Introducing Electronic Music in Undergraduate Music Theory: Pedagogy and Theory

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". . . it must also be possible to make such [coherent] progressions out of the tone colors . . . with a kind of logic entirely equivalent to that logic which satisfies us in melody. . . . I firmly believe it is capable of heightening in an unprecedented manner the sensory, intellectual, and spiritual pleasures offered by art . . . it will bring us closer to the illusory stuff of our dreams."
(Schoenberg 1978: 421-22)

Abstract:
Undergraduate students may briefly encounter electronic music in their music history courses, but the most popular music theory textbooks fail even to recognize this developing field. Theory books generally provide no insightful discussion because there is little practical and efficient pedagogical material of a sufficiently theoretical nature. At the 1999 ICMC conference in Bejing, Bonnie Miksch and I proposed a quick analytical system that could be presented within two class periods. That paper contains a basic vocabulary, a procedure for notation, and brief suggestions for interpretation. This pedagogical procedure and especially our tripartite division of interpretative approaches implies a theoretical framework of perception which I will explore using the Schoenbergian concepts of coherence and the musical idea. All these ideas naturally lead to the realms of aesthetics and music pedagogy in general. This presentation will summarize the previous Couch/Miksch paper, provide an example analysis, discuss the theoretical and aesthetic implications of the analytical system, and suggest areas for future research and development of pedagogical materials.

Keywords: Pedagogy, Undergraduate Music Theory, Analysis, Electronic Music, Miksch, Couch, *Zymurgy*, Robert Frank, *Whitewash*, Paul Koonce, Coherence

1. Introduction

By providing a fast and effective system of aural analysis, I hope to persuade music faculties to include electronic music in their general undergraduate music theory courses. Bonnie Miksch and I initially proposed this approach at the 1999 ICMC conference in Bejing, and, since then, I have been using it successfully at Luther College. Once I have presented the Couch/Miksch system and discussed my approach to teaching it, I will use Schoenbergian terms to explore some implications of our system. Finally, I will suggest areas for future work in aesthetics and pedagogy.

2. Undergraduate Music Theory and Electronic Music

Undergraduate music theory courses have three main goals: (1) to provide a common vocabulary and conceptual framework for meaningful conversation among professional musicians. (In American schools, this often implies a conservative, academic value system.); (2) to teach fundamental skills to aid performance, listening, teaching, and composition; and (3) to introduce and promote understanding and appreciation of a large variety of western art music and popular music styles.

In American liberal arts colleges, all theory instruction, from reading common clefs to advanced harmony, must fit into the first two undergraduate years, leaving little room for twentieth-century music in general. As a result, these curricula usually fail to address electronic music, and they rarely achieve the three goals above for this emerging

field. For other reasons, other music institutions frequently omit electronic music as if it were nearly invisible.

Nearly all instructors feel a lack of time to devote to challenging material. Along with its technical and specialized technics, electronic music's lack of obvious terminology, apparent compositional procedures, and stylistic norms make electronic music seemingly impossible to present. Many teachers simply ignore electronic music because few practical theoretical-analytical systems exist. Believing in the power of sheer exposure, others merely throw unfamiliar styles at their students and provide little substantive guidance. Theory courses, therefore, leave students unprepared to appreciate *avant garde* music such as sound mass music and most electronic music.

As a result, electronic music composers lose a potential audience prepared to appreciate their efforts. For students, the omission of electronic music in the academic canon often implies what is considered music, what pieces exhibit excellence, and how valuable music can be made. For instance, when sophomore theory courses attempt to introduce unfamiliar twentieth-century styles, students usually learn a rudimentary music vocabulary to describe only rhythm and pitch. With previous emphasis on tonal harmony, students quickly infer and accept that pitch-oriented music must be superior to any alternative.

As a result, students may actually become less receptive to new music after their general music education. The category of "good music" (or at least, approved music) now embraces the music of Stravinsky, Ives, and so forth in addition to Bach and other common practice composers. Many theorists stretch this category to encompass Schoenberg's and some of Babbitt's compositions because they depend heavily on pitch and rhythm. But, I assert that electronic music is valuable, important, and special. Students should not only be exposed to electronic music, they should think about it.

3. The Miksch/Couch Approach to Teaching Aural Analysis

3.1. Vocabulary and Materials

To remedy the situations above, Bonnie Miksch and I proposed an approach to aural analysis at the 1999 ICMC conference in Bejing. The method is relatively simple, efficient, and effective. Liberal arts students consistently remark how this approach helped them appreciate electronic pieces that were initially beyond their grasp. As a result, some students have asked to pursue undergraduate research and senior theses on electronic music. A few now continue such work in graduate schools.

Miksch and I divide aural analysis into three basic tasks. First, students must learn new ways of listening by practicing the identification of **fundamental parameters** (technically verifiable musical elements) beyond pitch and rhythm. This is a fairly simple task of informing them about musical parameters they often forget to consider and providing a convenient vocabulary to articulate their observations. Table 1 achieves this in a logical and quick way. Students readily agree with each other on observations of fundamental parameters. Second, students learn to notate their listening experiences as a memory and analytical aid. We have a general notation system that works for most electronic music. (See Table 3 for notation and Couch/Miksch 1999: 515-18 for further discussion.) Our notation emphasizes simplicity, somewhat at the expense of precision.[i] Most students use our system as a spring board, tailoring their own notation for the particular piece at hand. They usually use icons to conveniently represent recurring timbres, such as "space aliens." Third, we describe three **listening modes**, or general approaches to interpreting musical works. (See Table 2 containing the interpretive parameters.) These modes are loosely based on Dennis Smalley's research, but these categories that contain **interpretive parameters** have more intuitive labels that students find handy (Smalley 1992: 519-20).

