

EXPLORING THE PULSE OF DESIGN AND MUSIC

The Impact of Visual Rhythm
in Design for Auditorily Impaired
Music Students

Nina Tedeschi



©2022 Nina Tedeschi

Written, photographed, and designed by Nina Tedeschi, *drTdesigns*.

CONTACT INFORMATION:

<https://exploringthepulseofdesignandmusicdrtdesigns.com>

EXPLORING THE PULSE OF DESIGN AND MUSIC:
*THE IMPACT OF VISUAL RHYTHM IN DESIGN FOR
AUDITORILY IMPAIRED MUSIC STUDENTS*

By: Nina Tedeschi

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF FINE ARTS IN GRAPHIC DESIGN
Liberty University, Lynchburg, VA

©2022 Nina Tedeschi

Professor Sarah Hoyt, CHAIR

Professor Elizabeth Mackey, FIRST READER

Professor Joshua Wilson, SECOND READER

Professor Todd Smith, DEPARTMENT CHAIR

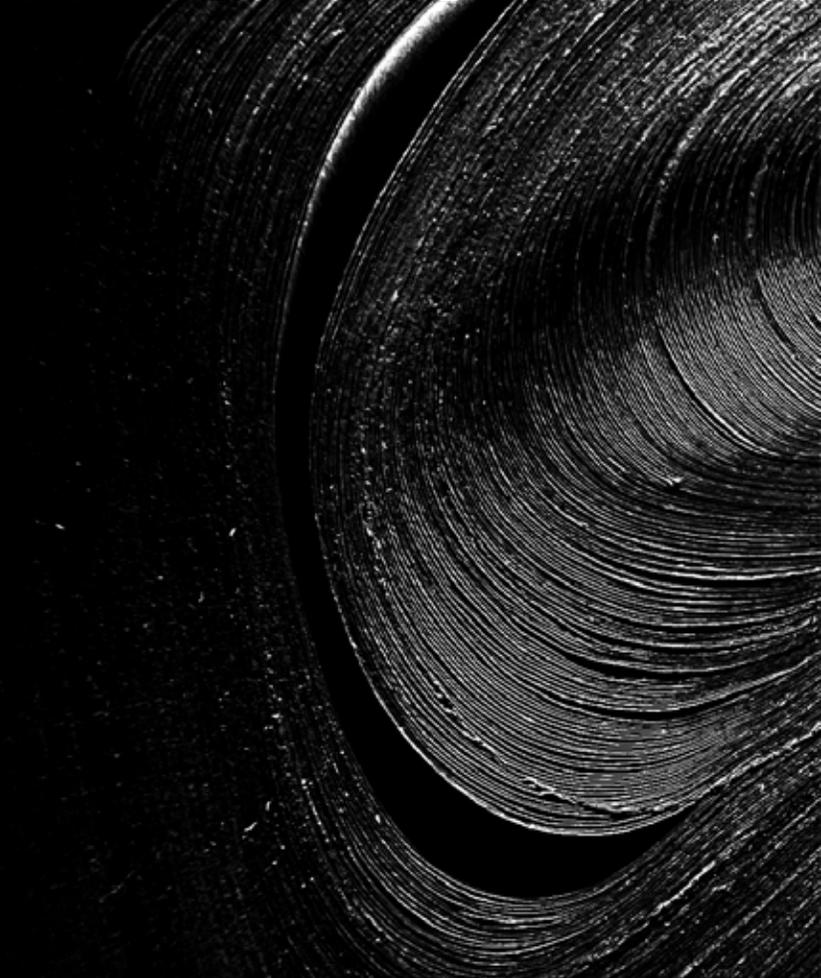
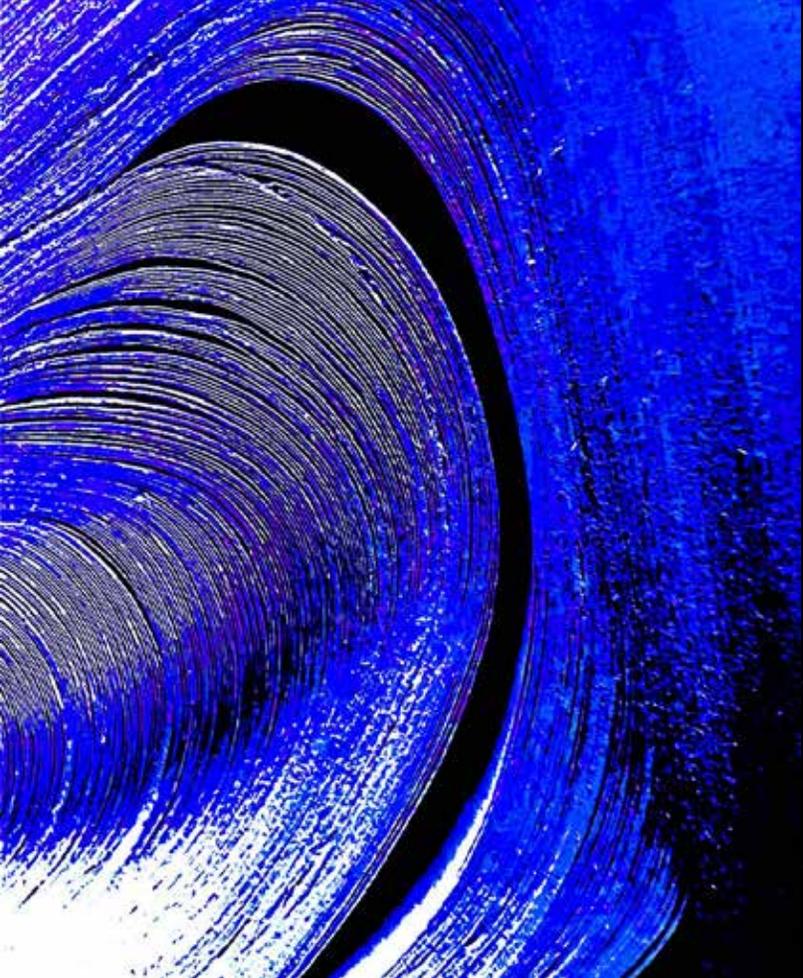
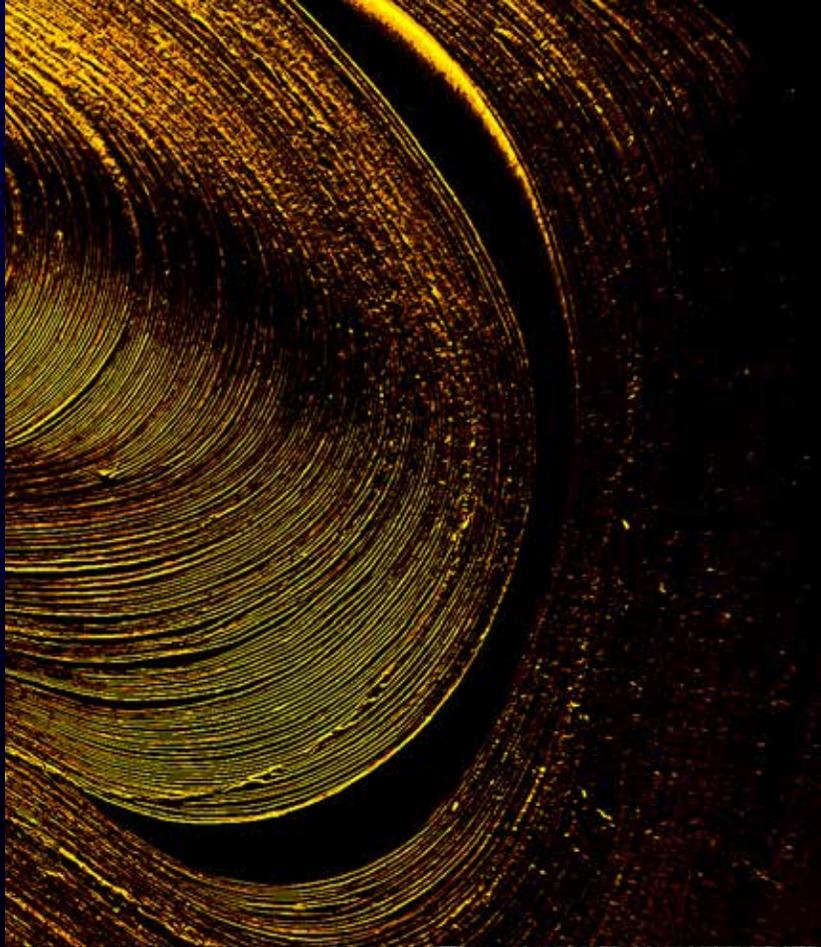
LIBERTY UNIVERSITY SCHOOL OF VISUAL AND PERFORMING ARTS DEPARTMENT OF STUDIO AND DIGITAL ARTS

CONTENTS

Contents	4
Abstract.....	5
Chapter 1: INTRODUCTION.....	7
Chapter 2: RESEARCH.....	15
Chapter 3: VISUAL PROCESS.....	42
Chapter 4: VISUAL SOLUTION	60
Chapter 5: CONCLUSION	77
Notes.....	82
Bibliography.....	83
Appendix.....	87

ABSTRACT

Auditorily impaired music students struggle to understand musical rhythms and patterns which can lead to frustration, low self-esteem, lack of developing musical skills, and reduced music appreciation. Often, the needs of those with hearing challenges are overlooked in the curriculum planning process. This research aims to show the importance of providing appropriate learning methods and materials for music students who are hearing impaired. Specifically, this study focuses on the elements of patterns, repetition of patterns, and rhythm within the visual designs used in the instruction of musical elements. The methods used in this research are based upon observation, investigation, and analysis of prior research and case studies using visual artifacts as learning tools. Moreover, the results of this research involve the revelation and importance of using adequate visual materials as supplemental learning materials for music students of all levels of abilities, specifically designed for those with special needs, hearing disorders, and auditory challenges.



CHAPTER ONE

Introduction



Research Problem

Throughout my teaching career, which spans over fifty years, I have had the pleasure of teaching students of all ages and abilities. Access to resources, curriculum content, and supplemental teaching materials has been plentiful over the years, but lacking in appropriate teaching methods in music for those with auditory challenges and impairments. This research project recognizes the need for additional supplemental teaching materials which serve to reach those music students with auditory disorders and varying levels of abilities.

PROBLEM STATEMENT

Auditorily impaired music students struggle to understand musical rhythms and patterns which can lead to frustration, low self-esteem, lack of developing musical skills, and reduced music appreciation.

Objectives

Therefore, via observation, investigation, and conclusive documentation, this research lends insight into the need for improved musical methods. Enhanced methodology will increase effective teaching and learning. Musical skills will improve through engagement with methodology involving visual designs. How then can design adequately provide a solution to this problem? This research proposes a design methodology focusing on rhythm and repetition of patterns which will afford more effective interaction for music students with auditory impairments.

Research Questions

Engaging in this research has presented many questions for consideration. *Exploring the Pulse of Design and Music:: The Impact of Visual Rhythm in Design for Auditorily Impaired Music Students* involves the study of visual stimuli, sensory perception, perspective, visual and auditory processing, neurological reflexes and processing, and more. The research questions listed are among many relevant to the topic under investigation.

The following questions form the basis of this research:

1. ***WHAT is the approach used in teaching music to the auditorily impaired?***

This question addresses the challenges faced by hearing-impaired students and their teachers. In asking and seeking answers to this question, the research offers insight into music methodology for those with auditory challenges and students with varying levels of abilities.

2. ***ARE hearing impaired individuals able to succeed in the study of music?***

By examining this question, this research aims to reveal the benefits of visual learning methods and materials which focus on auditory challenges and impairments.

3. ***WHAT is aural perception, and auditory processing disorder, and how are music students with hearing impairments impacted by these conditions?***

This question provides a basis for conducting the research into the procedures within the human senses and how all levels of abilities are impacted by challenges when approaching the study of music.

4. ***IN the absence of a curriculum focused specifically upon the needs of auditorily challenged students, what are the potential benefits of using a specially designed learning methodology?***

This question serves to seek, find, and show a need for further observation, investigation, creation, and development of a visually designed learning methodology which will enhance the encounter by music students.

5. ***Are those with hearing impairments able to succeed in the study of music?***

This research provides acknowledgement of the existence of auditory processing issues due to hearing impairments and challenges. Moreover, the research offers information which shows that engagement with visual learning materials designed for those with impairments, will enhance and embellish the auditory process while increasing acquisition, retention, and refinement of musical skills.

6. ***Is it possible for an experience with music or art to become a whole-body experience involving the senses?***

Investigating this question reveals evidence of the action and participation of the whole body in sensory perception and processing of visual and auditory stimuli.

7. ***WHAT are the roles of auditory abilities, challenges, and visualization in sensory experiences? How do the processes unfold for those with hearing impairments?***

Looking into these areas allows the research a path to observing and investigating the neurological sensory processes while considering the auditory abilities, challenges, and processes of visualization.

8. ***HOW does the overall interaction with rhythm and pattern repetition in design and music impact the learner and the auditorily challenged music student?***

By asking this question, the research aims to connect learning with the needs of challenged students through a visual solution which provides supplemental learning methods and materials.

9. ***WHY then do individuals react to rhythm and repetition of patterns in art and music? Is it therefore possible to teach the skills of rhythm and pattern repetition to those with hearing impairments?***

Inquiring via research about this area of questioning is essential to the understanding of visual perception and processing in design. As design is important to the study of music, it is of great importance to delve into these areas and provide conclusive understanding of the learning/teaching materials available to all learners.

10. ***HOW then is the representation of ideas via the visual arts helpful in music education? What is the geometry of music and how is this an essential element of designing applicable learning designs for the music student?***

These questions provide a further look into the interaction of the neurosensory processes and the impact of visual design upon the learner, regardless of ability. Investigating these areas offers a glimpse into the visual process and the use of symbols as visual communication learning tools.

11. ***HOW further is the representation of ideas via the visual arts helpful in music education? What learning methods and tools are available for teaching music to the hearing impaired?***

Researching these questions provides a look into the experience of visualization in art and how it is related to the education process. The research presents explanation of the various difficulties experienced by those with hearing impairments, specifically rhythmic replication and accuracy in duplicating rhythms and patterns in music.

12. ***HOW then can rhythm and pattern repetition enhance learning for those with auditory challenges?***

Research shows that design includes rhythm within the visual patterns and repetitions of patterns; thereby providing movement within the design. The use of rhythm and repetitions of patterns visually is an aid in learning music.

Knowledge Gap

Although the objective of this research is to investigate, observe, and offer solutions which enhance teaching music to students with hearing challenges, the research also emphasizes the benefits of designing and implementing supplemental curricula for all students regardless of ability. Through additional secondary research of available teaching methods and visual exercises, enhanced listening and rhythmic skills will be possible. The current gap involves observation of



multi-faceted instructional methods and those which incorporate the use of design cards within the supplemental teaching resources. Moreover, this research aims to spotlight a teaching method which is relevant to all learners, thus filling a gap in available teaching materials. By investigating the existence of current curricula which utilize graphics to accompany rhythmic drills and exercises, the research provides focus upon the need for using visually designed methodology as a tool for teaching and learning music to those with hearing challenges.

Significance

We live in a culture of signs and informational technology. Prior to this age of seemingly infinite possibilities afforded by digital advancements, those with auditory challenges were left to rely on limited information and methodologies. Arriving at the current stage of technology, creative designs offer improved teaching methods. This research suggests that by employing contemporary technology in design creation, including the visualization of rhythm and pattern repetition, those individuals with auditory challenges will gain increased interaction and understanding of music. The significance of this research begins with the individual music student. Although the research primarily involves those with auditory challenges, the research also reaches those students with varying levels of ability and those who need additional study tools. Furthermore, the research aims to provide educators, teachers, administrators, and curriculum planners supplemental teaching methodologies for students of all levels of abilities.



CHAPTER TWO

Research



Research Rationale

One of the primary objectives of the proposed research *Exploring the Pulse of Design and Music: The Impact of Visual Rhythm in Design for Auditorily Impaired Music Students*, is to examine the role of rhythm within visual design and music. The goal of this direction is to offer evidence that visualization impacts learners, specifically those with auditory impairments. Moreover, this research presents the need for visualization in music instruction via investigation of the visual elements within design that cause rhythm to occur, from the initial stimuli, through perception, and to understanding via processing. Additionally, it is the goal of the research study and visual solution to provide support within learning methodologies which will assist those with hearing impairments to acquire higher success in music comprehension and skills. Why is this important one might ask? Providing inclusion and equal opportunities for all levels of ability is especially important to ensure that students with musical interests receive the best methodologies and learning materials that are available.

Research Methods

The planning and preparation of the research methodology for this project involves prior studies, primarily case studies and visual analysis. Investigation and observation of learning methods serve as interpretation of prior research in rhythm and pattern repetition learning methodologies. The proposed research reports on the impact of rhythm as a propellant of rhythmic patterns, repetition, motions, and movement within the design, leading to increased musical skills, abilities, development, and understanding. . The use of case studies and visual analyses provides an abundance of applicable materials which support this research. Moreover, these resources confirm this research to be a viable area of concern and need for solution. Through this research the author has made attempts to provide a systematic description of form and content of written, spoken, visual material expressed in themes, patterns, and occurrences, in the visual and auditory processing of visual learning materials and other artifacts. Along with these research methods, additional use of image boards for styling, design, and targeting along secondary, traditional, observational, and investigational research methods increase the spectrum of content within the scope of the research. Content analysis and visualization research methods are employed, providing additional access to information which assists the resolution of the research problem.

