective experience (See Table 2).

TABLE 2 SOUND TECHNIQUE VALIDATION

Sound Texture	**Sonically Adapted Impressionistic Techniques**	**Intended Mood and Atmosphere Responses**	**Validated Mood and Atmosphere Response**
Sound Texture 1	Low frequency steady pulsations (Impasto)	Soulful, almost hypnotically grounded	**Mood:** Soulful, grounded, **Atmosphere:** Soothing, dark tones; haunting-esque
Sound Texture 2	Intentional mid to high frequency staccato fluxes in dynamic shifts of amplitude, intensity, & volume (Pointillism)	Anxious, slightly overwhelming energy	**Mood:** Anxious, slightly overwhelming energy **Atmosphere:** Anxious, slightly overwhelming energy
Sound Texture 3	Mid to low dynamic shifts in intensity, amplitude & volume (Sgraffito)	Suspenseful, tension-creator	**Mood:** Suspenseful, tension-Inducing, very uneasy **Atmosphere:** chaotic
Sound Texture 4	Chaotic staccato rhythmic patterns (Stippling)	Panic-y, hyper, anxious but bubbly energy (picture shaking chihuahua)	**Mood:** Panic-y, hyper, bubbly **Atmosphere:** Jittery energy
Sound Texture 5 (Composite)	Composite of all 4 sound textures	Cumulative environmentally rich sensory experience that is more robust than each individual sound texture	Validated as a cumulative environment that is more robust than each individual sound texture

DATA COLLECTION

Participants were exposed to the same five (5) Impressionistically adapted sonic stimuli in two consecutive phases: mood and atmosphere. Mood: participants listened to each sound texture once after which they responded to the question: ''How did the sound texture make you feel?'' Participants rated their response using a 7-point Likert scale and eight (8) different word prompts. Atmosphere: participants then listened to each sound texture twice more, after which they rated their lingering emotional, aka "atmosphere" response using a 7-point Likert scale and eight (8) different word prompts.

Word prompts were selected as descriptors of the intended affective responses, which were consistent with the validated responses of the experts. During the listening sessions, participants responded to antonymic word prompts, individually and unmatched. Word prompts represented a broad emotional spectrum. Word pairs are presented in Table 3.

TABLE 3 MOOD AND ATMOSPHERE WORD PROMPTS

Mood Prompts		**Atmosphere Prompts**	
Pleasant	Unpleasant	Fragile	Powerful
Happy	Sad	Bright	Dull
Calm	Anxious	Tender	Desperate
Powerful	Fragile	Chaotic	Control

DATA AND DATA ANALYSIS

Data were collected using an electronic survey constructed using Google Forms, LLC. Data were analyzed using IBM Analytics SPSS software package, version 23.

RESULTS

PARTICIPANT CHARACTERISTICS

Thirty (30) people participated in this sonic exploration. The mean age was 32.2 years old. Male and female sex were evenly distributed across participants, specifically, female-identifying persons (N=15; 50.0%) and male-identifying persons (N= 13; 43.3%). Participants were principally White (N= 19; 63.3%) with representation from across groups, namely: Black (N= 5; 16.7%); Asian/South Asian (N= 2; 6.7%), and Hispanic (N= 2; 6.7%). Participants were recruited from the Boston University, including the School of Theatre and Design (SOT) and included family and friends of the principal investigator: non-SOT students (N= 12; 40.0%); SOT students (N= 4; 13.3%); SOT faculty (N= 3; 10.0%); family (N= 3; 10.0%); and others (N= 8; 26.7%). (See Table 4 Description of Participants)

TABLE 4 DESCRIPTION OF PARTICIPANTS

Characteristic	**Frequency (N=30)**	**% of Total**
Sex		
Female	15	50.0
Male	13	43.33
Ethnicity		
Asian/South Asian	2	6.67
Black	5	16.67
Hispanic	2	6.67
White	19	63.33
Role		
Faculty	3	10.00
Family/Friend	3	10.00
Student: Theatre	4	13.33
Student: Non-theatre	12	40.00
Other	8	26.67
Age	32.21	Mean

MOOD AND ATMOSPHERE

Participants were exposed to 4 different and uniquely constructed sound textures that were designed to elicit affective mood and atmosphere responses. Participants listened to each sound texture once after which they rated their immediate, instinctual, aka “mood” response using a 7-

point Likert scale and eight (8) different word prompts. Participants then listened to each sound texture twice more, after which they rated their lingering emotional, aka "atmosphere" response using a 7-point Likert scale and eight (8) different word prompts. Four (4) antonymic word pairs comprised each set of word prompts, however words were presented singly rather than in pairs so as to not instill an "either/or" response.

Pairwise correlations were calculated for each word pair. Table 5 details these findings.

