Standard Improvisations

VISUALIZING CORE COMPETENCIES IN MUSIC EDUCATION

Ashley Treni
Masters Thesis Project
Standard Improvisations

VISUALIZING CORE COMPETENCIES IN MUSIC EDUCATION

Thesis presented by

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Education reform is sweeping the country. Our technology-driven economy is placing an ever increasing emphasis on STEM education (science, technology, engineering, and mathematics). This shift in educational objectives has led to the development of new policies — the Common Core Initiative¹, intended to homogenize educational goals through the implementation of national standards and mandatory evaluations. In addition, students must take the nationally administered PARCC² assessment (Partnership for Assessment of Readiness for College and Careers); the data collected ultimately determines how the government will distribute educational funding. An emerging precedence is given to the academic courses that “teach to this test.”

Confronted with the current educational reforms, teachers of the arts are fighting to preserve the inclusion of their disciplines in primary and secondary public education. Since student growth in the arts is demonstrated through performance, and not through PARCC test results, more weight rests on regularly administered evaluations, where teachers must articulate how concepts, as defined by Common Core and State Standards, are reached. The opportunities to communicate that relationship are linear and limited at best.

Harnessing the power of information visualization, this exploration helps music teachers capture and communicate the richness and multi-dimensionality of an arts curriculum. Visual artifacts of this nature can serve as a tool to support dialog and alignment, and bridge the gap of understanding between experts and non-experts.

KEY TERMS: generative research, design as facilitation, mental models, curriculum planning, diagrams, cultural data.

¹ A set of high-quality academic standards created to ensure that all students graduate from high school with the skills and knowledge necessary to succeed in college, career, and life, regardless of where they live. Forty-three states have voluntarily* adopted. *You must enroll to receive government funding.

² Partnership for Assessment of Readiness for College and Careers is a group of states working to develop a set of assessments that are aligned with the new, more rigorous Common Core State Standards; they ensure that every child is on a path to college and career readiness by measuring what students should know at each grade level.
"Design takes place in the world of the imagination, where one invents and manipulates ideas and concepts instead of the real thing — in order to prepare the real intervention. They work with models as means of vicarious perception and manipulation. Sketches, cardboard models, diagrams, and mathematical models, and the most flexible of them all, speech, serve as media to support the imagination."

The Universe of Design
Horst Rittel
Acknowledgements

It has been an absolute privilege to study and learn from the incredible people who are shaping this innovative program in Information Design and Visualization. This program taught me how to ask questions, deliberate, and engage in meaningful design thinking. I am incredibly grateful for all the people who encouraged my curiosity and helped me build an understanding throughout this investigation. I was fortunate to connect with domain experts in design, music, and education who were gracious with their time and knowledge. I would like to personally thank:

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Target Audience

Primary and secondary school music teachers who are looking for methods to build a performance repertoire based on curriculum requirements, and developing documentation that concretely establishes the relationship.

District administrators responsible for evaluating the planning documents submitted by music educators, which must identify and fulfill educational objectives as defined by government standards.
Statement of Intent

The following collection of diagrams visualize concepts as they are found within music, to support curriculum planning for primary and secondary music educators. By making concepts visible, teachers can identify pieces of music that best support their teaching objectives. It is my hope that these visualizations, which are modeled after existing planning mechanisms, will support the creative authorship of planning a concert repertoire. They can also provide a meaningful way to validate or test the comprehensiveness of a collection of music.

As teachers put together a concert repertoire for the year, they must consider how concepts, as defined by State distributed curricula, Common Core and State standards are integrated and taught to students. This planning process introduces concepts through carefully selected repertoire pieces that sequentially become more challenging over the course of the year as concepts build on one another.

It is imperative that music teachers explain how the retention of these concepts is demonstrated through the performance repertoire of two concerts, one in winter, one in spring. Teaching both lessons and full band rehearsal, they must develop lesson plans and rubrics that show when concepts are introduced and how they are practiced and reinforced through performance. Each lesson plan must contain the following: concepts, Standard reference numbers, concert repertoire, SWBAT (student will be able to), and essential questions. These diagrams augment these existing forms of required documentation by giving shape to concepts in the context of a piece of music.

An administrator is in charge of approving these planning documents, searching for the integration of concepts defined by educational guidelines. These diagrams can support the dialog between music teachers and administrators, by visualizing the relationship between concepts and concert repertoire. Using visualization to map these relationships is a more effective way to discuss, evaluate, and understand the structure of musical concepts, and visualize the educational objectives for both teachers and administrators alike.
“We often say we “reach agreement” with others on some matter. We talk as if there is a view that we then all share, a “common ground.” In contrast, our view is that the idea of “reaching a shared view” is a linguistic gloss, shorthand for something much more complex and powerful. Agreement is not a single ground. Rather, it is a commitment to continue to work together to maintain coherence.”

Conversational Alignment
Jared Harris and Austin Henderson
What is a concept?

- concept

(an abstract idea; a part of something more complex)

Where can concepts be found in music?

Examples of musical concepts:
- notes: dotted, half, and whole
- key signatures
- counterpoint
- coda signs
- articulation

fewer concepts tends to mean the piece is less challenging

more concepts means the piece is more complex and difficult/challenging

How can we visually pull out concepts/highlight concepts in a piece of music?
Concepts are educational building blocks. Musical compositions can be broken down into concepts - which build upon one another and carry through music over time. A repertoire of music is put together strategically by music teachers, to target certain concepts students will learn while playing the music.

What determines WHY and HOW these concepts are taught are two different agendas.

WHY: TOP DOWN PLANNING

The Department of Education gives grants to selected educators to develop curriculums that reflect the current education reform objectives. Learning science is an evidence based practice of designing instructional methods based on learning results. This is why so much emphasis is placed on standardized testing.

HOW: BOTTOM UP PLANNING

Teachers on the ground are given these curriculums, and develop lesson plans to accomplish learning objectives. Teachers learn to craft and facilitate experiences with their students that reinforce how learning works, not just giving out information. In music, practice and performance demonstrate the comprehension and retention of concepts.
Building a Concert Repertoire

A flow diagram of the specifications and deliverables in a music teacher’s planning process.

Music Teachers receive Federal and State educational objectives as which specify Core Curriculum State Standards which specify Standards 1.1.B.5.1 IDENTIFY 1.1.B.5.2 DEMONSTRATE.

Concepts which specify Core Curriculum Content Standards NJ World Class Standards Visual and Performing Arts by grade level reinforce Concert Repertoire which specify 1.1.B.5.2 DEMONSTRATE.

Performance which specify Core Curriculum Content Standards NJ World Class Standards Visual and Performing Arts reinforce Concepts taught to Students.

Lesson Plans which specify 1.1.B.5.1 IDENTIFY.

Rubric/Assessment which specify how to document

Students are taught to practice for Full Band Rehearsal which specify 1.1.B.5.2 DEMONSTRATE.

“Pull out” Lessons which specify 1.1.B.5.1 IDENTIFY.

SGO Documentation to be evaluated and approved by District Administrator.

Student Growth Objectives to be evaluated and approved by District Administrator.

Curriculums which specify Core Curriculum Content Standards NJ World Class Standards Visual and Performing Arts.

Core Curriculum State Standards which specify Core Curriculum Content Standards NJ World Class Standards Visual and Performing Arts.
Mental models are ways that we think about the world and they way it works. We rely on our individual mental models to construct meaning and understanding. Though we often assume we share mental models when we communicate with others, our individual definitions can be very different. In order to communicate, we must establish a shared mental model. We do this by engaging in conversation, using language and drawing to craft meaning through semantic and visual relationships.

