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From the Editor

Compositional works from Turkish electronic music composers are perhaps not best known in the United States, even though Journal SEAMUS recently included a review of Erdem Helvacioglu recordings. To put it mildly, my own familiarity with Turkish electronic music, especially works stemming from the early days of our field, has admittedly lacked in depth. I have thus found the interview conducted by Bob Gluck that much more informative and hope that our readers will find it equally engaging. For this issue, Gluck interviewed Istanbul-born composer and writer Ilhan Mimaroğlu. Mimaroğlu's musical trajectory is somewhat unusual as his early academic path choices were seemingly split between architecture and law, with the latter leading to a university degree. The former potential career path choice did not go beyond an attempt to draw a vase in trying to follow the footsteps of his famous father, architect Memaleddin Bey. Looking at the big picture, it is clear that both potential career paths were mere detours, as they were ostensibly short pit stops and only part of a larger lifelong journey that lead him to work at the Columbia-Princeton Electronic Music Center, engage in collaborations with jazz legend Charles Mingus, and work as an Atlantic Records producer.

Otto Laske also contributes an essay elaborating on the notion of critical musicology – his essay outlines the main tenets of cognitive musicology based on Adorno's research and his own earlier work in this area, while also exploring its extension to dialectic thinking in music. The essay also makes a case for including a cognitive science curriculum to help in dialectic thinking with the aim of "… focusing attention on mental processes in music, rather than only the artifacts such processes yield." In those contexts, Laske proposes that it is then possible to explore the question of musical competence and link answers to "knowledge of musical performance" and "musical task environments."

On the more technical side of the electro-acoustic music spectrum, we have an article discussing the feasibility of MIDI-based networked musical performance taking WANs, LANs, and WLANs into account. Teeter et al present a detailed study by examining issues such as transmission latencies and synchronization problems to determine possibilities for networked performance in household and university network environments. The studies are based on empirical data which are used to discuss the feasibility of networked performance with respect to cognitive, physical, and technical delays. Based on these data, the authors found strong evidence for making networked performance feasible when performance locations were restricted to 400 miles in distance and network latencies were smaller than 20 milliseconds.

Jeremy Baguyos' article is an in-depth study of Mario Davidovsky's *Synchronisms No. 11*. Instead of engaging in a more "standard" analysis of the piece, however, the author focuses on performance insights, which makes it a particularly interesting read as Baguyos is not only as an established composer but also as an accomplished contrabassist.

In this issue we once again have the *Tips and Tricks* section introducing tricks that may prove to be useful in our work to create, analyze, teach, learn, and engage with electro-acoustic music. The topic in this issues centers on the exploration of possibilities in using the MATLAB programming environment in electro-acoustic music research and pedagogy, while introducing some useful tricks and tips that can help in the aforementioned endeavors.

Finally, we would like to submit a note of apology as there was a misprint in our previous issue (Volume 20. No. 2). The date was incorrectly printed as *Spring* 2009. The correct date is *Fall* 2009. Our sincere apologies for any inconvenience this may have caused. As always, please feel free to contact our team for any questions, comments, and concerns. Enjoy!

Tae Hong Park, Editor

From Cognitive to Critical Musicology: Shifting Notions of the Structure of the Musical Mind

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In memory of Th. W. Adorno

This paper provides an outline of the notion of critical musicology as grounded in dialectical thinking and the cognitive-developmental sciences. Notions of cognitive musicology are detailed from an epistemological point of view in the sense both of Adorno's and my own writing. After recalling the cognitive revolution of the 1970s and 1980s and the impact of artificial intelligence thinking on musicology, I briefly outline the main tenets of cognitive musicology and extend its research program into dialectical thinking in music. In addition to establishing a link between dialectical and developmental thinking in cognitive musicology, I outline the epistemological foundations of critical musicology including some pedagogical ramifications.

Historical Introduction

Critical musicology in the sense here intended has a complex intellectual history (1955-present) which is best understood by beginning with the Frankfurt School, especially Adorno's musicological work. In the late phase of his adult development and thinking, my teacher Adorno established a new type of musicology that was "critical" in the sense that it discovered traces of societal transformation in the very core of notated music compositions and performances of classical and "new" music that, as a composer, he was deeply knowledgeable about. Immediately after his untimely death in 1969, I began to establish the foundations of cognitive musicology (Laske 1972), a discipline whose foundations can be found in the computer sciences, especially generative grammar and information processing psychology (Chomsky 1965; Simon 1973). These foundations are laid out in a large number of – today often inaccessible – publications between 1970 and 1993, initially summarized in my book on Music, Memory, and Thought (Laske 1976; Schuler 1995; Tabor 1999).

In harmony with Adorno's focus on compositional thinking, cognitive musicology as I have designed and practiced it is grounded in the theory of knowledge (epistemology). I focused this discipline on the composer's cognitive process – especially in electronic music. The question that arose for me in the 1970s was: "what is the structure of the musical mind?" This question conveys the structuralist approach I followed based on early tenets of computer science [co-created by H. A. Simon, M. Minsky, A. Newell, and J. McCarthy in 1956] and generative grammar. I attempted to answer this question based on Chomsky's work regarding generative grammar (Chomsky 1965) and slightly later on the new knowledge flowing from the young discipline of computer science, especially information-processing psychology (H. A. Simon 1973).

It speaks to the caliber of Chomsky's research that he initiated a debate with J. Piaget about the underlying structure of thought and language (Inhelder 1978). What initially pitted Chomsky against Piaget (Piaget 1975) looks quite different from our present knowledge of adult cognitive development (Basseches 1984; Laske 2009). The major difference between Chomsky and Piaget is found in the fact that what for Piaget is an outcome of a gradual process of construction throughout childhood and adolescence is for Chomsky an innate capability of synthesizing increasingly complex levels of human cognition. Chomsky and Piaget's debate was advanced another notch by the Kohlberg School (1960 f.), whose members – among them my teachers R. Kegan and M. Basseches – showed that human development is life-long and that the development of adults is qualitatively different from that of children and adolescents, a fact referred to by the notion of adult development (Kegan 1982; Basseches 1984).

All of these intellectual streams from the 1970s onward have a bearing on what today we might want to consider critical musicology. Now that Adorno's work has become available in English, it is, I think, time to bring together the two strands of the new musicology, namely the critical and the cognitive strands. In my own work, the cognitive strand has undergone a further transformation beyond Piaget which I will briefly outline below. This transformation has to do with the notion ultimately deriving from Piaget's studies in child development, that human cognition is a constructive-developmental process whose phases can be outlined by way of qualitative research, using semi-structured interview-based assessment methods (Laske 2006, 2009).

In what follows, I will link the tri-partition of cognitive musicology into competence, performance, and task environment studies, inspired by computer music technology and introduced in my Utrecht Writings (Schuler 2004), to the foundations of post-Adorno dialectical thinking as outlined by M. Basseches (Basseches 1984), R. Bhaskar (Bhaskar 1993) and myself (Laske 2009). I will further link cognitive musicology activities to the use of dialectical thought forms that can be taught as a basis of, and tool set for, practicing critical musicology.

A short review of Cognitive Musicology

Computer music composition technology in the 1960s and 1970s – when I studied it – offered to composers and music theorists the challenge to rethink not only their tool set but also the process by which music is made, and even the categories in terms of which "music" had so far been thought about in musicology. This holds true for both score synthesis (the computation of score parameters) and sound synthesis (the computation of acoustic material to be machine-read based on score parameters). Rather than becoming a critic of conventional, historically-oriented musicology – a thankless task given the dominance of that kind of musicology – I decided to bypass it entirely and put in place a cognitive framework for studying music based on Chomsky's and Simon's writings (Tabor 1999; Schuler 2004). This entailed asking myself, as a philosophy-trained composer, what were the dimensions of real-time compositional work using hardware and software – and thus of musical competence – that I could conceptualize such that a new kind of musical research based on real-time observation and data collection would become possible. Following Chomsky, I called these dimensions syntax, semantics, and sonology (Laske 1972, 1975).

Together with an electronic music composer and student of mine at the Instituut voor sonologie, Utrecht, Barry Truax, I put in place the software system OBSERVER (1972-75). Observer was based on the PDP-10 and permitted letting children use electronic sound – thus bypassing notation – in elementary composition tasks in which the melodic, rhythmic, and harmonic structure of the sound stream could be modified based on listening. The computer kept a "protocol" inspired by H.A. Simon's protocol analysis procedure (H.A. Simon 1973) by which Simon "observed" chess players at work for the purpose of building computer programs that could win a game of chess against a human player. The purpose of Observer was not to produce computer music, but rather to generate new insights into the development, in children, of compositional thinking in the sense explored by Piaget regarding logical thinking (Laske 1979). In analyzing Observer protocols – which later, at Carnegie-Mellon, I attempted to use as a basis of simulating the children's work on a computer (1975-77) – it became clear that the categories of traditional musicology would have to give way to three different dimensions of the musical mind which, following Chomsky, I called:

Competence [syntax, semantics, and sonology]

Performance [real-time use of competence in social environments; musical "speaking"]

Task environment [comprising the technology and historical conditions influencing the composer's work].

Having sorted out Chomsky's and Simon's respective contributions, respectively, to cognitive musicology, I began to see these dimensions as forming the logical structure of a generative grammar for music (Schuler, 1995; 2004). Competence was conceived as the intrinsic living musical knowledge of the composer and performer. Performance was conceptualized as the use of competence in real time along information processing psychology lines. Performance could potentially be split up between the knowledge of the living composer and the software he/she had selected to use for a particular composition, which contained automated knowledge (Laske 1990). [The notion was that work with sounds in real-time would be "observed", i.e., categorized and stored, by a computer keeping track of operations performed on musical material The process data generated by the composer would subsequently become available to researchers in the form of "compositional protocols" who could analyze patterns created or rules followed by the composer (OBSERVER by Truax and Laske, 1975). In this way, the process of music creation could be understood in an operationalized form at a deeper theoretical level.]

Task environment, finally, comprised the entirety of compositional tools – whether notation, software, or hardware – with which the composer's mind intimately had to connect in order to bring a work to fruition. This might include designing one's own task environment (as far as one was conscious of it), by selecting specific computer programs, either for score synthesis or sound synthesis, or both.

From this tripartite concept of the compositional process derived an equally-partitioned notion of new music research – first called "psychomusicology" and then "cognitive musicology" – that was meant to account for the structure of the musical mind observed in real-time work, whether regarding composition, performance, analysis, theory of music, or musicology (Laske 1984). From this concept also sprang the notion (Laske 2004) that there is no other history of music than the contemporary musical performance practice by which historical musics are actually "remembered" here and now. These thoughts were summarized by me as follows (Schuler 2004 [from the German]):

My Utrecht Writings are an attempt to create, in bypassing conventional music theory and musicology, a cognitive theory of music that employs ways of thinking fostered by the computer in order to open a window into future music. The author argues that a theory of music has to understand not musical results but rather the mental processes that lead to such results. It is thus not compositions, but their relationship to the musical processes they are created by that are in focus in the new musicology. As a result, this discipline needs to become a cognitive discipline focused on the goal to understand processes of musical thinking, with a precision now possible on account of computer software.

This notion of cognitive musicology naturally led to what in the 1980s began to be called "music and artificial intelligence" (Balaban et al. 1992). While this discipline quite successfully undertook to shed light on musical performance and the task environment (of both composition and analysis), it failed to answer the – rather presupposed – question of what was to be considered musical competence. Although Lehrdahl and Jackendoff attempted to answer this question for the special case of tonal music (Lehrdahl, Jackendoff 1996; Laske 1992), a theory of musical competence in a more general sense of the term never came to fruition. In my view, this is due to failing to understand the developmental underpinnings of adult mental processes employed in music making. In addition, bringing competence, performance, and task environment together requires dialectical thinking, and such thinking was not available to music researchers outside of the Frankfurt School.

Two Dimensions of Adult Development

The discussion between Piaget and Chomsky in 1975 rendered two opposing views of linguistic, and by extension, musical competence. What one saw as a life-long process of internal cognitive construction, the other saw as innate. From a dialectical-thinking point of view, this separation between innateness and construction is an artifact of human understanding in contrast to dialectical reason (Bhaskar 1993; Laske 2009). Understanding is rooted in formal logic and consequently unable to fathom that historical processes are inseparable from innate capabilities and that both need to be linked using dialectical thought forms (Adorno 1999; Laske 2009). While this seems straightforward enough once one grasps what dialectical thought forms are and how to apprehend them, the cognitive sciences that investigate adult development – above all "developmental psychology" – have (in my mind) put further obstacles in the way of seeing clearly what is the nature of musical competence.

The main obstacle to making cognitive musicology plainly "critical" in the precise scientific sense is the present cleavage between what I refer to as the social-emotional in contrast to the cognitive development of adults (Laske 2006, 2009). The lack of distinction between these two best researched strands of adult development dates from Loevinger's (Loevinger 1976) and Kegan's work (Kegan 1982) that is based on a very narrow concept of cognition excluding dialectical thinking in the sense of Adorno (Adorno 1999), Basseches (Basseches 1984), and Bhaskar (Bhaskar 1993). In present developmental research, a difference is set up between a "social-emotional" and a "cognitive" line, but the two are not seen as intrinsically related; rather, they remain unrelated to each other or else one of them is reduced to the other (Laske 2009).

Few would doubt that in music making, both developmental lines are observable: the composer makes "meaning" of his/her experiences socio-emotionally as well as constructs this experience cognitively, through musical operations, thereby bringing these experiences into balance with each other. This can be elucidated further for the case of musical creation and listening.

Making Sense Versus Making Meaning in Music

It is evident from self observation that musical listening as well as composition and performance call upon all human capabilities, and that these capabilities are emotional as well as cognitive in the sense of "thinking." Due to the fact that the legacy of the Frankfurt School, especially Adorno's work, has so far not been integrated into developmental studies, there is presently a paucity of practice of dialectical thinking both in the social sciences and in arts education. This is indirectly supported by the fascination the glittering contents of the Frankfurt School evoke, which makes it easy to bypass the question of what presicely is the structure of the School's thinking.

I have attempted to remedy this situation in my recent book entitled Measuring Hidden Dimensions of Human Systems (Laske 2009), by including a Manual of Dialectical Thought Forms. The book shows that in contrast to social-emotional development cognitive development does not occur in "stages" but rather in "phases", and that these phases – first outlined by Basseches (Basseches 1984) and further clarified by Bhaskar (Bhaskar 1993) – have to do with the gradual refinement of formal logical thinking (researched by Piaget) in the direction of using dialectical thought forms. I have also shown that the present phase of an individual's dialectical thinking, in and outside of music, can be empirically assessed by semi-structured interview.

Western – in contrast to Asian (Nisbett 2005) – dialecticism originates in works of the late Plato and Hegel's work, although elements of it can be found in Aristotle and Kant as well (Bhaskar 1993). It is a way of thinking in which the linguistic relationship between subject and predicate is not one of description of static objects having attributes ("the rose is red"). Rather, the subject "rose" – to employ this example – is considered as something that has to be discovered through further conceptual elaboration and argumentation (dialectical comments) transcending the simple assignment of an attribute or set of attributes. The question we are left with after reading dialectical thinkers such as Hegel, Adorno, and others is, of course: "how does dialectical thinking develop?" and "how can it be taught?" Answering the first question lays the foundation for answering the second.

The first question was first taken up in the 1980s by a member of the Kohlberg School at Harvard, my teacher M. Basseches who, in Dialectical Thinking and Adult Development (Basseches 1984), showed that the development of dialectical thinking can be empirically investigated by semi-structured interview. The interview probes the present capability of an adult to use a finite set of dialectical thought forms in reflecting upon a particular task and task environment.

As I have shown in my teaching at the Interdevelopmental Institute since 2000 (www.interdevelopmentals.org), the use of dialectical thought forms can be taught to anybody who is at the required epistemic position of seeing the world – including esthetic artifacts --as being in unceasing transformation, composed of a multitude of layers, and defined by intrinsic and constitutive relationships.

When the notion of dialectical thinking as a result of adult development, and pragmatically as a discovery procedure (rather than only a mode of argumentation or rhetoric), is adopted, a notion of human cognition, including musical thinking, emerges that is quite different from the formal-logical procedure of fixating attention on objects having attributes. The latter notion is provably insufficient for mentally conceiving of what we call "music" which, like the real world, is in unceasing motion, always pointing to a broader past and future context, and filled to the brim with relationships between its parameters and elements. As a result, thinking "music" requires a transformational kind of thinking optimally modeled by Adorno's writings on music.

For example, in his study of Wagner's work, Adorno deals with both the socially-mediated emotional meaning-making of Wagner the person and the structure of his thinking as a man of his time as it becomes visible in his work. Adorno trusts that in bringing to bear his own compositional and performance knowledge of Wagner's work and insight in the historical task environment in which Wagner created his compositions, he can "discover" fresh implications of how Wagner, the composer, actually though.

Adorno would have dismissed attempts on the side of developmental psychology to understand Wagner's creativity based on the reduction of a complex historical task environment to a single ephemeral individual – thus as a "de-totalization" of this individual ' s mind. He would, rather, have insisted that this individual represents a micro-cosmos that no other than a dialectical analysis of the structure of his notated and sounding work could successfully reconstruct, even disregarding Wagner's personal life. Unable to say anything about the use of Wagner's competence in real time (performance) – Wagner being dead – he focused on what he inferred was Wagner's musical competence and task environment. In this way, he adhered to conventional musicology procedures, but with an important twist since he was superbly capable of linking elements of competence and task environment by using dialectical thought forms.

Consequences for Critical Musicology

In light of the fact that empirical research in dialectical thinking in music can only be carried out by engaging living composers, performers, critics, and teachers, Adorno's example of studying a dead composer based on the notation and performance of his works represents a standing invitation to a critical musicology that has learned the lessons of cognitive science, especially cognitive-developmental research. In accepting this intriguing invitation, the pedagogical question that arises is simply: "how can we teach dialectical thinking (beyond reading and regurgitating Adorno's work), to keep Adorno's thinking alive?" In fact, in my experience as a participant of Adorno's Hauptseminar from 1958 to 1966, this question was at the core of all of his teaching.

Clearly, to think about music in the way Adorno was able to do is an adult-developmental, not just a cognitive, achievement. As Adorno's writings show it requires a level of both social-emotional and cognitive adult-development that is not reachable for everyone. To understand a composer's work at the level of Adorno's thinking would presuppose being able to answer four main questions:

> What is the composer's level of social-emotional development, i.e., how does he/she as a person relate to others and society at large in terms of stages of adult development (or meaning-making)?
>
> What is the composer's level of cognitive

development, i.e., how far does he/she transcend formal-logical thinking into dialectical thinking, and how does he/she transfer his thinking-in-language to the structure of a notated or electronic work (sense making)?

What in the structure of notated work performed in real time elicits in us as listeners a comprehension of our adult existence and the social world we live in that transcends formal-logical thinking (i.e., understanding in contrast to reason)?

In what way does a musical work lead us to transcend our notion of ourselves and our society as we psychologically experience it?

I would venture the hypothesis that answering these questions in itself requires exercising dialectical thinking, and that this kind of thinking can be taught to students of music and musicology today. Both as a composer and musicologist who has observed and "protocolled" himself and interviewed others at work in music I would say that awareness of an individual's musical thinking, when probed by semi-structured social-emotional and cognitive interview, goes a long way toward understanding the structure of the works the individual is able to learn, compose and/or apperceive.

