

A PERFORMER'S GUIDE TO GEORGE CRUMB'S  
*MAKROKOSMOS IV* (CELESTIAL MECHANICS)

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George Crumb (b.1929)'s *Makrokosmos* is recognized as one of the masterpieces of twentieth century piano writing. Inexplicably, volume four of *Makrokosmos*, Crumb's only four-hand piano piece, is rarely studied by Crumb scholars. According to Crumb's program notes, his *Makrokosmos* is meant to be a hybrid of piano and orchestral sound. Crumb devised a list of signs and abbreviated letters to explain his specific instructions to the performers. The pianists who plan to perform *Makrokosmos* need to study Crumb's notations carefully in order to faithfully realize the composer's intentions. Therefore this dissertation will examine the composer's treatment of four hands at the piano. In addition, a performer's analysis and practical "translation" of these techniques will be provided, in the hopes of rendering this amazing piece more accessible to pianists in search of new and wonderful repertoire for piano four hands. It is also hoped that future composers will be inspired by Crumb's innovations and imaginative ideas.

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## CHAPTER I

### INTRODUCTION

Pianists today are increasingly turning their attention to duo piano repertoire. Over the years, composers have taken various approaches to the sound of four hands on the piano. This piano four hand repertoire has a history which reaches back to the Viennese composers such as Mozart, Schubert, and Brahms whose masterpieces have been handed down to us.<sup>1</sup> Twentieth-century composer, George Crumb (b.1929) has written a most imaginative and creative work for piano: *Makrokosmos*.

Crumb's *Makrokosmos* is recognized as one of the masterpieces of twentieth century piano writing.<sup>2</sup> Volumes one and two are for solo amplified piano, volume three is for two pianos and percussion, and volume four is for piano, four hands. George Crumb enjoys playing four-hand piano works of Schubert, and his interest in this genre is the genesis of volume four of *Makrokosmos*.<sup>3</sup> Many of the sounds in these masterpieces are created by amplifying the pianos and by using extended piano techniques. Inexplicably, volume four of *Makrokosmos*, Crumb's only four-hand piano piece, is rarely studied by Crumb scholars.

Crumb himself states in his program notes for *Makrokosmos* that he wanted to devise a hybrid of piano and orchestral sound. The result is hardly a traditional piece. In

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<sup>1</sup>George Crumb, *George Crumb: Profile of a Composer*, (NY: C.F. Peters Co., 1986), p.111.

<sup>2</sup>Richard Bass, "Set, Scales and Symmetries: The Pitch-Structural Basis of George Crumb's *Makrokosmos I and II*," *Music Theory Spectrum*, vol.13/1 (Spring, 1991), p.1.

<sup>3</sup>David Burge, "Music Reviews," *Note* (June, 1989), p. 859-860.

addition to amplification, use of harmonics, preparing of piano and playing inside the instrument, Crumb actually employs six hands by including the page turner in the performance, giving him/her a substantial role in the performance.

The principal source for this study, specifically dealing with volume four, subtitled “Celestial Mechanics,” will be the composer’s program notes. Based upon Crumb’s own specific signs and marks intended to help the performer and guide the performance of the piece, this dissertation will examine the composer’s treatment of four hands at the piano, using a variety of innovative and extended piano techniques. In addition, a performer’s analysis and practical “translation” of these techniques will be provided, in the hopes of rendering this amazing piece more accessible to pianists in search of new and wonderful repertoire for piano four hands. Techniques which will be addressed include a variety of sound effects such as plucking and muting of strings, use of harmonics, and dropping a light metal ruler onto the piano strings.

## CHAPTER II

### GEORGE CRUMB: BIOGRAPHY

George Crumb was born on October 28, 1929 in West Virginia. His father was a clarinet player, music copyist, and conductor. Crumb's mother was a cellist in a local orchestra. Clearly, his musical talent was influenced by his parents.