Visual Solution

The visual solution for the research project is based upon the research topic, studies, and findings. The primary objective of this research is to provide awareness of the needs and of the benefits of enhancing music instruction with the use of visual designs containing patterns and repetition. The result of engaging with the visuals will enhance and result in learning rhythm skills. The visual solution focuses upon the development of flashcards which represent various levels of learning and engagement with music, which provide additional visual aids within the curriculum and teaching tools, rhythm drills, and exercises. Basic patterns, lines, and shapes are fundamental to the designs. Assorted colors and combinations of colors and shapes, included in the designs, add interest and depth within the visual stimuli. Central to the composition of the visuals is the role of visual literacy through the facets of observation, recognition, reaction, information processing, pattern repetition and reproduction via movement, vocal, or instrumental responses by the viewer. The deliverables offer an additional dimension to the teaching tools available to music educators while providing specialized teaching materials for those students with hearing impairments or challenges. The collection of supplemental music teaching tools provides potential for both instructional and entertainment engagement for all participants. The deliverable designs and content are constructed and designed graphically and interactively while compiled based upon musical elements, patterns, repetition of patterns, illustrations, and graphics.

Summary of Findings

Via observation, investigation, and analysis of case studies and visual artifacts and teaching methodologies, this research explores and reveals the ways design can serve as an aid to those with hearing impairments. The questions raised, and the conclusions acquired through research, provide substantial information which assists in the visual solution of this research, which is to design and compile a collection of study guides, skill exercises, in the form of flashcard drills for those with auditory challenges. There is an abundance of material available for researching topics related to those individuals with auditory impairments. The following materials chosen for this research, draw from those existing theories and conclusions presented by others who have studied the topics of auditory impairments, learning methodologies for those with auditory challenges, visual and sensory information-processing in the deaf. The materials provide insight on neural processing patterns in the deaf, human cognition and information processing, and rhythm and repetition of patterns within learning by the auditorily challenged. This research aims to provide investigation, observation, and conclusive documentation of prior research and case studies offering teachers and students supplemental learning materials to assist those with auditory challenges. These studies provide a foundation for the visual solution using patterns and repetitions via rhythm.

LITERATURE REVIEW

Definition and Background of the Auditorily Impaired

Perceptual Categorization

WHAT is the most effective approach to teaching music to the auditorily impaired? In researching this topic, Fulford addresses not only the challenges faced by the hearing impaired, but also who teach auditorily challenged individuals.

“It is perhaps in the fields of music education and music therapy that the interaction between technology, music and the deaf community is best understood. Hearing impairments place tangible limits on access to music, best evidenced in the self-reports of deaf musicians.” (Fulford, 449)

Information Processing

ARE hearing impaired individuals able to succeed in the study of music? “These facts and figures suggest that contrary to the view that music making with a hearing impairment must be unfeasible, as some may think, it is actually quite prevalent. Music is a powerful means of positive communication and expression, especially between and within groups of people (Cross 2009).” (Fulford, 448)

Aural Perception, Music and the Hearing Impaired, Auditory Processing Disorders

As Fulford’s research confirms, although teaching music to the hearing impaired is a challenge it is not an impossibility. Research by Nabhan, in teaching music to the hearing impaired provides confirmation of Fulford’s assertions. Nabhan’s article discusses a musical approach to aid in the treatment of Auditory Processing Disorder saying, “Auditory Processing Disorder (APD) is a Learning Disability (LD) that many Lebanese learners suffer from. An enhanced method is needed for all students that can be implemented in schools as part of the curriculum. This research aims at finding and implementing a constructive musical learning environment that could be of help to those students to break the barriers between them and proper education.” (Nabhan, 48) Nabhan further defines Auditory Processing Disorder saying, “Much research was done on the relation between Auditory Processing Disorder, phonological awareness, and music. Seeing that some of the latest research suggested that some of the auditory analysis skills used in the processing of language are parallel to skills necessary for music perception (Lamb & Gregory, 1993), music can be linked to phonological awareness.” (Ibid, 50)

Nabhan's research offers strong evidence of the impact of music as an aid in diminishing the impact of auditory processing issues. Through visually communicating and exchanging via music, art, and design Nabhan's research confirms the increased possibility of successful music training and acquisition of musical skills.

“What is needed is a method that can be implemented in schools as part of the curriculum.”
(Nabham, 48)

Visual, Music, and Sensory Experiences

Is it therefore, possible that the visual experience can benefit the auditory processing of information within the area of music? Can the visual enhance and embellish the auditory process thus increasing acquisition, retention, and refinement of musical skills? Grammatikopoulou analyzes the engagement of the visual senses and how they impact the entire body. Grammatikopoulou states, “Through participation, the experience of art unfolds within a broader life experience. Instead of maintaining a critical distance from the artworks, people are expected to intervene in them.” (Grammatikopoulou, 42)

Pitches, Abilities, and Learning

Is it possible for an experience with music or art to become a whole-body experience involving the senses? Grammatikopoulou's research reveals that, “The body has become a center of experience in participatory art and the latest generation of information technology such as motion-tracking video games, smart phones, touch screens, and tablets. It entails a radical shift from the view that the body is a mere “tool” of the mind that receives stimuli through the eyes and other senses and gives orders to hands, fingers, and other body parts.” (Grammatikopoulou, 43) “The movements and gestures of the body are from a Merleau-Pontian point of view. When we reach out our hand to pick up

an object, thinking and reaching out are inseparable and form an integrated bodily performance. This is also true of artistic works whose existence cannot be the embodiment of the artist's intention." (Grammatikopoulou, 44) Grammatikopoulou's explanation of the whole-body involvement in sensory experiences indicates the importance of sound differentiation and the involvement of the senses in learning experiences.

Tallal examines the impact of speech production and realization of and differentiation of sounds. Also discussed by Tallal are the influences of hearing various pitches and the results in abilities and learning. Tallal's research focus is upon the interworking of auditory processing, music, and language as stated, "The connections between periodicity coding and speech intelligibility on one hand, and between musical training and pitch perception on the other, suggests a possible association between musical training and speech understanding: musical training may lead to enhanced neural coding of periodicity, which in turn may lead to enhanced perception of speech in noise." (Tallal, 1) Is this relationship between the auditory process directly related to experiencing music and language development? Tallal answers,

"The aim of this study was to test the hypothesis that musical training leads to improved speech understanding in noise because of enhanced periodicity coding. If the hypothesis is correct, then the speech-in-noise benefit found previously for musicians using normal (voiced) speech should not be found using whispered speech, due to its lack of periodicity. We tested the intelligibility of normal (voiced) and whispered speech in steady-state noise, as well as in amplitude-modulated, or gated, noise."(Ibid, 2)

Almeida's article "The Process of Visualizing Information in the Deaf" provides answers to this question. Almeida's article presents documentation regarding rhythm and repetition of patterns within graphic design and focuses upon individuals with auditory and visual impairments. Almeida discusses the neurological sensory processes within the visual and auditory cortexes which are involved in the sensory experiences and investigates and reports upon the stimuli and mapping examines sensory deprivation in individuals due to congenital defects. Almeida's research shows that the neural processing of sensory information to those visually impaired has indicated, "For instance, blind individuals show finer auditory pitch and tactile discrimination than sighted individuals. (e.g., Gougoux et al., 2004; Van Boven, Hamilton, Kauffman, Keenan, & Pascual-Leone, 2000." (Almeida, 1771)

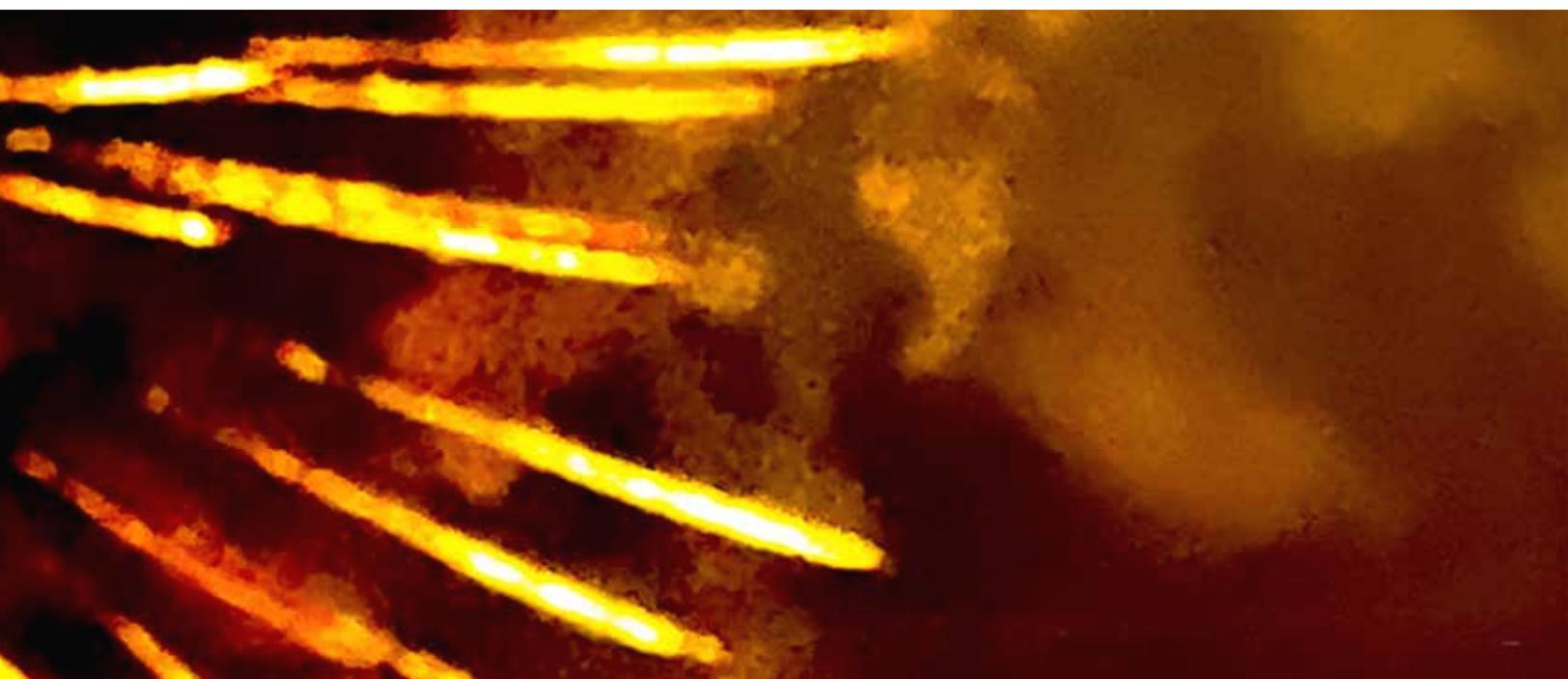
Neurological Sensory Processes

WHAT are the roles of auditory abilities, challenges, and visualization in sensory experiences? How do these processes unfold for those with hearing impairments? Additionally, in

speaking about stimuli and responses within the neurological processing of visual information Almeida's research offers, "We found that the location of a visual stimulus can be successfully decoded from the patterns of neural activity in auditory cortex of congenitally deaf but not hearing individuals. This is particularly true for locations within the horizontal plane and within peripheral vision. These data show that the representations stored within neuroplastically changed auditory cortex can align with dimensions that are typically represented in visual cortex." (Ibid)

Visual Stimulus

Realizing the role of the sensory visual experience within individuals with hearing impairments precipitates discussion of tactile learning, perception, and neural activity patterns in hearing. How does this relate to the overall interaction with rhythm and pattern repetition in design and music? In her article, De 'VIA: Investigating Deaf Visual Art, Patricia Durr addresses the experience with visual art by the deaf saying, "Visual art can enlighten deaf and hearing observers by presenting experiences reflective of a deaf person's world." (Durr, 177) Durr subsequently proposes that the deaf engage with visual art, while reflecting their own culture through art saying, "Some Deaf artists feel that visual art can be a 'way of life' among Deaf people and a part of Deaf culture in the same manner that music is a way of life among the hearing society." (Durr, 167) Does Durr consider the influence of rhythm and repetition of patterns within her assertions about the deaf and visual art? Realizing the role of the senses. The proposed research focuses on how rhythm and pattern repetition impacts the engagement with visual art by the deaf, therefore extending the assertions of Durr who states, "Just as other disenfranchised groups choose to communicate and share their experiences via visual art, so too have Deaf people." (Durr, 168)



Rhythm and Repetition in Visual Arts and Music

DOES rhythm and repetition of patterns increase the experience in both visual arts and music? Sharon Kennedy indicates that rhythm and pattern repetitions enhance visual and musical arts sensory experiences. She examines the process of engaging with visual art as her title indicates, via painting the music rhythm and movement. Kennedy states, “The music and art connection can best be described in the late 19th century concept of synesthesia or the blending of senses. The idea means that sensory perception of one kind can manifest itself as a sensory experience of another.” (Kennedy, 2) Kennedy investigates, evaluates, and presents narrative and visual art examples which support her research into the comparative experience with music.

Blending of the Senses

WHY then do individuals react to rhythm and repetition of patterns in art and music? Is it possible to teach the skills of rhythm and pattern repetition to those with hearing impairments? LaLonde cautions that teachers must be aware of the extent of hearing abilities and hearing impairments saying, “Elementary music teachers often have students who are hard-of-hearing participating in their classes. Teachers need to be aware of what hearing impairments are and how these hard-of-hearing students have entered the music classroom.” (LaLonde, iii) LaLonde continues “A misconception about students who are deaf is they have no hearing. However, in a more accurate view, it means they communicate through visual means and the hearing they have left is not enough to process speech; generally, this is a hearing loss of 90 decibels (dB) or more. Hard-of-hearing students use the hearing they have and assistive hearing devices to process speech and therefore can develop language skills.” (LaLonde, 1)

Music Geometry

If as Ruggles suggests in the article “Influence of Musical Training on Understanding Voiced and Whispered Speech in Noise,” early training and discriminatory analysis of sound is a benefit to all learners no matter their ability or impairment levels, then what method of teaching is to be included in the curriculum to reach all students? Additional input is offered through the research of Ravignani in “Visualizing and Interpreting Rhythmic Patterns Using Phase Space Plots.” Ravignani’s research focuses upon visualizing and interpreting rhythmic patterns during the visual exchange and communication in the observation of art and design. Is this element of learning via repetition of patterns and the resulting rhythms a form of music-geometry? Ravignani reveals that a direct relationship occurs within visual observation and interpretation of repetitions of patterns and the resulting rhythms. (Ravignani, 557-568)

Visualization Processes, Symbols as Communication

Ravignani summarizes her research saying, “I suggest that research in music perception and performance can benefit from systematically adopting phase space plots, a visualization technique originally developed in mathematical physics that overcomes the aforementioned limitations. By jointly plotting adjacent interonset intervals (IOI), the motivic rhythmic structure of musical phrases, if present, is visualized geometrically without making any a priori assumptions concerning isochrony, beat induction, or metrical hierarchies. I provide visual examples and describe how particular features of rhythmic patterns correspond to geometrical shapes in phase space plots.” (Ibid, 560)

Music Curriculum and Methods for the Hearing Impaired, Communication Tools

How further is the representation of ideas via the visual arts helpful in music education? According to Taylor, “Artistic Data Visualization and Assessment in Art Education” the experience of visualization in art is related to the education process as she states, “Learning in visual art involves pictorial representations of ideas, images, concepts, context, critical observations, and connections. Students and teachers talk, write, journal, sketch, and make art. And although many of the ideas that compel them to do so may not necessarily be visual, their processes are often image- or object-oriented.” (Taylor, 59) Taylor’s research is specifically aimed at the visualization process within education and assessment processes, hence the findings are also appropriately connected to the visualization processes involved in teaching and experiencing music. As in art, music utilizes the visualization process involving “knowledge, technical skill, aesthetics, and meaning making.” (Ibid, 60)

Learning Methods and Skills for the Hearing Impaired

Rhythm and Notation, Sympathetic Vibrations

WHAT learning methods and skills are available for teaching music to the hearing impaired? This question is an important consideration for those who select curriculum for and teach hearing impaired students. Alice-Ann Darrow provides research focusing on the methods available for teaching those with hearing impairments. Darrow’s article “Music and the Hearing Impaired: A Review of the Research with Implications for Music Educators” discusses the role of the educator in selecting and using appropriate materials and methods in their teaching. Additionally, the Darrow article presents explanation of the various difficulties experienced by those with hearing impairments,

specifically rhythmic replication and accuracy in duplicating rhythms and patterns in music. Proper communication tools and instructional methods are extremely important in teaching hearing impaired students. With proper instruction students experience successful results. Darrows states, “The music educator is often at a loss for requisite information regarding this sensory impairment.” (Darrows, 10)

Rhythm and Pattern Repetition as a Tool of Learning Music Through Design

Rhythm in Design, Cognitive Strategies, The Cause of Rhythm, The Force of Repetition

How then can rhythm and pattern repetition enhance learning for those with auditory challenges? The proposed research discussions show the relationships between visual and auditory learning. Furthermore, this research shows that proper teaching methods afford greater opportunities for hearing impaired learners by presenting materials which combine visualization with pattern repetition within music. As a learning tool, rhythm and pattern repetition in music is possible through visual design. Chui-Shiu Chan provides research which examines the question, how is design related to cognitive processing of information? Chan’s research includes the conclusion that cognitive processing of information is possible via rhythm and repetition of patterns as he states, “Rhythm in design, as explored in this research, is proposed to be the result of cognitive performance generated stylistically by creators and recognized consciously by beholders.”(Chan, 253) Chan’s research provides observation that design is directly related to cognitive processing. The proposed research asserts that design includes rhythm within the visual patterns and repetitions of patterns; thereby providing movement within the design. The use of rhythm and repetitions of patterns visually is an aid in learning music. In identifying and discussing the impact of visual rhythm and patterns in design, one must also consider the automatic reaction, impulsiveness, and instantaneous desire for engagement with the appealing elements of design.

