Recording Studios Without Walls:
Geographically Unrestricted Music Collaboration

by

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Abstract

Music production fuses the technical requirements of the recording process with the aesthetic imperative of music creation and performance. The producer is an advocate for both technical and artistic excellence. It is the collaboration, or co-performance, of the recording engineer, producer and performer that generates music recordings and it is the role of the producer to intermediate between the worlds of technology and art. The psychological and social details of the interaction between these collaborators are numerous and complex and they are essential to the production process.

Music producers and recording musicians move from city to city and one recording facility to another in order to expand the their options for collaboration with other musicians or technicians. This examines the development of an Internet-based, music recording system that will enlarge the pool of potential collaborators without requiring physically movement from location to location. The Internet provides a medium through which recorded performances can be transmitted from performer to producer in (near) real-time over great distances. This research investigates the design of a system that will make optimal use of available bandwidth during transmission while retaining the artistic dialogue between collaborators that is central to the music production process.

To envision an expanded music production paradigm that takes advantage of the opportunities presented by networked collaboration it is necessary to thoroughly comprehend the production process. Production can be analyzed as a set of tasks that support collaboration. These tasks can be examined independently of the technology that supports them. This thesis begins with a detailed analysis of the cognitive, psychological and social aspects of artistic collaboration that underpin the behaviors observed during the production process. This foundation provides the basis for the design criteria of a networked collaborative system presented later in this thesis.

Readers who are interested only in the specifics of the proposed system may wish to skip the introductory material. However, the later material presumes a deep understanding of music production process, and the system s design is integrally hinged on the elements of production process essential to music collaboration.

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The following people served as readers for this thesis:

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The completion of this thesis feels like a significant event, but it is not because of the effort required to meet the task that the accomplishment is notable. It is cogent because the opportunity to deliberately construct a vision for the future has expanded my perspective on what can happen to an individual in life.

I dedicate this thesis to the dark, looming figures of my childhood — the pure scientists and detached, analytical observers — who thought the world was a subjugating stricture to the imagination and the spirit. How glad I am to have found out you were wrong!

I also dedicate this to the Bedouin of the Southern Sinai Peninsula who, in the August of 1990, offered me water from hidden wells and asked me to join them in their songs even though I did not know the words.

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1 Introduction

In dreams begins responsibilities
- Delmore Schwartz

Sound recordings are a re-creation of sound locked in time. When we listen to an old Jazz recording we don t just hear Billie Holiday. We hear the microphones that were manufactured that year. We hear the leather on her shoes, and a Gardenia wilting in the humidity of a Harlem Jazz club in 1945. No signal processor could ever replace this. We really do hear the Gardenia. Maybe it s because the petal hits an earring or sweeps across the microphone. In between saxophone notes leaks the sound of a brush moving across the head of a snare drum, or a gust of air rushing through the opening club door. It s barely audible. It s a sound that can not be synthesized nor copied in any modern studio, with any amount of time or recording equipment or with any attention to detail. When we record, yes, we artificially create and construct a sonic image. But unavoidably, inadvertently, we capture reality. Always. No matter how much we try to suppress it.

That is why recording music is an art. Any recording tool must be precise enough to render the unique, subtle signatures of each artist that uses it. Any limitation of the technology must be organically integrated into the experience of listening and the craft of recording. Music production is the process through which performances are captured and processed to create a completed recording. It is a sinewy and intricate undertaking. It is the process of applying technology artistically to the creation of a recording. The experience of the audience is markedly different from the experiences of the musicians responsible for that recording. When listening to a completed recording, the listener derives meaning from the lyrics and timbres, and from the rhythmic and harmonic relationships between the elements. The listener ascribes significance based on context both internally according to the musical structure itself, and also, externally based on culture and society or musical genre. The sonic components of any style of music from any place take on meaning based on the context constructed by the listener. While

human s ability to derive significance is strong and there are many excellent tools for recording, there is something missing. The current technology still curtails our creativity by restricting the environments in which we can record, and thus limits with whom we can record.

1.1 Motivation

I grew up in, New York, one of the most culturally diverse, metropolitan centers on the planet. As a kid, my favorite toy was the radio. I could hear within a matter of minutes John Coltrane, the latest punk band from London and Jamaican Ska from the fifties - everything a few megahertz away from each other filtered through a pair of rusty rabbit ears precariously balanced on a windowsill. I thought the whole world was like that. I have never been able to compartmentalize genres or musicians or cultures. All these musicians were connected in one great big artistic community of musicians each a few megahertz away from the other.

1.2 Cross-cultural, Pan-global Artistic Community

The goal of this research is to facilitate music collaboration across great geographic distances through the application of networked technologies. Internet-based music production extends the production paradigm much further than mere geographic measures. It champions pan-global artistic community. The implications of such a broad musical community is multifaceted, and can be viewed from its economic, political, artistic, and social implications. This characteristic only lends to the credibility, flexibility and complexity of the tool of networked-based music collaboration. For some musicians, the notion of the global village significantly impacts their music and their ability to support themselves as musicians. Senegalese, Afropop musician, Baaba Maal, observes,

> But now when you play music you play not just for your own society, you play for the whole world. The world is one planet, it s like one big village. You must show what you ve learned from your house and combine it with what is your experience in life. People travel, they go to school and know what s happening in the other part of the world, they look at the television, they read the newspaper, and everyone is involved in what s happening on the other side of the world. You must be an African talking to the rest of the world, or an American talking to the rest of the world. [Monson, 1999, pp. 54]

Network collaboration extends their opportunities to interface with the global musical community at the embryonic level of production. Through networks, these cross-cultural interactions can be explored not only through the relatively slow and removed venues of music distribution and touring, but through direct, artistic exchange at the instant of recording.

This liberates the artist. Geographically unrestricted collaboration introduces artists to social, intellectual, political and aesthetic influences from both internal and external, macro and micro, influences simultaneously. Semioticians refer to this as bricolage. [Campbell, Buck and Cuthbert, 1991] It is a social and artistic process which Campbell, Buck and Cuthbert refer to as encoding. Through encoding musicians juxtapose

musical styles, technologies, and timbres to create (innovative) combinations. These decisions include the personal influences, musical practices, social conventions, and political, economic and psychological influences that impact every music creator. [Campbell, Buck and Cuthbert, 1991] Foreign and indigenous music is transported in and out of countries and cultures influencing the meaning of the music to its composers and to the audience. Campbell, Buck and Cuthbert observe,

> Music production continuously emphasizes or combines disparate eras of musical convention; it also mediates and represents class, ethnic, generational, gender, and taste differences [Campbell, Buck and Cuthbert, 1991, pp. 33]

Frequently, musicologists chart the flow of influence from a politically or economically dominant culture to a sub-dominant one where foreign music is then incorporated and transformed by the sub-dominant, or host, culture. However, several studies have shown this conclusion to be premature, or at least heavily biased, in its view of cultural impact. In a study on Israeli popular music by Adonis, it was show that the external influences of other cultures, primarily Western popular music, do not overshadow the influenced musicians individuality, but instead serve to stimulate creativity and support innovation. [Campbell, Buck and Cuthbert, 1991] It should not be assumed that the aesthetic contributions of a real-time, networked music production would necessarily flow in one direction.

Fundamentally, collaborative systems are bi-directional. Unlike the divisions imposed by standard forms of music distribution, the divide between collaborators during production is porous. Without permeability production can not happen. Generally, finished recordings from outside the musical community influence productions in progress. This is a slow process. The (near) real-time aspect of Internet-based collaboration amplifies the influence of those who are currently on the periphery of the global musical community.

Additionally, it can not be assumed that all musicians intellectually embrace the indigenous musical styles and traditions made available to them.

> It is sometimes forgotten that local traditions may or may not be experienced as liberating from the perspective of the people born within them. [Monson, 1999, pp. 54]

Under these circumstances, it is readily apparent where the ability to collaborate with musicians outside the immediate community would present opportunities for expression that are invaluable to the individual artist. Networked collaboration gives musicians the opportunity to create their own artistic community regardless of cultural, political or economic confines.

1.3 Humans, Collaboration and Machines

It will be demonstrated that there are three central roles in the music production paradigm: the performer, the producer, and the recording engineer. Likewise, there are three central anchors for the examination of geographically unrestricted music production. First, the actions of the *humans* involved which includes human perception

and psychology, the roles played by participants in the production process, and their positions socially in the studio dynamic. Second, the notion of *collaboration* represents what constitutes an artistic exchange between musicians, what social and technical mechanisms support that discourse, and the particulars of collaboration in the recording context. Third, the nature of the *machine* must be considered which is an appreciation of the technology that supports these human interactions traditionally in the studio, but eventually, across networks. Just like the network itself, each node is separate yet connected. The whole is greater than the sum of its parts. Understanding the modality of these crucial nodes and the relationships they have to one another is essential to the comprehensive mastery of the network as a medium for artistic exchange.

> The immediacy of *presence* is extended by humans, first through language, [and] now through technology — Friedland andBoden [Lee, 1999, pp. 92]

Computer networks and the Internet used as medium for artistic expression and collaboration possess unique properties. Because of the unique nature of the environment, networked art including music explores synchronicity, simultaneity, and ubiquity. Networks are flexible. The ability to juxtapose parts of the work either during the creation process or as a feature of the completed work extends the limits of artistic expression. Networks are multi-modal on many levels. They not only defy the sense of geographic confinement, they alter the temporal context of communication versus distance. The art created on networks is different not only in how it is made, but in what it reflects about the society that produces it.

The Internet has placed music from Dar-es-Salaam a mere URL address away from an audience in Istanbul. But while access to more music and a greater diversity of styles has increased our ability to hear what is going on in other places, the ability to collaborate with those musicians producing these recordings has not grown significantly. There are many factors that prevent musicians from being able to communicate face to face. These include the pragmatic constraints of scheduling and financial restrictions of a given production. Also, political and economic factors can hinder cross-cultural collaboration though federal legislation (through visas, immigration, etc.). The Internet has proven to be an efficient vehicle for the distribution of regionally produced music recordings. What remains is a need for a medium that supports the process itself of making these recordings, music production, which is broadly distributed, crosses cultures and countries, and spans musical genre.

1.4 We-ness

Recordings reflect the consolidated interpretations and contributions of each participant in the production. This collaborative process is complex and relies heavily on real-time, face to face interaction. The process of music production is, to large extent, tethered to the recording studio. The notion of geographically unrestricted music production needs to be viewed from two perspectives: as broad medium for cross-cultural, musical collaboration, and in terms of the microcosmic communities of the individual recording studio or session. This implies in an Internet-based system, the engineering of the network that supports the transference of musical data between musicians is as equally

important as the communication systems interfaces that support the artistic dialog between collaborators.

The community of the recording studio is unique. This is not merely an artifact of the professional and artistic roles played out by the members of this community. It is the result of the unusual way collaborators communicate modally about the project at hand, about their relationships to one another while working, and about the significance of the music as a work of art. This community survives because it functions as a group while preserving the individuality of its constituent members. Thomas Porcello calls this shared studio experience we-ness.

> The existence of a plurality of we-ness that plays among the spaces of multiple individuated and shared musical experiences suggests that we-ness is better described as a fluid movement between social and coalescence and fragmentation, shared and individual modes of apprehension and tuning-in, and public and private beholdings of music the we-ness achieved in the recording studio often appears more tentative, experimental, and distanced: one perhaps characteristic of individual epistemologies brought into contact by audio technologies that make it easy to manipulate temporal boundaries in music, and are being used to create a shared experience from joint, though spatially and temporally fragment, musical encounters. [Porcello, 1998, pp. 496]

Networked music collaboration fosters community in a similar way. Participants share spatially and temporally fragmented musical encounters, albeit more spatially and temporally fragmented than a traditional recording environment. Regardless, the challenges that face the success of this community and the production of music in this realm remain mostly the same. The more effective the tool designers are at creating intuitive technology to support artistic exchange, the greater the illusion of shared creative space and the diminishment of artistic gaps.

1.5 Industrial Expansion

On the macro level, removed from the cultural significance of a style of music or the artistic pursuits of the individual, Internet-based collaboration extends what is possible in the recording studio and creates opportunities for the recording industry. It encourages the development of new production techniques and styles or modes of working collaboratively, and abets a production scenario with fewer pragmatic constraints like scheduling, location and availability of participants. It also makes collaboration for the sake of adding music to other media (i.e. film) more accessible (and potentially less expensive) to more content creators.

This scenario not only extends the technical possibilities for professional recording, but expands the artistic possibilities, as well, by enlarging the pool of talent and influences. It provides greater resources for music creators and improves access to musical specialists. This serves to diversify content and push the professional standard higher. Opportunity promotes competitive production, musical composition, and musical performance in an expanded market of music creators and music consumers.

1.6 Recording Studios Without Walls

A recording studio without walls would enable musicians to co-create musical recordings in real-time as they are recorded. To make the medium malleable, the musical material can be repeatedly recorded or modified according to the needs of the collaborators. Recording music is a real-time experience. The networked collaboration must support a live discourse between the performer and those assessing the performance because instantaneous feedback is crucial in the studio environment. Furthermore, this discourse must be supported by specialized communication technologies that sustain the idiosyncratic nature of this dialog.

This investigation is constrained to a study of professional, music production and how it relates to networked collaboration. This is not a broad study of networked music experiences and artistic exchange that encompasses areas such as jamming or interactive music. Rather, it is an investigation into artistic communication as it exists in the professional recording environment, and how burgeoning networked technologies can support this musical exchange in the future.

The qualification of *professional* music production carries with it specific implications. Professionalism is assessed not only by the quality of the end product, but by the methods used to obtain those results. It implies a set of preferred modes of working, standards of performance, technical expectations for the recording quality and format, financial considerations, and a type of artistic discourse and exchange that meets a certain level of intricacy. While entirely new methods for musical collaboration may indeed yield engaging music, the established production process is exceedingly robust, and renders professional results in the face of many obstacles. It is the amalgamation of tried and proven musical, technical, managerial, and psychological techniques. There is a clear distinction between artistic exploration and experimentation and the pressures of producing an artistic work under the constraints of contractual obligation or financial limitations. This forces musicians to rely on proven methods. This is, in part, how and why the production paradigm evolved. The recording studio is rarely a place for unbridled experimentation.

Clearly, however, there is some experimentation as it is part of the process of creating and recording music, but it is usually heavily bounded because the average recording financier can not afford a limitless amount of time in a studio. The prevalence of high quality home recording equipment has also shifted the amount and character of experimentation in the production process. It has also made recording technology available to a greater number of musicians. The introduction of network tools for production follows logically from the growing phenomenon of home and personal studios. The impact of home recording is evident in many of the recordings of the past ten years. Artistic innovation (as it is shaped by the application of technology) extends only as far as the technical prowess of the user. Home recording is different than professional, studio recording. Recording studios do something to the collaborative process that extends far beyond sampling rates and acoustic isolation. The physical

structure of the environment creates an atmosphere that forces the performer, producer and recording engineer to perform for each other and co-perform together simultaneously. This creates a social dynamic that imparts a particular characteristic to the collaborative process. The dynamic of the studio promotes focused concentration on performance and articulation of artistic thought. It is something of great value to those seeking to record at a professional level.