For the purposes of this paper, the three listening modes in Table 2 deserve special attention. The **object-centered mode** captures what we traditionally call analysis: How do musical events technically relate to other passages, i.e., "relationships inside the music." Recognizing an A-B-A' form, for instance, is an object-centered conclusion. In the **subject-centered mode**, listeners describe their personal responses to sound, i.e., "relationship between the

[i] Many more precise systems exist, but the required time, the complications of the procedure (such as sonograms), and their vocabulary prevent their use in undergraduate classrooms. Sometimes such detail can hamper interpretation. Helmuth 1996 exemplifies a remarkably convenient system using sonograms.

music and the individual." For instance, a loud blast from the speakers may cause pain, or smooth waves of verbal compliments may soothe sore emotions. These experiences not only provoke one's memory; they often capture essential and normally unarticulated musical experiences. The **context-centered** approach encourages listeners to connect musical events to non-personal situations outside the formal music, i.e., "relationships between music and society and physical reality." Titles and program notes, such as those for Barry Truax's *Riverrun*, contribute to understanding of the musical processes and expression. This approach is vital to music with explicit programs or political agendas. (Furthermore, one can easily claim that most music reflects or even molds our social experiences.) In summary, the interpretive parameters create three categories of meaning. I simply allow students to think, feel, and imagine.

3.2. Details in the Classroom

At Luther College, our curriculum allows me to devote only two class periods to electronic music. I follow six steps to introduce the genre and an analytical way of approaching it:

(1) I present the vocabulary and interpretive parameters in Tables 1-2.

(2) Students practice their skills at recognizing or vocally producing examples of fundamental parameters in Table 1.

(3) We work together on notation of most parameters (Table 3) by listening to fairly short works with clear sectional forms and well-defined timbres such as Robert Frank's *Zymurgy* or Miksch/Couch's *sirens*. At this point, I refrain from reading program notes or even mentioning the titles to the class so that students concentrate on fundamental parameters. (The lack of extra-musical associations, whether they are provided by the composer or imagined by the listener, quickly demonstrates their importance to appreciation and memory.) In this third step, I display a sonogram and example analytical drawings of the first two sections of Robert Frank's *Zymurgy*. (See Figures 1-4.) Students find these figures fascinating because the visual relationship between the sonogram and aural experience (represented by the drawings) can be striking or totally obscure at points.