I immediately hear the objection, of course, that thinking in language is incommensurable with thinking in music. This is certainly true. But from my compositional experience I would postulate that there is a discernable and explicable connection between a composer's thinking in language and music. This connection can, I believe, be gauged in terms of dialectical thought forms as I have shown in my recent book on dialectical thinking (Laske 2009). I would suggest, therefore, that we study the history of music through real-time and recorded performances of historical artifacts as well as contemporary music creations through recordings, sonographs, program notes and other musical texts, as well as developmental interviews of their learners and creators.

Conclusion

As a prolegomena to critical musicology studies I would thus recommend introducing a suitable cognitive science curriculum structured so as to enhance dialectical thinking. Based on my own musical research, on one hand, and my research in dialectical thinking, on the other, designing and experimenting with such a curriculum is an exciting task. All that is needed is focusing attention on mental processes in music, rather than only the artifacts such processes yield, as I first proposed in my Utrecht Writings of the early seventies (Schuler 2004). Once we are so engaged, it will become possible to take up the question of "what is musical competence?," and to link answers to this adult-developmental question to our knowledge of musical performance (in the sense of Chomsky) and of musical task environments (in the sense of Adorno).

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Conducted by Bob Gluck, January 3, 2006, in New York City

Ilhan Mimaroğlu, composer and writer, came to the United States on a Rockefeller Fellowship to study musicology at Columbia University, where he began a long association with the Columbia-Princeton Electronic Music Center in 1959. He has also produced electronic music programs for the radio and, working as a recording engineer and producer at Atlantic Records, helped craft landmark jazz recordings by Ornette Coleman, Charles Mingus and others. His own music often engages with political concerns.

Law School and Journalism

Ihan Mimaroğlu: To begin, let me read something from the back of one of my books. It is in Turkish. I'll translate:

"How bad I am with numbers, with dates. At least I know my date of birth, which is 1926. It was the time when the song 'Valencia' was sung by everybody. And I was born on March 11, on the same day Kaiser Wilhelm II was born in Holland. It was a Thursday. Where was I born? In the city [Istanbul], the center of the world, as some Byzantine emperor once said.

"Just like any other normal kid, when I grew up, I wanted to be a driver, a fireman, and a water carrier. But I was prevented from being such and since I didn't know what else to do… I was oriented to music… [first] writing about music … and [then] writing music itself. In time, I moved to another city, which pretends to be the center of the world: New York. And I saw my name on a calendar which mentioned Kaiser Wilhelm! And I started seeing my name in encyclopedia pages, which are regarded as cemetery stones [laughter] which someone put there a bit early!"

BG: Like an epitaph, here lies so-and-so and here's what their life was about ...?

IM: [laughter] Yes.

BG: You have a very creative way of seeing the world. In that biography, all roads led to music. So, why did you go to law school?

IM: Ha, ha. Good question. My father, whom I never met, was an architect. He died when I was a baby. My mother wanted me to be an architect, like my father. Since I didn't know what else to do, I said: "all right, let's go to that school where they teach architecture." The people at the school said: "You'll have to pass an examination to enter." What is the examination? They put a vase on top of the table and they said "draw it," which I did and I failed [laughter]. What's that got to do with architecture? So, what do we do with this child? At that time, my mother and stepfather were in Ankara, and the only university where you can enter without an examination was the law school. So they said: "Why don't you enter the law school?" And I said [laughter]: "Why not?" And I did. And that was the story. Well, I finished it. I have a law diploma that I am keeping [laughter] somewhere.

BG: Did you ever think about it again after graduating?

IM: No, not really. Never. Never. It was at that time that I started writing for newspapers, writing music articles. So that's where my life was oriented – writing about music and writing music itself.

BG: What did you write about?

IM: Reviews of concerts. That's what I used to write about. And I used to work at Associated Press, which was in the office of one of the main newspapers. At the same time, I was doing radio programs. Bülent Ecevit, who became Prime Minister later on, was working at the newspaper, too. Somehow, Mr. Marshall of the Rockefeller

Foundation came to Ankara and asked Ecevit – they had this strange idea of having a music critic brought to New York. "Who would you recommend," they asked. "Mimaroğlu." So, Mr. Marshall came to see me and said: "Would you come to New York to study at Columbia University, to study music criticism, music history, whatever, for one year." I said: "I am busy here. I'm writing articles and so on. But for six months I will." So I did.

The Columbia-Princeton Electronic Music Center

BG: So the idea was that you'd be in the States, get your education and then come back and be a critic there or, was it to be in New York and write for Turkish papers?

IM: The idea was to be in New York and get a music education at Columbia University with Paul Henry Lang and Vladimir Ussachevsky. So, I started attending classes. When I saw the electronic music studios at Columbia, I said: "Well, that's what I want to do."

BG: How did you know that?

IM: That's the impression that I got when I saw all the equipment.

BG: Was it something about how Ussachevsky described the equipment or what it looked like...?

IM: It was mostly what it looked like – and already I knew about electronic music.

BG: How did you know about electronic music?

IM: Recordings.

BG: Where were you learn about them and where did you find them?

IM: When I was in Ankara, I used to get them from abroad. From France, from America, by mail they would arrive and so that's how I got toknow about electronic music.

BG: How did you know that you wanted to look for them – and what exactly you wanted to look for?

IM: Well I knew of those music magazines. I used to read the papers and read the reviews. These magazines would arrive at Customs. I would go to Customs and get them. So, by reading, I knew a lot about electronic music.

BG: Did you know anybody else who was also listening to electronic music?

IM: No, not really, not really. If they ever listened to it, it was because they listened to what I used to play them on the radio.

BG: How did people respond to that?

IM: Well, it depends on the people.

BG: Did anybody ever tell you that they liked or didn't like what you played?

IM: Not really, not really.

BG: But that's really something to do that out of the blue.

IM: Yes, well, since my early age I was interested in what was going on in the world in terms of music, new music. New music, that's what interests me, new music. It was my principle: you have to start with what's going on today and then, gradually, go back to the past, where it came from. Rather than start in the past and going forward, you should know what's going on today in the world [laughter], and then learn where did it come from. That was my view.

BG: I once heard that you didn't want to go to music school because it wasn't going to teach you the way you wanted ...

IM: It was because they would teach me the wrong things, and I was saying that it's only when I know enough about music that I will go to a music school. Because then I will know whether what they are teaching is wrong or right. And when I started knowing enough about music, [I could tell when they were wrong]. I have a few examples of that.

I was a student at Teacher's College here. Why Teacher's College? Well, at Columbia, if you attended any particular school, you can follow classes at the other departments. Why Teacher's College? Maybe it had something to do with the fact that my mother and my three aunts were all teachers [laughter], so I said “fine, I’ll go to the Teacher's College.” And I was following classes at other departments of the University – and here’s one good example of the wrong thing they taught: I remember the conducting class. How does it go? First they show you how to hold the baton. And then how to beat the rhythm. Good. And then, come out, they say, “start conducting!” [laughter] There are were many other things I have to learn about conducting! They told me to start conducting the orchestra. I made too many movements, and they say “no, no, no, you have to give them one movement to start them.” I said “you didn’t teach me that!” [laughter] And so on, yes.

BG: Did you challenge Lang and Ussachevsky?

IM: Not really. No. I was listening to what they were saying, taking my notes. The thing is that since Ussachevsky was a busy person, he would say to me, at the very last minute during an electronic music class: “You go teach this class!”

BG: He was just leave and say “take over”?

IM: Yes, he would just leave and I would take over. This happened a couple of times. [laughter] I would just start with something like how to use a reverberation chamber or something like that. I would try to manage. In the meantime, I was also taking some private lessons from Edgard Varese. Most of the time, I used to talk to him over the telephone. One day, he asked me “What do you want to do in New York, what are you doing here” I said: “I want to study with you!” He said: “All right, let’s start!” [laughter] So, I would go to his place, something like every week. It was very interesting. I used to write a few things, and he would take what I wrote and he’d start adding notes to it. [laughter]

BG: Was there something in particular that you learned most from him?

IM: Just knowing him is learning about music. He was an exceptional person, a very exceptional person. I even asked Varese to come to Columbia to teach an electronic music class, which he did. Just one day. He came and talked to the students. He did.

BG: What was that like?

IM: Well, he was quite angry about what was going on in the music world.

BG: Did you ever spend any time with him in the studio?

IM: No. No.

Music and Politics, Music and Ideas

BG: When did you start thinking about art and politics? Was it in Turkey or when you got to the States?

IM: Well, it must have started most particularly when I came here. You would know about those days (the 1960s)! I’m still watching them on television! [laughter] And it was not only television for me, but I was in the middle of it. So it did have certainly some influence.

BG: Was there a particular event or just the climate?

IM: No, not really, just the climate. Yes. Columbia was a particular center of activity.

BG: What do you remember about WBAI?

IM: I don’t recall how I started at WBAI. But I did several programs. I didn’t go to the station. I just prepared recordings and sent them over and they would broadcast [them]. Some of my WBAI talks or excerpts are in my book, which is in English - its called Other Words. It was published in Turkey. A few quotations from it were printed in issues of the magazines EAR and Bananafish. For instance, “Take an ‘o’ out of ‘good’ and its ‘God’. Add a ‘d’ to ‘evil’ and its ‘devil’. To recognize ‘God’ and ‘evil’ and ‘good’ and ‘devil’, one must be a proofreader.” Here’s another: “We composers worry so much about posterity that we fail to notice what’s happening to our posterior." [An aside:] ... My records are so badly distributed. In Tower Records, there's a divider, but nothing in it.

BG: Let me ask you something about your ideas. Most composers are interested in sounds and musical form but very few seem interested in ideas. You seem very unique in that way. What do you want most to communicate in your music?

IM: What I want to communicate is written in the title of that given piece, if there are no other words. But if it's music with words, either sound words or spoken words, those words communicate what I want.

BG: But how important to you is communicating ideas through music? Some would say that music in itself cannot communicate anything.

IM: Well, music in itself cannot communicate anything, yes, verbally. But as I said, if there are words connected to that music ... a common example is a cantata; another common example is an opera: words, words, words, words! They should be clearly understood. Thankfully nowadays, operas have super-titles. You cannot understand a word of what they are singing, but you can read them! [laughter]

BG: But your messages seem much more important to you than to a lot of other composers.

IM: Yes, they are important. I'm trying to use music as a means to communicate what I want to say. This book (Other Words) is full of such examples [he flips through the pages of his book, again]: For example, "Calling a judge 'justice' is like calling an artist 'masterpiece.'" [laughter]

BG: Where did you gain your sense of outrage? Did you grow up with that, with a sense about morality and justice? Where did you learn that?

IM: I guess I grew up in a country where you are allowed to think about such matters. Turkey, the Turkey of Ataturk was a totally new country. We used to see signs here: "How happy is the person who says 'I am a Turk'", for instance. And indeed as I grew up and found out what was going on in other countries of the world, it became clear that this was a truly exceptional country, no question about that! Particularly the War years (World War II). Thankfully, we did not enter the War. But I am reading Ataturk's diaries, here and there. About Hitler, he says: "Hitler is not only a crazy man, but look at the vulgarity of his style." That's after he read Mein Kampf. [laughter]

So, came 1939, and we were all scared that Turkey would be invaded by the Nazis. Thankfully it wasn't. It came very close. We came to the center of Anatolia, because we thought that they were going to come. Then we returned again to Istanbul. Finally in 1945, I remember the day [laughter] when the Nazis were vanquished and there were celebrations in the street. So, those were important years for me.

BG: So, it was really during the War and the context of Ataturk and the Nazis that helped build your sense of justice...

IM: Well, all these build up, I'm sure.

BG: Had you done anything that was a work or act of protest before the 1970s, or was that new for you at that point?

IM: I don't recall anything before that time. No. But certainly my articles here and there no doubt contain a few political notes.

BG: I can think of other composers whose music reflected an engaged message. I think of Nono, of Berio's 'Sinfonia' and some others. But you did this in a sustained kind of way. That was unusual, no?

IM: In a kind of way, yes. But then, what purpose does it serve?

BG: What was the purpose that you wanted it to serve?

IM: Well, it's no different than speaking in a meeting or writing a book about whatever. Hoping that what you say would influence certain people towards changing the world or leading the world to a direction that it should, it should go.

BG: But it's not so usual. I don't know many composers who think that they have the power to do that or even care about that.

IM: Oh, they don't even think about it. For them music is just music, that's all.

BG: Is that an issue about which you spoke much with other composers in those days?

IM: No, not really.

BG: Was there anybody to talk to, if you wanted to?

IM: No, not much. Actually I didn't care about talking about these matters with composers. It's up to them to do whatever they wanted to do. [laughter]

Memories of Vladimir Ussachevsky

BG: Can I ask you a few things about Columbia?

IM: If I can answer them! [laughter]

BG: From whom did you learn the most in the early days?

IM: I cannot single out this or that teacher. I learned something from every one of them.

BG: Did you learn anything special from Ussachevksy?

IM: Well, that he was a good teacher, yes? That's true. I even have an interview with Ussachevsky, somewhere. I wish that I could play it to you. It is a recorded video interview. He used to live right around the corner down from where we used to live. This brings me to the question of why I stopped going to Columbia-Princeton Electronic Music Center. Actually, I didn't quit. But it was such a difficult place to go. The studio at McMillan Theater on 116th Street was closed. That was a place where it was convenient for me to go. Ussachevsky used to give me midnight hours. Actually, after midnight, so that I could go all the time I want to do what I want. So that's good. Then that studio was closed and the Center was moved to 125th Street. It was such an inconvenient place. Go down the hill and to the edge of the Hudson River. I could not afford taxis and you can't find taxis when you want to come back. And climb that hill. I remember that Ussachevsky used to have a bed there. [laughter] He used to sleep there! He was living around the corner from where I lived, and it was difficult for him to go down the hill. That's the reason I stopped. It's not that I composed enough; I decided that I couldn't go there anymore.

BG: Were you still going when Mario Davidovsky was in charge?

IM: Yes, but only a couple of times. I didn't continue.

BG: Who were the people with whom you talked to at Columbia?

IM: I cannot single out anybody. We didn't have much time ... we used to gather for class and the class would then finish.

BG: And then you'd come in the middle of the night...

IM: Yes.

BG: How did you learn how to use the studio? Did somebody teach you or coach you?

IM: I discovered it and figured it out myself.

BG: What did you most like working with? Was it tape, the tone generators ...?

IM: All the equipment. All the equipment. Ussachevsky of course did teach how to use pieces of the equipment. Certainly he did. I remember him when one of my loudspeakers at home broke down, and it was [of] the same kind [as the] loudspeakers used in the studio. I remember Ussachevsky carrying it the whole way, from 125th Street, one of the speakers [laughter], bringing it to my home, to my apartment. I remember that. Yes. I still keep it.

BG: A few people say that you helped them in the studios.

IM: I was assigned students.

BG: Who assigned you the students, was it Ussachevsky?

IM: Yes, yes.

BG: Were you ever paid to do this?

IM: I wasn't paid. I don't think so. I don't remember. [An aside:] What's all this. Who listens to electronic music? Who listens to new music?

BG: That's a real problem. We listen to ourselves and that's not terribly useful.

IM: Absolutely not useful.

Pierre Schaeffer and Musical Listening

IM: [Changing topics:] My contacts with Pierre Schaeffer were very good.

BG: How were you in contact with him?

IM: I talked to him. Sometimes I still make calls to the Group for Musical Research in Paris. But I can't go there anymore. They invited me once to give a lecture, when I was still able to go there. But now, because of the prohibition on smoking on planes, I can't go.

BG: You won't go anywhere that you can't smoke?

IM: No.

BG: That must be hard for you.

IM: It is. It is. But at least I can smoke here in my apartment. I used to smoke on the planes. I remember going there [to Paris] once to give a lecture. In my biography for the event it says that I'm a smoker. Yet, during the lecture I didn't smoke at all. So at the end someone asked me why I didn't smoke. I said that when I was a child, my mother said to me: "My son, the day will come when you grow up, you will go to Paris and at the Group For Musical Research, you will give a lecture. It is not in good form for you to smoke in front of an audience." So, it was my mother! [laughter] That's why I didn't smoke. So my mother saw the future! [laughter]

BG: How sympatico were you with Schaeffer and his approach to composing?

IM: Very much, very much. Yes. Particularly the idea that electronic music and cinema were in a parallel, the same thing basically. One is for the eye, the other for the ear. The same idea for me and for Pierre Schaeffer.

BG: Did you ever do any work that combines things for the eye and things for the ear?

IM: Did I? I can't recall that I did. No.

BG: Did that idea ever appeal to you, as opposed to just sounds so that people don't have anything to look at.

IM: No, it doesn't appeal so much to me. Because the eye is always more receptive than the ear, so they will look at what is being shown and not listen to what is being played. For me, it's not like that, but for most people, that's the way it is. In the movies, I always listen to the soundtrack music, together with what I see on the screen. But for most people, music is an accessory. They don't listen. That's my impression. I don't know, maybe.

BG: Is there a particular way that you hope they will listen? Do you want them to do nothing but listen? To close their eyes? To listen abstractly? What kind of a listener do you want?

IM: As you say, abstract listening.

BG: Like Schaeffer, do you want them to specifically not make associations, not to reference things?

IM: Well, for me it is hard to make references. It is not easy to follow both things at the same time. So, when I go to a concert, a standard regular concert when somebody is playing the violin, what do I care about the man who is playing the violin? It's what is being played that's important to me. For that reason, it's difficult to both see and hear at the same time, which by some effort I manage to do, particularly in the movies.

BG: My typical student does not have a background in listening abstractly. It takes them a long time to learn skills to listen without making references, without saying "that reminds me of this or that, or of another piece of music ..." This skill seems like something that is hard to learn.

IM: Well, it shouldn't be. Because there's nothing abstract about sound. It is something real.

BG: What do you mean by that?

IM: Just like things that we see, there are things we hear. If you listen to a piece of music, you don't have to make any references to something else. But there are works that combine both.

BG: I didn't mean composers choosing to make references, but listeners who can't seem to help themselves from making references in their own heads, when the music is abstract. The uneducated listener doesn't seem to know how to listen as Schaeffer says, with "blinders", so to speak.

IM: I don't know whether it's a matter of teaching. Music is something very concrete. Sound is something very concrete, so why shouldn't we listen to sounds as they are? Again, when we go to an orchestra concert, is it the presence of the orchestra, with all those instruments playing, the conductor conducting? Is it sight that makes the difference, that makes us listen to it? No, it shouldn't be.

As a Record Producer, Memories about Jazz

BG: Would you prefer to listen to music on recordings, then?

IM: Yes, it's not a preference really. It's the way I was brought up, the way that I listened to music all the time, through recordings.

BG: Is there something different for you about the experience of listening to music "live" or on recording? Or do you listen to both in the same way?

IM: As a maker of recordings, the thing that makes a difference for me is to regard myself as a recordings producer. That's often how I listen. "Oh, that note on the oboe, stop! another take!" [laughter].

BG: I'd like to ask you a few questions about your career as a producer of recorders. What was most important to you – was it the performance, the recording technique, a particular aesthetic?

IM: Both, of course. Sound has to be right, whatever that is. And the performance has to be "correct." That included recording multiple takes and fixing the recordings in the studio.