Music was a major activity in Crumb's early life. One of his most significant early musical activities was playing flute, piano, and clarinet in his family chamber orchestra. When Crumb graduated from high school, he already had composed about forty pieces including his first two orchestral works namely *Poem* (1946) and *Gethsemane* (1947). The two pieces were performed by the Charleston Symphony. He was very excited about having his compositions played by such a prestigious professional orchestra. Sometimes he followed written music while he listened to records or symphonic broadcasts on the radio. He tried to imagine what they sounded like instead of paying attention to his teacher. He read books such as Thayer's *Life of Beethoven*, and Einstein's *Mozart* in his high school years.

After graduating from high school, he entered Morris Harvey College in Charleston, West Virginia for his Bachelor's Degree. Subsequently he got a Master's Degree from the University of Illinois in Urbana-Champaign.

His most substantial compositional outputs from his Urbana period were *Trio for Strings* (1952) and *Sonata for Viola and Piano* (1953), and both works demonstrated the



influence of Hindemith and Bartók. Crumb began his doctorate at the University of Michigan in 1953. He dealt with the music of mainstream composers such as Bartók, Schoenberg, Webern, and Stravinsky in doctoral seminar classes. He studied composition with Ross Lee Finney and Boris Blacher while at Michigan.

In 1955, Crumb was awarded a Fulbright Fellowship to study music in Berlin. After staying in Berlin, he returned to Ann Arbor in 1957 to complete his doctoral degree. His dissertation consisted of *Variazioni for Orchestra* (1959), using the twelve-tone system and other techniques of Arnold Schonberg. Crumb continued to write many compositions. He wrote *Sonata for Solo Violoncello* (1955) in a style similar to Bartók and dedicated the work to his mother.

In 1962, he was awarded a faculty position at the University of Colorado and met fellow faculty member, pianist David Burge, an ardent supporter of new music. Crumb's *Five Pieces for Piano* (1963) was dedicated to Burge who premiered the piece. *Five Pieces for Piano* foreshadows some of his ideas later developed in *Makrokosmos*, such as varying the quality of sound or timbre of the piano: pianists are required to pluck the strings of the piano and to lightly touch some strings while playing the corresponding keys. This produces high-pitched sounds called harmonics. Additionally, new ways of using the three pedals are explored.

In 1965, Crumb joined the composition faculty at the University of Pennsylvania, and remained there until he retired. In 1968, Crumb was awarded the Pulitzer Prize in

Music for his orchestral work, *Echoes of Time and The River* (1967), and composed *Songs, Drones, and Refrains of Death* (1968), scored for baritone, electric guitar, electric contrabass, amplified piano, amplified harpsichord, and two percussionists. This is the first piece in which Crumb used electric instruments. In 1970, he wrote *Black Angels* which is a long work for electric string quartet. Crumb chose to electrically amplify the instruments because special dynamics such as *pppp* are so soft that they would be difficult to hear without amplification. One of his major works, *Voice of the Whale* (*Vox Balaenae*, 1971) which was inspired by the singing of a humpback whale, is written for three instruments: electric flute, electric cello, and amplified piano. The musicians who perform the work are required to wear black masks. The masks represent the impersonal forces of nature. Deep blue stage lighting is used to suggest the ocean. There are major works including *Makrokosmos, Vol. I* (1972) and *II* (1973) for solo piano; *Star Child* (1977) for soprano, children's voices, and orchestra; *A Haunted Landscape* (1984) for orchestra; and *The Sleeper* (1984) for soprano and piano. Crumb completed volume four of his *Makrokosmos* in 1979 for amplified piano, four hands. The complete *Makrokosmos* was premiered in New York that same year by Gilbert Kalish and Paul Jacobs.