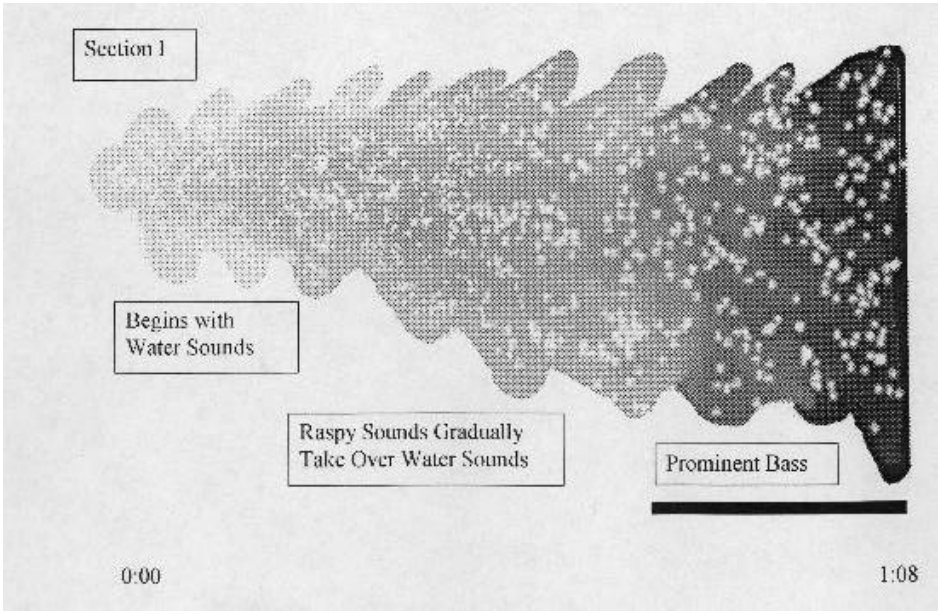

Figure 1

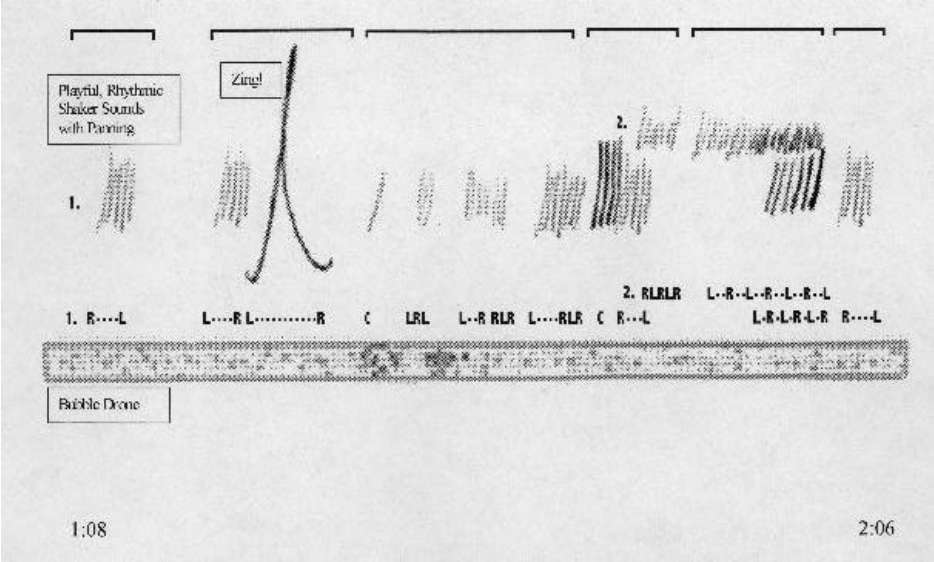

Figure 2

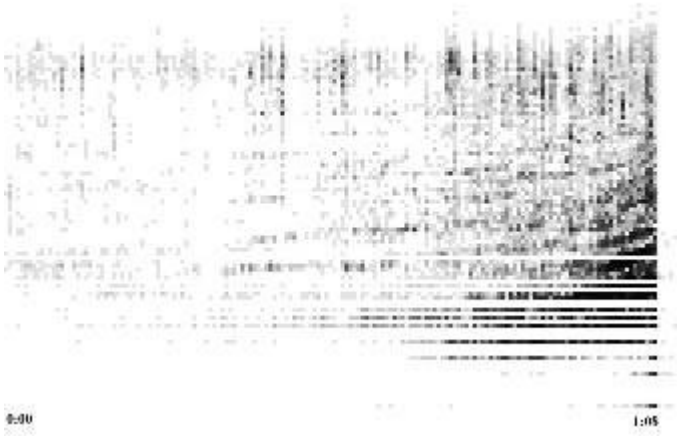

Figure 3

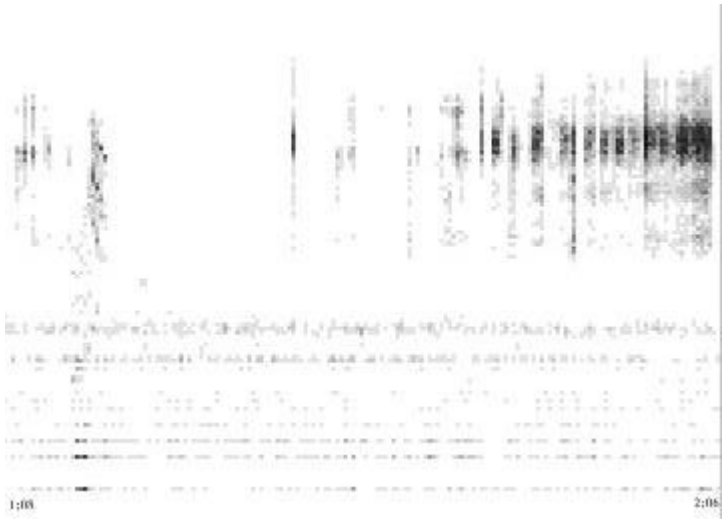

Figure 4

(4) Then, the students discuss various object-centered interpretations of the piece played in class. At first, unfamiliar timbres and compositional procedures seem shocking and random to most students. The following suggestion seems to help: Gradual change in any parameter normally indicates direction toward or away from goals while discontinuity in any significant parameter, esp. silence or a sudden change in texture or timbre, often creates sectional divisions. The organization of sounds usually begins to make sense after a few listenings, but such a purely object-oriented listening seems overly abstract to them. ("What is the piece about?" or "What does the piece say?")

Zymurgy presents an obvious shape and sectional form with either a gradual increase or decrease in dynamics, texture, and tessitura throughout each section. (These parameters are in agreement with each other.) All the sections are highly unified in nearly every parameter. Students instantly suggest helpful names for various events, such as "bubbles," that help them recall these moments. Silences and/or conspicuous changes in sound sources clearly mark sections. Most students hear five or six sections: (A) bubbling water, (B) rhythmic shaker, matches, and an airy pedal point, (C) deflating computer sounds, (D_1) sparse bubbles, (D_2) exponentially increasing frequency of bubbles with matches, (E) pouring water (very brief). Almost all hear (E) as a coda or codetta. A significant minority hear the long passages (A) as an introduction and (C) as a transition. After achieving some consensus on an object-centered conclusion and entertaining subject- and context-centered responses, I read the program notes to *Zymurgy*:

> Zymurgy (the chemistry of fermentation, as applied in brewing) celebrates the process by which simple grain and water are transformed into one of the world's most popular beverages. Using only the sampled sounds of grain, water, a metal pan, a grinder and bottling equipment, the composition follows the same form as the process of brewing. Pure water is heated to a boil. Then grain is ground and added. After the boil has extracted the essence of the grain, it is cooled and yeast added. The yeast digest[s] the mixture, releasing tiny bubbles of gas and transforming the "wort" into brew. When captured in bottles, the bubbles accumulate and the yeast, becoming drunk on their own alcohol, carbonate the beverage in a wild, yeast hoe-down. Listen responsibly . . . *Zymurgy* was composed in the Electronic Music Studio at Southern Methodist University on a Power Macintosh 9500 using SoundEdit 16, SoundHack, and Pro Tools (Frank 1999: 2).

The compositional process and timbres form an analogy to brewing (Zymurgy), an attractive and helpful association for twenty year olds. With the program revealed, I find that the next listening yields quite a number of "A-ha's" and giggles. Their new understanding and appreciation demonstrate the importance of reading titles and program notes as an aid to comprehension and memory. Such information almost always solidifies their object-centered conclusions more quickly than most technical arguments.