BG: How did you respond to Teo Macero's work with Miles Davis, recording and very creatively editing, in a sense re-composing in the studio....

IM: I don't know what kind of difference it would make in the case of Miles Davis. Here and there in restaurants I hear a trumpet player and I think: "That's Miles Davis. So many bad notes, so meaningless." Well, Miles Davis is one player that I never liked. Technically, musically, seems to play the wrong thing all the time.

BG: Did you like Freddie Hubbard better?

IM: Definitely, oh definitely.

BG: What did you like about Freddie Hubbard?

IM: He has good technique. He expresses himself. I don't know where he is now ... It is unfortunate when a player like Freddie Hubbard disappears from performing and public view.

BG: What other jazz musicians have been special to you?

IM: Oh, quite a few since I grew up with jazz recordings. I don't know names. I always liked jazz, from the beginning. Something new, always something different.

BG: Did you get into record production because of jazz or did you get into producing jazz because you were a record producer? Which came first?

IM: Well, both. I became a record producer just to earn some money. And thankfully, at Atlantic Recordings – Ahmed Ertegun, Nesuhi Ertegun, they were jazz experts. So they said go ahead and do jazz, do whatever you want.

BG: Did it help that you were all from the same country?

IM: [pause] I don't think so. Why should it be? That they trusted me to do what I wanted may have something to do with my being a Turk. They offered me a job, and I said that I didn't want to work in an office. I went back to Turkey. But then, I gave them a call, said that I wanted to work. They said "fine" and I came back.

BG: How did they know about you?

IM: It was first when I came here on a Rockefeller Fellowship, I had heard about Ahmed Ertegun, Nesuhi Ertegun, and I went to visit their offices, and I remember Nesuhi taking me to a night club to hear Errol Garner. That's one of the memories, yes.

BG: What was it like working with Ornette Coleman?

IM: He was fine to work with. That reminds me, I should give him a call. [laughter] I have to call him and just talk. I want to call him to tell him about a film, a British film in which on the sidewalk they put a sign in front of a restaurant that says "Omelette Coleman." [laughter]

BG: You did a lot of records with Charles Mingus. What do you remember about that?

IM: One thing that I remember is doing a take of a given piece, and it was such a good take in one [attempt] that at the end he says "mother [unintelligible]." [laughter] That I kept on the record. Occasionally I talk to his wife, Susan Mingus.

BG: One thing that is big right now is record companies going back into their vaults and releasing alternate takes, practice sessions, and so on. What do you think about that?

IM: I don't think it's a good idea, basically. Because for whatever reason for the artist or the producer, the others have been eliminated and the best accepted, so why put out out takes? They may not be so good or they may be ok, but I don't think that it's basically such a good idea.

BG: Were there times when you recorded a few takes and they were all basically good, and it was a judgment call to decide which to include on the record?

IM: Well, yes, that's a normal thing to do. [The decision is] just a matter of appreciating music, that's all. If the performer is around, yes, I always listen to it together [with the musician] and reach an agreement. If my judgment is rejected by the artist himself, he wants the other take, fine, its his record; I do it that way. [laughter]

BG: What do you remember about the recording session for Ornette Coleman's Free Jazz. Did you know that Atlantic recently released a new CD that includes alternate takes?

IM: How do they sound?

BG: They sound good, but the CD is different from what I grew up expecting of that recording.

IM: When you mention Free Jazz, that reminds me about one of Freddie Hubbard's recording sessions. There was a section that I wanted to do in that way, and I explained it to the performers in very academic terms. And Freddie says: "free, man, free!" [laughter] Yes, that is what it was.

BG: Did they talk much before making the recording of Free Jazz? How much did they know going into that session?

IM: It was just like any other session. They came in, fixed their instruments. [laughter] Go out, drink something. They don't talk much to each other. Then, when the time comes, they go about playing, just like anything else.

BG: How did your record label within Atlantic Finnadar Records come about?

IM: I just wanted to do some recordings and release some that wouldn't sell. [laughter] So, Finnadar was born. They were happy to let me do it.

BG: Did they ever give you any trouble about anything that you did?

IM: No.

BG: They just said: "Great, we'll keep paying?"

IM: Yes. As long as you don't spend too much money. And I knew how not to spend much money. So they said: "Just go about doing what you do ...." [laughter] I was into jazz all the time growing up. I had a group of friends who were also interested. We used to listen to recordings. I used to play the clarinet. I used to give concerts myself, with this friend or that friend, a guitarist, whatever, it was a jazz group primarily that I was into. At school that's what I was doing, meaning school has a radio, meaning a sound system that covers all the grounds, up in the air, on the ground, in the refectories. I used to go to that radio station, and I started playing records. It was my pleasure. And then one day, when the discipline board was in session, I was playing jazz records again. They sent someone, made me turn off the radio and gave me a punishment. [laughter] Oh, great. That I told to my mother, and she went to the director of the school and said "Why are you doing this? Is it a bad thing that the child plays music to his friends? Does he interfere with his classes? Why are you doing this?" [laughter] On that day, they permitted me again to play music on the sound system, but the punishment remained in my records. [laughter] And mother didn't tell me after I finished school, so I didn't get spoiled from what she did to protect me.

Bülent Arel, Turkey, Stockhausen and Babbitt

BG: After returning to Turkey and then coming back again to the United States, did being Turkish in any way impact on how you thought of yourself as a composer?

IM: No, except the language that I speak. My wife and I often meet with Turkish friends. At the Turkish Consulate they ask me to give some lectures.

BG: Was there any special connection you had with Bülent Arel because of a shared common culture?

IM: Well, I knew him when I was in Ankara, before I came here. We were living in the same city. He was an important composer; I knew that. Then, when I came here, he was just living across from where I lived – Harvey House, I think it was, uptown.

BG: Did you ever listen to each other's music, talk about each other's music? You're both really different from one another.

IM: Yes, very much so. He had at the time started working at Columbia-Princeton. I wasn't there yet. Yes, I knew him very well.

BG: Did you ever work together on anything? Ever talk about doing that?

IM: No. No, not really. I remember playing a trick on him. I sat at the piano and started banging the keys [Mimaroğlu makes "busy" sounds with his mouth] and recorded it. I said: "Bülent , I want to play you something. Its a new piece by Stockhausen." So I played it. With great seriousness, he starts examining it, analyzing it. [laughter] When I told him what I did, he got very angry. [laughter]

BG: He was unfortunately a very under-appreciated composer.

IM: Yes, he was a good composer. [unrelated to Arel and meant lightly:] You know, there really are many under-appreciated composers. But being under-appreciated doesn't make someone special! [laughter] The world is full of them!

BG: Since you brought up Stockhausen, how did you relate to his music?

IM: Overall I liked it very much, yes. Overall, whatever of his music came to me I liked very much.

BG: What about other, more serial composers at Columbia, like Milton Babbitt?

IM: Ah yes, well, Milton Babbitt. I may not be too fond of his music, but I must admit its important. It's important. It's beautifully crafted. It's not always a great pleasure to listen to, but he's an important composer, yes.

BG: Were you able to have your music played at Columbia?

IM: Well, it is difficult to have it played there. The sense is that there are no organizers of concerts. With all the sound system and everything. I used to organize concerts there. It's a very good hall, good acoustics, good sound system, so why not? Nobody is doing anything. They should do it. It's one of the rare places in New York where concerts should be given. It's the center of the University.

BG: I think that it's better now.

IM: Somewhat. They have great pianos.

Determining the Feasibility of Networked Musical Performances over WANs, LANs, and WLANs (Part 1: MIDI)

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In this study we combined empirical data about latency (delays) inherent in the transmission of information via the Internet with psychoacoustic information about the ability of musical performers to synchronize their playing and discern independent musical events. We used this information to determine the feasibility of conducting networked musical performances over local-area networks (LANs), wireless local-area networks (WLANs), and even wide-area networks (WANs), including performance of music that requires relatively tight synchrony of events. The experimental psychoacoustic and performance data we collected implies that successful rhythmically-synchronized networked performances can occur if the network latency is less than the time needed to perceive musical events as simultaneous, and less than the ability of the players to synchronize. These stipulations were usually met in performances involving MIDI transmission between two locations that are less than 400 miles apart (where network latency is below about 20 ms). In a future article we will detail the latency characteristics of networked performances involving transmission of audio streams, In this article we restrict our discussion to MIDI streams, which is far less demanding of network bandwidth. By conducting our tests on commonly available hardware and software, we have shown that networked performances are accessible to both household users and university performers alike.

Introduction

Thanks to the increased prevalence of broadband Internet connections, software designers are exploring new applications of the Internet as a low-latency communication medium. One such application of interest in the arts is networked musical performances. In a networked musical performance over the Internet, performers play in two or more physically remote locations. The audience is also usually in two or more locations, possibly including locations where no performers are present, such as via an Internet media stream. This presents many new questions and challenges in performance practice, not the least of which is the technical problem of the delay caused by the transmission of information over the Internet.

Long-distance musical interaction has the potential to revolutionize music teaching, rehearsal, and performance. For instance, the Yamaha Disklavier piano has been used to enable a piano teacher to give lessons remotely to a student hundreds of miles away (Campbell, 2004). The same technology can allow performers in different locations to play together, or one performer to play multiple instruments in different physical locations at the same time, potentially enabling a single musical performance to reach a larger live audience. A large number of instruments, each in a different location, can replicate the performance of one performer. The instrument(s) at the remote location can receive information from the instrument that the performer is physically playing, and instantaneously replicate the same musical events locally. In addition, networked musical performance allows musicians to rehearse pieces without traveling to the same location, saving transportation costs and time. The feasibility of real-time networked music performance has also given rise to new paradigms for performer interaction, such as group improvisation by performers in remote locations.

All that is needed to create a networked performance is a computer and a MIDI-enabled instrument. MIDI has some obvious advantages for networked musical performance compared with streaming raw audio data, in that MIDI requires much less bandwidth and can allow a performance to be perfectly replicated on an instrument at another location. Transmitting audio data in real time to distant locations usually does not work as well for musical situations that require tight rhythmic synchronization. However, as we will discuss in part 2 of this study, low-latency networked audio is increasingly accessible.

A goal of most networked performances is to achieve a high degree of transparency—to minimize noticeable problems that occur due to network latencies. A highly transparent system allows the performers to play together as if they were in the same room. One key to maintaining a transparent system is to keep latency times to a minimum. This is especially important in musical performances, because the slightest delay time can propagate back and forth between locations and interfere with accurate musical performance. Previous studies have shown that delays of 200 to 300 ms are the most disturbing to performers, and such delays make it very difficult to play notes in the correct rhythm (Willey, 1990). Previous research at Stanford University has shown that it is desirable to keep delay time as close as possible to 11.5 ms for performers attempting to keep an accurate tempo (Chafe et al., 2004).

To understand why even small delays are harmful to a networked performance, consider the following scenario. Imagine two performers are trying to play a duet together that involves playing four separate notes per measure. Performer 1 starts off a networked performance by playing the first measure alone. Performer 2 tries to synchronize with Performer 1, and begins playing in the second measure at the same tempo as Performer 1. All networks have some amount of delay due to physical properties of the connection medium and laws of nature; we call this delay "network latency." Because of network latency, the notes played by Performer 1 reach Performer 2 after a short time. Likewise, the notes played by Performer 2 reach Performer 1 slightly after they were actually played. Performer 2 uses the (delayed!) first measure played by Performer 1 as a reference for synchronization. Performer 1 listens to the timing of notes played by Performer 2, and slightly adjusts his/her own tempo in order to stay synchronized with Performer 2. Even if both performers had instantaneous reaction time and played their notes at the exact same time as they heard them played by the other, delays in the network will cause the other person's notes to arrive slightly after the original person played his/her own notes. This results in each performer hearing the notes they played, followed slightly by the notes of the other person. Since this complicates timing and tempo tracking, latency must be kept below the time a person is able to distinguish two musically independent events. As long as that is the case, the delay between when the first person plays notes and when the other person's notes arrive will be indistinguishable, giving the impression that both performers were playing together in the same physical location.

We included three different types of networks in our experiments in order to measure and compare the latency differences present in each type of network. We needed this information to determine if networked performances were feasible over LANs, WLANs, and WANs. LANs are smaller networks typically found in a home or building. Because they span relatively short distances, delays were expected to be less than 10 ms. WLANs, or wireless local-area networks, are similar to LANs in many respects except that information is sent via radio waves instead of over a wire. This results in slower transmission time than LANs. Finally, WANs span large geographic locations, such as states. As a result, the latency on this network is higher than that of LANs and WLANs. We were most interested in studying latency on WANs because the delays on these networks vary widely depending on distance. We also sought to determine the maximum distance two locations could be separated by while still maintaining a level of latency conducive to networked performance.

Previous Work

The concept of a networked musical performance is not new. As early as the 1970s, individuals in the League of Automatic Music Composers were investigating the idea of using networked computers to create and perform music (Bischoff and Brown). Members of this group typically brought their computers to the same room and had their programs perform a musical concert. Each person programmed his computer to obtain information from other computers it was linked to, allowing the machines to "improvise" together. The group known as the Hub emerged in the 1980s, and they were the first to have computers playing music together from different buildings in the same city. The work done by these groups was revolutionary during that time, but their work focused on creating new styles of computer music, instead of allowing synchronized real-time networked performances between human instrumental performers.

When the Internet began to be widely adopted in the 1990s, new possibilities enabling long-distance performance emerged. The concept of a networked performance expanded from being a local event of computers linked by MIDI cables in a room to an inter-city phenomenon in which electronic instruments communicated via the Internet. In contrast to the networked computer performances of the previous decade which required small amounts of bandwidth and often did not require precise timing, real-time performance consumes more bandwidth and requires higher-speed connections. This is because in a real-time performance, the success of the concert depends upon having information transmitted in a timely fashion. In the Hub's performances, it was not disastrous if a program received information from another computer 200 ms late. This is because the programmers would know about such latency and could compensate ahead of time. On the other hand, delays of this magnitude could ruin a real-time performance in which precise timing is of the utmost importance. Moreover, human performers rely on auditory feedback while playing, and the slightest delays can disrupt one's concentration. As a result, previously-avoidable problems such as propagation delay must be dealt with using more elaborate solutions when the connected devices are miles apart instead of in the same room.

An early demonstration of a real-time networked musical performance occurred in 2001. Jazz pianists Kei Akagi and Anthony Davis simultaneously performed a duo piano concert from two cities, with Akagi playing at UC Irvine and Davis playing at UC San Diego (Dobrian). This networked performance was as tightly synchronized. Although no precise controlled experimental data was recorded, anecdotal evidence during testing in rehearsals showed that the delay due to Internet latencies was about 10 ms.

Recently, UC Berkeley professors John Lazzaro and John Wawrzynek implemented a system allowing networked performances using the Real-time Transport Control Protocol (RTCP) (Lazzaro and Wawrzynek, 2001). Their software ran on the Linux operating system and was tested between UC Berkeley, Stanford University, and Caltech. While musicians may not always think about delays when performing, acoustical delays are present not only in a networked performance, but also in performance settings where all of the musicians are in the same room and close proximity. Players on a stage may also be separated by several meters, in which case they often use visual cues of the conductor to stay synchronized. Keeping this in mind, Lazzaro and Wawrzynek reasoned that the network delays observed could be combined with information about the speed of sound to determine the "distance" that networked performers would have between them if they were in the same physical location. Therefore, given a latency time in milliseconds, the equivalent distance between the two performers could be calculated. They concluded that such networked performances were feasible because the average observed latency was 14 ms, equivalent to performers being separated by 4.8 meters. Musicians often play together with ease at such distances.

In our study, we sought to determine if such musical performances were feasible using computer hardware and software that is more readily available to end-users. Although the Linux OS has made impressive strides forward in improving the user experience, most musicians desiring to participate in a networked performance would own a computer running Windows or Mac OS. Thus, in order to see how well a networked musical performance could work on the Mac OSX operating system, we conducted our latency tests using Macintosh computers running OSX 10.4. Version 10.4 allows one to create a virtual MIDI device that is connected over the network. Apple claims that OSX's audio platform, Core Audio, was designed with the goal of keeping MIDI latency to a minimum. One of our objectives was to find out if these optimizations in Core Audio would allow a networked musical performance to take place using commonly available Macintosh computers, running Mac OSX 10.4.

Our study further sought to gather and thoroughly analyze empirical data concerning the cognitive, physical, and technical latencies involved throughout the entire process of a networked performance. We also investigated whether extremely long-distance communication was feasible (ranging from hundreds to thousands of miles apart), and in addition, studied how feasible a networked performance would be over a WLAN connection. Wireless capabilities enable many exciting possibilities for computer music concerts, but we will not discuss the significance of these capabilities at this time.

Methods

When developing our experiments, there were three factors that we needed to test: (1) the average delay times over computer networks; (2) the average precision with which two performers could synchronize their playing; (3) the average ability of listeners to discern separate musical events. Our reasoning was that if the average delays over a network were less than the time needed for pianists to synchronize, and those network delays were also less than the time needed for performers to perceive independent musical events, then network delays should not impede networked musical performances.

To test how well pianists could synchronize their playing in the best-case scenario (i.e. in the same room), we developed a program in the Max/MSP programming environment that would allow us to store the time discrepancy in milliseconds between two performers pressing the same note several octaves apart on a keyboard. The measurement program also allowed us to control various cues from which the performers would set their tempo. The cues we used were either a visual metronome or an audible metronome, or both. The audible cue was similar to a metronome, whereas the visual cue was similar to a conductor. The pianists observed a laptop that displayed a red circle in one of four locations to indicate the beat. Finally, to determine how well pianists could begin playing together, we kept track of their ability to press a note simultaneously after the musicians cued one another with a nod of the head (which is common practice in chamber music). When using the head nod, pianists were specifically instructed not to follow a tempo, so that their ability to start a performance could be observed. The pianists attempted to synchronize their playing using the cues at 80, 100, and 120 beats per minute (bpm). We tested a variety of pianists ranging from casual players to those majoring in Piano Performance at UC Irvine. Each of the test subjects had played the piano for at least 5 years and many had taken formal lessons during that time. To keep the performance material simple, we tested the pianists' abilities using only notes from a C major scale. For each test, the pianists played the C scale up an octave, then back down, and repeated this three more times. Thus, for each run, the time discrepancy between a total of 57 notes was recorded. For a more detailed description of this experiment, please see Appendix A.

The concept of propagation delay was not considered in this experiment because the performers were in the same room. Because of this, each performer heard the notes played by the other performer "immediately." Thus, the growing note-transmission delay phenomenon described previously did not arise in this situation. We did not test the ability of performers to synchronize in the presence of growing delay because it was already known that such delays make network performances impractical (Willey). Instead, we wanted to use information on pianist synchronization ability to determine conditions which permit successful networked performances (in terms of distance, medium, delay in milliseconds, etc).

A networked performance requires a continuous stream of musical information to be delivered to all participants. But how far apart can these musical events be without noticeably affecting the performance? If the network delay time is less than the time needed to perceive separate musical events, then the performance would appear perfectly identical to a conventional performance, which is the ultimate goal of this system. This is due to the fact that humans will not notice any latency in the system, since the delay time required to transmit the musical events from one location to the other is less than the time humans can even perceive such events. In order to test how well the human ear can distinguish separate musical events, we conducted a test where listeners closed their eyes and listened to two piano tones which began a few milliseconds apart. If the listener subjects believed the sounds to be distinct in their starting times, they would raise their hand. In contrast, if subjects believed the tones sounded simultaneously, then they did not raise their hand. One experimenter controlled the program which generated the tones, and observed the subjects' responses. We shifted the delay between the tones from 10 ms to 30 ms. This listening test used sampled piano sounds to ensure a fast attack time. A sound with a slower attack time might have skewed the results because it would be more difficult to tell exactly when a sound was played.

