

George Crumb and Set Theory:
An Interesting Musical Journey for Theory Students

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Music theory is such a broad subject. Typically in a high school course, the primary focus is put on tonal practices, but by the end of the year, classes will venture briefly into more modern aspects of theory. One of these newer practices that may be studied is set theory, which is an organizational system that focuses on “sets” of pitches and their various uses (to be further described in a later discussion). Composing in this manner can be an informative and interesting activity for a theory class, but in order to first learn enough about this practice, students must be given a model to dissect that clearly exemplifies set theory. Additionally, it would be very motivational to use a piece that students will find immediately interesting despite its daunting tonal unfamiliarity. Conveniently, George Crumb’s song cycle *Ancient Voices of Children* possesses both of these qualities; it is aurally relatable despite its many modern qualities, and it provides an ideal model from which to teach set theory. Let’s discover what makes this piece so interesting, exploring its unusual instrumentation, extended techniques, unique notation, and various stylistic references, and then we will move on to its theoretical applications and introduce a sample curricular unit.

First, a brief overview of the song cycle is necessary. *Ancient Voices* is comprised of five different movements plus two instrumental interludes.¹ The overall work is part of Crumb’s so-called Lorca Cycle, which is defined as the compositional period in which Crumb pulled inspiration from the Spanish poet Federico Garcia Lorca’s work.² He was first introduced to Lorca’s poetry by a colleague during his time at the University of Michigan earning his Doctorate degree.³ This began the cycle which ends several pieces later with *Ancient Voices*.

¹ George Crumb, *Ancient Voices of Children* (New York: C. F. Peters, 1970).

² Gilbert Chase, “George Crumb: Portraits and Patterns,” in *George Crumb: Profile of a Composer*, ed. Don Gillespie (New York: C. F. Peters Corporation, 1986), 2.

³ David Cope, “Biography,” in *George Crumb: Profile of a Composer*, ed. Don Gillespie (New York: C. F. Peters Corporation, 1986), 10.

Interestingly, Crumb doesn't simply set a couple poems to music like his colleague did. He instead chooses short selections from various poems and pieces them together throughout the entire song cycle into what he calls a "larger rhythm" or form.⁴ Not all of the vocal lines in the piece are given text from the selected poems, however; some use vocalise, or various syllabic or vowel sounds, and these are sometimes sung into an amplified piano to create a unique timbre.⁵ Additionally, the two interludes don't contain any vocal lines at all. Instead, they call for an optional solo dancer.⁶

As hinted at above, Crumb heavily focuses on creating new and unfamiliar colors throughout the entire piece, and these instantly catch the ears of our students. The very first sound we hear of movement one is a tongue click in a solo soprano voice followed by vocalise into a piano.⁷ The various pitch sets Crumb uses create a unique harmonic environment, and soon the piano and harp briefly enter in their lower range. The vocalist enters again with some flutter tonguing, and soon after, percussion enters with tam-tam scrapes and whispering, creating an eerie soundscape. An offstage boy soprano enters and sings alone through a cardboard tube, and he effectively sounds as if he is off in the distance. This ending of movement one sets the listener up for a shocking *ffz* in the mandolin, harp, and finger cymbals and a *ff* in the oboe at the start of the first instrumental interlude. Each movement and interlude has a unique soundscape, and any one of them can prove interesting to a high school class if properly introduced.

Crumb has experience on a wide variety of instruments due to his diverse musical training growing up, so he is aware of both the potential and limitations of many different

⁴ Don Gillespie, ed., "Annotated Chronological List of Works," in *George Crumb: Profile of a Composer* (New York: C. F. Peters Corporation, 1986), 107.

⁵ Crumb, *Ancient Voices*.

⁶ Ibid.

⁷ Ibid. Information in rest of paragraph from this source.

instruments.⁸ This allows him to call for pitch bends in instruments such as the piano, harp, and mandolin (instructions for doing so on each instrument are provided within the score).