Lesson plans, in a sense, are diagrams - created to clarify the relationship between concepts in music. This example lesson plan is a teacher’s mental model of how music education is constructed, and uses language to communicate those relationships. The linear nature of this list does not capture the network of relationships that are actually present. Visual language is a more powerful way to share our mental models, because it uses spatial organization, connections, and pictograms which can more accurately describe these relationships.

The information exchange between an expert and non-expert can be a very challenging communication space, especially when both stakeholders represent different agendas and potentially different mental models. Documents, like lesson plans and other diagrams, are ways to share knowledge and develop shared mental models of how music is a construction of musical concepts, and how these concepts are taught to students.

Model of “conversational alignment” by Hugh Dubberly. These models visualize the complexity of communication, which requires listening, sharing, and developing a shared understanding.

But ‘sharing’ is shorthand for a more complex process in which we form a mental model of our interlocutor’s mental model of the topic at hand, ...
Sample Lesson Plan for 7th & 8th grade chorus:

NJCCCS standards

Standards
1.1B Grade 8 CPI 01, Analyze the application of the elements of music in diverse Western and non-Western musical works from different historical eras using active listening and by reading and interpreting written scores.
1.1B Grade 8 CPI 02, Compare and contrast the use of structural forms and the manipulation of the elements of music in diverse styles and genres of musical compositions.
1.3B Grade 8 CPI 01, Perform instrumental or vocal compositions using complex standard and non-standard Western, non-Western, and avant-garde notation.
1.3B Grade 8 CPI 02, Perform independently and in groups with expressive qualities appropriately aligned with the stylistic characteristics of the genre.
1.3B Grade 8 CPI 03, Apply theoretical understanding of expressive and dynamic music terminology to the performance of written scores in the grand staff.

21st Century Themes
None

21st Century Skills
*Creativity and Innovation
*Critical Thinking and Problem Solving
*Communication and Collaboration

Goals and Objectives
Ongoing Goals - to be used throughout the year

SWBAT demonstrate mastery of vocal warm-ups, rounds - specifically in the areas of intonation, blend and expression
SWBAT demonstrate knowledge and mastery of Solfege
SWBAT incorporate Performance strategies / Team Building Exercises & Activities in daily lessons

Objectives for week of 11/10

SWBAT demonstrate mastery of dynamic markings
SWBAT begin demonstrating mastery of articulation, pronunciation and diction
SWBAT show growth and retention with Winter Concert pieces
SWBAT follow choral music and sit with appropriate posture
SWBAT demonstrate proper intonation

Essential Questions

What is intonation?
What does it mean to have a good choral blend?
What are the lines and spaces of the treble clef?
What are accidentals?
What does it mean to have good posture in choir class?
What are the different voice parts that make up our chorus?

Learning Activities or Instructional Strategies

Warm-ups / Solfege
Dynamic Markings in Music - class discussion, marking music, changing markings as needed
Articulation, Diction and Pronunciation

*continue work on new flow for folders at the end of large classes

Winter Concert Pieces:
*students will continue to work on the different songs over the course of the weekly lessons

Repertoire

7th and 8th grade:
Bidi Bom
All the Things you are
Freedom Train
Kyrie Eleison
pink panther
no one is alone
I believe
The concepts defined for 3 - 5th grade music

So what are musical concepts, and how are they organized and structured? State curriculums and standards don’t often make explicit the exact concepts that music be present, but give general guidelines (as shown to the right) about what students should be able to IDENTIFY and DEMONSTRATE.

I received a catalog of all the documented concepts from my domain expert in the field of music. This “tried and true” list of concepts is based on an educated understanding of music construction, as well as method books that teach introductory concepts in music such as Standard of Excellence. Concepts are introduced sequentially as they become more complex.

To support the present planning process, variables in the music were selected, based on teachers’ current methods of identifying concepts within music and building a concert repertoire. These variables are: presence/ frequency of specific concepts (which helps to determine the level of complexity and therefore identify songs that would be appropriate to introduce certain concepts), and categories of concepts (form, rhythm, tonality, and expression).

Encoding concepts in these categories prevents the need to assign each discrete concept a color value of its own. A series of qualitative colors reinforce the different types of categories, and visually show distribution.
The four qualitative categories of concepts in music:

- **RHYTHM**
- **FORM**
- **EXPRESSION**
- **TONALITY**

### 1.1 The Creative Process

#### B. Music

**BY THE END OF GRADE 5, SWBAT** *(student will be able to)*

1.1.5.B.1 By the end of 5th grade all students shall: identify the elements of music in response to aural prompts and printed music notation systems.

1.1.5.B.2 By the end of 5th grade all students shall: demonstrate the basic concepts of meter, rhythm, tonality, intervals, chords, and melodic and harmonic progressions, and differentiate basic structures.

As defined by the New Jersey Core Curriculum Content Standards for Visual and Performing Arts, the following standards must be documented and connected in lesson plans.

<table>
<thead>
<tr>
<th>CONCEPTS</th>
<th>SEQUENTIAL VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in order of introduction)</td>
<td>(least to most challenging)</td>
</tr>
<tr>
<td>1</td>
<td>time signature (meter)</td>
</tr>
<tr>
<td>2</td>
<td>notes: whole, half, quarter</td>
</tr>
<tr>
<td>3</td>
<td>rests: whole, half, quarter</td>
</tr>
<tr>
<td>4</td>
<td>intro, tag</td>
</tr>
<tr>
<td>5</td>
<td>notes: dotted (half)</td>
</tr>
<tr>
<td>6</td>
<td>key signature</td>
</tr>
<tr>
<td>7</td>
<td>tempo</td>
</tr>
<tr>
<td>8</td>
<td>accidentals (sharps, flats, naturals)</td>
</tr>
<tr>
<td>9</td>
<td>counterpoint</td>
</tr>
<tr>
<td>10</td>
<td>ostinato</td>
</tr>
<tr>
<td>11</td>
<td>dynamics</td>
</tr>
<tr>
<td>12</td>
<td>crescendo, decrescendo</td>
</tr>
<tr>
<td>13</td>
<td>rests: extended</td>
</tr>
<tr>
<td>14</td>
<td>notes: eighth notes</td>
</tr>
<tr>
<td>15</td>
<td>coda signs</td>
</tr>
<tr>
<td>16</td>
<td>repeat signs</td>
</tr>
<tr>
<td>17</td>
<td>endings</td>
</tr>
<tr>
<td>18</td>
<td>key change</td>
</tr>
<tr>
<td>19</td>
<td>articulation</td>
</tr>
<tr>
<td>20</td>
<td>accelerando, ritardando, fermata</td>
</tr>
<tr>
<td>21</td>
<td>phrasing</td>
</tr>
<tr>
<td>22</td>
<td>notes: dotted quarter &amp; eighths</td>
</tr>
<tr>
<td>23</td>
<td>notes: dotted eighth &amp; sixteenths</td>
</tr>
<tr>
<td>24</td>
<td>genre, style</td>
</tr>
<tr>
<td>25</td>
<td>notes: sixteenth notes</td>
</tr>
<tr>
<td>26</td>
<td>notes: triplets</td>
</tr>
</tbody>
</table>
### Banana Boat

Sheet music from the Complete Year of Band collection for a song called “Banana Boat.”

The same piece is shown in the data below, which encodes which concepts are found per measure number.

