CONNECTING CROSSMODAL INTERACTIONS IN VISUAL MUSIC TO CREATE “MINDFUL” EXPERIENCES

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ABSTRACT

Our society experiences the illusive juxtaposition of sound and images on television, the internet, smartphones and other media devices on a daily basis. Artists can use audiovisuals to create realities strikingly similar to the natural world to create meaning, to create an aesthetic, to facilitate learning or even to provide a therapeutic experience. How artists utilize these elements can have tremendous impact on whether or not the work achieves crossmodal integration or a “unity assumption” for the viewer. Crossmodal integration refers to the perception of multiple sensory stimuli interacting, whereas the “unity assumption” is the observer’s belief that the sensory cues belong together. This thesis examines participants’ experiences of crossmodal integration and the “unity assumption” with Visual Music, an art historical term referring to abstract visuals connected to sound, in a multimedia installation. Participants experienced an audiovisual exhibit, Tropos, and were subsequently interviewed. Their responses to the installation were analyzed using grounded theory analysis and a theoretical model was produced to explain their experiences. Results also suggested that participants believed that these experiences would be useful for aesthetic, educational or therapeutic purposes. This thesis provides a grounded theory model which suggests that when motion, sound, colour, shape and space create a crossmodal interaction, it can lead to “mindful” states. The model provides strategies to increase the likelihood of achieving mindfulness with crossmodal interactions, such as using combinations that are appealing to the majority or increasing the artistic or sensory combinations explored in the public school system.
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DEDICATION

To my husband, as we always try to connect the art forms of visual art and music.

He also carried the installation that was examined in this thesis up several stairs and multiple times.
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Connecting Crossmodal Interactions in Visual Music to Create “Mindful” Experiences

Our society experiences the illusive juxtaposition of sound and images on television, the internet, smartphone and other media devices on a daily basis. Such devices create the illusion of crossmodal integration - a merging of sensory experiences into a perceptual whole (Schutz, 2009). We experience such an integration of the senses, regularly. For instance, when one experiences someone talking, one both hears and sees the person speaking. The brain interprets these sensory signals and creates a cohesive experience of that person despite that information originating from the separate sensory organs of the ears and eyes. A similar holistic experience can be created with audiovisual interfaces as when creating a film, video or computer-generated image of a person talking.

Artists can use these audiovisual combinations to create realities strikingly similar to the natural world, while utilizing differences for the purpose of creating meaning, to create an aesthetic, to facilitate learning or even to provide a therapeutic experience. How artists juxtapose these elements can have tremendous impact on whether or not the work achieves crossmodal integration for the viewer. This thesis is interested in examining participants’ experiences of crossmodal integration in the context of an art installation, Tropos, that combines visuals, video, and music.

Of interest to this thesis project are abstract or non-objective audiovisual artworks that fall under the title of “Visual Music”, a term coined by Roger Fry in 1912. Visual Music refers to art that uses the combination of sound and visuals to create abstract aesthetic experiences. For the purpose of this research, the “aesthetic experience” will be
defined as sensory experiences that lead an individual into contemplation, mindfulness or other altered states of mind. “Visual Music” includes works that suggest the experience of sound, such as paintings or photographs, as well as media works that aim to create an illusion of a unified sensory experience through the combination of sound with films, musical light shows, installation and digital media (Strick, 2005). In essence, these works are new realities created by artificial juxtapositions of sound and visuals. In cases in which these new experiences diverge from reality, such as in the case of being primarily abstract (i.e. the elements are broken down, exaggerated or exist in varying degrees from the reality of human perception), would they be bound to the same established perceptual rules? For example, would an abstract audiovisual installation be able to create “unity assumptions” (Schutz, 2009; Vatakis & Spence, 2008)? This refers to the viewer’s belief that multiple sensory signals are part of the same unified experience when the signals’ qualities of time, space, patterning, number or semantic content are closely congruent or synchronized (Schutz, 2009; Vatakis & Spence, 2008).

Much has already been written regarding the visual music aesthetic, in which a relationship between colour and sound or pitch is theorized (DeWitt, 1987; Greated, 2009; Harrell, 2000; Ione & Tyler, 2004; Strick, 2005; Ward, Huckstep, & Tsakanikos, 2006). These aesthetic theories appear to be heavily influenced by colour-hearing synesthesis, which is an integration of the senses. In the case of colour-hearing synesthesia, a synesthete may experience the sensation of colour when he or she hears sound, such as musical pitches (Ward et al., 2006). In contrast, less has been written about the impact of motion in the context of Visual Music (Bailey, Fells & Moody, 2006). This is surprising, considering movement is a crossmodal connector in
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audiovisual experience and explains why Visual Music eventually became dominated by film in the 20\textsuperscript{th} century, as film can create the illusion of motion. The importance of motion and its connection to space, would also explain why Visual Music evolved into installation art of the late 20\textsuperscript{th} and early 21\textsuperscript{st} century, which can have elements of actual movement as part of the art form (Strick, 2005). The ability of film to match the visual motion with the elements of music such as rhythm, tempo or timbre, gives it superiority over a “frozen” painting in connecting the two art forms. While painting might be able to suggest motion through visual repetition and movement, a video will always surpass its ability to directly in time match sound to visuals.

Understanding Visual Music can also point to better ways of designing audiovisual interfaces. If it is the case that certain conditions, principles or media are better suited to bridge the gaps between the arts in multimedia and technology, then it is important to sort out the intricacies of these relationships for the advancement of design in computer programs, mobile phones, as well as, educational or therapeutic technology. This thesis will investigate the aesthetic of Visual Music to build on the understanding of how our daily multimedia interactions are created and experienced.

**Theoretical Framework/ Literature Review**

To examine multimedia experiences, this thesis will explore the experience of visuals and sound in an art installation. It is important to examine the literature to understand how these aspects are experienced. A variety of intellectuals and artists throughout history have already examined the genre of Visual Music and have made claims as to which specific sounds tend to inspire certain colours - often forming colour scales. For Isaac Newton the C Major scale was analogous to the rainbow (C-red, D-
Orange, E-Yellow, and so on) whereas Nikolai Rimsky-Korsakov saw C, D, A, F and F sharp as white, yellow, rose, green and grayish green, respectively (Harrell, 2000). The Greek philosophers, Pythagoras and Aristotle, also believed that there must be correlations between the musical scale and the rainbow spectrum of hues in a similar vein to Newton (Greuel, 2009). In particular, the current literature review will need to consider Visual Music, crossmodal integration, and the unity assumption from multiple perspectives, such as from the art-based approach, as well as the psychology-based approach to these topics.

**Psychology**

First, we will consider these topics from the perspective of psychology. It is important to note that there is a difference between merely experiencing multimodal stimuli in the same space as compared to those multimodal stimuli achieving the “unity assumption” and thus crossmodal integration. Schutz (2009) compared two audiovisual experiences to illustrate this difference: a dog barking versus listening to music while reading text. In the case of a barking dog, crossmodal integration and the “unity assumption” is achieved. The perceptual system interprets the sensory information so that the dog is perceived as causing the bark. In the case of reading text with music playing in the background, no “unity assumption” is achieved. That is, the reading of the text is not perceived as causing the music and thus the two stimuli are therefore not integrated. It has also been observed that an illusion of causality and crossmodal integration can occur in disconnected stimuli; such is the case in the “ventriloquist illusion” in which sounds are localized at a doll’s moving lips (Schutz, 2009; Welch & Warren, 1980). This illusion also happens when one watches television and the sounds are attributed to the movement
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of an actor’s lips rather than the loudspeakers from where the sounds are actually originating.

Research suggests that participants have a better aesthetic experience of an environment when elements are experienced as an audiovisual whole, as compared to when the audiovisual parts are disconnected (Kuwano, Namba, Komatsu, Kato & Hayashi, 2001). Kuwano et al. (2001) examined how aesthetic judgments are affected by the way audio and visual stimuli interact. In their study they used a variety of conditions juxtaposing the sounds and images of traffic cars or green vegetation to test the compatibility of these sensory experiences. The study utilized visual images of cars, visual images of trees, and visual images of cars with trees in the background, as well as audio clips/recordings of the sounds of cars and the sounds of trees (e.g., sound of a breeze rustling tree leaves). Audio and visual images were first viewed separately and then audio and visual images were presented simultaneously. Of particular interest was when the sound of trees alone was judged without any visual indication of the origin of the sound source; the sound of trees alone was judged more negatively as opposed to when the image of the tree leaves was also present. Kuwano et al. stated that “the results suggest that the impression of environmental sounds, especially in the aesthetic sense, is dependent on the perceiver’s [visual] knowledge of sound sources” (p. 198). Such statements suggest that there is a particular pleasure or aesthetic experience of auditory and visual stimuli when they are placed with a compatible source context and thus create the illusion of the “unity assumption” and crossmodal integration.

Understanding the significance of visual movement to crossmodal binding in audiovisuals may impact the way audiovisual interfaces are aesthetically designed.
Namba, Hayashi and Wako (2003) have investigated how visual movement and audio synchronicity can create more effective media entertainment systems by examining the effect of moving visual stimuli with audio signals to identify how these stimuli are crossmodally integrated. Of interest was how the relationship between the motion of the visual image of a moving disk on a screen and the onset of a pure tone affected the perception of audiovisual synchrony between the disk and the tone. The disk appeared at the middle of the screen and then appeared to fall towards the bottom of the screen, over a 1000 ms period while accompanied by a pure tone. Two conditions were explored: Series E (the disk is presented on the screen with no sound at first however, the sound is presented before, and ceases when, the disk reaches the bottom of the screen) and Series S (the sound is presented with the appearance of the disk and the sound ceases before reaching the bottom of the screen, despite the disk continuing its movement to the bottom of the screen). The duration of the pure tone varied from 500 ms to 1500 ms in 100 ms ascending increments or 1500 ms to 500 ms in 100 ms descending increments. Participants identified whether the disk duration and the sound duration were identical or different. A greater number of identical judgments were associated with Series E (when the sound was synchronized to end with the disk’s movement) than with Series S (when the sound was synchronized to begin with the disk’s movement). Namba et al. (2003) concluded that the tests supported the suggestion that it is important to consider visual motion and changes in sound when creating multimedia interfaces. Namba et. al argued that knowing about the perception of synchrony between a visual moving object and an auditory signal aids in producing effective multimedia interfaces aimed at communication.
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In the case of the Kuwano et al. (2001) experiments, the sound and visual sources were logically connected whereas Namba et al.’s experiments created a synchronous relationship with minimal and abstract elements. In the case of a complex audiovisual artwork, the viewer’s knowledge of sound and visual sources is not always congruent or natural. However, artists can still achieve the illusion of compatibility, crossmodal integration and unity assumptions even when they juxtapose elements that do not logically fit together or are complex. For example, they can create crossmodal interactions within the realm of the abstract or non-objective, such as colourful shapes dancing to music, as in many of Norman McLaren’s films (McLaren, 1971). A similar secular experience of this crossmodal integration would be the display of pulsating colour that often accompanies digital music. These examples reflect the colour-hearing form of synesthesia, which is not always accessible to non-synethetes.

Early psychological research sought to find connections between colours and music, trying to connect sound waves to light waves; the reasoning was that light waves and musical tones could be measured and therefore an analogy could potentially be discovered (Li, Tao, Maybank & Yuan, 2008). During the early twentieth century there was also much debate between artists and psychologists regarding developing a music analogy to painting/visuals (Zilczer, 2005). Psychological researchers exploring these ideas would concur that only a true colour-hearing synesthete experiences colour to sound constantly (Ward et al., 2006). In experiments comparing synesthetes to non-synesthetes, those with colour-hearing synesthesia showed very specific colour-pitch pairings, whereas the non-synesthetes were less organized in such pairings (Ward et al., 2006). Although this experiment did point to a possible connection of pitch to value of
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colour in synesthetes and non-synesthetes, the researchers acknowledged that this relationship could be a conditioned response to various cultural art forms. One example they cited was Walt Disney’s film “Fantasia” (1940), which often used this inferred relationship between colour value and pitch. For instance, during the section “The Soundtrack,” in which the sounds of instruments were animated as soundwaves, the colours changed not only in conjunction with the timbre of the instrument, but also in conjunction with the pitch. When the conductor instructed the bassoon to play a lower pitch, the colour switched from hot pink to purple, which was darker in value, thus connecting lower pitches to darker colours. In these examples, the artist creates a synesthetic experience for any viewer, where the nature of the “unity assumption” is informed by the relationship between elements developed in the audiovisuals.