After having introduced *Zymurgy* to six theory classes, I decided to ask the composer about his compositional intent. Frank himself planned three main sections, the minority viewpoint:

> When composing *Zymurgy*, I thought of it as the following:
> Introduction: Water pouring
> **Section 1:** Grain shakes and grinds
> Transition: Descending grinds and shakes (same sound material but a new process)
> **Section 2:** Fermentation bubbles
> **Closing Section:** Ascending bubbles (process of intro. applied to bubbles of section 2)
> Coda: final beer pouring . . .
>
> The extra-music form is that of beer brewing: bring water to a boil, grinding grain and boiling, cooling down, adding yeast (low growls), fermentation, carbonation, drinking . . . [boldface not in original and text edited slightly] (Frank 2001: 1)

Notice the composer's concern not only for material, but also process, in his vision of the piece.

(5) For homework, I select compositions devoid of familiar instrumental timbres and tonal harmony or pitch-based development: Paul Koonce's *Whitewash*, for instance, forces students to practice unfamiliar skills. They identify the musical form and support their conclusions with specific observations because this object-centered approach requires repeated, engaged listening. Furthermore, the class can discuss object-centered interpretations more easily and achieve some consensus. Without the need of much encouragement, students routinely delve into context-centered approaches and connect musical events with some subject-centered responses.

(6) Finally, I ask them to defend their point(s)-of-view in a paper, supported by evidence from their analytical graphs. Writing promotes synthesis of all their repeated listening experiences with *Whitewash*. Because *Whitewash* uses a number of parameters and timbres that sometimes contradict each other, it easily lends itself to more than one formal interpretation. Depending on what parameters a student feels are most significant, she will divide the form in different places. If timbres change radically, some students will mark an end of a section or phrase, while others privilege silences or changes in texture. Many students believe *Whitewash* contains a few large sections with subsections or phrasing. Others hear many sections. Some identify relationships between sections while a number feel the material of different sections contrasts too greatly.

Figures 5-8 display a few student analytical drawings. In Figure 5, the student uses icons to represent sound sources; the accented vertical dimensions emphasize frequency. Textures, range, and dynamics seem to be the focus of Figure 6. The drawing in Figures 7 contains vivid colors that represent timbres, while the shapes generally follow our notation methods. Figure 8 presents two pages out of five containing a hybrid notation. Some students write (mostly appropriate) subject-centered responses, such as "lonely" under their drawings, while most provide some apt associations such as "fog horn." I have omitted the students' accompanying essays here to save space. Their essays draw conclusions from their graphs in logical and sometimes surprising ways that I will discuss further in my oral presentation.