Additionally, Crumb calls for a paper-threaded harp, which creates a more percussive, rattling sound; frequent singing, shouting, and whispering from various musicians; Tibetan prayer stones; a toy piano; a musical saw; sleigh bells; a harmonica; a tam-tam; and a wide variety of other percussion instruments.⁹ Having students follow along to a recording with the score will allow them to better identify all of the new sounds and not become lost in this new timbral environment.

However, that score has an interesting twist. Crumb is known for placing emphasis on the notation of his works. His composition teacher at the University of Michigan, Ross Lee Finney, was meticulous regarding notation, and this greatly rubbed off on Crumb.¹⁰ In the score for *Ancient Voices*, on most pages we find various systems like we'd expect, but when an instrument enters later in the system after resting, Crumb doesn't write in bars of rest. Instead, he doesn't notate the staff at all; he simply begins the staff wherever the instrument enters in relation to the parts around it. This visual representation of the music forces us to consider the piece as a cohesive unit, not a combination of independently crafted lines, especially in movements without a time signature to guide us.

There is one visual exception in this piece, however. The "Dance of the Sacred Life-Cycle," part of the movement "¿De Dónde Vienes, Amor, mi Niño? (From Where do You Come, My Love, My Child?)," is written in a visual cycle.¹¹ A circle is drawn in the center of the page, and various musical segments rest on various parts of the edge of this circle. We begin with the

⁸ Cope, "Biography," 10.

⁹ Crumb, *Ancient Voices*.

¹⁰ Cope, "Biography," 11.

¹¹ Crumb, *Ancient Voices*. Information in rest of paragraph from this source.

vocal line labelled A1, and as we move through the music, dotted arrows guide us to where we should go next and when. Lines often interrupt each other, so the arrow may start in the middle of one musician's line and point to the beginning of another. As in the rest of the score, very specific directions are listed next to each part, guiding the musician how to interpret the notation, perform an extended technique, or interpret the mood of the piece. Beginning the set theory unit by guiding students through this page of the score while listening may spark greater interest in the project.

There is one more point of interest to note before discussing the theory behind this work. Robert P. Morgan's book *Modern Times* discusses characteristics of music from the twentieth century based on geographical region, and in Carol Oja's chapter entitled "The USA: 1918-45," she defines "experimenters" as composers who try using things that were formally considered "unusable" in music, try different methods of creating musical material (mathematical formulas, et cetera), and avoid reusing material.¹² These are compared to neoclassicists who enjoy writing with more modern harmony but preserving Classical aspects of music like various forms and transparent textures.¹³ Therefore, by this definition, Crumb is an experimenter; he includes various instruments that other composers would find "unusable" and he uses set theory to create his material. However, it's this third point that will interest our students the most. Crumb does in fact reference other existing musical styles; he includes elements from the Flamenco, characteristics of Mahler, and a Baroque quotation out of the Notebook of Anna Magdalena Bach.¹⁴ These styles and more can be heard throughout the piece as something slightly familiar to latch onto, and it would best serve our students if we point these out as we come across them.

¹² Oja, Carol J, "The USA, 1918-45," in *Modern Times: From World War I to the Present*, ed. Robert P. Morgan (New Jersey: Prentice Hall, 1994), 211.

¹³ *Ibid.*, 210-211.

¹⁴ Gillespie, "Annotated Chronological List," 108.

However, despite this “reusing” of material, we can still consider Crumb to be an experimentalist due to the way he manipulates these existing styles. He consciously desired to juxtapose greatly differing styles while composing this piece, and his act of doing so creates something completely unique; this new material is not something many composers would have attempted in the past.¹⁵ Additionally, Crumb also states in his program notes that composers like Mahler and Bach borrowed musical material from others all of the time, but they still retained their own unique style.¹⁶ Therefore, while there are recognizable styles found throughout this song cycle, the overall effect is something experimental and ear-catching for our students.