TABLE 5 PAIRWISE CORRELATION COEFFICIENTS FOR MOOD AND ATMOSPHERE ACROSS 4 UNIQUE AND 1 COMPOSITE SOUND TEXTURES

	Texture 1	**Texture 2**	**Texture 3**	**Texture 4**	**Texture 5**
	Mood				
Calm	-.509**	-.459*	-0.073	-0.267	-.406*
Anxious					
Happy	-0.225	-0.345	-0.089	-0.205	0.018
Sad					
Unpleasant	-.556**	-.527**	-0.211	-0.128	-0.328
Pleasant					
Power	-0.033	-0.137	-0.224	-0.143	-0.275
Fragile					
	Atmosphere				
Fragile	-0.02	0.149	-0.072	No Pair	-0.092
Strong					
Dull	0.131	0.193	0.103	-0.102	0.08
Bright					
Control	.425*	0.183	0.227	-0.199	-0.046
Chaotic					
Desperate	0.029	-0.012	0.276	0.252	0.2
Tender					

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Negative correlations were hypothesized as descriptive of the relationships among the various word pairs. Indeed, this is evident in the data describing "mood", however only calm/anxious; and pleasant/unpleasant are statistically significant in sound textures 1, 2 and 5; and 1 and 2, respectively. Though significant these relationships are only moderate. Similarly, negative correlations were anticipated related to evaluations of atmosphere. Fewer pairings reflect a negative correlation. Only control/chaotic is statistically significant in these evaluations; and the relationship is moderately positive.

Applying impressionism to sound suggests that the fifth sound texture, which is a composite of the four individual sound textures is uniquely different from the four original sounds. To measure this, two variables were constructed for each sound texture by aggregating scores across each of the word prompts for mood and for atmosphere. Pairwise correlations were calculated for each aggregated mood score and the composite mood score; and pairwise correlations were calculated for each aggregated atmosphere score and the composite atmosphere score. In addition, these aggregated scores were compared for differences.

Table 6 details the paired samples correlations. Each sound texture is moderately to strongly correlated with the composite sound texture, and each is statistically significant.

TABLE 6 PAIRED SAMPLES CORRELATIONS COMPARING AGGREGATED MOOD AND ATMOSPHERE SCORES FOR EACH SOUND TEXTURE WITH THE COMPOSITE SOUND TEXTURE

Pair	***r***	**Sig**
Mood		
Mood 1/Composite Mood	0.52	0.003
Mood 2/Composite Mood	0.63	0.000
Mood 3/Composite Mood	0.66	0.000
Mood 4/Composite Mood	0.71	0.000
Atmosphere		
Atmosphere 1/Composite Atmosphere	0.53	0.003
Atmosphere 2/Composite Atmosphere	0.75	0.000
Atmosphere 3/Composite Atmosphere	0.85	0.000
Atmosphere 4/Composite Atmosphere	0.72	0.000

A paired samples test was used to compare differences between the individual sound texture and the composite sound texture. Sound texture 3 and sound texture 4 differ significantly from the composite sound texture with respect to mood. Relative to atmosphere, sound texture 4 differs significantly from the composite sound texture. See Table 7.

TABLE 7 DIFFERENCES BETWEEN INDIVIDUAL SOUND TEXTURES AND THE COMPOSITE SOUND TEXTURE

Pair	**Mean**	**Std dev**	***t***	**Df**	**Sig**
Mood 1/Composite Mood	.767	5.41	.776	29	.444
Mood 2/Composite Mood	-1.43	4.50	-1.74	29	.092
Mood 3/Composite Mood	-1.90	5.14	-2.02	29	.052
Mood 4/Composite Mood	-2.60	4.35	-.98	29	.003
Atmosphere 1/Composite Atmosphere	-0.82	5.89	-.76	28	.455
Atmosphere 2/Composite Atmosphere	-0.36	4.52	.42	27	.679
Atmosphere 3/Composite Atmosphere	-0.31	3.74	.45	28	.659
Atmosphere 4/Composite Atmosphere	93.07	4.10	-4.03	28	.000

DISCUSSION

Four accomplished sound designers listened and evaluated the sound textures and techniques, providing validation.

The strength of the pairwise correlation coefficients is generally weak, suggesting that participants had difficulty discerning the two terms. The word-pairs: calm/anxious, unpleasant/pleasant are negatively correlated with significance, suggesting participants could differentiate each emotional pair. Across all five sound textures, participants distinguished their emotional responses better in response to Sound Textures 1, and 2 as compared to Sound Textures 3, and 4.

Of note, participants were able to distinguish their emotional responses to Sound Texture 5 the most confidently when evaluating with the pair calm/anxious. Of significance, participants' responses to the terms associated with mood for Sound Textures 1, 2, and 5 are moderate, suggesting they had greater assurance/confidence in their responses.