Next, in order to observe the amount of delay inherent in networks across the United States, we used the standard network ping command to record the roundtrip times between UC Irvine and a variety of locations. We developed a Visual Basic program which utilized batch commands to organize and record ping results. These results were then used to determine the average delay times between various locations. To allow for variances in daily Internet traffic, we ran the program five times per day, evenly spaced out from 9AM to 9PM. To allow for weekly variances, we ran the program every day for a full month. We tested network latencies by pinging the following areas: the same building at UC Irvine, across the UC Irvine campus, UCLA, UCSD, a residential area in San Diego, UC Merced, UC Berkeley, University of Texas, and New York University. We included the residential area to provide insight into what kind of delays would be involved when communicating with a location off of the high-speed Internet2 network which links the universities. Typical home users would not have access to such a high speed network, and we wanted to observe the extent to which latency increased when utilizing a slower, residential network.

Lastly, we wanted to determine how the connection medium would affect network latency. Wireless Internet access is becoming more and more commonplace, especially with new musical instruments like the Yamaha Disklavier Mark IV, the first piano with built-in wireless communication capabilities (Yamaha Corporation). To see if wireless communication would impede a networked performance, we ran tests on two Macintosh G4 Powerbook computers running Mac OS X 10.4.5. First, we tested latency when the computers were connected to the LAN with an Ethernet Cat 5 cable, and then we tested again when the computers were connected through the wireless LAN using the Apple Airport wireless Ethernet card. In this configuration, we pinged the other computer repeatedly, tried sending a three-byte MIDI message once every second using the MXJ net.udp.send/recv object (in Max/MSP), and also tested latency by sending a three-byte MIDI message once a second using the operating system's built in MIDI networking technology. The MIDI tests were conducted using Max/MSP version 4.5.5. For each test, we took three minutes of data, and averaged the results.

Results

After several days of experimentation with over six pianists, we recorded the ability of two pianists to synchronize their playing when using various cues in Table 1:

Cue Type:	**Avg. Discrepancy (ms):**	**Standard Dev. (ms):**
Sonic	24.56	6.97
Visual	34.81	12.05
Sonic and Visual simultaneously	29.22	13.90
Head nod	36.45	5.62
Overall	30.06	11.89

Table 1. Average discrepancy between two pianists attempting to synchronize using various cues. These results are the averages of all pianist groups who participated in the study.

On average, the pianists could play a note together within approximately .03 seconds (30 ms) of each other. If the network delays were less than 30 ms, the quality of a networked performance would not improve, since the pianists could be the limiting factor in that case. Thus, network delay times greater than 30 ms do indeed pose a problem for networked musical performances.

We combined this information with the results of our musical perception test. The subjects we tested were able to distinguish musical events that were approximately 20 ms apart, but failed to do so if the musical events were less than 20 ms apart. These results agree with earlier studies done by Tanaka (Tanaka 2000) and Winckel (Winckel 1967), which produced similar findings. Therefore, it is reasonable to assume that if the average network delay is less than 20 ms, we can expect to have a high-quality network musical performance. We should, however, keep in mind that this perception test was an artificially controlled situation, where the subjects were concentrating on listening for two notes, instead of a typical musical setting where many more notes are heard in rapid succession. We can assume that humans can notice a difference of 20 ms in a controlled environment, but that slightly longer delays would be tolerable in a more complex musical context.

After a month of testing latency in the networks to various universities from UC Irvine with the ping command, we averaged the roundtrip times. The roundtrip time is the time between when a packet is sent from the local computer and when the remote computer's response arrives at the local computer. These times for each location are shown in Figure 1:

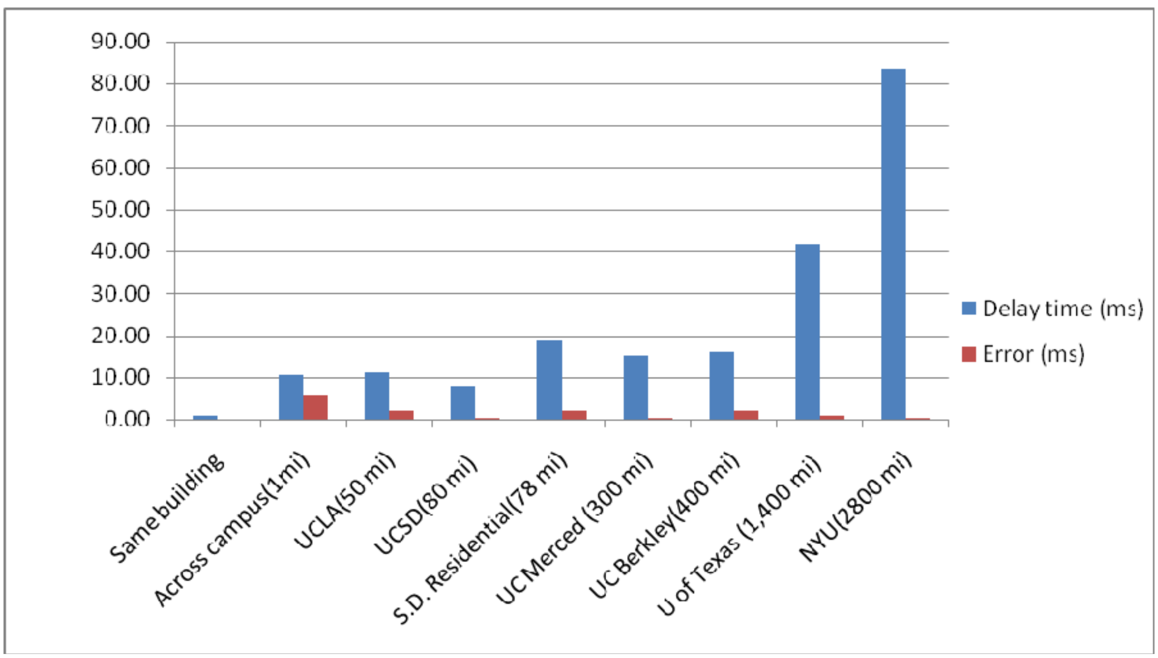

Figure 1. Average roundtrip time to various locations from UCI, determined using the ping command.

Because of very little variance in the data between times of day, only the overall average delay times are shown here. In addition, there was no noticeable difference between weekends and weekdays. The delays, however, were occasionally slightly longer on weekday mornings (9:00 AM), but since most performances would likely occur later in the day, this does not appear to be a significant concern in most cases.

We see that the average network delay times for locations in California are less than 20 ms, which indicates that a networked musical performance is certainly possible when performing with someone who is 400 miles away. On the other hand, the average delay to out-of-state destinations, including the University of Texas and NYU, was about 40 ms and 80 ms, respectively. While it may be possible to conduct a networked performance with higher delay times like these, such a performance will lack the seamlessness and fluidity that performers and audiences expect of a conventional performance. It is also interesting to note that delay times of the residential area in San Diego were about twice as high as those of UCSD. This implies that a networked musical performance may still be possible over a typical Internet connection if the performance locations are close enough (100 miles or less), but will likely encounter a higher degree of delay, possibly to the extent of resulting in lack of synchronization.

Test Method	**Wired Delay using LAN (ms)**	**Wireless Delay using WLAN (ms)**
Ping	0.4	3 with occasionally spikes of 24
Max/MSP UDP objects	7	11
OSX MIDI Networking	4	7 with occasional spikes of 28

Table 2. Network latency determined using various methods on a LAN and WLAN.

It is also important to notice that the OSX MIDI networking and Max/MSP MIDI objects had higher delays than the ping times. This is due to a greater amount of overhead involved in the transmission protocol. For example, the ping command uses ICMP (Internet Control Message Protocol) Echo Request and Reply messages, which are small and require little processing. Typical network applications, however, use TCP (Transport Control Protocol) or UDP (User Datagram Protocol), which require additional time to package and process because of built in mechanisms for error correction, flow control, and congestion control. The Max/MSP UDP send and receive objects tended to have slightly more latency than Mac OSX MIDI networking capability, which suggests that the Max/MSP UDP objects (mxj net.udp.send and mxj net.udp.recv) may send information less frequently than the Max/MSP MIDI objects (notein, noteout, midiin, midiout, etc). This

Finally, we come to the question of wired vs. wireless. Not surprisingly, we found that wireless communication is slightly slower than a wired medium, but also found that moving to a wireless medium only increased latency by a few milliseconds (see Table 2). Occasionally, however, there would be spikes in latency when using the wireless medium, likely caused by collisions of packets. Because of this, to ensure the most reliable connection a wired network should be used.

would also explain why the latency times were reduced when using virtual MIDI devices, even though the Max/MSP environment was used for testing both the UDP objects and the OSX MIDI networking latency.

Conclusion

This study sought to produce empirical data about cognitive, physical, and technical delays involved in a networked musical performance to determine if such performances were feasible across various types of networks. Latency hampers a smooth networked performance, and is caused by delays in the instrument itself, processing time in the computer, ability of the players to synchronize, and delays in the network. We found that listeners are only able to cognitively discern independent musical events when the events are at least 20 ms apart. Performers were only able to play within approximately 30 ms of each other in the same room, although this reached as little as 14 ms depending on skill level and tempo. There were only a few milliseconds of computer latency involved in processing the incoming messages. Finally, the network delays ranged from less than 10 ms on a LAN or WLAN to greater than 30 ms using the WAN. Collectively, the data implies that successful networked performances can occur if the network latency is less than the time needed to perceive musical events as simultaneous, and less than the ability of the players to synchronize. These stipulations are usually met with performances between two locations less than 400 miles apart (network latency < 20 ms).

By conducting our tests on commonly-available hardware and software, we have shown that networked performances are accessible to both household users and university performers alike. We hope that with the widespread and escalating adoption of broadband Internet connections an increasing number of amateur and professional musicians will utilize networked musical performances to take advantage of the many benefits such technology brings.

Our work for this article has primarily focused on MIDI streams that require low amounts of bandwidth. Streaming of audio and video signals continues to be a more challenging problem because these streams consume much more bandwidth than MIDI. As higher-speed networks continue to evolve, and more efficient video and audio codecs are developed, future musicians may utilize audio and video streams for even more immersive, networked musical performances.

Acknowledgements

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Appendix A: Detailed Experiment Protocols

We conducted the following tests on pianist synchronization ability to determine how well pianists can play together in the best circumstances (i.e., in the same room). The program we made would watch for the first note in the sequence to be played by either person. It would record the time when this happened, and wait for the same note to be played 2 octaves apart by the second pianist. The time difference would be recorded. This process would repeat for every note in the sequence. At the end of the test run, the delay times would be averaged. The results are shown in Tables A1 ~ A3.

Part 1: Audible Cue Only

Two pianists sat side-by-side on a piano bench in front of a keyboard. They were instructed to play the C scale upward with their right hand. One pianist would start at middle C, while the other would start at the C two octaves down. For each test, the pianists played the C scale up an octave, then back down, and repeated this three more times. Thus, each person played a total of 57 notes each test. Pianists were instructed to play one note per beat. They tried to play each note together, as closely as possible. There were also two measures of lead-in for each test, so the pianists started playing at the beginning of the third measure. For this test, pianists listened to an audible cue program which played a high C on beat 1 and a C an octave lower on beats 2, 3, and 4. For each experiment, the program that displayed the collected data for that run was hidden, so that the pianists would not concentrate on judging their performance while playing. This experiment was repeated 3 times per pianist group, using a metronome speed of 80, 100, and 120 beats per minute (bpm).

Part 2: Visual Cue Only

This experiment followed the same format as the previous one, except the pianists relied upon a visual cue instead of an audible cue. A laptop was placed in front of the pianists, which ran a program that imitated a conductor. A large red dot appeared in one of four locations (bottom, left, right, top), indicating the beat. This experiment was repeated 3 times per pianist group, at 80, 100, and 120 bpm.

Part 3: Audible and Visual Cue

This experiment followed the same format as the previous one, except the pianists relied upon both a visual cue and an audible cue. Thus, the metronome was playing at the same time as the pianists were observing the laptop conductor. This experiment was repeated 3 times per pianist group, at 80, 100, and 120 bpm.

Part 4: Ability to Start in Unison

This experiment followed the same format as the previous one, except the pianists were instructed not to follow a tempo. One pianist would use the “chamber music head nod” and press one note, and the other pianist would watch his or her partner and try to play their own note (2 octaves apart) at the same time. After a short pause, this process would be repeated, entirely out of tempo, because we were trying to measure how well pianists could start a performance. Thus, we measured 57 starts in total per pianist group.

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Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo(bpm):	80	Tempo (bpm):	80	Tempo:	80
Std. Dev (ms):	20.556	Std. Dev (ms):	23.176	Std. Dev (ms):	21.864
Mean(ms):	25.643	Mean(ms):	28.276	Mean (ms):	23.828
Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo:	100	Tempo (bpm):	100	Tempo:	100
Std. Dev (ms):	20.833	Std. Dev (ms):	32.686	Std. Dev (ms):	16.463
Mean(ms):	20.69	Mean (ms):	33.759	Mean(ms):	20.055
Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo:	120	Tempo (bpm):	120	Tempo:	120
Std. Dev (ms):	11.465	Std. Dev (ms):	20.107	Std. Dev (ms):	12.444
Mean(ms):	17.448	Mean (ms):	22.034	Mean (ms):	14.996
Cues:	head, Subject 1 leading	Cues:	head, Subject 2 leading		
Tempo:	free	Tempo:	free		
Std. Dev (ms):	22.822	Std. Dev (ms):	22.614	Overall	
Mean(ms):	28.545	Mean (ms):	33.179	Average (ms):	24.40481818

Table A1. Subject 1 and 2

Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo(bpm):	80	Tempo(bpm):	80	Tempo:	80
Std. Dev (ms):	21.968	Std. Dev (ms):	31.403	Std. Dev (ms):	25.187
Mean(ms):	26.474	Mean(ms):	37.729	Mean(ms):	33.328
Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo:	100	Tempo(bpm):	100	Tempo:	100
Std. Dev (ms):	12.737	Std. Dev (ms):	19.496	Std. Dev (ms):	14.168
Mean(ms):	17.638	Mean(ms):	21.259	Mean(ms):	18.069
Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo:	120	Tempo(bpm):	120	Tempo:	120
Std. Dev (ms):	13.293	Std. Dev (ms):	25.024	Std. Dev (ms):	11.757
Mean(ms):	17.086	Mean(ms):	21.69	Mean(ms):	14.362
Cues:	head, Subject 3 leading				
Tempo:	free				
Std. Dev (ms):	30.896			Overall	
Mean(ms):	39.724			Average(ms):	26.05775

Table A2. Subject 3 and 4

Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo(bpm):	80	Tempo(bpm):	80	Tempo:	80
Std. Dev (ms):	25.589	Std. Dev (ms):	49.053	Std. Dev (ms):	34.428
Mean(ms):	38.386	Mean(ms):	55.966	Mean(ms):	56.345
Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo:	100	Tempo(bpm):	100	Tempo:	100
Std. Dev (ms):	33.231	Std. Dev (ms):	35.742	Std. Dev (ms):	26.305
Mean(ms):	33.07	Mean(ms):	45.931	Mean(ms):	36.241
Cues:	sonic metronome	Cues:	visual metronome	Cues:	sonic and visual
Tempo:	120	Tempo(bpm):	120	Tempo:	120
Std. Dev (ms):	17.987	Std. Dev (ms):	25.372	Std. Dev (ms):	27.954
Mean(ms):	24.632	Mean(ms):	44.155	Mean(ms):	41.724
Cues:	head, Subject 5 leading				
Tempo:	free				
Std. Dev (ms):	27.189			Overall	
Mean(ms):	41.089			Average(ms):	42.31725

Table A3. Subject 5and 6

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Aspects of Coordination between Fixed Media Electronics and Contrabass in Mario Davidovsky's Synchronisms No. 11

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This article is a guide for performing Mario Davidovsky's *Synchronisms No. 11* (2005) for contrabass and fixed media. The paper focuses on the coordination between the contrabass and fixed media electronics, examining insights gained from research of previous *Synchronisms* compositions. Comparing earlier *Synchronisms* works and *Synchronisms No. 11*, it can be said that the performer is given clearer guidance in *No. 11* as far as coordination between the live performance and fixed media sections are concerned. These aspects of coordination are as follows: (1) embedding acoustical sounds into the electronic soundscape and creating a unified texture through tightly controlled rhythmic integration; (2) juxtaposition and unification of acoustic and electronic domains as a musical gesture; (3) timbral integration; and (4) acoustic instrument extension via coordination of acoustic gestures with manipulated envelopes in the electronic domain. Earlier *Synchronisms* works discussed in this paper include *Synchronisms No. 1* (1962) ; *No. 2* and *No. 3* (1964); *No. 5* (1969); *No. 6* (1970); and *No. 9* (1988) for violin and electronic sound.

Introduction to the Genre and Mario Davidovsky

After World War II, a number of composers started to turn to electronics for new materials and it was at this time that some musicians began to take advantage and incorporate emerging technologies and aesthetics into their works. The rise of the academy as patron of art music, the philosophical underpinnings of "futurists" like Russolo and Busoni, the increasing power and cost-effectiveness of music technology platforms, and the new compositional directions of the post-World War II avant-garde, contributed to the establishment of the electro-acoustic music genre in the United States and Europe. A large number of electronic music from the 1950s through the mid 1990s consists of fixed media works or fixed media works combined with live performers. The electronic component was generally realized through either analog or digital synthesizers and/or computer-generated. Sounds were stored for playback on a fixed medium such as analog electro-magnetic tape (cassette or reel-to-reel), Digital Audio Tape (DAT), or Compact Disk (CD).

More recently, audio has been stored as mp3 for playback via software-based media players such as Apple's iTunes. Also, a practice we can commonly see today is storage of the audio within a Digital Audio Workstation (DAW) environment such as Avid/Digidesign's Pro Tools or MOTU's Digital Performer system. The platform notwithstanding, the electronics were fixed while the live instrumental or voice parts were performed live. One of the most important bodies of work in the genre of tape and acoustic instruments is Mario Davidovsky's *Synchronisms* series, a seminal body of work that the composer wrote over a span of more than four decades. *Synchronisms No. 11* for contrabass and electronics is the first of the two most recent *Synchronisms* that were premiered in 2007.

Composer Biography and Background

Mario Davidovsky (b. 1934) is a member of the American Academy of Arts and Letters, director of the Koussevitzky Foundation at the Library of Congress, and Founder and Vice-President of the Robert Miller Fund for Music. He received a Pulitzer Prize in 1971 for *Synchronisms #6* for piano and electronic sounds, awards from BMI, and numerous fellowships including the Guggenheim Foundation, Rockefeller Foundation, and Koussevitzky Foundation Fellowships. Highlights of his list of commissions include the Juilliard String Quartet, Yale University, the Philadelphia Orchestra, Speculum Musicae, the San Francisco

Symphony, MIT, the Emerson Quartet, and Orpheus Chamber Orchestra. Davidovsky is the Fanny P. Mason Professor of Music, Emeritus at Harvard University and is the former Director of the Columbia/Princeton Electronic Music Center. Born in Argentina, he immigrated to the United States in 1960. He currently resides in New York City and remains active as a composer, educator, and clinician (Oxford Music Online 2008). Composer George Crumb refers to Davidovsky as "the most elegant of all the electronic composers whose music I know" (Crumb 1980). Composer Eric Chasalow refers to Davidovsky's utilization of very detailed articulations within relatively sparse texture through which "the result is an elegance seldom achieved in the music of our time" (Chasalow 2005).