Crumb most frequently refers to influences from the music of Debussy and Bartók. Debussy's influence is evident primarily in Crumb's usage of timbre, extended pedal, whole-tone scale and resulting symmetrical chord structure. While Crumb

acknowledged the influence from Schoenberg, Berg, and Webern, he never accepted strict serial technique a dominant influence. However, a particularly prominent influence of Webern is reflected in Crumb's use of brief and dance-like musical gesture. In addition, the influence of Bartók is found in relation to formal organization and timbre. Bartók's uses of cyclical and arch forms as well as various small-scale symmetrical relationships were described by Crumb as "a primary influence." Moreover, both Bartók's and Crumb's music make frequent use of the sounds of nature, particularly nocturnal sounds.

## CHAPTER III

### INNOVATIVE SOUND EFFECTS

George Crumb is notable among other things for producing innovative sounds and colors from the piano. In order to produce percussive effects he utilizes various techniques. For example, following to some extent the model of Henry Cowell (1897-1965), he asks for sounds produced from inside the piano such as hitting or plucking the strings. When Crumb asks for strings to be played inside the instrument, he is experimenting with various pedaling techniques. The pedaling in this work is very significant because the sound produced by pedaling is sustained throughout the piece.

George Crumb wrote "Performance Notes" to accompany his *Makrokosmos* and included them in the score. He categorized the special sound effects as follows: 1. Harmonics, 2. *Pizzicato*, 3. *Glissando* over the String, 4. *Glissando* on the string while playing partials, 5. Boxed Notes, 6. Muted Tone and Non-Muted Tone, 7. Various pedal usages indicated by the composer, 8. Rests.

#### 1. Harmonics (5<sup>th</sup> partial, 2<sup>nd</sup> partial)

*Celestial Mechanics* utilizes harmonics of 2<sup>nd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> partials. The precise nodal points can be indicated by affixing tiny slivers of tape to the strings. The finger(s) touching the nodes should come off the string(s) immediately after single harmonics or groups of harmonics are struck so that the harmonics ring more luminously.<sup>4</sup>

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<sup>4</sup>George Crumb, "Performances Notes" in *Celestial Mechanics (Makrokosmos IV), Cosmic Dances for Amplified Piano, Four Hands* (Peters ed., 1973). p.1.

In acoustical theory, a certain length of string creates a certain pitch on an instrument. The frequency can be expressed by vibrations per second. When that one string is divided into equal distances, a series of sounds is produced that is called the harmonic series. When one considers the given note A, the “A” vibrates at 440 vibrations per second. The second partial is one octave higher than the given note, “A2” and vibrates at 880 per second. The third partial is a fifth higher than the given note, “E2.” The fourth partial is twice the frequency of the second partial, so it is again “A3” but one octave higher than the second partial. In order to find the 5<sup>th</sup> partial of the string, one must divide the string into five equal lengths. Then one must find one fifth of the length from the key pin. That is where the sound of the 5<sup>th</sup> partial will be.

Crumb usually points out how the partial should sound. Crumb tries to indicate the sound of harmonic effects precisely. The strings are clearly marked by a piece of drafting tape. Each piece of tape is written with a pitch on the string. While it is not an exact replica of the partial, normally the human ear cannot distinguish and differentiate between sounds, even though one may be a few inches away from the source of the actual sound.

## 2. *Pizzicato*

*Celestial Mechanics* also requires *pizzicato*, a technique normally used by string players.

When *pizzicato* playing is indicated, the string should be plucked with the fingertip (f.t.), unless specifically marked “at end of string” (for a more nasal,

metallic timbre). Normal playing on the keyboard is indicated by the instruction “on key.”<sup>5</sup>

According to Crumb, when playing inside the piano, the intended special effects include differentiation of dynamics by using the fingernail or the fingertip.

### 3. *Glissandos* over the String

As with *pizzicato*, *glissando* is also a technique used by string players. Crumb indicates how a pianist should produce a *glissando* effect.

*Glissando* sound is to be played with the fingertip (f.t.), fingernail (f.n.) and the thumbnail or the end of a metal ruler. The strings may be strummed in the front of the dampers (i.e., between the front structural beam and the pins) or behind the dampers; the choice, depending on the considerations of timbre and ease of performance, is left to the discretion of the pianists. The precise duration and approximate range of the *glissando* is always given in the score.<sup>6</sup>

### 4. *Glissando* on the String while Playing Partial

In the beginning of the second movement, Crumb uses *glissando* on the string when a performer is playing a second partial. This is a similar effect to the harmonic *glissando* on string instruments. Since it is very hard to hear the difference when it is gliding, one must use strong and clear fingertips to make the best sound effect.