In reviewing the psychological literature, it is apparent that there is a positive aesthetic experience when the “unity assumption” is achieved. This can be created through logical relationships of reality, as in the case of Kuwano et al.’s experiments, but also austere abstract shapes and sounds, as in the case of Namba et al. It is also apparent that while synesthesia can only truly be experienced by synesthetes, a similar experience can be expressed in audiovisuals to anyone where the artists creates the relationship that informs the unity assumption.

Art History

Next, we will consider Visual Music, crossmodal integration, and the unity assumption from the perspective of visual art history. Although Visual Music includes art forms that have both visual and auditory elements, it also includes (or evolved from) paintings created to suggest sound. Like crossmodal integration, Visual Music is
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associated with the artist’s obsession with connecting sensory experiences through the arts. The literature surrounding Visual Music strongly focuses on synesthesia and colour-or form-to-sound as being the connector or crossmodal binding between these senses (DeWitt, 1987; Greated, 2009; Harrell, 2000; Ione & Tyler, 2004; Strick, 2005; Ward et al., 2006). Strick suggested that “the idea of synesthesia served to mediate between music and visual art in the early twentieth century and proved essential to development of abstraction” (p.16). He further implied that the twentieth century’s interest in synesthesia caused artists to break down each element of an art form to find the equivalent to another. An example of this would be to connect the lights and darks of a colour to the volume of sound. He highlighted that visual art “aspired to the condition of music,” which often focused on a relationship of sound-to-colour (Strick, 2005, p. 16).

Regarding colour-to-sound in art, Strick noted that neither Colour Music nor Visual Music was an adequate title to describe the complex relationship between music and the visual arts. It is important to consider other elements that create audiovisual crossmodal integration. In endeavouring to examine the layers of this relationship, Strick notes the importance of considering the differences between the arts to examine what can connect them:

Yet, as expressions of musical analogy, these paintings always fall short in one important respect. Music is, of course, a time-based medium. Musical compositions unfold through time: even the character of a single note is partly defined by duration. In some respects, a complex painted composition is closer to a single musical chord than it is to even a relatively simple musical composition. And while it is true that a viewer might take considerable time
to apprehend fully a complex painting, the painter still has little or no control

over the sequence or order in which the viewer observations are made.

Abstract film developed as if in direct response to this shortcoming (Strick,

2005, p. 18-19).

As Strick mentions, film had an advantage over paintings in their ability to connect
to music because it contained the element of time. Even though the colour-to-music
connection was prominent at the time, the first abstract Visual Music films were in black
and white and had sequences of geometric forms “move” across the screen through time
directly analoging the changes in sound. This interpretation highlights that colour is not
the only way to connect sound and image in Visual Music, although Strick does discuss
the fact that these abstract films did evolve to colour and referenced their “still paintings
counterparts” (Strick, 2005). This suggests that while a colour-to-sound relationship is
important to Visual Music, it is secondary to the element of time. Many writers have
commented on the transition from Visual Music artwork in paintings to its use in film or
installation. These writers attribute this change to the addition of the element of time,
which is one primary difference between the mediums of painting and sound (DeWitt,
1987; Strick, 2005).

As a temporal medium capable of setting abstraction in motion, film allowed
painting to break out of its static frame and enter a new world of motion and
spectacle. Painters, who had been confined to merely suggesting motion and
rhythm through static fragment, could now create flowing movements and
rhythmic schemes that shape time, thereby bridging visual art closer to music
(Brougher, 2005, p. 100).
Although Bailey, Fells and Moody (2006) acknowledged the history of the colour-to-sound aesthetic, they argued that there is no truly objective connection between colour and sound and instead argued that motion is a more reliable connector between sound and vision. Arguing for a mapping framework that connects motion to sound in audiovisual interfaces, they cited the film theorist, Michael Chion’s, notion of “synchresis” to support their points.

Our experience of the physical world tells us that objects which we can see are in motion will tend to emit sound, as a consequence of this motion (from this perspective, the visual stimuli telling us the object is in motion is also a consequence of the motion)… Our experience tells us to expect some kind of sound in conjunction with certain visual stimuli (and vice-versa, depending on the situation), and our brain, expecting this aural ‘event’, will connect almost any sound to the visual, assuming there is some kind of related motion between the two (Bailey et al., 2006, p. 3).

In their work they reference the unnatural audio that is often associated with dramatic punches between fighters on film. Audiovisual punches are far more direct and strong than in real life. He suggests that the motion synchronized with sound enhances the image (which Chion refers to as “added value”) and fools the viewer into thinking it reflects reality. He posits that certain sounds adhere better to certain visuals and that this is deeply dependent on the motion associated with the visuals (Chion, 1994). Such statements point to the need to further understand the intricate relationship between visual movement and sound, as it can alter or manipulate a viewer’s perception of reality and thereby give it “added value.”
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The review of the art literature reflects a strong interest in synesthesia as informing the language of abstraction in visual music, but also acknowledges the importance of the element of motion in creating “unity assumptions.” In considering both the psychological and visual art literature, it is apparent that “unity assumptions” play an integral role in the creation and experience of multimedia artworks and are heavily informed by synesthetic experiences. It is suggested that the element of motion could have a significant impact on how the “unity assumption” is informed.

The Importance of Installation and Tropos:

To begin exploring a variety of questions as to how individuals connect the senses in an artwork, the installation Tropos was created (Musgrave, 2011). Tropos combines colourful elements of painted canvas panels suggesting movement, along with video projections of actual motion and sound in an integrative panoramic display. Each canvas panel is comprised of a colour scheme focused on blues and reflects an abstraction of sky and water. It blends abstract expressionist marks into optical patterns of squares, designed to create a wave-like motion juxtaposed with circular shapes. There are 12 painted panels and two video panels. The video panels are created with sheets of frosted mylar with rear projections of abstract moving video comprised of water textures and jellyfish-like motion. The surround sound is created through various speakers around the space and behind the canvas panels. The composition of the soundscape was created by the composer, Andrew Reed Miller, and includes various wave and cloud-like sounds with melodic ornamentation. In effect, this installation creates an environment where all elements discussed in this Introduction are present: colour, movement, painting, video, as well as sound. The integration of these elements within an environment was chosen to
investigate whether participants will perceive the sound as being part of the visual image (e.g., colour, shape), moving image, the painting or the whole exhibit. This thesis project will explore the participant’s experiences of Visual Music in a space where viewers experience painting, video and sound in one installation. It also investigates how all these elements interact together or are experienced by the participant. This research will also explore whether the sound-to-visuals relationships or the motion-to-sound relationship dominate in the perception of Visual Music in the current artwork.

The choice to integrate these elements into a whole installation experience was influenced by statements made by Strick and Wiseman (2005), which suggest that Installation is the art form in which Visual Music can mimic the immersive perceptual qualities of an actual environment (Strick, 2005; Wiseman, 2005). Installation is therefore an ideal candidate to compare the similarities between perceptual experience of reality to an artificial and abstract one:

A further step in uniting visual and auditory experience has been developed in recent years through the medium of installation art. A characteristic of sound is that it is perceived as ambient, existing in and moving through space. While sound may be directional in origin, it can be perceived no matter what direction the listener faces; though the listener’s movements through space can affect the quality and character of sound. By contrast, a painting requires a more-or-less fixed gaze to be perceived, as does a film. Installations activate both the space they occupy and the viewer. The physical quality of sound (loud enough, sound can be felt) is both approximated and augmented by the totalizing character of the installation space (Strick, 2005, p. 19).
Although the illusion of moving colour and form could be greatly achieved by film, Strick points out that it still lacks the element of the viewer’s embodied experience in the space that connects the sensory elements that are typical in an environment. Such statements suggest that neither painting nor film reach the total sensory experience of crossmodal integration that installation can achieve. An installation may be an ideal setting to question the nature of the crossmodal binding relationship in Visual Music, as well as the importance of colour, form or motion in the binding process. From a psychological standpoint, Schutz (2009) has also acknowledged that research has provided a variety of information exploring the experience of crossmodal integration, however, he suggested that there needs to be more examination of it in “naturalistic settings” (p. 2). While an art installation is not a “naturalistic setting” it creates an environment or three-dimensional space or sense of place that is not traditionally created in other laboratory-based settings. Our embodied and aesthetic experience of the space influences our emotions, actions and productivity. New research conducted by architects and neuroscientists examined different effects of light, ceiling height, and aesthetics in architecture to health, wellbeing and mindfulness. For instance, Bermudez (2014) conducted an fMRI study to capture the effects of “Contemplative Architecture” versus “Non-Contemplative Architecture” on the brain. By “contemplative,” Bermudez is referring to buildings designed with contemplation in mind such as museums, cathedrals, and libraries. The findings showed that the brain did behave differently when exposed to images of “contemplative architecture” and that the experience of contemplative buildings mirror neural correlations to mindful and meditative states.
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Grounded Theory:

Using the installation *Tropos* and the qualitative research method of Grounded Theory, a series of questions was presented to each of the participants while they viewed the exhibit to understand how each viewer experienced the installation and to provide insight into how each participant interpreted the interaction of audiovisuals in the exhibit. The sociologists, Glazer and Strauss, originally developed the method of Grounded Theory, positing that through data analysis a theory could be created and is thus “grounded” within a set of data (Glazer & Strauss, 1967).

This method was chosen for data collection and analysis because its approach allows for flexible, but also specific, data collection and analysis as to the participants’ experience of motion, visuals, sound, painting or video within the installation. It also requires the researcher to remain open to new concepts and theories that can be derived from the data. These new theories may inform this literature review, but they also provide a model to explain how participants interpret Visual Music artwork that involve painting, video, sound, colour and motion.

While traditional Grounded Theory guidelines discourage researchers from conducting literature reviews prior to research (Strauss & Corbin, 1990), many contemporary grounded theorists are of the opinion that it is nearly impossible to conduct any study without prior influence. Chamaz (2003) states that a researcher’s prior knowledge in an area can alert them to new concepts and ideas, which are important to explore. The knowledge of the subject matter can guide the researcher to the kinds of questions that are important to explore in a topic.

Thomas and James (2006) also supports the notion that it is impossible to free
oneself of preconception in collection and analysis of data and as a result they called to “re-invent” Grounded Theory. They argued that data analysis confined only to the context of the interviews, and not interacting with outside information, would be a detriment to the evolution of ideas (Thomas & James, 2006). Considering these criticisms, this thesis project will utilize a model of Grounded Theory that takes into account the literature review to the extent that it provides a context for the phenomenon of interest. The researcher would simultaneously remain open to new concepts that arose in the data, as in the case with traditional Grounded Theory. Further, while a literature review was conducted it did not provide a theoretical model to explain the experience of Visual Music and its relationship to visuals, motion, painting, video and sound. Thus, it is arguable as to whether it would influence or create prior bias in the researcher as data was analyzed or a model was developed. Instead, the researcher relied on the themes within the data to guide the development of the model.

Grounded Theory is not typically concerned with testing a hypothesis. The current analysis will provide insights as to whether participants describe motion as a common theme in the experience of Visual Music or whether motion is secondary to visuals, which was of interest in the current literature review. In this vein, a balance between understanding the participants’ experienced phenomena and, more specifically, of motion and colour in Visual Music will be achieved. The interview questions were designed to remain open to what the participant wished to discuss, but also enabled the researcher to become more specific as the interview progressed by slowly “funneling” the participant towards a particular issue of interest (Smith & Osborn, 2003). While still open-ended, these questions were aimed to encourage the participant to talk about how sound and
visuals were experienced in the exhibit.

This method used transcripts of structured interviews, which were then coded in detail, focusing towards codes/themes, concepts or claims that reoccurred in the data by the participant, as well as, the interpretation of these claims by the researcher. These codes/themes were analyzed and compared to build a framework for a theory or model as to how participants experienced Visual Music in an installation.

**Methodology:**

This study sought to understand the viewer’s experience of multimedia installation artwork involving video, sound and painting. This chapter outlines the qualitative method involved in participant selection and data analysis. Grounded Theory was utilized as a method to examine participant’s perceptions of the installation *Tropos*, as well as, the implications of their perceptions to visual music, art education and art as therapy. Initial questions were designed in consultations with experts in psychology and the arts focusing on the themes of perception, education and therapy.

**Participants**

Interview participants included 4 male and 11 female individuals ranging from age 16-49 (average age 27.73 years) from the university population, as well as, local citizens of Saint John, New Brunswick, Canada. All participants reported normal hearing and normal or corrected-to-normal visual acuity and normal colour vision. They were compensated for their time by obtaining credit towards their first year psychology course at the University of New Brunswick or a monetary amount of $10. The research protocol was on file with the University of New Brunswick Research Ethics Board and all relevant ethics procedures were followed during the completion of this study.
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Materials

For this study, a large audiovisual installation, entitled Tropos (refer to Figure 1 and 2), was constructed. Tropos was comprised of a series of 45” x 96” painted canvas panels and two 20” x 96” video panels, all presented in a panoramic circle. The visual installation was also accompanied by a musical piece. The goal of the artist was to create a space that integrated painted movement with audio and visual movement.