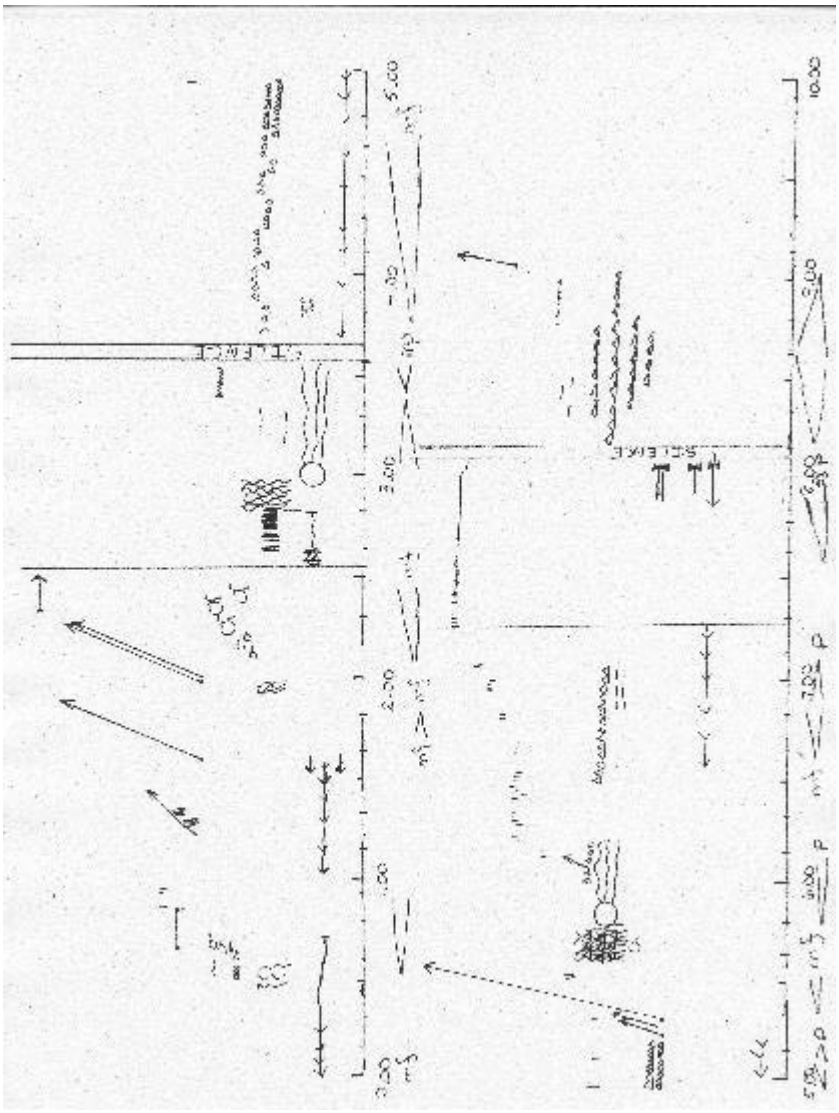

Figure 5

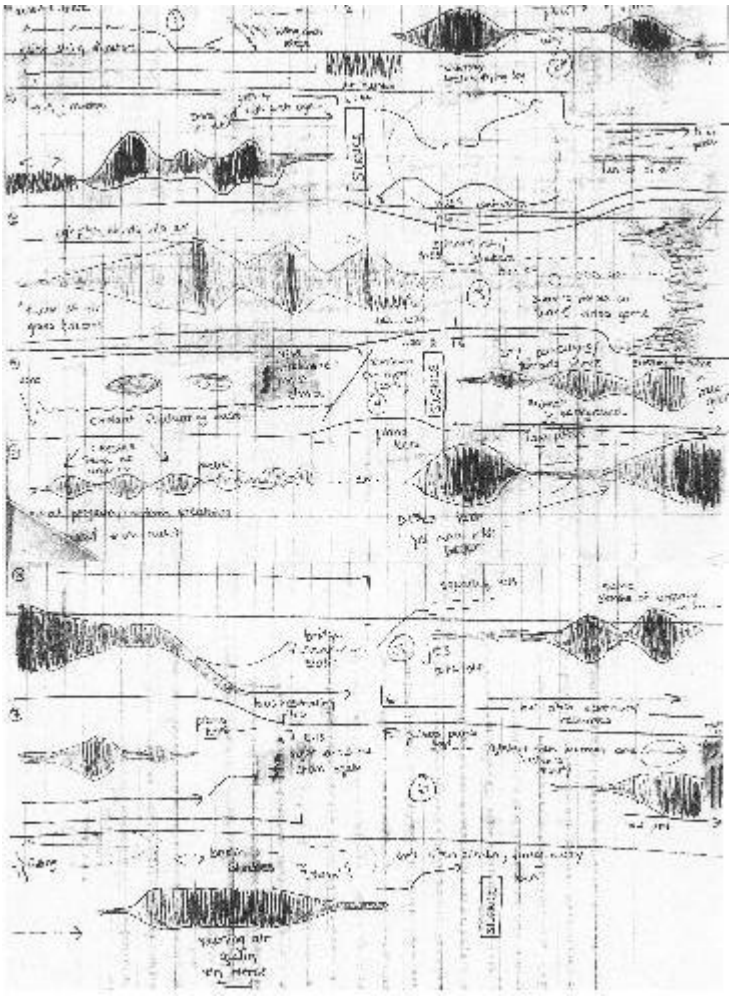

Figure 6

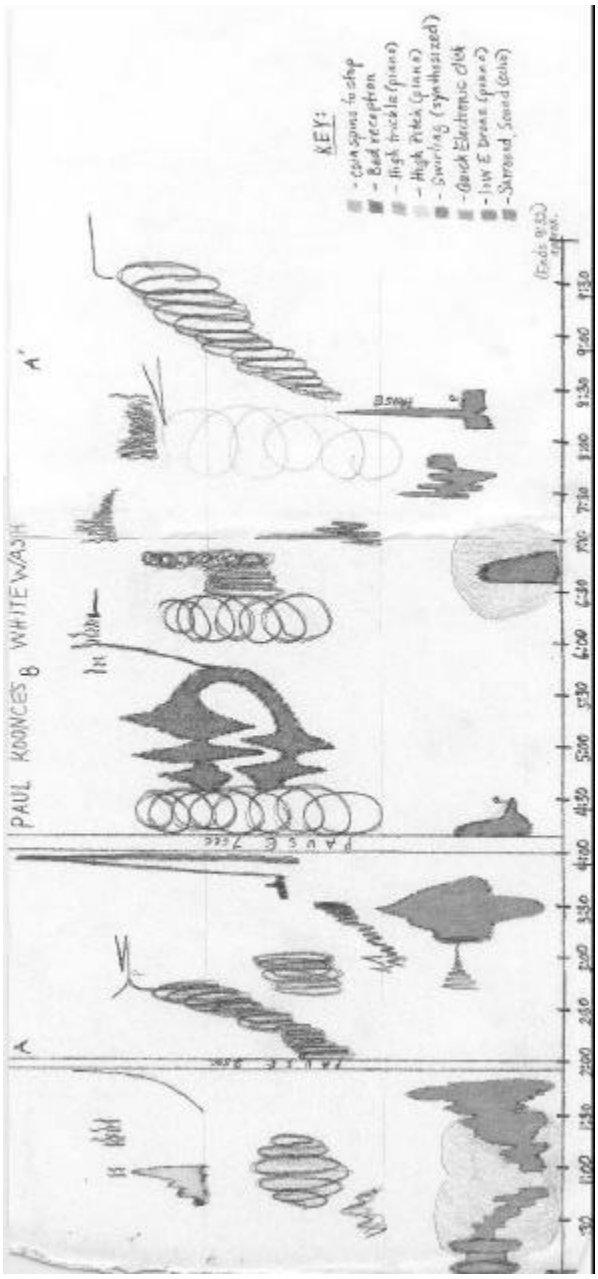
PAUL KOUNCES
WHITEWASH
A
A'
B
B'
KEY:
- Click sound to ship
- Beat reception
- High Pitch (plane)
- High Pitch (plane)
- Swirling (synthesized)
- Quick Electronic click
- Low E Drone (plane)
- Slowed Sound (echo)