### 5. Boxed Notes

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<sup>5</sup>Ibid.

<sup>6</sup>Ibid.

Crumb creates a special “Box” in *Celestial Mechanics*. The composer specifies that all boxed notes are to be silently depressed.<sup>7</sup> Boxed notes appear in the score in the beginning of the piece. This indication appears with *sostenuto* pedaling. For example, the notes in the box are “a2” through “a1,” so the pianist presses all the notes in this octave. The left palm presses the eight white keys, and right palm presses black keys of “a#2,” “c#2,” “d#2,” “f#2,” “g#2,” “a#1.” Then the pianist silently presses the *sostenuto* pedal, and then depresses the notes with the palms on the keyboard. The *secondo* pianist holds this *sostenuto* pedal throughout the first movement. It creates an echo effect in stereo because a vibration is now created by holding the *sostenuto* pedal.

#### 6. Muted Tone (“+”) and Non- Muted Tone (“n”)

Muted tones (indicated by the symbol “+”) are used extensively in *Celestial Mechanics*. The string(s) should be muted (with firm pressure) at the very end (next to the bridge) in order to produce the maximum resonance and beauty of tone. Passages involving rapid alternation of muted and non-muted tone (as in *Alpha Centauri*) are precisely marked in the score and should be carefully observed. Crumb uses the term “on key” for non-muted tones (“n”), for example, in the first movement of *Alpha Centauri*, crumb precisely indicates the rapid alternation between muted and non-muted tones.<sup>8</sup> The effect of a non-muted tone is similar to the sound of percussion.

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<sup>7</sup>Ibid.

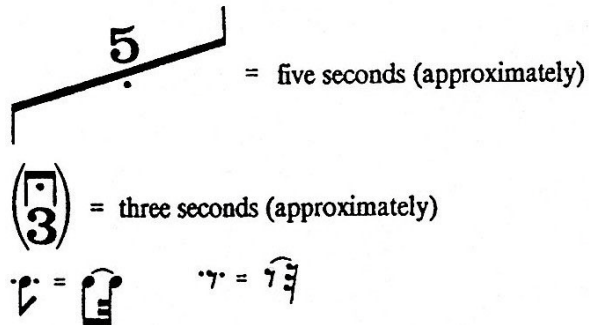
<sup>8</sup>Ibid.

Crumb uses the term “on key” for non–muted tones (“n”). A regular playing, for instance, in the first movement of *Alpha Centauri* movement of a (“n”) involves rapid alternations of muted and non-muted tones. The effect of a non-muted tone is similar to the sound of percussion.

## 7. Various Pedal Usages Indicated by the Composer

Crumb differentiates the use of various pedaling with markings PI, PII, and PIII. PI means right (or damper) pedal, PII indicates middle (or sostenuto) pedal, and PIII is for left (or una corda) pedal.

## 8. Rests



Crumb uses the mark SB to indicate striking the soundboard (through the circular opening in the metal frame) with the fingertips. The markings of CBI, CBII, and CBIII are for sound effects produced by using the metal crossbeams of the piano. CBI is the leftmost beam; CBII and CBIII are the next beams to the right.

Crumb uses a single line (instead of the usual five staff lines) to indicate that the performer will be playing some sounds that are percussive at rehearsal number 34. By adding a sign like CB III or IV and a couple of notes written below or above the



line with a diagonal line connecting those notes (at rehearsal number 36), Crumb asks the performers to make a new and different sound other than the regular keyboard sounds.

In his performance notes, Crumb made a list of these signs and abbreviated letters to explain his instructions. For example, at rehearsal number 36, the performers are instructed to play tremolos on top of the stainless steel ruler which are placed on the strings or to strike the top of the ruler.