The imagery of the painted panels was created using abstract expressionist marks and shapes which were designed to express movement. The more abstract expressionist marks were gestural in nature and could be recreated by listening to music while pretending the paint brush was a conductor’s wand. These marks were placed on top of an atmospheric painted texture, similar to clouds. These marks make reference to the work of Jackson Pollock and Wassily Kandinsky. These organic marks were then integrated into a more graphic optical grid pattern designed to create the illusion of movement. The optical illusion grid makes reference to various wave illusions which utilize a grid, however, the Tropos grid is unique in that the hue of the colours within the grid gradually shift from cobalt blue to yellow ochre while maintaining the exact same value/shade. The edge of the squares of the grid can be created using masking tape. The colour scheme was mostly the blues of cobalt and ultramarine with highlights in a complementary burnt sienna orange. Manganese blue was used as a glaze over some blue areas. Shape and hue were varied between areas to create a gradual transition between the more organic and optical illusion sections. The center of the painting of Tropos is based on the shapes of soundwaves oriented vertically and then mirrored.
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The videos for the video panels were made to mimic the qualities of the painted panels and involved video abstractions of the sky, waves, jellyfish and other aquatic moving forms. Of importance to the artist, was the use of movement that was consistent, steady and gradual. It is the artist’s theory that such movement allows for a trance-inducing effect, similar to the feeling of watching a video of a fireplace or how hypnotists used the gradual movement of a spiral on their clients to improve trance depth (Barrios, 2007). The video was edited using Final Cut Pro using multiple tracks, fade out transitions, luma key and mirror perspective filters in order to layer and abstract the imagery. Any transitions between imagery were subtle and slow. Of importance to the artist was for the representational movement to be abstracted to the point that the viewer might get a sense of the original source material, however, the overall image would be interpreted as nonobjective. The video was rear projected onto frosted mylar pinned at the back of the canvas. A piece of 1 by 4” wood was placed at the bottom of the mylar panel to hold it in place.

Audio was presented in a surround-sound format from speakers placed behind the canvas panels and edited using Sound Studio and Max MSP software by composer, Andrew Reed Miller. The piece is a sonic landscape floating between melodic fragments and noise. As with the video imagery, the musical piece focused on consistent, steady and gradually changing sounds. Most of the source material was derived from the composer’s and artist’s own breathing and voice processed to the point that it evoked the sound of rolling waves of the ocean or loud air, as it would sound to a person in a flying plane. The composer used sound filters such as reverberation to process the sound. These filters also allowed him to create reversed sounds, that were manipulated to slow and speed up the
sounds. He also used a process of granular synthesis to derive drones. A subtle melody made up of reversed piano pitches floats atop the drone created by the processed voice.

Interview questions were first tested on a focus group of 5 people to determine the relevance of the questions. The response of the focus group was positive and provided support that the questions were appropriate. The process continued with 15 participants who were interviewed one on one.

The questions (refer to Appendix) considered overarching themes of interest to this thesis such as the general experience of the exhibit, how the visuals and sounds were perceived to connect and how the participants perceived the installation of the artwork. Questions were general and open ended at first, but then “funneled” towards specific areas of interest, such as specifically asking how the participant perceived the sounds and visuals interacting.

**Procedure**

Participants viewed the exhibit for 10-15 minutes after which time a structured interview commenced in the space so that participants could return to viewing the exhibit, if needed. Participants viewed the installation without music for about 10 minutes and then with music. The interviews were recorded using an audio device for later transcription and analysis. The interviews involved 41 questions (refer to Appendix), which were designed to encourage participants to discuss their audiovisual and crossmodal experiences of the installation *Tropos*. The researcher avoided mentioning that they were the artist of the exhibit so as not to influence the interviews. If asked who had created *Tropos*, the researcher stated that the identity of the artist would be revealed
later, after the interview had concluded. The viewing of the exhibit and interview took an hour.

**Data Analysis**

Grounded Theory involves the construction of a new theory through systematic analysis of data. The study often begins with a question and the theory is developed through the collection and analysis of data using specific tools such as “coding” and “categorization.” Researchers review the data and seek to highlight repeated ideas or concepts that become tagged with “codes” extracted from the data. As more data is collected and reviewed, “categories” begin to emerge that become the basis for a new theory (G. Allan, 2003).

While this method provides extensive analytical tools to interpret the data, there are varying opinions as to how Grounded Theory should be conducted (Thomas & James, 2006). In the case of this thesis, a literature review was conducted prior to conducting the research as it informed the development of the interview questions. In most cases, a literature review is not conducted prior to a Grounded Theory study. While this thesis’ focus regarding visual music and the perception of crossmodal integration was informed by a literature review the questions were designed in such an open ended way as to allow for a new grounded theory to emerge from the participants’ experiences, thus honoring the intent of grounded theory to “generate a theory that accounts for a pattern of behavior which is relevant and significant for those involved” (Glaser, 1978, p. 93).

Data was transcribed from audio recordings into a Microsoft Word document and analyzed using Grounded Theory’s “analytical tools” such as “codes,” “memos” to categorize data into patterns and develop a “theory” to be later discussed in context of the
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literature (Strauss & Corbin, 1990). During “open coding,” sentences were labeled or coded with words that represented the general theme of the sentence such as “motion,” “sound,” “escape,” “ocean,” or “colour” to name a few examples (Somekh & Lewin, 2011; Strauss & Corbin, 1990). The next stage of “selective coding” allowed for these “open codes” to be organized into broader core “categories” of: “Sensory Experiences,” “Crossmodal Integration,” “Altered States” or “Personal Experience” (Somekh & Lewin, 2011). The relationships between the latter “categories” were reviewed and interpreted to determine how they related. The “open codes” were organized into their “categories” using a document that included written statements theorizing the reasons for their relationships (i.e., “memos”). This relationship was described using a “Grounded Theory Model” where the “Categories” were then organized into “Causal Conditions” (what elements needed to be present for the Phenomenon to occur), the “Phenomenon” (what occurred), Interactions (what elements could possibly alter the experience of the phenomenon), Consequences (additional effects of the phenomenon) and Strategies (which strategies are there to create the phenomenon) (Somekh & Lewin, 2011; Strauss & Corbin, 1990). A “Diagram” (Figure 3) was created to visually represent how these Categories connected (Somekh & Lewin, 2011; Strauss & Corbin, 1990). The Results and Discussion section will outline the resulting grounded theory and its relevance to the Literature Review.

To ensure a rich data source was collected for analysis, 15 interviews were conducted with careful attention paid to Grounded Theory’s “Saturation Point” when participants began to repeat themselves (Somekh & Lewin, 2011; Strauss & Corbin, 1990). In the case of the participants, there were repeated comparisons of the installation
to the “ocean” and common perceptions of how the sound and visuals interacted.

**Results**

The Results section is broken down by different themes that emerged regarding the participants experience of the installation.

**Motion**

Motion was an early topic in many of the interviews. Over half the participants mentioned motion as significant to their experience early on and before being funneled toward the topic (Participant 1, 2, 3, 4, 11, 12, 14 and 15). Participant 14 described the installation briefly as “kinetic” while Participant 3 enjoyed the interplay of the “moving with the non-moving parts.” Participant 4 went into great detail about their experience of the movement illusion caused by the squares:

Participant 4 (P4): I was looking at all of the checkerboard part to see if they all moved and I find some of them move more than others. Like the bottoms down there? I don’t really see it moving, but it’s like I see that moves and like it moves a little. This part right here moves a lot [pointing to the grid pattern on the left side].

Participant 12 also spoke of the movement of the squares in response to the first question, which asked how they would describe their experience of the installation. They spoke of how the movement of the pattern connected with them having a positive experience:

P12: [My experience was] Positive. Comfortable. I was very interested in it. I was like sometimes when you see an exhibit or you see artwork you have … a really immediate sense of what’s going on, but for me it was very
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accumulative like it evolved over time and …it was because of all the organic shapes and the movement in the artwork that my thought process kind of matched that.

Participant 1 also spoke of the squares and movement immediately after the first question regarding their general experience of the exhibit:

P1: Some of the patterns are somewhat hypnotizing. It seems like they are alive in a way, like it seems like they are moving even though, I don’t know what you would call that, the grid?

Researcher (R): Yes

P1: When you concentrate on it, [it looks like] it’s moving

Also in response to the first question, Participant 3 responded:

P3: I like…the moving in with the non-moving parts. I think that is really neat because you’ll be looking at one part and your eye will be drawn to the moving part and back and forth …

The prominence of motion in the participant’s description of their experience would suggest that it plays an integral role in the audiovisual exhibit. Other participants brought up motion early in the interview, but also connected it with sound. These interconnected experiences are discussed in the next section.

**Motion and Sound**

While the above examples highlight only the painted motion of *Tropos* without mentioning the sound, other participants went into greater detail expressing that their experience was related to an integral relationship between the motion and sound.
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In response to the question that asked, “is there anything that is strong for you in the exhibit?”, Participant 2 responded:

P2: I...noticed them at first [referring to the squares] and went “hmm” and as soon as the music came on it was almost like they started moving…

When asked if they felt that the sound affected the visual elements, Participant 14 said “I think it makes…what you are looking at a little bit more kinetic.”

One participant quickly connected the motion to sound stating that “there is a lot of vibration going on here in the artwork, visually there is a lot of movement and energy similar to music” (Participant 13). Participant 15 brought up the connection of synchrony to sound and visuals:

P15: [referring to which senses are stimulated by the exhibit] I get into that place where everything is feeling in sync. I want to move…my two senses that are more easily activated or stimulated. I guess hearing and touch or movement...I found they worked really well together, the sounds and the images…I like the video because the canvas sort of almost looks like it wants to move and then the video does have movement in it and then the music just brings in even more movement…by movement I mean like subtle movement….just like patterns…felt like it was moving or that in order to experience [the installation], required movement.

Participant 13 also described an integral relationship relating to a narrative when asked if the visual elements affected the sounds.
P13: Yeah, they do play off each other. And when the sounds did come into play then I started to accept the sound more. I started to kind of look deeper into the visual elements that were around. And it kind of had a different story with the sound as opposed to before the sound was incorporated.

R: What was the story before and after?

P13: I think that it added a lot more with the sound. Because when the sound came in and when I started to pay more attention to the moving image more then I felt more like I was inside the piece with the music and it did feel like that safe kind of womb feeling and it got me thinking about if I was a baby inside a womb what would it…sound like and what would they look like and would my vision be totally different? And the sounds I would hear wouldn’t be the normal sounds I would hear today and how would I interpret those sounds? What would I think was going on in that big scary world?

The prominence of motion and sound in the participant’s description of their experience would suggest that it plays an integral role in the audiovisual exhibit. For some participants, this synchronicity between the sounds and visuals enriched their experiences and led to elaborate narratives.

Many participants described being focused on visual elements of the painting, such as colour, when the music was not playing. However, when the music was on, their attention was now directed to the visual motion of either the painting or the video. In the case of Participant 13, they were more focused on the colour when there was no accompanying sound, but then their attention was drawn to the video when the sound
 Vive la musique visuelle à “MINDFUL”

Experiences

came on and they described being pulled into the center of the piece and focused towards
the moving images. A similar experience was described by Participant 11:

P11: My first reaction when I came in was awe of the size and I lov[ed] the
detail parts and the colour. I didn’t immediately look at the moving [pointing
to the video] panels… I found that after you put the music on, I was more
drawn to the movement [meaning the video] and wanted to focus on that
more.

…

When there was no sound I guess there wasn’t as much movement even to the
visual parts of it like I was drawn in the checkboard parts throughout
because…those parts caught my eye, but once the music came on and along
with these… it kind of added to the movement of the entire piece.

Participant 11 later stated “when there was no sound... there wasn’t as much movement
even to the visual part of [the exhibit]” referencing the square grid pattern saying that
once the music came on it appeared as if the entire work was in motion. Participant 9
expressed a similar experience stating that the music “enhanced” her experience and also
discussed how the sound affected the painted elements:

P9: I didn’t see the little squares at the beginning, like I was looking at those
and then the music with the sound like other things started coming out at me
and it made the painting, the actual painting not the video that is moving, but
it made the painting seem like it was moving.
Participant 2 also expressed that the music “enhanced” their experience and stated that the grid pattern began to move when the music came on or that she noticed the movement more with the music.