<table>
<thead>
<tr>
<th>Category</th>
<th>Concept</th>
<th>Measures Found</th>
<th>CPI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>rhythm</td>
<td>time signature (meter)</td>
<td>1</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>4/4</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: whole, half, quarter</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>rhythm</td>
<td>rests: whole, half, quarter</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>form</td>
<td>intro, tag</td>
<td>1-8, 46-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>tonality</td>
<td>key signature</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>Bb major</td>
</tr>
<tr>
<td>expression</td>
<td>tempo</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>“Andante”</td>
</tr>
<tr>
<td>tonality</td>
<td>accidentals (sharps, flats, naturals)</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>counterpoint</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>ostinato</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>dynamics</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>expression</td>
<td>crescendo, decrescendo</td>
<td>36, 45-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>cresendo, decrescendo</td>
</tr>
<tr>
<td>rhythm</td>
<td>rests: extended</td>
<td>1-8</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>some parts</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: eighth &amp; rests</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>form</td>
<td>coda signs</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>form</td>
<td>repeat signs</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>form</td>
<td>endings</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>tonality</td>
<td>key change</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>articulation</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>expression</td>
<td>accelerating, ritardando, fermata</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>phrasing</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>staccato, legato</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: dotted quarter &amp; eighths</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: dotted eighth &amp; sixteenths</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>genre, style</td>
<td>1-53</td>
<td>1.1.8.B.1 (Identify) &amp; 1.1.8.B.2 (Demonstrate)</td>
<td>Calypso (Caribbean Folk Song)</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: sixteenth notes</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: triplets</td>
<td></td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
</tbody>
</table>
Locating concepts within music

The present practice of building a repertoire is based on finding music that is appropriate for student levels and that targets the concepts a student must identify and demonstrate. Teachers must look through sheet music to identify and determine where concepts are found within the music. They base their decision on concept density, frequency, and type.

My first exploration used the sheet music itself to locate and highlight the present concepts, and I ran into several challenges right from the beginning. Some concepts are always present, for example, notes or rests, it was challenging to visualize 100% of the whole throughout the entire song.

This exploration led to the distinction between concepts which are always present, and those which appear in occurrences, and how to treat those visually different from one another.

Visually mapping concepts within a piece of music, identifying concept density, frequency, and type.
Individual concepts are mapped to individual repertoire pieces. Concepts are introduced in a linear progression that builds upon itself. Instead of mapping each concept to a piece where it appears, concepts can be shown embedded within a piece of music, which allows you to see the number of concepts that appear within each discrete piece of music.
Teachers must find music that matches an appropriate student level defined by their rubric. They must locate these concepts within sheet music and determine the difficulty level of the piece through concept density, frequency, and type.

Introducing concepts sequentially

From the start, it was important to identify a system for what determines a strong correlation between a concept and a piece of music. Considering the variables at play—occurrence, frequency, and density—it seemed natural to organize songs by the concepts they introduce, based on the sequential order of concepts over time. This is a way to build a repertoire by directly targeting pieces that apply to the specific concept. Opacity was introduced as a way to differentiate new concepts.
The data: music from *Complete Year of Band*

*Complete Year of Band* is a collection of concert repertoire intended to assist teachers by streamlining the curriculum planning process. The excel spreadsheet below shows how songs in this collection have been encoded with concepts per measure number and state standards. The song displayed, “Banana Boat,” shows the concepts in sequential order, and where those present can be located within the piece of music itself.

As I began to look through this data, I recognized the need for an additional level of organization. It was not enough to see the locations of concepts within the individual pieces, the progression of the collection of music needed to be considered. Working with teachers, we developed a logic that would make sense for this progression; to highlight concepts as they are introduced, as is built into the concert repertoire. An example of these planning documents for the full year is shown to the right.

<table>
<thead>
<tr>
<th>Category</th>
<th>Concept</th>
<th>Measures Found</th>
<th>CPI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>rhythm</td>
<td>time signature (meter)</td>
<td>1</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>4/4</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: whole, half, quarter</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>rhythm</td>
<td>rests: whole, half, quarter</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>throughout</td>
</tr>
<tr>
<td>form</td>
<td>intro, tag</td>
<td>1-8, 46-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>Andante</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: dotted half</td>
<td>6, 8, 44</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>tonality</td>
<td>key signature</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 ( Demonstrate)</td>
<td>Bb major</td>
</tr>
<tr>
<td>expression</td>
<td>tempo</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>counterpoint</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
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<tr>
<td>rhythm</td>
<td>ostinato</td>
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<tr>
<td>expression</td>
<td>dynamics</td>
<td>1-53</td>
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<tr>
<td>expression</td>
<td>crescendo, decrescendo</td>
<td>36, 45-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>Crescendo, decrescendo</td>
</tr>
<tr>
<td>rhythm</td>
<td>rests: extended</td>
<td>1-8</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>some parts</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: eighth (6 rests)</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>form</td>
<td>coda signs</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
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<tr>
<td>form</td>
<td>repeat signs</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
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<tr>
<td>tonality</td>
<td>key change</td>
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<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
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<tr>
<td>expression</td>
<td>articulation</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>accelerando, ritardando, fermata</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>phrasing</td>
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<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>staccato, legato</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: dotted quarter &amp; eighths</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: dotted eighth &amp; sixteenths</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>expression</td>
<td>genre, style</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td>Calypso (Caribbean Folk Song)</td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: sixteenth notes</td>
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<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
<tr>
<td>rhythm</td>
<td>notes: triplets</td>
<td>1-53</td>
<td>1.1.5.B.1 (Identify) &amp; 1.1.5.B.2 (Demonstrate)</td>
<td></td>
</tr>
</tbody>
</table>

The music and planning rubric used for this investigation was written and built by a domain expert in the field.
A Complete Year of Band
Lesson Sequence

Year 2
Fall-Winter

Materials: A Complete Year of Band: Banana Boat Song, My Country “Tis of Thee, Jingle Bells, My Dreydl, Major Scale Studies in Eb

<table>
<thead>
<tr>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review:</td>
<td></td>
</tr>
<tr>
<td>Banana Boat Song</td>
<td>Major Scale in Eb</td>
</tr>
<tr>
<td>My Country “Tis of Thee</td>
<td>Jingle Bells</td>
</tr>
<tr>
<td>Concepts Reviewed</td>
<td>My Dreydl</td>
</tr>
<tr>
<td>time signature (meter)</td>
<td>Concepts Introduced</td>
</tr>
<tr>
<td>intro, tag</td>
<td>• endings</td>
</tr>
<tr>
<td>notes: dotted half</td>
<td>• key change</td>
</tr>
<tr>
<td>key signature</td>
<td>• accelerando</td>
</tr>
<tr>
<td>tempo</td>
<td></td>
</tr>
<tr>
<td>accidentals (sharps, flats, naturals)</td>
<td></td>
</tr>
<tr>
<td>counterpoint</td>
<td></td>
</tr>
<tr>
<td>crescendo, decrescendo</td>
<td></td>
</tr>
<tr>
<td>rests: extended</td>
<td></td>
</tr>
<tr>
<td>articulation</td>
<td></td>
</tr>
<tr>
<td>phrasing</td>
<td></td>
</tr>
<tr>
<td>notes: dotted quarter &amp; eighths</td>
<td></td>
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</tbody>
</table>

November

December

Continued review of concert music
Concert etiquette

Winter Concert

Banana Boat
My Country “Tis of Thee
Jingle Bells
My Dreydl

◊

Year 2
Winter-Spring

Materials: A Complete Year of Band: Ode to Joy, Saints Go Marching In, Grand Old Flag, The Star Spangled Banner, Major Scale Studies in F