Overview of Synchronisms No. 11: Context within the Composer's Compositional Output

The electronic sounds in *Synchronisms No. 11* were produced with the technical assistance of Greg Cornelius at the University of Texas Electronic Music Studios. It was the eleventh of twelve *Synchronisms* that Davidovsky had written for fixed tape and acoustic instruments. *Synchronisms No. 11* was composed for, and premiered by Donald Palma on March 10, 2007 at the 2007 National Conference of the Society for Electro-Acoustic Music in the United States (SEAMUS). With coordination from SEAMUS, the work was commissioned by a consortium of academic institutions including Brandeis University, Columbia University, Harvard University, Rice University, Temple University, University of Missouri at Kansas City, University of Oregon, University of North Texas, University of Pennsylvania, University of Texas at Austin, and Wellesley College. The performance took place at the Martha-Ellen Tye Recital Hall on the Iowa State University campus in Ames, Iowa. At the end of March of 2007, *Synchronisms No. 11* received its second performance by Palma at Merkin Concert Hall in New York City. The work was published by C. F. Peters Corporation in 2008 after some modifications by Davidovsky (Edition Peters No. 68199).

Synchronisms No. 11 holds the distinction of being Davidovsky's first published electro-acoustic piece since *Synchronisms No. 10* for guitar and electronic sound (1992). From 1974 until 2005 Davidovsky composed only two works that utilized electronics, *Synchronisms No. 9* and *Synchronisms No. 10*. The landmark date of 1974 was the year that he composed *Synchronisms No. 7* for orchestra and electronic sound and *Synchronisms No. 8* for woodwind quintet and electronic sound before abandoning the electro-acoustic genre for the next 18 years. The 12th *Synchronisms* for clarinet and electronics was also commissioned by the same consortium that commissioned *Synchronisms No. 11* and *No. 12* and was premiered by clarinetist Allen Blustine on the same SEAMUS 2007 program on March 10, 2007.

Davidovsky apparently stated that he intended to write a *Synchronisms* for contrabassist Don Palma in the 1960s. Although *No. 11* was almost 40 years overdue, it does not depart radically from the earlier *Synchronisms* and preserves the *Synchronisms* series as a cogent set of compositions. It is clear that Davidovsky's goal was to create a concise virtuoso piece for the contrabass – there are numerous instances of disjunctive melodic gestures, abrupt dynamic contrasts, and meticulous articulations that pose technical challenges for the performer. In addition to the inherent technical difficulties of the contrabassist performing the atonal leaps, detailed articulations, and complex dynamics, there are also artificial harmonics, double stops in extreme upper registers, and quick rhythmic passages.

The electronic timbres were derived by sampling sounds from the contrabass and were created by "subjecting them to processes of additive synthesis and editing via the dazzling technology available today" (SEAMUS 2007). The electronics are reproduced from a stereo audio CD and is included with the score. The composer suggests that the amplification of the electronics be diffused from two loudspeakers placed on stage at either side of the performer. Minimal amplification on separate loudspeakers is also suggested for the contrabass (Davidovsky 2008).

Like the other works in the *Synchronisms* series, *No. 11* explores the combination of fixed electronic media and live performers. In terms of the coordination of acoustic contrabass performance with the electronics, *Synchronisms No. 11* utilizes many of the coordination strategies that Davidovsky employed in some of his earlier *Synchronisms* works written decades before. It is in these earlier *Synchronisms* that a 21st Century performer can discover aspects of coordination between the performed parts and the electronic parts and apply them in guiding the performance of the more recent *Synchronisms No. 11*.

Embedding the Acoustic into the Electronic Soundscape: Creating a Unified Texture through Tightly Controlled Rhythmic Integration

The *Synchronisms* are described by Davidovsky as "a series of short pieces wherein conventional instruments are used in conjunction with electronic sounds" and "to achieve integration of both into a coherent musical texture" (Composers Recordings 1966). Throughout the various iterations of *Synchronisms*, and especially Nos. 1, 2, 3, 5, 6, and 9, the composer demonstrates a wide variety of formats for rhythmic integration between the electronics and performer. As executed in *Synchronisms No. 1* and *No. 3,* rhythmic integration can consist of occasional timings that require coordination between tape and performer only at certain junctions in the music, which leaves the performer ample freedom to exercise *rubato* techniques. The other end of the spectrum is *Synchronisms No. 6* which requires total, controlled interaction between the tape and performer. The score is notated with precise indications resulting in a highly integrated work with almost no opportunity for creative interpretation (Soule 1978).

In all of the *Synchronisms*, the performer must identify the level of rhythmic integration, and respond accordingly with one of three different performance approaches: (1) a freely performed *rubato* layer of live acoustic instrumental sounds superimposed over a tape part that does not require precise coordination; (2) an exact coordination with tape; or (3) some approximate level of coordination between the two polar opposites as described in (1) and (2).

Any bassist that attempts to perform *Synchronisms No. 11* will have to learn or even memorize the electronic part in order to appropriately synchronize the contrabass part with the electronics. Fortunately, the electronics are meticulously notated in the score. Furthermore, the complex rhythms of both the tape part and the contrabass part are clearly decipherable and accurately notated.

Regarding structures related to rhythmic integration, *Synchronisms No. 11* is very similar to *Synchronisms No. 6*. As in *Synchronisms No. 6*, the contrabass and electronics of *No. 11* are precisely coordinated and create a texture in which the live contrabass becomes embedded within the electronics counterpart, creating a complex but singular soundscape.

One of the most difficult aspects of performing *Synchronisms No. 11* is inherent in the fact that it is not an interactive piece and thus requires absolute coordination between contrabass and electronics without the help of external sound triggering devices that can facilitate aligning the electronics with the performed contrabass. In some sections of the piece, the coordination is imperative, and must be precisely performed. For example, measure 27 contains the first instance of total synchrony where a Gb note is played in unison in the electronics and performed contrabass. Similar gestures in m. 138 and m. 149 will require the same sense of tight synchrony. Another example can be found in mm. 43-47 articulated through long durational notes. In these measures, the contrabass is one voice of a four-part homo-rhythmic texture with the other three parts supplied by the electronics. Both contrabass and electronics share the same rhythmic durations throughout the passage. In this particular passage, the performer must play slightly ahead of the chord changes to perpetuate the illusion of interactivity. A similar gesture requires the same treatment in mm. 132-135. Measure 74 is the first time that the electronics and contrabass share a fast rhythmic gesture for an entire measure and also signals the end of that section.

Another example where absolute coordination is required is between mm. 103-185 which is punctuated with silence in m. 186. This section resumes a more active texture, but unlike mm. 25-75, mm., 103-186 tends to be more pointillist. Embedding of the contrabass part into the electronic texture is achieved through pointillist interplay between bass and electronics. It should be noted that although this section should be executed as articulated in mm. 25-75, the rates of variance between differences in articulations, dynamics, and expressive markings are not nearly as rapid as before.

Much of the aesthetic of "embedding" as employed in the *Synchronisms* pieces is seemingly related to a religious viewpoint: Eric Chasalow mentions that "As Davidovsky sees it, the challenging work of creating a coherent whole from a broad universe of possibilities derives from monotheism. Many elements must be embedded to make the whole, but then 'the whole is indivisible'" (Chasalow 2005).

Juxtaposition and Unification of Acoustic and Electronic

One of Mario Davidovsky's contemporaries, Jacob Druckman, outlined a useful compositional tool in the liner notes of the recording of his composition Synapse/Valentine when it was recorded along with Animus III on the same release. Druckman's notes pointed out that the organizing principle of Synapse/Valentine consisted of a large-scale juxtaposition of opposite musical ideas. In this case, the juxtaposition was between electronics and human performer. In the work, the electronic portion (Synapse) is presented in its entirety and then is followed by the live acoustic Valentine (Baguyos 2008). In *Synapse/Valentine* "the electronic and the live are juxtaposed, but completely separate" (Nonesuch 1971). In discussing the theme of juxtaposition in a videotaped interview with Frank Oteri, Davidovsky states:

> "The rhetorical situation between two opposing things is inherent to music. It's almost having the two themes, or you have the tonic and the dominant. Having two extremes to create tension, love or hate, or on/off, is a natural way of creating narrative" (American Music Center 2009).

Synchronisms No. 11 begins with a linear juxtaposition between acoustic and electronic. The first section, mm. 1-24 features the solo contrabass, unencumbered by the electronics. The silence of the electronics allows a flexible tempo range of quarter note = 100~110 and is accompanied by the descriptive tempo marking of *Liberamente*. This section allows the contrabassist considerable freedom in the interpretation of durations. The acoustic introduction is a prelude to the acoustic and electronic interplay that follows. It is a stark contrast to the remainder of *Synchronisms No. 11*, however, and offers a slowly paced, delicate warm-up that sets up a jarring juxtaposition when the electronics eventually enter. To further set this section apart, the acoustic introduction utilizes three instances of a compound interval based on a major 3^{rd}. The first is a melodic major 10^{th} in m. 12, a harmonic major 10^{th} at the end of m. 24, and a compound harmonic interval built on the major 3^{rd} in m. 22. After the entrance of the electronics at the beginning of Section II in m. 25, the use of the major 3^{rd} is no longer as predominant. Finally, the entrance of the acoustic part utilizes an instance of pitch organization that is also unique to this particular section and should be dramatically outlined by the performer. The intervallic construction of mm. 9-12 and mm. 17-23 are very similar and add to the unity of the solo contrabass section. Both sections utilize pitch relationships of a minor 3^{rd} descending 14^{th} ascending major 2^{nd} minor 3^{rd} major 3^{rd}. This completes the linear juxtaposition between the acoustic domain and the electronic domain at the beginning of the work.

Synchronisms No. 3 begins in the same manner as *Synchronisms No. 11*. There is a long introduction in the cello sharing many of the traits of disjunctive melodic contour, pointillist texture, a variety of articulations, sudden contrasts in dynamics, and short rhythmic bursts alternating with abrupt interruptions of sustained notes. *Synchronisms No. 3* can thus serve as a starting point for a contrabassist new to the *Synchronisms* series and for someone who is attempting to learn *Synchronisms No. 11.* A recommended recording is Madeleine Shapiro's recording of *Synchronisms No. 3* from the album *Electricity* (2005).

Another section that demonstrates linear juxtaposition is between m. 76 and 102. This section marks the return of the solo contrabass unencumbered by the electronics with the first recurring entrance of solo contrabass lasting for only six measures. Unlike in the beginning, however, they are more frequent, although the solo contrabass sections are shorter. Measure 76 to 102 is exemplified by solo contrabass work with interspersed static ambient electronic sounds. The electronics are static in that once they make their entrance, they do not change very little. This section features the contrabass and electronics in an extended call-and-response musical dialogue. There are many opportunities for the contrabassist to spontaneously revise the interpretation of durations and allow for a more personal interpretation of the durations as the gestures may overlap. Instead of a vertical relationship between contrabass and electronics, there is a horizontal relationship as the contrabass and electronics allow each other to sound in turn giving the illusion of interactivity between the fixed tape part and contrabass.

The strategic use of fermatas by Davidovsky is also quite interesting as noted in m. 102: the fermata seems to not only function musically but also practically in allowing the contrabass and electronics an opportunity to get re-synchronized. This is similar to what Davidovsky describes as an "escape point" in reference to fermatas at the end of solo violin sections in *Synchronisms No. 9* (Kimura 1995) – providing a mechanism to allow the tape part to "catch up" to the contrabass part. The fermata ends the section of linear juxtaposition between the acoustic domain and electronic domain. It is in these sections that *Synchronisms No. 11* has characteristics of *Synchronisms No. 9*. These sections allow the contrabassist some flexibility in measuring the durations of the contrabass part. In the general tape plus live musician repertoire, the performer must always seek out the sections where some amount flexibility is allowed or even expected. These flexible sections are usually within sections of linear juxtaposition of the acoustic and electronic domains. Davidovsky himself made his intentions explicit to performers as witnessed in the interaction with violinist Mari Kimura. In a section that featured six measures of solo violin in *Synchronisms No. 9*, Davidovsky clearly indicated that the violinist sing expressively instead of concerning herself with timings and the electronic part that was to follow (Kimura 1995).

On page nine of *Synchronisms No. 2*, Davidovsky presents another type of juxtaposition by delineating heavy percussive articulations through a systematic alternation with lighter sustained timbres. In this case, a timbral distinction or juxtaposition is achieved. When performers identify this type of juxtaposition, they are to delineate it through a exaggerated articulation in order to enhance the effect of timbral contrast (Soule 1978). By the same token, in *Synchronisms No. 11* there is a timbral distinction between the acoustic domain and the electronic domain in mm. 103-114. In the electronic part, with notable exception of the E in m. 107, the low Ab in m. 108 and the low E in m. 109, every timbre is an electronically augmented extended technique with exaggerated envelopes. The exaggerated envelopes help in bringing out the bass timbres, as without gain adjustment and envelope manipulations, those timbres would likely not be heard through the mix. This creates an electronic part that is really a recording of extended contrabass techniques, which simultaneously adds a synthetic quality to the resulting sounds. Juxtaposed against the electronic part is a pure acoustic contrabass part utilizing conventional techniques which is, nevertheless, very difficult to play. The dualistic result is one of juxtaposition, yet unified, as all source material in this section results from the contrabass part.

Measures 25 through 75 demonstrate another type of juxtaposition on a smaller scale which is further characterized by heterogeneous textures comprised of sharp contrasts and rhythmic juxtapositions in dynamics and articulations and short, disjunctive melodic constructions. Both the contrabass part and the electronics share these qualities, and as in the *Synchronisms No. 6*, the contrabass part is scored so that the varied articulations and heterogeneous sounds of the contrabass become seamlessly embedded in the texture of the heterogeneous electronics. In this section, all dynamic levels are abruptly explored. This includes dynamics that employ *subito* markings and tapered dynamics. In a similarly terse fashion, numerous contrasting articulations and expressive markings for contrabass are explored with eagerness and brevity. There are a handful of changes from *arco* to *pizzicato* with the first instance found in mm. 27-28. Davidovsky instructs the performer to employ often underutilized contrabass timbres created by using the extreme tip of the bow in order to provide contrasting timbres between the middle of the bow and the frog. An example of this can be seen in m. 34 and 72. In m. 30 there is an *espressivo* marking that will contrast with the *dolce* marking in m. 35, and in m. 30 we will note a *senza vibrato* marking that is followed immediately by a *subito vibrato molto* marking.

Between mm. 62-64 the articulations switch from accented *martellato* to *col legno battuto* to *ordinario* to *legato*. Both contrabass and electronics share sharp juxtapositions of contrasts in dynamics, articulations, and expressive markings and together, they create a unified sonic tapestry.

For the contrabassist performing the work, the delineation and communication of the heterogeneity of dynamics, articulations, and expressive markings through vivid exaggerated contrasts is the most important consideration in the execution of the juxtapositions in mm. 25-75. It is the heterogeneity of sounds that defines this section, which provides a simultaneous juxtaposition between the acoustic and the electronic domains, delineating the dualism of separation and unity all at the same time.

Peter Susser makes a similar statement about *Synchronisms No. 3*, in that "the dissonance and rhythmic complexity of *Synchronisms No. 3* is not merely the rhetoric of Davidovsky's style, but also can be looked upon as the process which explores its own goal – the synchronism of two profoundly different, and in 1964, previously unmatched instruments" (Susser 1994).

It can also be noted that *Synchronisms No. 11* shares more characteristics with *Synchronisms No. 6* and less with *No. 1* and *No. 3*. Throughout *No. 11*, despite the effect of spontaneous juxtaposition, there are few opportunities for flexible durational interpretations beyond linear juxtapositions. The spontaneous vertical juxtapositions that occur in previous *Synchronisms* such as *No. 1* do not exist in *No. 11*. Apart from the sections of linear juxtaposition, under no circumstances should the performer assume that the rhythms do not have to be exact, even if the overall effect of successful coordination to the listener is an experience of disjointedness and jarring superimposition of the acoustic domain against the electronic domain.

Timbral Integration

The ending section of *Synchronisms No. 11* begins at m. 187. Unlike the previous sections, however, the ending is not built on a succession of abrupt, non-repetitive musical parameters but instead focuses on an extended homogeneous texture. Several different instances of timbral integration are demonstrated here.

In one instance, timbral integration is used to complete the textural integration which ultimately leads to a singular soundscape. Dexter Morrill points out: "compositions that feature timbres similar to those of live performers have a potential for balance that might not otherwise exist." He also further promoted the idea of "confusion between real and synthetic sound sources" (Morrill 1989). This "confusion" can be accomplished through appropriate mixing of amplitude levels, careful loudspeaker placement, judicious use of reverb, performance articulations, and the exploitation of dynamic range and color of each instrument. Timbral blurring can also be achieved by utilizing sampled or synthesized sound sources that are similar in timbre to the performed acoustic instrument.

Another example of timbral integration occurs in mm. 144-15. In this section, the contrabassist is instructed to tap various sections of the instrument's body. At the same time, the electronics consists of sampled percussive sounds derived from previous recordings of a contrabassist tapping various parts of the instrument. The two parts are coordinated and the desired effect of timbral integration is achieved when the contrabassist is cognizant of and adept enough to match the percussive attacks and releases of the tape part.

Yet another approach to timbral integration is to use similar timbres of the acoustic instrument. The texture throughout mm. 187-198 is a choral texture resembling the beginning of *Synchronisms No. 9*. The contrabass part is coordinated with different sections from the four different voices of the electronics. Like *Synchronisms No. 9*, the contrabass employs careful use of open strings and harmonics while the tape part utilizes similar sampled double bass sounds manipulated and displaced by several octaves (Chasalow 1999). This final section, however, does not employ many variances in articulations, expression, and dynamics, but is rather precisely coordinated in a vertical fashion through the electronics. The acoustic contrabass elegantly plays simple harmonics unencumbered by exact articulations that have characterized much of the rest of the work. At this stage, the contrabassist's role is simply to match the choral texture of the electronics and to once again achieve timbral integration. It is interesting to note another similarity between *Synchronism*s *No. 9* and *No. 11*: as in *No. 11*, Davidovksy composed *No. 9* after a long hiatus from composing electronic music. For this reason, referring to a recording of *Synchronisms No. 9* would be beneficial.

In terms of tonal integration, *Synchronisms No. 11* utilizes techniques employed in *Synchronisms No. 3* (1964) for cello and electronic sound which was the first of the *Synchronisms* to utilize pre-recorded sounds (Neubert 1983). David Neubert states that *Synchronisms No. 3* "effectively integrates instrumental and electronic sounds in terms of color. A good example of this type of timbral integration occurs towards the end of the work when the cello sustains a low C# note and the tape part literally takes over the same pitch by imitating the cello timbre" (Neubert 1983). A very similar technique is utilized in *Synchronisms No. 11* at the end of the piece (mm. 206-208). Overall, *Synchronisms No. 11* executes much of its timbral integration from its pre-recorded contrabass samples as first used in *Synchronisms No. 3*.