P2: They seem to pop right out for some reason. It was really interesting. I guess it’s just like trying to pretend what could be underwater and like all the sounds that you hear and it was neat to actually try to imagine I guess.

Participant 9 described a similar experience:

P9: It [the music] just enhanced it and it brought out different things like I was saying I didn’t see the little squares at the beginning, like I was looking at those and then the music with the sound like other things started coming out at me and it made the painting, the actual painting not the video that is moving, but, it made the panting seem like it was moving.

R: How so? Can you describe that?

P9: Well, [it] just came of out of the corner of my eye I was like “did that shift? Did that staircase [referring to the linear lines at the right end of the painting] move?” whereas when the music wasn’t on I didn’t know if I or maybe I did see that, but yeah, I felt that the music definitely enhanced the movement of the painting.

Participant 10 described a similar experience:

P10: The movement of the checker pattern…that runs through. There’s a lot of movement in that and I feel it’s almost 3D like the waves, one thing when the sound came on I felt like I saw that move more than anything else. I didn’t notice them move as much before without the music and then when the
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music came on I felt they started moving…Obviously the video portion because it’s actually moving in front of me. Where I didn’t see movement were those bold lines on the right yet I could feel as if I was moving across them because it was almost as some type of path or walking bridge so I feel that I could be moving on them but in the painting. I didn’t see movement in the center part, the part that I really liked with the dark section [referring to the center of the exhibit]. I didn’t feel as much movement there.”

These experiences would suggest that the music changed in the perception of visual elements and made them more mobile. In many cases this involved the square grid pattern which was comprised of a particular sequence of colour and shape to create a movement illusion. As stated in the Introduction, this focus on the grid is likely due to the ventriloquist illusion because of the pattern’s subtle movement illusion. Participant 9 mentioned another area, which they referred to as the “staircase” as having moved. This “staircase” on the right of the painting was a pattern composed of various linear lines.

When asked to compare the experience of the installation with and without sound, Participant 7 stated that the sound helped reinforce a narrative they imagined with the visuals involving the movement of someone “running away,” a “chase” or an “escape.”

That the majority of participants associated the sound with the movement of the optical grid pattern or video is consistent with the theory of the ventriloquist illusion, in which sounds are most likely to create a unity assumption and crossmodally bind with moving imagery. Of interest, is that the ventriloquist illusion was maintained despite the imagery being abstract.
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Sound

Although the sound was installed all around the installation, 9 of 15 participants clearly stated that the sound was localized at the video panels. Only 2 of 15 perceived the sound as “all around” (Participant 2 and 15). One participant thought the sound was coming from both the painting and the video and two others interpreted the sound as emanating from the central section located between the two videos. This would again give support to the ventriloquist illusion given that the more mobile aspects of Tropos tended to crossmodally bind with the sound.

Of particular interest to this thesis was whether the movement of the video, despite being abstract and smaller in proportion to the painted parts of the installation, would maintain the ventriloquist illusion and crossmodally bind with the sound. Based on the latter experiences, it would appear that the ventriloquist illusion held true even in cases of visual music abstractions. More participants described a crossmodal binding of the sound with the video, rather than the painted sections. In the case of the installation Tropos, the painted movement illusions appeared to produce more crossmodal bindings than the suggestive movement within the abstract expressionist marks. In addition, many participants were able to read intricate narratives into the work when sound and visuals were synchronized and created an environmental experience.

Colour and Shape

The experience of colour was discussed in the context of creating an emotional response and/or establishing an idea of an environment. First, we will consider the influence of colour on the participants’ experience of Tropos. Seven of the participants discussed colour as connected to emotion. Participants often described the positive
emotions of happiness, peace or calm in relation to colour (Participant 2, 8, 10, 12). Participant 14 said that they “physically…felt kind of elated when [they] walked into the room” because the colour “lifts you up.” Participant 1 went further with their description of colour and emotion and ascribed light and dark changes in the colour to transitions in emotion:

P1: I see it as a transition of emotion…when I look from the left, the lighter contrast [and] the brighter colour gives me a sense that it is in a happier state…but, as [it] transitions towards the middle, where it is darker, the emotion is stronger. It gives me the feeling that there is stronger emotion and maybe because the colour is also darker the emotion transitions to sadness.

Participant 2 expressed that their initial attention was to the colour and that this affected the emotional influence of the piece, but that the emotion changed after the music was presented:

P2: I felt happy at first because the colour choice…those colours to me are really happy and warm…I felt more conflicted like I kind of jumped between emotional [states when the sounds came on]. At first I was “this is beautiful and this is warm” but, then when the sounds came in…[it became] a heavy feeling.

This quotation suggests that sound also has a strong influence in the area of the emotional impact of Tropos, as does colour, and that the emotion, colour and sound affects the conceptual synchronicity of the perceived mood of the artwork to the mood of the painting/video.
In many cases, music enhanced the experience of colour while establishing the environmental location of the installation. When asked to describe their experience with the exhibit Participant 2 said it was “peaceful and colourful.” When asked if there was anything strong for them in the exhibit, Participant 2 answered:

P2: It would be the music and because I found that as soon as the music came on it kind of enhanced my experience…It reminded me of an octopus or something. I don’t know if it’s supposed to be an underwater theme but, definitely the colours and just the contrast.

Participant 5 also stated that the colours helped to inform their interpretation that the exhibit related to water, waves or the ocean:

P5: To tell you the truth, I was amazed when I saw it because of the sheer magnitude of it because I thought it would be just a small painting or something like that…also the colour choices, in terms of a visual aspect of it. I think of the ocean perhaps under the water because I dive once or twice a year, so…that brought back my perceived notion of what the world under the water is….

According to these quotations, colour had an emotional effect on the participant’s aesthetic experiences, but also informed participants as to the environment they were in while experiencing the installation.

**Space – The Panoramic Layout**

An unexpected element of importance to complete crossmodal integration and “unity assumptions” was the element of space, size and the perception of being surrounded. Many participants, including the previous quote by Participant 5, remarked
on the panoramic display and the fact that it was large and overtook the periphery or gave them the sensation of being surrounded, encompassed or connected (Participant 2, 3, 5, 10, and 12) and that the layout added to the emotional reading of the piece (Participant 11).

Participant 2 expressed that the layout created a “flow” which echoed Participant 3 who attributed this to the panoramic curve creating a sense of fluidity so that connections between elements became more fluid:

P3: I like it because it kind of connects things. It’s more of a fluid movement where it’s not jagged and I’m going to turn walls and stuff like that. It’s kind of a more you can walk around and enjoy it, more of a fluid.”

They expressed that the curve allowed for the viewer to see the connections, thus “fostering connections” or crossmodal integration, potentially:

P2: …I think giving the opportunity to be able to see more because sometimes you can link things that you would never have linked if you can kind of see them against other things. So, if things are tucked away in different rooms, you don’t see something aligned with something else and also where it is round shaped it doesn’t put to mind that there is a powerhouse somewhere…in the room because there is nothing at the head of the table or the head of the room because it’s a circle so it’s kind of more everyone’s involved type of idea.

R: So, you would say it fosters connections?

P2: Yes
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Participant 2 also expressed that the panoramic made things appear “more real.” When asked to explain what they meant by “more real” they stated: “It’s almost like you are stepping into it…you just have to go through the different motion almost whereas if you were just looking at something straight on you kind of get distracted by something that is right beside it but, here you are almost forced to view the entire exhibit.”

Participant 10 expressed a feeling of being “encompassed” as adding to the experience of the exhibit:

P10: I like the panoramic layout. I like being encompassed with it. I feel it works well for the piece and I’m hoping that was the idea was to be just surround with it so you walk in and the experience is just around you as opposed to…if it had ever been played with the idea of making it a straight line or a diagonal with the panels going flat. I don’t think the experience would have been the same as this kind of arc shape.”

Instead of “encompassed,” Participant 11 used the word “enclosed” to describe the layout and added that this contributed to their emotions of warmth or intimacy with the exhibit:

P11: I think that adds to the sense of relaxation or comfort that it gives. If it was a long [format, such as] a straight line it may not have that kind of warm, or as warm of a feeling to it. It’s kind of and like being enclosed made it, just feel more intimate.

The sense of being surrounded applied to the sound, as well. Participant 12 said that “when the second component of the sound came in [they] felt more surrounded by the
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artwork.” Participant 9 and 10 commented that when the sound was turned on it made them feel like they were part of the whole canvas. Participant 5 expressed that the “magnitude of it is that you feel like you are in an environment” and referenced both the surrounding nature of the visuals and audio. Participant 9 also expressed that, in general, the music created a sense of wholeness: “I found it interesting but I wanted just to look at the paintings, but then when the music came on it kind of filled it all in like it all made sense, it all came together.”

Many participants expressed that the feeling of being surrounded, encompassed or enclosed added to their experience of the exhibit in terms of crossmodal integration or an emotional reading. The panoramic layout gave more of a sense of place or an environment.

**Environmental Schemas**

When participants discussed the various sensory elements such as motion, colour, shape, music, and space it often led to an elaborate narrative involving a description of an environment. These environments were informed by previous schemas which informed the participants as to how those environments work (Fournier, 2018). In psychology, a schema is referred to as a pattern or thought that organizes information and their relationship among elements, whereas, in visual art, it refers to the outline or building blocks of an image. For the purposes of this thesis, schemas will refer to the psychological definition and explore the built awareness of how things work based on the memory of past experiences that built the schemas.

Participant 5 offered that they had a background in diving which may have contributed to an environmental schema of the ocean with regard to the blue colour. This
schema continued to affect the participant’s experience when other elements were examined:

P5: The second part of the exhibit when you turned on the sound it didn’t make me continue thinking of the underwater world…Maybe an underwater volcano. I don’t know if you have, you do scuba diving or not but, when you’re under the water actually you don’t hear anything, you mostly hear your own breathing. So, your own breathing [making underwater breathing sounds]. So, some of that sound is kind of like it sounds familiar to me… It’s hard to explain it because it’s not a familiar sound that you hear every day. It’s a sound that for me kind of like I hear once or twice a year and that is what brought me back.”

When participants were asked about a singular sense, such as sound, it often led to discussion of all the sensory elements as a whole. Participant 13 was not clear about the exact location of the sound, but offered:

R: Where do you think the sound is coming from?

P13: [long pause] I am not sure.

R: Okay. Where do you think the artist intended you to think the sound was coming from?

P13: …the sound came first and inspired the piece and it was kind of a visual representation of the sound.

R: What about location, like where the sound is actually emitting from in the…. 
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P13: Oh, I feel it’s an underwater sound. Yeah, like that was another thought I had, there’s a lot of kind of images and just kind of shapes and colours that make you think you’re deep, deep underwater which is like a peaceful feeling because it would also be that heaviness that’s weighing down on you if you are underwater so but, yeah, it’s definitely the sounds definitely feels like you’re underwater and like beautiful spooky jellyfish are swimming around you and you’re just like taking it all in.

While this participant did not directly state where the sound was coming from one might interpret the answer as the sound coming from all around given that the experience of being underwater, as described by Participant 5’s scuba diving experience, creates a surround sound experience of a breathing drone.

When sensory elements of sound, colour, motion and space were perceived to be in synchrony based on the participant’s environmental schemas it played an important role in crossmodal integration and the aesthetic experience. The majority of participants related the environment to either the ocean, womb or inner body. Given that the ocean is generally associated with the colour blue, the same colour as the installation, one could surmise that colour played a major role in this assertion. In the latter cases, the establishment of a holistic environment through familiar relationships of blue ocean-like colours with wave-like sounds supported the crossmodal integration and aesthetic experience; this is similar to the findings in the studies conducted by Kuwano et al. (2001), referenced in the Introduction, in which tree sounds were judged more aesthetically when paired with tree visuals. In other cases, the participant’s perception and experience was disrupted when they perceived that the sounds did not conceptually
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match with visuals one would associate with the ocean. In the case of Participant 6 they perceived the gridded optical pattern as representing a “spider net” which they described as “confusing” and thus created a disharmony to their aesthetic experience and thus crossmodal integration, whereas the elements synchronized for Participant 9:

P9: Well I think because the sound, because of that rushing sound, that is just continuous that to me just makes sense with the painting because the painting is constant and the rushing is constant so the whole thing to me was just constant movement.

So, for this participant their schema informed them that environments have consistent motion with consistent sound. Participant 8 had a similar experience, but attributed it to consistent visual changes with consistent sound alterations:

P8: I felt the sounds were in sync with what the painting was showing which was changes happening, changes say happening on earth, on the universe or it could be in the development of a specimen. It could be anything and so I felt it was truly portraying…what is going on in the painting right now which is changes.