<table>
<thead>
<tr>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ode to Joy</td>
<td>Saints Go Marching In</td>
<td>Grand Old Flag</td>
</tr>
<tr>
<td>Concepts Introduced</td>
<td>Concepts Introduced</td>
<td>Concepts Introduced</td>
</tr>
<tr>
<td>• Ostinato (review)</td>
<td>• fermata</td>
<td>• key change (reviewed)</td>
</tr>
<tr>
<td>• ritardando</td>
<td>• notes: dotted eighth &amp; sixteenth</td>
<td>• Genre (March)</td>
</tr>
<tr>
<td></td>
<td>• genre (jazz)</td>
<td>• notes: sixteenth notes</td>
</tr>
<tr>
<td></td>
<td>Major scale in F</td>
<td>Major scale in F</td>
</tr>
<tr>
<td></td>
<td>(see major scale studies)</td>
<td>(see major scale studies)</td>
</tr>
<tr>
<td></td>
<td>Major scale in Ab</td>
<td></td>
</tr>
</tbody>
</table>

April

May

June

The Star Spangled Banner
Continued review of concert music
Concert etiquette

Spring Concert

Ode to Joy, Saints Go Marching In, Grand Old Flag, The Star Spangled Banner

Assessments
(see below)

Teachers must teach specific concepts defined by curriculum and government standards. These concepts are sequential in difficulty, and therefore introduced progressively over time.

The concert repertoire must include pieces which introduce concepts and pieces which reinforce them once they have been taught.
Creating diagrams of songs in the library of music

The following diagrams focus on the concepts that are present per song, and where they occur within the piece. Concepts introduced are shown at full opacity. The duration of each song is based on the number of measures in the music itself.

Here, one is able to see the frequency of each concept. This is particularly interesting for those concepts which appear as discrete occurrences, in comparison to those that are present for the entire duration of the piece.

This view offers a quick visual reference to show the presence, frequency, and introduction of concepts within each song. With this visualization, a music teacher would be able to select level appropriate songs, based on the number of concepts present, and the number of occurrences for more challenging concepts. Showing this collection as small multiples¹, comparisons can be made between different pieces of music.

¹ Small multiples are a series of graphics, showing the same combination of variables, indexed by changes in another variable, for example, location. The structure remains constant, so that attention is directed toward changes or shifts in the data associated with the variables which have been changed.
Ode to Joy

Grand Old Flag
A visual library of concert band music that diagrams concept introduction, presence, location, and occurrence.

The Star Spangled Banner

Saints Go Marching In
Histograms are graphical representations of the distribution of quantitative, numerical data. These histograms are an aggregate total of all the concepts found within the piece - with no distinction given to frequency - to determine the proportions of concepts and categories found from the song detail view.

Using the small multiples metaphor again builds a library that shows the relative proportions of each piece. These simple comparisons might be more appealing to teachers with more experience, who may have other planning methods than building a repertoire directly from the curriculum.

Proportions by concept type can be more helpful to a teacher with more experience, who knows that their students need to focus on rhythm or tonality, for example.
“Road map” timeline of planning for the full year

The final composite visualization is a diagram of the planning for the year, which shows the organization of the concept repertoire, based on the concept progression. Similar to a project management board, the visualization, known as a Gantt chart, fits well into a timeline view, not giving too much detail but still offering the administrator an overall view of the year long planning ahead.

This was challenging to visualize using the histograms, because of conflicting time scales. There are three variables of time to resolve in this visualization: duration of a piece of music, duration of learning a piece of music, and the duration of the school year. Here, histograms are used as static placeholders for a few weeks of lesson plans, and duration over time is shown through the concert repertoire.
The steps in building a concert repertoire:

1. **Teachers look through sheet music to locate musical concepts and deliberate the level of appropriateness for their students. They do this by identifying the presence and occurrence of specific concepts.**

![Diagram of a concert repertoire]

2. **CONCEPTS** (in order of introduction):  
   1. time signature (meter)  
   2. notes: whole, half, quarter  
   3. rests: whole, half, quarter  
   4. intro, tag  
   5. notes: dotted (half)  
   6. key signature  
   7. tempo  
   8. accidentals (sharps, flats, naturals)  
   9. counterpoint  
   10. ostinato  
   11. dynamics  
   12. crescendo, decrescendo  
   13. rests: extended  
   14. notes: eighth notes  
   15. coda signs  
   16. repeat signs  
   17. endings  
   18. key change  
   19. articulation  
   20. accelerando, ritardando, fermata  
   21. phrasing  
   22. notes: dotted quarter & eighths  
   23. notes: dotted eighth & sixteenths  
   24. groups, style  
   25. notes: sixteenth notes  
   26. notes: triplets  

   **SEQUENTIAL VALUES**  (least to most challenging)  
   - rhythm  
   - form  
   - tonality  
   - expression  

   **CATEGORY** (type of concept):  
   - rhythm  
   - form  
   - tonality  
   - expression  

   **QUALITATIVE VALUES** (type color value):  
   - red  
   - orange  
   - yellow  
   - green  
   - blue  

*They deliberate against a list of concepts defined by the curriculum, and their individual understanding of music composition.*
Creating diagrams of the distribution and frequency of all concepts for an individual song, for the duration, in measures, of the piece allows for a more optimized way to sort through sheet music.

Proportions of category presence for each song can be compared as small multiples.

A timeline of planning for the year can be built from the repertoire selection, which reflects the intentional progression of songs taught over time based on the concepts introduced.
Proposal for an interactive repertoire building platform

Using the sequence of these visualizations as a process to support discovery and planning, it is my intent to build an online platform which allows teachers to build their own concert repertoire. The concept map to the right documents the proposed user experience flow. Starting with a list of specific concepts defined by the Common Core and State standards, this web application will support music teachers as they build a repertoire based on concept objectives, using these visualizations to make informed decisions.

For each concept, arrangements from the Complete Year of Band library are recommended which introduce these concepts. As concepts build upon each other, arrangements increase in difficulty but always reflect a progressive path. Teachers are given the freedom to author within a space that assists in the planning and building of up to a three year curriculum with year end performances and learning assessments.

There are two entry points. The first is a linear progression of all the concepts as they are introduced sequentially. For a teacher who uses these concepts to build a repertoire, this process flow will recommends relevant songs. Each of those pieces can be opened to reveal a more detailed diagram of all the concepts as they appear through time within the discrete piece of music.

Each of those pieces can also be viewed by proportions of each category as a histogram. This is the second entry point - to view the entire library of songs as histograms, to make comparisons between them. At this abstraction, “sliders” can be used to target songs that emphasize desired categories. This process might be used for teachers who have more experience identifying what areas of music their students need improvement in.

This process generates the final visualization of the “Road Map” timeline of planning for the entire year. If accompanied with lesson plans, this visualization can explain a great deal about the planning of the proposed curriculum over the course of the year, supported by the concept building decisions that went into the process.

This framework can be expanded in the future through the inclusion of additional musical works from any source that are encoded and entered into the system.

