DIFFERENT APPROACHES TO PIANO WITH ELECTRONICS USING FOUR CASE STUDIES

by

PENG-CHIAN CHEN

(Under the Direction of Evgeny Rivkin, Peter Van Zandt Lane)

ABSTRACT

This is the accompanying document for a CD recording. This study will analyze the compositional techniques in four contemporary works that pair the piano with electronic devices and provide practical suggestions for both pianists and composers.

The four pieces, chronologically by date of composition, are:

1. Pierre Charvet's *Neuf Études aux deux mondes* for piano and computer, 1999.

2. Elainie Lillios's *Nostalgic Visions* for piano and live interactive electroacoustics, 2009.

3. Peter Van Zandt Lane's *Studies in Momentum* for piano and live electronics, 2014.

4. Cindy Cox's *Études*"I. La Ciguena for piano and keyboard sampler" and "II. Mallets for keyboard sampler,*" 2014.*

These works are chosen as examples of the use of three distinct types of technology: fixed media, interactive technology, and keyboard sampler. Also, they contain the use of contemporary pianistic techniques: extended piano, improvisation, and switching keyboards. This project will be a helpful introduction for pianists and educators who are interested in playing or teaching electro-acoustic music.

INDEX WORDS: electro-acoustic music, extended piano, fixed media, interactive electronics, keyboard sampler

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INTRODUCTION

There is a growing repertoire for solo piano music that requires the use of electronic devices for performance. For pianists who are interested in broadening their repertoire to include contemporary literature, engaging electroacoustic music poses and additional set of challenges. The purpose of this study is to survey four pieces for piano and electronics which contrast their use of technology, compositional style, and performance practice include recording. Moreover, I will develop practical suggestion for both pianists and composers.

The repertoire examined with their pianistic and technological approaches includes (listed by chronological composition time):

1. Pierre Charvet's *Neuf Études aux deux mondes* for piano and computer, 1999. This set is notated in traditional notation with fixed media.

2. Elainie Lillios's *Nostalgic Visions* for piano and live interactive electroacoustics, 2009. This work is notated in a non-traditional way requiring the pianist to use extended techniques and improvisation with interactive electronics.

3. Peter Van Zandt Lane's *Studies in Momentum* for piano and live electronics, 2014. This composition is notated in a traditional way with interactive electronics and fixed media.

4. Cindy Cox's *Études*"I. La Ciguena for piano and keyboard sampler" and "II. Mallets for keyboard sampler," 2014. The first Études requires a traditional piano and a 61-key velocity sensitive sampler keyboard with interactive electronics. The second Études requires an 88-key velocity sensitive sampler keyboard with interactive electronics.

These works were chosen as examples of three distinct types of technology: fixed media, interactive technology, and keyboard sampler. Also, they contain examples of contemporary pianistic techniques: extended piano, improvisation, and switching keyboards.

In my experience, it is hard for the academically trained pianist to engage with electro-acoustic music. There are at least three reasons for this difficulty. First, the technology changes so fast that few pianists have specialized skills in electro-acoustic music. Second, scheduling issues are challenging because a pianist needs to find a music-trained engineer to set up all the equipment for the rehearsal and to check the balance between the piano's sound and the electroacoustics for the performance. Third, it is difficult to find the space and means necessary to play this music. For example, the performer may need to find a piano upon which he/she can play extended techniques and have enough amplification for the electronic components.

Therefore, this project may serve as an introduction for pianists and educators who are interested in playing or teaching electro-acoustic music in order to have the basic concepts of how to prepare for and practice it. This project also serves as a guide to what kind of style performers would prefer: either fixed media or interactive electronics. On the other hand, it will benefit composers who are interested in working with performers on interactive devices, because they will understand how to assist the performer and determine what is, or is not, a practical innovation for a performance. As a performance-based scholar, it is my duty to contribute to the field with detailed guidelines that incorporate these questions in a clear and well-defined way.

PIERRE CHARVET

NEUF ÉTUDESAUX DEUX MONDES FOR PIANO AND COMPUTER

(*NINE STUDIES TO BOTH WORLDS*), 1999

From the program notes on his website, Charvet says that he wrote these pieces: "with the aim of integrating instrumental music with the natural tools of my time and finding the right balance between a formal approach and an intuitive attitude. These Nine Études have a relatively symmetrical architecture around Études 5, in unison. Études 1, with repeated notes, refers to Études 9. Études 2 presents a melodic and harmonic material found in Études 8. Études3 and 7 are constructed on different sound spectra. Finally, Études 4 and Études 8 use the same harmonic material." [1] These nine piano Études are a commission from GRM, the Groupe de Recherches Musicales founded by Pierre Schaeffer. Charvert was inspired to dedicate the set to Michael Abramovich after hearing him perform J.S. Bach's *Goldberg Variations.*

Charvert's *Neuf Études aux deux mondes* for piano and computer is notated in traditional notation with fixed media. Fixed media (which encompasses tapes, compact discs, or computer files) consists of pre-recorded synthesized sound (*elektronische Musik),* recorded sound (*Musique Concrete),* or both. The "tape" or fixed media approach creates a conclusive performance, with the electronic sounds remaining the "same" performance every time. Interactive electronics is more difficult to work with but provides more flexibility and freedom in performance. On the performer's side, working with fixed media is not as complicated as employing an interactive

[1] Pierre Charvet, "Nine Studies in Both Worlds," *Pierre Charvet* website, http://www.pierre-charvet.com/musique/ (accessed March 1, 2019)

device; most of the time, it only requires amplifiers during performances. Jeffery Hass states, "A fixed media piece with click track makes it easier for the performer."[2] Moreover, it is easier to practice with fixed media than interactive electronics because the ensemble remains the same creating a solid and stable backdrop to the practice, almost like working with a metronome.