One of the most striking features of the work is the use of amplified piano. The amplification of the piano is specifically called for by Crumb. In effect, this makes the amplification an extension of the piano as an instrument, and is essential to the effectiveness of the work's performance.

## CHAPTER IV

### ANALYTIC OVERVIEW

This chapter provides an introductory analytic overview of *Makrokosmos*. There are four distinctive movements, *Alpha Centauri*, *Beta Cygni*, *Gamma Draconis*, and *Delta Orionis* named after popular stars.

#### 1. *Alpha Centauri*

The first movement, titled *Alpha Centauri*, is named after the brightest star in the southern constellation and the fourth-brightest star in the night sky. The piece reflects the composer's response to the enormity and infinity of time and space. A strong single voice opens the piece in the middle register, and a rapid movement of notes connecting from the *primo* (first pianist) to the *secondo* (second pianist) is imitative in nature.<sup>9</sup>

Ex.1. *Makrokosmos IV* – I: page 6, beginning<sup>10</sup>

Handwritten musical score for the beginning of *Makrokosmos IV*, movement I. The score is for two pianists, Primo and Secondo. The Primo part starts with a 'Molto ritmico' tempo marking and a metronome indication of 60 for a half note and 180 for a quarter note. The music is in G major and 4/4 time. The Secondo part enters with a 'Pia. II sempre' marking. The score includes various dynamics like 'f', 'ffz', and 'fz'. There are also handwritten notes in parentheses: '(as in Pia. I!)' for the Primo part and '(with dignity and secure with Pia. II)' for the Secondo part. The score ends with a 'Pia. II sempre' marking and a 'fz' dynamic.

<sup>9</sup>Crumb's score clearly indicates *primo* for first pianist and *secondo* for second pianist in performance with a piano.

<sup>10</sup>Examples from *Makrokosmos IV* in this document will be represented by a Roman numeral indicating the volume number and movement number, following by the page number indicated with "p."

In the middle, the texture gets thicker by using cluster chords; the rhythmic intensity is increased by using triplet rhythms.

Ex.2. *Makrokosmos IV – I*: page 9, rehearsal 5, Chromatic Cluster Chords

The conversation gets intense as the piece progresses and the dynamic stays in *fortissimo* until a few measures before the end. The piece dies out gradually with fewer notes and less sound.

The techniques used in this movement are muted notes, scraping low register strings, and 5<sup>th</sup> partial harmonics. There are also various combinations of chords, such as 7<sup>th</sup> chords, minor 3rds, and minor 7ths (see Ex.1), as well as chromatic cluster chords (see Ex.2) and whole-tone/step chords (see Ex.8). The use of harmonics adds a different color to the sound. At rehearsal number 6, the first harmonic tones are presented. These 5<sup>th</sup> partial tones are 14 cents lower than the regular sound that a piano key produces. Normally it is not audible to people because it is difficult to



### 3. *Gamma Draconis*

If the first movement (*Alpha Centauri*) and second movement (*Beta Cygni*) are about the peacefulness and brightness of space and stars, this movement (*Gamma Draconis*) is like a storm in that peaceful space. In the beginning of the movement, the performers have to place three stainless steel rulers with cork stripping on one side inside the piano, two that are 12 inches long and one that is 15 inches long.

These must be placed exactly on top of the strings. When the rulers drop onto a vibrating string, it makes a rusty sound. Sudden dynamic changes from *pianissimo* to *forte* create a surprise attack on the listeners.