Once we have captured our students’ attention through the mature and uniquely interesting nature of this piece, we can begin to teach them the theory behind it. Set theory is a compositional method based on sets, which are collections of pitches that can be arranged in any order and contain any number of pitches.¹⁷ Pitches are assigned numbers, or classes, which we will find to be useful in a moment. The classes are defined in Table 1.

Table 1. Pitch classes

C	C#	D	D#	E	F	F#	G	G#	A	A#	B
0	1	2	3	4	5	6	7	8	9	10	11

Source: Thomas de Dobay, “Harmonic Materials and Usages in the Lorca Cycle of George Crumb” (PhD Diss., University of Southern California, 1982), 12.

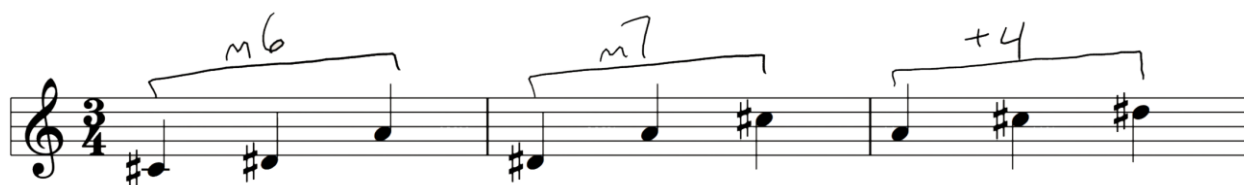
All possible enharmonics for each pitch are grouped into one class. Therefore, a Cb is an 11 and a Db is a 1. Additionally, these pitches may appear in any octave and will still be assigned the same number, thus simplifying the music into more easily recognizable sets of numbers.

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Thomas de Dobay, “Harmonic Materials and Usages in the Lorca Cycle of George Crumb” (PhD Diss., University of Southern California, 1982), 12. Information in rest of paragraph from this source.

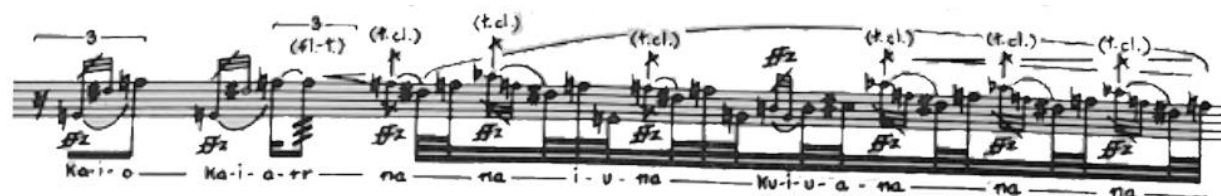
Figure 1. Possible configurations of the set [9, 1, 3]



As we can see, the interval of A to D# (9 to 3), an augmented fourth, is the smallest option. Therefore, we put 9 at the beginning and 3 at the end of our set. Since we only have one more note, it goes in the middle. The second rule to this order of pitches, or normal order, is that all pitches must be listed in ascending order.¹⁹ [9, 1, 3] doesn't initially seem to fulfill this requirement, but adding the number 12 to our 1 and 3 results in their octave equivalents, so the set becomes [9, 13, 15], thus meeting this requirement.

There are a few other terms to be discussed while introducing set theory. The cardinality of a set is simply the number of pitches the set contains.²⁰ Our favorite set of [9, 1, 3] would therefore have a cardinality of 3. Sets of this cardinality are otherwise known as trichords, and they are especially significant in Crumb's work. Another example of these trichords can be found later in movement one (see Example 2). We find a [3, 4, 5] and a [3, 5, 8] set within one line, and they are relatively clearly defined.

Example 2. George Crumb, *Ancient Voices*, Mvt. I, system 5 (segment)



¹⁹ De Dobay, "Harmonic Materials," 14.

²⁰ Ibid.

Additionally, a set's interval content can prove to be important. To find this content, we subtract each smaller number in the set from each larger one.²¹ Taking the set [3, 5, 8] from Crumb's work above, we have 8-3, 8-5, and 5-3, giving us the intervals 5, 3, and 2. These numbers are not the intervals themselves but represent the intervals. Those corresponding intervals can be found in Table 2.