People react to and remember many things, from simple to complex, but do they consider the reasons? For example, do people think about and remember the details of how they breath, see, hear, or move while they are engaged in those activities? Therefore, although people are impacted by the superficial and immediate layout or color of a design, do they think of the rhythm and patterns of which the design is constructed?



Heath states, “Your brain hosts a truly staggering number of loops. The more hooks an idea has the better it will cling to the memory.”(Heath, 89) The totality of the function of design and the elements which “make an idea stick” (Ibid) are proposed to have a core relationship via rhythm (pulse) and repetition (patterns) – all of which will be examined throughout this research topic, arriving at conclusive evidence that in fact, the reactionary process of engagement with design is based upon an inner rhythm; a core pulse and desire of pattern repetition.



To understand the challenges faced by auditorily impaired individuals, it is relevant to define the condition of being auditorily impaired. It is beneficial to observe background information about the auditory processes to understand how to better meet the challenges of teaching music to those with auditory impairments.



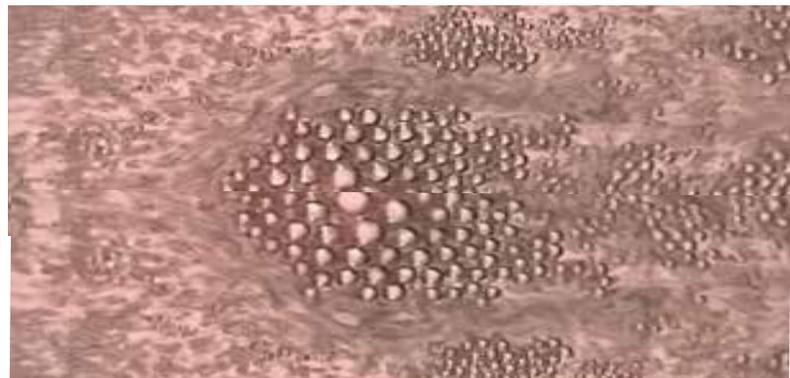
Hallam’s research shows that music, aural perception, and language skills join within the processing of aural information while acquiring skills as she states, “Music and speech both depend on perceptual categorization. In speech the focus is primarily on timbral contrasts, while in music it is on distinguishing differences in pitch. Vowel sounds and sound contrasts, while in music it is on distinguishing differences in pitch. Vowel sounds and sound frequencies are spread along continua. Acquiring musical and language skills requires individuals to learn to separate the sounds in each continuum into separate vowels or pitches. The auditory analysis skills used in language processing (phonological distinctions, blending and segmentation of sounds) are like the skills necessary for the perception of rhythmic (Lamb and Gregory, 1993; Lipscomb et al., 2008), harmonic and melodic discrimination (Anvari et al., 2002; Barwick et al., 1989; Lamb and Gregory, 1993).” (Hallam, 389) Furthermore, in hearing impaired individuals, an auditory process disorder often inhibits the brain function of perceiving the aural stimuli along with adequate processing of the information. Hallam further explains, “...the neuroscientific evidence shows that active engagement with music has a significant impact on brain structure and function.” (Ibid) In addressing aural perception as it relates to music Hallam proposes that her “research provides a synthesis of research on the relationship between music and language, drawing on evidence from neuroscience, psychology, sociology, and education. It sets out why it has become necessary to justify the role of music in the school curriculum and

summarizes the different methodologies adopted by researchers in the field.” (Hallam, 388) Hallam’s research provides insight about musicians, how they process the information they learn, practice, and refine.

CASE STUDIES

“The case study method focuses on gaining detailed, intensive knowledge about a single instance or a set of related instances. These instances, or cases, may be of individuals, organizations, entire communities, events, or processes... Case studies are inclusive, assuming that consideration of the whole, covering interrelationships, is more advantageous than a reductionist study of parts, and that this depth compensates for any shortcomings in breadth and the ability to generalize.” (Martin,28) The case studies provide investigative information, and visual analyses which add confirmation of the role of visualization and interaction of the neurological processes within engagement with patterns and rhythms in music and design.

Content analysis and content mapping are two research methods employed in addition to storytelling and experience. These methods assist in providing materials which support the research goals as follows, “Content analysis provides an established and systematic technique for dealing with qualitative data, whether analyzing existing records and archived documents.” (Martin, 40) The case studies chosen as additional research methods engage in research of learning methods, music methods, curriculum, and spoken and visual patterns. These methods will aid in observing, investigating, analyzing, and developing the topic of the proposed research.



“Deficits in Auditory Rhythm Perception in Children with Auditory Processing Disorder Are Unrelated to Attention.”

provides on rhythm processing while considering the overall acoustic dimension of the event from inception and perception through processing.

The study by Sidaris answers the questions:

1. *What is acoustic processing?*
2. *What is the processing order for rhythmic events?*
3. *What constitutes deficits in processing acoustic events?*
4. *What role do neural sensors and responders play in processing acoustic stimuli?*
5. *How is rhythmic ability related to acoustic stimuli and perception?*

Sidaris concludes, “Auditory processing disorder (APD) is defined as a specific deficit in the processing of auditory information along the central auditory nervous system, including bottom-up and topdown neural connectivity. Even though music comprises a big part of audition, testing music perception in APD population has not yet gained wide attention subjects with APD. rhythm, i.e., short isochronous sequences of beats, in APD children and to

compare their performance to age-matched normal controls.” (Sidaris, 1)

A second case study has focused upon adults with central auditory processing disorder. This case study provides insight regarding older learners and auditory processing disorders thus contributing to the essence of the research objective. The research considers “the behavioral manifestations and symptoms reported and/or observed during interviewing or observation of patients (both children and adults) suspected of having CAPD may include difficulty with understanding speech in competing background noise or reverberant environments, localizing to sound sources, hearing on the phone, following rapid speech, following directions, detecting subtle changes in prosody, learning a foreign language or novel speech materials, maintaining attention, musical ability, literacy and learning. Further behavioral manifestations include seeking visual or facial cues to aid understanding, frequently requesting repetition or rephrasing, responding inconsistently or inadequately, having hyperacusis and being easily distracted.” (Heine, Slone, 2)

The Heine and Slone case study offers conclusive evidence regarding the following questions which are part of the ongoing research project.

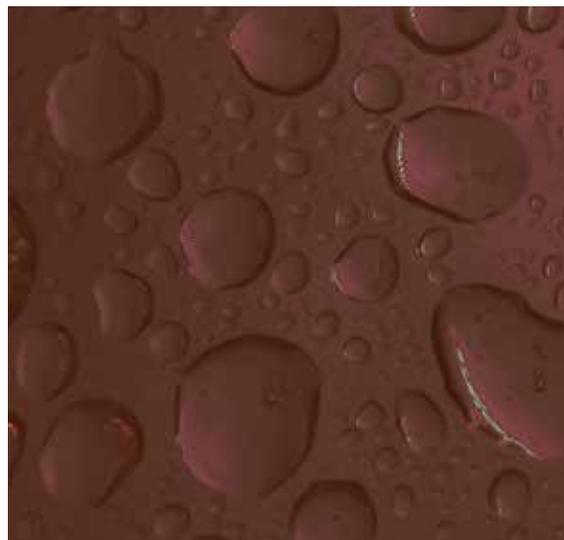
- 1. What tests are used for learners for assessing pitch and pattern recognition?*
- 2. What considerations are made for the aging and cognitive skills in auditory processing testing?*
- 3. What factors determine sensory and mental processing speeds?*
- 4. How is listening impacted by cognitive skills including memory and attention?*
- 5. How does the environment impact auditory processing?*

A third case study expresses the importance of testing for those with demonstrated difficulties in perception and processing of auditory stimuli. By investigating this case study, the current research reveals additional information regarding the role of testing and learning methods. The research examines “auditory behaviors: sound localization and lateralization, auditory discrimination, auditory pattern recognition, temporal aspects of audition and auditory performance decrements with competing acoustic

signals and degraded acoustic signals.” (Sharma, Purdy, 40)

The case study also contributes investigation into the following questions, producing conclusive evidence which supports the current research project.

- 1. How does poor listening impact auditory processing?*
- 2. What type of testing exists for poor listening and poor speech perception?*
- 3. What is the role of audiological assessments and at what ages does testing being?*
- 4. What are the risk factors for those with auditory processing disorders?*
- 5. What interventions exist for those with auditory processing disorders?*



Through the analysis of the following visual artifact Schirmer reveals “A free tapping exercise was used to measure spontaneous tempo. This was followed by a 3 min period in which participants performed the visual target detection task in silence. Afterwards, participants were presented with four blocks each comprised of a 9 min sound and 3 min silence phase. Illustrated on the right is a target trial. For half the measures/trials, the fixation cross changed color for 100 ms prompting participants to press a button.” (Schirmer, 61) Through this analysis the current research project obtains answers to the following questions:

- 1. What is the role of listening and memory in rhythmic imitation?*
- 2. What causes the reaction of movement when hearing rhythm?*
- 3. What is the role of rhythm on attention?*
- 4. How does metricality impact rhythmic responses?*
- 5. What is the role of sequential stimuli in rhythm processing?*

Breska offers visual artifacts revealing the influences of rhythm on brain function, this being an essential element within the current research stating, “Making predictions is a major adaptive brain function. Predicting the timing of upcoming events enables the brain to prepare for them. However, it is unclear how this is achieved... It is believed that in rhythmic environmental context, such as in music and speech, temporal predictions are achieved by synchronizing the naturally occurring brain rhythms to the external rhythms, a process referred to as oscillatory entrainment.” (Breska, 2)

- 1. What is the significance of pattern repetition in ascertaining the role of rhythm in learning and memory?*
- 2. How do stimuli, perception, reaction, and memory interact to form retention?*
- 3. What is involved in being able to repeat rhythms via clapping, tapping, or singing?*
- 4. Does visual recognition of rhythm enhance repetition of rhythm?*
- 5. What is the function of neural stimuli within the processing of rhythm?*



Bauer's study provides this research project evidence of the important role of visual discrimination and rhythm. The study illuminates thought regarding the following questions,

- 1. What is the path from auditory to visual processing and perception?*
- 2. Are there similarities in the patterns of stimuli which involve auditory and visual processing?*
- 3. How does sensory perception impact rhythmic processing?*
- 4. Is visual memory increased by rhythm?*
- 5. How does frequency of sound impact processing and retention of rhythmic patterns?*

The data acquired and indicated within the visuals of the Bauer research add depth and substantiation to the assertions within the current research involving the role of rhythm and patterns as methods of reaching out to those with hearing impairments with mean of visual learning tools. "The current study provides a strong validation of cross-modal entrainment as a useful means for organizing the perception of multisensory stimulation in the natural environment." (Bauer, 7073)

Another case study provides information based on investigation of the role of visualization within the auditory process. Yu Fan's study also provides insight into the role of visualization of sound, musical sound, and the interaction of the neurological processes within patterns and repetition of patterns resulting in musical rhythms. This case study and visual analysis, serves to provide a path to observation and realization of the roles within auditory processing. *A Study on Audio-Visual Interaction: How Visual Temporal Cues Influence Grouping of Auditory Events* by Yu Fan is defined as a study which investigates "audio-visual interaction in rhythm perception. The central questions addressed are whether visual rhythm influences human's rhythmic grouping of auditory event sequences, and whether musical training intensifies or weakens this influence." (Fan, ii) Fan's research has a responsibility to investigate and show the intersection of stimuli and responses via the auditory system. Fan focuses upon the fact that auditory processing is not confined to one action but rather is a "multisensory process." (Ibid) Fan states, "Music

provides us a complex, rapidly changing acoustic spectrum, and when presented with such stimuli, the human auditory system spontaneously groups acoustic elements together. Real-world experience of rhythm is often multisensory, involving both auditory and visual systems, such as when we observe drumming. However, the way auditory grouping behavior is influenced by concurrent temporal cues from visual stimuli is not fully known yet.” (Ibid) This study reaction to musical stimuli, and investigates the types of reactionary responses to the stimuli and concludes with summation of the interaction of multisensory processing within the study. Additionally the study focuses in great depth on the impact of visual perception within the processing of information and auditory function and experience. Fan also discusses sensation and perception and the role of the senses in processing information. Fan offers insight into both aural and visual sensations and perceptions, explaining in detail the processes of both functions. He states, “Perception and cognition are often regarded as interchangeable terms because they both denote the abstract mental processing of sensory inputs.

The term cognition is occasionally distinguished from perception for denoting higher-level abstraction, such as abstracting meaning, emotion, structural information, etc., from language, literature, or music.” Fan, 6) Research by Chiu-Shui Chan provides information regarding the role of visualization within the auditory process and supports the assertions of the proposed research project . Chiu-Shui Chan describes his case study titled Phenomenology of Rhythm in Design in this way, “This study describes the phenomenon of rhythm; how it is created; the factors that comprise rhythm; the types of rhythms created by human cognition of repetition, and why repetition is recognized as a part of human cognition. Images of seven buildings designed by Alvar Aalto are used to demonstrate the creation and expression of rhythm in building compositions. Evidence gathered in this research explains that rhythm in design is a result of the design method consciously applied by human cognition of repetition. Rules of generating the phenomena of rhythm are also summarized. Designers could apply these rules to generate harmonious patterns through the

effective usage of repetition. In sum, rhythm is ingrained in the human conscience and therefore should be a key component of design applied universally. (Chiu, 253)

Chan's research in rhythm offers insight into rhythm. The research by Chan provides investigation and observation into rhythm within the arts. His work concentrates on construction and recurring patterns and "the regular, harmonious recurrence of a specific element, often a single specific entity coming from the categories of line, shape, form, color, light, shadow, and sound." (Ibid) Additionally, Chan's research concentrates on the elements of repetition, rehearsal, and memory through the processes of repetition via practice. Inspiration for Chan's research is found in his interest of patterns and the process of visual engagement with the pattern's stimuli, reactions of which contain varying responses. that "repetition is the cognitive strategy used to persuade belief (in rhetoric), to emphasize a notion (in literature), to improve learning (in psychology), to generate a style (in design); and is the human cognitive operation used in everyday life. By the same token, in fields of design, repetition is also one of the cognitive mechanisms used from



applying a basic module together with a set of rules to create a pattern that expresses rhythm in design." (Ibid) This study embraces the entity of rhythm and lends insight into visual design and the processing of information from stimuli and perception to function and understanding. He also provides information about "reasons for causing repetition in design" and the rhythmic process "could either be the intentional plan or the well-practiced procedural knowledge that was automatically applied to create similar patterns. Thus, repetition and methods of application are the factors causing rhythm, yet its basic driving force is repetition." (Ibid) Chan also delves into the phenomenology of rhythm and explains that "rhythm, by definition, is repetition and repetition could automatically create an order to the whole design. Such a created order is the character of rhythmic phenomena... repetition with similar movement and/or transformation rules would always generate an ordered pattern." (Ibid)

What is the significance of visual rhythm in learning? What is the role of visual rhythm in design? Furthermore, how does visual rhythm impact those with auditory impairments in learning music? These are just a few of the questions considered within the proposed research *Exploring the Pulse of Design and Music: The Impact of Visual Rhythm in Design for Auditorily Impaired Music Students*. Observing the interplay among visual rhythm and learning is essential in offering effective visual learning materials for all learners, specifically the hearing impaired. This case study and visual analysis examines the role of lines, direction of lines, repetition of provides lines, and various patterns involving lines within design and music. It reveals observation and investigation into the use of lines and repetition of lines within visualizations, potentially enabling learners with more effective music studies. Si's case study titled *The Power of Lines: Creating Rhythms for Visual Relations* answers the proposed research questions saying, "Lines are fundamental in design. They have great ability to transform their physical features and fit into different context. Lines are used everywhere in information design." (Si, 2)