Figure 7

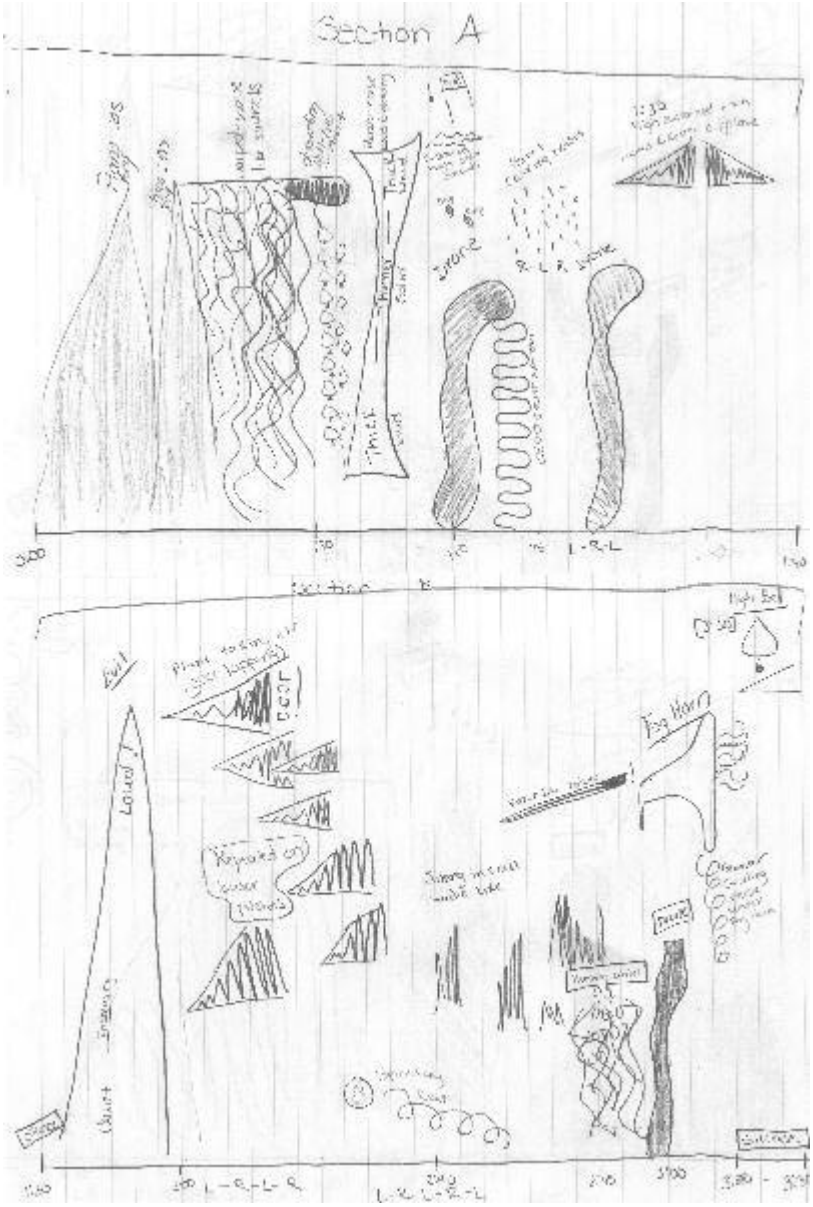

Figure 8

4. The Couch/Miksch Approach and Coherence Theory

Like all approaches to listening, our method implies some beliefs about how music should or can work; perhaps some composers avoid outlining such approaches in their theory teaching for this reason. (Later, I will mention that such an attitude is less effective with most general undergraduate music majors.) The few Schoenbergian terms below may expose some beliefs inherent in the Couch/Miksch approach, but more importantly, these terms point towards further pedagogical solutions.

Coherence simply describes relationships within an artwork, i.e., "How an artwork fits together." Coherence results from similarity of material or procedures within the artwork (repetition and variation).[ii] **Comprehensibility** is a

[ii] In Schoenberg's organic viewpoint, all passages should have some similarity to other parts, but contrasting elements may be emphasized to avoid monotony from excess repetition. Schoenberg concentrates on similarity between motives for coherence, but he does mention other sources: "metaphysical coherence" and "psychological

measure of the clarity of the coherence, i.e., "how well the composition communicates its ideas."[iii] For instance, popular song contains a high level of coherence because of the abundance of repetition and variation; the arrangement of material, understanding performers, and listeners' familiarity with its tonal style also lend popular song a high level of comprehensibility. Twelve-tone music, on the other hand, has a high level of coherence, but a low level of comprehensibility for most non-academic listeners. Simple factors such as static interference or hiding melodies within thick textures may inhibit comprehensibility. Low comprehensibility reduces the size of the potential audience (to an "elite" group perhaps), but does not necessarily imply a lack of artistic merit.

Composers imbue compositions with different levels of coherence. As a result, I will concentrate on comprehensibility because I am primarily concerned with students' appreciation and understanding in the classroom. Comprehensibility depends on three main sources: (1) the clarity of the composer's presentation of coherence,[iv] (2) the performer's skill of interpreting and projecting coherence (assuming a performer is required), and (3) the listener's ability to recognize coherence. In theory teaching, we seek to increase the second and especially the third factors; i.e., we want to augment students' abilities to relate material to what has already occurred and to the overall structure. Schoenberg's explanations of comprehensibility seem to aim toward an object-centered listening, and his theory on coherence elevates context-centered approaches above the other two listening modes.

The listener can develop the following skills that influence comprehensibility:

- **Recognition of <u>all</u> basic musical elements.** Here, I must stress the importance of vocabulary and the concepts they embody: from tonal elements to traditional twentieth-century devices to newer electronic

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coherence" (Schoenberg 1994: 5). On p. 63, he states that spiritual ("non-musical") content derives primarily from the sung texts and "images that are either conscious or unconscious, external connections." Schoenberg never develops these ideas on extra-musical coherence.