Extending the Acoustic Instrument: Coordinating Acoustic Gestures with Electronically Manipulated Envelopes

Eric Chasalow, a former student of Davidovsky, states, "In Davidovsky's electronic works, control of articulation becomes more significant. A succession of widely varying articulations can shape an event, a gesture, a motive that can be developed in the course of a piece" (Chasalow 1999). As in the performance of the other *Synchronisms* works, special attention must be paid to musical parameters such as articulations, dynamics, and durations of the notated notes in order to match the same parameters played through the electronics. The contrabassist must be cognizant and versed in the sounds' attack-decay-sustain-release structures: its envelope shapes. In addition, Chasalow notes that the key aspects in generating electronic sounds in the *Synchronisms* pieces lie in the fact that Davidovsky "takes into account the most basic acoustical properties of the live instrument employed" and in doing so, "live and electronic forces reinvigorate one another in surprising ways. In these pieces he achieved the first true 'hyper-instruments' where the live and the electronic modulate one another and become something totally new, joined in one expanded acoustical space" (Chasalow 1999). In using very detailed articulations, "the result is an elegance seldom achieved in the music of our time" (Chasalow 2005). The contrabassist must make every effort to match the articulation and tone quality of the electronics because not only does Davidovsky utilize the acoustical properties of the contrabass as a starting point for electronic realization, it is through the electronics that Davidovsky is able to exceed the limitations of the instrument. Eric Chasalow summarizes the point of use of articulations to achieve an extension of the acoustic instrument:

"It is a particular talent of Davidovsky to make us listen to details of sound, then to make these count as the musical plot unfolds … Davidovsky captures the essence of the instrument he is writing for, the sense of it that we all hold in memory, and reinvents what it can do and become. And by using instruments in seamless combination with electronic sound, their shapes seem to modulate, along with their colors and tunings." (Chasalow 2005)

The most cited example of the extension of an acoustic instrument via electronics is in *Synchronisms No. 6*, where at the very beginning of the work, the piano and electronics combine to create an illusion of a crescendo based on a sustained G note: as the piano articulates the G pitch which eventually, and inevitably decays, the tape part takes over and sustains the same pitch, creating a very unnatural crescendo. This is followed by an interval of a minor 3rd/major

6th (E) which punctuates the texture in the tape part. It is also interesting to note some similarities between *Synchronisms No. 11* and *No. 6*: at the very end of *No. 11*, although no artificial crescendo is necessary to extend the natural resonance structure of the instrument in the tape part, the contrabass sustains a G pitch followed by an interval of an octave-displaced minor 3rd/major 6th (Bb) which punctuates the texture in the tape. This reference as used in No. 11 obligates the contrabassist to evoke the opening of No. 6, which is achieved by matching the articulation, and to an extent, the dynamics and tone of the electronics.

Richard Soule identifies additional examples in the Synchronisms series that extend acoustic instrument possibilities through careful considerations in the tape part. In *Synchronisms No. 5* written for five percussion players and electronic sound, the notated electronic Bb in mm. 72-75 which is in unison with the marimba, sustains and crescendos as the marimba decrescendos. In another example where the focus is on the attack rather than sustain portion of the sound object, the cymbal rolls that begin softly in m. 91 are augmented in the tape part with a simultaneous forte-piano. This allows for an articulation on the cymbals that would be impossible to render otherwise (Soule 1976). In both instances, the performers are obligated to accurately coordinate the acoustic and the electronic parts as indicated in the score to maximize the effect of the acoustic instruments being extended beyond their acoustic limitations.

By the same token, in m. 183 of *Synchronisms No. 11*, if the contrabassist accurately coordinates the pizzicato C# note with the unison C# in the tape part, the pizzicato has the effect of a *fp* crescendo, an effect that would otherwise be infeasible with the contrabass alone.

In mm. 117-119, the contrabassist plays with ricochet spiccato articulations followed by a sustained electronic note initiated with an accent. If written for contrabass alone, this gesture would not be playable. In m. 118, however, the tape part surreptitiously begins a G crescendo note from *niente* to sustain the previous G that was started by the contrabass, which cannot be sustained without the aid of electronic. A few measures later in mm. 120-121, the roles are reversed and the contrabass assists the tape part. When a quick disjunctive gesture in m. 120 ends with a sustained E, the contrabass surreptitiously matches that same note in unison and fades-in as the E in the tape articulates. The contrabassist must immediately and seamlessly take over that E senza vibrato and then switch to a subito molto vibrato in m. 121. In this instance, a truly "expressive" vibrato in the tape part is next to impossible regardless of one's expertise in the art of "LFO" – it is the contrabassist that brings about the right expressive vibrato instead.

A final example which shows how Davidovsky utilizes detailed articulations to expand the timbral possibilities of the contrabass, we look at m. 185. The contrabass plays an open A *Bartok pizzicato* note in conjunction with the entrance of the tape part. The *Bartok pizz*., however, is a "one-off" articulation and cannot be easily repeated in quick succession. However, through careful coordination between the tape and contrabass, the illusion of rapid Bartok pizzicatos is achieved through acoustic-electronic "hocketing."

Conclusion and Relevance

Throughout the *Synchronisms* compositions, Mario Davidovsky demonstrates a wide variety of formats for rhythmic integration between the electronics and the live acoustic instruments. When viewed as a compelling summary of integration techniques, the compositions establish the norms for performance with tape and acoustic instruments (Baguyos 2008).

Synchronisms No. 11 is a retrospective summary of previous integration techniques witnessed in other *Synchronisms* works through the lens of a composer who has been away from the *Synchronisms* series since 1992. An interesting observation is that the considerations in interpreting *Synchronisms No. 11* are not only applicable in guiding performance of other Mario Davidovsky works, but they can also be applied to performing electronic works utilizing fixed media electronics in general.

Echoing the *Synchronisms* series as setting the standard for performing a live instrument with fixed media, Guy E. Garnett points out that there are two sub-categories of live electronics styles: the more recent interactive computer music and "the traditional tape-plus-instrument" medium (Mario Davidovsky's series of Synchronisms [e.g., Davidovsky 1988] are paradigmatic)" (Garnett 2001).

Davidovsky contributed in defining a new type of ensemble performance that focused on the performer's ability to integrate with the tape medium and helped establish tape and performer synchronization as an artistic pursuit (Neubert 1983). In researching previous literature on coordination between the electronics and the live acoustic sounds in Davidovsky's *Synchronisms*, a performer can gain insight into the preparation and performance of the more recent *Synchronisms No. 11*. In turn, the study, preparation, and performance of *Synchronisms No. 11* can provide insights into aspects of coordination between the electronic and the live acoustic domains in the first ten *Synchronisms*. This helps us in furthering our understanding of the compositional techniques of one of the most influential composers in the United States, and also helps us in developing an appreciation of established performance practices in the broader genre of electro-acoustic music.

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The sound of gently pulsing rhythms, sine tones, and bursts of noise wafted through the humid air of a warm December evening in Miami, Florida. Artists and collectors, random passersby, and musicians clamored about to find the source of the electronic tones, only to discover a group of musicians huddled around their laptops as they improvised on the sounds created by the audience. This gathering which coincided with the 2009 Art Basel Miami began a 3-day concert series that was the culmination of the 12 Nights Festival of Electronic Art and Music spearheaded by Juraj Kojs. The festival, hosted within the intimate and vibrant space of the Harold Golen Gallery, allowed concertgoers to enjoy artwork while listening to three different concerts loosely centered around the themes of "Beauty," "Horror," and "Silence."

The festival officially kicked off on Friday, December 4, 2009. The first series of performances began with a set performed by the FLEA (FIU [Florid International University] Laptop and Electronic Arts) Ensemble on the sidewalk in front of the gallery. The group's diverse set began with Daniel Lepervanche's gently pulsing and rhythmic *YouGrooving*. A collaboration between Orlando Jacinto Garcia and Jacek Kolasinski followed, with the group performing the haunting and evocative work *After Life*, which utilizes cello samples of Madeline Shapiro and slowly moving images. Jaclyn Heyen's *the things we do* followed with punchy, explosive sounds of feedback triggered by sounds the group sampled live. The set concluded with an adaption of Elliott Sharp's energetic and vibrant work *Hammer Anvil Stirrup* (1988), originally written for the Avanti String Quartet.

The concert then moved indoors for a delicate performance of live electronics and viola de gamba by David Mendoza, performing his own piece *Incantation*. Jorge Variego then joined Mendoza on stage for the subtle performance of *Any Lucky Ten* by Howard Kenty. An intense and well-paced set of works for bass clarinet and electronics performed by Variego followed. Variego's smooth tone and shimmering multiphonics brought to life three varied pieces: his own composition *Now That You Are Here*, Jorge Sosa's *Refractions (I)*, and Jeff Herriott's *Window: A Vision in Multiple Stages*. The evening concluded with a performance of *In Strange Paradox* by Margaret Schedel and Nick Fox Gieg. Schedel performed intensely on electronic cello, and, utilizing the K-Bow, seamlessly processed the sound of her instrument while subtly influencing Nick Fox Gieg's colorful animations, creating a highly engaging dance between light and sound.

The second concert, addressing the theme "Horror," began with a thought-provoking performance by Sarah O'Halloran of her work *Cat House*. The performance involved elements of storytelling and performance art with electronics providing a counterpoint to the serious and humorous elements of her work, leading to a unique and evocative performance experience that evolved elegantly. Lawrence Moore's hearty and rich piece *Insaxation* followed, featuring deep low tones that balanced with the high squeaks of samples of the saxophone. Percussionist Michael McCurdy then took the stage to perform Heather Stebbin's striking piece *Still Intersections* for vibraphone and electronics. McCurdy then leapt into a performance of Philip Schuessler's *Supercell*. The explosive piece involved the tight coordination and balance of percussion and electronics as well as McCurdy's own energetic and vibrant vocal counterpoint through enunciating percussive syllables and glissandi that enlivened the room.

The series concluded with a concert of works centered around the theme of "Silence." Frances White's multimedia composition *The Old Rose Reader* involved the subtle interaction between text and sound, both seen and heard. Nathan Wolek then took the stage for a performance of live electronics for his work *Desire For*. The piece evolved beautifully, with sustained tones and slowly emerging pulsations. Clarinetist Christa Van Alstine joined Scott Miller on stage with Scott Miller for a performance of a set of his works including, *Chimeric Night*, *Haiku*, *Interrupted*, and *Ventriloquist*. The three pieces formed a well-rounded set that involved interactions between Van Alstine's delicate performance and nuanced electronics manipulations, often evoking different elements of space and elegant timbral development. Percussionist Michael McCurdy then joined Van Alstine for a performance of *El Hotel de los Musicos* by Ricardo Gallo. The energetic piece filled the room with its shifting rhythmic patterns and melodic contours, often working in counterpoint with the electronics. McCurdy then moved to a position behind the audience to perform Alvin Lucier's *Silver Streetcar for the Orchestra* on amplified triangle. The room absolutely filled with sound, allowing one to become completely immersed in the resonant and cascading tones emanating from the triangle and bouncing off the walls of the gallery.

The concert concluded with the performance of Michael Boyd's *Bit of Nostalgia* (2005-06) for household appliances, including a hair dryer, blender, various knives and cutting boards, and electronics. McCurdy's imaginative and lively performance involved the amalgamation of various quotidian sounds, such as the opening of a carbonated beverage, as well as the chopping, dicing, slicing of various fruits and vegetables, that worked in conjunction with the electronics. During the performance, McCurdy exclaimed bits of text such as "Hot Dog Surprise" and at times burst into exaggerated tones slipping into laughter. The dynamic performance was an excellent conclusion to well-paced and extremely varied program over the three days.

A different jukebox selection of works was performed each day of the festival, each of which addressed the various themes for each day of the festival. The enormous and diverse selection of artists whose work was featured included Maggi Payne's *Liquid Amber*, Paul Rudy's *Invisible Island*, Tae Hong Park's *Omoni*, Joo Won Park's *Reversible Jacket*, Mike Vernusky and Daniel Maldonado's *Episode #22: Missing*, David Kant's *Variation III*, and Ted Coffey's *To Poets*. The extensive group of composers and artists presented (the complete list is too long to feature here but can be found online at http://12nights.org) not only showcased the diversity within the various realms of electro-acoustic music, but also poignantly revealed the many ways in which people allude to the expansive themes of beauty, horror, and silence.

Sonoimages

Review by Jorge Variego
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Few things are more exciting than early spring in beautiful Buenos Aires, Argentina! Everything, even the weather, contributed to making the 9th edition of the International Acousmatic and Multimedia Festival "Sonoimágenes" (September 2-4, 2009) a wonderful musical experience. Hosted by The National University of Lanús, the Sonoimágenes Festival has been an international venue for electro-acoustic composers and visual artists since 2000. For the last nine years the festival has involved the country's most renowned institutions and international artists such as Hans Tutschku, Jacopo Baboni Schillingi, Flo Menezes, and Rodrigo Sigal.

The Festival consisted of three full days of intense activity. Mornings were dedicated to seminars offered by guest artists, each of whom explored topics related to intersections between audio and video. These guests also faced the difficult task of depicting themselves through their work in a sort of mini autobiographical concert called an espacio retrato (Spanish for space - portrait). In the evenings we also had three great juried concerts in the cutting-edge Tita Merello Auditorium, on the university campus. These concerts showcased outstanding compositions that spoke well for the high standards of the festival.

João Pedro Oliveira opened Sonoimágenes 9 with a presentation on "Models of Interaction

Between Music and Video." Professor Oliveira, a composer from Portugal, has received distinction from the Fulbright Commission, Bourges International Composition Composition, Alea III, and Earplay, among many others. He teaches Composition and Electronic Music at the University of Aveiro, Portugal, where he serves as the Director of the Electronic Music Studio. His presentation discussed the relationship between the languages of music and video, and their inherent collaborative possibilities. For that purpose, he presented three of his works: *Hydatos* (acousmatic 8 channel work), *Bloomy Girls* (video), and *A Escada Estreita* (for flute and electronics).

The first evening's concert was dedicated to works for fixed-media and video. The program included works from four continents: *Spuxis*, Pôm Bouvier B. (France); *Avatar*, Fabian Esteban Luna (Argentina); *Drishti III*, Jen-Kuang Chang (Taiwan / USA); *Arborescences*, Aki Pasoulas (UK); *L'instant en vain*, Dominic Thibault (Canada); *Sinus Aestum*, Bret Battey (UK); and *Hammerklavier*, Massimo Biasoni (Italy).

Seminars continued early on Thursday with a presentation by guest artist, the Argentine Elsa Justel. Justel is a graduate from the University of Paris VIII and also an educator and researcher in the US and Europe. In her seminar, Justel discussed the French genre of video-musique with a vast explanation of the available tools and different strategies for composition and animation. Structured as a workshop, participants explored their own sounds, allowing an immediate application of the new ideas. In her espacio retrato concert, Justel played three works involving different types of media: *Debris*, *Moure el món*, and *Bastet*. The evening concert offered a playful mixture between nature and geometry: *La jungla gris*, Hugo Victor Druetta (Argentina); *Heavy Liquid*, Gordon Delap (Ireland); *Champs de fouilles*, Martin Bedard (Canada); *Breakwater*, Panayiotis Kokoras, music - Dimitris Vourdoglou, images (Greece); *Canon Papageno*, Rodrigo Sigal (Mexico); *Pl@y* Federico Schumacher Ratti (Chile); and *Giant shapes*, Jorge Variego.

Swedish composer Åke Parmerud started off the last day of the festival with his seminar, "The Creative Use of Media and Sound Design Using MAX/MSP and Jitter." He offered an overview of the possibilities of this software for interactive settings using video to control audio and vice versa. Parmerud, a member of the Real Academy of Music of Sweden, is also an internationally-renowed composer who has worked in collaboration with the Canadian choreographer Mireille Leblanc. That evening, Parmerud presented three works in his espacio retrato concert: *La Vie Mecanique*, *Bows, Arcs and the Arrow of the Time*, and *Crystal Counterpoint*.

The juried concert that evening included stunning compositions like *The Journey* by Chein-Wen Cheng (Taiwan), who used digital signal processing techniques to recreate underwater aural images. Also on the program were: *Sponge*, Maurits Fennis (Holland); *Piano Chimera*, Chikashi Miyama (USA – Japan); and *Pollock's Dreams*, Konstantinos Karathanasis (Greece – USA), who was inspired by Pollock's dripping technique to generate sounds.

Sonoimágenes Festival has overcome a number of challenging hurdles over the past nine years to become one of the most prestigious enclaves for electronic artists in the southern hemisphere. Congratulations to the people of The National University of Lanús, Prof. Daniel Schachter, Prof. Raúl Minsberg, and their colleagues and administration for making it happen.

Electric LaTex 2009 Festival

Review by Peter Leonard
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For the ninth consecutive year, a consortium of students from select Louisiana and Texas universities converged to participate in the annual Electric LaTex Festival. Throughout these years, the task of hosting the festival has been shared by the participating institutions: the University of North Texas, Louisiana State University, University of Texas-Austin, Tulane University, Texas A&M University, and Rice University. This year, LaTex was held at Texas

A&M University in College Station, Texas, from 13-15 November, 2009. Texas A&M Assistant Lecturer Jeff Morris presided over the weekend's festivities, proving to be a hospitable and capable host.

The predominant focus of the three-day festival was a series of four concerts of new student electronic works puncuated with a final event presentation of the Vox Novus International Mix 2009 program with video by Patrick Liddell. All of the programs were presented in the Texas A&M Fallout Theater, an intimate black-box theater equipped with a 14.1 surround system consisting of ten speakers at ear level, four overhead speakers, and a sub-woofer. During the festival, Texas A&M premiered their multi-touch Jazzmutant Lemur interface used for spatialization of sound via a Max/MSP patch. The use of this live diffusion tool was made available to all presenting composers. In addition, two multimedia installations were presented in adjacent lecture rooms.

The opening concert on Friday evening primarily featured students' works of the hosting university. Several pieces were presented by first-time composers who were undergraduate students enrolled in a course in electronic music composition. It was encouraging to see that the TAMU program was reaching out to communities not typically associated with, nor often interested in, electro-acoustic music: African Americans and women. The majority of the works presented in the concert were miniatures, works of a minute or less in duration. This specification was assigned by the students' instructor who had the foresight to designate this practical limitation. That being said, to compose a miniature is difficult in its own right as it is quite challenging to present convincing form or narrative in a minute. Among the group of works presented in this category of minatures, a number of works were successful in presenting a concise, interesting, and musical experience well suited for an intimate black-box theater environment. *Bongo Roof* by Kaitlin Teske, a music major at TAMU, was such a piece, showing a distinct musical form emulating the natural pattern of rain drops falling on a tin roof. In this case, the practical limitation of one minute diminished the overall effectiveness of the piece; it would have been more dynamic had the storm been able to evolve and develop over many more minutes. Nonetheless, the composer demonstrated impressive musical consideration and compositional skill. *An Echo Precedes the Source* (2009), by Ilya Y. Rostovstev, a Master's student at the University of North Texas, was another highlight of the first concert. In this composition, the composer paralleled sounds borrowed from early Russian vinyl and film soundtracks with newly-recorded environmental sounds. The low fidelity of the archival recordings was prominently featured in this work and helped to create an unusual and intriguing sonic atmosphere.