In this case, the schematic consistency led to a narrative. Participant 9 went further as he too described an integrated narrative which he described as causing him to become more engaged with the panoramic layout which was activated by multiple senses being activated giving the exhibit a holistic/environmental aesthetic:

R: How would you describe your general experience of the exhibit?

P9: Well, when I first came in I was trying not to look at it while we were talking because I wanted to have the experience of seeing it and then I
discovered that I didn’t want to look at the whole thing in its entirety. That I really wanted to go panel by panel. When you turned the music on, or the sound, it really made me feel like I was part of the whole canvas as opposed to without the sound. I did feel like I could almost “okay this is this, this is this” like I could differentiate but when the sound came on it definitely, at moments, it was overwhelming. There was one part on this second screen. R: The left or right? P9: The right, where it looks like, I don’t know if it’s a cloud or what it is that is coming down, but it looked like a person was actually falling and I didn’t notice that and as soon as the music and sound came on there it is. It was just like this and it’s not a person but, it looked like that, it looked like someone falling backwards and year, it was really, it really pulled me in and gave it a very…human experience at that point.”

From these qualitative experiences, it would appear that environmental schemas played a role in how the participants interacted with the exhibit and perceived crossmodal integrations. It also had an influence on whether the participant had a positive aesthetic experience, as suggested in the next section.

**Personal Preferences and Artistic Background**

Personal preferences and the artistic backgrounds of the participants had an influence on the crossmodal interaction experienced. In certain cases, participants offered that they had a lack of experience with abstract art and suggested that this contributed to a lack of a schema for that experience and thus as to how abstract art and sound could
integrate (Participant 4). In the case of the participants who found an ease of crossmodal integration, they all had experience with art, art galleries, etc. and had well-developed schemas to draw upon for a variety of experiences.

Early in Participant 4’s interview they stated they had a hard time integrating the sound and visuals because they felt there was a contrast between the sound and visuals:

P4: …I didn’t really know what I was supposed to look at when the sounds played. I thought that the music was a little bit of a contrast to what the picture is because the music seemed a little more down, negative or scary than what the picture was saying.

When asked about their previous experience in art galleries they said:

P4: I haven’t been to many art galleries. I have somebody who I work with who paints sort of like this, like just kind of like random[ly], it’s like a whole bunch of things all piled into a picture…I just don’t know what to take from it. It’s neat, but I can I probably won’t be able to do something like that, but other than that I haven’t seen anything like this. I probably have, but I just have seen it that often.

At the end of the interview Participant 4 was asked if there was something they wanted to add, to which they offered:

P4: Well, I didn’t really know what I signed up for when I did this. Something about art but,…I don’t usually do stuff like this… try to interpret it because I don’t really know what to take from it so …beside that one girl…She paints stuff like this but, like my parents go and we have an art show that comes every year…at the church…I like going to that one but, I
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don’t really go that often. I think that’s nice but, it’s not stuff like this. It’s more flowers, apples or something like that. So, this is different.

Participant 3 also expressed that the music did not fit with the installation and that this caused a conceptual disharmony in their perception of the crossmodal integration. They associated the music with sounds of a fair, ferris wheel or happy clowns whereas the visuals evoked the imagery of the ocean. They added that their personal preference would be for classical music.

R: Do you think the artwork is trying to convey an emotion?...
P3: I think it’s a calm emotion but, I find water calming too.

R: So the association of water?
P3: Yeah.

R:…So tell me your thoughts regarding the sounds and images of this installation. Did you like or dislike them? Do you find that they are distracting?
P3: I like the sounds of waves and stuff like that, the music in the background from the waves was a little bit, if it was more of a classical maybe it would have flowed a little bit better. I don’t know, in my opinion but, the visuals of it like I really liked, I could walk from side to side of the room and follow it along.

R: So you feel a different style of music would have gone better with it?
P3: Yeah, yeah.

R: Why do you think classical?
P3: I love all music. I listen to everything but, when I’m out on the water canoeing with a group of gazillion kids it’s I tend to have an iPod in one ear and it tends to be classical. Just something to relax.
P3: Classical is calming. I like the sounds of the waves and stuff like that, the music in the background from the waves was a little bit, if it was more of a classical maybe it would have flowed a little bit better. I don’t know, in my opinion, but, the visuals I really liked, I could walk from side to side.

For Participant 3 they had a strong personal preference of classical music for relaxation and they associated water with that same emotion. Due to the fact that Participant 3’s first experience was of the visuals as “calming” it led them to believe that the music should also be calming and based on this participant’s personal interest that should have been classical music. When the conditions of the participant’s perceived ideal crossmodal pairing were not met, it may have created a cognitive dissonance that interfered with crossmodal integration or the aesthetic experience. Similar to Participant 4, they did not have many experiences with art, cultural experiences and visiting art galleries:

P3: Not since I was a kid. I mean my mom used to work at the [a cultural organization] when I was really little. So, I used to [be more around cultural events]. I loved [it and] that is why I love classical music is because…Symphony New Brunswick would go in there and play and I can remember waiting for my mom to get off work and sit beside her and listen to that or going on at night…they had a health thing in there one time that stuck with me. So, things like that are neat but, I haven’t by no means as an adult. I do go to the Symphony at least once a year but, that is about it.
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Participant 8 described how the sounds were “in sync” with what the painting was showing, which they interpreted as changes on earth, the universe or development of a specimen and that this synchronicity or crossmodal integration created a greater sense of a reality for them.

R: Do you find that your sense of sight, sound, touch, smell or taste was stimulated by the work at all?

…

P8: Well the images that are going on now, I thought it was really…stimulates to the painting itself so…it brought more clarity as to what [the artwork was] trying to convey more…

R: Tell me about your experience with the installation when there was no sound.

…

P8: …The sounds just added more to it and I think in some instances the sounds kind of brought me more to the moment.

R: By “moment” what do you mean?

P8: Well the moment of well not actually physically being there but, being in the moment of wow.

Participant 10 remarked that there was an increased focus when the stimuli synchronized with their own concept of the environment being underwater and that he enjoyed when the sound confirmed his reading.

R: So now we are going to move into specifically talking about how you experience the visuals and sounds. Tell me your thoughts regarding the sounds and images in the installation.
P10: Yeah, well the sounds and the images, I had already kind of made up my mind on what I thought of the work before you played the soundscape and then I felt with the sound playing, it kind of confirmed of what I thought of “Oh this is definitely the underwater part” because it felt like it sounded very underwater. So, then I felt when I was listening to it I looked at the video more. I think partially too because when you see video playing or projection to silence and maybe that is the internal part of making music inside of me, you just associate a sound with it because it’s not something in my head so when the music came on it was like “yup, this is what it was supposed to be, it’s underwater” or that’s what I thought. If any of the elements were perceived as incongruent according to the participant’s personal preferences or artistic schemas based on their background the illusion of the unity assumption was disrupted leading to a lesser aesthetic experience.

**Mindfulness**

When participants experienced a crossmodal interaction, or full crossmodal integration, coupled with a positive aesthetic experience, they often described altered states that could be described as extrasensory, awareness of inner body, out-of-body experiences, greater focus and relaxation. As stated previously, Participant 1 even used “hypnotizing” to describe their experience with the exhibit and light hypnosis and mindfulness are often used interchangeably (Spiegel, White, & Waelde, 2010). The experiences described by the participants may fall under the umbrella of “Mindfulness” (Spiegel, White, & Waelde, 2010). However, it is important to note that the term is still evolving and that researchers have a variety of ways to define it (Grossman, 2011). Grossman suggested that “one essential aspect to consider is that there is a lack of clear
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external referents, or gold-standard measures, with which to define a mindful person.

Therefore, no possibility currently exists to assess whether these questionnaire measures accurately reflect mindfulness or something else” (p. 1035).

While the experiences of the participants are consistent with how a variety of researchers have defined mindfulness, for the purposes of this thesis, it is not important to determine definitively whether or not that it is so. Instead, what it is important is that the viewers described these mindfulness-like experiences relating to their experience of the installation.

With regard to relaxation, Participant 2 frequently stated that the sounds and visuals created a “calm,” “peaceful” or “tranquil” effect. When asked the first question about describing the installation they stated: “I would describe this experience as peaceful and colourful. Just kind of calm” and later when asked if their senses of sight, touch or taste or smell had been stimulated by the work they answered: “Sight and sound because yeah, it was really calming.” When discussing their emotional reactions to the work they described it as a “comfortable feeling.” Participant 10 also stated that they felt “calm” in response to the exhibit.

When asked about any bodily or emotional reactions, Participant 8 stated that they felt “warmth” from the exhibit. As stated in the previous section, Participant 8 also talked about their consciousness being altered by the sounds and visuals to give them a sense of escapism or catharsis. They described this altered stated as “the moment of not being physically here.”

Participant 14 stated “Physically, I felt kind of elated when I walked into the room and I still kind of do because of well just the colour…just lifts you up.” When asked
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about their senses being stimulated they stated “Touch…very lightweight, very light, weightless.” When asked specifically about sound and visuals, they stated that these experiences related to a blending or connectedness of the sound and visuals:

P14: I thought they [sound, colour, space] paired really well with the music and the sound…I think walking into the exhibit and having that going right away would certainly be cool.

R: The sound you mean?

P14: Yeah, having that go all the time…I find it kind of blended after a few seconds for me…it became the same thing. It sounded like they knew each other really well.

One participant suggested that when elements were in sync that they were more likely to have other senses simulated (Participant 15). Participant 13 described that because the space was all around she had more sensations. Participant 15 described a positive bodily reaction to the work of being “grounded” or “solid in [their] body.” Participant 12 even described the experience as if one’s body or organs could talk back. Participant 13 attributed their bodily reactions to the fact that the installation was surrounding them:

P13: …it makes you feel like you are in it, like you are in the work so it feels the work is all around you so you can kind of feel that on your body as opposed to just looking at a piece of art that is just kind of set right on the wall. It’s a different experience to have it totally surrounding you and it does make you more aware of your body and your senses and with the sound stimulating, as well as the moving image and the stationary images.
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If it is the case that a crossmodally integrated environment elicits a more present state of awareness within the body, then it may have applications for therapy or education. In terms of therapy, having more of an awareness of body might help a patient to note imbalances in the body. In terms of education, a more crossmodally integrated environment could keep students from losing focus and remain present in mind and body during a lecture. Participant 9 attributed this bodily awareness to a greater sense of focus:

P9:…kids, especially now, they want to be immersed in something as opposed to just looking. Everybody watches way too much television and on Youtube® or whatever. You are always looking at stuff but, you are never it always just in front of you, but you never kind of taking it in with your whole body. It just there, move on.

As Participant 9 mentions, it is rare for a child to take information in using the whole body, as opposed to the disconnection created by looking through a window-like screen. When the crossmodal experiences involve the whole body there seems to be a greater experience of being present or ability to have greater focus.

An altered state of greater focus was mentioned by many participants and they attributed this to having more senses stimulated. It may be that this experience of focus is related to crossmodal interaction or integration, as the participant’s statements would suggest. When asked about the addition of sound to the exhibit Participant 6 stated that it “made [them] focus more” and allowed them to “think more deeply in the pictures and then to think with the water… to sit on the sea and …remember something back in your life.” It was Participant 3’s assertion that “the more senses you stimulate the better people related and remember and put things together.” While Participant 5 also agreed
that the more senses activated resulted in maintaining attention they also attributed the
greater focus to the sheer magnitude of the exhibit allowing for someone to fall into an
environment and have less distraction. They also stated that “rather than just listening to a
lecture and you could get kind of carried away in your own thoughts, but if it’s audio and
visual, it does help you to keep your focus on more.” In discussing the panoramic display
Participant 12 commented that you would not be able to escape what you were learning
about if you were surrounded by it. Participant 2 expressed that because you are “forced
to experience it” there are fewer distractions. It would appear by all these accounts that
the greater awareness of the body was a result of being immersed in a sensory experience
and that this could have the effect of greater focus.

P11: It’s just how it’s encompassing instead of having you know distractions
of so many other things, things going on. It just kind of helps you focus on
what’s happening now and not thinking about everything else that’s going on.
You can just focus on now.

Only Participant 4 expressed that the magnitude gave them a sense of distraction or
confusion, but they attributed this to a need to try to “figure out” how it all worked as a
whole. It is possible that altered states of trance were not achieved in this case because a
crossmodal interaction was not initially achieved. This participant noted that they were
unfamiliar with abstract art. As theorized, it is possible that personal preferences played a
role in whether these participants experienced crossmodal integration, so it is possible
that this prevented the participant from going further in the experience of trance.