The proposed web application will be a tool for new and experienced teachers alike. Using this concept building framework, with the support of visualization, teachers can feel supported through the planning process and have tangible documentation to share which supports their decision making. It can even become a blueprint for teachers to share and compare repertoire amongst themselves.
### Los Angeles

- **String Quartet 2**: 1 hour, 20 minutes
- **For Philip Guston**: 8 works performed

### Huddersfield

- **“Missing Morty” Festival**: November 17 - 26
- **Piece for Violin and Piano**: Projection 4
- **Extensions**: 1
- **The King of Denmark**: Piano, Solo
- **Patterns in a Chromatic Field**: For John Cage
- **Spring of Chosroes**: Piano, String Quartet
- **For Philip Guston**: Piano, String Quartet

### Additional Information
- **Rabbi Akiba**: *estimate, no documented recording of
- **1 hour, 20 minutes (roughly)**
- **4 hours, 30 minutes (roughly)**
- **2 hours, 30 minutes**
- **2 hours, 30 minutes (roughly)**
- **6 hours (roughly)**
- **7 hours, 30 minutes**
Visual Resonance: mapping the music of Morton Feldman

This collection of visualizations is inspired by the music of Morton Feldman. Each discrete city is a timeline view of every performance of Feldman’s work, set relative to the duration of the work performed. The nuances of Feldman’s compositional styles, notably his graphical scores and works that play with “extremes of duration,” are pulled out to reveal the culture of Feldman’s music, and the culture of these individual cities. The length of each composition has been averaged, based on the complete list of recordings found on the Morton Feldman Page¹.

The minimal and open-ended notation of many of Feldman’s compositions can result in performances that vary in length. Works with the greatest variability are notated. The hope is that even someone with no understanding of Feldman’s music would be able to understand the “visual resonance” of his style and gain an appreciation for the diversity in the varying lengths of his compositions.

I developed this series of small multiples in the Fall 2014, under the instruction of Isabel Meirelles. At the time of its development, I did not anticipate how much it would tie to this thesis investigation. However, managing different time scales in the same visualization proved to be one of the main challenges in building the timeline of concert repertoire visualization.

One of the major challenges of these diagrams was visualizing duration of a piece in relation to other pieces, as well as duration across time. The same challenge was present when trying to integrate an individual song in relation to the overall timeline for the year. Duration of a song and duration across time are two very different time scales that needed to be resolved. Part of that solution was the decision to build multiple views in isolation, so they could be compared as small multiples at the same scale.

¹ An online repository of Feldman’s work, complete list of past and forthcoming performances, and related projects.
New York City

String Quartet 2

4 hours, 30 minutes

Triadic Memories

1 hour, 30 minutes

For Philip Guston

Piano

1 hour, 40 minutes

P1

3 hours

For Christian Wolff

P2

6 hours (roughly)

For Bunita Marcus

P3

20 minutes

Palais de Mari


Amsterdam

6 hours, 30 minutes

Instruments 2

For Frank O'Hara

Violin and String Quartet

Crippled Symmetry

Only

6 hours (roughly)

String Quartet 2

February 7 - 10

Morton Feldman Festival

For Stefan Wolpe

Routine Investigations

Three Clarinets, Cello & Piano

Instruments 2
1 hour, 30 minutes (roughly)

Triadic Memories

20 minutes

2 hours

Why Patterns?

Patterns in a Chromatic Field

Boston


Milan


1 hour, 30 minutes (roughly)

For Christian Wolff

Festival Morton Feldman

October − November, 2013

7 performances
“Design innovation employs the social science of ethnography - the collection of data about people through direct observation and interaction with them - to develop a deeper understanding of people.”

101 Design Methods
Vijay Kumar
Sensing Intent

In March of 2014, I spent the afternoon at the Massachusetts Music Educators Conference in Boston with my Dad, a composer and music educator. He was there to promote his new venture, Complete Year of Band - a collection of well known arrangements for elementary and middle school band, that strategically introduce musical concepts through a curated performance repertoire.

I watched in frustration as people flocked past my dad’s table to the display racks of sheet music containing compositions from new movies and pop culture. A packaged DVD, despite the innovative contents, didn’t stand a chance against the tangible experience of flipping through sheet music, looking closely at the scores, and the creative authorship of curating one’s own performance repertoire.

As I engaged in conversation with people that day, a complex system began to reveal itself. Music teachers seemed very concerned about the Common Core Initiative, a federal education platform intended to standardize primary and secondary school curriculums and monitor student growth through a series of evaluations.

I sensed a palpable tension as teachers discussed the difficulty of incorporating these evaluative measures into a performance based curriculum, as student growth is monitored qualitatively. Selecting sheet music, a joyful part of curriculum development, was now riddled with insecurities and hesitations.

I considered what design thinking could bring to this space. It appeared there was a disconnect between federal agendas and local methods for teaching and evaluation, and the rapid introduction of new policies was not supporting a thorough and deliberate implementation.

At this point, my observation was purely
speculative, though I felt the sense of urgency in the room. The unfolding of these events had revealed a wicked problem¹, one that resonated a great deal with me. Compelled by a determination to help, I decided to use the time and planning dedicated for my thesis to research, create, and design an offering for this space. I reached out to my sister Tiffany, also a music educator, and my Dad to connect me to their network of teachers in the NJ/NY tri-state area, and I was fortunate to have the opportunity to connect with several music teachers.

My design strategy was to conduct bottom up, generative research, to listen without preconceived assumptions of what to make, and document the thoughts and concerns of the teachers. It would be imperative to cultivate an open discussion, to fully allow the wants, needs, hopes, frustrations, and suggestions to reveal themselves.

This book documents my research, methods, observations, and experiments around the making of this thesis. It is a reflective account of the many roles a designer must play in the design process - facilitating, translating, problem solving, and finally acting as an architect and designer to build an experience to support the audience in need.

¹ As defined by Horst Rittel, “Some problems cannot be solved, because their definition cannot be agreed upon by stakeholders. These problems are called wicked, but sometimes they can be tamed. To tame a wicked problem, they have to agree on goals and actions for reaching them. This requires knowledge about actions, not just facts.”

“A participatory mindset can break down the disciplinary and/or cultural boundaries.”

Liz Sanders, The Convivial Toolbox
Building an Understanding

One of the challenges of design is that it is not always possible to envision a solution from the start. Though we can sense intent and recognize systems that can benefit from design thinking, it can be challenging to identify the form or function of exactly what can and should be designed. Generative research is a participatory approach to research; collecting an informed understanding from the people directly affected by the systems at play.

To best design for others, we must first understand their experiences and existing means, to fully observe the present state. Only then can we begin to consider how to improve existing processes, that still work within the constraints of the users. Recognizing these opportunities relies heavily on design research. User interviews, field research, and surveys are just a few examples of ways to gain insights. This kind of research can reveal patterns and opportunities that might have otherwise gone unrecognized, based on assumptions or lack of true understanding.

To fully understand the scope of responsibilities and challenges that music teachers face, I reached out to several teachers from different school districts in the NY/NJ area. I conducted several informal in-person interviews, or conversations, to gather insights about their present and past experience. I gathered a large amount of qualitative data, via recordings and collaborative concept mapping about the space of music education, and the larger system of education and public policy creating the constraints. It was important to understand the challenges of the system, and the opposing agendas between educational policy makers and teachers in the classroom.

To gain a more informed understanding about the opportunities for gathering and collecting through this kind of exploratory research, I discovered the Convivial Toolbox: Generative Research for the Front End of Design by Liz Sanders. This book highlights the methods and tools used in participatory design research, and types of probes and activities to actively engage interviewees. The book also emphasizes the importance of this kind of research in the space of design, and how to begin enacting on turning knowledge into action.

“Generative design research is an approach to bring the people we serve through design directly into the design process in order to ensure that we can meet their needs and dreams for the future.”

Liz Sanders, The Convivial Toolbox

Participatory design research, like generative research, is a methodology that places the user as an integral part of the research and planning process. It utilizes the power of collective understanding to gain insights about people. Actively engaging the user and providing prompts to aid in discussion is a way to better
Common Core Reform Initiative

Education policy making mechanism:
organization of authority, acts, and implementation methods
A flow diagram of the implementation process of education acts that stem from National education reform objectives. These policies are passed to State and District levels, where teachers must develop plans that connect teaching plans and activities to these guidelines for evaluation.
understand and identify the challenges and opportunities for design. This kind of research is often used to identify opportunities for innovation, where wicked problems are present, and a clear solution or opportunity is not already defined.