The most memorable event of the first evening was a live performance by the Texas A&M (TAMU) Laptet. This performance featured six "novice" undergraduate students, performing alongside Croatian guest composer Ivan Božičević. Each student stood behind a personal laptop station and used a Nintendo Wii controller to modulate basic sound parameters using electronic keyboard sounds from the composer's improvisations. This was a clever approach in addressing the human-computer interface dilemma - exploit off-the-shelf technology for artistic purposes. The performance was noteworthy for providing a novel example of the laptop-ensemble model. On a side note, the reaction of the general audience seemed to support the fact that traditional standards persist: most concert goers, at least in the US, seemingly prefer a live performance to a fixed-media "performance." Even those of us who work in the field of electro-acoustic music will seek respite from the monotony of staring at an empty stage within the context of a weekend's worth of (bad?) electronic music concerts. It seems, therefore, that pieces that feature live, performative components are, often, well received.

The second concert of the festival, held Saturday morning, reflected this demand by presenting a stronger emphasis on works with a performance component. The concert began with a performance of *HOOLA* (2009), composed by the author. The performance featured three musicians playing on five, electronically-modified hula-hoops. The hoola-hoop instruments which were fitted with evenly-spaced rivets amplified via contact microphones, created a rhythmic pulse when scratched with a stick around the inner circumference of the hoop. These impulses were used to trigger pre-composed music stored on the computer. The piece began with the hula-hoops being played unamplified then fading into a noise-based introductory section. This was followed by a central section of pitch-based, microtonal nature and concluded with a coda which recapitulated the introductory section.

A second performance piece from this concert was *Dinosaur* for live piano, composed by Daniel Zajicek of Rice University, and performed by Andrew Schneider. In this work, the composer attempted to combine aesthetics borrowed from the "drum and bass" genre with modern compositional idioms for the piano part. This was an inspiring choice, especially within the context of a festival of "high-art" music. The piece offered a reminder to the listener to revisit his or her musical roots, whatever those may be. It is safe to say, whether one comes from a Classical or a popular music background (or both), few of us came to music exclusively by way of electro-acoustic music. Despite entitling his piece *Dinosaur*, a title intended to imply the dated nature of both the piano and the drum and bass genre, did not sound "old" at all. As a matter of fact, the skillful combination of two musical genres seemed to create something entirely fresh.

The third concert of the festival, held Saturday afternoon, offered an even representation of the involved institutions and a uniform balance between fixed-media and performance-based works. The concert commenced with a performance piece entitled *EPIPHENOMENALISM EXPLOITED*(!) (2009) by Alan Newman (aka DJ Blorgpulkf Plorksickle) of Tulane University. An audience participation piece in essence, the performance began with video instructions displayed on a screen, which requested that audience members participate in a conference call with their speakerphones on. The piece thereafter evolved with the composer's prearranged music projected via loudspeakers which was set against the cacophonous texture of the audience's voices amplified by their cellular phones. Here, one again sees the inventive appropriation of commonplace technology, used in this case to create an otherwise implausible, dense spatialization of sound. This piece was especially refreshing for being the only piece that directly involved the audience.

On the other end of the spectrum, *Audio Babel-Etude No. 1* (2009) by David Hyman of Tulane was a fixed-media work. The piece was reminiscent of classic electronic music, being comprised wholly of sinusoids. The composer created the work using a process-based technique of using phase relationships to effect timbral changes over time. The piece opened with the introduction of a bell-like sound created using additive synthesis. Specifically, each overtone in the sound was comprised of a pair of sine tone partials with identical frequencies. Over the course of the piece, each of these pairs faded in and out due to phase differences in the paired tones. As a result of this process, out of the music emerged slow rhythmic gestures, melodic fragments, and sections in which certain frequencies were accentuated. It was stimulating to hear this piece, which stood out in the festival for having a sound quality considerably different from any other piece presented.

Another innovative presenter at the festival was Jack Stamps, a composer from the University of Texas. He offered a sampling from his recent catalog, playing a few segments from his work in progress *Dispatches From Unnoted Stations, Book III: THEXPOSITION*. In this work, the composer clearly demonstrated the art of musical narrative, drawing on the spoken voice as musical material using it for a variety of purposes, including farce. In particular, one of the segments presented, which followed a character's experience at a bar, included text by the character regarding his goal of drinking a Corona beer. This comical situation was creatively presented in a manner that allowed the audience to be entertained while still appreciating the artistic merit of the work. All in all, Stamps' presentation, although the penultimate of the concert, provided a pleasing feeling of closure to the event.

The fourth concert of the festival, held Saturday evening, opened with a live performance piece *Gua* (2009), by J. Corey Knoll, Lindsey Jacob, Wennan Wang, and Jeff Albert, all composers from LSU. The piece in conception was an improvisation on a pre-composed theme for trombone, cello, and computers, although in practice, the performance leaned more toward a "free-improv" aesthetic. Trombonist Jeff Albert gave a skillful performance, displaying a host of extended techniques reflective of electronic sounds. In general, the piece blended the skills of all of the collaborators quite well, giving the impression that the LSU composers have a tightly-knit community. A second highlight of this concert was The *Color of Music* (2009), a collaboration between composer Alvez Barkoskie IV and digital artists Kristal Cazella and Robby Donovan of the University of Texas. Their work created a color-based, visual representation of the chromatic musical scale, providing one color for each pitch based on a mapping created by Scriabin. Live music for piano and horn was tracked in real-time to trigger the video component, a small colored-circle representative of the current melodic tone's pitch. The simplicity of this visual representation was a little disappointing, given the intriguing nature of the music - perhaps the artist's intention was for the audio-visual connection to be as clear as possible to the audience. However, further investigation of this concept could definitely lead to very promising artistic output.

Upon reflection, this year's LaTex Festival was a great success. Texas A&M provided a comfortable and intimate space for the weekend's events, encouraging presenters and guests to network. The festival was well attended and a wide variety of novel musical ideas and musical styles were presented, spanning from the purely electronic, to pieces for sound and video, to works including traditional instruments, to pieces presenting new, electronic interfaces. Everyone involved certainly seemed to leave the festival with many new ideas than they had initially arrived with three days earlier. Hopefully, we will see the fruition of these seeds presented at next year's LaTex Festival and other concert venues.

Eighteen July Two Thousand Four
by Kort* / Kitundu*

LP, Not On Label, 2007
Reviewed by Iroro Orife
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For this review, I've chosen another to draw attention to *Eighteen July Two Thousand Four*, a rare, limited edition recording on 10" vinyl by a pair of San Francisco Bay Area artists, Alexander Kort and Walter Kitundu.

Alexander Kort is a filmmaker, installation artist and cellist, who plays both the electric and acoustic variants of the instrument, as well as double bass. He has performed as both a traditional classical instrumentalist and also played more improvisational, experimental electro-acoustic music. His credits include performances with Tony Conrad, *The Phantom Of The Opera*, *The Thief Of Baghdad,* and creating *mindstream*, an orchestral arrangement of a work by Meat Beat Manifesto which accompanied his directly animated film.

Kitundu is an experimental composer, graphic artist and musical instrument builder best known for his family of phonoharps. He handcrafts these unique electro-acoustic instruments that are one part turntable, one part stringed instrument. The string instrument components can range from standard harps and guitars to traditional West African instruments like the Kora. In addition to collaborating with groups such as Kronos Quartet, Kitundu is a professor at the California College of the Arts, a regular Artist-In-Residence at a number of institutions on the West Coast and in 2008 was a recipient of the MacArthur Fellowship.

Of this record, Alexander says: "It was very important for us at the time to be very spontaneous in the music making. So there was no conversation about content or direction. Walter and I had played together several times at venues like the Luggage Store, but there was no rehearsal or repetition in the stuff we did. My friend Peter Glazer came to see us at one of these luggage store shows, and enjoyed it so much he offered to share the production costs of the low-run 10". We made only 300 copies, making all the covers ourselves. As it turned out, making our own covers was very time consuming... but gave us time to hang out and talk about music and make bad jokes. The huge increase of music sharing on the internet was really in full swing by 2004, so it was particularly relevant for us to release the music on vinyl only."

Min-Oh is the first track on the EP, commencing with a smattering of string textures, looped feedback and flecked operatic soprano textures reminiscent of a distant memory from long ago. The latter clearly must have come from the record player component of Kitundu's phonoharp. This introduction gives way lazily to a flurry of contrapuntal plucked micro-melodies evocative of a master Kora player like Djeli Moussa Sissoko. At one point, a distinctly Malian refrain appeared ever so fleetingly, it nostalgically made me listen ever so much more attentively.

On *Rokafela*, Kort and Kitundu go on a distinctly asymmetrical experimental electro-acoustic jaunt, presenting the listener with a veritable haberdashery of alien tones, amorphous percussive spasms and utterly exquisite sonic contradictions!

With *So*, we're back in a seemingly large acoustic space populated by clusters of “smoky” harp and cello lines that evoke feelings of smoldering embers of sound. Kort is fantastic on the cello, bowing dark melancholic, rustic phrases, while Kitundu's plucked phonoharp flickers gentle harplike ostinatos with effortless warmth. The sonic versatility of the phonoharp and its compatibility with the cello is on full display here. This is perhaps my favorite piece on the EP, as Kort's carefully executed electric cello lines manifest as filtered through the technological and cultural prism of the Kitundus's phonoharp stylus.

Flipping the 10" record over, we are presented with *6ix Days Ago*, which initially, is possibly the most of approachable of the entire EP. By approachable, I don't mean to suggest the others are inaccessible, but rather, that this sounds like your garden variety duet. That is until about about halfway through. Then some of the tones and melodies start to wobble and stray from their tonal centers. Before you know it, a subversive textural drone has risen up, flooding the spaces between the notes, and giving the piece a decidedly droney lilt, interspersed with digitally dissected cello figures.

Abacus is a perhaps the most rhythmically linear of the pieces on this 10". A few detuned string phrases chug along earnestly, interweaving wherever it is convenient. The amount of detuning between the lines varies in a way that keeps the listener's interest in a state of suspense. It is, however, the reverberant, quivering sustains of the occasional primary melody that holds the piece together, preventing it from slipping into a cacophony of fractured hyper-prismic rhythms.

The final track on the EP, *Aria* is a short outro featuring a recording of an actual aria on the phonoharp with a dash of effect processing by Kitundu. Kort provides an appropriately disconsolate accompaniment on cello in a way that fits the recording's forlorn contours perfectly. It is rather unfortunate that this piece is only some two mintues long, as I was leaning back in anticipation of another seven minute epic, when it was all over too quickly. Now it was I that was crestfallen!

Overall this 10" vinyl EP would be a perfect score for the fan of contemporary electro-acoustic music and collectors of fine wax alike. Its hand-made covers and prodigious display of improvisation by two of the West Coast's most forward-thinking young composers is just the icing on the cake.

Ghost Words
by Robert Scott Thompson

Audio CD, Aucourant Records 0804, 2008
Reviewed by Ronald Squibbs
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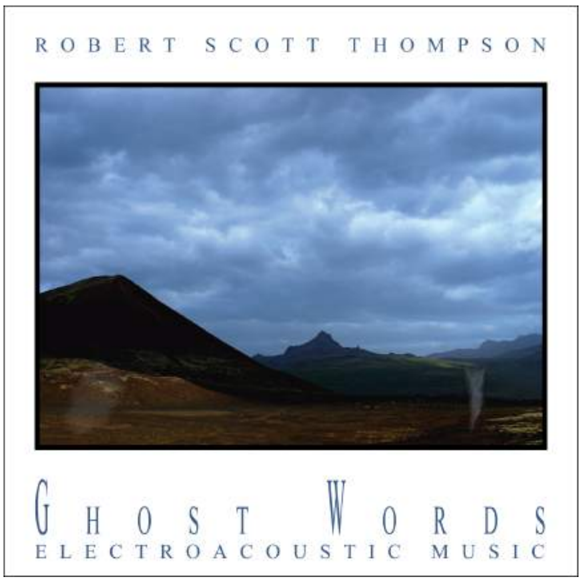

Robert Scott Thompson's *Ghost Words* is a concert suite of electro-acoustic music in four linked movements. The first and last movements were commissioned by the (regrettably now defunct) Institut International de Musique Électroacoustique de Bourges (IMEB) in 2007 and the entire suite was premiered in a 4-channel version at Aberdeen, Scotland in 2008. The CD version is a stereo mix intended for private listening.

Orgone opens the suite with a mixture of metallic sonorities and disembodied voices, setting the tone for the work as a whole. Its fluid, layered textures are embellished with clusters of tapping and whirring sounds that pan between the channels. The resultant atmosphere suggests a resonant environment of concrete, metal, and liquid, calling to mind an image such as the abandoned factory in Tarkovksy's *Stalker*. Its 15-minute length divides into sections that flow into one another like smooth cinematic edits. At around the 5 minute mark, soft bell-like sounds introduce a lighter texture in which the voices, formerly song-like, take on a more speech-like quality. Here, as elsewhere in the suite, the phonemes are filtered to such an extent that the impression is one of veiled, ghostly voices that strain to communicate messages from the beyond. One of the most remarkable sections occurs at about 11 minutes, when what seems to be a filtered noise band in the low register descends slowly, lightly accompanied by other textures. This is followed by a similar sound in the middle register that gradually fades out, suggesting that the movement may be reaching its conclusion. A final section emerges, however, during which the ghostly voices emerge into the foreground once again.

At just over five-and-a-half minutes in length, the second movement, *Shadow of Water* on *Sky*, is continuous rather than sectionalized. Within its dense but permeable textures, a wordless melodic voice stands out from time to time in the middle register. This movement gives the impression of moving in a more open space than *Orgone*, as if its sounds are being heard through a metallically tinged fog. Within the context of the suite, it gives the impression of being an etude in sustained sonorities, or perhaps a prelude to the next extended movement, *Sanctum*.

Like *Orgone*, the third movement, *Sanctum*, suggests the acoustic of a vast, enclosed space, but this time the effect is more luminous than dark. Thompson's notes reveal that *Sanctum* is based on improvisations by percussionist Stuart Gerber. Ebbs and flows among the percussion sonorities generate the work's formal design, creating a succession of local climaxes over which other sounds are layered to create a blended texture. As might be expected, cymbals and gongs figure prominently in the source materials which, when filtered, shimmer and fade within a sonically mythic space. Around 3 minutes into this nearly 15-minute-long movement, chorused voices play off of the percussion sonorities, suggesting an ecumenical space in which aspects of European and Asian sacred music coexist freely. At around 9 minutes a sustained texture begins, recalling the ambience of *Shadow of Water on Sky*. In this extended section the chorused voices return, swirling and echoing within the movement's virtual sacred enclosure.

The fourth and final movement, *Ghost Words after Trees Fall*, is the longest track on the CD. Over 20 minutes in length, its sectional structure is punctuated by explosive, percussive gestures, suggesting the image of falling trees from the work's title. As Thompson explains in the liner notes, the title is a line from a poem by celebrated Northern Irish poet Mebdh McGuckian, whose poetry is known for its sonorous richness, its deeply interior passions, and its skillful blending of veiled literary references. While such mentions of poetic inspiration often seem to mean more to the composer than to the listener, in this case the evocation of McGuckian's verse speaks to an atmosphere that pervades all four movements of the suite. This movement divides into two large sections of approximately equal length, which in turn divide into smaller subsections whose boundaries are articulated by changes in texture and timbre. This is perhaps the darkest and most forbidding movement of the four, its dense atmosphere ushered in by the first percussion explosion shortly after the track begins. Ghostly voices start to emerge at around 3 minutes and then come to the fore about a minute later. It is tempting to try to discern syllables from the track's title at this point, but once again filtering diffuses the phonemes into a sonorous sheen. Within this first large section, exploration of the phonemes generates alternating episodes of activity and quiescence not unlike those that result from the ebbing and flowing percussion sounds in *Sanctum*" The music trails off into a contemplative mood about halfway through the movement, at which point a renewed burst of energy propels the piece forward once again. Over the course of the second large section, veiled vocal sounds emerge intermittently into the foreground until the work gradually fades to its conclusion.

Ghost Words is a somber, concentrated, mature work, and may even be Robert Thompson's most substantial album since his 2001 compilation *Acousma* (EMF 034). Because the four movements of this suite are connected, one's initial impression may be that this is a continuous, long-form piece. Adding to the sense of consistency is the use blended electronic and concrète textures throughout, lending uniformity to the work's sonic ambience. Upon repeated hearings, however, the individual characteristics of the movements begin to emerge more clearly, as subtle affinities are revealed among their related, yet distinct, moods and materials. This is particularly true of the latter portions of *Orgone* and *Ghost Words after Trees Fall*, but just how this connection is achieved is difficult to put into words. As rich as the experience of the work is in its stereo realization, one wonders what additional details and atmospheric qualities would emerge in multi-channel performances with optimal sound diffusion.

Into The Trees
by Zoë Keating

Audio CD, Not On Label, 2010
Reviewed by Iroro Orife
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I first heard of Zoë Keating's music via an MP3 blog posting in around 2005. The recording in question was recorded before a live audience where Keating played the cello while using a laptop and foot controller as a "live-looper." She recorded and layered fragments upon fragments of cello sounds, creating a dense fabric of sound material that seemed to lithely float through my musical consciousness with wool-lined ease. So it was with quite a bit of eagerness that I attended a sold-out performance of hers not too long ago in San Francisco.

Now, after having had the chance to marinate in both her recordings and experience her music live, it is fair to say that Keating is still a bit on an enigma for me. On the one hand, she cuts a striking figure, sporting long, ginger-colored dreadlocks and standing at 5'10". She performs with all the allure of a "single person orchestra," marrying the use of live-looping technology with the tradition of a classical solo instrumentalist. On the other, Keating fascinates me for her ability as an artist to cross over to a larger and more "popular" audience. Keating has been commissioned to write music for museums and documentary & film soundtracks while keeping a busy touring schedule. She also actively collaborates with other artists and regularly performs at festivals. She currently has well over 1.3 million Twitter followers and self-releases her CD albums via modern Direct-To-Fan platforms like Bandcamp.com. Her latest album *Into The Trees*, has sold tens of thousands of copies and has spent time on the Billboard classical charts, all without a label!

According to her website, *Into The Trees* was recorded in Keating's home studio and made entirely of the sounds of her acoustic cello. I will review a selection of tracks from the digital version of the album, available at http://music.zoekeating.com.

After a short 45 second introductory interlude aptly called *Forest*, the first substantial composition on the album is entitled *Escape Artist*. It is an immediately accessible, contrapuntal work that mixes strong, melodic bowed phrases with delicate, plucked, repetitive rhythmic schemes and showcases Keating's live-looping techniques in a direct fashion. As the piece unfolds, majestic cloud-like structures of cello lines intertwine deftly, leading to surprising and spirited miniature-orchestral swells. This most definitely doesn't feel like a traditional solo cello piece.

The next piece on the album, *Optimist*, offered on Bandcamp as a complimentary track, starts with a quiet bowed ostinato line, giving way over the introductory minute, to variations and layers of the same, all with a similarly slow harmonic movement. The piece unhurriedly crescendos to a point where a low cello line enters, bringing heft and a haunted melancholy to the performance. This paves the way for a final more lyrical line that Keating appears to play in real-time (versus playing to be subsequently looped). At this instance the textural bed upon which this final line sits is full-throated, each part hazily washing up against the other – the net effect is unambiguously impressionist in style but also provides a willing and constantly shifting foundation for the improvisatory melodic lines that sees the piece through to the end.