Playing with a steady tempo could be difficult for pianists using fixed media, as it works against the performer's natural inclination to use tempo rubato. In much of the solo piano repertoire, pianists have the freedom to express themselves with the flexibility of making space of the time, playing with deeply emotional feeling. Playing with a fixed media restricts our habit of using rubato for delivering expression. It is like a solo pianist playing a concerto with an orchestra. When a full orchestra is accompanying a soloist, the soloist must maintain a steady rhythm. On the other hand, there is still the freedom for the soloist to slightly alter the tempo when the orchestra is playing long notes or is silent. Therefore, keeping the rhythm stable will be a topic of pedagogical discussion when considering Pierre Charvet's *Neuf Études aux deux mondes* for piano and computer.

From the composer's standpoint, having all the electronic sounds on fixed media has some advantages, such as having plenty of time to work on the complexity of the electronic parts (layers, mix, space, articulations, etc.) and less advanced technology requirements. The main challenge of fixed media is to make the audience feel the cohesiveness of the piano and the electronics. The sound quality and the level of the amplifiers (speakers) play an important role, so it is helpful to have a sound engineer to mix in real time during performance.

Shiau-uen Ding categorizes four distinct synchronization rhythmic interaction types of music for fixed media with piano, from loosely to tightly synchronous: 1. independent with

[2] E-mail with composer Jeffrey Hass on April 4, 2018.

sectional synchronization, 2. free rhythm with relative synchronization, 3. free time within strict synchronization, and 4. steady strict rhythmic relationship.[3] These can be used to categorize Charvet's études.

Independent with Sectional Synchronization. The piano and fixed media do not have close rhythmic interaction, but rather are independent from each other.[4] There is no Études composed in this set.

Free rhythm with relative synchronization. The rhythmic relationship between the piano and fixed media is closer, even though the timing and rhythm of each part is free, and it may be without a constant pulse.[5] Charvet's "Études 5" shows this type of rhythmic interaction. It is like chamber music, in that both the live music (piano) and the fixed media are of the same importance. The form of the piece is A-B-A'; both A and A' are played on only piano while the B section has fixed media accompanied by piano. The composer writes the instruction on the score: "Attack measure 31 just at the end of the crescendo of the electronics and repeat measure 30 if in advance."[6] It illustrates that pianists have to listen carefully to the fixed media and react with it to finish

[3] Shiau-uen Ding, "Sitting at the Piano, Cradled by Speakers: Developing a Rhythmic Performance Practice in Music for Piano and "Tape"." Doctor of Music Thesis. University of Cincinnati, 2007. https://etd.ohiolink.edu/

[4] Ding, "Sitting at the Piano, Cradled by Speakers," 5.

[5] Ding, "Sitting at the Piano, Cradled by Speakers," 15.

[6] Pierre Charvet, *Neuf Etudes aux deux mondes, pour piano et dispositive informatique* (Paris, French: Inédit, 2000), 7.

together while at the end the assistant needs to click the fixed media on time to synchronize with the last piano note.

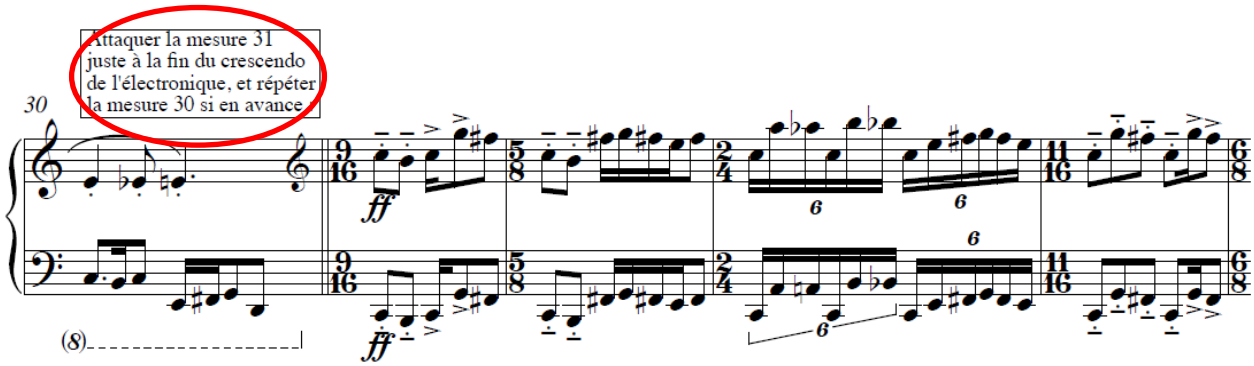

Figure 1: Pierre Charvet, "Études 5," (from *Neuf Études*), mm. 30-34

Free time within strict synchronization: In this style, the pianist is required to remain synchronized with the tape through stretches of relatively unmeasured time. The precise timing in seconds is indicated in the score. In Études 7, there are only three phrases, indicated by the commas. The piano part and the fixed media don't play at the same time but are strung smoothly together. In the piano pulse, the fixed media comprises a long sustained acoustic: connecting the volume between each sound is good inner hearing training for the pianist.

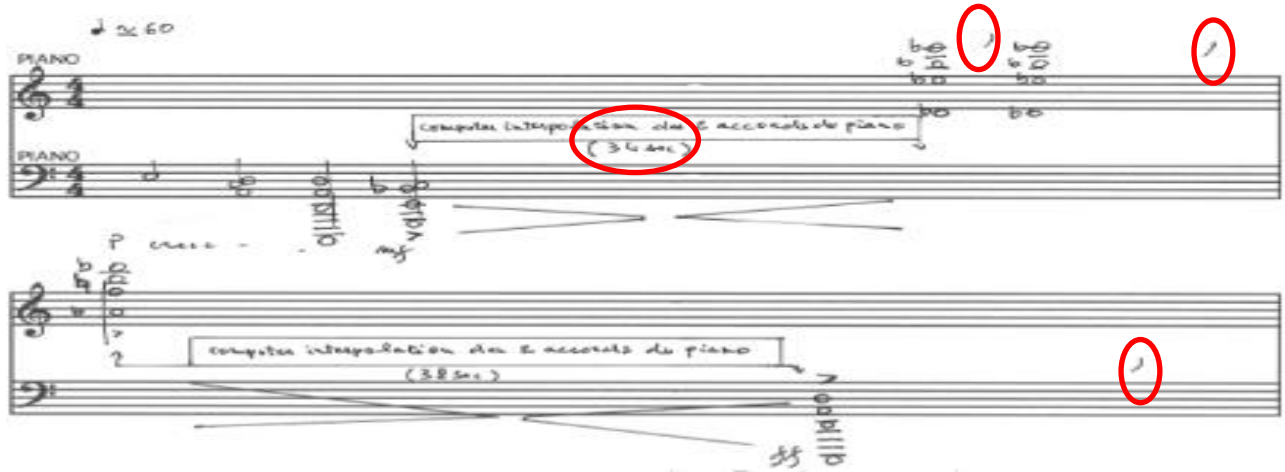

Figure 2: Pierre Charvet, Études 7, (from *Neuf Études*), beginning[7]