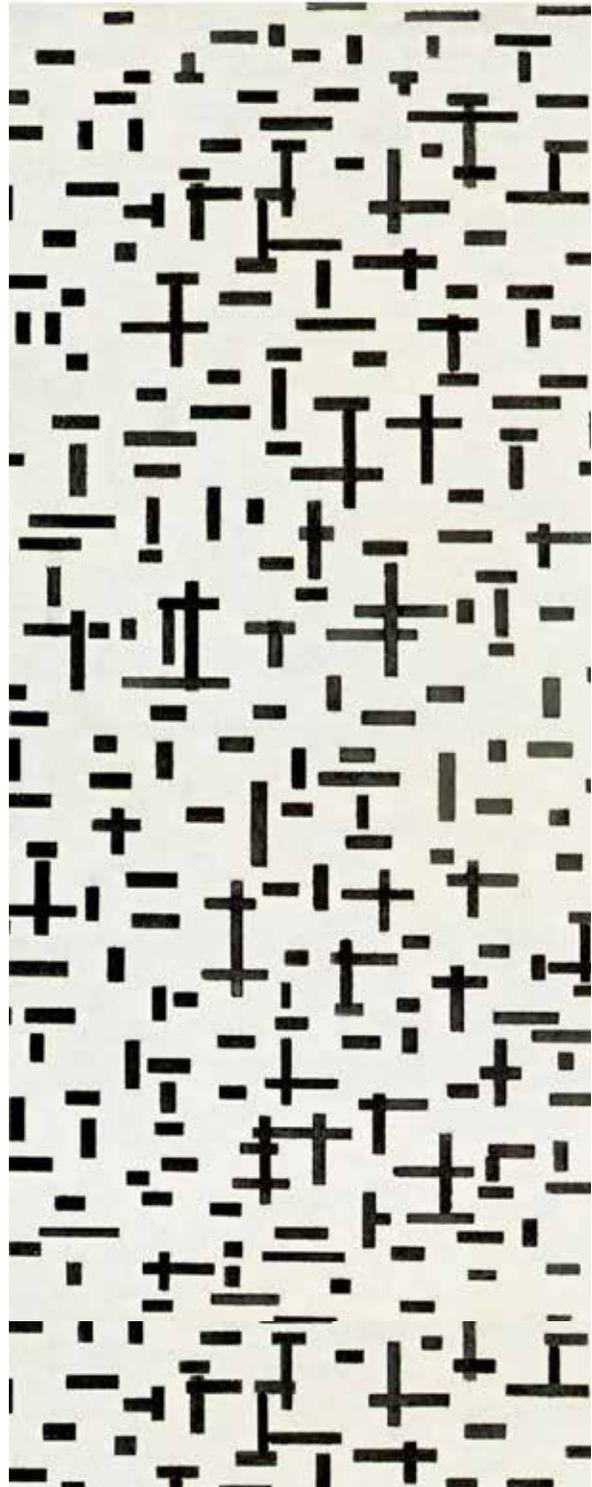
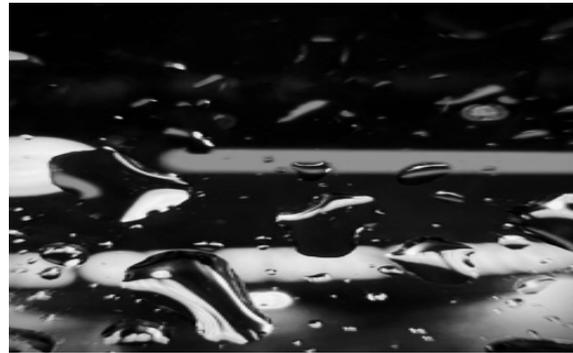


Fig.1 PIET MONDRIAN PAINTING OF LINES, Si Study

Si states, “We should see what the power of lines in visual art – it could be ambiguous; it could be specific; it could be irregular. Complexity and dynamism are an intrinsic nature of our world. There are some visual evidences that tell us that we can illustrate these natural features of the world in a planar space. We should further explore more about lines for illustrating the rhythms of nature by creating a dynamic space that contains various relations in this connected world.” (Ibid, 37) In attempting to provide justification for his assertion that, “Creating rhythms is a possible solution for constructing comprehensive structure in space” (Ibid, 41) Si offers a visualization of Piet Mondrian’s painting which involves the arrangement of lines.



The visual solution consumption method in the visual artifact is best explained by Si’ as he states, “Rhythms can capture our attention because it defines the relations among individuals. Therefore, our eyes prefer to look at rhythmic structure of elements. With rhythms, line congestions can work better, by which we create visual relations that coordinate with data relations from datasets. A group of lines needs rhythmic organizations to define the relations among individual elements in space.” (Ibid, 41) While viewing this visual artifact, the reader is involved in an active visual experience wherein repetition of various sizes and lengths of lines in different arrangements enhance the engagement with the design. The patterns, repetition, and arrangement of the lines give way to active visual stimuli and information processing which results in a rhythmic encounter.

Conclusion

Research confirms that rhythm and repetition of patterns in design are essential to communication and learning techniques. By employing contemporary technology in design creation, including the increased use of visual designs encouraging rhythm and pattern repetition, those with auditory impairments and challenges will gain increased interaction and understanding of music. Through studying the needs of the auditorily impaired, their abilities and learning challenges, visualization teaching methods are possible to offer greater opportunities for participation in music. Using visual design to increase the spectrum of music teaching tools which utilize rhythm and pattern repetition will present increased effective learning by all students including the hearing impaired. The research, case studies, visual artifacts and analyses encountered in this research contributes greatly to the understanding the project while providing groundwork for the visual solution of the project, that of a collection of designs which serve to provide appropriate learning methods and materials for those with auditory challenges.



CHAPTER THREE

Visual Process



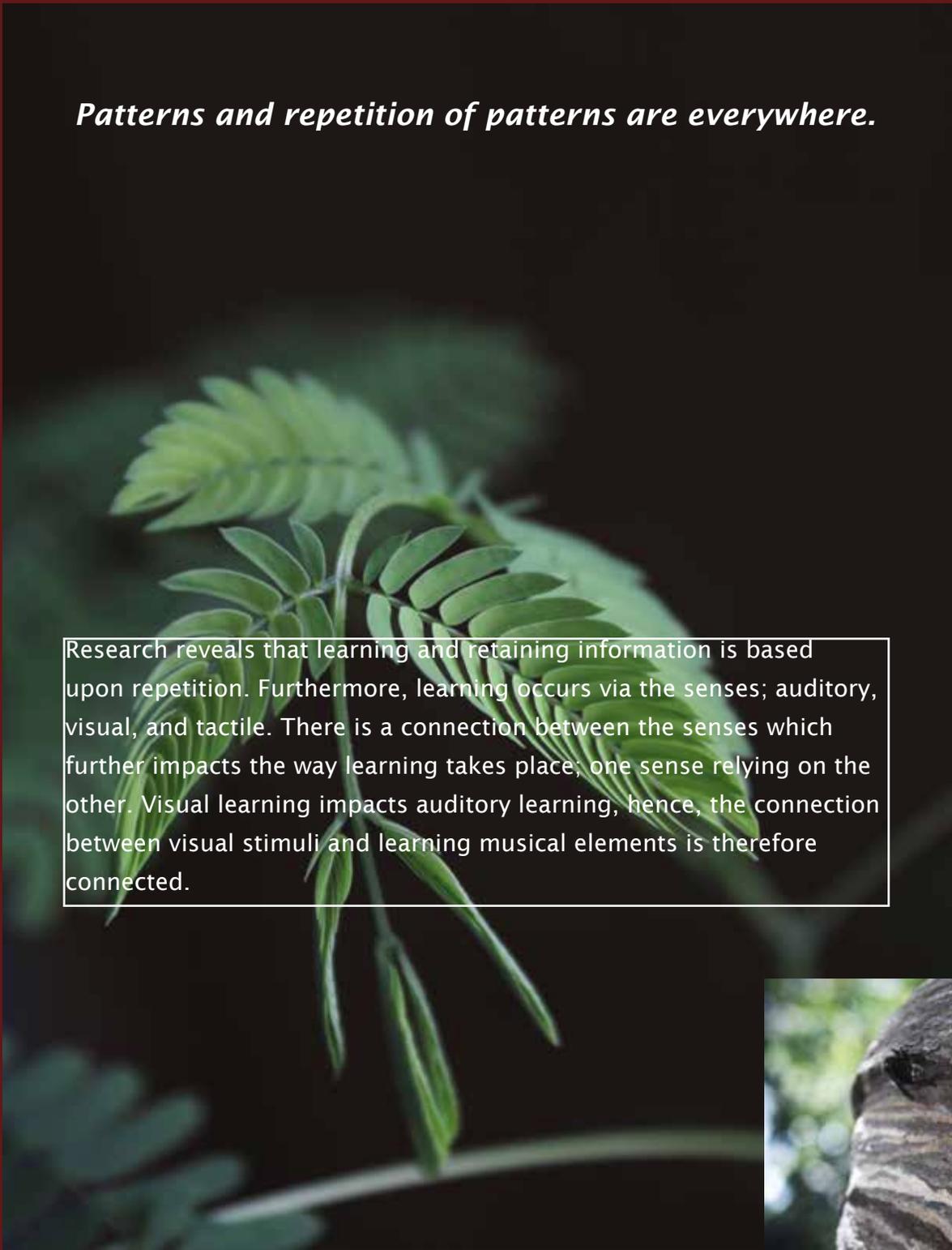


Introduction

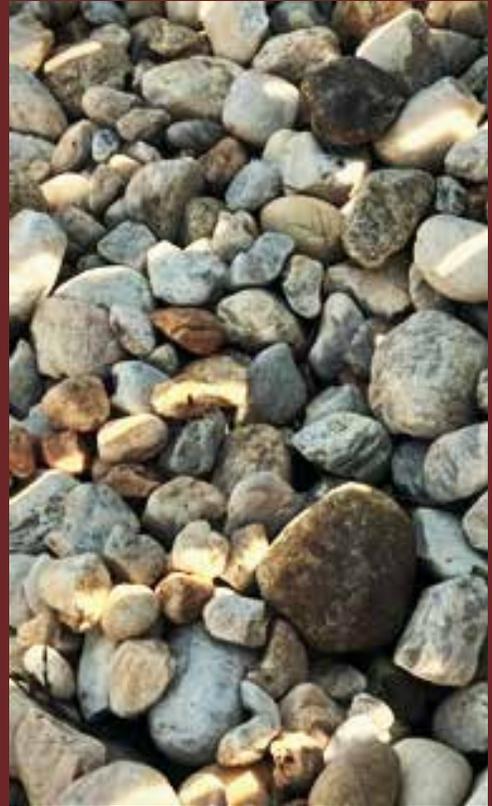
Planning, developing, and compiling the visual solution for my research topic has begun with first an observation of the immense resources of patterns and the repetitions of patterns within the creative aspects of nature and life all around us. That realization has provided inspiration for the visual solution that consists of developing a packet of skill/drill cards for learning musical terms and other elements of music. After engaging in research of the auditorily challenged, I chose to develop a simple, practical, and beneficial visual solution for both the teacher and student, a collection of flashcards.

Patterns and repetition of patterns are everywhere.

Research reveals that learning and retaining information is based upon repetition. Furthermore, learning occurs via the senses; auditory, visual, and tactile. There is a connection between the senses which further impacts the way learning takes place; one sense relying on the other. Visual learning impacts auditory learning, hence, the connection between visual stimuli and learning musical elements is therefore connected.



Patterns and repetition of patterns...



...impact perception and the senses.



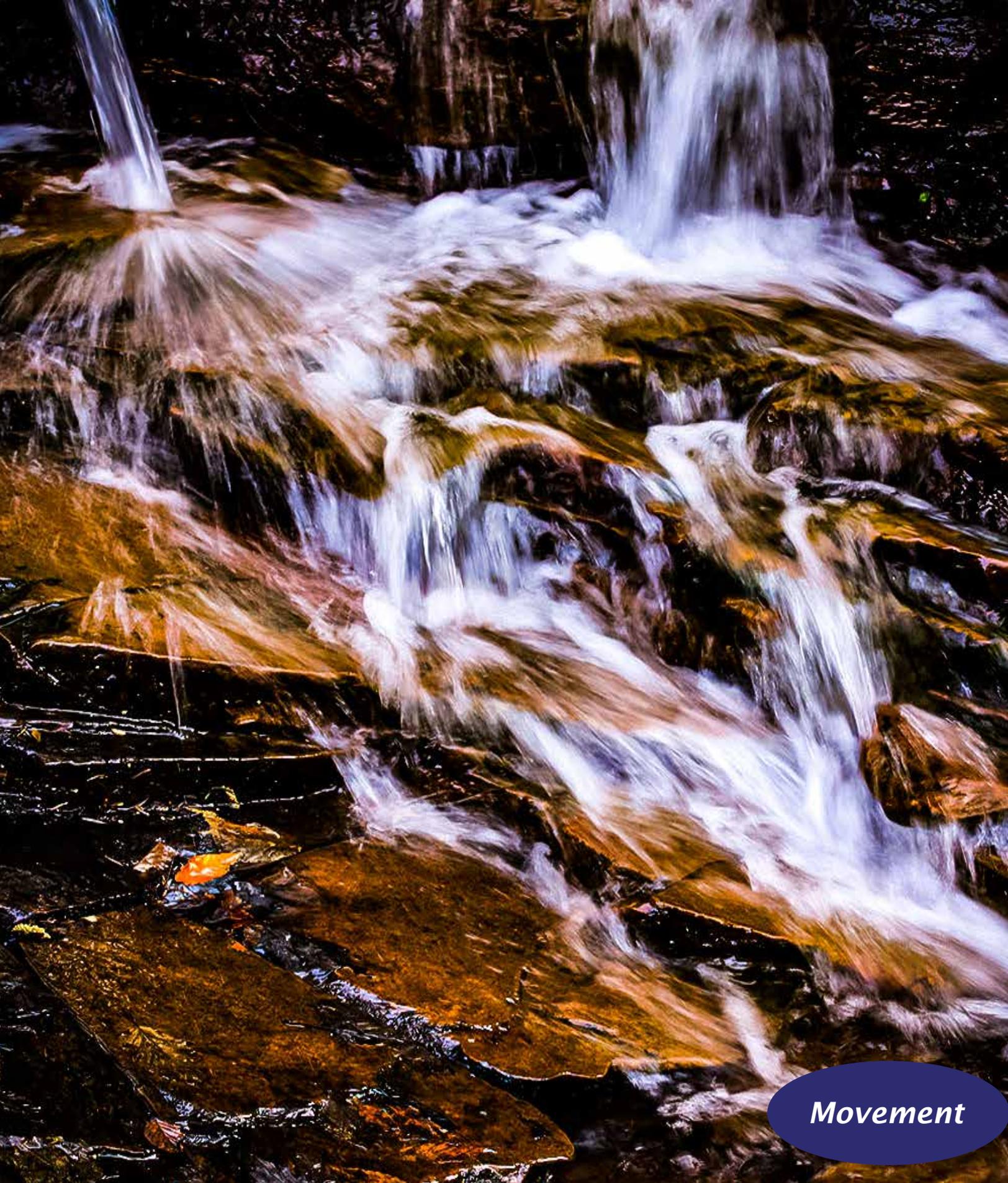
Repetition

The Methodology

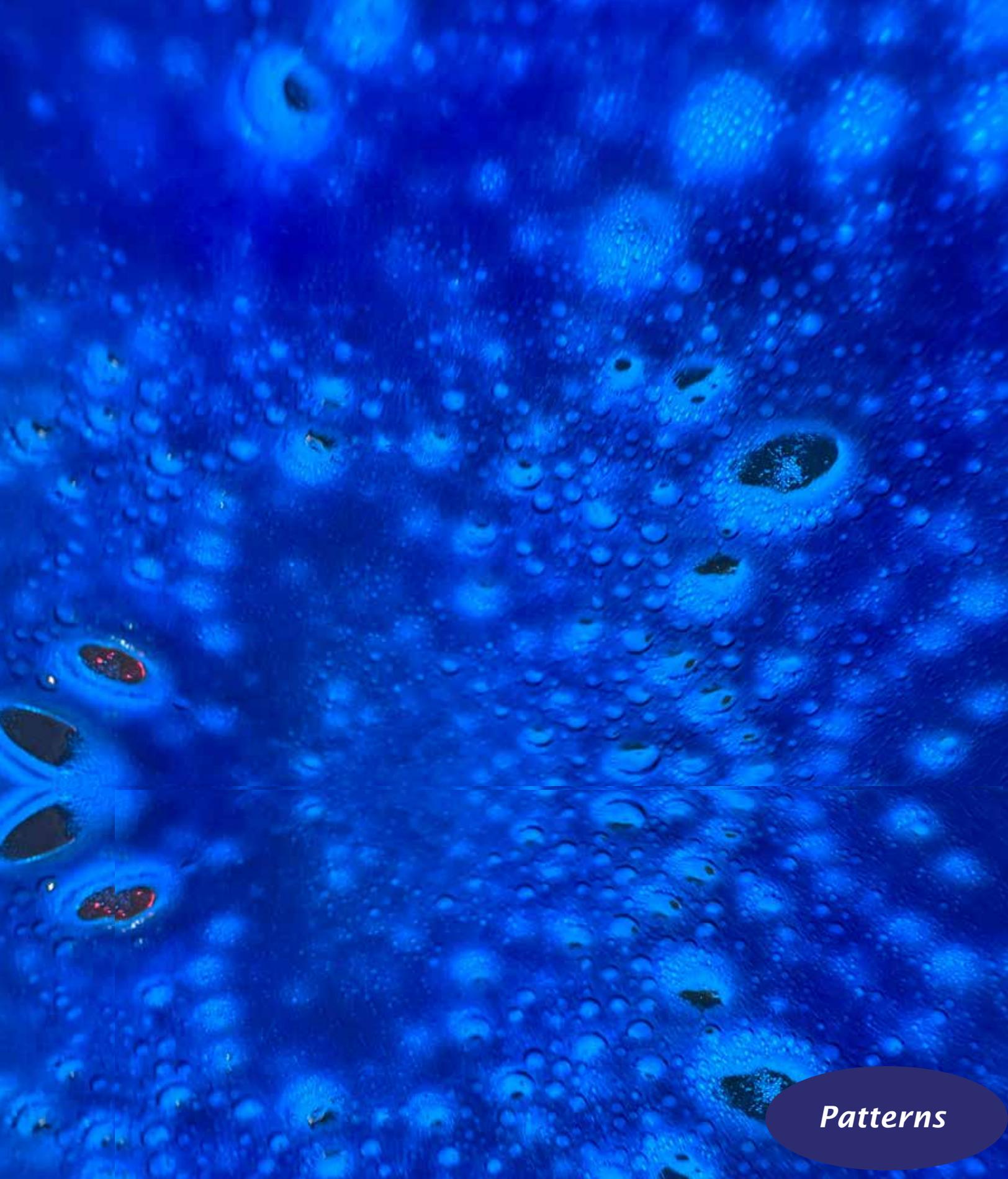


An integral part of this research project and visual solution is the concept of influences of patterns within nature. A major portion of the visual solution is the capturing of patterns in nature which are readily associated with musical elements, via original photographs. By first seeing the content of the photograph, the visual stimulation and consequential visual processing of that information presents a reaction to the visual content of the photograph. Likewise, with a musical element in combination with the photo content, the viewer can associate the visual content with the musical element, thus increasing the effectiveness of the visual and learning experience. Via this process one might ask, “What do you