Table 2. Interval labels

m2	M2	m3	M3	P4	TT
1	2	3	4	5	6

Source: Thomas de Dobay, "Harmonic Materials and Usages in the Lorca Cycle of George Crumb" (PhD Diss., University of Southern California, 1982), 17.

This means our [3, 5, 8] set contains the intervals of a P4, m3, and M2. If we find a number higher than 6, we simply take 12 minus that number to find its inversion, and this will give us the most basic form of the interval.²² Just like in a 12-tone row, the selection of pitches in a pitch class is greatly based on the intervals it will provide the composer to work with. In our example set, these pitches can translate in our ear to Eb, F, and Ab, which are all within the tonal center of Eb major. This sounds especially true when the set repeats itself multiple times in a row, which it does in Crumb's vocal line in Example 2. The aural effect of this is something less striking and much more tonally familiar. This sets us up for significant contrast with improvised ascending laughter in the vocalist that follows. The laughter appears as a more unique event to our ear due to the aurally familiar set used beforehand.

Additionally, by knowing a set's interval content, we can compare different sets to determine if they are equivalent. Sets can be equivalent if their cardinality is the same and they

²¹ De Dobay, "Harmonic Materials," 17.

²² Ibid., 18.

contain the same intervals.²³ Again taking our Crumb [3, 5, 8] set with intervals of a P4, m3, and M2, we can determine that a [2, 5, 7] set would be a valid equivalent; it also has a cardinality of 3 and contains our 5, 3, and 2 intervals. When played on a keyboard, they both sound very tonal (in different tonal centers, of course) and therefore have a similar collective aural effect.

Our final step is applying all of this information to our musical selection so our students can have a complete picture of set theory in action. The Appendix consists of a sample curriculum that pulls together the main points of this analysis into a cohesive instructional unit based on Crumb's *Ancient Voices*. As we familiarize ourselves with the piece before teaching it to our class, we should try to find several new examples of sets within the piece that we can point out to students. Some are easier to find than others, but there are many that are relatively clear. For example, instruments that are notated with a limited number of pitches (tam-tam, et cetera) will be restricted to certain sets. These instruments can provide an ideal place to begin if we send students on a hunt of their own for sets within Crumb's piece.

In the end, we are always on a journey to best serve our students with the curriculum we design and/or supplement. It is important to meet students where they are at and provide them with pieces they can relate to as they learn from them. Crumb's *Ancient Voices of Children* is an excellent example of the topics being covered in the unit of study in question, and it is also an interesting piece. Ultimately, we should always be looking to expand our knowledge of our field of study, and this will provide us with an ever-evolving and perpetually interesting curriculum for not only our students but for us as well.

²³ De Dobay, "Harmonic Materials," 17.

Curriculum Guide: Set Theory

Unit Name	Unit Length	Unit Placement	Resources Required	
Set Theory	Instructor Choice	End of Year	Score ¹ , recording ² , speakers, keyboard, staff paper, student notebooks, worksheets, other instructional materials (pencils, etc.)	
Standards	Objectives	Instructional Strategies	Concepts/Vocabulary	Assessment
EU*: Musicians' creative choices are influenced by their expertise, context, and expressive intent. ~MU:Cr2.1.C.IIIb ³	<i>Students will:</i> ~Describe how a composer's expertise affects their compositional process ~Describe how the time period of a composer affects their compositional choices ~Describe how other art forms can affect composers	<i>Instructor will:</i> ~Discuss a brief overview of George Crumb and his highly musical childhood/exposure to many instruments ~Discuss historical context of piece (Modern Era) ~Discuss influence of poet Lorca	~Neoclassicist ~Experimentalist ~Modern Era ~Lorca Cycle	<i>Students will:</i> ~Keep a notebook with summaries of the discussion points covered in class and definitions for select terms, collected at the end for completion points
EU: Understanding connections to varied contexts and daily life enhances musicians' creating, performing, and responding. ~MU:Cn1.0.IIIa	<i>Students will:</i> ~Describe the effect of instrumentation on a piece ~Describe the specific effect of Crumb's choice	<i>Instructor will:</i> ~Describe the various instruments in <i>Ancient Voices</i> ~Play segments of an <i>Ancient Voices</i> recording for students	~Musical saw ~Tibetan prayer stones ~Sprechstimme ~Vocalise ~Timbre	<i>Students will:</i> ~Assemble a list of unique instruments for a potential future composition and provide reasons for
EU: The creative ideas, concepts, and feelings that influence musicians' work emerge from a variety of sources				