Removing the physical architecture and placing the producer/engineer and performer on different nodes of a network hinders the production and collaborative process in. Three physical elements of the recording studio play a crucial role in shaping communication, collaboration and performance. These elements are the walls themselves that acoustically isolate the rooms in the studio; the glass windows that provide visibility between the rooms; and the *talkback*, an intercom system, which enables verbal communication from room to room. The walls are an instrument for political, managerial and psychological control and negotiation. They foster specialization in the roles of the producer, performer and engineer. Both the glass windows and the talkback provide the mechanisms for feedback, communication, and support between collaborators. This is a bi-directional dialog for addressing musical/artistic, technical, and emotional issues during collaboration. Collaborators rely heavily on visual contact for what is not said during the exchange. Body language is crucial for both producer and engineer to understand the performers physical and mental state. It is essential for technical issues like microphone placement or assessing fatigue.

These social and musical exchanges through the glass and through the walls are skillful and involved. At first, it may appear that developing networked systems for music production would require the use of standard, network-based communication technologies to compensate for the lack of physical presence. For example, the loss of eye contact might be solved by the use of teleconferencing. However, teleconferencing is a fundamentally different experience than face-to-face communication. The richness of face-to face interaction helps to sustain collaboration. Proximity affects social interaction. Initiating and sustaining interaction, and negotiation are more readily accomplished in face-to-face interaction. [Hollan and Stornetta, 1992] Current teleconferencing technologies are limited in resolution, field of view of the camera, bandwidth requirements, and accuracy of synchronization with audio during live encoding and transmission. These constraint create several subordinate problems related to the issue of visual contact: subtlety, synchronization of audio to video, freedom of movement and bandwidth.. Although these limitations may diminish with improvements in technology, they must be weighed (and tested) against the immediate need for visual contact between collaborators.

Likewise, several other fundamental problems emerge in the development of an architecture that supports collaboration such as synchronization between collaborators and individual media files, social presence, asserting managerial control, and maintaining the technical standards of the recording. These general categories, again, are layered and constrained by the unique requirements of the production scenario.

For example, in the studio, recording devices are kept in fairly close proximity to the performer. The recording engineer and producer listen to the performance as it is

transferred to the recording medium. In a networked recording environment, this proximity to the sound source is not possible. Recordings must be made at the performance site and transmitted to collaborators. The issue of synchronization applies to transmission of streaming audio from performer to collaborator, but also to how collaborators can communicate about specific sections of the recording. In some instances collaborators can refer to measures of a pre-composed piece, but often they need to discuss elements whose locations are referenced to the beginning of the recording.(i.e. that *sound* thirty seconds before the end) Also, if the recording is a new part being added to an existing recording, the previously recorded material must be synchronized to the new recording.

Social presence, or rather the lack of presence, affects the production process at many levels. Peer pressure in a conventional studio helps maintain professionalism in performance and interaction. Physical isolation and loneliness has an emotional impact on performers. The lack of direct contact limits collaborators ability to communicate and thus exposure to new concepts by making learning/teaching and general artistic exchange more difficult. Recording sessions have a tendency to shift direction in pursuit of musically interesting ideas. This is not always in line with the goals of the session, and the responsibility of asserting managerial control generally falls on one person. The physical walls of the studio and restricted methods of communication support managerial control and session pacing. It is also important to be able to interrupt or alert musicians while they are performing. The standard studio provides several channels of communication for alerting performers such as verbal, sonic and visual cueing. These cues need to be communicated across the network.

There is, additionally, the issue of bandwidth usage. The greater the bandwidth necessary to support the collaborative system, the smaller the pool of musicians becomes who will actually be able to benefit from the broad distribution of these collaborative tools. Lastly, a system intended for professional users, must render a high fidelity end product. Collaborators must have a way to ensure the quality recording throughout the on-line collaborative process.

New technology should not attempt to recreate all the tools found in a recording studio in the networked environment. Instead, it is important to recognize that studio technology enables collaborators to accomplish certain tasks. New technology should enable collaborators to participate in the production process as they would in the recording studio. Each participant would be able to fulfill their role in the collaborative process even without direct contact between collaborators. The mechanisms and technologies by which these tasks are accomplished may not be the same as in a standard studio, but the process of production should remain very similar to the established standard.

This research presents findings that suggest it is possible to sustain an artistically meaningful dialog across a network thereby presenting the possibility for real-time, geographically unrestricted music collaboration. It adds new artistic options to the music production paradigm, and expands our concept of artistic collaboration. Recording studios are beautiful places. They sound beautiful. They house the most delicate instruments — microphones, recording devices, signal processors — which orchestrate the

documentation of musical thought with tremendous precision and subtlety. But it is time to tear their walls down and build a greater musical community.

1.7 Art versus Engineering

Aesthetic creation and artistic creativity differ remarkably from both scientific exploration and from technological invention. In science, questions in are imposed from external forces. Answers are generally limited to only one possible solution. Artistic work emerges from within.

> A machine or apparatus is always made in response to some clearly felt need, clearly formulated; and they have only a single meaning or purpose: whatever the inventor had in mind in constructing them. The work of art, on the contrary, springs more from subjective causality than from objective finality, and fulfills the obscurely felt need of the artist. - Jean-Paul Weber [Weber, 1969]

Production is subjective. When creating machines that facilitate artistic creativity, the challenge is to create technology that not only does not impinge upon subjectivity, but that directly support it. Findings in generalized studies of music psychology and perception explain consistencies in behavior found in music collaboration and the production process. This ultimately leads to the development of tools that support the most core principles of effective collaboration.

To comprehend the music production paradigm, collaboration in the recording studio must be analyzed. Chapter Two explores the relationships found in the studio environment in the more general context of music cognition and psychology. It provides a basis for understanding the artistic discourse and the social mechanisms that support music production. These fundamental elements will provide the foundation of the proposed collaborative system. The incorporation of these basic requirements is crucial for sustaining a professional level of discourse between collaborators in the networked environment.

Studios provide more than sonic isolation. They facilitate the jobs of musical specialists who are responsible for different aspects of the production process. Chapter Three introduces the various roles of the studio specialists and examines how the physical, technical and social make up of the studio supports them in their responsibilities. This provides a strong foundation for understanding the production paradigm.

Chapter Four surveys other research in the area of networked musical collaboration, and shows where much progress has already been made in connecting musicians across geographic boundaries. Prior research and our understanding of the production process support certain assumptions about the development of a system to support this type of networked, recording scenario. Based on these conclusions, the characteristics of an ideal system are presented in Chapter Five.

1.8 Experimentation

An experiment has been conducted to develop a better understanding of how musicians intuitively overcome the obstacles of the network during collaboration. It was assumed that by observing production in a networked environment, the primary tasks of the producer and performer that are central to the production process would reveal themselves. At the beginning, the hypothesis was that a simple collaboration could be sustained in a networked environment if latency and audio degradation could be minimized. Primarily, the goal of the experiment was to prove that this hypothesis was correct, and to determine general estimates for latency and sound degradation limits. It was also expected that observations made during networked collaborations would inform assumptions about what sorts of technologies could facilitate production tasks. It was assumed that a certain amount of delay and sound quality degradation would be tolerated without sacrificing the sense of real-time collaboration. Furthermore, it was expected that new production techniques would emerge to compensate for the unique challenges of the environment.

During this experiment, two musicians, one acting in the role of a performer and the other in the role of the producer, collaborated in a networked environment to make a recording. The influence of an unfamiliar user interface was intentionally avoided. Both participants used familiar studio equipment including small mixing consoles, headphones and DAT (Digital Audio Tape) machines during the experiment. However, they were physically isolated. Their only channel of communication was an ICQ (on-line chat-room) and the recordings that were streamed from musician to producer in real time. The details of this experiment are explained in Chapter Six. Chapter Seven presents the observations made during each Internet recording session and generalizations about networked collaboration based on that material. Chapter Eight re-analyzes the design assumptions of an ideal collaborative system based on experimental results. Central to the issue of developing an effective architecture for a collaborative system is the configuring the technologies that will support the musical exchange and the collaborative dialog. Synthesis, signal processing, machine listening, streaming audio, synchronous and asynchronous communication, multicasting, etc. are tools for building collaborative network systems. Existing technologies configured to support the underlying tasks of collaboration may prove to be a major component of a comprehensive system for production.

1.9 Methodology

The methodology applied to the construction of this collaborative system involves several steps. The conventional music production paradigm is observed and analyzed. The tasks that support this collaborative process are identified and distinguished from the application of technology used to accomplish them. An understanding of the psychological, social and cognitive aspects of collaboration facilitates this division. Next, by creating an on-line scenario for music production and observing its use, comparisons

can be drawn between key tasks observed on-line and those found in the traditional model.

These observations should reveal which tasks exist as entities nearly detached from technology thus needing minimal technical support and where the production process falters on-line from a lack of effective communication technology. Technology that is consistent with the psychological, social and cognitive models of collaboration can support these on-line production tasks. A robust system for collaboration will incorporate these mechanisms for co-creation. The completion of the preliminary stages of research mark the first steps in redefining conventional notions about producing music.

1.10 Audience

This work is intended for two audiences. First, it is hoped that artists in general, but musicians in particular, will come away with a better sense of how networks can play a powerful role in collaboration and the creation of new musical works. Although this research focuses on music, many aspects of the analysis of collaboration are applicable to all creative, collaborative activities. Networks will not only make powerful tools for recording, they will ultimately bear new forms of artistic content altogether. Second, this work it is for the engineer and software developer creating technologies for artists. Great art can be made with crude tools. Understanding why one tool facilitates the creative process while another is a hindrance is an elusive dilemma. This thesis is an analysis of the music production process, in the context of the technology that supports it, and subsequent comparisons to the technologies that support communication across computer networks. It is intended to serve as way to more deeply incorporate the creative, music-making process into the development of computer applications.

1.11 Musical Evolution

It is important to bear in mind that there has always been cross-cultural musical collaboration. The technology presented here would expedite that process tenfold. By understand how the advances in technology have changed this pan-global flow of musical influence over the centuries, a more informed approach can be taken towards the design of effective systems.

Inevitably, cross-cultural, pan-global collaboration will yield new forms and styles of music. The very nature of production technology is changing. These tools lend themselves to modality and temporal manipulation in away that was previously unavailable to music makers. It may change the way we think about content and creating content. Working in the networked environment requires new methods for production that may ultimately alter what is produced.

The Internet presents a new construct for developing artistic community. We are musically connected not only in our individual localities, but also, in our virtual communities. Exposing musicians to new forms, new styles, and new perspectives on music and creating music. This will surely set musical minds moving in new directions.

In his book *Noise: the Political Economy of Music*, Jacques Attali delineates four stages of musical evolution: Sacrificing, Representing, Repeating, and Composing. These stages overlap and must be considered cumulatively to adequately represent the history of musical development. [Attali, 1985]

> **Sacrifice** emerges from oral societies where all aspects of social, political and economic relationships are imbibed with some sort of sacred significance. Musical practices were integrally linked to ritual. The music of this age is characterized by the dominant positioning of words, chanting and narrative. The use of instruments is relegated to dramatic accentuation.
>
> **Representing** music in the form of notation did for music what written language did for communication. Music could be stored and recreated. The works of others could be distributed. This era emphasized the accomplishments of the individual, both as composer and performer. It encouraged the transference of musical knowledge through non-aural, personal mediums.
>
> **Repeating** encapsulates the past one hundred and twenty years. It is the era of recording technology. The production paradigm has evolved over all this time and has led to the creation of music as a commodity through mass production and global distribution and consumption. This era has had a paramount impact on how we thing about creating music, performing music and the role of technology in music making.
>
> **Composing** is Attali s future musical utopia. It is an era where people are unrestricted in their creation of music, and free from social, political, economic and technical hindrances to creativity. [Campbell, Buck and Cuthbert, 1991] It is an era into which we have perhaps already slipped — silently.

It is with these ideas in mind that tools and instruments of future musicians take form.

2 Cognition, Music Psychology and Artistic Expression

This chapter explores the processes behind the production process at a more fundamental level. It is possible to analyze what happens during production superficially, but that would not provide a mechanism for understanding why the paradigm works or how it evolved. By understanding how musicians (and artists in general) collaborate we are better equipped to tackle the problem of creating tools for artistic collaboration.

2.1 Human Perception and Collaboration

The process of collaboration can be analyzed from a cognitive perspective. This includes not only an analysis of how the individual derives significance from his surroundings, but how groups of individuals can share their experiences and perceptions and arrive at a mutually agreed upon explanation of the objects they observe together. Music collaboration can also be analyzed from a psychological perspective. The presence of a group affects the performance of the individual in the collaborative or co-performance setting. Furthermore, each collaborator plays a part in the society of the group. This impacts the dynamic of collaboration for the group as a whole, but also impacts the perceptions of the individual member. These aspects of human interaction not only provide a basis for analyzing behavior in the studio it provides insight that may eventually be applied to developing computer systems that facilitate these interactions. Between humans and (networked) machines is communication and collaboration.

2.1.1 Cognition and Artistic Collaboration

Comprehending how aesthetic and production decisions are made necessitate an understanding of human perception in relation to Art. This includes but is not exclusive to music. What we seek here is an understanding of how the individual attributes meaning to artistic gestures, how artists communicate these perceptions to one another during collaboration, and how artistic gestures in completed works are ultimately perceived by the audience. We seek a base level insight into how the creative process manifests itself in a finished piece.

In all forms of creative expression, we ascribe significance to artistic gestures and derive meaning from the manner in which elements are featured and juxtaposed in the medium. Both the creation and experience of Art forces us to derive significance from representation and grapple with finding the correlation between the gestures contained in a work and their meaning. By symbolically representing things and ideas, the artist gains the ability to manipulate the context in which the object is presented or exaggerate and distort specific properties of that object. The artistic intent is to convey ideas from the artist to an audience in a way that is vivid. When seeking vivid expression in Art, it can not be assumed that the meaning is obvious. Successful Art engages those who experience it, and challenges them to think or feel with heightened intensity. Art provokes. The provocation may be positive or negative or simply question our common perceptions of the world.

To derive meaning from the contrived and constructed symbols in Art, it is necessary to logically classify the content, and identify objects. An object is a thing, tangible or non-tangible, which constitutes a unit of something with identifiable features or behaviors. Objects may combine to make other objects. Objects may be mental processes or ideas. It is not necessary to have a clear mapping of real world objects to artistic representations. The objects in the context of a given artistic medium are manifestations of real objects and ideas. Objects are identified according to their features. Thus even abstract objects may represent concrete things. To create Art, one engages in a process of defining intent, choosing forms or representational objects to convey that intent. The audience also defines the context or environment in which those objects are contained. When the audience makes the correlation between the representation and real world objects, meaning is conveyed from artist to audience.

We approach Art with some preconceived templates for arrangements or behaviors of real world objects. Similarly, we have some mental models for how commonly encountered things work. We frequently match an established template to an artistic representation. Through the match we recognize elements. To derive meaning, the audience must think about the relationship between the objects used as forms of representation in the Art and features of objects that are familiar from experience. This is a modal relationship. A mode is a conjunction of lawful regularities that obey a set of simple rules.[1]

Artists seem acutely aware of the modality that connects objects in the world and apply this understanding of the cognitive process when creating a piece of work, explaining or critiquing work and also when participating in collaborative, creative environments. Through our perceptions of the (real) world we know that there is a high likelihood, or prior, for the occurrence of certain physical or mental configurations (i.e. facial expressions and emotions, things that obey the laws of gravity, etc.). This gives weight to interpretation.

[1] This definition of a Mode comes from Whitman Richards and was taken from class notes of MAS 234 taken in the Fall of 1999.

2.2 Collaboration Process

Collaborative, creative activities have two basic forms of participation. First, individuals contribute to collaboration based on distinct areas of expertise. Second, multiple participants negotiate an interpretation collectively, and create or ascribe meaning to representations. As a group, they determine how these representations are manipulated to convey meaning, or are combined to create a finished product. Frequently participation vacillates from explicit contribution to group consensus. To create a finished work, collaborators must mutually define their shared context.