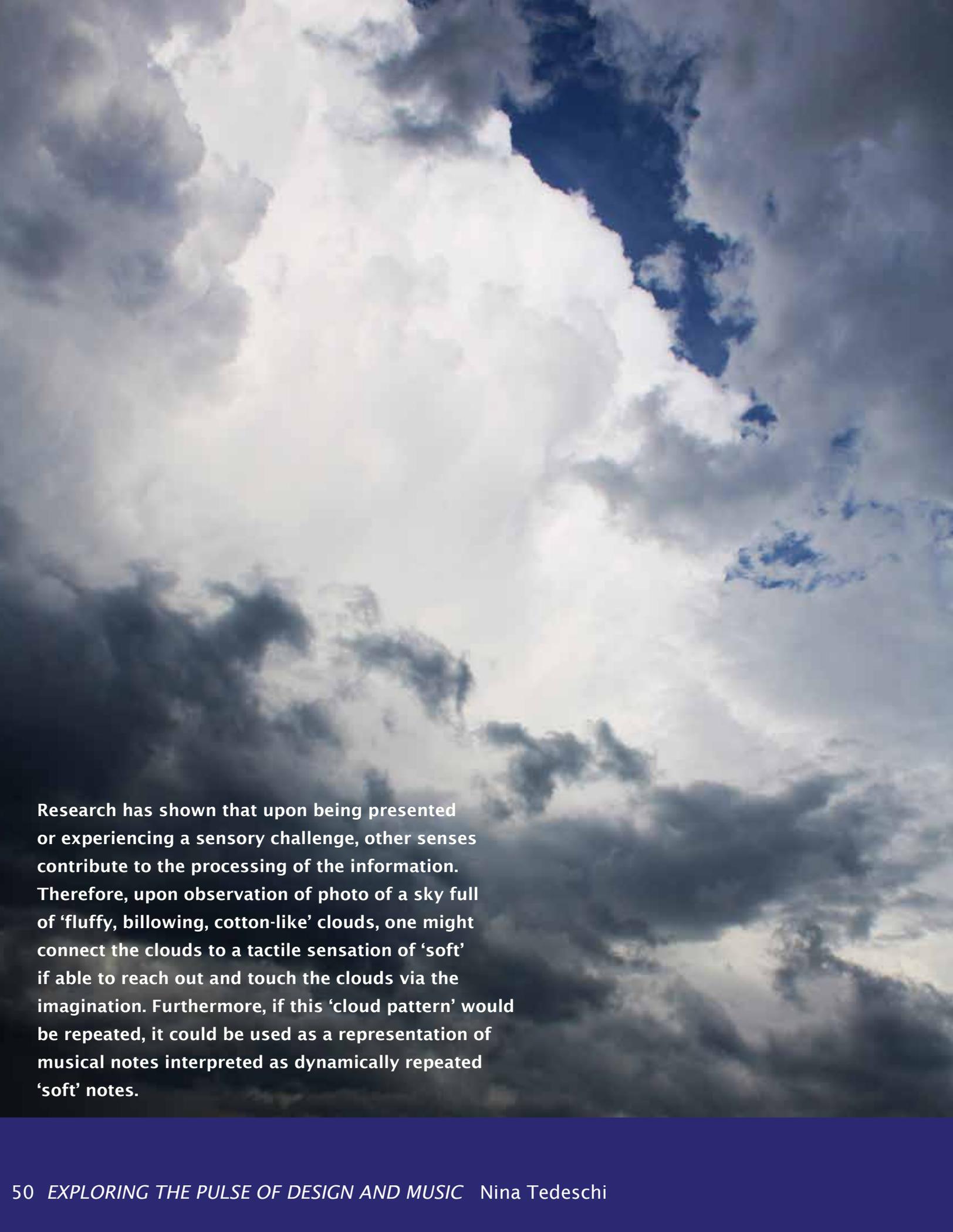
see? How can you interpret the content of the photo? What is pattern and musical association? What does the picture sound like?” See *Visual Literacy* for further insight about “how we use visuals to convey meaning.”¹



Movement



Patterns



Research has shown that upon being presented or experiencing a sensory challenge, other senses contribute to the processing of the information. Therefore, upon observation of photo of a sky full of 'fluffy, billowing, cotton-like' clouds, one might connect the clouds to a tactile sensation of 'soft' if able to reach out and touch the clouds via the imagination. Furthermore, if this 'cloud pattern' would be repeated, it could be used as a representation of musical notes interpreted as dynamically repeated 'soft' notes.

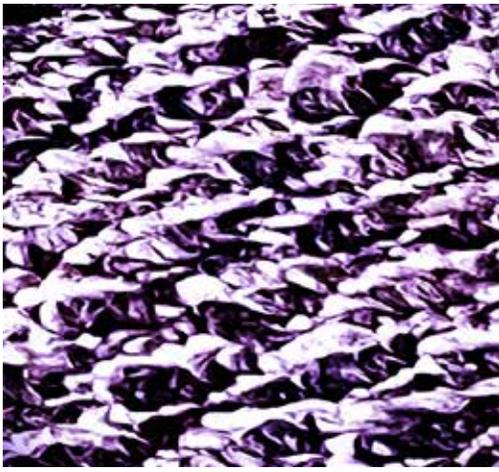


The
Sound
of
Silence





The plan and process of initiation, designing, and completing the visual solution has begun with thumbnail sketches, photographing sessions to include visually stimulating content which is appropriate and fitting for association with various musical elements, and development of a set of skill charts and slides for inclusion in a set of flashcards for use in musical lessons and classes.



“Eye Has Seen, Ear Has Heard.”

A VISUAL SOLUTION TO THE RESEARCH

EXPLORING THE PULSE OF DESIGN AND MUSIC: *THE IMPACT OF VISUAL RHYTHM IN DESIGN FOR AUDITORILY IMPAIRED MUSIC STUDENTS*



Several years ago I heard the song *Can You Hear Me?* by Bob Chilcott. The impact of that performance has resurfaced as motivation for this research and the development of the visual solution called, *Eye Has Seen, Ear Has Heard*. The lyrics of Chilcott’s song, scenes from nature and other captivating scenery, process sketches, and developmental stages of the project follow as representation of the inspiration, ideation, and implementation of the visual solution.

Can you hear me?

by Bob Chilcott

I look around me as I grow

I'd like to tell you all I know

I see life
With all it's energy
The city streets
The rush of time
This is my world
It's where I like to be
So much to find

I feel life
With all it's energy
The joy of waking every day
This is my world
It's where I like to be
So much to do
So much to say

I sometimes sit and wait a while
I see the sun
It makes me smile

I some times sit And feel the sun
It's warmth
Is there for everyone

Can you see it
Can you see it too
Can you see it
Can you see it too

Can you feel it
Can you feel it too
Can you feel it
Can you feel it too

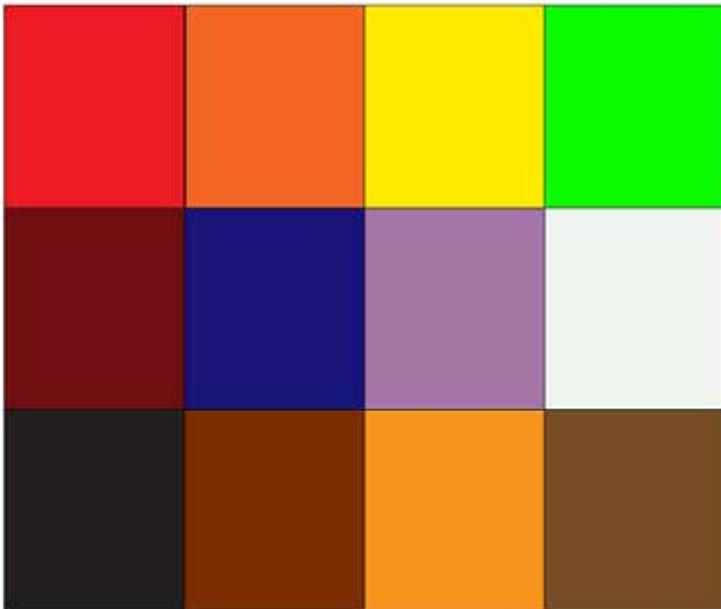
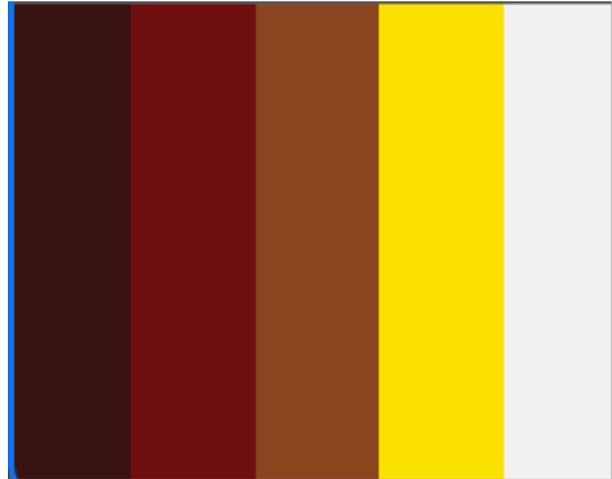
My world is a silent one But it's enough for me I hear you Through your hands
The movement sets me free But it could be a special thing To hear your voice
To hear you sing Can you hear me Can you hear me too Can you hear me
Can you hear me too

I look around me as I grow

I'd like to tell you all I know

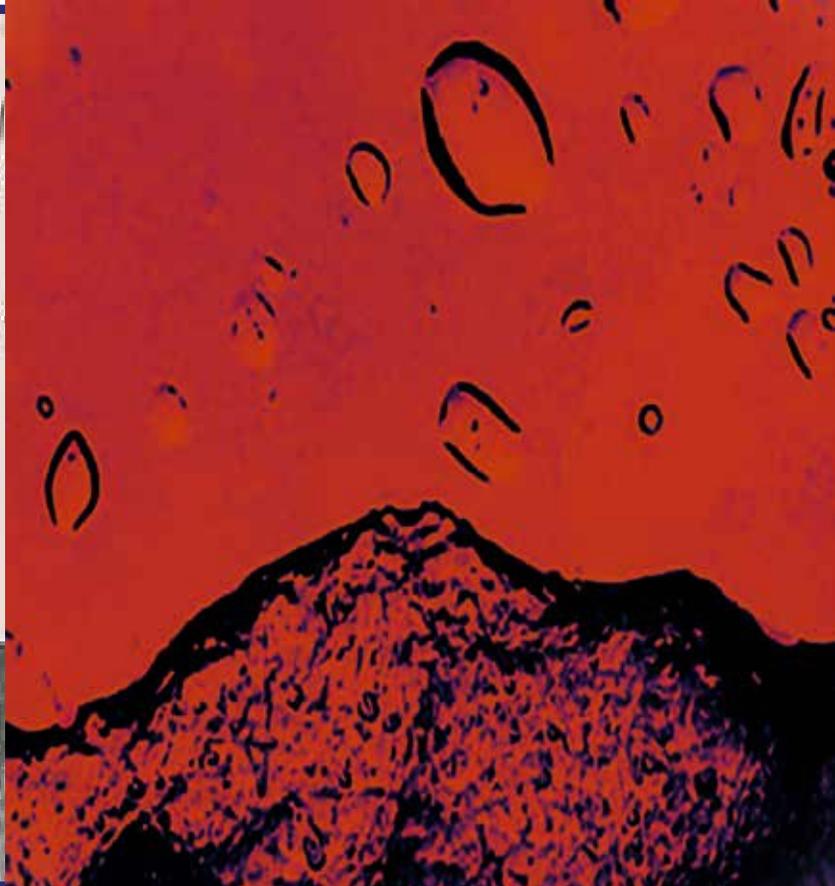
Can you hear me?

Inspiration and Ideation for the flashcard collection is based upon the observation of nature and life. Finding an abundance of resources all around me, my visual process is rooted in identifying potential photo opportunities and subjects for the visual content of the flashcard.

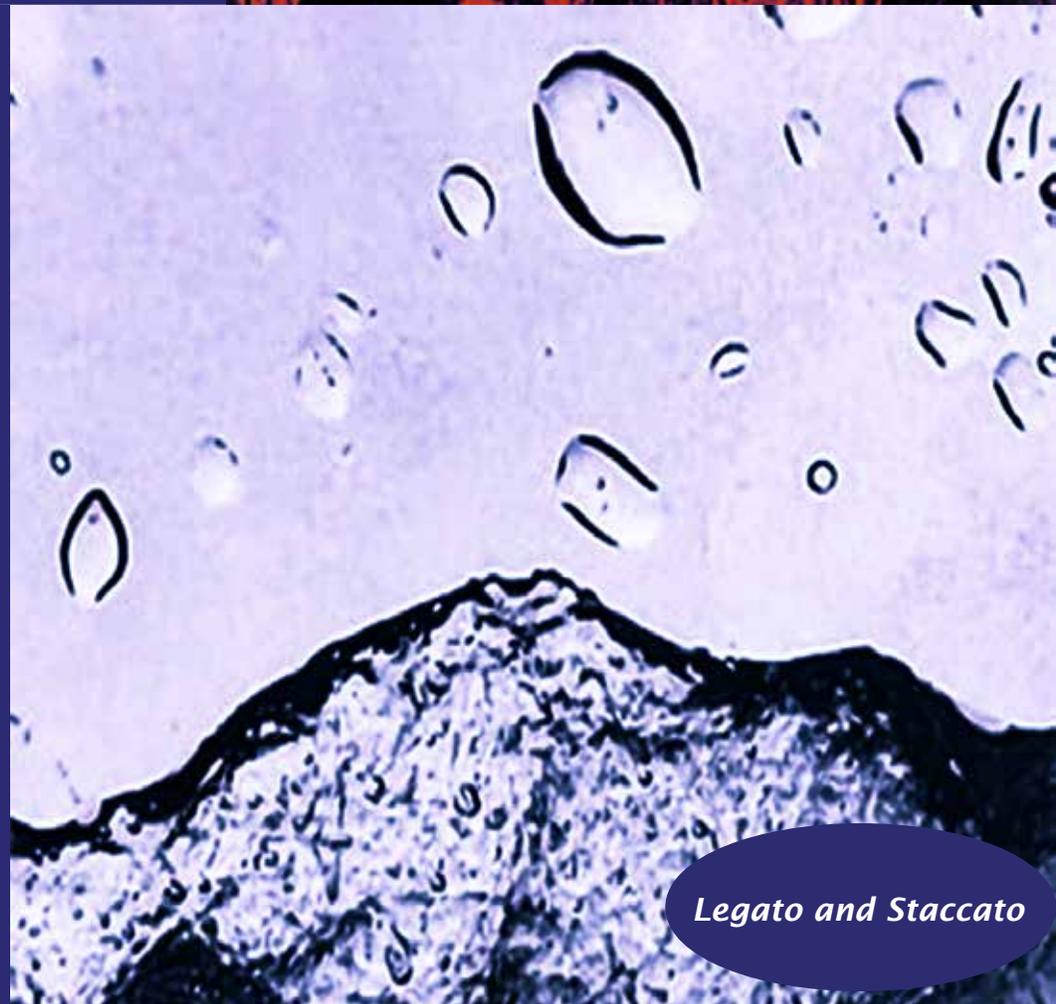


Although the color initial choice of colors included rusts and brights of a splendid autumn season, soon the color palette grew to include bright prime and secondary colors to appeal to students of all ages. The visual stimulation embedded in the bright colors serves to attract and hold the attention of all learners.





In a short time, the inspiration and ideation phases of the visual solution provided a large collection of photos from which to make associations with musical terminology and references. The next phase of the process involved matching the photo content with musical terms and ideas. Additionally, grouping the flashcards according to thematic color families provided more depth and organization to the flashcard project.