[7] Charvet, *Neuf Etudes aux deux mondes, pour piano et dispositive informatique*, 12.

Études 2, 8 and Études 4, 6 are other examples of free time within strict synchronization. The piano and fixed media start and end at the same time. In the fixed media, pianists can hear the harmony change, but it is difficult to detect the rhythm. As a result, the composer provides the soundtrack with a metronome click so the pianist can easily follow the beat. Once the pianist gets used to the pace of the music, he or she does not need to use the click anymore. For practice purposes, Charvet provides a click on the soundtrack. The click assists a pianist not only in playing the tempo precisely, but also in listening for the harmony changing on time.

While Études 3 is for solo piano, Études 1 and Études 9 are composed in the **steady strict rhythmic relationship style**. The fixed media acts as the role of metronome, providing the steady rhythm of the sixteenth-note tremolo as the beat. The picture below is the sound wave of Études 9 measures 1-8. We can see that the spaces between each wave trough have the same length.

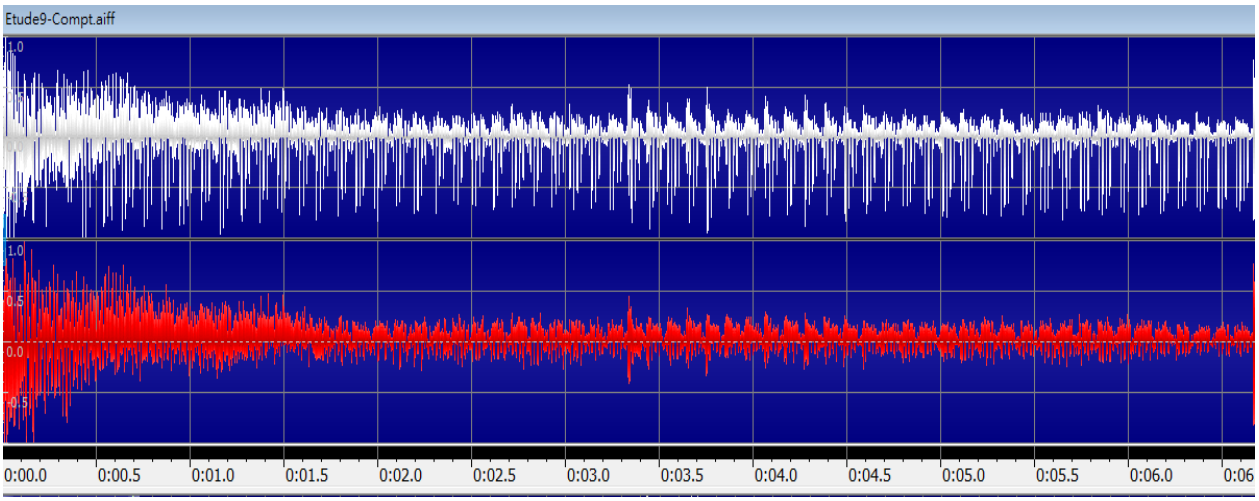

Figure 3: Soundwave from Pierre Charvet "Études 9," mm. 1-2

Neuf Études aux deux mondes combines the world of live music (piano part) with the world of unchangeable music (fixed media). The sonority from the fixed media includes not only synthesized acoustics, but also sounds from real life: cell phones ringing, women's speech, and children's laughter. In some parts of the études, the fixed media is even louder than the piano,

while there are some virtuosi techniques on the piano. Therefore, we can see piano and fixed media as the two main instruments. The balance between them is more like chamber music instead of the piano dominating the texture.

ELAINIE LILLIOS

NOSTALGIC VISIONS FOR PIANO AND LIVE INTERACTIVE ELECTROACOUSTICS, 2009

"*Nostalgic Visions* is inspired by a stanza of "Balada de la Placeta" ("Ballad of the Little Square") from *Libro de Poemas* by Federico Garcia-Lorca. Lorca's text expresses the longing felt by one seeking a return to the innocence of youth. The poem's dual time streams, the reality of present day and visions of the past, are expressed musically by the pianist, who alternates between playing on the keys and inside the piano. At times present and past are clearly divided; other times the lines between them blur and reminiscence becomes a hopeful yet impossible reality. *Nostalgic Visions* was commissioned by and is dedicated to pianist Thomas Rosenkranz."[8] *Nostalgic Visions* requires the pianist to use his/her imagination and enthusiasm to create his/her own intimate, personal version of the piece. According to the notes to the performer, improvisation plays a large role, allowing the pianist to explore his/her own musical ideas and memories through performance. Certain notations in the score are approximate; the instrumentalist should use his/her judgment when sculpting the temporal form of the piece.[9] There are no bar lines for the music, and the patterns are only indicated to finish in the duration of timing. Lillios also quotes the Spanish folk song "*Nana de Seilla*," which she specifically wrote down. It is nostalgic, reflective with melancholy in the score to reinforce the piece's nostalgic essence. The other modern approach in

[8] Elainie Lillios, *Nostalgic Visions* for piano and live interactive electroacoustics (Bowling Green, Ohio: Theodore Front, 2017), front page.