The shared context is the pool of modal relationships from which each collaborator draws to communicate with the group. The phenomenon of attributing specific meaning with given artistic gestures is not of particular interest when examining collaboration. Instead, the focus is on the process through which significance is mutually agreed upon within group settings. Multiple participants negotiate an interpretation. Participants may enter collaboration with some notion of general context, but they must collectively define the details of the collaboration and work being created.

2.2.1 Collective Choices and Individual Contributions

There are two major influences steering the group decision-making process: perceptual influences and social influence. Individuals interpret sensory information through a combination of perceptual experience and the ability to discern modal relationships. Our precepts, or primary preferences, are consistent with our biases and beliefs. Participants bring to the collaboration socially and culturally imposed biases. Choices are drawn from a set of preferences held by the individuals that make up the group. These are the collective choices, and they are constrained to the preferences and biases of group members. Biases and beliefs within the collective choice set may be contradictory, but are negotiated through the shared context. [Richards, McKay, Richards, 1998]

The process of defining the shared context is restricted by several factors that are generally non-negotiable by collaborators, and include: the basic intent of the collaboration, the technical setting, limitations of the medium, the individual abilities of each participant to control and manipulate the medium, and the resources available. Similarly, participant s biases and history may succumb to influences that have no direct relationship to the creative decisions at hand or the collaborative processes of choosing or manipulating specific representational objects. The imposition of a particular production style, restrictions of business interests/budget, concern for commercial viability and consideration of group/artist identity may add to the complexity of defining the shared context.

These issues do not bias all participants equally. Potentially, what is at stake for each participant may effect the group choice set.[2] The shared context contains elements that

[2] from Whitman Richards and was taken from class notes of MAS 234 taken in the Fall of 1999. Class discussion: risk may bias preference. For example, a pathologist s interpretation of medical data may be influenced by the context of treating or not treating a certain disease

are arbitrary and unstable. [Richards, McKay, Richards, 1998] The aggregation process is contained in the discourse surrounding the choice and manipulation of representational objects, in the testing of options and examination of participants perceptions, and in developing analogies through demonstration and example.

No artist develops in a vacuum. To a greater or lesser extent, artists are influenced by not only by the biases of their own education, but by the tastes and normative values of society. The audience does not decipher artistic works solely by seeking a correlation between the features of the representation with real world objects. If meaning is not vivid, the audience seeks an alternative explanation for the artist s choice of a given representation using modality and seeking associations within a larger context.

Witkin and Tenenbuam hypothesized that perceptual organization is not a means of describing an object, but instead a crude mechanism for causal explanation. Plausible explanation for the significance of artistic gesture for both artist and audience is influenced in part by an understanding of how a medium may be manipulated. Also, the artist must possess some understanding of how a generic category of gestures is perceived by the culture, or particular audience, as a whole. An individual s ability to discern priors may be effected by the history of work in a given medium or genre. If an artist works directly against this, the audience finds it more difficult to correlate representational objects with real world objects. [Witkin, A., and Tanebaum, J. 1985]

2.2.2 **Choice Set**

The choice set contains a minimal level of shared information structures about characteristics or relationships within the medium and about the artistic intent. [Richards, McKay, Richards, 1998] The choice set is an integral part of the definition of the shared context. Negotiation is possible when each collaborator has an adequate model of each participant s decision-making process. The decision-making process is shaped, for each individual, by precepts and biases.

The shared knowledge structures incorporate the technical fundamentals necessary to control the medium or a model of how individuals with specific areas of expertise perform their tasks. The shared knowledge structures also include the common familiarity with the chosen genre and related genres. Participants must share some overlapping knowledge of the history of the medium or genre in which they work, and knowledge about possible ways to manipulate objects within the medium.

Additional factors may also influence individual s contributions to the definition of the shared context. With regards to musical collaboration in particular, Jackenoff and Lerdahl support a generative music theory that is analogous to phonological theory. They suggest that musical intuition is based perhaps on the understanding of the formal grammar of (the music) language, as it is believed to shape language perception by some linguists. They found a high correlation between prosody, rhythmic stresses and time compression and the theoretical understanding of musical construction by listeners. [Jackenoff and Lerdahl, 1982] Similarly, Minsky favors the notion that regularity and repetition bring a sense of order in musical form. Either of these ideas could substantially impact the collective choice set. [Minsky, 1982]

Artists use modality not only to construct artistic gestures and representations, but also, to collaborate. By establishing a shared context, individuals are able to identify and negotiate significance and representation in the creation of Art. Understanding the cognitive process not only enables us to grasp the details of collaborative exchange, but it also presents insight into the technologies that will work in consort with the organic nature of the creative process.

2.3 Human Behavior and the Psychology of Music Performance

In surveying the literature, various parallels can be drawn between the psychology of learning music and music performance and how the recording paradigm has evolved. There are consistencies throughout all aspects of musical engagement. Four areas in particular lend insight into why the studio arrangement is so effective: the teacher/pupil relationship, social facilitation, leadership in ensemble settings, and effective communication during performance. These concepts are introduced in a broad context here, but will be used to reinforce the analysis of the production paradigm in the following chapter. These relationships are important whenever musician interacts with musician.

2.3.1 Teacher/Pupil Relationship

The guidance a teacher provides a student is based on the teacher s education and professional experience. Through this the instructor leads the pupil towards improved technique and artistic maturity. Familial bonds are important in establishing favorable learning environments and encouraging development. Personal bonds between teacher and student evolve over time. The teacher s professional aptitude becomes a model for the student and helps to establish the student s expectation and standards regarding playing ability, interpretation, teaching skills, and professionalism. Successful students are able to discern the personal characteristics from the professional while poorer students tend to blur the two. The teacher s expectations effect the student s performance in the learning environment. Achievement is linked to standards set by the teacher. Collaborative activities like private or classroom instruction provide motivation and encourage practice and learning. They foster engagement in the musical tasks and activities at hand. [Davidson, 1997] Since all musicians are not equally experienced, in group settings individuals frequently encounter teachers. Even if the role is not formalized, the relationship is the same. For example, aspects of the teacher/pupil relationship are evident in the conductor orchestra/scenario.

2.3.2 Social Facilitation

Musical performance in front of others promotes physiological changes in the performer. These changes include an increased heart rate, greater oxygen supply and improved visual sensitivity. These factors can serve to improve performance. If the presence or feedback of others creates extreme physiological changes, it can lead to an impairment of performance skills. It is not just the presence of others but the acceptance of those present that is crucial to encourage peak performance. The appraisal of others is the psychological trigger for the performer. It may make the environment more favorable for

focused attention to musical detail, but it can also elicit competition between performers. [Davidson, 1997]

2.3.3 Leadership

For groups to function cohesively there needs to be a sense of affiliation between members. Recognition of performance skills is important for creating the sense of belonging to a group, and also helps temper the balance between the division of power and the sense of group affiliation. In a study by Murning and Conlon, successful leaders were directive and democratic, and were flexible in their leadership strategies depending on the situation. Totalitarian leaders lost the support of their constituents. [Davidson, 1997]

2.3.4 Effective Communication

Verbal communication between co-performers (and conductor) during rehearsal are essential to arrive at a consensus on performance practice and interpretation. Non-verbal skills enable musicians to communicate during the actual performance. Co-performers must react immediately to variations in performance, interpretation, and new musical ideas. Accuracy of timing cues depends upon close physical proximity. Similarly, eye contact and facial expression suggest a mechanism for feedback and mutual encouragement during performances. [Davidson, 1997]

2.4 Conclusions

By pulling together the cognitive, psychological and social aspects of collaboration, we get a more complete perspective of the intricacies of fostering artistic collaboration. All these elements working in conjunction support the production paradigm. We turn towards networked technologies to expanding the pool of potential talent and expand our artistic community. However, in doing so these underlying elements grow in complexity. Not only is there an increase in the number people with whom we collaborate, but the channels of communication available for this discourse in a networked environment fundamentally curtail our mechanisms for emoting. Our technologies must include a means to amplify our artistic discourse to compensate for the interference of distance and communication technology. This chapter explored how an artist forms intellectual and social bond with another artist. Now it is time observe how these behaviors are actualized in the professional recording environment.

3 Recording studios: the science of duplication, the craft of replication, and the art of interpretation

This chapter illustrates what it means to produce. It also identifies the various roles that work in consort to accomplish this process. The goal of a recording session is to obtain the most accurate sonic representation of a *musical expression* possible given the technology, production abilities and performance skills of those involved in the process. The goal of production is to apply technology effectively to the creation of a sound recording and socially facilitate the performances captured by the recording process.

3.1 Roots of Contemporary Music Production Technique

The earliest production techniques come from Musique Concrete. Composers such as Messiaen, Boulez, and Stockhausen, in the early 1950 s, started using audio technology as an instrument of music composition. These composers were drawn to a radio technician, Pierre Schaffer, who created pieces by juxtaposing unrelated sound materials that had been removed from their original context and played back at varying speeds or reversed. These techniques filtered into more conventional forms of music production. As Chanan puts it,

> These were the first recordings that seemed to be composed for the medium, rather than the medium transparently producing them they began to spread beyond their immediate market and exert their influence undetected Revolver (the Beatles), released in 1966, had already used backward tapes and splicing techniques derived from musique concrete and the electronic music studio. [Chanan, 1995, pp. 142-43]

Since then the methodologies and techniques that constitute the production repertoire have, certainly to a large extent, been driven by popular music. However, any study of the production paradigm should not be limited to the creation of popular music nor

should the development of new technologies confine the user, musically, to a particular genre. As is readily apparent in the work of classical pianist Glenn Gould, the pervasiveness of the modern recording studio has had an impact on all music both in its conception, presentation, and how the audience ultimately receives the final production.

3.2 The Art of Production

Much of this chapter is drawn from personal experience. Despite the rapid increase of academic programs and music curricula geared towards audio engineering and music production (from which I personally have benefited, none the less), the craft of recording is still learned primarily by apprenticeship. Academic scholarship in this area is still relatively sparse. To learn how to record music, one must record music - a lot of music. The role of intuition in the process of creating music recordings can not be overstated.

The experience of learning audio engineering or music production is very much like playing a musical instrument. A musician can not read about playing Blues guitar and appreciate how a guitar will feel when they bend a string just so. They must simply bend the string until it sounds right, and develop an intuition for creating sound with the technology of the guitar and bio-mechanics of the human hand. At first, they can only make certain notes or registers of the instrument sound good, then they can only play their instrument. Eventually, they understand enough about strings and hands and guitars that they feel confident picking up any, old guitar and bending strings. Any analysis of the music production process or the application of theories about production to the creation of new technology must confront directly the unpredictable and incalculable nature of artistic intuition.

It is important to emphasize that this discussion does not pertain to the art of performing music nor music composition, but very specifically, the creation of a music recording. Although, there will obviously be cross over between these worlds with regard to aesthetic and musical decisions, making a recording has an agenda and technical and artistic questions unique to the medium of recorded sound and the process of music production. Furthermore, it must be said that it is the tasks performed by each participant in the recording process that forges the music production paradigm and not the application of any given piece of technology to the recording of a piece of music. In the context of production, the masterful use of technology is analogous to aptitude on an instrument. The technology or the user s ability to control it may be sub-optimal, but if the production process is solid, a compelling recording will still emerge.

3.3 The Medium of Recorded Music

Production is the art of replication. Its purpose is to archive and repeat live musical performances and the soundscapes that can be created in the technology rich, studio environment. The end result is not always realistic. In many instances, especially in popular music production, the use of technology is so entwined in the creative and production processes that the end result is not just overtly manufactured, but fundamentally surreal. Even in the purist of commercial recordings like classical music which tries to conceal the technology used to create the recording, the final performance is so perfect and the timbres of every instrument so rich that these sounds could never

have been experienced in a real concert hall. When we listen to recordings we believe that these notes were performed just as we hear them in the recording. This belief drives our expectations of human capability and perfection to a higher level. Sometimes this sonic fantasy is far more pleasurable than the reality. Sometimes we are left feeling as if we have been cheated. As music production has evolved, more and more sonic control is relinquished to the ears and taste of the technician/artist who can use technology to (re)create a performance or the perceived (and manufactured) impact of that performance.

The production process yields a highly complex layering of aesthetic information. This serves to make the expressive meaning clear to the listener. The recording process attempts not only to capture a harmonious collection of instruments, but also to emphasize the theme and sentiment of the pieces recorded. Jean-Pierre Vignolle has the following remarks regarding popular music production:

> It is a music that draws its problematic unity from the superimposition of heterogeneous levels. None of these levels or these component materials could suffice on its own, yet there is no formal syntax governing the mutual organization of elements, a sign-logic which would make it possible to extract a structure analogous to that of the language of grammarians and linguists. Unity occurs only at the level of meaning-for-the-listener, and the only discernable logic is that of the signifier, which pre-supposes a subject. [Vignolle, 1980 , pp. 91]

The difference between a live performance and a studio recording might almost be analogous to viewing (or copying) one of Warhol s reproductions of the Mona Lisa. In creating a silk screen the colors are layered - first the light colors then the dark - yellows, blues, red, then black. The next time the some colors are omitted or substituted for others. In each of Warhol s replications, we still see the intended message and power of Da Vinci s original. It is the same smile, but we are also reminded that Warhol s artistic use of technology enables us to shift our perspectives. The Mona Lisa could have been yellow. Mona Lisa could have been slightly mis-registered thus revealing the technology behind the creation of a copy.

Listening to a recording is not like listening to a live performance. It is a different experience. Recording technology fails to capture a significant amount of sonic data and that changes the auditory experience. Also, when listening to a recording, there are no visual and social cues. We have no body movements or facial expressions to reiterate phrasing or emotion. The listener may be in a drastically different climate, geographic location or time than where the recording was made. Through production allusions can be made to non-musical phenomena as well as to elements with purely musical significance. Where some information may be lost, new information is added.

Production decisions yield deliberately chosen musical and sonic gestures used to convey the meaning of the piece. Incongruous production techniques are immediately apparent. For example, we have certain expectations about flutes and sonatas. A gentle flute sonata recorded with a brittle tone fails to lull the listener. Sometimes, the ability to overstate the obvious is consciously applied (as in Punk music). The production process inevitably truncates or quantizes the listeners experience of a live musical performance.

To illustrate how production augments the listening experience, consider the techniques that may be employed to enhance a song about divorce. The song s protagonist is presenting a callus, indifferent front, but internally, is heart broken. It might be appropriate to include an instrumental solo that is brusque and truncated for several measures, but then melts into a mournful cry. It may be effective to expand the acoustic environment enshrouding the instruments from something close in and clinical at the beginning to something more spacious and less distinct towards the end. These are production decisions. The decisions may be political. Is the features soloist loud enough? It is her recording. Should she be heard above everything else? The power of applying recording technology with regards to musical, artistic intent is enormous. It is a line that must be tread across carefully by both musician and technician. Too much is distracting, too little and the recording is ineffectual.

Audio technology enables detailed sound coloration and blending beyond techniques available for a particular instrument or a specific acoustic environment. It is insufficient to record just a pizzacatto violin. Through production a very specifically conceived pizzacatto is deliberately recorded. The detail possible in the recorded medium is staggering.

Space and intimacy is controlled through the application of technology, and the cast of dramatic characters is represented through featured performers and expressive sonic elements. Striking the balance is the result of the production process that provides a mechanism for defining goals and setting priorities that support the aesthetic imperative. Artistic judgement is wielded through the application of technology and musical techniques employed for their unique characteristics. The selection of microphones and pre-amps, their placement with respect to the sound source, every link in the recording chain effects the recording and its reproduction in the less ethereal medium of recorded sound. Furthermore, the physical recording environment is a tool with which to sculpt sound. It imparts its own sonic signature, and can also be played like an instrument. Placement of instruments in relation to each other and with respect to architectural features yields more colors for the sonic palette.