Ex.4. *Makrokosmos IV – III*: page 20, beginning

**Gamma Draconis**

*Molto ritmico, meccanicamente* [♩ = 100]

**Primo**

*(Ped. I sempre)*

*Drop a 12-inch metal ruler onto strings (cork stripping down)!*

*Drop a 15-inch metal ruler onto strings (cork stripping down)!*

*gliss. over strings (ftr.)*

*on keys*

*touch 5th partial modes*

**Secondo**

*pp*

*mp*

*f*

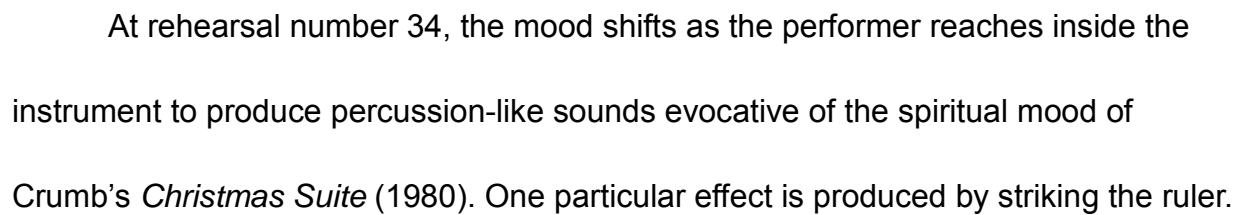
*molto*

*f*

*4*

The muted metal sound is similar to the sound created when putting papers on the strings. However, a metal ruler makes a warmer and deeper sound than paper. Dramatic changes in sound intensify the mood of the piece. The actual storm hits when the piece reaches the at rehearsal number 27. Fast rhythms and loud dynamics wipe

Ex.5. *Makrokosmos* IV – III: page 22, rehearsal 27



**34** Poco languido [ $\text{♩} = 50$ ]  
(with Knuckles)

CB IV

(aim.)

CB III

on Keys (legatissimo)

(with Knuckles)

CB II

(aim.)

(on Keys)

(not heard)

Pad. III (soprano)

strike strings (mxt., f.t.)

(150) (140)  
(touch notes for  
5th. part. harm.)

17



Ex.7. *Makrokosmos* IV – III: page 9, rehearsal 42

4. *Delta Orionis*

After removing the rulers, we are back to the sounds that were introduced earlier. Particularly special in this piece is the composer's fascination with the decay of the sound. At the beginning, the *secondo* presses given notes silently and then *primo* rapidly makes a *glissando* on the string. As the string sound fades out, the *secondo* has to release notes a particular rhythmic pattern and that pattern is immediately introduced on the keyboard. The rhythmic pattern goes back and forth between the two performers.

Ex.8. *Makrokosmos* IV – IV: page 30, beginning

handed piece. Crumb gave a special title to the section, beginning at rehearsal number 49- *Cosmic Canons*. This ending is meant to symbolize the four stars in our constellation.

Ex.9. *Makrokosmos* IV – IV: page 34, rehearsal 49

49 *Adagio molto* [d. = 40] ("Cosmic Canons")  
SB strike-soundboard with fingerings

I

II

III (page turned)

flang. G hand

on kaga (rit. - - - -)

gently stroke strings with palm

CB I strike with knuckles

See note on page 10



## CHAPTER V

### PERFORMER'S GUIDE

#### 1. *Alpha Centauri*

Before the *primo* starts to play, the *secondo* needs to press the block of chords that approximately covers the indicated notes within the box while using the *sostenuto* pedal. The *secondo* presses the pedal until the end of the piece. When the *primo* plays on the keyboard, it sounds like the damper pedal is being used. At the end of the first system, the *secondo* comes in playing notes, muted with the fingertips on the string. The long arrow indicates the exact places for both performers to come together. Eye contact and body movement must be coordinated and synchronized between both performers. At rehearsal number 1, there is a black block with sharp and flat signs next to it. The block indicates an approximate place for the performer to strike the strings with the palm of the hand. Additionally, there is specific indication for usage of the damper pedal for the *primo*.

On page 7, at rehearsal number 2 toward end of the upper system, the *secondo* has another black block sign with grace notes and a *tremolo* sign within. This means the performer will use fingernails to scrape the string in a fast motion like playing a grace note. The *tremolo* sign indicates a strumming of the strings.