[9] Lillios, *Nostalgic Visions* for piano and live interactive electroacoustics, front page.

piano technique is that the pianist shifts between the keyboard and the inner strings to reflect reality and memory. Moreover, the score provides all the details for mood in every second, asking the performer to read the score carefully and deliver the emotions through the sounds.

Nostalgic Visions uses the concept of chance music, which allows the performer to make his/her own determination of notes and rhythms. Hence, if the piece were composed with fixed media, there would be a limitation for the performer to improvise due to the limitation of timing. On the other hand, the interactive electronics gives free rein to the performer's imagination. In the score, Lillios draws varied shapes to demonstrate distinguishable electroacoustics. You can see them in the next page: 1. Swirl: sounds like the echo of the piano. 2. Electrocardiogram: a single whistle acoustic, in which the pitch follows the shape of the line. 3. Dot: drier, percussive acoustic. 4.Jellyfish: bouncing on the wood. 5. Density swirl: intense echoing acoustic. 6. Plenty of glass marbles in different sizes: the sound reflects the dropping of rain. 7. Bubble: it sounds like the bubbles are gradually getting bigger and then bursting.

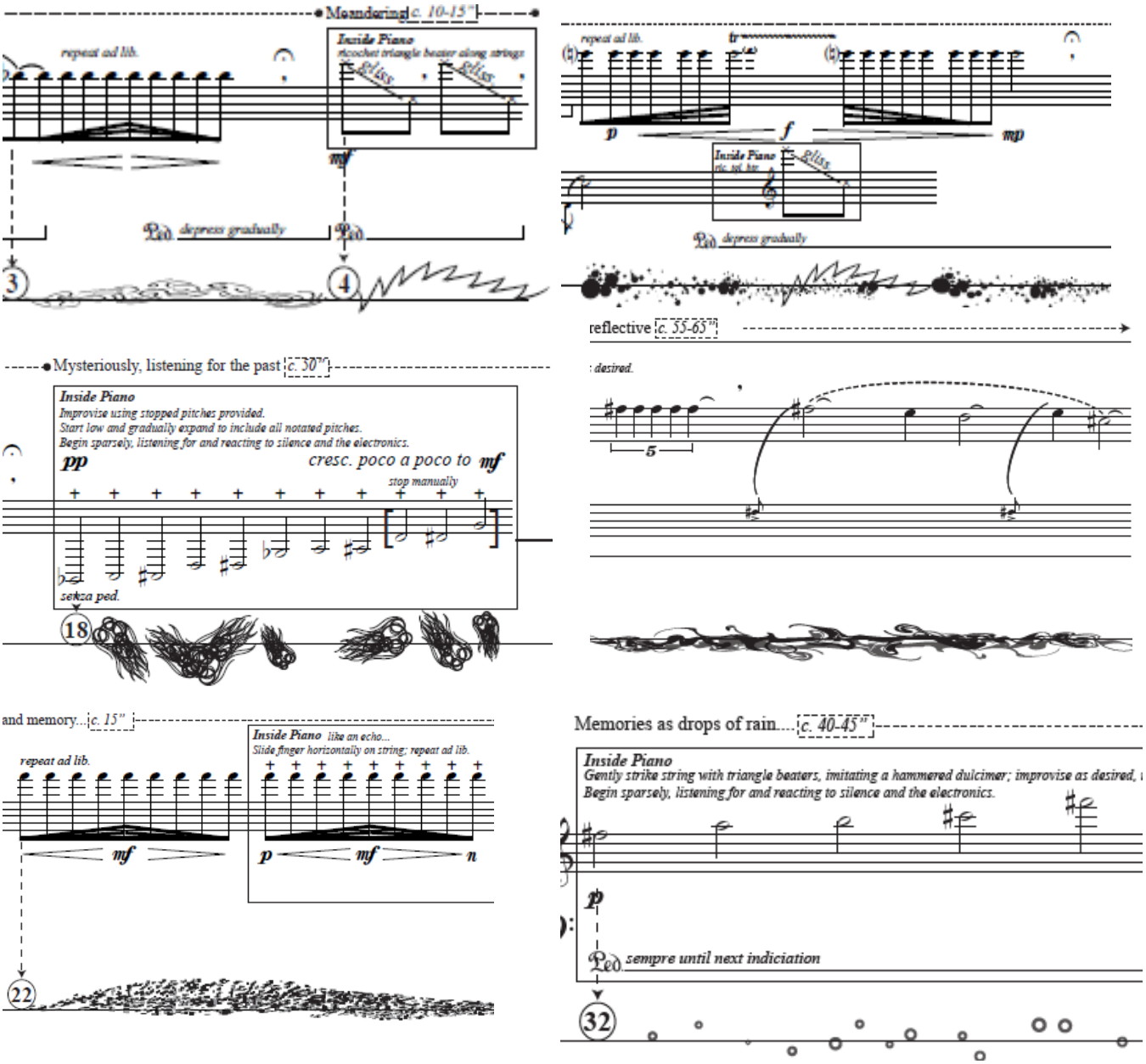

Figure 4: Shapes 1-7 of distinguishable electroacoustics[10]

[10] Lillios, *Nostalgic Visions* for piano and live interactive electroacoustics, 1-6.

This piece touches the Achilles heel of many classical pianists: improvisation. The piece opens with improvising inside the piano expressing a curious feeling for twenty seconds. How does the performer design the improvisation? The dialogue box in the score indicates the upcoming rhythmic figures, the elements to use for improvising. The performer must study the piece and find out the different types of elements, including rhythm, melody, clusters, and so on. After the pianist absorbs them he/she can arrange them into new materials. Therefore, for the twenty seconds, with curiosity, the performer can use rhythmic patterns from slow to fast or fast to slow by hitting the same metal frame because later there are many patterns playing on the same notes gradually speeding up or slowing down. The next significant improvisational part is at number 18 where the mood is "Mysteriously, listening for the past" for fifty seconds. In the box is written: "Begin sparsely, listening for and reacting to silence and the electronics."[11] This is the place that requires listening more for the silence. The Spanish folk song "*Nana de Seilla"* appears at number 20 with the description: "pluck strings, improvise as desired."[12] The melody can be embellished by several kinds of ornaments: turns, trills, mordents, appoggiaturas, glissandos. At the place where memories are compared to drops of rain, the music indicates: "use individual motives provided or create your own."[13] Since it is improvisatory, there are no rules given to make personal motives. However, as motives, they should be several small segments joined together instead of one long phrase. The next instruction box indicates "evolve into extended cadenza/climax passage; use entire keyboard to illustrate frustration and agitation."[14] After the climax, two options are given: one is to end with a strong event or cluster and the other is to dissipate, as if running out of steam and unable to go

[11] Lillios, *Nostalgic Visions* for piano and live interactive electroacoustic, 2.