3.4 Human Behavior and the Recording Studio

It is the perceptions, social interactions and tasks of each individual involved that supports the collaboration of production. In the recording studio, individuals perform specific tasks and exhibit particular behaviors some are unique to the studio environment and some are consistent with the generalized model of behavior presented previously.

3.4.1 Job Allocation

In almost every professional recording scenario, three primary roles emerge in working relationships: 1) *musical performer*, 2) the *producer*, and 3) the *recording engineer*. Each is an artist in his own right. It is the collaboration between these three entities that forms the core of the production process. These roles are frequently misinterpreted as job titles. One can, indeed, be contracted to perform a specific role. Historically, these roles could be neatly defined as sound mixers (recording technicians), sound marketers (record producers) and sound makers (musicians-composers). In practice, aesthetic control and

approach towards distribution were, and still are, distributed amongst these participants. [Kealy, 1982] Where traditionally the sound makers were lauded as the creative impetus, the producer and recording technicians have now achieved a degree of prominence as sound artists. Increasingly, intricately produced, contemporary recordings must be presented and critiqued as the work of a team of artists.

Practically speaking, as in all relationships, boundaries are fuzzy, and one person may subtly or not so subtly shift roles or perform multiple roles during the production process. Ethnomusicologist Leslie Austin noted,

> The concept of the producer, engineer, and recording artist as separate people with distinct functions has been replaced by a collaborative performer, and inseparable producer-engineer-recording artist trio, involved with the larger performance of the recording. The new collaborative performer is a direct result of the invention of modern recording studio technology. [Austin, 1993 pp. 94]

Each collaborator s role can change very quickly — between takes, between sentences, decision by decision. Roles continue to change repeatedly over the duration of the production process. For example, a producer may decide that a percussion part would enhance certain elements of the song. If the producer performs that musical part, who then becomes the producer? Is he self-produced or do the recording engineer or lead vocalist step into this role for the four and a half minutes of recording? In practice, it depends of the individuals involved and the details on the situation. Every situation is unique.

When discussing the relationship of these roles to the application or design of technology, it is useful to think of them in terms of the contribution of each role to the production process. Hence, it is convenient to consider the music producer, the performer and the recording engineer as archetypes, or characteristics of the studio dynamic, rather than specific individuals.

There is also fourth archetype to consider. This is the role of the musical/artistic idea generator. However, for the sake of this research, not a lot of time will be devoted to how this role is instantiated in the production process. Let it be sufficient to conclude, that all musical collaborators have and generate musical ideas so that the collaborative, production process itself can be examined more closely. At the root of all musical productions, a leading artistic figure emerges with a creative vision, and typically a substantial amount of pre-composed content. This is usually, but not always, the musical performer. Where the content has already developed into a mature piece of music (i.e including arrangements, orchestrations, etc.), the production process is a mechanism to transfer it onto a recorded medium in a way that remains true to the artistic intent. Where the artistic ideas are raw, the artistic mark of each contributor tends to be more pronounced and the process of collaboration, itself far more vivid.

3.4.1.1 The Musical Performer

The musical performer is the sonic protagonist. He is the hero or anti-hero in the drama of the music. He is the actor, not the screenwriter. He interprets his role. He may have the leading role or he may be an extra. The performer obviously can be multiple people. It can be an entire orchestra. The performer provides the primary sound source(s). The greater the number of performers the more obvious the hierarchical structure between the group of performers. This structure itself may form a sub-level of shifting roles. It is tempting to think of the performer as *the* artist in a production. But even in the earliest days of recording, there were a host of arrangers, composers and conductors guiding what was performed and how. The musical performer s role is to be an expert on creating sound with their particular instrument. Their expertise or style of interpretation may be the primary focus of the recording, or their contribution may be a mechanism through which to convey a specific, artistic intent without drawing attention to an individual musical personality.

3.4.1.2 The Producer

The producer s role is complex and its definition elusive. The music producer is the muse, the oracle, the nurturer, the protector, the temptress, and at times, the savior. The producer facilitates the act of creation. The producer tends it, molds it, focuses it. The producer s role is analogous to that of a film director, and his responsibilities fall into three categories: artistic, social, and economic. The producer is a go-between in the world of music and the world of recording technologies, and often the world of commerce. He is an expert on translating the idea generator s creativity into recorded music. He may also offer his own subjective opinions, as critic, regarding artistic content and creative ideas through out the process.

The producer s social responsibility is to create a suitable working environment for all collaborators. This means managing needs and tastes of a disparate group of individuals with varying professional and artistic requirements. These responsibilities are internal to the studio. Simultaneously, the producer must represent the audience who will ultimately hear the performance. [Muikku, 1990]

Charlie Gillet notes,

> The essence of the producer s role is to be the catalyst for the other participants in the studio, the person who sparks them off into delivering their best, together. In some cases, the producer is doubling up some other role, as a songwriter, arranger, recording engineer or performing musician, in which case he (producers are rarely women) can lead by example and physically control what happens. [Muikku, 1990, pp. 1]

The producer catalyses the session through management, applied psychology and musical leadership. He makes available his experience and instinct. Because time is expensive in the recording studio, it is not a place to learn fundamentals. It is a place for the active generation of art. It is a fabrication plant. This does not remove all opportunities for experimentation, but it is not an environment for planning and contemplation. It requires

focused construction. In this way, music production differs from its music concrete origins. The production process is a performance art, but it is not a real-time or linear performance.

Lastly, the producer has economic responsibilities both in the daily accounting of the recording budget, but also in making the various parties involved aware of the potential cost/benefit of artistic decisions on the commercial viability of the final product. [Muikku, 1990]

3.4.1.3 The Recording Engineer

The recording engineer is the magician and the technical alchemist. He is a sonic sculptor. He may be a realist or a minimalist or a modernist, but he will always leave an indelible mark on any sound recording. The recording engineer is a technology specialist. He is also responsible for the technical logistics (i.e. what equipment is needed to record the various instruments, the determination of how these technologies will be used together). The engineer works under the direction of the producer, but is always responsible for the proper use and care of equipment and the sound quality of the final product.

3.4.2 Subjective Meaning in Music

The production process is a highly subjective one. Participants evaluate performances and recording quality through both critical and analytical listening. Analytical listening is the process by which the significance of musical elements is judged. It is an analysis of sonic characteristics in the context of the intended meaning. This includes how each element (lyrics, orchestration, signal processing) interrelates to create a cohesive presentation. Analytical listening is crucial for defining the shared-context and artistic intent of the recording.

Alternately, collaborators must be able to evaluate the recording critically, and assess the audio signal or musical performance on a technical level. Critical listening is separated from the internal time of the music, and focuses on the listener s ability to hear each element on a purely perceptual basis. Decisions regarding spatial imaging and uncover psycho-physical phenomena like auditory masking, but also pitch and rhythm are informed by critical listening. [Moyan, 1992]

3.4.3 Music Psychology in the Studio

Teacher/pupil relationships emerge in the studio especially between the producer and performer, but it can also arise between engineer and producer if one expands the other s view of what is possible technically in the studio. The producer sets the standard for performances of each participant in the studio environment. The production process quite clearly impacts the performer s technique and artistic maturity. Furthermore, the performer depends on the producer s experience or their ability to envision the completed work. The collaborative nature of the relationship motivates the musicians, and keeps them focused and engaged in recording.

Social facilitation contributes significantly to the studio atmosphere. There is always an audience in a recording studio. Everyone performs for everyone else regardless of the task. The performance aspect of the process helps maintain focus on the project making it not only a mechanism for efficiency, but also a way to enhance the performances of everyone involved.

During the recording session, the producer usually takes full leadership responsibility. However, like the ensemble, if that leadership is totalitarian and eclipses the talents and ideas of any or all other collaborators involved, the session will yield poor results. Alternatively, without someone providing leadership, the sense of affiliation is lost and the ability to prioritize tasks is obscured. This jeopardizes the ultimate goal of the collaboration.

Verbal and non-verbal communication constitutes a crucial component in the collaborative process of music recording. Verbal communication is essential for establishing expectations and addresses specific technical and artistic issues. It helps define the shared context. It allows collaborators to aggregate collective choices and negotiate preferences.

In recording, non-verbal communication is heavily relied upon not only between performers, but also between performer and producer, performer and engineer, and producer and engineer. While listening critically to a recording, non-verbal communication provides co-listeners with an avenue for feedback that does not disrupting concentration. Also, during recording, there are technical decisions to be made that may ultimately effect the quality of the recording. These decisions need to be made instantaneously and acted on immediately. Recording is a real-time task, and verbal communication might be too slow to affect the necessary actions. Additionally, the need for sonic isolation may require the use non-verbal communication. The producer in the control room may conduct or cue performers in the tracking room, reminding performers of their entrances, or he may come up with a new musical idea that could be communicated through gesture and incorporated on the spot.

Mutual encouragement and approval is instantaneously transmitted through the glass dividing control and tracking rooms. Non-verbal communication, especially body language, provides important feedback to the producer about the performer and engineer s psychological state, physical comfort, and level of attention. As it the producer s job to create an effective working environment for all collaborators, he needs constant influx of this information in order to pace the session appropriately. Non-musical communication is an essential part of music collaboration. It is not that one can not create music without the feedback of others, but this is not how the professional recording paradigm has evolved. The social aspects of music performance create a favorable environment for high standards of performance, creative adrenaline and professionalism.

3.5 Social Aspects of Collaboration

All participants come to the recording collaboration with certain preconceived notions about the presentation of music. Collectively, these notions form the choice set. The way individual ideas and performances will be combined to create a finished mix remains unknown until the moment it is completed. Discourse in the studio must overcome the technical hurdles of communicating through the physical divisions, and cross the psychological and professional gaps between collaborators. [Porcello, 1996]

It is evident in the social makeup of the studio that the psychological aspects of performance add to the favorable conditions of the environment. Members of a community perceive association. Whether performing in musical groups or generalized social music activities, participants develop a sense of commitment and responsibility to the group. The group or community also provides a sense of mobility, and presents opportunities for socialization and competition that are unavailable outside the context of the musical activity. Individuals are able to shift social positions and levels of authority inside the musical community, in ways that may be unavailable outside of music making. [Slobin, 1993] In contrast to the larger context of a community defined by cultural context, genre or geographic location, the studio and collaborative group may provide a temporary restructuring or suspension of standard activity and relationships. The ability to form subcultures coalesces though the superposition of common artistic goal. This supports innovation, and allows the group to break away from the expectations of the society at large.

3.5.1 Vocabulary of the Communication

From a purely practical perspective, it is important to note exactly what social mechanisms support the artistic dialog. Ethnomusicologist Thomas Porcello s describes several types of communication that occur regularly in recording studio settings. In the recording studio, performers, with or without technical expertise, must convey to a recording engineer, with or without musical expertise, ideas about how they wish their instrument to sound in the context of the other instruments and the affectations of recording technology itself. This clearly demonstrates how significance and representation in art, modality, and defining a shared context is central to the recording process. The performer and engineer switch roles back and forth from artist choosing a representation to observer seeking highly correlated features and/or explanation. Porcello found six basic kinds of objects used to convey meaning.

- singing/vocables: para-verbal sounds used to convey the intended timbre of the instrument being recorded or processed.
- lexical onomatopoesis: words bearing a resemblance to the sounds being described (i.e. ring, flat, hollow)
- metaphor: words used to describe an acoustic characteristic (i.e. pitch bend, tight)
- association: taxonomy, making analogy to a specific genre or performer
- evaluation: collaboratively developing a vocabulary for a particular performer s sound

- metaphor and association: naming sound qualities in the context of a particular performer, song or genre

To illustrate, a performer might say something like, I want my hi hats (a type of cymbal attached to a trap drum kit) to sound like tht, tht, tht - really tight. The engineer might try to further constrain and define the context by offering specific examples of hi hat sounds on well know records. Like [this drummer] on [that] record? [Porcello, 1996]. The creative options are restricted by the set of collective choices. Communication obstacles separating collaborators may limit restrict the vocabulary of the discourse by making singing/vocables and lexical onomatopoesis far more difficult to convey. It complicates the process of defining the shared context. Inequality in monitoring conditions for each participant intensifies interference in communication by leaving each uncertain about what the other is hearing.

3.5.2 Non-Linearity in the Recording Process

The nature of production is non-linear. While working on the creation of the highly, linear format of music, time shifts, expands, reverses and contracts. As collaborators rewind recordings, add parts to various sections of the piece, and edit and substitute parts they defy the internal time of the piece. This is an approach to music creation that is not possible in music performance, but is familiar to music composition. Ethnomusicologist Thomas Porcello considers,

> Processes of musical encounter are, after all, inscribed in the passage of time, and local epistemologies of time are therefore crucial to understanding how concrete encounters work, and for arriving at a socially informed phenomenology. This is especially true for music, with its duality of time: the temporal relations that are established internal to the musical work by rhythmic and harmonic structures, and the flow of that internal structure through the temporal epistemologies of the social world in which music is performed, listened to, remembered, or otherwise experienced. [Porcello, 1998, p. 486]

This temporal plasticity effects not only the ultimate perception of the music recording, but the production process itself. The evolution from recording direct to wax cylinders and metal discs to magnetic tape that could be recorded over multiple times is essential to modern recording. The ability to freeze, reverse, and repeat moments in time, and the ability to change what happens during those moments is one of the qualities that makes modern production techniques so powerful. There is immediacy in the production process. We produce with the knowledge that we can focus our attention on some details while others can be scrutinized off line or in this non-real time context. Furthermore, collaborators do not necessarily shift time synchronously with one another adding even greater complexity to the definition of a shared context.

3.6 Recording Machines

The recording studio is a complex piece of technology. Not only does it house both recording and communication technology to support the production process, the physical

architecture of the studio itself is important to artistic discourse and control of the recorded medium.

3.6.1 The Studio Architecture

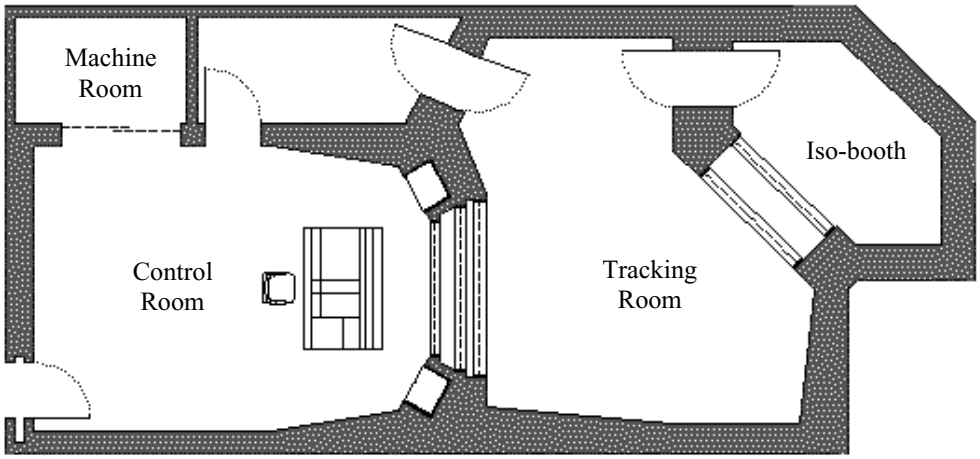

Figure 1 [3]

The recording studio is a labyrinth of sound-shaping chambers. Each room is designed for a specific function. Each has unique acoustic qualities which aid the tasks performed in them. The control room supports critical listening. The tracking room has pleasing acoustic properties for performance. More and more spaces for tracking (recording) performers are constructed to be as acoustically neutral, or dead . Thus trying to remove the peculiarities of a given recording space from the production equation. The choice of a recording space is a crucial production decision.