This type of exploratory, open, participatory research was my primary methodology for data collection. It gave me permission to conduct informal and free form interviews with each music teacher, and not rely on a strict script or agenda. It ultimately revealed many more observations and opportunities based on the wants and needs of the teachers impacted by education reform, and gave me a much clearer understanding of the system itself.

SETTING THE STAGE

To create an open conversation space where teachers would feel free to discuss their observations and hesitations, I decided to record all of the conversations. I did not take notes, but rather maintained full attention with teachers at all times, so I could fully participate in the discussion. I developed a few preliminary questions to serve as an outline of the major topics. I familiarized myself enough with the Common Core initiative and curriculum development enough to be able to participate in the conversation.

I intentionally left conversations open; a loose framework for discussion might reveal more

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Liz Sander’s model of the changing landscape of design research.
potential insights. I developed an outline with discussion topics, to refer back to in case the conversation moved off topic. It was challenging to listen and participate simultaneously, trying not to lead the conversation, but also staying true to the discussion at hand.

Setting the stage can be challenging, especially if you are acting in another’s space. I conducted two of my interviews at a middle school in New Jersey, and as a result, I had to be more flexible with the space that was offered to me. Though I brought tools, such as post its, paper, and sharpies to the interviews, the opportunity to use them wasn’t always available.

ACTIVATE LISTENING

It was incredibly challenging to listen and participate in the discussion simultaneously. I often had to consider HOW I was listening. I needed to keep an open mind but also hone in on topics that might be most relevant to the exploration. I had to listen with and without expectation.

I had several assumptions going into these conversations, that were continuously shifting from one teacher to the next. These conversations also helped me understand the education system as a whole, specifically the dynamics between administrators and teachers. It is the unified perception of a shift in relationships between teachers, students, and administrators; that was a key factor in the development of the visualization as a tool to create alignment in understanding.

“Design takes place in social context. Virtually all plans affect many people in different ways. Plan-making aims at the distribution between advantages and disadvantages. Designing entails political commitment.”

Horst Rittel, The Universe of Design

This kind of participatory mindset forced me to be continuously aware of my role as a designer. Not only was I an active participant in the conversation, it was necessary for me to facilitate - to steer the conversation toward moments of progress, and translate - to be reflective and reiterate points; “I heard you say,” a listening response utilized often by Hugh Dubberly to confirm the establishment of a shared understanding.
Patterns and Observations

After all of the conversations, I made a list of major points made by each teacher on cards. I sorted the cards in groups of similarity, and looked at the patterns that emerged from the collection of perspectives.

The most compelling similarity was the shared feeling that there was a general loss in the appreciation of music education, in light of the emphasis placed on PARCC testing. This was demonstrated by the consistent frustration that fellow teachers were not supporting students leaving class to attend pull out lessons - an integral part of music education.

There seemed to be a general drop in the number of students electing to take music courses, which seemed to be a pressure coming from test preparation from teachers, and influenced by parents as well. The pressure is impacting and shifting views around the arts, despite the numerous studies that have been done which show how much impact the arts have in other subjects.

This pressure to perform well on the PARCC assessment comes from many reasons. The data generated from these tests determine how much funding each district will receive from the Federal Government. Future policy states that a ranking system will be implemented based on this data, and districts and teachers will be ranked and paid on a uniform ranking scale.

Every single teacher I interviewed seemed to have the same frustration in being able to communicate the value and multi-dimensionality of a music education, and the impact it has in other courses by encouraging discipline, collaboration, and understanding a new language.

Though no frustration was articulated with the actual production of required documentation such as lesson plans, it was generally viewed to be incredibly time consuming. The increase in documentation is challenging, especially for courses which are performance based. Music curriculums are incredibly multi-dimensional, continuous, and goal oriented. Administrator evaluations occur daily, weekly, or monthly lesson plans (depending on the district), and the tools to communicate how concepts are mapped to both curriculum, standards, concert repertoire, and activities, are linear at best.

The richness of the conversations I was able to have with these teachers, helped me to understand the challenges they face. Without an exploratory and participatory research approach, I would never have become sensitive to the needs of the teachers in such a broad capacity.
Elements of Variability

OBSERVATIONS

1. Teachers need tools to help them streamline the development of the required documentation
2. Teachers need support in the communication channel from music expert to non-expert in the instance of evaluation
3. PARCC testing pushing music down as a priority

OBJECTIVES

1. Help teachers move quickly through the documentation/evaluation process
2. Build a more informed understanding for non-experts - visualize the multi-dimensionality of a music curriculum

How do you design a process to support a system that leaves room for flexibility and change? Though the Common Core is attempting to standardize education, there are so many variables which are inconsistent between states, districts, schools, and teachers. Every district has different requirements for the pre-test, evaluations, student growth objectives, and lesson plan submission timelines, many of which are still in development.

VARIABLES

1. Curriculums vary by state
2. Evaluation systems vary by district
3. Lesson plan submissions can be daily, weekly, or monthly
4. Individual teacher methodologies; strategies for developing their rubrics, repertoire, and lesson plans.
5. Student growth and progress

A collaborative concept map of the space of curriculum planning and distribution developed by one interviewee and myself. Together, a word list was generated throughout the conversation, and they were given the opportunity to organize it afterwards.
The Pull Out Lesson and Full Band Rehearsal Relationship

It is important to note the value of the pull out lesson and full band rehearsal relationship. Pull out lessons are a common practice in secondary education where students who participate in band are pulled out of class, usually on a five week rotation, to meet as instrumental sections with the band teacher. It is during these lessons that students learn to identify specific concepts, pulled from excerpts of the concert repertoire. Time is used to monitor individual student growth, exercise tonality and expression, and learn practice techniques.

In full band rehearsal, a full class period that meets regularly each week, students come together to rehearse the concert repertoire pieces. It is here that students demonstrate the concepts learned in pull out lessons, exercise concert etiquette, collaborative listening, and performance skills. The pairing of these two components is extremely complimentary to a well rounded and successful music education.

With the pressure to prepare for the PARCC assessment, a shift in support of these pull out lessons has been significant. A consistent observation that was discussed during my conversations with teachers was a growing resistance against this common practice. Each teacher mentioned a similar (and very recent) push back from fellow teachers in regards to students attending pull out lessons. In a few cases, teachers in academic subjects have actually begun to refuse to let their students leave class to attend these pull out lessons. This lack of collaboration between teachers in the same school system is yet another factor contributing to the general loss in appreciation of music and arts education.

One school district that became a sort of case study for me has already administered a district wide schedule redesign for the district’s two middle schools, which completely removes pull out lessons from regular school hours. For students to participate in band and chorus, these courses are now only considered electives and meet once per week. Pull out lessons are only offered before and after school, at the discretion of both students’ and teachers’ availability. This is a significant and demanding change for both students and teachers alike.
works to be performed
“Other possible outlets involve the design of systems, wayfinding systems, and visualizations of statistical data. All examples share the common objective of revealing patterns and relationships not known or not so easily deduced without the aid of the visual representation of information.”

Design for Information
Isabel Meirelles

visualization techniques
Exploring visualization opportunities

There are different methodologies and visualization types for representing specific kinds of data. In order to resolve the complexity of visually abstracting concepts in music, I needed to research diagrammatic visualization techniques that addressed the different nuances found within the data. It was imperative for me to identify the types of techniques that my data would support, and research and explore other visualizations in the same space.