Ex.10: *Makrokosmos IV* – I: page 7, rehearsal 2

Handwritten notes in the score include: "(grace notes always together)" and "scrape metal winding of strings (a cluster - f.m.); a single rapid stroke".

On page 8, in the *primo* part, when he/she plays the quintuplet of 32<sup>nd</sup> notes, the performer needs to know that the grace notes are regular notes while the 32<sup>nd</sup> notes are muted. Unless it is indicated with (“+”) sign, notes are played on the keys without sound quality changes.

Ex.11: *Makrokosmos IV* - I: page 8, rehearsal 3

Handwritten notes in the score include: "(muted string, v.m.)" and "(Ped. II tempo)".

On page 9, the cluster chords are played on the keys but at the same time the

Ex.12: *Makrokosmos* IV - I: page 9, rehearsal 5

22

## 2. *Beta Cygni*

The peaceful and tranquil mood is evocative of this movement the grandeur of the night sky and gives the effect of a slow movement in context of the entire movement. The extreme difference in dynamics expresses the brightness of the many stars. On page 15, the *primo* starts the piece by striking the soundboard with their fingertips and by pressing the damper pedal “violently.” The soundboard sound is like a grace note to the vibration of the damper pedal. After allowing the sound to resonate for five seconds, the *secondo* enters with a three-note chord. This sound starts with the 5<sup>th</sup> partial of the actual note; by gliding the fingers toward the center of the string, the sound falls off from the given pitch.

Ex.13: *Makrokosmos* IV - II: page 15, beginning

slowly; fantastically; quasi improvvisando

ff [♩ = 60]  
stroke soundboard with firm stroke

Depress Ped. I violently, so that all strings vibrate! (Ped. I someone -)

5 (actual sound) (gliss.) (sliso.)

(on keys)

CBII (stroke with firm stroke) ff

stroke strings gently with palm

touch makes for 2nd partial harmonic

sim.

touch 5th partial notes for the first note; then gradually slide fingers down strings (towards center of strings), thus producing a falling off of pitch over the figure.

Then, the *secondo* strikes the second crossbeam with the knuckles as a grace note follows, produced by gently striking the lower strings with the palm. Again, five seconds later the *primo* enters with the *secondo* by pressing the 2<sup>nd</sup> partial harmonic

notes (specific notes are written out) that will be played by the *secondo*.

On pages 16, a few notes are still held by both performers to produce the 2<sup>nd</sup> partial harmonic sound. As the *secondo* plays trills on given harmonic notes with the right hand, he/she will lift the fingers off of the string on grace notes so that the fundamental pitch momentarily emerges; then the 2<sup>nd</sup> and 4<sup>th</sup> fingers slide along the given strings to produce a rising-falling *glissando* of various partials (see Ex.3).

On page 16, at rehearsal number 15, the *secondo* plucks the strings with the fingertips while holding the 2<sup>nd</sup> partial of the strings, and the *primo* plays both on the keyboard and *pizzicato*. In the second system, the *primo* will hold the string close to the pin to mute the string and produce percussion-like sounds. The rest of the movement is treated in the same fashion.

At the end of movement, on page 19, the sound should resonate for seven to ten second, after which Crumb indicates to move into the 3<sup>rd</sup> movement right away.

Ex.14: *Makrokosmos IV - II*: page 19, rehearsal 20



The *primo* presses the damper pedal throughout the entire movement. The *secondo* starts the piece by playing *glissando* over the low strings and drops the 12-inch metal ruler onto the strings. The performer must ensure that the cork stripping is faced down on the strings. The *Primo* has similar notations to follow the *secondo* with a 12-inch ruler and 15-inch ruler. The approximate places are indicated on the music.

On page 27, at rehearsal number 36, on the first system, there are blocked notations for *secondo*. Here the *secondo* will strike his/her ruler with the fingertips simultaneously; the *primo* will play a trill on the top of his/her ruler from bottom to top as indicated in the directions.