At various levels, the recording studio facilitates sonic isolation. Frequently, tracking rooms (sometimes referred to as a cutting room or the studio) which are designed for live musical performance will be subdivided into a large central room with smaller, iso or overdub booths around the room perimeters. The iso-booths are physically and acoustically isolated from the main tracking area. Usually there are windows connecting these side rooms to the main area. By using iso-booths, multiple performers can record simultaneously while remaining sonically separate. The control room holds the recording equipment, and is home to the technicians and producers, or artistic directors. It is connected to the tracking room via a large window. The control room is frequently subdivided, as well. Machines that make extraneous noise are cordoned off to make the control room as acoustically pristine as the tracking room.

Individuals in the control room communicate with the tracking room and iso-booths via an intercom system called the talkback. Conversations in the tracking room are available to the engineer and producer through the same microphones used to record the

[3] Based on an illustration from Sound Scene Acoustics, Inc.

instruments. Sometimes a microphone is placed in the studio solely for the purposes of control room/tracking room communication. These microphones are turned on and off by the engineer in the control room at the recording console. They are rarely turned off. The producer generally knows what is happening in the tracking room at all times. Frequently, when recording large ensembles with a conductor, there will be two talkbacks — one between the conductor and the control room and one between the control room and the entire ensemble. The control room has a single microphone, usually connected to the recording console, which can be turned on and off by the producer or engineer and is routed into the performers monitoring system (generally headphones or occasionally monitors). The engineer is rarely heard on the talkback communicating directly to the performers. The producer can convey or restrict information available to individuals as is conducive to the recording session. Too much superfluous, technical information and the performers loose focus, too little, and they do not understand what is expected of them.

While recording, collaborators hear different things. Each has different monitoring conditions. This disparity can be capitalized upon to provide each individual with exactly what they need to hear in order to perform their specific task. The performing musician may need to hear the rhythm section clearly, but may find a particular harmonic section distracting. Thus, a unique mix can be created for each performer. Similarly, the producer needs to hear each part relative to the larger musical context. The engineer requires the ability to isolate, or solo, individual instruments while recording to monitor timbre, volume, background noises, etc. For critical listening of recorded materials, the control room offers significantly higher fidelity and a more accurate representation of how the performance will sound as the end product. The performer is given all the musical information they require in order to perform, but they are not afforded the monitoring fidelity available in the control room. Thus the actual effects of the recording process on the music is relatively unknown to them while they are performing.

3.6.1.1 **The Studio Configuration**

This structure is designed to help collaborators hear better, to impose a managerial and political structure, and to implement psychological divisiveness all in the name of achieving superior musical performance. This professional and physical arrangement works because it encourages and supports specialization, and with specialization comes standards of professionalism by which individual performance can be judged. The music making community develops a set of expectations that it depends on each specialist to deliver. The studio fosters peer pressure. Every participant is looking through the glass at everyone else. Everyone is being examined. Everyone is performing under scrutiny.

The architecture of the studio is a tool for enforcing a control structure. It is necessary to control time and money, channel artistic energies, conform to industry standards, and promote excellence in performance. Recordings occur when the recording engineer presses the record button on the recording device. The producer controls the record button. The engineer records under the direction of the producer. There is a safety mechanism, however. If there is a technical problem, the engineer can override a decision to record. Under these circumstances, the recording engineer has the last word. If there are no technical issues, the recording engineer will only record at the instruction of the producer. No matter what the musical performer wants, he depends on the producer to

actually record. This can mean recording things the performer did not feel were adequate or destroying things the performer thought were good. This has many political, economic and psychological repercussions. The producer s role as artistic gate keeper is a double-edged sword. It is a tremendous responsibility, and requires a remarkable amount of trust on the part of all the other collaborators. If there is no gate keeper, however, much time may be wasted in the studio travelling down many musical dead ends, spending a lot of money, and leaving the artistic vision unrealized or feeble in its approximation.

The studio is also a flexible tool. The power structure, the performance aspects, and the presence of collaborators can all be obscured or emphasized to facilitate the production process. Peer pressure can be emphasized or de-emphasized. For example, if the lights in the tracking room are turned off, a musical performer who needs privacy can retreat into their music. The performer can see everyone in the control room, but can not be seen himself. Simultaneously, the producer and engineer can hear the performance, but their critical listening experience is altered by the loss of visual contact. Alternatively, depending on the instrument, the performer might feel comfortable playing in the control room sitting right next to the producer and engineer where there are no communication barriers, and less need to trust one s collaborators. Individuals can be isolated or drawn into the fold as the situation dictates.

There have been a few attempts to radically alter the physical structure of the recording environment. One notable exception is Real World Studios, a studio in Wiltshire, England built in 1987-88 by pop musician, Peter Gabriel. The designers of Real World attempted to integrate the control room and the studio. According to the general manager of this facility,

> Peter [Gabriel] had spent his recording life working in traditional facilities, principally as a vocalist, and had come to the conclusion that the rigid association of control room — console — monitors — glass — studio — overdub booth was rather restrictive and militated against the vocalist. He asked for suggestions as to how they could break this down, how to make a much more flexible design, and how to involve everybody in the creative process of recording Peter had definitely concluded that the most important thing was the quality of the performance, not the technical quality or how well you could hear it. And not just musical performance, because the engineers are performing, too. Mixing is a performance and the quality of that performance is very much dependant on the environment. [4]

In Real World s Big Room there are no physical dividers between collaborators. It is literally a big room. In this sort of flexible design there are virtually no communication barriers. Every performer must face their peers directly. Everyone knows what is being recorded and when. While music is being performed, everyone is almost equally clueless about how the music actually sounds played back from the recorded medium. There are still specialists in this environment, however, and some who are better qualified to make

[4] Taken from the Real World Studio web site on 4/30/2000 featuring an interview with the facilities manager, Michael Large.

intuitive technical guesses than others. There is no mystery about what is being recorded. There is intense immediacy.

Whether divided by planes of glass or not, this community of collaborators is bound together by a common artistic vision. Even participants with very marginal contributions, are still tied to a project by the desire to create a recording. This network of collaborators is bound by the subjective view of artists and specialists involved in the production process, and runs the perpetual risk of developing a musical or aesthetic language that is unintelligible to music audience at large.

3.7 Conclusion About Production

The question remains, when looking at the sonic canvas who is the painter and who is the paint? Who generates the dominant creative impetus? Where do the artistic ideas come from and who performs them? It varies from recording to recording and instance to instance. The point is that audio technology should not in anyway pre-determine how these roles are allocated. It is a state of perpetual flux, and all tools for collaboration must support these shifting roles.

We hear a singer s breathing between notes or violin rosin when the bow pulls across the strings when the producer deems the technique suggestive and revealing. These artifices are often effectual production techniques and support the overall sonic experience. It is a conscious choice to reveal the limitations of the recorded medium or the replication device. The producer chooses to show the audience this is a copy. At times, popular tastes would have us believe we prefer the copies to the genuine article. Many artists go to the lengthy extreme of copying themselves in live performance. And the studio copy is then re-generated in live performance. In this we can see the ultimate power of repetition. The line between genuine and copy are thoroughly blurred beyond recognition, and perhaps, reveals a stylist movement pushed to its extreme. This will ultimately give way for the entrance of new forms of musical expression.

What follows will focus predominantly on the Producer-Perfomer collaboration. This is not because the other roles are secondary, but because this analysis will be used to understand how the introduction of computer networks effects the artistic dialog between control room and tracking room. The choice is to view the problem from the perspective of the individual who controls that line of communication.

4 Networked Music Collaboration

The following pages survey previous and current research and technology in the area of long distance collaboration. Most of these experiments are not directly related to the music production paradigm, but instead try to approach the problem of musical collaboration in more general terms. The techniques and solutions employed can only be evaluated from the broader perspective of general, networked music collaboration. The findings, however, are still valuable when examining the studio environment.[5] None of these systems can be embraced as a thoroughly satisfactory paradigm for professional music collaboration. However, each addresses both the technical and artistic aspects of geographically distanced, musical exchange.

4.1 Humans and Networked Machines

Networks provide new spaces to work. These collaborative technologies create alternative opportunities for musical creation not just in styles of working but by bringing production to places where recording tools or the channels of distribution are unavailable for economic, social, or political reasons. Campbell, Buck and Cuthbert remark,

> Industrial choices and categories limit how we think of music and how we think about ourselves in relation to music. [Campbell, Buck and Cuthbert, 1991, pp. 258]

Conversely, technology can empower the individual or the musical community to create space for its own continuance.

[5] While I have not seen and tested all of these systems personally, my approach has been informed through studying these various design approaches.

4.1.1 Technology and Musical Society

An exemplary example of the supportive role of technology in creating an alternative venue is the use of radio to broadcast Islamic calls to prayer in Signapore. Beginning in the 1970 s, rapid urbanization and cultural diversification created escalating tensions between ethnic groups. Every mosque recited/sang the traditional call to prayer, adhan or azan, five times a day and amplified it (loudly) from the mosque minaret. This became a bone of contention with neighboring ethnic groups who felt their acoustic spaces were being violated. Quite simply, the radio became a means for electronic mediation. By broadcasting prayers over the radio, these sacred sounds were widely dispersed and yet personalized for the community. The community could retain the sacred sounds that defines its identity while requiring less acoustic space in the greater context of Singapore at large. According to Tong Soon Lee, this offers the Islamic community a means of self-production. [Lee, 1999, pp. 94]

Internet-based collaborative systems disseminate the power of production to more musicians. Wide distribution of the tools for production via ubiquitous channels of distribution and communication (i.e. the Internet) contributes to survival of non-mainstream music by making production less expensive, and stylistically defined, musical community less disparate. This is a cultural preservation tool for the marginal artist. By finding greater audience and community globally, the fringe artist is less threatened locally. Thus technology strengthens both tradition and experimentation.

4.2 Collaboration and Machines

The nature of computer networks poses an interesting temporal dichotomy for those working on music applications. It presents the possibility of exceptionally fast data delivery. Yet no data transfer is actually instantaneous. There is no real-time, only near real-time. Delays caused by network congestion, packet switching, buffering, and routing always make estimating the exact arrival time of data unpredictable. The signal processing liabilities of the applications receiving, transmitting and utilizing this data adds another layer of uncertainty. Furthermore, the potential for losing data tempers some of the speed advantage.

When considering the temporal sensitivity of musical collaborators and the potential for disrupted or distorted musical communications, several challenges arise. How can one create musically meaningful exchanges in a near real-time networked environment? And, how should these systems be design to feel intuitive to the artistic users? There is no direct network counterpart for face to face collaboration or co-performance. Near, real-time may be very close to actual real-time, but it will never be like sitting across a room or a stage from a co-performer. When we talk about real-time systems for music collaboration what we can actually expect is live interaction between participants. Communication maybe almost instantaneous or it may be a little longer, but it sustains the sense of connectivity between participants. Networks offer a tremendous potential for long distance collaboration, and new types of working paradigms.

4.3 Integrated Services Digital Network

Some studios are already networked through Integrated Services Digital Network, or ISDN. It is a digital telephone network that uses existing telephone cables to transmit digital rather than analog data at a vastly higher data transmission rate. ISDN has been around for more than ten years. Bearer channels carry voice and data at 64 Kbps. Data channels carry signaling information at 16 or 64 Kbps. Latency on ISDN lines is approximately half of that found on traditional analog lines. ISDN customers, however, must be with in 3.4 miles (18000 feet) of the telephone company s central office to subscribe for ISDN connection service. Beyond this geographic boundary, customers must use (costly) repeaters to extend the range of the service.

Recording facilities (within 3.4 miles of the telephone company) can fairly easily use ISDN lines to transmit and receive real-time, audio data which can be synchronized with existing recordings (or if one compensates for latency potentially) other live, sound sources. This approach clearly, addresses the issue of obtaining sound sources from great distances and integrating them, relatively seamlessly, into the studio environment. It even retains a fairly high level of sound quality. (To transmit FM quality sound requires speeds of 64-128 kbits/s.) ISDN technology is easily integrated into the studio configuration. The system does not impinge in anyway on instrument selection or sound source, nor does it restrict the selection of performance space with the caveat that collaborators both need ISDN connections. Besides the distance restriction, ISDN service is available by subscription (in the United States), and its availability is potentially prohibitive to studios and musical collaborators by geographic constraints and cost.

4.4 Previous Experiments and Approaches to Internet Collaborations

Some of the earliest experiments for using the Internet as a collaborative medium for geographic divided musicians took advantage of existing digital, music technology and the ubiquitous MIDI (Musical Instrument Digital Interface) standard. MIDI is a widely employed and very compact representation of musical performance. It is easily transmitted across a network. MIDI is a serial protocol with a data transmission speed of 31.25 kbps. (I have also seen speeds of 32.5 kbit/s published) It has 16 multiplexed channels.

Instead of connecting MIDI device to MIDI device directly, as is typically done in a studio, a network can be inserted in between. This removes the geographic limitations of the physical MIDI cable. However, MIDI is only a representation of a musical gesture. While it is restrictive in that it does not fully capture all the nuance of a live musical performance, it is flexible in that can be rendered using multiple (MIDI compatible) sound sources. It is also practical because the sound quality is limited only by the quality of the device used to render the performance. MIDI has been the basis of several Internet collaboration projects that involved the transmission of live music streams between participants. There are notably two different approaches to handling latency: turn taking and synchronized playback of performances.

4.4.1 **Turn Taking**

An example of the turn taking approach is the Piano Master Classes via the Internet project at Peabody Conservatory [Young and Fujinaga]. Young and Fujinaga were concerned about the effects of delays on the musicality of a single performance stream. This system was uni-directional. They attempted to retaining a high level of musical detail (and subtlety) in a master class setting while broadcasting to a geographically, dispersed group of students. Interruption in the musical flow, or pauses that were not controlled by the performer were unacceptable in this environment. They created a transport protocol specific system using UDP (User Datagram Protocol) which does not compensate for lost or out of order packets. As a result, it is speed efficient. (It is connectionless and bears no overhead for communication between sender and receiver.) To compensate for lost data packets, they implemented a redundancy scheme. They also indexed packets to compensate for packets sent out of sequence. Mandatory buffering prevented artificial breaks and pauses. It was intended that a videoconferencing would provide bi-directional communication between teachers and students, but this was not implemented. [Young and Fujinaga].

4.4.2 **Synchronized Playback**

Synchronized playback has been used in scenarios where the emphasis is on the near-real time exchange. Mmidi, developed at the University of Virginia [Hope, 1996], is a system that enables multiple participants to play over the performances of other musicians and resubmit them to the group of collaborators. It synchronizes the playback of other s musical contributions by buffering all the performances. To synchronize playback, it imposes pre-determined criteria felt, by the experimenters, to be musically appropriate. Researchers found other synchronization methods designed for speech (like talk spurts) unmusical.