The Path differs from many of the works on this album because of its decidedly electronic feel. The piece is underpinned by a repeating pizzicato phrase that would feel at home in a club or lounge had it been played on a Roland TB-303 instead of a cello. Next, one channel of her live-looping rig appears to be running through a delay effect – as groups of notes and short phrases are "let in," they cycle in the background rhythmically with other hazy synthetic-sounding embellishments, effectively providing Keating with a metronomic template upon which she mixes her trademark melodic phrasing, punctuated by wild and intense glissandi. The overall shape of the sound is unmistakably cinematic in scope and grandeur.

On *Hello Night*, Keating once again explores the outer limits of what it means to create a contemporary sound exclusively with an acoustic cello. The introductory phrases are slight, seemingly sampled-and-pitch-shifted phrases, dipped in reverb, and looped in a way that evokes wind-chilled electronics of distant Finnish ambient music. As Keating plays and adds more parts, especially bowed phrases, she takes care to play them with a measured control of dissonance. These out-of-phase phrases "fatten" the sound, similar to how a chorus effect might artificially. Upon a closer listening, however, one notices that these passages have intricate micro-structures made up of roughness and beating features that are mirrored in the spectrally-sifted character of the entire composition itself.

On the final original track, *Flying & Flocking*, the composer once again resorts to the highly effective alchemical blend of playing short pizzicato phrases and running them through a delay line while bowing and looping highly cinematic lines. This living, breathing structure of intricately juxtaposed syncopations and textural “cello-scapes” builds into a blistering feast of unfathomable solo cello virtuosity, which is one of the many highlights of this CD.

As an independent artist and DIY musician, Zoë Keating makes some of the most captivating and rich contemporary music, all within the confines of a very modest setup. Her results on *Into The Trees* are evidence enough.

MATLAB ® for Computer Music, Part I: Sound, Plot, and Action!

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In this issue's *Tips and Tricks*, we'll introduce the MATLAB programming environment and explore some its possibilities for computer music. We will begin with a brief overview of MATLAB, discuss some features of the DSP Toolbox, and then jump into the main topic – animation.

Introduction: Why use MATLAB?

MATLAB is a high-level technical computing language and interface environment. The software can be very useful for computer music practitioners and researchers as it is effective for quickly testing algorithms, prototyping ideas, and exploring concepts. It is also useful in allowing for immediate audio and visual feedback without having to compile any code. These types of programming environments are commonly referred to as 4GL languages. 4GL (4^{th} Generation Programming Language) generally refer to programming environments that are designed to reduce programming effort, software development time, and cost. MATLAB, however, has over the years developed into a more "serious" programming language and it is not surprising that it also includes object oriented programming capabilities. One of the benefits in MATLAB is the availability of a very large library of customized tools for specific areas ranging from curve fitting, filter design, genetic algorithms, neural networks, image processing, statistics, virtual reality, and wavelets – for our field, the DSP Toolbox is perhaps the most widely used. The language itself is a scripted language and comes with a standard debugger and editor as part of the software package. As it is a scripted language, execution of code can be somewhat "slow," at least when compared to compiler-based systems. Nevertheless, computers are rapidly and continually becoming faster, which in turn has made the wait time become smaller and smaller for all software, including MATLAB.

Pros	Cons
Easy to program	Not "immediately" most elegant programming environment for creating very complex systems
Instant feedback	Memory issues – large data cannot be displayed or read easily
Easy to handle I/O: plotting, saving/reading, outputting audio, etc.	I/O can be slow depending on data size
Considerable GUI creation capabilities (based on Java)	Customization is limited
Plethora of libraries	Libraries provided by MATLAB are not free. The DSP Toolbox, however, is included in the student edition.
Interpreted language (no compiler needed)	Interpreted language – not ideal for real-time applications
Large user base, extensive documentation, and code examples	Not free, although there is the Pd version of MATLAB called Octave. The student version includes the DSP Toolbox and is quite affordable. Licenses are usually available at universities.

Table 1. Practicality of MATLAB for computer musicians: pros and cons

The increase in speed has perhaps been one of the most significant factors in making MATLAB a practical tool for computer music exploration (see Table 1 for pros and cons). Although computational efficiency is not one of the highlights one immediately thinks of when using MATLAB, there are, nevertheless, ways to increase speed by creating "executables," exploiting the Data Acquisition Toolbox, or using Simulink (which looks very much like Max/MSP) to allow strategies for real-time signal processing. In this issue, however, we will concentrate on some very simple ways to read sound files, play them back, synthesize sounds, do some signal processing, and create animations.

MATLAB for Computer Music?

MATLAB is perhaps not the most widely-used programming environment for musicians, and there are clearly more flexible and specialized systems including Max/MSP, Supercollider, CSound, and various DAWs that offer an incredible number of third-party plug-ins. It is probably also fair to say that MATLAB is more frequently used in computer music research circles as there are clear advantages opposed to using, for example, Supercollider. There is, however, ample opportunity for musicians to take advantage of MATLAB and exploit it for creating and analyzing music/sound. There is also much potential in using the software for developing "applications" that can house any number of custom DSP algorithms and modulation modules with a typical GUI-based interface. In short, MATLAB may be regarded as another software tool that can potentially fill some of the shortcomings of existing specialized music software; in the process of using it, musicians may learn the intricacies pertinent to signal processing and software development. In general, however, as far as large-scale projects are concerned, it is certainly more appropriate to use C/C++ or Objective C/C++ SDKs for optimal speed and interface customization. However, even in the aforementioned situations, MATLAB users can go quite far after learning some of the quirks, as is the case with any language. One such quirk that is still a part of the MATLAB skeleton is matrix computation. MATLAB is most computationally efficient when data is manipulated in matrix format à la linear algebra (MATLAB is shorthand for MATrix LABoratory). This, however, is becoming less and less important as computers are becoming faster, and it is usually sufficient to use the standard for and while loops for crunching numbers. There are a many examples of third-party (and free) toolboxes including MIDI Toolbox (Eerola and Toiviainen 2004), MIRToolbox (Lartillot and Toiviainen 2007), EASY Toolbox (Park et al 2009), FMS Toolbox (Park et al 2007), IPEM Toolbox, and many more small-scale software packages for music, audio, sound analysis/synthesis, modulation, and pedagogy.

Audio Playback and Visualization

One of the best features in MATLAB is the ease of playing short sounds and visualizing data via built-in functions sound and plot. For example, let's say we have a sound file called `mySound.wav` and we want to load the sound into the MATLAB workspace, play it, and also plot it. Code Example 1~3 shows how this can be easily accomplished. We begin with reading the file:

```
[x, fs] = wavread('mySound.wav');
```

Code Example 1. Reading a wave file

As shown in Code Example 1, wavread returns two parameters which we named here as x and fs. x is the raw audio data and `fs` the sampling rate. One can also just read the size of the file, load a specific portion of the file, and write to a wave file using the wavwrite function. There is also a function called auread/auwrite but no aifread/aifwrite is currently available as part of the standard library. To play the data is equally easy:

```
sound(x, fs);
```

Code Example 2. Playing a audio signal (or any signal, for that matter)

As seen in the above code, we use variable x and play it back at the sampling rate obtained from wavread. We could, however, have used a different sampling rate for the second parameter in sound – if we used `fs/2` for example, we would get a downwardly octave shifted and time expanded output. Viewing the data contained in x is as simple as “plotting” the data as follow:

```
plot(x);
```

Code Example 3. Plotting data

MATLAB for Exploring DSP

As mentioned in the beginning of this article, MATLAB is very effective for quickly testing ideas, algorithms, and concepts. In this section we will show some DSP code examples and also discuss some useful tricks to view and display the data in different scales. In the example below, we start by creating a simple one second sinusoid sampled at 44.1 kHz. We create the code using the standard sine function format shown in Equation 1 where T is $1/f_s$, f is the frequency in Hz, y the output, and n is the sample index.

$$y[n] = \sin(2 \cdot \pi \cdot f \cdot n \cdot T) \quad (1)$$

The MATLAB code for a 1 second sinusoid at 440 Hz and sampling rate of 44.1 kHz is shown below:

```
fs  = 44100;
f   = 440;
dur = 1;
y   = sin(2*pi*f*[0:fs*dur-1]/fs);
```

Code Example 4. Creating a sine wave

The “:” operator in conjunction with the square brackets is a convenient way to create an array – this results in a one second array consisting of discrete time indexes from 0 to 44099. To view the sine wave or hear it, we use the plot and sound function as before.

We will next compute the DFT (Discrete Fourier Transform) of the sine wave and plot it. This is facilitated by using the DSP Toolbox which includes a plethora of basic as well as advanced set of functions that can help us analyze sounds, design filters, and more. To compute the DFT we use the fft function. Let’s try this on the sine wave we created in Code Example 5 and plot the results.

```
X = fft(y, 1024);
plot(abs(X))
```

Code Example 5. Computing and plotting the power spectrum

The second parameter in `fft` is, of course, the window size and the abs inside the plot function is there to ensure that we plot the magnitude of X as the `fft` output results in a set of complex numbers. To get help on how each of these functions work, just type help `functionName` – `help fft` in the case of the `fft` function.

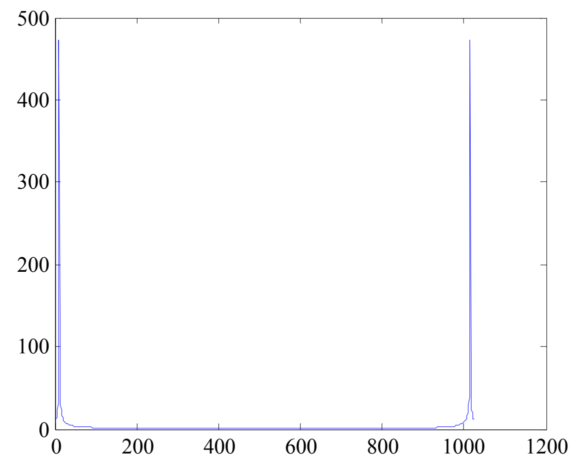

Figure 1. A simple FFT plot using the fft and plot functions

Since we are interested in just half of the spectrum (up until the Nyquist limit) we can modify the plot to only show half of the frequency bins by using the end operator. The end operator essentially is a shorthand command for computing the length of the spectrum. Alternatively, we could have used the more general length function to determine the length of X.

```
plot(abs(X(1:end/2)))
```

Code Example 6. Computing the magnitude and positive frequency components

Plotting in log frequency is also straightforward – we could do it manually by using the plot function with two input vectors `plot(x, y)` or we could use the built-in function called `semilogx` as follows:

```
semilogx(abs(X(1:end/2)))
```

Code Example 7. Log scale for the x-axis

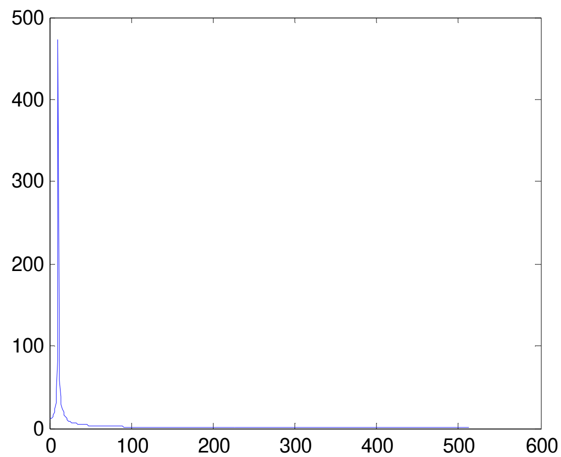

Figure 2. Positive magnitude of the FFT

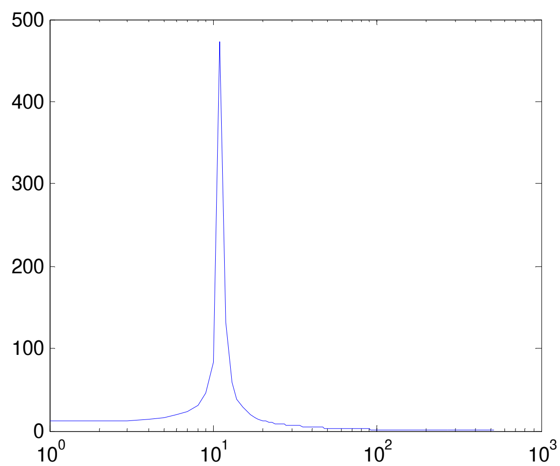

Figure 3. Log frequency for the sinusoid in the frequency-domain

Animating Plots

In this section we will introduce tricks in implementing animation and will use DFT frames as an example. We will first start by obtaining DFT frames, or more accurately, use STFT (Short-Time Fourier Transform) to compute the DFT frames. STFT can, of course, be implemented "manually" using for loops and shifting windows. The DSP Toolbox, however, already provides us with a function called spectrogram which efficiently does this for us:

```
fftSize           = 1024;
overlapInSamples = 1000;

spectrogram(x, fftSize,
overlapInSamples, fftSize, fs,
'yaxis');
```

Code Example 8. Creating a spectrogram

The first parameter in spectrogram is the signal we want to analyze, the 2nd and 4th related to the DFT window length (they are usually the same and the DFT is implemented via a FFT algorithm), the 3rd parameter the sample overlap amount between windows, the penultimate parameter the sampling frequency in Hz, and the last parameter indicates whether to have the y or x-axis represent frequency (anything enclosed in '…' is interpreted as a string). Figure 4 shows the output of spectrogram when used without any output arguments.

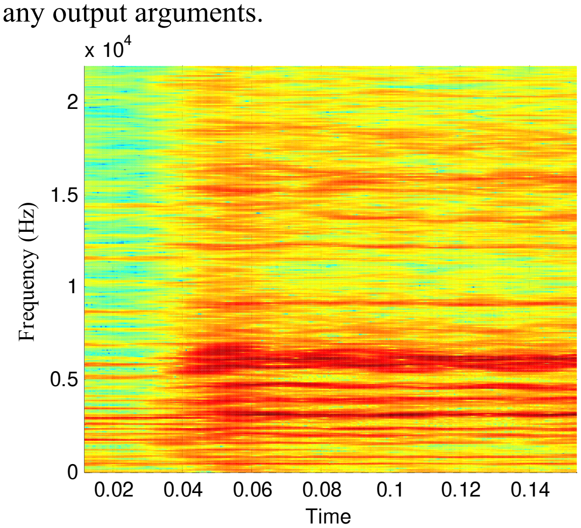

Figure 4. Standard spectrogram using the spectrogram function

Next, let us try animating the STFT frames so that we view one DFT frame at a time, and at a specific frame rate – imagine that DFT frames act like frames in a film reel. In order to accomplish "moving frames," we use the same spectrogram function and also include output arguments as shown in Code Example 9. Including output arguments disables automatic plotting of the spectrogram as we have seen in Code Example 8.

```
[s, f, t] = spectrogram(x, fftSize, overlapInSamples, fftSize, fs, 'yaxis');
```

Code Example 9. Using the spectrogram function

The 1st argument s refers to the spectral data in complex number format, t the time index (in frames), and f the frequency bin numbers. In our example, we happen to have 771 frames, which makes s a 513 by 771 vector. Now, to animate the 771 frames all we need to do is use the pause function and run the "film" so-to-speak:

```
for i=1:length(t)
    plot(abs(s(:,i)))
    pause (.1)
end
```

Code Example 10. Animating frame by frame STFT via the `pause` function

We use the `for` loop to traverse through the 771 frames. Within the loop we display each frame via the plot function and use the `pause` function to allow the plotting to complete. In the plot function we again use the '`:`' operator to access the entire frame's data indexed by frame number `i`. Note that in MATLAB, vector indexes start at 1 and not 0 as used in most other programming languages (another example of some of the quirks). The argument to `pause` sets the pause duration in seconds which is roughly equal to the frame rate (most platforms allow down to 0.01 sec pause durations). This type of setup can be used to render animation of the DFT frames but is very inefficient – the execution of each plot function requires quite a bit of overhead. In this particular example, it is not a big problem because: 1) we are not doing anything that is processor intensive inside the `for` loop, 2) the data size is not very large. However, as resources become more and more scarce and data becomes bigger, animation will not run smoothly. One trick that is used to alleviate this type of bottleneck is to do all the "setup" before we enter the `for` loop. We already do this here somewhat as we do not *compute* the FFT at every loop, but rather chose to do the entire STFT outside the loop before starting the loop, and *access* the STFT frames inside of it. Another trick that we can use is the exploitation of *handles* to update only necessary graphic components in a plot and leave everything else unchanged. In other words, we will not call plot at every loop cycle, but rather, we will call it only once *before* the loop starts. When *within* the loop, we will only update the magnitude values of the plotted object as everything else can remain unchanged. The following code illustrates this idea:

```
hPlot = plot(abs(s(:,1)));

for i=2:length(t)
   set(hPlot, 'ydata', abs(s(:,i)))
   pause (.1)
end
```

Code Example 11. Animating frame by frame STFT via the pause function: efficiently

The top portion of code calls the plot function and returns the handle (stored in `hPlot`) of the plot. The handle manages all the plot information via tags. Inside the loop, we use the set function to update only the necessary tag – magnitude values accessed via the `ydata` tag. Note that we never actually execute the plot function inside the `for` loop, and thus much of the overhead for displaying new data is bypassed entirely.

Lastly, we can also replace the `pause` function by the `drawnow` function to have "immediate" plot updates through event queue flushing.

Conclusion

In this article we gave a brief overview of some of the possibilities in using MATLAB for computer music. We introduced some code in creating simple signals sinusoids, obtaining the DFT, reading sound files, and displaying sound files. We have also presented some basic animation strategies for the MATLAB programming environment. In our next Tips and Trick article, we will discuss strategies pertinent to visualizing data in synchrony with audio, which is impossible with using the sound function we used in our examples here.

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Founded in 1984, The Society for Electro-Acoustic Music in the United States (SEAMUS) is a non-profit national organization of composers, performers, and teachers of electro-acoustic music representing every part of the country and virtually every musical style. Electro-Acoustic music is a term used to describe those musics which are dependent on electronic technology for their creation and/or performance. Many members of SEAMUS, like Jon Appleton, the guiding light in the conception of the Synclavier, are recognized world leaders in their fields. All are dedicated to the use of the most advanced technology as the tools of their trade.

SEAMUS seeks to provide a broad forum for those involved or interested in electronic music. Through its journal, newsletter, national meetings, and its national archive at the University of Texas, SEAMUS seeks to increase communication among the diverse constituency of the relatively new music medium.

The Society's objectives include:
To encourage the composition and performance of electro-acoustic music
To develop a network for technical information and support
To promote concerts and radio broadcasts of electro-acoustic music both in the US and abroad
To create an exchange of information through newsletters and other means of communication
To establish and maintain a national archive and information center for electro-acoustic music
To attract a wide diversity of members and supporters
To advocate licensing and copyright concerns

SEAMUS strives to address not only relevant technology but also the non-technical issues pertinent to the electro- acoustic music community. In a field usually dominated by technical concerns, it is refreshing to hear paper sessions devoted to aesthetics, collaboration, education and of the ethical and social issues facing electro-acoustic musicians. The provocative sessions provide fuel for lively discussions during the national meetings.