In contrast to inner body states, many other participants described an out of body
state that was therapeutic. Participant 1 expressed that they were put into a state of trance.
Participant 13 specifically cited that the sensations of sounds “wrapping around” as putting them into a therapeutic altered state and Participants 10 and 11 described being taken to “that other place” and that it would be useful in hospitals to give patients a place to escape from a difficult reality that they are living Participant 9 described feeling like she was a fish in the ocean and also stated that this sort of escapism could be used in hospitals as therapy:

P9: I don’t like hospitals at all and they are so starchy and well there is just so much, you just walk in and you just feel sick, you know? And I think that having artwork like this for patients or for families who are visiting patients it would be just really, it would take them somewhere else for a brief while, you know so that they could, if there is something traumatic happening with their loved one or you know if the patient then I think being able to kind of in a way it’s a form of escapism right? Like you could kind of escape to this other, this world for a while as opposed to being in your hospital room or your ward or whatever.

According to these experiences, an environment created with the aim of crossmodal integration has the potential to elicit trance experiences such as more sensations, an awareness of inner body or an out of body experience that could be useful in education or medicine. As a result of these states, many participants mentioned a greater sense of focus and relaxation.

**Grounded Theory Model: Crossmodal Interactions and Mindfulness**

From the above interviews the “Grounded Theory Model: Crossmodal Interactions and Mindfulness” (Figure 3) was derived. This model outlines a theory as to
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How crossmodal interactions can perhaps lead to mindful experiences. The term Crossmodal Interactions refers to the different degrees to which stimuli can appear to be integrated, whereas Crossmodal Integration refers to all stimuli being perceived as unified. Crossmodal Integration was included in brackets as to not exclude the possibility of it from the model, however, it was not necessary for participants to experience it to proceed to subsequent levels of the theoretical model.

Conditions lists the senses that influenced the Phenomenon (i.e. what is happening), which, in this case, was the experience of various combinations of Crossmodal Interactions. Conditions related to the Phenomenon were derived from the coded interviews which were organized into larger units called categories, as mentioned in the Method section, and were discussed at length within the Results section. The categories of “Motion,” “Sound,” “Colour,” “Shape” and “Space” were included in the Conditions section. When these Conditions were present it was possible for the Phenomenon of a Crossmodal Interaction to occur for Participants 1-15. The contents of the interviews revealed the extent to which these interactions occurred and in which combinations of the senses. For instance, a Crossmodal Interaction of sound and motion was described by Participants 2, 6, 7, 9, 10, 11, and 13, whereas an interaction of colour and shape was of greater focus for Participants 1, 2, 5, 8, 10, 12, 14 and 15. Experiences in sound, motion, colour and shape were mentioned by Participant 2 and 10. The elements of sound with the panoramic space was discussed by Participants 5 and 9.

When the Phenomenon of Crossmodal Interactions did occur for these Participants it was possible for them to experience the Consequences, in this case a state of mindfulness (Participants 1, 2, 5, 6, 9, 10, 11, 12, 13, 14 and 15). The Consequences
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section highlights the specific sub-headings of extrasensory experiences, inner body awareness, out-of-body experiences and focus which these participants expressed in their interviews. For instance, Participants 8, 9, 10, 12, 13, 14 and 15 brought up experiences of additional sensations or awareness of inner body whereas, Participants 1, 9,10,11 and 13 discussed out-of-body experiences. A greater sense of focus was discussed by Participants 2, 5, 6, 9, 11, 12 and 13. A state of relaxation was described by Participant 2 and 14. All these experiences could be described as qualities of mindfulness.

Interactions refers to aspects that interfered or had influence on participant’s experience of the Phenomenon, or in this case, also the Consequences. The reason to include two arrows is to highlight that the outlined Interactions can have an impact on reaching the Phenomenon of Crossmodal Interactions, as well as, the Consequences of Mindfulness. In this case, the Interactions were Environmental Schemas, Personal Preferences or Artistic Backgrounds. Although further research would need to be conducted to address this possibility, it is possible that these aspects could hinder the experience of crossmodal interactions such as in the case of Participant 3 and 4 whose personal preferences and/or artistic background may have kept them from having an integrated experience. By this model, it is theorized that their inability to achieve a crossmodal interaction could be at fault for them also not achieving the Consequences of mindfulness. It is also the case that while some participants did experience the Phenomenon of Crossmodal Interactions that they stopped there and did not proceed to the Consequences possibly due to the Interactions. For example (Participants 1, 2, 5, 6, 8, 9,10, 11, 12, 13, 14 and 15) went into detail about their crossmodal interactions and trance-like experience, whereas, Participants 7 discussed crossmodal interactions without
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mentioning a heightened state of mindfulness. It is possible that these four participants simply did not discuss their mindful experiences, chose not to discuss an interaction that was listed or there is another unexplored interaction (titled “factor x”) that interfered with their ability to advance in the model. For instance, the “factor x” could be a quality in certain individuals that makes them more able to go into mindful states or easily experience crossmodal interactions that Participant 7 perhaps lacked.

Strategies outlines ways to bring the Phenomenon and Consequences about. Considering Participants 3’s difficulty in experiencing a crossmodal interaction because of their personal preference for classical music one could consider choosing conditions that are preferred by the majority. For instance, if a study showed that the majority of people preferred classical musical music or the colour blue, a designer wishing to create a space to induce mindfulness would consider these qualities in the installation. When considering Participant 4’s interaction of artistic background and unfamiliarity with abstract art, one could consider a strategy to increase the variety of sensory experiences in public education so that adults have a greater openness to different or unusual crossmodal pairings and thus will more likely achieve the higher functioning states as a result of any crossmodal experiences.

In summary, conditions of movement, sound, colour, shape and space could combine in varying degrees to allow the Participants to experience the Phenomenon of a Crossmodal Interaction. In some cases this led the participant to the Consequences of mindfulness which includes extrasensory, inner body or out of body experiences, as well as, greater focus, mindfulness and relaxation. It is important to note that the Interactions of environmental schemas, personal preferences, artistic backgrounds and factor x can
have an impact on whether or not the Participant experiences the Phenomenon or Consequences. If a participant’s environmental schemas, personal preference or background causes them not to experience crossmodal interactions in an environment, then they will not go on to experience the positive altered states of mindfulness.

**Discussion**

This thesis investigated the aesthetic experience of Visual Music to build on the understanding of how our daily multimedia interactions are created and experienced. From early childhood mobiles above the crib to adult interactions with mobile phones, society’s interactions with multimedia technology are prevalent throughout life. It is possible that they contribute to the development of intelligence and wellbeing (Luskin, 2012). Given that motion, colour, sound and space were elements discussed in length during the interviews, it is important to understand how these elements interact in multimedia and art to assist in the creation of more efficient devices, positive experiences with technology and art, as well as, how these elements influence therapeutic spaces.

It was discussed by participants how the elements of motion, colour, sound and space led to different crossmodal interactions and mindful altered states that could be beneficial for education, therapy, wellness and aesthetic experiences. These mindful states included an awareness of inner body, out-of-body experiences, extrasensory experiences, focus, and relaxation. Understanding what influences and interferes with these mindful experiences can inform designers and artists when working with visual music and multimedia technologies. As suggested by the interviews, the participant’s artistic background, personal preferences or other factors can influence and/or interfere with their ability to achieve mindfulness. The “Grounded Theory Model: Crossmodal
Interactions and Mindfulness,” suggests working with sound and visual combinations to reflect what the majority of the population prefer or to have more exposure in public education to various sound and visual combinations to expand the aesthetic diet of the population. This theoretical grounded theory model adds more validity to previous research in psychology, education, aesthetics and art. It also offers insight into how we should pursue multimedia design and research going forward with a consideration of mindfulness.

In reflecting back on the psychology literature review, the grounded theory model aligns with the findings of Kuwano et al. (2001) whose work suggested that aesthetic judgements were contingent on the “perceiver’s [visual] knowledge of sound sources (p. 198).” As previously stated, their study used a variety of conditions juxtaposing the sounds and images of traffic cars or green vegetation to test the compatibility of these sensory experiences. In the case of this study, Participant 6 perceived the “spider net” to be “confusing” or Participant 3 felt the sounds didn’t align with the oceanic quality of the visuals. In both the Kuwano et al. (2001) study and the current interviews, participants were more likely to have an experience of a crossmodal interaction and aesthetic experience when the participant could situate the experience in a familiar environmental schema such as Participants 13 stating that the sounds and visuals were both underwater. This adds support to the Strategy of choosing elements which reflect a majority preference.

Considering the statements made by Participants 2, 7, 9, 10, 11, 13, 14, and 15 regarding the synchrony of motion and sound, this grounded theory model is also consistent with the study by Namba, Hayashi and Wako (2003) which focused on the
的重要性与同步性之间的关系。由于许多参与者强调了运动、颜色、形状和空间在绘画中的作用，这个模型挑战了艺术史文献中所回顾的内容，即Strick的声明：“绘画将永远无法做到……因为音乐是基于时间的媒介”而且静止的绘画无法与音乐同步。参与者2讨论了当音乐被添加时方形光学图案的运动，并且参与者13表示“有很多运动和能量，类似于音乐。”参与者的注意力集中在“空间”元素上，这表明静止的绘画仍然有可能在它是建筑空间的一部分（如壁画）或装置艺术的情况下产生跨模互动。

尽管文献回顾中讨论了共感，一些参与者的经历可以被解释为共感性质，但没有参与者直接使用术语共感来描述他们的经历，因此
the term was not included in the final grounded theory model. This is not to say that it is not possible that synesthesia was occurring as part of the many crossmodal interactions and could be a possible Interaction that assists in leading a participant to crossmodal interactions and mindfulness. Further research considering this model within the context of synesthesia would be needed to make such an assertion.

This grounded theory model suggests the need for arts education in the school system, given that the ability to reach positive altered states of trance through crossmodal interactions is contingent on the participant’s environmental, personal and artistic preferences. The few participants who became distracted by elements such as the “spider net” shapes (Participant 6) and unfamiliarity of abstract art (Participant 4) did not achieve the positive altered states reported by other participants. The absence of these experiences may be because their background did not familiarize them with it. Although more research would be needed to confirm this possibility, it may be important to familiarize the population in multiple sensory aesthetic combinations, so that they are more open to a variety of sensory combinations and would thus be more likely to achieve the higher functioning of mindfulness associated with crossmodal integration according to this model. This could be achieved by having more variety of audiovisual and sensory combinations explored in public education, so that students gain openness to new experiences and thus any combination of stimuli could elicit the desired altered states, as well as, focus and relaxation.

As was the case with Participant 3, 4, 6 and 8, any perceived disharmony (from environmental schemas, personal preference or background) between the elements could lead to a negative experience of confusion. It is more likely that by following
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themes/sounds/environments that the majority finds to be aesthetically pleasing that the participants are more likely to achieve crossmodal interactions and thus positive altered states of mindfulness. When participants perceived the sensory elements as dissonant they expressed annoyance or confusion (Participant 8). So, one might take from this that a public space, such as a classroom or hospital, should be comprised of elements that the majority finds appealing however, when considering the previous point about having more variety of crossmodal pairing, it might be wise to expose the public to more variety and consider the elements of motion, colour, sound and space in architecture.

It is also important to point out that for artists, there are other results that they may wish to achieve by purposefully disrupting the crossmodal interaction. There may be greater insights that the artist aims for the viewer to receive though elements that they may find disjointed or disharmonious. The artist, composer and musician, Andrew Reed Miller, often alternates between having audiovisuals synchronize or be disjointed. In 2016 he composed a music score for the silent film “The Cabinet of Dr. Caligari.” Sections of the music were perfectly in sync while other sections were less so. He did this with the purpose of creating a sense of unease in the viewer because one of the themes of “The Cabinet of Dr. Caligari” is madness. Having the sound disjointed at times from the video distinguished it from typical soundtracks for movies and this created a sense of the unfamiliar. In this case, having the crossmodal interaction disrupted may have added to the aesthetic experience of madness.

While the grounded theory model suggests a Strategy of ascribing to preferences of the majority for the sake of achieving mindfulness, it is important to acknowledge that practicing this perspective can run the risk of inhibiting experimentation, creativity and
growth. For instance, Impressionistic art was not initially admired in the mainstream but, has since become a celebrated form of expression (Ayala, 2015). The author of this thesis strongly prefers the other **Strategy** of increasing the variety of crossmodal interaction experiences in the public education system through the arts. It is also important to acknowledge the author is influenced by her perspectives as a professional artist.