Legato and Staccato

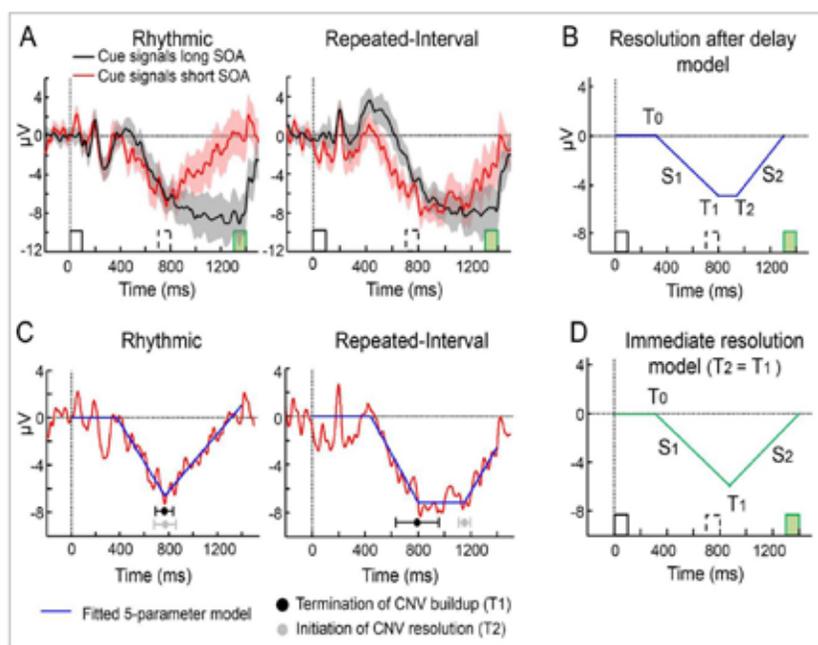
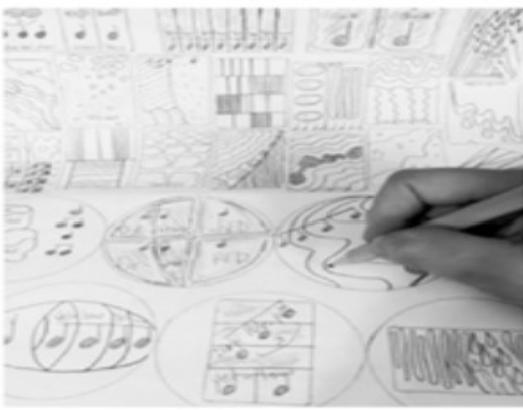
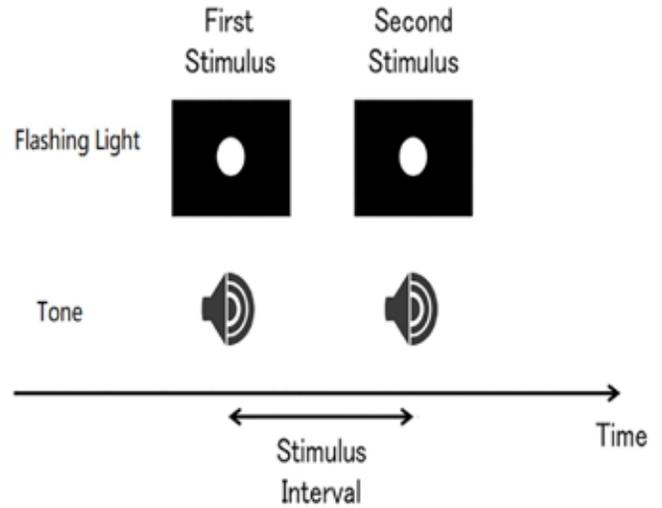
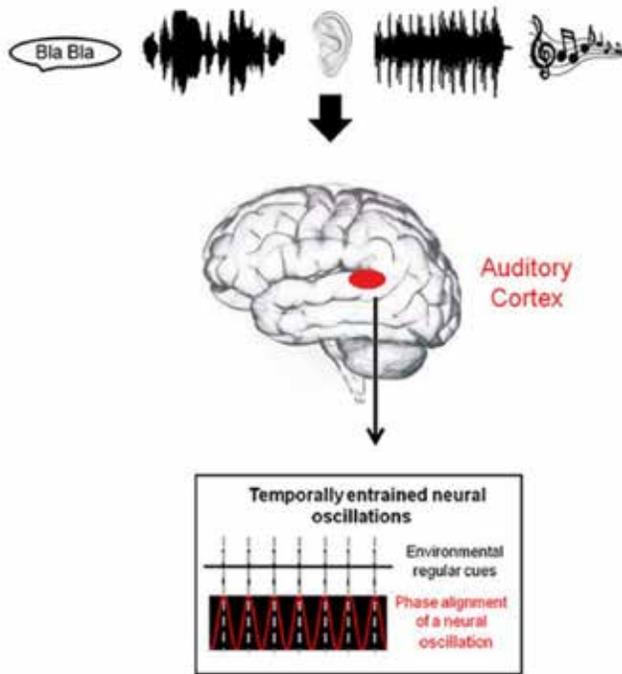


Fig 3. Immediate CNV resolution after omission of an expected event for rhythm-based temporal predictions. (A) Group averaged waveforms (central cluster electrodes) in the two predictive conditions exclusively for trials with long SOA targets (green bar). Black line—expecting the target in the long SOA; Red line—expecting it in the short SOA, but it is omitted (invalid short cue trials). Error margins—standard error for the difference between SOAs. (B) A five-parameter model that allowed a delay between buildup and resolution was fitted to the CNV waveform. (C) Waveforms of the Rhythmic and Repeated-Interval when an expected short SOA target is omitted (red) fitted with the five-parameter model (blue), with estimated latencies of termination of the CNV buildup and initiation of the CNV resolution. (D) A four-parameter model that coerced immediate resolution after buildup termination was used as a null model for model comparison.

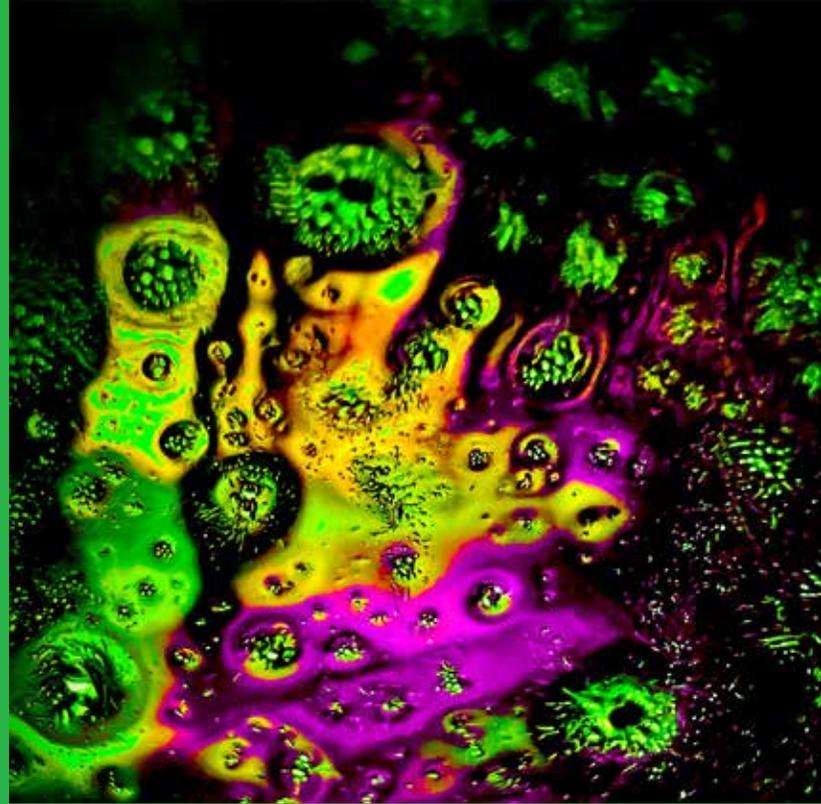
doi:10.1371/journal.pbio.2001655.g003



Inspiration and Ideation for this research has been experienced via research, case studies, study tools and materials, and flashcard designs by others. All of these areas have had an impact on the creation of the visual and musical flashcards within this research project. Observation, investigation, and study of this information has helped shape the theoretical visual solution within the research project as all shows the significance of the interworking of the senses in design and music.

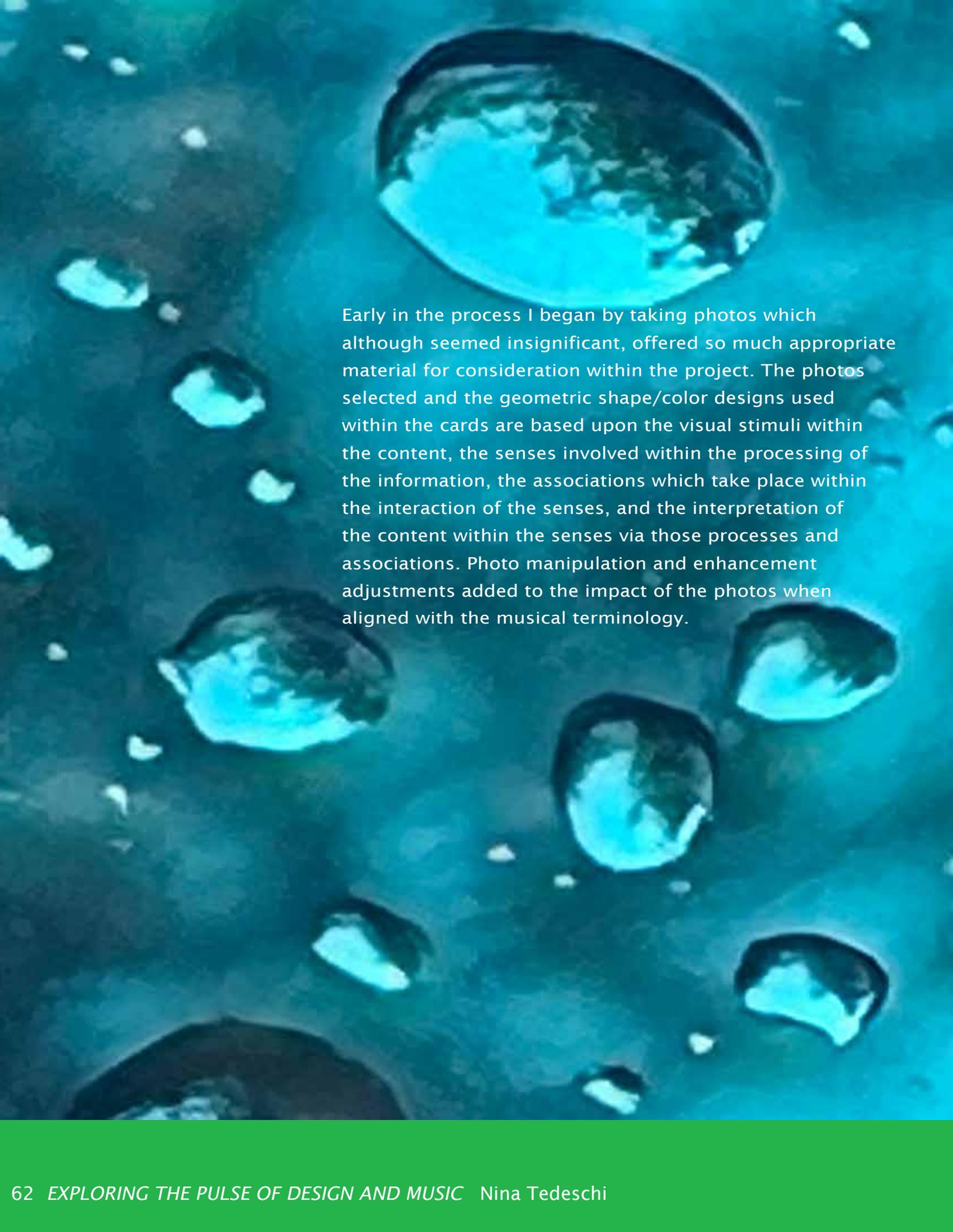
CHAPTER FOUR

Visual Solution

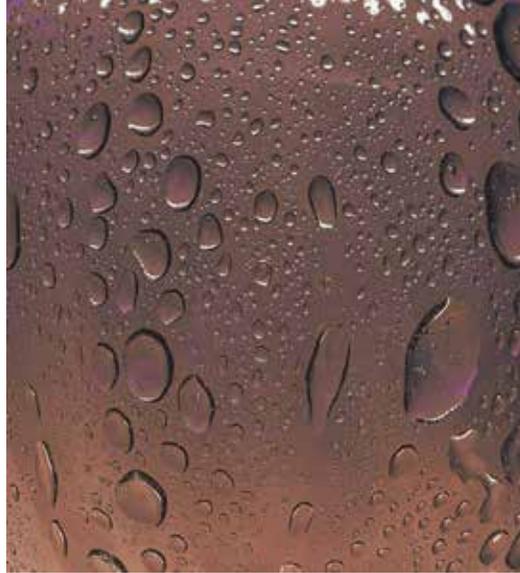


The realization of the importance of patterns and repetition of patterns which create rhythm in design communication has been made intensely stronger via the research within this project. Each step of the visual design solution process has confirmed the key role of the patterns within life itself and the impact they have within learning. Aiming toward the goal of designing and developing a supplemental learning packet for music students with auditory challenges has been short of inspirational. During the ideation stage of the design process, I became observant of patterns and repetitions of patterns within my home, work, church, and nature environments.





Early in the process I began by taking photos which although seemed insignificant, offered so much appropriate material for consideration within the project. The photos selected and the geometric shape/color designs used within the cards are based upon the visual stimuli within the content, the senses involved within the processing of the information, the associations which take place within the interaction of the senses, and the interpretation of the content within the senses via those processes and associations. Photo manipulation and enhancement adjustments added to the impact of the photos when aligned with the musical terminology.



Commencing with acquiring photographic content representing patterns and repetition of patterns, each slide has undergone development and manipulation through Adobe Illustrator and Photoshop. Each card has been selected according to musical elements and terminology represented in the visual content of the photograph. Each flashcard is described in the following card collection. The final flashcard collection is presented at the close of this chapter and serves to provide supplemental skills and drills for music students of all learning abilities. Organization of the flashcards according to color themes also has taken place to encourage visual and musical observation and engagement. These colors also serve as borders and chapter dividers within the research project. Suggestions for use by the instructor are provided on an instructional guide.



In approaching the research topic which focuses upon the pulse, patterns, and repetition of patterns in visual design and music, I have *explored* those elements of rhythm in nature and everyday life. The inspiration and ideation undergirding this research project is one which brings emphasis to areas of visual communication otherwise omitted in the world of music education, concerning those with special needs and varying levels of learning abilities. Hence, my direction and objective for this project has been crafted in a simplistic manner with insightful and informative results. The first consideration for the visual process has been to rely upon research of visuals. A few seen below, have impacted the goal of showing the pulse within both visual design and music. Pattern repetition leads to rhythm in both visual design and music, this being the foundation of my research.

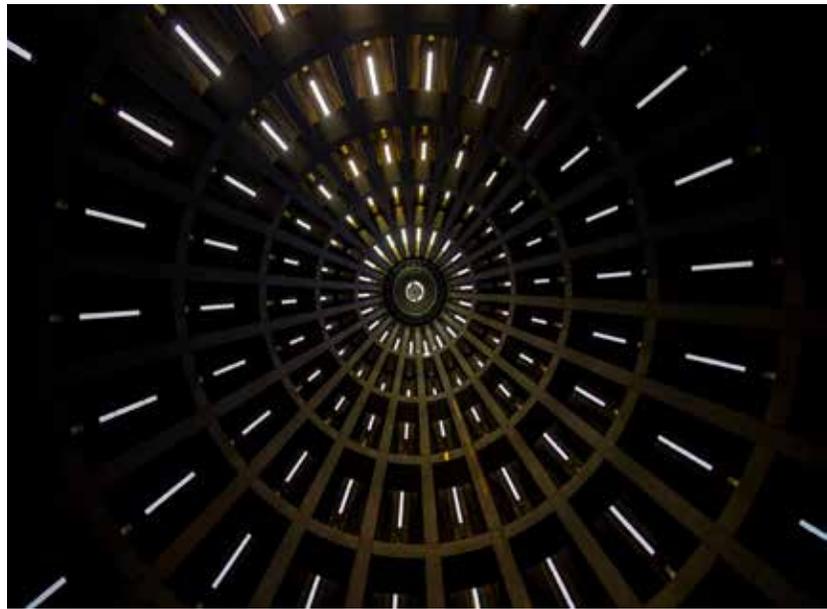
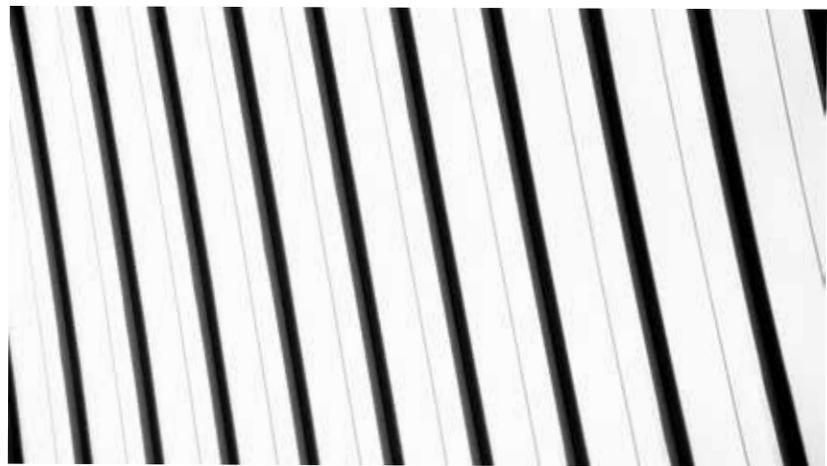


PHOTO CREDITS: pexels.com *Studies of Lines*

INSTRUCTIONAL GUIDE

“Eye Has Seen, Ear Has Heard”

Flashcards Skills and Drills

The SUPPLEMENTAL TEACHING FLASHCARDS packet allows a student to engage with visually stimulating pictorial content while utilizing critical thinking skills in music via musical associations, analogies, and terminology. Through this process students will develop a greater self-image and sense of achievement. Teaching prompts are included on the back of each flashcard. The flashcard collection offers a unique way to combine visual content with the study music concepts and terminology. By the use of critical thinking questions, responses, and discussions, students will engage with, learn, and retain the lesson content.