[iii] Because Schoenberg believes the tenets of organicism, he states that comprehensibility involves apprehending the whole and relating the parts to the whole. I have provided a more general definition, simply that one perceives the coherence (*Zusammenhang*). Schoenberg further distinguishes between comprehensibility (*Fasslichkeit*) and understanding (*Verstehen*). Comprehension occurs in time as the piece unfolds, while understanding requires more reflection out of time to consider relationship between parts of an organic form. Thus, understanding requires greater memory and skill, and provides amplified meaning. Understanding is defined as "recognition of similarity" (Schoenberg 1994: 11). For simplicity, comprehensibility in this essay encompasses both of Schoenberg's terms, *Fasslichkeit* and *Verstehen*.

[iv] The laws of comprehensibility as they relate to the composer are listed in Schoenberg 1995: 133-43. As a composer and theory teacher, Schoenberg spends little effort on the role of the performer or listener. In tape music, the role of performer is fulfilled by the composer and board technicians.

music techniques. Recognition depends heavily on familiarity. In musicianship courses, we only practice the parameters most important to tonal music: distinguishing pitches, direction of pitches, collection of pitches, and rhythms. For *avant garde* music, a wider range of possibilities exists, all the fundamental parameters in Table 1. Lack of time, plain vocabulary, and available overarching concepts have so far restricted musicianship teachers who attempt to equip students for newer music. The Miksch/Couch method solves the problem of efficiency and obscure vocabulary.

- **Recognition of similarity** (and thus, contrast). Most musicianship courses do not directly address this vital skill. I invite ideas on how to pursue this methodically.
- **Aural memory.** This is necessary for recognizing similarity while listening. Visual representation, scores, and dictations in ear-training courses can aim directly at increasing retention. Table 3 provides a simple way to make "scores".[1]
- **Theoretical and analytical skills.** Theory and analysis not only improve memory and promote understanding. They also create expectation in the listener: the ability to predict and be surprised by musical events, knowing past ones in the same and other similar pieces. Once again, the few extant generalizations about compositional procedures in electronic music tend to be complicated or rely heavily on approaches from other disciplines. (The narrative strategies of Giomi and Ligabue 1998 are particularly interesting but the terminology is not immediately accessible to undergraduates.)
- **Extra-musical associations.** A narrative, for instance, may bolster memory and will increase meaning. These associations can also lead to analytical revelations within all three listening modes, as classroom experiences with *Zymurgy* consistently demonstrate. (Ferreira 1997 addresses these associations in some detail.)

Since many technical features of electronic music are currently beyond the scope of most undergraduate courses, the object-centered listening mode concentrates on more obvious features of repetition and contrast, especially in timbres and timing of sound events. Because many sound processing techniques that may appeal to a small audience (electroacoustic composers themselves) are beyond students' level of experience and would require too large a block of time devoted to such material, students must instead venture into subject- and context-centered approaches to aid memory and create meaning. (Remember Frank's mention of process that contributed to his object-centered formal analysis, and then remember his "extra-musical form.")

Valuing these alternative listening modes, subject- and context-centered, has political ramifications. Music theory courses generally suppress these ways of thinking, despite "the new musicology" that entreats everyone to consider context and recent narrative theories. Teachers suddenly attempting to teach these approaches may see in retrospect that they should not have ignored these listening modes when investigating tonal music. In other words, we do not practice nor encourage many of the most basic approaches to music, because we overemphasize strict harmony and positivistic thought. (Strangely enough, the two less-honored listening modes routinely surface in music appreciation texts and classrooms as well as in writings from famous nineteenth-century critics and theorists.)

5. Areas for Future Work

5.1. Electronic Music Compositional Practices

Without some theoretical framework, contemporary composers will continue to prevent inclusion of their music in the theory classrooms: Despite composers' frequent aversion to sweeping generalizations about compositional procedures, such generalizations are a helpful and necessary starting point for students new to electronic music.

Our field still needs more research that generalizes about compositional procedures within electronic music genres. Object-centered generalizations seem rare because few orthodox forms and processes exist in *avant garde* music. Perhaps more theorists need to concentrate on particular composers' styles, as they have with twentieth-century acoustic composers. Both historians and theorists would appreciate more stylistic commentary on different "schools of electronic composition." Subject-centered generalizations seem difficult to agree upon universally, except for aural pain thresholds; so they are generally ignored in professional literature. Context-centered generalizations seems to be particularly fruitful. For instance, the narrative theories of Giomi and Ligabue seem to capture some essence of many works. Perhaps my training in music theory makes me wish for more object-centered generalizations. These certainly would be most persuasive to the general theory community and would be most likely to become part of routine music education.

5.2. Aesthetics and the Relationship between the Extra-musical and Coherence Theory

From Schoenberg's viewpoint, if a composer wishes to create coherent music, the composer has an obligation to reuse material. Of course, composers can avoid this definition of coherence to meet certain artistic goals. If the composer desires comprehension of his ideas (in the Schoenbergian sense), the composer must consider how to communicate to the target audience, i.e., so that they can recognize the coherence that may be present. The listener likewise has the responsibility to be engaged and educate himself to the level of the music he is listening to, especially if the music derives from another culture or employs unfamiliar techniques. This theory of coherence may provide some potential aesthetic criteria. Are the level of coherence and the materials appropriate to the composer's idea (*Idee*) and does the level of comprehensibility match the audience's abilities?[v] Or worded more controversially, did the composer create an artwork that expresses his ideas? Since the intent of the composer may not be verifiable or even known to the composer herself, perhaps this can be solved by fabricating a fake intent as a listener, hopefully based on whatever evidence may exist (program notes, the title, text, and suggestive timbres). (In the case that communication is not intended, fabricating an intent may still be important to listeners.) The composer as listener may be the only one who can answer such an aesthetic question accurately.