In terms of education, Participant 9 spoke of the importance of having students “immersed” in the learning experience and Participant 3 students were more likely to “relate,” “remember” and “put things together” when more senses were stimulated. This grounded theory could be applied to the future design of classrooms allowing for more integration of the elements, perhaps including the teacher. Additional research would be needed to explore such a possibility. If more crossmodally integrated environments elicit greater focus for the student, then it would be advantageous to create a classroom similar to an IMAX theatre that could shift the causal conditions of colour, space, sound and movement with each subject matter. This would require a classroom which supports both multimedia and transmedia, possibly to the degree that the teacher themselves becomes an integral part of the design as a transhumanist. While multimedia refers to the use of multiple media formats, transmedia refers to different media platforms, such as our mobile phones, televisions, being able to flow together and create a sense of unity. A transhumanist teacher would have elements of this technology imbedded into their body or attached like a prosthetic, to the degree that the teacher’s movements synchronize with the presentation of the educational materials adding to the illusion of unity. Such technological interactions are already envisioned in many Science Fiction movies, such as Minority Report (2002) or The Matrix (1999), where the movement of one of the
actors directly affects the presentation of information. For instance, Tom Cruise alters projected floating pages of information with his bodily movements while researching the background of possible criminals. This futuristic classroom is already in its infancy with how a teacher engages with the Interactive Whiteboards. There is a wealth of research already investigating the use of Interactive Whiteboards such as Alvarez, Salavati, Nussbaum, and Milrad (2013) who discuss in detail new media literacy, the use of Interactive Whiteboards, digital pens and transmedia navigation support learning and expand mental capacity. In their research, they proposed a problem-solving activity that bridges the gap between digital pens and Interactive White Boards on 7th grade Swedish students. They highlight the importance of the student’s ability to “follow the flow” of information across different media as integral to new media literacies. In this study, they presented Collboard a digital interactive framework involving Interactive Whiteboards and digital pens for collaborative problem solving. After experiencing Collboard, students completed a survey and a semi-structured interview to determine the effectiveness of Collboard in the classroom. The results showed that it was easily integrated into the classroom, improved students learning ability and students were more motivated to take an active role in their learning when interacting with the digital system because of the transmedia navigational nature of Collboard. Henry Jenkins also examined the potential of transmedia for entertainment purposes, stating that “Transmedia storytelling is the art of worldmaking. To fully experience any fictional world, consumers must assume the role of hunters and gatherers, chasing down bits of the story across media channels, comparing notes with each other via online discussion, groups, and collaborating to ensure that everyone who invests time and effort will come away with a
richer entertainment experience” (Jenkins, 2006). A transmedia classroom would involve the same features of creating a world that would motivate students to connect and gathering information, as well as, share ideas across multiple media platforms. A transmedia educational space would be crossmodally integrated and create frequent unity assumptions to maintain the illusion of flow. This would assist students in creating connections but, also to maintain altered mindful states of focus.

The mindful effects of awareness of inner body, out-of-body experiences, extrasensory experiences, greater focus, calmness and relaxation that the participants described may also provide a use in education. Many students are distracted from the personal, emotional and physical difficulties they face (Lawson, 2002). Having a room where they could experience a sense of escapism as a result of crossmodal interactions could allow them to release some of their anxiety and thereby be less distracted and gain greater focus during their classes. One may also point out that having a participant have a sense of security in their environment is key to engaging the student and that the therapeutic effects of a crossmodal environment could assist.

A similar argument for transmedia spaces could be made for the design of therapeutic spaces, hospitals and educational spaces for health. Participant 9 stated how they felt a room like Tropos would be useful in a hospital as it would allow those struggling from trauma to have a break and escape for a time from their suffering. They stated that the current design of hospitals lacked areas for this time of mindfulness. Many articles are coming out stating that doctors will soon be prescribing visits to art galleries to improve on wellness (Kelly, 2018) or that the arts to promote empathy, emotional intelligence and wisdom in medical students (Lesser, 2018). If this the case, perhaps it
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would be more efficient for hospitals and other spaces focused on teaching aspects of health to have their own artistic and mindfully designed spaces. As in the case of the transmedia classroom, a fictional world could be created with the purpose of hunting and gathering information and creating connections for the purpose of learning to support a person’s healing journey. Barbara Buckner discusses the uses of interactive media in therapy stating that “The user builds an iterative cycle of aesthetic relationships, and through this cycle of perception and co-creation, fulfils the meaning of the work” and that this creation of meaning is therapeutic for the participant. She further states that “healing is possible with an aesthetic multimedia interaction” when the participant creates a unity assumption through the digital elements and the “user is empowered to move beyond duality (stress) to find unity among dissimilar elements.” For Buckner, it is in this perception of unity and the personal creation of a crossmodally integrated environment that empowers the individual toward a state of healing (Buckner, 2001). Future hospitals could create a single room, which uses sensory information aimed at achieving crossmodal integration and a sense of unity for the viewer. As suggested by the grounded theory model, it would stimulate the viewers into more awareness of their bodies and relaxation, which would aid in their ability to heal.

Viewing the interviews as a trained hypnotist for wellness, it is apparent that the benefits described in this model could also be related to hypnotic trance and could be considered when discussing the benefits of Visual Music for the design of therapeutic spaces, technology or aesthetic experiences. The mindful states described under Consequences, could fall under the umbrella of what hypnotists and hypnotherapists describe as a state of trance. Hypnosis and trance are described as “a state of highly
focused attention coupled with a suspension of peripheral awareness…The hypnotic narrowing of focused attention is analogous in consciousness to looking through a telephoto lens.” There are “many analogies between hypnosis and mindfulness” (Spiegel, White, & Waelde, 2010). The difference between mindfulness and hypnotic trance is subtle. It is important to note that the author of this thesis is a trained hypnotist who would be inclined to interpret the participant’s experiences in this way and some participants may not agree with this interpretation. Unfortunately, the interview questions were not designed to investigate or measure the level of hypnotic trance experiences. As stated previously, one participant offered that the experience of *Tropos* was “hypnotic” (Participant 1). Further studies into the relationship of Visual Music and crossmodal interactions of motion, sound, colour, shape and space to hypnotic trance would be needed to enrich the grounded theory model to include hypnotic trance however, it can be discussed from a theoretical standpoint for the purpose of encouraging future researchers to pursue this concept. If the “Grounded Theory Model: Crossmodal Interactions and Mindfulness” was expanded through research to include the Consequences of deeper levels of hypnotic trance, it would again have implications for the design of wellness devices. For instance, a room or chamber within a hospital could be designed with sound, motion, colour, shape and space interactions, as well as, an intention to induce trance in a client, patient or a patient’s family for wellness benefits. Such a model could give creditability to the use of light and sounds meditation and hypnosis devices. These devices utilize moving coloured lights while the wearer listens to a meditation or hypnosis soundtrack.
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Summary/Conclusion

In summary, the “Grounded Theory Model: Crossmodal Interactions and Mindfulness” offers insight into the complex experience of crossmodal interactions which are becoming ever more paramount to understand given the speedy evolution of technology which uses multisensory information.

When the Conditions of motion, sound, colour, shape and space are synchronized they can create a Phenomenon of a Crossmodal Interaction which leads to further positive Consequences such as altered states of mindfulness. Interactions that can interfere with or alter this process are a person’s environmental schemas, personal preferences, artistic background or factor x. If a majority of Conditions are synchronized and align with the participants schemas, the phenomenon of crossmodal interaction is likely to occur and lead to the Consequences of positive altered states of mindfulness such as extrasensory experiences, awareness of the inner body, out of body experiences, greater focus, calmness and relaxation. Possible Strategies to increase the likelihood of this process occurring are to have conditions informed by preferences of the majority. For instance, if the majority prefers the colour blue, the ocean and classical music then architecture, design or a public art installation having these qualities would more likely to create the latter positive altered states. Another Strategy would be to have more exposure of different artistic and sensory combinations in the public’s school system so that the majority of the public is more exposed to a variety of schemes which leads them to become open to a variety of sensory combinations and therefore can easily achieve these positive altered states in any situation.
There are a variety of avenues for further research that could expand on the ideas considered in this thesis. For instance, the current project introduced the installation to the viewer with no sound and then accompanied by a musical piece. It is not clear how this sequence of events influenced the viewer’s experience. As such, the study could be repeated but with the stimuli experienced in a different order to determine if it has an effect on the participant’s aesthetic or mindful experiences. A researcher could examine the experience with music alone before experiencing the visual installation or examine experiences with no video versus with the video. Alternately, specific aspects of the installation could be altered, such as changing the type of music or the style of movement in the video. They could also omit certain aspects of the visual style, such as have the painted aspect completely an optical movement illusion. Different multimedia installations could be created in a similar circular format but, with different colours, styles of painting and sound. These manipulations would allow us to determine which aspects of the installation were crucial to the experience reported by participants.

Future research could also extend this project with the use of quantitative methods. Earlier, we considered the work of Bermudez that used fMRI scans to compare brain activity when looking at architecture. A similar method could be applied to this study. Specifically, researchers could examine fMRI activity of participants looking at a multimedia installation and compare them to brain scans for those participants during the course of meditation or while in other mindful states. Given the particular interest of hypnotic trance to the artist and researcher of this thesis, it would also be interesting to consider how these brain states might differ if the viewer was encouraged into a trance state prior to viewing the artwork.
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Aspects of this thesis supports research into the arts as a supporter of wellness. A report by the organization, “Art Fund,” in the UK used surveys to report on the effectiveness of visiting art galleries for wellbeing. Their findings from research surveys suggest that 63% people visit art galleries to deal with stress and anxiety (Deuchar, 2019). Combined with this thesis research, one could start supporting and researching the idea of prescribing mindful and wellbeing activities with installation and multimedia art.

This research also may point to aesthetic principals of what abstract and multimedia artwork is appropriate in hospital settings. In a study that considered the use of visual art in hospitals, Lankston et al. (2010) suggested that patients tended to prefer landscape and natural environments in art. These authors also stated that patients may not always be comforted by abstract art and highlighted the importance of positive emotional states associated with using specific hues, such as blues and greens and flourishing natural environments. While Tropos would be considered abstract and non-objective art, there are several references to the natural environment, as well as, the favoured colour of blue. Lankston et al.’s conclusions combined with this research support the contention that abstract art can be beneficial in a hospital setting when it has references to nature.

The conclusions of this thesis are also relevant to research which suggests that the arts can be used to assist people with multiple intellectual and physical disabilities. Cunha et al. (2018) suggested that multimedia, in the form of virtual reality, could assist those with mobility issues to go wherever they wish. Specifically, the arts can assist with the challenges associated with aging and dementia. The research of Cohen (2006) studied a control group who did not receive creative activities and another group they termed the
“cultural group” which did receive creative activities. The cultural group showed improvements in depression, fewer visits to the doctor, decrease in medication usage and overall sense of wellbeing increased. This suggests that there are varied benefits to exposure to cultural and creative activities. Future research should investigate the influence of multimedia and installation art on aging and dementia.

Finally, the model derived in this thesis points to the benefits in experiencing the unity assumption, crossmodal integration or crossmodal interactions in public, educational and therapeutic settings and offers strategies to increase the likelihood of having a beneficial experience with multisensory information. It highlights the importance of public, educational and therapeutic spaces being designed with crossmodal interactions in mind in order to create more mindful experiences. It also points to the value of arts education in the school system, as it allows for exposure to more types of sensory combinations so that more creative or unusual schemas to be developed. These more open schemas can allow for greater opportunities to achieve positive altered states of mindfulness through crossmodal interactions.
Figure 1. *Tropos* installation, comprised of painted canvas panels each 45” x 96” and two video panels 20” x 96”, all presented in a panoramic circle. [https://vimeo.com/26229031](https://vimeo.com/26229031)
Figure 2. *Tropos* installation (second view), comprised of painted canvas panels each 45” x 96” and two video panels 20” x 96”, all presented in a panoramic circle.

https://vimeo.com/2629031
Figure 3. Grounded Theory Model: Crossmodal Interactions and Mindfulness
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First, the participant will experience the installation for a short period of time (approximately 10-15 minutes). The participant will be instructed that he or she can express their thoughts about the exhibit during this time period.

Thank you for agreeing to participate in this interview. I will be walking you through a number of questions about the artwork you just experienced. I am interested in your experience, so nothing that you say is correct or incorrect. Please feel free to express any thoughts or opinions you have. As such, I will not be giving you any positive or negative feedback on your answers, so don’t feel anxious if I simply move onto the next question.