SUGGESTIONS for teachers:

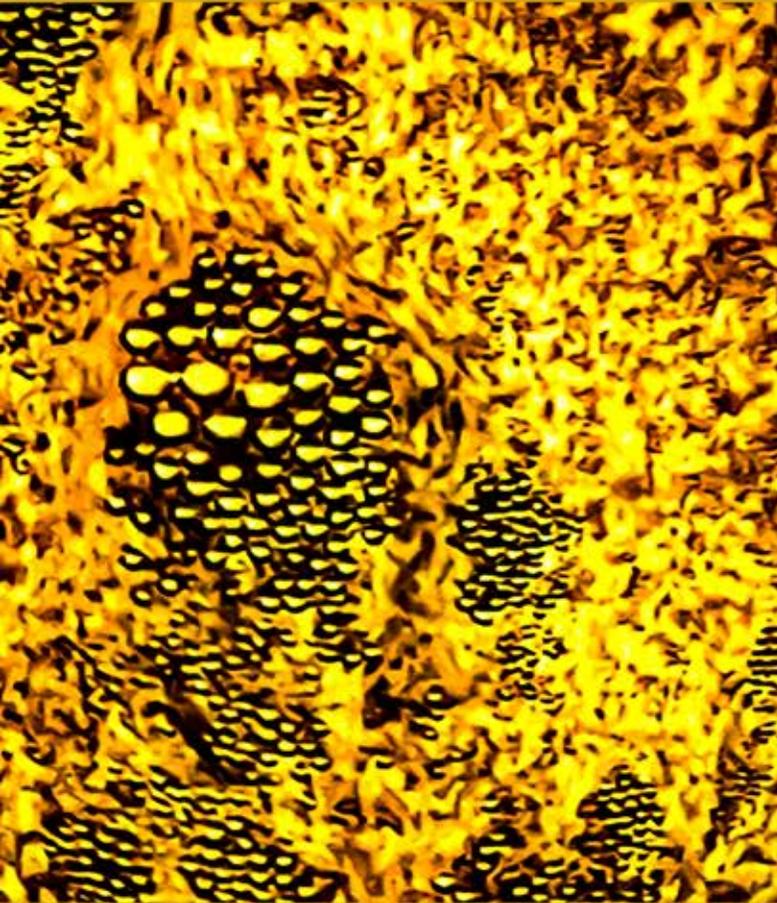
- Hold card in front of student (s).
- Speak clearly.
- Ask students to:
 - o Look at the picture
 - o “What do you see?”
 - o “What are the colors?”
 - o “Are there overlaps?”
- Can you imagine the types of sounds or music that this picture might make? (Ask students to describe)
- Play a musical example to accompany the card (if available.)
- Ask which instrument would be used to play music for the picture.

Creator/designer suggests using other applicable analogies and associations for the encouragement and appreciation of the visual and musical flashcard exercises/drills.

The flashcard skills and drills provides supplemental learning material which:

- Illustrates music concepts via visuals designs containing patterns and repetitions of patterns.
- Promotes visually enhanced learning for those with auditory challenges.
- Provides engagement with both visual design and music while learning musical concepts.
- Encourages critical thinking skills and problem solving.

ACCELERANDO



Gradually get faster

The other terms in the yellow color group have been selected due to the abundance of yellow color within the photo, and the interaction of the content, colors, and representation of the potential musical sounds.

SIMILE - in a similar way - similar type objects

The musical term ACCELERANDO refers to the way music accelerates through time. This term is represented visually by this photo of a water droplets and has been enhanced to show the gradual increase in the movement of the droplets. This term indicates that the musician should apply a technique of acceleration to the execution of the musical sounds.

ACCELERANDO

- 1. What do you see?**
- 2. What are the shapes?**
- 3. What are the colors?**
- 4. How does the picture show speed?**
- 5. Where do the shapes get faster?**
- 6. Where is the slowest movement?**
- 7. Who should play the music? Why?**
- 8. Describe the music.**

AGITATO



Agitation

The other terms in the orange color group have been selected due to the abundance of orange color within the photo, and the interaction of the content, colors, and representation of the potential associations with musical sounds.

*MOTIF - short theme - small repeated patterns
ALLEGRO - fast - quick small bursts of light
BARLINES - dividers - sections and dividers*

The musical term AGITATO refers to the emotion and condition of the sounds. This term is represented visually by this photo of a bright fiery sunrise which has been enhanced to reveal even greater intensity. Similarly, music has an inward drive of agitation within the sounds, which impacts the outward aesthetic results of the music.

AGITATO

- 1. What colors do you see?**
- 2. What shapes do you see?**
- 3. What is happening in the picture?**
- 4. How does the picture show speed?**
- 5. How do the shapes get brighter?**
- 6. How does excitement occur?**
- 7. What kind of music would this be?**
- 8. Who would play the music? Why?**

TEXTURE



Layer, quality, and type of sound

The other terms in the red color group have been selected due to the abundance of red color within the photo, and the interaction of the content, colors, and representation of the potential musical sounds.

*MAESTOSO - majestic - slendor and majesty
CON FORZA - forcefully - moving with force
GRAZIOSO - gracefully - graceful flower*

The musical term TEXTURE refers to the layering within the facets of the music. This term is represented visually by this photo of rose, the layers and folds within the petals of the rose showing the complexity of the structure of the flower. Similarly, music has texture and layers which add to the complexity of a musical composition.

TEXTURE

- 1. What do you see?**
- 2. Where are the shapes repeated?**
- 3. What are the colors?**
- 4. How are the colors repeated?**
- 5. How does this picture seem soft?**
- 6. Explain the mood of the picture.**
- 7. Is this picture busy or simple? Why?**
- 8. What is the picture's music like?**

PIU MOSSO



More motion

The other terms in the violet color thematic group have been selected due to the abundance of blue color within the photo, and the interaction of the content, colors, and representation of moving sounds.

*LEGATO/STACCATO - smooth/detached
CON MOTO - with movement - moving droplets
DISJUNCT - disconnected - separated content*

The term PIU MOSSO represents more movement within the droplets of water in this photo. The analogy of these moving water droplets can be made to the urgency expressed by more movement within musical notes.

PIU MOSSO

- 1. What do you see?**
- 2. What are the shapes?**
- 3. How are the shapes moving?**
- 4. How do the shapes repeat?**
- 5. Where do the shapes get faster?**
- 6. How are the shapes moving away?**
- 7. How does the picture make you feel?**
- 8. Describe the music.**

More motion

FORTE



Loud

The other terms in the blue color thematic group have been selected due to the blue color within the photo, and the interaction of the content, colors, and representation of the elements of music relating to treatment of volume, connection of sounds, and movement.

*STRINGENDO - rushing forward - front content
MOTO - motion - interaction of moving objects
DOLCE - sweet - intricate and delicate content
SIMILE - similar - content moving in similar way
LEGATO - connected - smoothly connected*

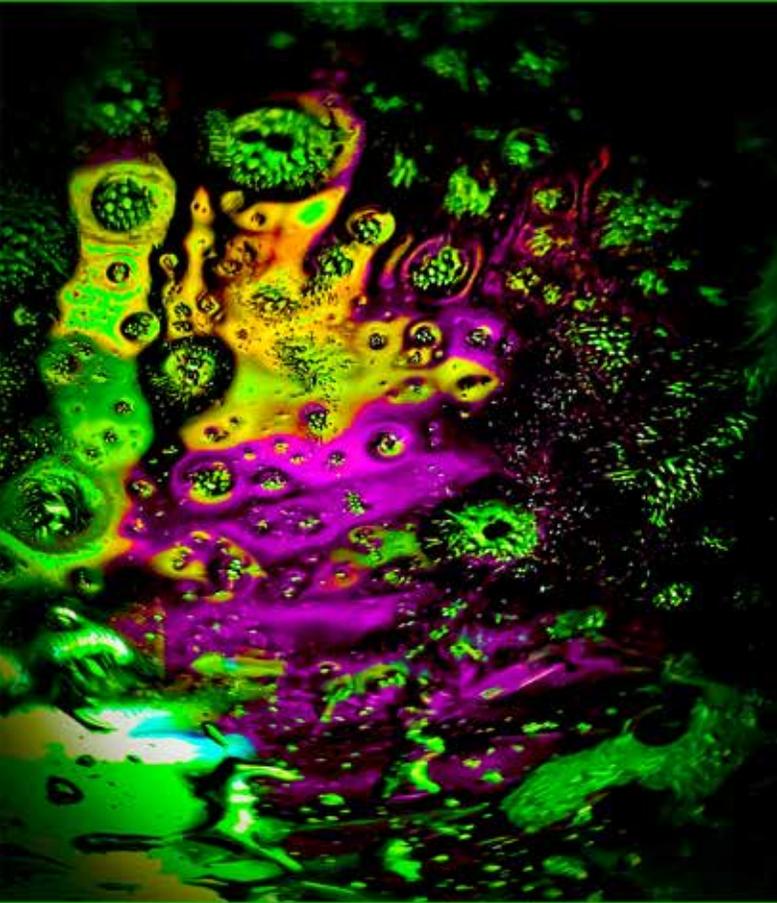
The term FORTE represents a loud condition of dynamic level. This term is represented visually by this photo of storm clouds which linger above in the sky during the onset of a thunderstorm.

FORTE

- 1. What do you see?**
- 2. What are the shapes?**
- 3. Where are the shapes moving close?**
- 4. How do the shapes repeat?**
- 5. Where are the shapes bold and dark?**
- 6. Where do the shapes get closer?**
- 7. If music, what type would play?**
- 8. Describe the music.**

Loud

DISSONANCE



Tension

The other terms in the green color thematic group have been selected due to the abundance of green color within the photo, and the interaction of the content, colors, and representation of clashing sounds.

*PIANO - soft - tactile content soft to touch
RHYTHM - pulse, beat - sections moving forward
TIMBRE - quality of sound - density of content
RONDO - form of patterns - repeated refrain*

The term DISSONANCE represents a manner of tension and clashing within the interaction between sounds. This term is represented visually by a manipulated and enhanced photo of water droplets which interact in a complex discord of action, color, and sound.

DISSONANCE

- 1. What do you see?**
- 2. What are the shapes?**
- 3. What are the colors?**
- 4. How is the picture calm or restless?**
- 5. Where is there tension and unrest?**
- 6. How are the objects moving?**
- 7. If music, name the instruments?**
- 8. Describe the style of music.**

RUBATO



Speeding and slowing of rhythm

The additional terms are chosen for placement in this group due to their manner of treatment of movement, tempo and dynamics.

PRESTO - quick and instantaneous speed

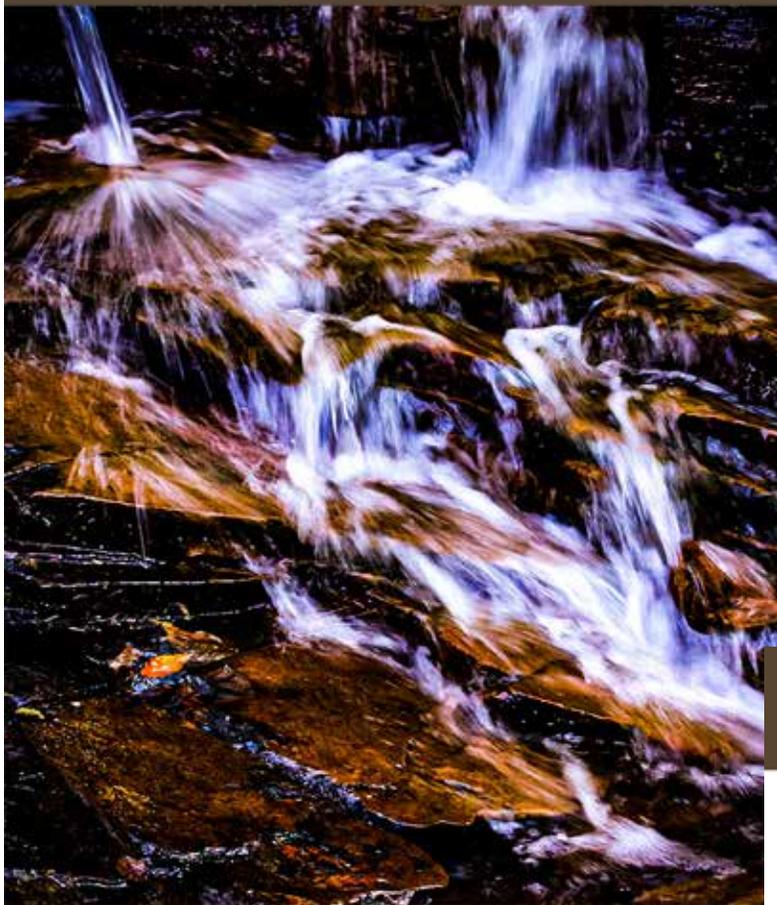
SFORZANDO - a sudden loudness of sound

The term RUBATO represents the quality of elasticity within musical sounds. This term is represented visually by this photo of water droplets which move with both quick and slow movements as in the stretching and relaxing of the speed of music.

RUBATO

- 1. What do you see?**
- 2. What are the shapes?**
- 3. What are the colors?**
- 4. How is the picture active?**
- 5. Where is the picture calm?**
- 6. Describe the movement?**
- 7. If music, choose the instruments.**
- 8. Describe the style of the music.**

RAPIDO



Rapid

The other terms in the brown color thematic group have been chosen for their content which is predominantly brown and earth tones and representing action, form, condition, or timbre of musical sound.

CONJUNCT - Close and connected sounds

BINARY - Musical form in two sections

PESANTE - Heavy and weighted sounds

STACCATO - Short and detached sounds

SECCO - Dry, brief, and brittle sounds

The term RAPIDO represents a fast movement which is extremely rapid and full of energy. The photo of rushing water over rocks has been selected for association with the term as the photo content sends a visual message of a fast-moving process.

RAPIDO

- 1. What do you see?**
- 2. What are the shapes?**
- 3. What are the colors?**
- 4. How does the picture sound?**
- 5. Describe how the picture feels?**
- 6. Identify the moving sections.**
- 7. Where are the repeated sections?**
- 8. Describe the musical style.**

LENTO



Slow

The other terms in the greyscale color thematic group are:

MISTERIOSO - mysterious - somber picture

SEQUENCE - repetition of motifs - order

MEASURES - organized pattern - shadows

DYNAMICS - volume - near and far objects

PIZZICATO - blunt short sound - plucked strings

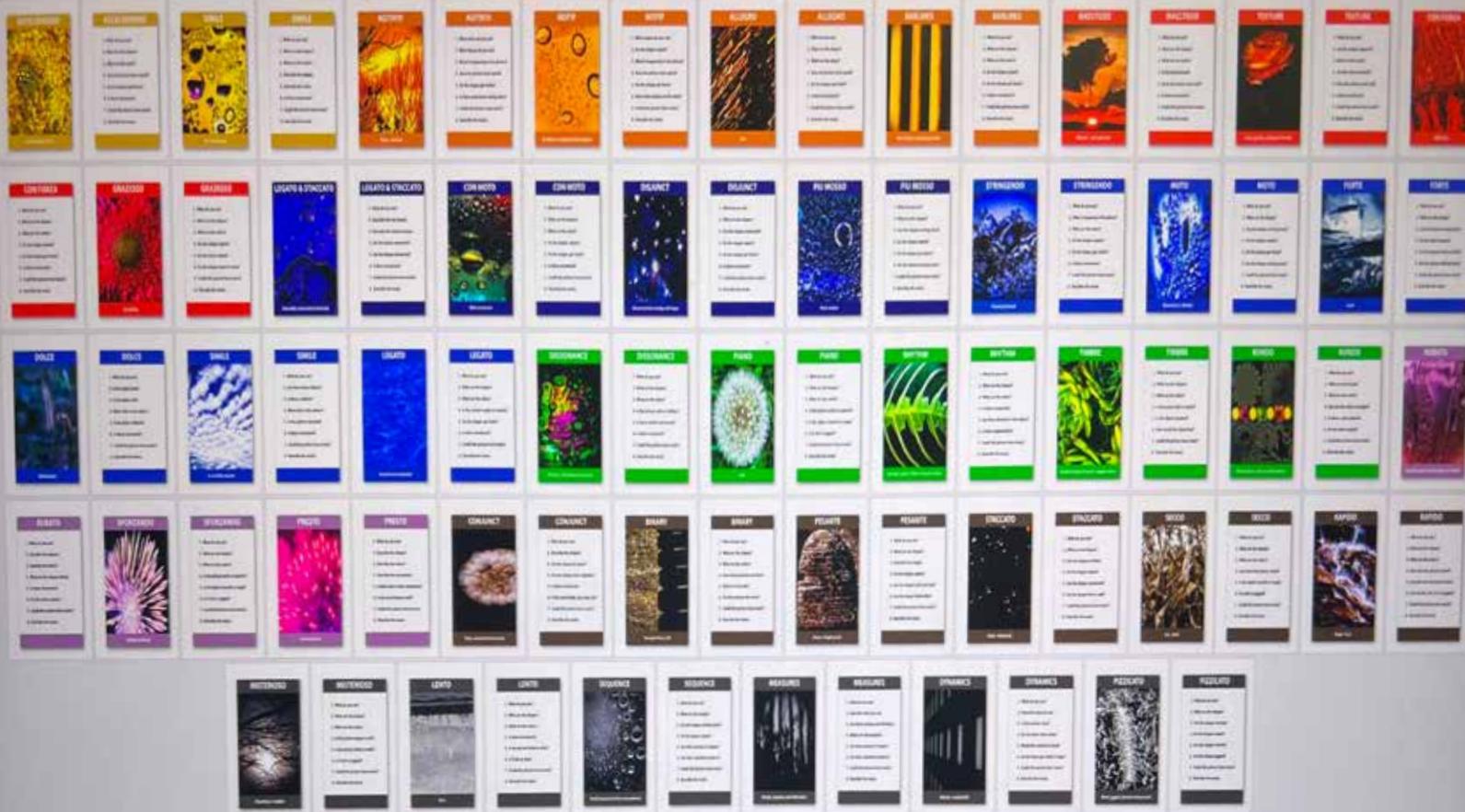
These terms and visuals are in this group as they are predominantly void of color and portray the term with greyscale and black/white.