I was inspired by two books in particular, *Visual Complexity* by Manuel Lima and *Design for Information* by Isabel Meirelles. Through reading these books, which both discuss formal techniques and emergent visualization styles, I identified four potential visualization types that were most relevant to my exploration: bar charts, histograms, flow diagrams, and Gantt charts.

“Taxonomy of Visualization Types” from *Visual Complexity* by Manuel Lima.
VISUALIZATION TECHNIQUE: CULTURAL DATA ANALYSIS

My first visualizations were inspired by the work of Lev Manovich and his work in cultural data analysis. This type of collection, analysis, and visualization uses qualitative data - images, video, and markup text to explore patterns and relationships in visual data that don’t necessarily follow the sequence of which they are produced. This kind of bottom-up exploratory data analysis is used to explore the complexity and diversity of cultural processes of.

His abstraction of the book Anna Karenina is a holistic representation of the complete text. Similar to a dot density metaphor, it visually captures the distribution of her name throughout the text. Though we do not see the specific nuances, we acquire an understanding of her role in the story through this abstracted view.

I used this method to dive into making, and used the collection of sheet music as my collection of images. Starting with a zoomed out view of the whole allowed me to locate patterns between concepts across pieces, and also discover ways to create meaning comparatively.

Early visualizations that used sheet music to locate and highlight concepts within the context of the piece.
“Cultural analytics can also be defined as discovery of new concepts and alternative ways to visualize and understand human cultural history and the present.”

Lev Manovich, Software Studies Initiative

“Anna Karenina” by Lev Manovich is a composite visualization of every page within the text, that uses color to highlight the frequency and placement of every occurrence where Anna’s name appears.
Visualizing parts of a whole is an age old visualization techniques. Some of the most common visualization types represent this kind of proportional data, including bar charts, histograms, and pie charts.

The stacked bar chart shows changes over time for several discrete variables. It can be used to show percentages, which must add up to 100% of the whole. This visualization technique is more accurate than a pie chart, because it doesn’t use area to create relative proportions.

“The Daily Routines of Famous Creative People” by Podio, is an interactive visualization which shows proportion across time. Similar to a Gantt chart, it also shows relationships between different people. Based on a timeline view of one day, it uses both a Channel and Gantt chart technique to show the duration of how different people spend their time across one day. Toggle views are available to isolate specific categories to make more specific comparisons.
Flow diagrams are ways to map relationships between multiple entities. This visualization strategy might by able to show the density of the concepts as they are introduced over time. This technique helped me to begin by breaking apart concepts and repertoire pieces to begin visualizing this type of comparison. However, the lines and the distance between them did not carry explicit meaning, therefore I decided to nest concepts within a repertoire piece instead of visually mapping between the two.
There are two common ways to visualize time. The most common visualization type is a linear horizontal progression that reinforces events over distance, the other is a cyclical representation that abstracts the nature of time as a recurring phenomenon. Timelines often have a uniform scale that represents discrete occurrences in relation to one another. Displaying events on a timeline in this fashion "imparts a sense of narrative to the diagrammatic representation of events over time." (Design for Information, pg. 98) Displayed relationally to one another, they assume a narrative of causation.

Gantt charts are a type of bar chart that illustrate events over time. They highlight the start and end dates, with events that occur within a predefined timeline. This visualization technique is often used for project management, as a way to quickly visualize the breakdown of the overlap of tasks. Gantt charts also show relationships between activities over time.

I explored Gantt charts as a visualization technique to capture the overlap of concept introduction. However, concepts are introduced but continue to be rehearsed, therefore, the following visualization experiment does not support the illustration of a end time frame. Instead, concepts are shown as they are introduced, and remain fully in the timeline in relation to the introduction of other pieces of music in which they also appear.

Early visualizations show the consideration of which variables to compare across time, however all the time scales were conflicting between time across the year and duration of time of a piece of music.
Herbert Bayer’s “Succession of Life” is a visualization which shows amount over time. It uses a cyclical timeline to show discrete events as they occur.

“A New Chart of History” shows proportion across time. Similar to a Gantt chart, it also shows relationships between places.
One of the greatest challenges in building this visualization was the balance of different time scales, and contextual multiple views of the same data. There were many "split views" to tackle: the split between lessons and performance, the view of a discrete piece of music juxtaposed to an entire series, and finally, the entire series over time.

The relationship between the lessons and band rehearsals were an important relationship to tease out. Because they rely on each other to reinforce and demonstrate growth and progress, it was important to show both views side by side. Simultaneously, it was important to consider orientation between the building of full repertoire, and how individually pieces fit into the larger collection of the whole.

This is certainly a visualization challenge, to orient the audience in more than one vantage point. There are both visualizations that do this successfully, like the ones show to the right, and many web experiences that are mean to simulate this as well.

Projects like Project Xanadu by Ted Nelson or Piccolo by Ken Perlin, which later became the Prezi presentation interface, are examples of spatial ways to move between different views. Moving away from a chronological progression or a static space provides more context for the relationship between multiple perspectives within the same information.

This is often found in game design, where it is important to use visual orientation to position the reader in both the present space but also identify the spot in the "world" they are in.

The examples to the right are two static visualizations which capture multiple perspectives across different scales of time.
From the “Visual Display of Quantitative Information” by Tufte, the visualization represents a process shown across space and time. It captures the multidimensionality of dual processes that work together but can be seen separately.

“Kindred Britain” by the Stanford University Libraries is a multi-dimensional visualization. It compares the same data in three ways: as a network to show relationships, those relationships across a timeline, and geographically across space.
“Story-centered design clarifies design goals up-front. When teams start by designing stories, it forces everyone to come to agreement on the design goals before working out the details. That’s helpful because after designers have spent hours on detailed UI mockups, critique will be narrowly focused on whether the designs accomplish pre-set and understood goals.”

Google Ventures, Bradon Kowitz
Complete Year of Band interface design

The development of this research and exploratory visual design was framed with the intent to eventually build a web application to support this process. As I explored the Complete Year of Band data and began to build the visualizations, I started to consider how the development and different perspectives could build a framework for this platform.

Since I had already identified the “world” of teachers and the repertoire building process, I began by creating use case scenarios through story boarding, to quickly problem solve through the intention of the user. It kept me focused on the essential process central to this story, and kept me in the frame of mind of the teacher working through this user flow. Through these quick iterations of sketches to map I discovered two central paths that the user might take, based on the visualizations that were developed from the music compositions.
These are the first sketches of both the CYOB interface flow as well as the outline of the roadmap. I have begun to sketch these simultaneously as the action in the flow will result in some aspect of the roadmap. It was first imperative for me to consider the content necessary for both, and how I could build off of an extremely simplified structure, for which to add complexity as it became relevant to the interface. While I was working through this iteration, I realized that I was missing three internal components:

1. A ranking system to determine which pieces are recommended by concept selection. The major distinction is pieces that INTRODUCE
the concept. The more concepts in a piece, the more difficult it is. As such, there are specific pieces which are best introduce the concept.

2. Concepts are introduced over time. Who determines this? It is based on the individual teacher’s preliminary assessment, and would need to remain flexible throughout the year depending on student progress. The natural progression of the concept introduction is a traditional strategy demonstrated in instrumental instruction methods (curricula) such as the Standard of Excellence. It was not necessary to define for teachers the order of the process, but give them the freedom to build it as they see fit.
After reviewing my first iteration sketches, I realized that it might be best to have teachers begin this interaction by building the roadmap. The advantage of the CYOB interface is that it offers a holistic view of the year which helps teachers plan for individual lesson plans and identify which pieces are best for their band based on that progression.