[12] Lillios, *Nostalgic Visions* for piano and live interactive electroacoustics, 3.

[13] Lillios, *Nostalgic Visions* for piano and live interactive electroacoustics, 5.

[14] Lillios, *Nostalgic Visions* for piano and live interactive electroacoustics, 5.

further. The music ends with the folk-tune "*Nana de Seilla."* Compared with its first appearance, it should have even more embellishments and harmonics. I would suggest using the given melody just as a reference, allowing the performer to create his/her own folk-tune.

Nostalgic Visions is a very personalized piece. Because it employs chance music, each performer will play his/her unique version without it being written out. The same performer, because of his or her mindset at the time and because of varied conditions, would play it differently each time. It proves one concept of music: music is the art of the time, in which the sound will disappear after the moment when the performer stops playing. The only way to preserve the sound is to make a recording of it. Accordingly, interactive electronics allow for this approach, when fixed media does not. In contrast, composers who do not use chance music write a detailed score including notation about mood, pedaling, musical terms, even interpretation. *Nostalgic Visions* reflects the concept that notation is limited, but human emotion is unlimited.

PETER VAN ZANDT LANE

STUDIES IN MOMENTUM FOR PIANO AND LIVE ELECTRONICS, 2014

Peter Van Zandt Lane's *Studies in Momentum* for piano and live electronics is notated in a traditional way with the interactive electronics combined with fixed media, which the composer dedicates to Keith Kirchoff. The composer asks the performer to play the five Étudesas a set with relatively little space between each movement. Compared to fixed media, the interactive electronics provide pianists more opportunity to interpret the pieces as traditional solo piano repertoire. Accordingly, the piano dominates the piece because if there is no piano sound created, there won't be any electroacoustic sounds.

In his program notes, the composer writes, "*Studies in Momentum* is a cycle of five miniatures for piano and live electronics. The piece is modeled as four Étudesand a fantasy, with the focus of each étude being a single kind of signal process: harmonization, downsampling, ring modulation, and delay (respectively). The closing fantasy, *approaching entropy,* combines the four while also including a kind of hyper-rhythmic *musique concréte* element that the composer often employs in his electroacoustic works.

The titles (which were each chosen before any of the music was composed) – ground state; projectile motion; escape velocity; Planck's waltz, and approaching entropy – give each étude's narrative a particular challenge, or sense of tension between where the music is going and how it gets there. These concepts – borrowed concepts from quantum mechanics and kinematics – are areas in which I have absolutely no authority (which is probably what makes them inspiring to me). But like many of my fellow composers, I find layperson-geared explanations of physics

highly evocative, sparking exciting ideas about relationships between musical narrative and motion in the physical world."[15]

The first piece *ground state* (*étude on harmonization),* is notated in two different versions: the first version shows the grouping of the harmonization and rhythm pattern while the second version is simpler and more direct for a performer to read.

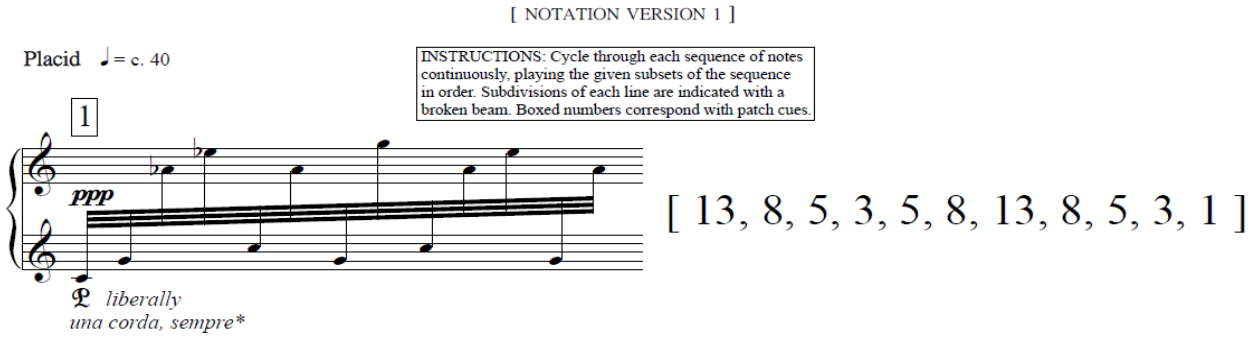

Figure 5: Peter Lane, "ground state" Version 1 (from *Studies in Momentum*), mm. 1[16]

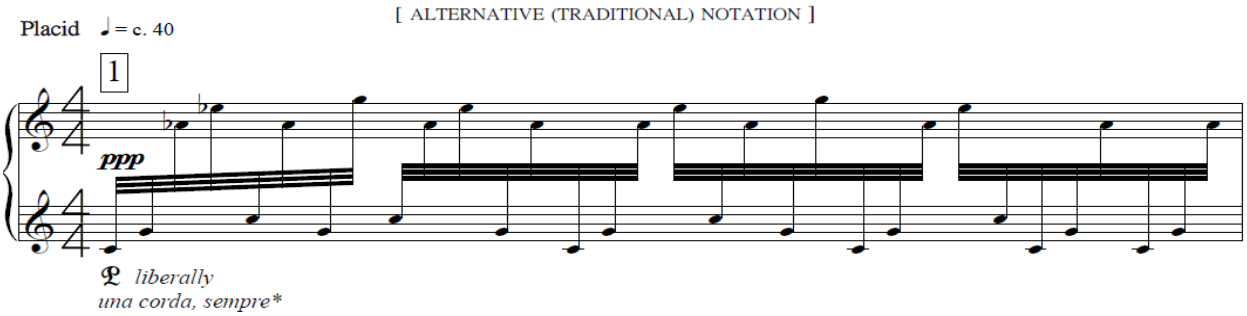

Figure 6: Peter Lane, "ground state" Version 2 (from *Studies in Momentum*), mm. 1[17]

While "ground state" is a practice in harmony for the composer, for the pianist it requires extremely even fingers to create a smooth, placid effect: no accents or missing notes. According to the composer, the piece is influenced by minimalism so the performer should not put too much

[15] Peter Van Zandt Lane, *Studies in Momentum for piano and live electronics* (2014), front page.