The term LENTO represents movement which is slow and with relaxed movement. The photo of melting ice has been selected for association with the term as the process of melting visually sends the message of a slow moving process.

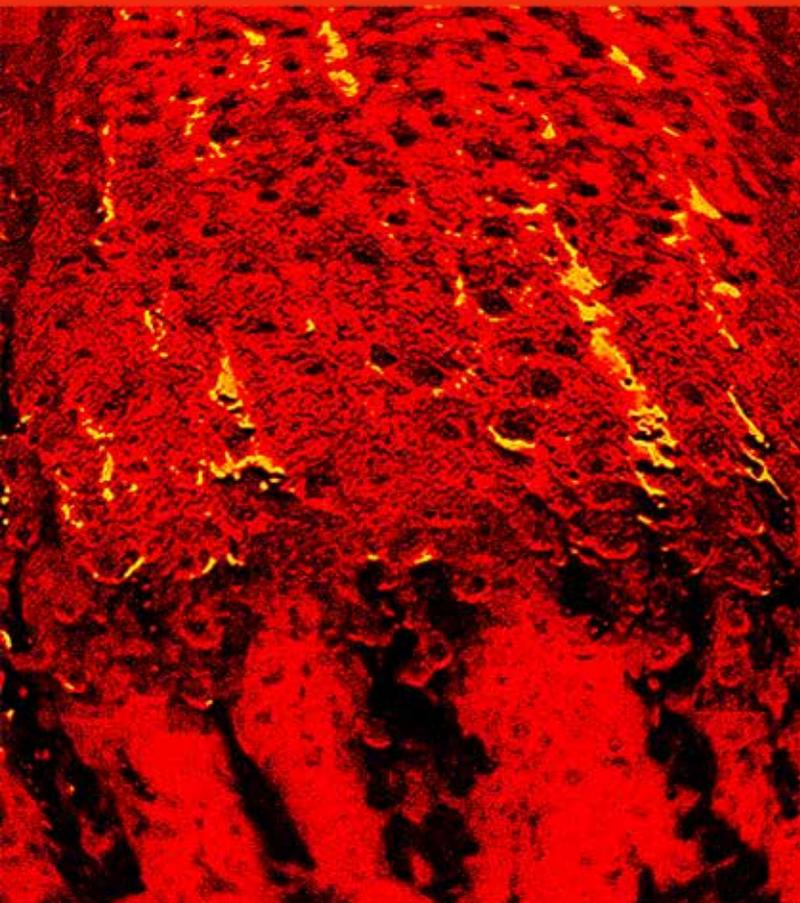
LENTO

- 1. What do you see?**
- 2. What is happening to the shapes?**
- 3. What are the colors?**
- 4. Describe the movement.**
- 5. Is the picture lively or calm?**
- 6. Is it fast or slow?**
- 7. If music, choose the instruments.**
- 8. Describe the musical sounds.**





CON FORZA



With force

STRINGENDO



Pressing forward

CHAPTER FIVE

Conclusion



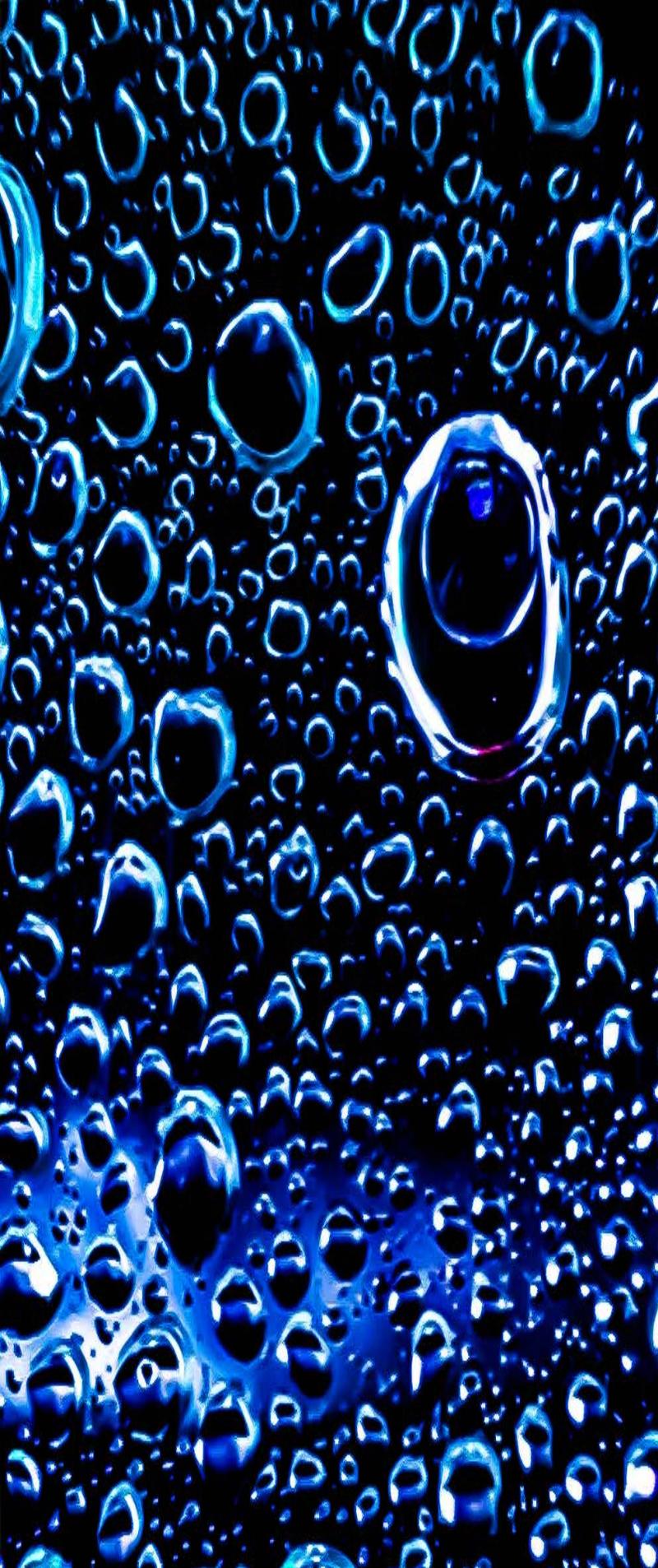
Alex W. White states, “Create a pattern of occupied and unoccupied spaces... Make their repetition and rhythm unavoidable...Repetition is not dull.” (White, 129)

Often, teaching includes being able to customize a lesson ‘on the spot’ due to varying attention spans or levels of abilities among those in attendance of the class. Drawing from resources that are full of visually stimulating content is one way to captivate the attention of any student. This research has concentrated on the way visually stimulating learning content is effective within the learning experience. Inclusion of simplistic yet visually stimulating photos, using flashcards containing photos which evoke the senses, and implementing combined and associated learning skills and exercises are shown to be ways that learning effectiveness is increased among all students.





Utilization of analogies and associations which contain visually stimulating content yield outcomes which are the result of the interworking of the visual, tactile, and auditory senses. The result of these stimuli and processing activities is one that is inclusive of all students and learners of all levels of abilities. On teachers using “visual art and music in their curriculum to strengthen thinking and learning” see *Artful Thinking*.²



Researching and creating a theoretical visual solution for the topic of the pulse of design and music, with a focus upon music students with hearing impairments or challenges, has proven to be especially interesting and informative. But more than that, the experience has given me an abundance of insight into visual communication and learning which often is overlooked in teaching methods and learning materials for students with challenges. My goal is to pursue a continued effort with this project, by reaching out to educators, publishers, and specifically music educators expressing concern for the need of additional supplemental teaching resources, such as the flashcard skills and drills packet I have created.

Through this research I have gained an abundance of knowledge in the area of auditory processing disorders and the challenges of the hearing impaired. The research has afforded me a path to creating a visual solution in the form of a supplemental teaching tool that is useful in reaching those music students who have hearing or other learning difficulties but have the desire to learn and experience music. My hope is that this research has shed light on a need in music education as well as having provided a visual solution to that problem.



NOTES

1. See <https://visualliteracytoday.org> for further insight.
2. For more on visual art and music refer to <http://pzartfulthinking.org>.

BIBLIOGRAPHY

- Almeida, Jorge, et al. "Decoding Visual Location from Neural Patterns in the Auditory Cortex of the Congenitally Deaf." *Psychological Science*, vol. 26, 11, [Association for Psychological Science, Sage Publications, Inc.], 2015, pp. 1771-82.
- Bauer, Anna-Katharina R. Freek van Ede, Andrew J. Quinn, Anna C. Nobre "Rhythmic Modulation of Visual Perception by Continuous Rhythmic Auditory Stimulation" *Journal of Neuroscience*. 18 August 2021.
- Breska A, Deouell LY (2017) "Neural mechanisms of rhythm-based temporal prediction: Delta phase-locking reflects temporal predictability but not rhythmic entrainment." *PLoS Biol* 15(2): e2001665. <https://doi.org/10.1371/journal.pbio.2001665>.
- Chan, Chiu-Shui. "Phenomenology of Rhythm in Design." *Frontiers of Architectural Research* (2012) 1, 253-258.
- Darrow, Alice-Ann. "Music and the Hearing Impaired: A Review of the Research with Implications for Music Educators." Update: Applications of Research in Music Education, vol. 7, no. 2, Mar. 1989.
- Durr, Patricia. De 'VIA: *Investigating Deaf Visual Art*. Rochester:NY. Rochester Institute of Technology, 2006.
- Fan, Yu. *A Study on Audio-Visual Interaction: How Visual Temporal Cues Influence Grouping of Auditory Events*. Columbus, Ohio. University of Ohio. 2019.
- Fulford, Robert & Ginsborg, Jane & Goldbart, Juliet. (2011). "Learning not to listen: The experiences of musicians with hearing impairments." *Music Education Research*. 13. 447-464. 10.1080/14613808.2011.632086.

- Grammatikopoulou, Christina. "Breathing Art: Art as an Encompassing and Participatory Experience." *Museums in a Digital Culture*, edited by Chiel van den Akker and Susan. Legêne, Amsterdam University Press, 2016, pp. 41–56.
- Hallam, Susan. "The impact of making music on aural perception and language skills: A research synthesis" UCL Institute of Education, University College London, London Review of Education. Vol. 15, Number 3, Nov.2017.
- Hansen, Kjetil Falkenberg and Rumi Hiraga. "The Effects of Musical Experience and Hearing Loss on Solving an Audio-Based Gaming Task." *Sound and Music Computing*, School of Electrical Engineering and Computer Science, 2017.
- Hash, Phillip M. "Teaching Instrumental Music to Deaf and Hard of Hearing Students," *Research & Issues in Music Education*: Vol. 1 : No. 1 , Article 5, 2003.
- Hidalgo, Céline & Zécéri, et al. Rhythmic Abilities of Children with Hearing Loss. *Ear & Hearing*. Publish Ahead of Print. 10.1097/2020.
- Heath, Chip and Dan. *Made to Stick*. New York: NY, Random House, 2008.
- Heine, Chyrisse, and Michelle Slone. "Case studies of adults with central auditory processing disorder: Shifting the spotlight!" *SAGE open medical case reports* vol. 7 2050313X18823461. 12 Jan. 2019, doi:10.1177/2050313X18823461
- Kennedy, Sharon L. *Painting Music: Rhythm and Movement in Art*. Lincoln, NB Sheldon Memorial Art Gallery, 2007.
- LaLonde, Kirsten M. Minot: ND, Minot State University. ProQuest Dissertations Publishing, 2017.
- Levy, Ellen K. "Repetition and the Scientific Model in Art." *Art Journal*, vol. 55, no. 1, [Taylor & Francis, Ltd., College Art Association], 1996, pp. 79–84.

Martin, Bella. *Universal Methods of Design*. Beverly: NY. Rockport Publishers, 2012.

Matson, Ann E. *Central auditory processing: a current review and summary of interviews with researchers on controversial issues related to auditory disorders*. Program in Audiology and Communication Sciences. Washington University School of Medicine, 2005.

Nabhan, Rabih & Bitar, Michelle. (2018). "Musical Approach to Auditory Processing Disorder and Phonological Difficulties." *Open Journal of Modern Linguistics*. 08. 48-53. 10.4236/ojml.2018.83006.

Nelson, Melissa Hedlund. *Art, Movement, and the Body: An Art-Based Research Exploration of Slow of Slow, Gentle, and Repetitive Painting Movements*. Lesley University, 2020.

Ravignani, Andrea. "Visualizing and Interpreting Rhythmic Patterns Using Phase Space Plots." *Music Perception: An Interdisciplinary Journal*. Vol. 34, No.5 (June 2017), pp. 557-568.

Ruggles DR, Freyman RL, Oxenham AJ (2014) Influence of Musical Training on Understanding Voiced and Whispered Speech in Noise. *PLOS ONE* 9(1): e86980.

Schirmer, Annett, Maria Wijaya, Man Hey Chiu, Burkhard Maess, Thomas C Gunter, "Musical rhythm effects on visual attention are non-rhythmical: evidence against metrical entrainment", *Social Cognitive and Affective Neuroscience*, Volume 16, Issue 1-2, January-February 2021, Pages 58-71.

Sharma, Mridula & Purdy, Suzanne. (2007). "A Case Study of an 11YearOld With Auditory Processing Disorder." *Australian and New Zealand Journal of Audiology*. 29. 40-52. 10.1375/audi.29.1.40.

Si, Yike. *The Power of Lines: Creating Rhythms for Visual Relations*. Boston, MA. Northeastern University, 2017.

Sidiras, Christos, et al. "Deficits in Auditory Rhythm Perception in Children with Auditory Processing Disorders Are Unrelated to Attention." *Frontiers in Neuroscience*. 06 Sept. 2019. Vol. 13. Article 95.3.

Tallal, Paula and Nadine Gaab. "Dynamic auditory processing, musical experience and language development." *TRENDS in Neurosciences* Vol.29 No.7 July 2006 Center for Molecular and Behavioral Neuroscience, Rutgers University, Newark, NJ 07102.

Taylor, Pamela G. "Artistic Data Visualization and Assessment in Art Education." *Visual Arts Research*, vol. 43, no. 1, University of Illinois Press, 2017, pp. 59-75.

Tedeschi, Dr. Nina. *Photographic Interpretations of Rhythmic Patterns and Repetition*. Created 2022.

White, Alex W. *The Elements of Graphic Design*. NY, NY: Allworth Press, 2011.

www.musixmatch.com. *Can You Hear Me?* Bob Chilcott. accessed July 2022.

Yasemin Karal, et al. "Standardization of a Graphic Symbol System as an Alternative Communication Tool for Turkish." *Journal of Educational Technology & Society*, vol. 19, no. 1, International Forum of Educational Technology & Society, 2016, pp. 53-66

Young, Leah. *The Staff of Life*. 2022. accessed July, 2022.

APPENDIX

“What is needed is a method that can be implemented in schools as part of the curriculum.”

~~~Rabih Nabhan

**“Visual art can enlighten deaf and hearing observers by presenting experiences reflective of a deaf person’s world.”**

~~~Patricia Durr

“The music and art connection can best be described in the late 19th-century concept of synesthesia or the blending of senses. The idea means that sensory perception of one kind can manifest itself as a sensory experience of another.”

~~~Sharon Kennedy

**“As in art, music utilizes the visualization process involving knowledge, technical skill, aesthetics, and meaning making.”**

~~~Pamela Taylor

“A direct relationship occurs within visual observation and interpretation of repetitions of patterns and the resulting rhythms.”

~~~Ravignani



Master of Fine Arts Thesis

*Dr. Nina Tedeschi*