Furthermore, Mmidi amended the MIDI standard. In MIDI, note duration is controlled by Note On and Note Off messages. Since buffering interferes with this process by adding a delay to the signaling, a note continuation message was added (note on — note continue — note off). Mmidi uses the Internet Mbone, The Mbone is the multicast backbone- a virtual network layer on top of the physical Internet. The Mbone supports routing of IP multicast packets. The Mmidi listens on one multicast address for each participant s contribution. It delays that packet for a pre-determined amount of buffering time and then repeats it to another multicast stream broadcasting it to each collaborator. [Hope, 1996]

Mmidi addresses the latency issue by creating an environment that feels musically comfortable to the user although it does not create a direct, immediate interaction. Participants feel connected to the exchange and it supports the notion of real-time interaction. However, collaborators are not aware of what is happening (musically) elsewhere. They can only react to what happened during the last performance. The interface is restrictive on instrument selection. Instrument choice was restricted by the nature of the MIDI interface, and the need to specify instrument samples.

4.5 Generalized Multimedia Control

There are areas of research not directed towards collaboration that may still yield tools for networked collaboration. The Open Sound Control project at University of California at Berkeley addresses the problem of controlling various multimedia formats and devices using computers. The protocol employs a message-based, operating system neutral, transport independent, URL-style symbolic naming scheme to integrate device controllers, synthesizers, and multimedia devices, etc. Unlike MIDI, it does not enforce channels, notes, orchestras, and velocity. Because it is transport independent, messages can be carried across a diverse assortment of networked devices. Open Sound Control transmits at 10 (or greater) Mbs/sec. Instead of supporting MIDI alone, it is capable of transmitting data with significantly greater bandwidth requirements. While not directly applicable to collaborative applications, Open Sound Control presents an interesting means to control geographically separated music devices and demonstrates the potential for underlying technologies for collaboration and/or long-distance control. [Wright and Freed, 1997]

4.6 Conference Call Paradigm

Rather than using MIDI, some research pursues the adoption of a teleconferencing architecture for broad, real-time distribution of audio. The Robust Audio Tool [Hodson, Varakliotis, and Hardman, 1998] developed at the University College London uses standard teleconferencing systems as a basic model for media rich, real-time interactions. The main objective of RAT is to maximize audio quality despite packet switching, processor switching and variability of client-side audio devices. The project was inspired by the need for multi-way music distribution across a network, but did not focus on bi-directional or interactive applications directly. RAT is flexible. It supports a broad and variable variety of media formats and supports multiple clients.

RAT supports multi-rate processing. It does not restrict audio frame duration and allows variable size audio frames, and it supports multi-channel audio. It employs multicasting via the Internet Mbone to support multiple clients. The key problems they faced were end-to-end transmission time, jitter (in end-to-end transmission), packet loss, out of sequence packets, and packet duplication. To address these issues the system processes and broadcasts audio in the following way. Audio is sampled in discrete blocks. The blocks are determined by which encoding scheme is to be applied to the audio. The signal is then passed through a channel encoder, packetized and transmitted. Three types of channel coding are supported — interleaving (adjacent blocks in the original are transmitted in different packets. So, the effects of losing an single packet is minimized), redundancy (multiple copies in different packets), and no channel coding. Maximizing the quality of the audio stream is an important consideration when thinking about the design of professional audio systems.

4.7 Synchronized Performances

Other research focuses more on interactivity and the synchronization of geographically separated events. The Technical Committee on Networked Audio Systems of the Audio Engineering society ran an experiment in September 1999 that synchronized a live

musical performance in Montreal, Canada and a live dance performance in New York City. The group of researchers was interested in investigating the problems of temporal subtleties in music (and dance) collaboration across networks.

The experiment produced a real-time Internet transmission of multi-channel, DVD-quality audio. The performance in Montreal was encoded using an off the shelf Dolby 5.1 surround sound encoder (sampled at 48 Khz, 16 bit) which yielded a 640 kbps signal. This was accompanied by an MPEG-1 compressed video signal requiring roughly the same data as the audio transmission. The signal was decoded in New York using an off the shelf Dolby decoder. There were four test of the system. The first used a 23 second buffer to compensate for network congestion and delays, but the remaining three tests used only 3 second buffers. The transmission was sent across the Canarie CA-Net (high speed network in Canada) and Internet2 (in the United States). They were able to sustain an uninterrupted audio stream for the duration of the performances. The video stream faltered once, but recovered. The challenges they tried to address were interactivity, latency, time stamping (maintaining continuous flow), quality of service, support multiple formats, multiple channels. [6]

In a similar study, the Distributed Rehearsal Environment [Konstantas, Orlarey, Carbonel, and Gibbs, 1999] was developed in a collaboration between the University of Geneva; Grame, National Center for Music Creation in France; and GMD, German National Research Center for Information Technology. It is an immersive environment based on teleconferencing that joins geographically distanced groups of musicians for shared rehearsals. Visual and audio feed linked dispersed groups to a single conductor in a multi-nodal rehearsal environment.

4.8 Networked Ensembles

Not unlike the Distributed Rehearsal Environment attempt to synchronize ensembles, the notion of creating an ensemble setting takes precedence in certain networked experiments. Orchestra!, [Guili, Pirri, and Bussotti, 1999] developed at the University of Florence, focused on generating an ensemble feeling in a networked environment for amateur musicians. Performers use a microphone to record tracks over a musical template — usually a drum or rhythm track. This creates a means of synchronization that is locked to an internal musical time. The system stressed an uni-direction flow of performances. Successive contributions made by each of the performers are referenced to the single rhythm track and time stamped. High quality streams are stored locally and compressed streams are mixed together with the template, rhythm track. These are then streamed to all participants.

Updated mixes are buffered on the musicians ends and synchronized with each participant s live performance. This creates a sort of intermediary synchronization . Performers play locally on the basis of incoming guide/rhythm streams. Orchestra! is easily distributed software, a Java applet, and makes use of the http-client architecture.

[6] Additional information on the AES initiative can be found in the AES Technology Report TC-NAS 98/1: Networking Audio and Music Using Internet2 and Next-Generation Internet Capabilities

Because tracks are always synchronized against a prerecorded rhythm track, they are insensitive to delays. Unfortunately, the prototype is not available for public testing, nor is subsequent data pertaining to the effectiveness of the environment. While the focus on synchronization based on internal, musical time certainly lends itself to more meaningful music collaboration, Orchestra! did not include any mechanisms for group communication, nor did it give the users any control over the pacing or flow of the performances. The research was focused on generic interactivity instead of the particulars of the studio paradigm. While the use of templates is interesting, the environment is restrictive making it unsuitable in the context of professional collaboration.

4.9 Commercial Applications

Few commercial applications have presented solutions for networked collaboration. Rez Rocket, developed by Rocket Networks, is one of the first commercially available software packages for real-time, music collaboration. It is an impressive application and makes some attempt to address the pressing issues of real-time collaboration. The Rez Rocket system includes a chat application (rocket control), web browser, hard disk recording system and sequencing package. It combines Internet socket control interfaces with existing hard disk recording applications and connects them to Internet Recording Studios , or central servers. Multiple collaborators can log into these servers and thereby gain access to the musical performances (recorded with these recording systems) previously submitted to the central server by other participants. Collaborators load a session from the Internet Studio which serves as a musical template of audio and/or MIDI files. Individuals then record new parts and overdubs, and post these musical offerings to the central server. The new performances are stored and replicated at the server, and transferred to performers as they request updates. Presumably, everyone is participating and recording at the same time. But, each individual is in isolation, and is unaware of the contributions of their collaborators for the duration of the overdub. Co-performers are connected by a chat room. The whole process of joining sessions is somewhat analogous to chat sessions, in general. Performers are responsible for posting (sending) their contributions to the rest of the participants.

This system does incorporate all the power of relatively complex dedicated recording and editing software. Users can do many of the things that can be done in a recording studio like punch-ins (where only a part of a pre-recorded performance is replaced). Musicians can cue easily to any part of a song. Performances can be destroyed quickly and redone, and multiple overdubs can be layered in rapid sequence. Rez Rocket also makes several concessions to the sorts of collaboration generally found in a traditional studio environment. A limited amount of managerial control can be enforces by setting user permission levels. However, participants are never actually performing live to their co-collaborators, and it is very difficult to maintain any production strategy. The system does offer messaging to inform each user the status of data transfers which does in a small way keep them connected if not to each other at least to the central server and their source of music content.

While this goes a long way in tackling various synchronization issues, there are several artifacts of this approach that may appear undesirable in the professional recording context. It is inherently locked to a tempo and timing template that is determined by the

hard disk recording system instead of timing information which is related to the internal structure of the musical performance. Many hard disk recording systems use measures and metronome markings to track and store time stamping information. This makes it quite difficult to record pieces with odd and changing meter or variations in tempo. This would restrict the sorts of genres that could potentially be recorded using this system (especially things like film scoring which is a rather important part of the recording industry). Also, Rez Rocket does not negotiate variations in bandwidth availability. It is linked to very specific, proprietary software packages. Both of these factors could severely restrict the potential pool of talent. (While Rocket Networks hosts several Internet Studios for free public sessions, they charge a fee for server space and time for private use.) Lastly, there is the issue of security that may be of some concern for professional users. If one is producing a recording for a major record label, for example, the thought of streaming your performers recordings to a central server where they are being stored and replicated may not instill a sense of confidence.

4.10 Next Steps

These experiments are informative, but a system that sustains a professional level of collaboration and production has not yet emerged. There is a need for an integrated system that enables users to switch emphasis based on production needs — musical, technical, and communication. Presumptions made by systems designers about production techniques, session pacing, genre, tempo, interpretation, or instrument selection could restrict collaboration and communication.

The system should be widely distributed and have a minimal number of device requirements. It should work with any type of Internet connection (dial up, cable modem, etc.). It should be musical. If a buffers empties, or the system fails in some way during live collaboration, it should do something that does not break the creative flow.

While specialized packages and interfaces appeal to particular consumers, if the goal is to expand musical community on a global level then it behooves us to seek solutions that would be relatively inexpensive to operate and distribute. Microphone quality and placement, the analog to digital conversion on the musician s end, the resolution of the application used to record and store the digital audio, and collaborators ability to discern a professional level of performance will ultimately impact the quality of any recording produced over the Internet. But one system, one basic architecture, may serve both amateur and profession.

5 Recording Studios Without Walls

New technologies for artistic collaboration should extend the established recording paradigm. It should not mirror the established paradigm directly, nor present an incongruous or alien production scenario. New production techniques will emerge logically from what is familiar and known to support creativity and collaboration. New applications should provide an intuitive environment reminiscent of the recording studio. Internet-based music collaboration systems should make use of the elements of computer technology and networking that have become familiar to the average computer user. Through this process of marrying the production paradigm to network technologies, the art of recording will evolve. It will not replace what exists, but it will bring new meaning to our understanding of the collaborative process.

The following is a description of a prototype system whose design is still evolving. These pages present the basic criteria for the system, and illustrate the scenario used to construct the experimental part of this research. These criteria were drawn from prior analysis of the professional recording paradigm.

5.1 Networked Music Collaboration

An ideal, creative environment will never arise in situations where thousands of miles separate collaborators. However, the ability to select collaborators from a vast pool of talent is an artistic luxury worthy of much bother and overhead. This research began with the desire to build a system that would enable one producer and one performer to use the Internet as a medium for recording and collaboration. Although, in practice, the role of the producer can pass from one individual to another during a recording session, a scenario was constructed to constrain the technical and design problems of the first prototype application. For this study, one person embodying the role of the producer would work on one end of a network, and a performer on the other. The roles, with regards to the design criteria of the technology, would remain fixed for the duration of the session. The one producer/one performer scenario was a fundamental platform through which collaboration could be studied, and central engineering issues could be addressed.

The producer-performer relationship is paramount in the collaborative studio environment, and therefore makes an effective backbone for a more elaborate system.

This configuration provided a way to examine the effects of latency and distance on the collaborative process. It was assumed from the onset that the system would eventually be expanded to support all the roles found in the studio environment. If an application could be developed to support this central exchange, the next stage of research may allow collaborators to alternate between interfaces customized to support a specific studio role or task. (i.e. producer s tools, performer s tools, and engineer s tools).

5.2 System Proposal

The system was conceived as a single application or integrated system which allowed collaborators to control all aspects of the exchange through a single, specialized user interface. The use of relatively inexpensive and readily available components was prioritized to facilitate the ultimate accessibility of the technology for the broadest spectrum of artists. To use the system, collaborators would require Internet access, but little demands would be placed on types of portal services or connections. The system had to work on both modem connections or fast, corporate LAN networks. Obviously, system users would require some nominal level of experience with computers, but the system should not require the experience of a trained recording engineer or computer scientist to configure and operate.

The proposed prototype supports the recording of a solo piece or an *overdub* played against a pre-recorded musical template or mix (presumably a mix of audio tracks from a production in progress). An overdub is a single performance, on a single instrument, performed against pre-existing musical material. A lot of recording is done this way even when all the participants are together in the same place for several reasons. Overdubbing accommodates musicians schedules, studio/equipment availability, sound isolation, and the physical and psychological comfort of the performers. While constraining the prototype in this way is not ideal, it is realistic within the context of the recording industry. Taking this one step further, it is fair to presume that a professional producer would not start a major production in collaboration with someone he would never see. Recording overdubs is frequently a major component in the production process.

In this system, the performer would stream an overdub performance to the producer. The two then communicate via a chat room to discuss the aesthetic issues surrounding the recording. The overdub scenario tempers many synchronization issues. The producer creates this musical template prior to the session, and save it as an audio file. This file is transferred to the performer who then plays against it during the session. By sending the template once, it reduces the data sent back and forth between collaborators during the session. Overdubs are generally monophonic tracks while mixes are typically stereo. By keeping the components separate, the producer maintains the ability to mix the two in a way that optimizes his ability to listen critically during the session.

In its most simplistic form the application could work as illustrated in the following diagram:

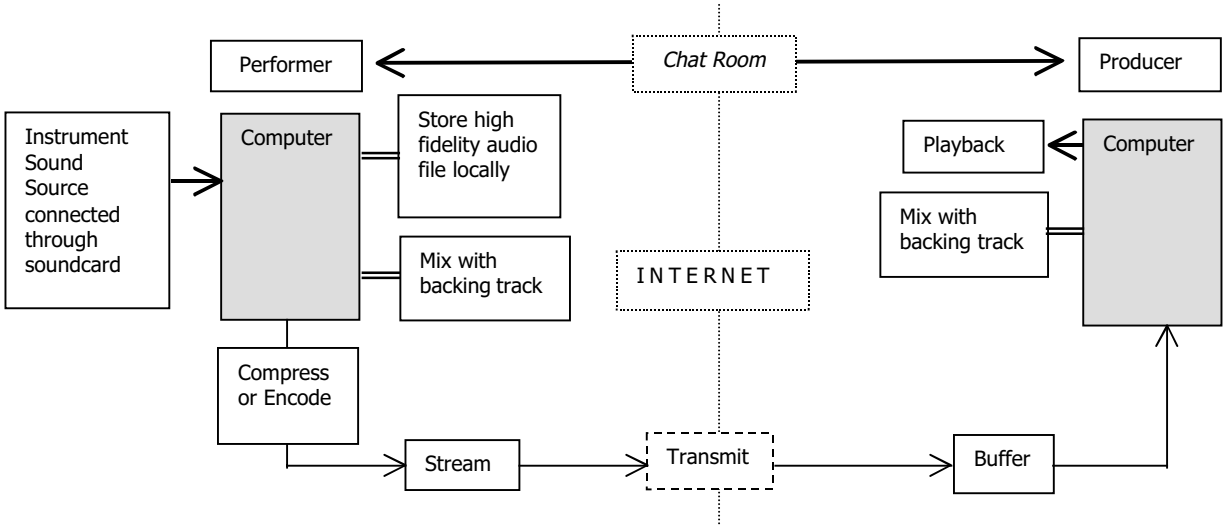

Figure 2

In this scenario, prior to an Internet recording session, a producer prepares the musical template over which the performer will perform or overdub. The Producer stores this mix as an audio file (wav, aiff, etc.) locally. This file is then made available to the performer for download prior to the session (from a web site, FTP site, etc.). He stores it on his hard drive. During the session, the musician connects a microphone or electronic instrument to the sound card of his computer. He monitors on headphones. Using the prototype application, he plays (and hears) the template file while simultaneously he records (at CD quality or better) an overdub. These two audio files are synchronized but not mixed. This overdub file is stored on the performer s hard drive. In real-time as he is recording, the overdub file is compressed and/or encoded and streamed to the producer.