¹ George Crumb, *Ancient Voices of Children* (New York: C. F. Peters, 1970).

² Recommended recording: George Crumb, *Ancient Voices of Children*, conducted by David Colson, *Complete Crumb Edition, Volume 9*, Bridge BCD9170, 2005, compact disc, accessed April 17, 2019. *Naxos Music Library*.

³ "2014 Music Standards (Composition/Theory)," National Association for Music Education, <<https://nafme.org/wp-content/files/2014/11/2014-Music-Standards-Composition-Theory-Strand.pdf>>, accessed April 24, 2019. All standards are taken from this source.

~MU:Cr1.1.C.IIa	of instrumentation	to hear various timbres/colors		selection (in notebook)
EU: Musicians' presentation of creative work is the culmination of a process of creation and communication. ~MU:Cr3.2.C.Ib	<i>Students will:</i> ~Describe the effect of visual representation of music	<i>Instructor will:</i> ~Provide segments of score for students to follow along while listening to timbres ~Initiate discussion about "Dance of the Sacred Life-Cycle" notation	~Notation	<i>Students will:</i> ~Write a short response about the implied intended meaning of Crumb's cyclical notation of "Dance of the Sacred Life-Cycle" (in notebook)
EU: Musicians' creative choices are influenced by their expertise, context, and expressive intent. ~MU:Cr2.1.C.IIIa ~MU:Cr2.1.C.IIIb	<i>Students will:</i> ~Identify sets according to their pitch classes, cardinality, and interval content (prime form) ~Rearrange sets into their normal orders and prime forms ~Identify equivalent sets ~Compose a short work using original sets	<i>Instructor will:</i> ~Define sets using Crumb's first [9, 1, 3] as an example ~Introduce key vocabulary in relation to Crumb's sets in <i>Ancient Voices</i> ~Provide various examples from <i>Ancient Voices</i> throughout to keep students interested while learning the content	~Set ~Pitch class ~Normal order ~Cardinality ~Trichord ~Interval content ~Equivalence ~Prime form	<i>Students will:</i> ~Identify sets through visual and aural analysis ~Label cardinality of sets ~Arrange sets into their normal orders and prime forms ~Define the intervals within given sets ~Distinguish between equivalent and non-equivalent sets ~Compose a short work using set theory

*EU = *Enduring Understandings*

Composition Assignment Rubric

	4	1-3	0
Sets	Used two clearly defined and labelled sets, 1 per every 2 measures	Used one clearly defined and/or labelled set, and/or used 1 per every 2 measures	Needs two clearly defined and labelled sets with 1 per every 2 measures

	1	0
Length	8-16 bars in length	Needs more/less bars to fit within 8-16 bar requirement
Articulation	Provided at least two unique articulations	Needs at least one more articulation notated
Expressive markings	Provided at least two dynamic markings and at least one tempo/expressive marking	Needs one to two more dynamic markings and/or one tempo/expressive marking
Notation	Clear, readable notation done on a computer	Needs to be cleaner and/or done on a computer
Orchestration	Monophonic for melodic instrument of choice	Needs to be monophonic and/or for a melodic instrument capable of performing sets

**Students do not need to be able to perform their piece for the class, but if they cannot, they should prepare a midi recording to share*

Comments:

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