The first set of 9 questions involves your general experience of the exhibit:

1. How would you describe your experience with this installation?
   a. Prompt: Choose three adjectives to describe your experience of this installation.
   b. Prompt: Is there something in particular about your experience in this installation that is strong for you?
   c. Prompt: What aspects of the exhibit are you attracted to and why? Are there elements of the work that you like or don’t like?

2. Are there words that come to mind regarding your experience of this work?
VISUAL MUSIC TO “MINDFUL” EXPERIENCES

a. Prompt: how does it make you feel, visual descriptions?

3. Tell me about any reactions you have to this work?

   a. Prompt: Do you have a bodily reaction? If so, can you describe it?

   b. Prompt: Do you have an emotional reaction? If so, can you describe it?

4. How would you describe this work via your senses? Sight, sound, touch, smell, taste?

5. Do you find your sense of sight, hearing, touch, smell or taste simulated by this work? If so, how? If not, how could it?

6. Is there any aspect of this exhibit that maintains or grabs your attention? Which aspect?

7. What topic do you think this exhibition is about? Why do you think the artist made the exhibition? Do you think there is a story behind it the work or that it is meant to tell a story?

8. Do you think the artwork is trying to convey an emotion? If so what type of emotion such as positive or negative, happy or sad, etc?
VISUAL MUSIC TO “MINDFUL” EXPERIENCES

Now we are going to transition into specifically talking about how you experience the visuals and sounds in this exhibit:

9. Tell me your thoughts regarding the sounds and images in this installation?
   
   Prompt: Do you like/dislike them? Do you find they work or are distracting?

10. Tell me about your experience of the installation when there was no sound?

11. In your opinion, does the sound affect the visual elements?
   
   Prompt: Does it make the visuals stronger or weaker?

12. In your opinion, do the visual elements affect the sounds?
   
   Prompt: Does it make the sound stronger or weaker?

13. Where do you think the sound is coming from?

14. Where do you think the artist intended for you to think the sound was coming from?

15. Do the sounds and images seem like they go together? If so, how? If not, how could they?
   
   Prompt: Does the sound seem to be coming from the painting, video or both?
VISUAL MUSIC TO “MINDFUL” EXPERIENCES

16. Do the images and the sound suggest an event or something happening? If so, what could you imagine is happening? If not, what would the images and sound need to suggest an event?

17. Do you think that there is an element (sound, video or painting) that should be removed from the installation? Why?

18. Do you ever think about images (in your head) when you listen to music? If so, could you describe this experience? Why do you think you connect sound and images in this way?

Prompt: colours, places to the music?

19. Can you discern movement or stillness in this piece? Where? Can you describe it?

20. Does the movement or stillness seem to have a connection to the sounds? If so, how? If not, how could it?

Ok, now we are moving onto the last section of the interview, which involves considering where and how this artwork is exhibited:

21. Do you visit art galleries often? How do you feel about art galleries?

Prompt: Are you comfortable/uncomfortable going into art galleries? Do you like viewing artwork in art galleries?
22. Tell me your opinions or feelings about this work being in an art gallery?

23. Tell me about your experience of the panoramic layout of this exhibit?

24. Can you imagine a better layout for this exhibit? If so, please elaborate.

25. Could you imagine this installation being useful in a different setting that is not an art gallery? If so, where and why?

26. Can you remember an experience (doesn’t have to be artistic) where sound and images (painting/video) were used together in a really powerful or interesting way? Can you describe this?

27. Can you remember an experience that was in an art gallery or concert or theatre where sound and visuals were used together in a really powerful or interesting way? Can you describe this?

28. Can you remember an experience in education (as an observer, student or teacher) where sounds and visuals were used together in a powerful way? What effect(s) did they have? Did it enhance the learning? How could it have been improved?
29. Can you describe your learning experience in the classroom with audio and visual material? What do you find is the most effective use of audio and visuals in education?

30. What do you think about the use of audiovisuals in the classroom (such as smart boards)? Does it improve learning or not?

31. How do you think audiovisuals could be used in different ways to enhance learning?

32. How could you imagine this exhibit being used for educational purposes?

33. How, in your opinion, can the combination of image and sounds in this format (panoramic) be useful for educational purposes?

34. Can you imagine advantages to an educational presentation being panoramic like this exhibition?

35. How would the use of artwork or music in hospitals affect your experience when visiting one? What affects might they have on patient experience?

36. Do you think this exhibition could be used for therapeutic purposes? If so, how? If not, what would be needed to make it therapeutic?
37. Do you find the combination of sound and images in the exhibit to be therapeutic in any way? If so, can you describe how? If not, what would be needed to make it therapeutic?

38. Do you have any previous experience with art or cultural activities?
   a. Prompts: do you play an instrument, paint, act, visit galleries, go to concerts, etc.)

39. Have you ever seen an exhibit like this one? Could you describe it?

40. When you were viewing this exhibit, did you find yourself forgetting that the sound and images were artificially created?
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Deanna Musgrave

Education

2017  NGH Consulting Hypnosis Certification, Rose Cottage, New Brunswick
2009  Diploma in University Teaching, University of New Brunswick
2008  Bachelor of Education, University of New Brunswick
2005  Bachelor of Fine Arts, Studio Art, Mount Allison University

Exhibitions and Performances

Public Work
2019  - Mirror, Carleton North High School, Florenceville-Bristol, NB
2017  - Nest, Skywalk Market Square, Saint John, NB
2015  - Cloud, Hans Klohn Commons, University of New Brunswick, Saint John, NB

Solo Exhibitions
2019  - Channel, AX: Center for Arts and Culture, Sussex NB
2018  - Sirens, Frazee Gallery, Saint John Arts Centre, Saint John, NB
2014  - Tropos, Peter Buckland Gallery, Saint John, NB
2013  - Coronation, Peter Buckland Gallery, Saint John, NB
2012  - Lighthouse, Ingrid Mueller Art and Concepts, Fredericton, NB
2011  - Tropos, Memorial Hall Art Gallery, Fredericton, NB
2010  - Empath, Ingrid Mueller Art and Concepts, Fredericton, NB
2008  - Metamorphosen, Ingrid Mueller Art and Concepts, Fredericton, NB

Group Exhibitions
2016  - Artists Under 35, Gallery on Queen, Fredericton NB
2014  - Off the Grid: Abstract Art in New Brunswick, The Beaverbrook Art Gallery, Fredericton NB
2013  - 43 Small Works of Great Beauty, Peter Buckland Gallery, Saint John NB
2012  - Contemporary New Brunswick Art, The Beaverbrook Art Gallery, Fredericton NB
2010  - All Places Beautiful, Ingrid Mueller Art and Concepts, Fredericton, NB
2009  - Rock, Paper, Scissors, The Yellow Box Art Gallery, Fredericton, NB
2008  - 2008 International Toronto Art Fair (Ingrid Mueller Art and Concepts) Toronto, ON
      - Gracious Gifts: A Selection, The Beaverbrook Art Gallery, Fredericton NB
2007  - Out of the BAG, Ingrid Mueller Art and Concepts, Fredericton NB

Collaborations
2016  - Siren: video/sound collaboration with Andrew Miller
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- Area 506 Festival (Saint John, NB)
2013 - Hic et Nunc: video installation in response to composition by Andre Cormier
   - Struts Gallery (Sackville NB)
   - Gallerie Sans Nom (Moncton NB)
2012 - Miniatures: video collaboration with Nadia Francavilla
   - Interaction School for the Performing Arts (Saint John, NB)
2009 - Sun: video/sound collaboration with Andrew Miller
   - Confederation Centre Art Gallery (Charlottetown, PEI)
2008 - Moon I: video/sound collaboration with Andrew Miller
   - The Sackville Music Hall (Sackville NB)
2007 - Eradrocer: video composition performed by Motion Ensemble
   - Association in Technology and Music Instruction /College Music Society National Conference (Salt Lake City, Utah)

Professional Experience

2016-18- New Brunswick Art Bank - Artist Teacher for VanGo! Program.
2014 - Assistant Administrator for the musical organization OPEN ARTS in Saint John
2012 - New Brunswick Arts Bank - Jury member for 2012 acquisitions program.
   - New Brunswick College of Craft and Design – Instructor in Painting
2010 - Saint Thomas University- lecturer for “Drawing and Sketching II”
2009 - New Brunswick College of Craft and Design – instructor for “Non-Objective Painting”
   - New Brunswick Department of Education -content developer for “Fine Arts 110”
2007 - Beaverbrook Art Gallery Workshops - instructor for drawing and painting.

Research, Conferences and Lectures

2011 - Conference Presentation: Catharsis, Empathy and Polemic Art: Fine Lines in Creating Social Change through Art as part of Congress of the Humanities and Social Sciences and the CWSA (Canadian Women’s Studies Association). This lecture was also presented at the CSEA (Canadian Society for Education through Art) national conference.
   - Conference Presentation: “Where Art and the Environment Intersect,” as part of Congress of the Humanities and Social Sciences and the ESAC (Environmental Studies Association of Canada).
   - Artist Talk, University of New Brunswick
   - Artist Talk, Saint Thomas University, New Brunswick
2009 - Artist Talk, Prince Edward Island Confederation Centre Art Gallery
   - Artist Talk, New Brunswick College of Craft and Design
2008 - Artist Talk: Painting Music, Beaverbrook Art Gallery, New Brunswick
   - Artist Talk: Painting Music, New Brunswick College of Craft and Design
2007 - Artist Talk: Studio Watch, Saint John New Brunswick Museum
   - Conference Presentation: Bellafigura - co-presented research with Dr. Jennifer Pazienza and Lindsay McKay (artist) on integration and interdisciplinary art
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education at the CSEA (Canadian Society for Education through Art) conference at York University.

2005 - Conference Presentation: Expression, Embodiment, and Exploration: Contemporary Artist’s New Forms of Medicine - co-presented research on relationships between contemporary art and medical representation with Professor Jeffrey Burns at the UAAC (Universities Art Association of Canada) annual conference at University of Victoria.

Grants and Awards

2018 - New Brunswick Arts Board Creation Grant, Category B
2015 - New Brunswick Arts Board Creation Grant, Category B
2014 - New Brunswick Arts Board Creation Grant, Category C
2011 - New Brunswick Arts Board Creation Grant, Category C
2010 - SSHRC- Joseph Bombardier Scholarship Canada Graduate Scholarships
   - Alumni Merit Award Scholarship, University of New Brunswick
   - New Brunswick Arts Board Scholarship
2009 - New Brunswick Arts Board Travel Grant
2007 - New Brunswick Arts Board Creation Grant, Category C
   - Studio Watch – Emerging Artist of the Year from the Beaverbrook Art Gallery
2005 - J.E.A. Crake Presentation Award in Fine Arts
   - John P. Asimakos Painting Award

Residencies

2009 - Prince Edward Island Confederation Centre Artist Residency, Dalvay, PEI
2008 - New Brunswick Music Festival Artist in Residence, Fredericton, NB
2007 - Casemates Artist Residency, Fredericton NB

Publications and Reviews

2018 - 150 Years in the Making, Billie Magazine, William Forrestall, p. 18-19
   - Acquisitions 2017-2018, New Brunswick Art Bank Catalogue p. 34
2017 - New Brunswick Studio Conversations, Billie Magazine, Stephanie Burhman, p. 15-16
   - Canada 150: Artist Deanna Musgrave Unveils New Mural in Saint John, THE EAST
2015 - Deanna Musgrave: Expressing the Ephemeral, the Intangible, the Invisible, THE EAST
   - Monumental Mural to be Unveiled in Saint John, Marie-Helene Morell, Telegraph Journal
2014 - Off the Grid, Beaverbrook Art Gallery Publication, p. 168-179
   - Artist splashes personality on UNB Saint John, Kelsey Pye, Telegraph Journal
2013 - Coronation, Mike Landry, Salon/Telegraph Journal
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2011  - Cyber-bully Catharsis, Shannon Webb-Campbell, Salon/Telegraph Journal
       - Testing the Waters, Shannon Webb-Campbell, Salon/Telegraph Journal
2009  - Classroom Creativity Meets Conservation, Jennifer Dunville, Daily Gleaner
2008  - Tuning in, turning off, Quentin Casey, *Telegraph Journal, October 2008*
       - A Musical Medley, Salon/Telegraph Journal, April 2008
2007  - Studio Watch: Emerging Artist Series, Deanna Musgrave, Exhibition Catalogue
       - Think Outside the BAG – Studio Watch: Emerging Artist Series, Deanna Musgrave,
       - The Next Big Thing, Karen Ruet, Salon/Telegraph Journal

**References**

- available upon request