[illegible]

25

piece, the page turner and the *secondo* will remove the rulers by pulling off from the string to make a *glissando*. Both performers will hold the pedal as the sound decays and will wait for a few seconds before moving on to the last piece.

#### 4. *Delta Orionis*

On page 30, the *primo* has specific indications to use the damper pedal. The *Secondo* has a group of notes that are indicated in the box at the beginning of the piece. He/she will press these keys silently, while the *primo* plays a rapid *glissando* on the strings with their thumbnails. It will then remove the fingers in a given rhythm in 5' intervals.

Ex.16: *Makrokosmos IV* - IV: page 30, beginning

On page 32, at rehearsal number 47, the *primo* plays black keys and white keys with his/her forearm, and the *secondo* plays *glissando* on lower strings. The notes in the box are to be silently pressed while the *primo* is playing.

Ex.17: *Makrokosmos* IV - IV: page 32, rehearsal 47

Crumb's reference to compositional techniques of the Baroque period appears in *Cosmic Canons*<sup>11</sup> from at rehearsal number 49 through the end of the piece. At this point, Crumb indicates the piece is officially for six hands. The *Primo* plays on the keys while striking the soundboard with the fingertips, the *secondo* plays on the keys while striking the cross beam with the knuckles, and the page turner plays harmonic notes with *glissando* along with striking the first cross beam with their knuckles. Specific rhythmic structure and dynamics are given.

At rehearsal number 52, the *second's* lower-note sounds end the piece first, but his/her crossbeam sounds still continue with the upper notes. Then, at rehearsal number 53, the upper notes of the *secondo* end followed by the crossbeam sounds of

<sup>11</sup>Crumb himself wrote *Cosmic Canons* on the score.



the page tuner. The final sounds of the piece are comprised of the soundboard and the keyboard sounds of the *primo*, the crossbeam sounds of the *secondo*, and lastly, the keyboard sounds produced by the page tuner.

Ex.18: *Makrokosmos* IV - IV: page 35, rehearsal 53

Handwritten musical score for rehearsal 53 of *Makrokosmos* IV - IV, page 35. The score is for three staves labeled I, II, and III, with a 'Trans. Channel' label on the left. Staff I is for the 'primo' (keyboard), Staff II is for the 'secondo' (crossbeam), and Staff III is for the 'page tuner' (keyboard). The score includes various musical notations such as notes, rests, and dynamic markings like 'pppp' and 'ppppp'. There are also performance instructions in parentheses, such as '(Mod. I asmpare)', '(Mod. II asmpare)', and '(Mod. III asmpare)'. The rehearsal mark '53' is in a box at the top left. The score ends with a 'Fine' marking and a signature 'S. 1911'.

## CHAPTER VI

### CONCLUSION

According to Crumb's program notes, his *Makrokosmos* is meant to be a hybrid of piano and orchestral sound. Crumb devised a list of signs and abbreviated letters to explain his specific instructions to the performers. The pianists who plan to perform *Makrokosmos* need to study Crumb's notations carefully in order to faithfully realize the composer's intentions.

This dissertation has examined the various sonorities which Crumb has devised, and the result is quite exceptional within non-traditional composition. Crumb uses amplification, harmonics, preparation of the piano, and playing inside the piano on the strings. Further, he gives the page turner a substantial role in the performance by calling for six hands at one point in the piece (see at rehearsal numbers 42, and 49 through 53).

At the same time, Crumb blends his less traditional approaches to sound with more traditional compositional ideas and structures; for example, the composer's idea of using the inside of the instrument to produce specific sound effects differs from the prepared piano of John Cage. For instance, Cage requires additional devices such as nails, pins, and extra tools to produce sound. Crumb, however, uses a piano without any extra tools.

By investigating and clarifying some of Crumb's intentions, this dissertation hopes to render this amazing piece more accessible to pianists in search of new and

wonderful repertoire for piano four-hands. Crumb's new and innovative thoughts advance the technique of playing the piano. Therefore, it is hoped that future composers will be inspired by Crumb's innovations and imaginative ideas.

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