[16] Lane, *Studies in Momentum for piano and live electronics*, 1.

[17] Lane, *Studies in Momentum for piano and live electronics*, 19.

emotional feeling in the phrasing but let the music flow itself. From the pedagogical standpoint, the fingers should stick on the keyboard with strengthened fingers to make a crystal color. In traditional notation, Lane indicates that beginning from box 6 the pedal should be slightly interruptive in every number pattern and hold the last note longer for resonance.

Contrasting with the first piece "ground state," "projectile motion" (*é*tude on downsampling) is an excited, animated short piece. The phenomenon of electroacoustics in this piece can be heard as dropping pitch. For the pianist, the challenge of the piece is the fast-repeated notes, and the rhythm is four (sixteenth notes) against three (triplets). For the repeating sixteenth notes, I would suggest the fingering should be 4-3-2-1 and triplet repeating notes on 3-2-1. One challenge for a pianist is the wide contrast in dynamics from *ppp* to *fffff*. The gradual crescendo and diminuendo need to be well planned. Another important element in the piece is the rests. They are the impulses for the new starts, which the performer should count precisely, waiting for enough time.

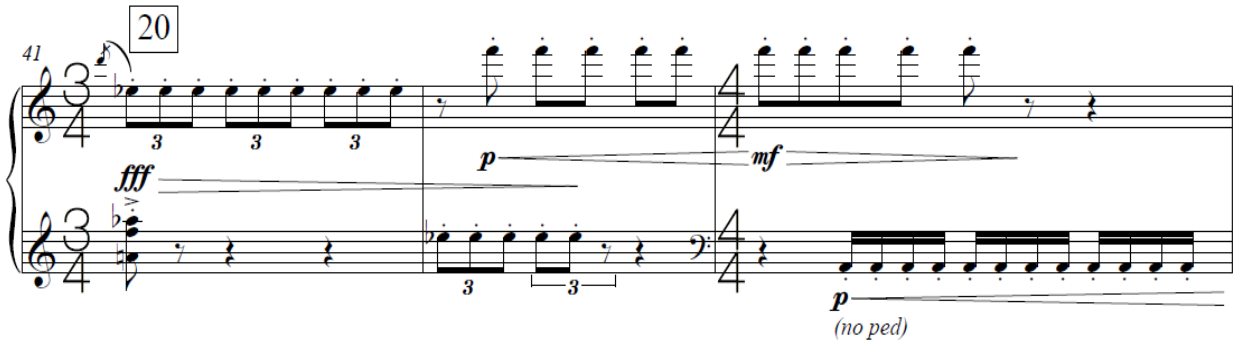

Figure 7: Peter Lane, "projectile motion" (from *Studies in Momentum*), mm. 41-43[18]

The third Études "escape velocity," (*é*tude on ring modulation), uses the mirror effect on the piano part: the line in the right hand converts into the line in the left hand. The most virtuosic passage in the entire set starts from measure 76 when the two hands play notes separated by a

[18] Lane, *Studies in Momentum for piano and live electronics*, 5.

thirty-second note value. This is especially difficult since the piece is fast, the arms are opening for the broader range of notes, and the two hands are playing separately instead of synchronized together. The climax of the piece is at measure 88 when the right hand plays C8 while left hand plays A1, covering the entire keyboard. I would suggest tapping the fingers on a desk (instead of practicing on the keyboard) to listen carefully for independence and strength in all ten fingers. Because the two lines on the two hands are sharing the same intervals in opposite directions, these two lines correspond with the hands' shape on the same finger numbers. Lastly, if the patch is to be changed by an assistant, the pianist needs to give a clear cue.

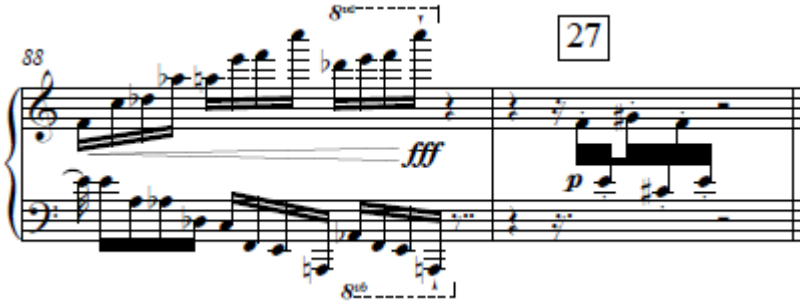

Figure 8: Peter Lane, "escape velocity" (from *Studies in Momentum*), mm. 88-89[19]

After two intense études, the fourth Études "Planck's waltz" (*é*tude on delay) is a slow Études in which the performer and audience can enjoy listening to the sonority of sound elimination. The tempo marking indicates freely, and in the score there are fermatas on the rests. Interactive electronics provide the performer the freedom of experimenting with the sound and timing. The entire piece is enveloped in a relaxing atmosphere. That is to say, don't be afraid to play the running passage with more rubato. The staccato mark on the last notes of each fast passage doesn't mean to play it short but can be understood as not holding the notes.

[19] Lane, *Studies in Momentum for piano and live electronics*, 8.