Once the framework is built, teachers would be able to select pieces - which could potentially capture a number of different concepts in one, and have more freedom to create a repertoire based on other potential motivations - such as themes or a divergent collection of pieces.

CONSIDERATIONS:

1. A rough timeline and how to “add” concepts. What variable of time makes the most sense to build upon?

2. Multiple agendas; the split between individual lessons and full band rehearsal.

3. Concept introduction and practice over time. Are there breaks in learning certain pieces and how can that be visually demonstrated. Or are pieces continuously rehearsed, and how is that visualized?

I began to think about some of the web metaphors for the building of the Complete Year of Band interface. A conceptual model is a deconstruction of how a user thinks about the way a system operates. Based on our observations of systems, goals, and interactions, we can try to understand how a user might anticipate how an action might accomplish a task.

Some of these conceptual models and metaphors relevant to the CYOB interface might include:
- Shopping cart/checkout experience
- Portfolio (Dribbble or Behance)
- Planning (Turbo Tax or airline selection)
- Tracking systems (UPS)

This interface is currently in development, based on the framework and process realized through the creation of the music diagrams.
appendix b: knowledge structures
Visualizing structures of thought

When we think of concepts as individual entities, they can exist across an expansive network of semantic and experiential relationships. The way we store information in our memories is highly based on types of connections we make between them, which is a result of our cognitive processing and retrieval capabilities.

Concepts maps are a way to make the invisible mapping in our minds visible. We can make connections between concepts by grouping them, to observe the way our minds organize them spatially in our long term memory.

There are many different structures of thought that we can use to organize concepts, and visualization forms that lend themselves to those types of mental models. Networks (which describe), tree maps (which classify), flow diagrams (which show sequence), as well as a number of others that compare, analyze, and show causality.

In education, this has very important implications, especially when considering that concepts have been defined and categorized with specific agendas. Lesson plans are concepts maps, which make visible the connections between types and groups of concepts and identifies the relationship between them.

Three mental models of the World Wide Web, developed from a generative research experiment in the Fall of 2014, which explored ways to engage participants in the creation of mental models and concepts maps.
Collaborative concept mapping

I had the very wonderful opportunity to participate in the Categorization and Reasoning Lab at Northeastern run by Professor John Coley in the Fall of 2014, while taking his Honors Cognition course. During that semester, I was given permission to conduct some informal user research experiments, to explore different approaches to encouraging others to create mental models, as a way to support conversation.

What I learned from this series of investigations was a best practice for engaging participants in the space of making - by creating an environment with context, opportunity, and direction. The following observations were key to generating concept maps and diagrams from individuals who had no prior experience. To alleviate the tension of representation and engage people in making, it is important to provide participants with:

- content to build and organize a structure
- an audience to frame the level of communication
- time to build and construct the representation
- freedom within parameters of representation, a guideline form
- open conversation and collaboration
- offer strategies for organization
- tools that are moveable and exploratory

This collaborative generative design methodology was a central technique for my thesis research. It helped me to confront that my role as a designer is critical in providing a strategy and feedback, and activating the space of making.
Co-designed concept maps developed by groups of students (in threes) on December 1st, 2014. This experiment took a total of 50 minutes, from generating the list to co-designing the concept maps.
annotated bibliography
Core Text:


The Convivial Toolbox is a holistic overview of the co-creation process. Positioning the reader at the ideation phase, it moves through techniques, methods, and case studies for identifying design opportunities through participatory design research. The goal of this book is to provide strategies for collecting, organizing and analyzing qualitative data, while orienting the reader objectively in the entire process.

It emphasizes the importance and capacity of bottom up, generative research to inform and identify opportunities for design of future states. Each case study catalogs the project’s strategies and designs for data collection, synthesis and methods for organizing qualitative data to find patterns and insights. Full of illustrated, simple models which visualize the space of design research methods, design process, and the world of design thinking, the tone of this book is light, informative, and inspiring.

Supplemental Texts:


A theory put into practice from Rittel’s theories of design as argumentation, the Deliberative Practitioner is an account of the importance of participatory planning. Forester uses example scenarios to demonstrate how participatory planning can bring a more enlightened, holistic perspective to collaboration, and how those practices can be implemented to achieve better and more informed solutions.


This lovely book by Nikolaus Gansterer is a collection of figures of thought that explore abstract systems, maps, and ideas. “Gansterer reveals drawing figures as a media of research which enables the emergence of new narratives and ideas by tracing the speculative potential of diagrams.” An inspiring collection of visualizations, it captures the power of drawing and diagrams, even of abstract entities.

101 Design Methods is an instructional design manual that breaks the “innovation system” into seven major sections and offers a collection of strategies to use when engaging in human centered design. The sections frame the stages of the design process; Sense Intent, Know Context, Know People, Frame Insights, Explore Concepts, Frame Solutions, and Realize Offerings.

Using case studies paired with prompts to help designers collect, organize, and present design research, it also includes explanations of how and when to select specific strategies. It was an incredible resource for quickly identifying ways to conduct my research; the methods are organized intuitively and extremely thorough.


Visual Complexity explores the world of big data, and focuses on different methods for visualizing patterns and relationships. He explores many visualization techniques, beginning with early tree diagrams, and moving to more abstract and illustrative ways to show connectivity. Network diagrams can be connected by many variables and by different types of connections. New languages which explore the multi-dimensionality of these relationships use visualization as a way to capture the patterns they create. Lima supports these techniques with several examples, and discusses the future potential of visualization.


*Design for Information* is a collection of case studies, terminologies, and visualization techniques that illustrates the best practices for selecting appropriate visualization types. There are many variables to consider when working with different types of data, and different content lends itself to certain types of visualization methods.

The book is divided into sections that discuss these data specific types; timelines, trees, geographic representations, spatio-temporal visualizations, and textual visualizations of multi-dimensional information. Its power lies in the clear narrative and instruction of which visualization techniques to use for specific types of data. It is easy to navigate, offers insights and observations about the challenges of data visualization, and provides references and examples to reinforce the nuances of data structure, storytelling with data, and visualization types.


From the perspective of ergonomics and industrial design, *Living with Complexity*
demands the considerations of human centered design artifacts. This book is a theoretical account of the motivations, perceptions, and experiences surrounding user experience design, and how our design choices can or cannot accomplish what we intend. Norman breaks the design of everyday things into three categories; visceral, behavioral, and reflective design, each which target different levels of user engagement and emotion.


“All designers intend to intervene into the expected course of events by premeditated action. Designing is plan-making.” (Rittel)

The design process relies heavily on conversations between stakeholders, often who represent different agendas. The discourse of articulating perspectives and goals, aligning that vision, and developing a plan is full of what Rittel refers to as “wicked problems.”

Wicked problems are hard to identify. It takes cooperation, argumentation, and compromise to arrive at shared understanding and design a plan that implements a collaborative goal. “Design terminates with a commitment to a plan that is meant to be carried out.”

The Universe of Design is a collection of Rittel’s writings that have been collected from various sources, and augmented with additional case studies and examples for present day practice. This book exists outside the realm of design and innovation. It is a discussion about the opportunities design thinking plays in planning on a universal scale, using technology systems and cybernetics as a metaphor for much larger systems.

Articles:


Millen, David R. “Rapid Ethnography: Time Deepening Strategies for HCI.”


COLOPHON

book size, 8.5 in x 11 in
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