Atmosphere is the lingering emotional response to the sound texture. To evaluate atmosphere In this project, listeners responded to different word prompts after hearing them three times. Responses to the atmosphere word-pairs is less consistent than responses to the mood word-pairs. Participants were less able to distinguish their emotional responses after hearing repeated sound textures across a longer period of time. Atmosphere, thus, is a more complex emotional response that may, or may not be the same as the immediate mood response. Contributing factors might include challenging cognitive and meta-cognitive processes; competing semantic interpretations of the word-pairs; and testing fatigue, e.g., too many word-pair responses.

Each unique sound texture is significantly and moderately correlated with the composite sound texture relative to mood. With respect to atmosphere, each is significantly and moderately to strongly correlated to the composite sound texture. This makes sense because each unique sound texture is fully represented in the construction of the composite sound texture.

The principal hypothesis underlying this project is that the composite sound texture will emote a different, more full response in the listener compared to each of the unique sound textures. Sound Texture 4 supports this hypothesis. Sound Texture 4 is different from the Composite Sound Texture with respect to both mood and atmosphere. Stippling techniques adapted for sound were used to build Sound Texture 4, specifically, repetitive timbre and tight melodic tonal ranges "stippled" the sound. Sound Texture 4 is represented in the Composite Sound Texture, resulting in a different and richer emotive effect.

Sound Textures 1, 2, and 3 - Impasto, Pointillism and Sgraffito, respectively, constructed for this project do not support the translation of painted Impressionism to sound. More than likely, this is not a failure in the theoretical application of Impressionistic , but rather is reflective of characteristics in the adapted sound texture and/or design features in this study, e.g., listeners' inability to discern word-pairs.

STUDY LIMITATIONS

Limitations in this project cross both sound composition and data collection. Sound Textures 1, 2, and 3 were abstracted too far from the specificity of technique used in Impressionist painting. Future projects require greater scrutiny and precision specifying timbre, dissonance and melodic/harmonic tonal ranges of the raw sound in processing their technical manipulations and adaptations. Relative to data collection, editing errors in the survey used for data collection were recognized after data were collected. More importantly, it is recommended that future studies engage in more stringent content validation to select better word-pairs. Further, testing fatigue should be a consideration prospectively as eight word-pairs across 15 listening events using a 7-point Likert scale for each approaches sensory and/or emotional overload.

CONCLUSION

I will start by returning to my initial question: could I sonically adapt Impressionistic painting techniques using contemporary sound art and design principles and techniques to direct or specify intended mood and atmosphere experiences? A comprehensive review of the literature revealed that the Application of Sonic Impressionism is documented. Having reviewed this literature, I was better equipped to further contribute to this literature with this project because it used most contemporary sound design and syntheses.

In this project, I recorded four unique and raw sounds for design and presentation to listeners. Creating these sonic textures was instructive in its own rite. Adapting the raw sounds required both creativity and reflection on action and in action. Specifying the emotive intent was challenging; one of the four unique sound textures most fits its matched Impressionistic technique, i.e., Pointillism. This achievement meets the intention of the project positively confirming my initial question.

Structuring a research design to measure the effects of sound art and design textures among listeners became an interesting endeavor. My research perspective prior to this project was that of a consumer and/or participant of convenience. Developing this project created new challenges and opportunities. My leadership and coordination skills advanced managing the project. I learned that numbers of responses in a Likert scale matters. Specific to this project, I learned that societally, we do not share a common language, nor do we clearly label emotions. Eight word-pairs were generated to evaluate emotional responses. Two of the eight word-pairs: calm/anxious and pleasant/unpleasant yielded sufficient data for analyses. Calm/anxious and pleasant/unpleasant appear in other research studies that measure emotional responses to sound. In this project, Sound Textures 1 and 2 distinguished anxious from calm and pleasant from unpleasant, with significance.

At the start of this project, I wanted to move past thinking of sound design solely within the container of Theatre. I wanted to dive deeper into the materials used in construction and synthesis of specific sound, and deconstruct it to its infant, most basic components. This was important to understand the relation of sound construction with theories of sound for setting an intended emotion. Impressionism was selected as a model because it always resonated with me, its liminal capturing of modern life – fleeting and existential sharply contrasting staged, forceful still lives. In this project, Sound Texture 4 - Pointillism was clearly represented in the Composite Sound Texture and emoted a unique reaction compared to the fuller Composite response.

Partnering Impressionistic principles with sound art and design offered me - and will offer future artists - a deeper palette to sonically deliver more robust, holistic soundscapes for amplifying an audience's listening experience. This project provides a foundation for future explorations and studies in applying cross-disciplinary artistic techniques with sound art and design or other artistic endeavors.