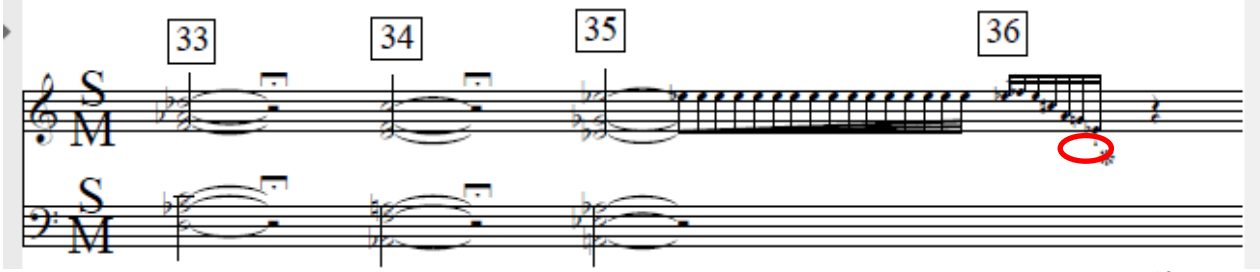

Figure 9: Peter Lane, "Planck's waltz" (from *Studies in Momentum*), second system[20]

The last Études "approaching entropy" (fantasy/+concréte) in *Studies in Momentum* is the conclusion of the former four études. In measures 134-146 and measures 165-168, it recalls the repeating-fast notes and dropping electroacoustic from "projectile motion." In measures 147-153, the chords are held for a long time with eliminated electroacoustics reminding the listener of "Planck's waltz." In measures 154-164, the use of the mirror effect in the higher register reminds the audience of "escape velocity," which also can be heard in measures 187-190. Nevertheless, there are also new elements in "approaching entropy": it is the only piece with extended piano techniques in the set. The introduction requires the pianist to mute the strings inside the piano, place his/her knuckles on the piano lid, and perform a fingernail glissando inside the piano, jumping the beams as quickly as possible in measures 117-119. However, Lane's instruction is like *Mission Impossible* for the pianist, having to hit the correct E1 after a glissando on the string. Another difficulty is that different piano models have different cast iron plate structures. I discussed this with Lane, and he suggests that in measure 119 the pianist can play a cluster glissando on the keyboard using the palms.[21] In measures 181-182, I would suggest using the right hand to mute the string while the left hand can hit the note E1. The other "new" element is fixed media with the piano to create the nightclub dance-like sections in measures 121-132 and measures

[20] Lane, *Studies in Momentum for piano and live electronics*, 9.

[21] Email with composer Peter Van Zandt Lane.

169-186. Since the interactive electronics allows the pianist to play more freely, the fixed media element in the piece uses strict rhythmic relationship style.

. From the pianist's point of view, I would suggest beginning this piece by listening to the piano part alone, because it allows the pianist to hear more carefully to what he/she is playing. There are several virtuosic passages that require the pianist to work on the fingers and phrases. In "approaching entropy" (fantasy/+concrete*),* the pianist should rehearse the section with fixed media with the electronic element because the pianist needs to feel the pause even better in this section to be in synch with the electroacoustic. It is a piece that the pianist can be comfortable rehearsing with interactive electronics and is not too challenging.

Each of the Étudeshas their own strong character. The composer suggests playing the piece as a cycle, since it shows different approaches in compositional style and piano style from peaceful minimalism to hot-rhythm nightclub dance.

CINDY COX

ÉTUDES "I. LA CIGÜEÑA FOR PIANO AND KEBOARD SAMPLER" AND "II. MALLETS FOR KEYBOARD SAMPLER" 2014

These études, which were composed at UC Berkeley's Center for New Music and Audio Technologies (CNMAT), require the pianist to play on a velocity sensitive keyboard sampler. A velocity sensitive keyboard sampler is a virtual instrument. It looks like a piano keyboard, with black keys and white keys, but without its own sound source. It is used to transmit signals to the relevant Digital Audio Workstations in a computer or tablet. This signal will find the corresponding sample, for example the C4 on the keyboard, and it command the computer or tablet to find the C4 sample. The keyboard senses the force with which a note is played: the sound will be louder with more weight and softer with less weight. The first Études "La Cigüeña" uses two different keyboards: one is a piano keyboard, and the other is a 66-key sampler keyboard. Cox indicates that the sampler should be on the piano where the music desk is normally placed. Therefore, the performer's hand can easily alternate between two keyboards.

La Cigüeña is the Spanish term for a large white bird with long legs, the stork, which is the metaphorical bringer of babies. Cox quotes John Campion, who is her husband and the poet of "La Cigüeña"**:**

Dropping true as Earth
La cigüeña flies an iridescent spiral
Shining white deep blue-green
An opal of great price given
To one whose luminous work
You may look into but never through.[22]

[22] Cindy Cox, *Etudes, "La Cigüeña" and "Mallets,"* 2014.

There are three Max/MSP program settings in this piece: seagulls_1, resmute_chord2 and slides_rubs_2. They deliberately paint in sound the images of the poem: a bird, flies an iridescent spiral, look into but never through.

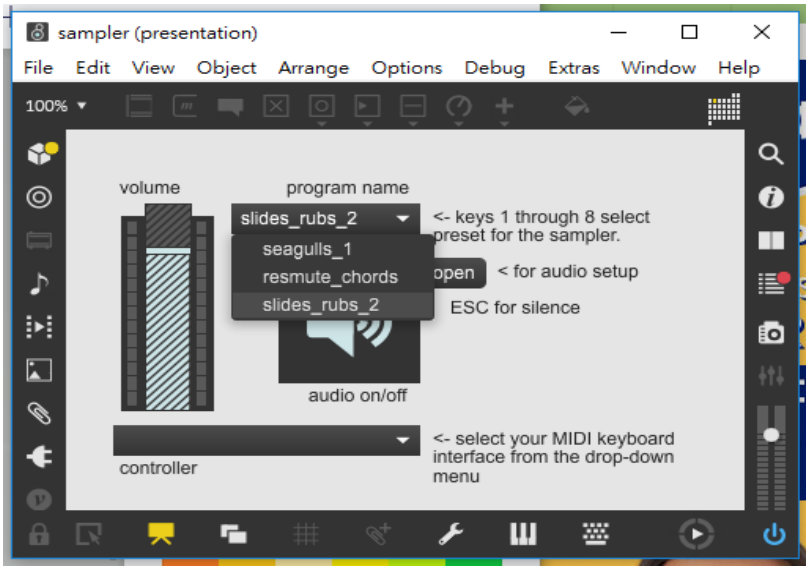

Figure 10: "La Cigüeña,*"* the software interface. This application requires Max/MSP to run.