On the producer s end, it is buffered then synchronized with the original, stored template and played back. Individual overdub streams could be stored on the producer s end and reviewed as the session progresses. These files are not CD quality. To optimize bandwidth they have been compressed. However, the high fidelity recording is preserved on the musician s end, and can be transferred after the session when real-time collaboration is no longer essential to the exchange. Throughout the session, collaborators communicate via a chat room to discuss the artistic and technical merits of the performance. The chat room replaces the *talkback* in a traditional studio setup.

One application needs to support communication in both low and high bandwidth conditions. If collaborators experience excessive latency or losing significant amounts of data, the sound quality of streams can be compromised in exchange for reduced latency. Where there is significant latency, a heavier signal processing burden may be carried by the computer on either end to compress or encode the performance in order to reduce the necessary bandwidth for transmission.

Instead of compressing the audio file, salient musical data can be extracted from the performance - the pitch, amplitude, envelope, and event timing information referenced to the template track. This alternative representation of the performance is then packetized and transmitted to the producer. The performer still hears himself playing his instrument against the mix. On the producer s end this data would be used to synthesize the performance which is then synchronized with the backing tracks and played back for the producer. The performance may be converted to MIDI data. The producer can utilize locally available synthesis models to render the performance. MIDI is not the only, potential representation. A synthesis language or program like CSound (Vercoe, 1986) score files, for example, would give the producer the power to create his own instruments. This type of system renders an interesting artifact. Even after the producer obtains the actually audio performance, he retains the information used to synthesize the performance. A MIDI or CSound transcription of the performance could be used for additional signal processing or orchestration in later stages of the production.

The following diagram illustrates this second type of transmission scenario.

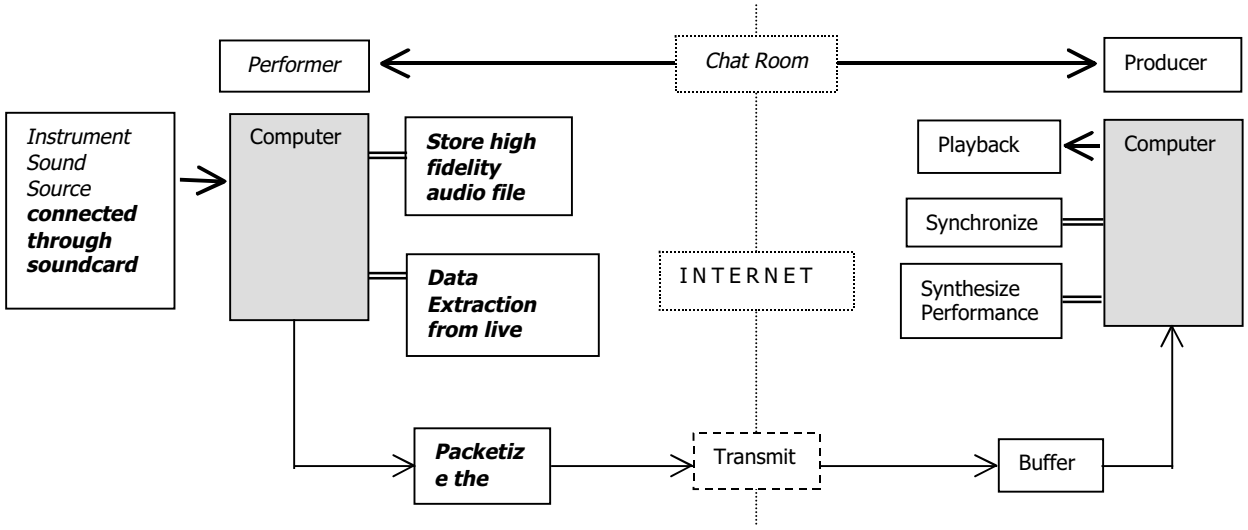

Figure 3

All the while, the CD quality performance is retained and stored on the performer s hard drive during the session.

The preceding paragraphs present the bare-bones architecture. They barely scratch the surface regarding how to support all the dense, context rich communication that happens between collaborators in the studio environment. It is not enough to create a system that moves audio back and forth between producer and musician quickly. All those other elements that pass through the glass between control room and tracking room must also make their way through the network. At the start of this investigation, many assumptions were made about what aspects of the production process had to be retained in a networked system. These requirements are enumerated in the following pages.

5.3 Constraints of an Ideal System

5.3.1 Musical Requirements

Musicality is of central importance to the development of any usable system. A mixing console, for example, can be used with musical intuition. Mutes and channels switching require rhythmic precision. Volume changes and fades are coaxed from the faders in the same way that dynamics are pulled from an orchestra by its conductor. If the system does not employ a form of logic that is harmonious with the music making process, it will be an ineffectual tool.

All collaborators must be engaged in real-time interaction during the session. In the recording studio, all collaborators perform for each other. The performer, producer, engineer are co-performers. In a networked collaborative environment no one should be performing in isolation. While the notion of individuals in isolation contributing to an existing piece sequentially may have artistic interest and validity, it is not how professional recordings are produced. Thus it is of central importance that each participant feels connected. No one should ever stream his music or artistic contributions out into a fiber optic void. The collaborators must always be listening.

There must be no genre constraint. The system can not be more suited to one musical genre over another. Likewise, it should not restrict compositional or performance technique. So, it can not be locked to a time signature, click track or metronome that marks internal musical time. It can not require constant tempo, or duration of performances.

There must be no instrumental constraints. There should be no restrictions on the types of instruments that can be used with the system. Ethiopian krar must be as equally employable as a MIDI keyboard. Any sound that can be recorded in a studio should work on the networked counterpart.

The recording format must be flexible. Multi-track formats for music recording, tape or hard drive, are extremely flexible as a recording medium. The system should allow users to employ the recording media it in all the same ways — overdubs, punch-ins, bouncing tracks, etc. It should be easy to replace sections of a recording, or combine takes.

The role of the producer must be preserved in the networked system. This implies a producer in the archetypal sense must be present in the sessions and his tasks directly supported by the architecture of the system. Music production is a highly specialized form of collaborative exchange. The environment must be conducive to artists producing artists not just the exchange of musical ideas. It is not enough to bring people together in the same (virtual) space. The environment must support the same sorts of specialization, isolation, and perspective available in a physical studio.

Musicians working with the system should feel as though they are in a familiar working environment. In a studio, an instrumentalist recording an overdub would generally monitor pre-recorded materials on headphones and hear his live performance mixed in. Depending on his instrument, he would perform into a microphone or provide a line level signal from an amplifier, signal processor, or sound module that he configured.
The system must support specialization. The physical architecture of the studio is designed in such a way that individuals perform highly specialized functions in different rooms. The tracking room is designed for the instrumental (or vocal) specialist. While there is a high expectation placed on the technique of musical performance in this room, there are low demands on the performer s control over the surrounding technologies. So, a networked system should place a low level of technical responsibility in the hands of the musician.

There are numerous production styles and artistic personalities. The ideal system would not presume anything about which production techniques will be used to accomplish a

specific task or how the collaborators choose to communicate. In other words, while the system may only provide limited modes or formats for communication it should not constrain how those channels are employed. It should not enforce turn taking or impose and sense of pacing on the session.

5.3.2 Communication Requirements

Ubiquity is a valuable characteristic of networks. Our goal is to create a system for geographically unrestricted music collaboration. This is to say it should be built upon the most broadly distributed means of communication a that can support the distribution of musical content in real-time. It should be global and facilitate communication across geographic boundary, political, social, and economic divide.

There must always be an open channel of communication during the session, including during a recording. In the studio, there are mechanisms for communicating even if collaborators can not hear one another momentarily. The window in a studio makes visual communication possible and leaves open a channel for cueing musicians or catching their attention. Visual communication is also a channel for artistic and aesthetic feedback. It is instantaneous and available even while a musician is performing. Eye contact enables the producer to assess how the musician is feeling and understand the environment in which they are performing. This can be of crucial importance in the production process. The network might force the producer to ask directly rather than surveying the situation for himself. In any case, there must be a means for the producer to understand the physical characteristics of the performing environment, and be in constant contact with his collaborator.

There needs to be a mechanism for conveying ideas musically. While a verbal or written discourse about a musical performance can go a long way in fostering collaboration. Face to face collaboration provides other concise, and invaluable, mechanisms for artistic dialog. A networked system could offer some sort of musical messaging system, perhaps MIDI based, which would enable even collaborators who are not performing to communicate in purely musical terms. Similarly, a whiteboard system would enable musicians to utilize notation in the collaboration.

It may appear at first glance that Internet telephony or video conferencing would be necessary constituents of this system, but this assumption may be premature. Firstly, the overhead in bandwidth, alone, may make it a prohibitively expensive addition. Additionally, it would probably necessitate compensating in some way for latency in the visual signal as well as the audio signal. For example, if the video and audio lost synchronization, collaborators might see someone tapping a foot or nodding a head out of sync with what they are hearing. Where multiple participants are performing this may prove to be a greater liability than asset.

5.3.3 Technical Requirements

There are no set rule for how the criteria set before us are met, but there are a few technical constraints that need to addressed when choosing the technologies that could support this sort of application. They are as follows:

The final product must meet professional standards, and thus yield CD quality (or better) audio. This is a minimum requirement. At this stage of development, the role of the engineer has been divided between the producer and the performer. Eventually, the need for a means to incorporate the engineer must be addressed. The ultimate quality of the recording will depend not only on the quality of the conversion on the musician s end, but the collaborators ability to control microphone placement, signal to noise rations, etc.

Unlike the studio, collaborators will presumably be in isolation on their respective ends. Collaborator must operate the interface themselves which diverts some of their attention away from their respective tasks. The configuration of the system must allow the performer to focus on performing and the producer to focus on producing while the session is in progress.

Point-to-point communication is preferable. Ideally, the system should be independent of any third party server. Each collaborator should be able to produce, encode and serve their own content to all other participants. Music streams should be transmitted from producer to musician. It is preferable that there be no intermediary storage facility or server replicating and broadcasting streams to collaborators. This sentiment stems from the notion that recording space should not be restricted. Tethering musicians to centralized servers is counterintuitive to this notion. Also, the thought that the role of the physical studio space could be reduced to data storage space is disappointing. It is preferable to define the space in terms of the collaboration between musicians.

The system should be robust and musical regardless of available bandwidth. Modems, cable modes, T1 connections, etc. should be able to use the same application effectively. If the system does fail it should do so gracefully and in the context of the music and artistic exchange. It would be less destructive to the critical listener to hear drop outs in the performance (streamed from performer to producer) than to stop the backing track all together, buffer and re-synchronize.

5.4 Presumptions about the System Architecture

In designing the basic architecture, consideration should be given to how the system will eventually expand. The underlying architecture should not box in the system. It should serve as a skeleton for the more elaborate system that can follow. It should be expandable to make use of new types of instrument/multimedia control like Open Sound Control, MIDI, etc.

The system should ultimately support multiple musicians, if not actually playing together, they should all have the sense that they are connected to the same session and are aware of all the musical changes. All must be constant participants in the artistic dialog. Also, The system so far primarily utilizes the computer as a storage mechanism, a messaging system, and at its most complex as, a signal processor. It makes no attempt to integrate the computer as a musical participant. This will prove to be a fundamental oversight. Eventually, the use of computers to listen to performances and inform collaborators could play and invaluable role in closing the gap between participants.

5.5 Current Progress

We can already stream audio back and forth across a network quickly, but this in itself does not make networked systems suitable for production. A system without the characteristics described above may support collaboration, but it will not support professional exchange. Unfortunately, this prototype application has yet to be built. The complexity of getting the various signal processing and synthesis components to run in real-time, while packetizing and streaming or buffering data, was too great a task to complete in the short time available at this stage of the research. However, there was an unforeseen benefit in failing to develop a prototype at this time. By using multiple computers and dedicated signal processing hardware, the Internet Recording Session scenario could be simulated and the collaborations between producer and performer could be closely scrutinized without having to factor in the impact of user interface. This experimentation revealed much about musical collaboration across networks and will help develop a far more effective prototype application in the (near) future.

6 Networked Recording Experiment

To further understanding of networked collaboration and the nature of the communication that flows between geographically separated musicians, an experiment was conducted to observe the impact of networks on the collaborative process.

6.1 Goals of the Experiment

The physical barrier to artistic communication in a traditional recording studio is the glass and walls that divide the control room from the tracking room. To preserve the social dynamic and professional roles that are integral to the architecture of that physical space, the weak link in the chain of communication on a network must be consistent with the studio model. In the ideal networked scenario, it would feel to collaborators as though the glass between control room and tracking room had been replaced with a network and supportive communication technologies. Identifying what the additional supporting technologies need to do this is no trivial task. To understand exactly what features are essential in an Internet Recording application, this experiment was designed to facilitate observations of recording that used a network-based communication system. The primary goal was to examine the effect of the network on the collaborative process and determine which the techniques and technologies familiar to the established recording/production paradigm are applicable to networked collaboration.

The experimental environment did not provide additional, supporting technologies. It provided a minimal interface that enables a performer to stream recordings to a producer. A chat-room provided the forum for discussion. We can examine the following aspects of geographically unrestricted music collaboration: where the process breaks down due to communication obstacles, where it robust despite the network obstacle, what sorts of production techniques emerge to compensate for physical separation, where do established modes of communication provide sufficient support, and where does technology need to create solutions to sustain collaboration.

6.2 Experimental Procedure

Transferring the professional production process to a networked environment is a multi-staged procedure. First, the production process and the role technology plays in supporting that process must be analyzed. Second, networked technologies need to be developed that support familiar modes of collaboration. Lastly, the production process itself will expand to incorporate new techniques that optimize the benefits and limitations of the networked environment. This experiment is part of the first stage. The analysis of production in chapter three does not yield any information regarding the impact of the network on the collaborative process. We can not build the supportive technologies that will bridge the geographic gap between producer and performer unless we can articulate the nature of the obstructions created by the networked environment.

The experiment was framed around the following scenario. During an on-line recording session, one producer collaborated with one performer to record a single overdub to an existing musical template, or they recorded a short solo piece. The experiment was restricted to collaboration between just two people for several reasons. Primarily, it emphasized the producer/performer relationship and revealed the effects of the network on each collaborator s role. The one producer/one performer configuration removed the complication of factoring in the production techniques for multitasking. Also, for the purpose of gathering preliminary data that would support an informed prototype design, it was not necessary to solve all synchronization problems simultaneously. In this way, the effects of the delay and geographic separation for a single performer scenario could be understood first. The system could be scaled later to support multiple participants while not loosing the integral characteristics of this important relationship.

Eight separate sessions were scheduled over a one month period. They covered various musical styles and genres from Classical to Avant-Garde Jazz. They employed instruments from digital keyboards to cellos. All collaborators used some sort of musical template that provided an intermediary type of synchronization. These templates varied from scores or sheet music to musical forms and temporal frameworks determined at the beginning of a session to pre-recorded accompaniments such as rhythm sections. All participants had substantial musical experience and some prior studio experience. Experience varied from semi-professional musician to studio musician, and from those that had collaborated with band mates to produce a recording to professional recording engineers/producers. Producers were varied in their favored production techniques, experience in genres, etc.