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DISSEMINATION

FINAL INTERACTIVE INSTALLATION

A Final Interactive Installation, which will be situated in one of the CFA buildings' lobby and available 24/7 for any passerbys to interact with, shall include the following:

1. The sound-making vessels secured to a 30 in. x 48 in. plank situated on top of a table for anyone passing by to interact with.
    a. Displays for each vessel will include:
        i. Descriptions of the final sound texture for which each was source material;
        ii. Descriptions of the sonically adapted impressionistic technique and the respective Impressionistic painting technique.
2. A 2.1 playback sound system connected to TV monitor with:
    a. Looped video of how the Impressionistic Sound Textures were created, i.e., footage of the recording sessions and screen recordings of the technique manipulations created in Cubase.
    b. Looped audio of the 4 unique sound textures & collective composition, timed with video footage of its creation process.

APPENDIX: SOUND TEXTURE RECIPES

IMPASTO

Materials: Wooden Bowl (12.6 x 6.1), 43 Wooden Spoon, 226.80g (1 US cup) of metal hardware (¼ hex nuts, ⅛ hex nuts, ⅛ copper pipe pieces, ¼ copper pipe pieces, #6 drywall screws, #2 screws, #4 screws, ⅛ fender washers)

Motion Recorded: Stir metal hardware in wooden bowl with wooden spoon at 30 BPM (half note count on 4/4 time) one complete rotation clockwise, beginning at twelve noon. Then stir metal hardware counter-clockwise one complete rotation. Repeat stirring pattern for 60 seconds.

Cubase Software Processing: Low Pass Filter (378 Hz at 36 dB roll off). Equalize: 400 Hz gained up 10 dB, 1k - 10kHz pulled down to -15 dB, 10kHz gained by 8 dB, and Bass Boost by 5 dB.

Reverb SFX Room Size: 75%

Pre-Delay: 99 ms

Reverberance: 44%

Damping: 67%

Tone Low: 75%

Tone High: 30%

Wet Gain: 0 dB

Dry Gain: -10 dB

Stereo Width: 55%

POINTILLISM

Materials: Triolin and 1/10th Student Cello Bow

Motion Recorded: Strum the Triolin with 1 second short staccato strum bursts on first twelve Triolin wires from shortest measuring 6 - 15 (mid to high tonal range) for 60 seconds. Triolin will rotate from twelve noon position to 9 o'clock counter-clockwise and back for maximum access to wires.

Cubase Software Processing: Layered 5 tracks. Quickened tempo of 2 tracks (from 36.70 secs to 21.67 (69.335% change)). Slowed/steadied tempo of 3 tracks (from 68.70 secs to 80.38 secs (-17%))

Reverb SFX: Room Size: 75%

Pre-Delay: 67 ms

Reverberance: 60%

Damping: 41%

Tone Low: 8%

Tone High: 74%

Wet Gain: -5 dB

Dry Gain: -15 dB

Stereo Width: 57%

SGRAFFITO

Materials: Triolin and 1/10th Student Cello Bow

Motion Recorded: Strum the Triolin with long 3 second back and forth strums, altering with 3 second circling strums on the thirteenth through twenty-fourth Triolin wire, measuring 15 ¾ - 24 for 60 seconds. Triolin will rotate from twelve noon position to 9 o'clock counter-clockwise and back for maximum access to wires.

Cubase Software Processing:

Reverb SFX: Room Size: 75%

Pre-Delay: 67 ms

Reverberance: 60%

Damping: 41%

Tone Low: 8%

Tone High: 74%

Wet Gain: -5 dB

Dry Gain: -15 dB

Stereo Width: 57%

STIPPLING

Materials: Manual Eggbeater with Glass Basin, 250mL viscous solution (175mL H_2O, 75mL corn oil), 2 ½ TBSP of granules (shell & rock particles, fragments/largest diameter 4 mm)

Motion Recorded: Rotate Manual Eggbeater Crank at 120 BPM (8th note count on 4/4 time). Begin at the 12 o'clock position. Crank counter-clockwise to the 9 o'clock position and back to the 12 o'clock position repetitively and as consistently as possible. Motion recorded 3 times for 60 seconds each.

Cubase Software Processing: Three tracks layered in DAW software. high pass filter at 1000 Hz with 36 dB roll off. Equalize with 1k - 4k gained up by 5 dB.

Reverb SFX (applied twice): Room Size: 41 %

Pre-Delay: 34 ms

Reverberance: 63%

Damping: 44%

Tone Low: 46%

Tone High: 63%

Wet Gain: -3 dB

Dry Gain: -6 dB

Stereo Width: 51%