The piece can be analyzed in five sections, followed by the double line with the patch changed. Even in this slow Études where an eighth note equals 76 beats per minute, shifting between keyboards can be a challenge for the pianist. Also, the pianist has to decide which hand to play on the upper keyboard (sampler) while the other hand plays on the lower keyboard (piano) because the score doesn't specifically point this out.

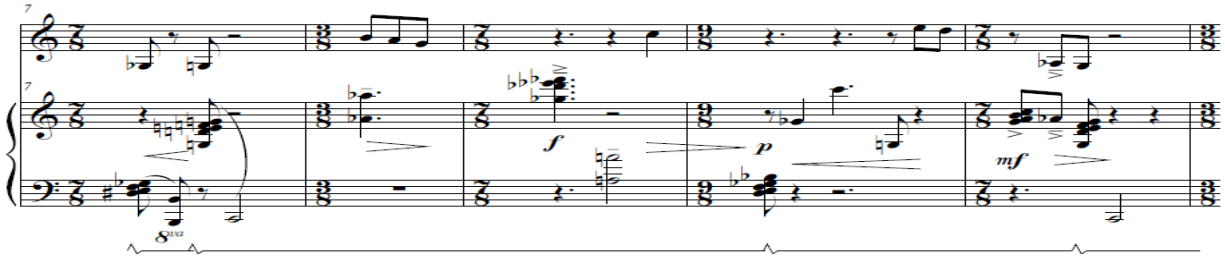

Figure 11: Cindy Cox "La Cigüeña*"* (from *Études*), mm 7-11[23]

[23] Cox, *Etudes, "La Cigüeña" and "Mallets,"*,4.

If “La Cigüeña” requires the creation of different tone colors with alternate hands, “Mallets” requires fast and even fingering with wide leaps. “Mallets” is played on a 88-key velocity sensitive keyboard. Instead of being played on a real piano, the signal from the sampler keyboard is remixed into a new percussive sound through a speaker. There are also three patches in the piece: orange and green_Eb, orange and green_E and orange and green_F#, which are triggered by x-shape noteheads.

In “Mallets,” almost every measure changes time signature with different groupings of sixteenth notes. This composition technique creates an incessant feeling until the end. Moreover, the asymmetrical rhythm makes the ringing long notes unstable. Reflecting the characteristic title of the piece, the pianist has to play in a non-legato fashion, which requires agile, stable fingers.

There are three levels of hearing for a pianist making electroacoustics: fixed media, interactive electronics, and keyboard sampler. Playing with the fixed media, piano sounds and electroacoustics are two independent sounds, as in chamber music. Playing with interactive electronics, electroacoustics with piano sounds is like a mutualistic relationship. Piano sound waves are delivered to a microphone through an audio interface, a mixing board, and sent out from the speakers. After this process, the electroacoustic can be heard by the audience, interwoven with the original piano sound. Playing on the keyboard sampler, the soundwave no longer has any relationship with the piano sound. It is like the pianist is playing on different keyboard instruments: harpsicord, organ, and so on. Regarding these levels of hearing, “Mallets” fully relies on technology instead of the piano while “La Cigüeña” requires one performer to play on two different keyboard instruments.

CONCLUSION

The styles of contemporary music are vivid and diverse. The four pieces selected for the recording are dissimilar from their comparable musical languages. The reason for the order on the CD (different from the chronological order in this document) is to put short and tonal pieces (Pierre Charvet's *Neuf Études aux deux mondes*) as an introduction, especially the pieces that are played with fixed media, which is the start of technology with live performance. As a contrast, Lillios's *Nostalgic Visions* jumps into the next generation where the technology is an interactive tool, so the performer has more freedom to improvise and move back and forth from the keyboard to inside the piano. After this extended piano piece, we move forward to a "keyboard sampler," that requires the pianist to play two keyboards at the same time. Compared to Lillios's liquid, flowing style, Cox's *Mallet* sounds percussive and rhythmic. After approaching newer technologies and styles, Lane's *Études* return to "tonal" music again with a combination of interactive electronics and fixed media.

Because technology is developing at a tremendous speed nowadays, people cannot keep pace with the latest media as easily as before. When Mario Davidovsky's *Synchronisms No. 6* (1970) won the Pulitzer Prize in Music, John Hohenberg wrote that "the piece shows mastery of a new medium and its imaginative use in combination with the solo pianoforte. "[24] Fixed media already seems old-fashioned. Interactive music performance allows more freedom between human and

[24] John Hohenberg, *The Pulitzer Diaries: Inside America's Greatest Prize* ([Syracuse, N.Y.]: Syracuse University Press, 1997), 150.

computer. Keyboard samplers give the performer control over the entire electroacoustic medium. Each technique has its own features, advantages and limitations. I especially love the way Pierre Charvet discusses different tech approaches: “Music ideas have to come first. In Music, and in arts in general, only the result matters. The most important thing is that the composer has to produce a piece of art, something that makes you believe it is as complex as the infinity of the world.”[25]

In my project, I have only discussed the audio portion of technology. But what is next? Composers are increasingly engaging with theater and visual art to create multi-media work, such as Johannes Kreidler and Mari Kimura, who are dedicated to employing multi-media elements like visual technology and motion sensors. If this music is to reach larger audiences, composers such as these need open-minded instrumentalists to explore their works.

[25] E-mail with composer Pierre Charvet on March 5, 2019.

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