These terms and aesthetic judgements may seem appropriate to most traditional western art and popular music, especially those springing from the German tradition (i.e., music employing development). Many of us, however, can think of compositions that use contrast, discontinuity, or unpredictability (e.g., aleatory) as their basic "organizing" principle or that simply avoid traditional coherence. These works fall outside Schoenberg's coherence theory, except in an abstract philosophical way: these works are unified by disunity. This ambiguous statement despite its ingenuity and rebellious political appeal is rarely helpful or insightful for a theory student trying to appreciate these types of unfamiliar music. Some music delivers sonic pleasures to the senses. Other exceptional music present constellations of musical signs that point to political or societal situations. I assert that these works employ subject- and context-centered parameters normally considered outside music to create meaning.

More directly put, I am claiming the extra-musical contributes to musical meaning and is part of the music itself. In a sense, the piece (or rather the listener's mind) reaches out to other realms of human experience and finds appropriate analogs, i.e., the context-centered listening mode. Should the extra-musical be promoted from the realm of comprehensibility to that of coherence instead? If so, a tremendous amount of difficult theorizing lies ahead as semioticians will attest.

5.3. Musicianship Courses

The third area for research is more practical and will be the focus of my endeavors. Theory teachers need more up-to-date pedagogy for musicianship classes that prepares students for more recent music. First of all, (1) we need to address more musical parameters in tonal music to practice basic skills and instill vital concepts. (2) Teachers should value, rather than disparage, the context- and subject-centered responses. We need simple exercises for (3) aural recognition of terms and (4) sound techniques specific to recent music. (5) We also need exercises to explicitly practice recognizing similarity and to further increase memory retention of all parameters (beyond four-bar phrase lengths of homophonic tonal material). (6) Some pedagogues may develop exercises to teach narrative or other context-centered strategies efficiently. In other words, we need to practice new ways of listening for all music.

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[v] For a provocative discussion of the social implications (the role of the composer and audience), read Babbitt 1958: 38-40, 126-27. The title of the article, by the way, was suggested by an editor rather than Babbitt's idea.

TABLE 1: Fundamental Parameters[vi]

DOMAIN	PARAMETER	CONTINUUM
Time	Temporal Progression	Continuous ‹——————› Disjunct
	Rhythm	Pulsed ‹——————› Non-pulsed
Texture	Vertical Density	Thick ‹——————› Thin
	Horizontal Density	Busy ‹——————› Sparse
Amplitude	Dynamics	Loud ‹——————› Soft
	Attack and Release	Sharp ‹——————› Gradual
Frequency	Pitch	Pitched ‹——————› Non-pitched
	Range (and Tessitura)	Narrow ‹——————› Wide
Location[vii]	Distance	Close ‹——————› Far
	Direction	Horizontal -180^{o} ‹——————› 180^{o} Vertical -180^{o} ‹——————› 180^{o}

[vi] Tables 1-3 are revisions of those in Couch and Miksch 1999: 415-19. Although Figures 1-4 were presented in Beijing, China, they were never published until now.

[vii] Although I mention the importance of polar coordinates in some concert settings and headphone pieces, most students find terms analogous to home stereos easier and nearly as informative: left, center, and right.

TABLE 2: Interpretive Parameters

LISTENING MODE	PARAMETERS
Object-centered	Form and shape, Phrasing, Meter, Pitch relationships, Tone color[viii]
Subject-centered	Physical responses & gut reactions, Emotions, Personal imagery
Context-centered	Title of work & artistic intention, Program notes, Historical & political background, Narrative & metaphor, Performance aspects (venue and room setup)

[viii] An interpretation of timbre, "tone color" refers to non-technical descriptions, such as "fat, grainy, and wet." Although electronic music courses would include sound processing as an object-centered parameter, the subject is far beyond the scope of most music general theory courses.

TABLE 3: Visual Representation of Parameters

CATEGORY	PARAMETER	REPRESENTATION
Fundamental Parameters[ix]	Time	Horizontal axis with timings (min : sec)
	Frequency	Vertical axis
	Amplitude Envelope	Shape
	Vertical Density	Height[x]
	Dynamic	Darkness
	Location	Letters L, C, R (left, center, right)
Interpretive Parameters[xi]	Prominence of Event	Colors or highlighter Pens
	Phrasing and Sections (Form)	Brackets and traditional letter designations
	Meter	Meter signature(s)
	Pitch Relationships	Roman numerals or traditional notations
	Tone Color and Timbre	Text box (words inside sound event shape)
	Subject-centered Responses	Text box (words underneath sound events)
	Context-centered Descriptions	Text box (words below horizontal axis)

[ix] Fundamental parameters not listed here (temporal progression and horizontal & vertical density) become clear when one graphically represents sound events with the listed parameters. One may, however, resort to traditional notation for rhythms, if it is simpler.

[x] Miksch and I essentially conflated the time vs. amplitude axes common to sound editors and time vs. frequency axes of sonograms into one graph. The vertical representation of both pitch and vertical density usually simplifies graphing in a classroom situation. For more greater precision, Helmuth employs two parallel graphs to avoid this potentially confusing problem (Helmuth 1996: 77). Because notation of the amplitude envelope also involves some vertical space, some students will occasionally find our notation less clear.

[xi] Interpretive parameters omitted here can usually be handled in text boxes, but I have found students address more involved or subtle interpretive issues better in essays or classroom discussion.

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