This experiment did not attempt to test an application, or interface design. Unfamiliar interfaces were intentionally removed from the experiment set up. Participants used familiar studio equipment during the on-line recording session: DAT (digital audio tape) recorders and a small mixing console. Performers monitored on headphones, producers on headphones or monitors as they preferred. The collaborators communicated via ICQ (ICQ Inc.) in a chat-room environment.

The sessions were kept to one hour in duration, and the (fabricated) objective was to record a single overdub or solo piece, composed or improvised, approximately five minutes (or less) in duration. These restrictions minimized the collaborative task. While

requiring focused production strategies. It was not intricate nor did it require pre-production. This also restricted the amount of data collected - enough to give insight into how to build a prototype.

The experiment did not offer collaborators many of the technical options available in a standard recording studio. While both the performer and producer had the ability to listen back to takes, they could not punch-in to an existing take (record over a section of a previous take) or splice between takes. Some producers took the approach of recording sections with the assumption that they could be edited together in post-production. This is done frequently in classical recording. Some pressed for multiple, complete takes and then selected the strongest one over all.

The hardware and software requirements could be divided into three distinct parts: the performer and audio stream producer, the server, and the producer. Participants were isolated in separate rooms (across the fourth floor of the Media Lab) during the networked recording sessions. A Real Audio Server was used to stream the performer s performances to the producer. The performer s set up consisted of a computer for ICQ chat, a mixing console (Mackie 1202), CD player (Denon DN-600F), DAT recorder (Tascam DA-P1) and microphone (Shure SM-57) for acoustic instruments or a line level input for electronic instruments. The CD player was used for the pre-recorded backing tracks in those sessions that used them. The performer could adjust the balance between the backing tracks and his own instrument as he liked. Everything he heard through this console was recorded to a DAT so that it could be reviewed as he liked or at the suggestion of the producer.

Hidden from the performer s sight was a set of signal processors and mixing consoles that enabled the stream to be effected or delayed before it was encoded and streamed to the server. The processing available included a pitch to MIDI converter (Yamaha G50) which converted the instrument being overdubbed into a MIDI signal. After conversion, this signal was sent through a sound module (Proteus FX) and resynchronized with the backing tracks (where used). There was also a thirty second delay (C code run on a Windows NT machine) which buffered the performance before sending it to the server. The dry signals of the backing tracks and the overdub and all the processed signals were connected to a mixing console (Mackie 1202) where the levels could be optimized for the encoding process. Processed signals could be easily substituted for the dry signals. The musician never heard the processing. They always heard themselves playing their instrument (against the musical template) and nothing else.

The computer running the performer s ICQ was also used to produce a live audio stream that was streamed to the Real Audio Server. The Real Audio stream was created and transmitted to the server using Real Audio Producer software. The stream was compressed and encoded with a bit rate of 20 kbps. The Real Audio Producer tries to optimize encoding for multi-rate streams for 28 kbps modem connections or better with a compromised frequency response of 5.0 kHz. This stream is transmitted to a Real Server G2. Also, out of the performer s sight was a digital multi-track machine (Tascam DA-88) that archived a copy of both what the musician heard and the stream made available to the producer on four adjacent tracks.

The server and the signal processing equipment used to prepare the audio for Real Producer was in the room next to the musician. The server simply received, archived, and multicast the stream to the producer. The server machine also ran the ICQ for the experimenter. The experimenter did not directly partake in the collaboration, but was available by ICQ to handle technical problems for either musician or producer. Collaborators were given a warning when the obstacle was about to change. (i.e. the change from a dry stream to one that was delayed an additional thirty seconds). Both collaborators were alerted to what changes were about to take place and when to give them an opportunity to strategize about collaborative or production techniques. Collaborators were also given a five minute warning before the session time expired. The producer was in another part of the building. The producer s setup was quite simple. The producer s computer ran the ICQ chat and also played the Real Audio stream using the Real Audio G2 player. The computer s audio output was connected to a mixing console (Yamaha 01) and routed to a DAT machine (Panansonic). The producer could adjust the levels of the live stream at his convenience and he could monitor on headphones or studio monitors. He was not able to adjust the balance between the overdub and backing tracks, but he could ask the experimenter to adjust the mix via ICQ. The live stream was archived to the DAT and was available for review at any time.

Figure 4 illustrates the components and signal routing of the system.

6.3 **Parameters**

The distance between collaborators was fixed for all sessions, but unlike in the studio there was no opportunity at all for visual contact. The producer always heard degraded audio quality. The degree to which the quality was reduced varied, but during the duration of the session the producer never heard exactly what the performer heard. (In a studio, the producer frequently has better sound quality than the performer, both in the details and subtleties of the instrument and, sonically and musically in relationship to previously recorded material). The most drastic alteration in sound quality was the conversion of an acoustic instrument to MIDI data. Where the performer was using a MIDI compatible instrument, a similar but different sound patch could be substituted in the producer s stream.

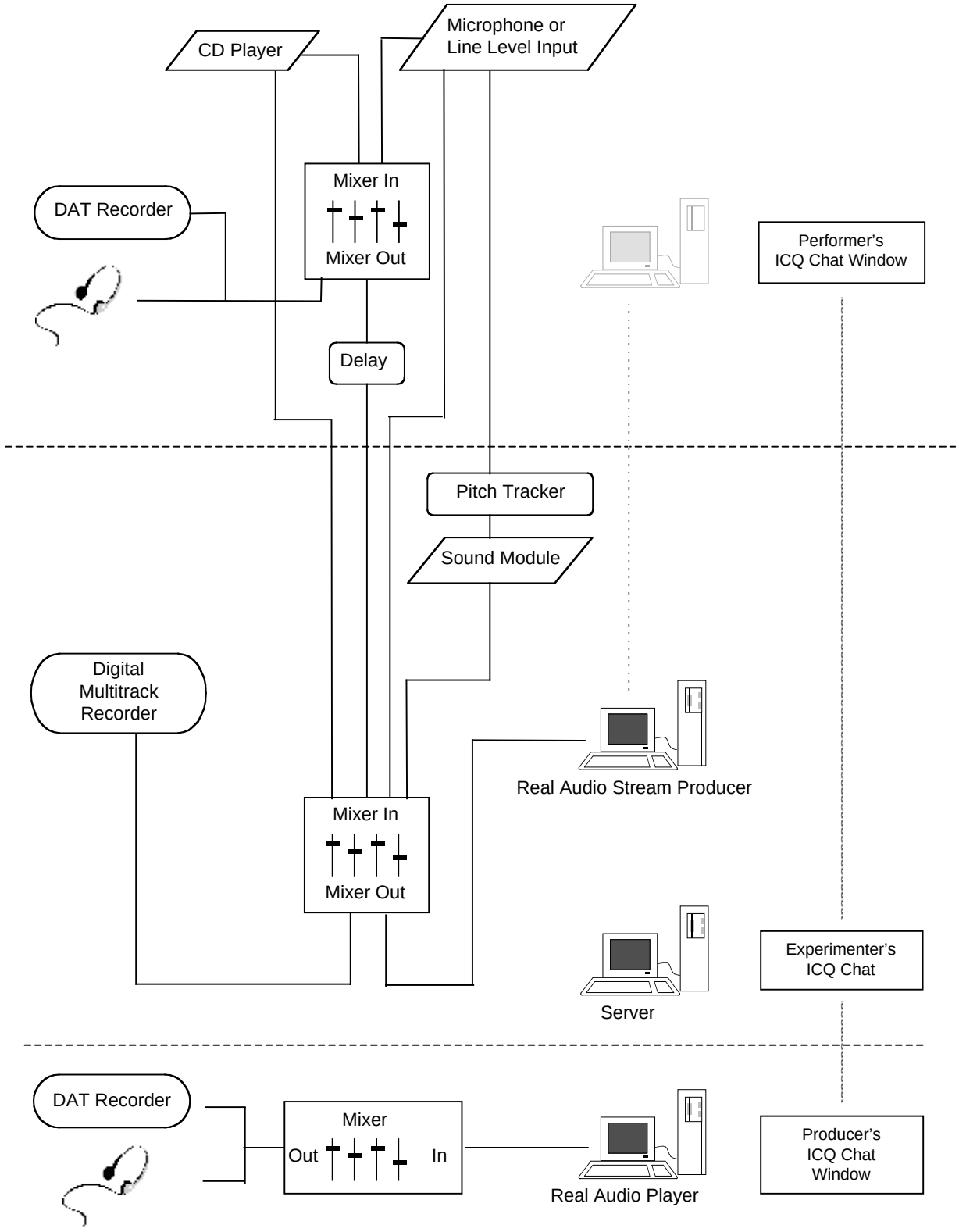
CD Player
Microphone or
Line Level Input
Mixer In
Mixer Out
DAT Recorder
Performer's
ICQ Chat Window
Delay
Pitch Tracker
Sound Module
Digital
Multitrack
Recorder
Real Audio Stream Producer
Mixer In
Mixer Out
Experimenter's
ICQ Chat
Server
DAT Recorder
Mixer
Out
In
Producer's
ICQ Chat
Window
Real Audio Player

Figure 4

There was always a delay between the time the performer recorded a take and the producer actually heard it. The minimum delay was the time it took for the performance to be streamed to the server and from the server to the producer on the Media Lab s internal network. This time varied over the month (and over the course of each session) from about five-nine seconds to as long as thirty seconds. Additional delays of up to thirty seconds could be added to this time to increase the communication obstacles. There was no verbal communication during the session only synchronous, written communication via ICQ.

6.4 Collecting Data

Data was collected in two ways. First, the sessions were observed. The three-way ICQ chat exchange was monitored without requiring participation by the experimenter. Transcripts of the chat-room exchange were stored for analysis after the session. Furthermore, the archived sound recordings of what both collaborators heard during the session could be examined off-line.

All test subjects were asked to complete an entrance and exit interview in the form of a questionnaire. The questions preceding the experiment were used to establish a base-line perspective of the participants recording experience and familiarity with computer-based music technology. Questions after the sessions were aimed at collecting subject s experiences regarding their perceived ability to collaborate across a network.

Observation and analysis of the questionnaire were used to identify the following points: which types of technologies and features are necessary to support an on-line recording session, what about the production paradigm is challenged by the network collaboration scenario, and what aspects are truly robust and not disturbed by the loss of face to face communication. Finally it was presumed the experiment would lead to some insight about which established or unconventional production techniques are applicable to the on-line environment.

6.4.1 Internet Recording Experiment Questionnaire

The session questionnaires are illustrated in Figures 5 and 6. Some of the questions are intentionally ambiguous to encourage subjects to reveal their perceptions of the experience without disclosing which aspects of the production process were of most interest to the experimenter. Each subject was expected to bring his own values, awareness, and understanding of the production process to the experience. Every attempt was made to not lead or affect their value system or encourage or dissuade them about the viability of networked technology. The test subjects represented a diverse set of backgrounds, styles, and biases, but all with prior studio experience.

Performer s Questionnaire

Pre-Session:

1. Rate your experience working in a standard studio or professional recording environment
2. Do you typically collaborate with others on musical projects (i.e. recording, performing, etc)?
3. Have you worked with your collaborator (musically) in the past?
4. Have you collaborated on musical projects using the Internet in the past?
5. Do you generally use computers for music production?

Post-Session:

6. Do you feel the collaboration was successful? Were you happy with the final performance(s)?
7. Did you feel that your collaborator was attentive to the performance?
8. Were you comfortable performing against the guide track?
9. Did you understand the producer s feedback?
10. Musically and aesthetically assess the outcome of this recording session and your performances. Did you find the feedback of another musician useful in completing this task, or do you feel the results would have been better if not producer had been involved?
11. Please describe, in your own words, how you felt about the task you just performed. Compare it to a standard recording studio environment. What was difficult about collaborating via a network? How did the time delays and distance between you and your producer effect the collaboration? Please include any other observations not covered in the questions above.

Figure 5

Producer s Questionnaire

Pre-Session:

1. Rate your experience working in a standard studio or professional recording environment
2. Do you typically collaborate with others on musical projects (i.e. recording, performing, etc)?
3. Have you worked with your collaborator (musically) in the past?
4. Have you collaborated on musical projects using the Internet in the Past?
5. Do you generally use computers for music production?

Post-Session:

6. Do you feel the collaboration was successful? Were you happy with the final performance?
7. Did you feel that your collaborator was attentive to your suggestions?
8. Was it difficult to make your ideas and opinions understood?
9. Did your collaborator incorporate your feedback?
10. Did you feel that you had control over the pacing of the session? Were you confident in your ability to shift the musician s attention from one musical section or stylistic approach when you deemed appropriate?
11. There were several temporal and sonic obstacles built into this experiment: long time delays between the start of the musician s performance and the time you started hearing the overdub; the audio streams were compressed and/or encoded which degraded sound quality; and the musical performance was converted into a MIDI signal which was then used to generate a synthetic, musical performance. Describe your experiences auditioning the performances under each of these conditions, and if applicable, describe how your decision making process and communication with the musician shifted to accommodate these challenges. In other words, in a traditional recording setting one might hear a take and say to a musician, that was good, but I think you can be more expressive. How did you adapt your production style to communicate in a networked environment and to the sonic restrictions?
12. Was the mix of the final performance and the guide track audio file as you expected? If not, how was it different? Please be as specific as possible.
13. Please describe, in your own words, how you felt about the task you just performed. Compare it to a recording studio environment. What was difficult? How did the time delays and distance between you and your musician effect the collaboration? Please include any observations not covered in the questions above.

Figure 6

6.5 Characteristics of the Data

Results were culled solely from analysis of the written discourse, the questionnaire and through observation. The questionnaire answers provided the most crucial information including: the participants perceived ability to perform their task, their impression of the communication between collaborators, and whether they felt an effective artistic dialog could be conducted across the network. Perceived success of the collaboration and comfort of participants during the session was also determined through the questionnaire.

It is important to note that there was no system interface, per se, for the participants to evaluate. Whether they *like* working this way or not was not of particular interest, but exploring the possibilities for using the network for professional collaboration was critical. It was expected that certain elements of the standard studio would be immediately missed, and that participants would point out their immediate needs for technologies that are essential to their production process.

6.6 Unexpected Benefits

There were unforeseen benefits to running this experiment in this configuration. It was expected that the experiment would reveal something about the collaborative process in the context of the recording studio. It was not expected to reveal how robust the production paradigm is in the face of severe obstacles. Furthermore, it was assumed that these fabricated obstacles (at their worst) would break down the communication between collaborators to the point where participants could no longer sustain any sort of meaningful musical dialog. This, however, never happened. Regardless of intentional or unforeseen technical obstacles, no session broke down completely.

Furthermore, removing the producer and performer from their familiar settings provided a better insight into the roles individuals play, how they interact in the production environment and the cognitive process behind these tasks. For example, it became obvious during these sessions that there is a point when the producer ceases to be a source for constructive suggestions, and becomes more like a cheering squad. This line is very clear on the network, while it remains fuzzy in a standard recording environment. The system placed more responsibility on the performer for starting and stopping takes and sustaining the dialog with the producer than would occur normally in a standard studio. It also forced the producer to find new ways of obtaining information generally collected through visual observation. This experiment reinforced thoughts about some aspects of the traditional roles, but it also opened the way for an expanded notion of these roles and their function in the production process.

Lastly, one of the most surprising results was the fact that most of the participants enjoyed the experiment and embraced working this way — even some who were extremely skeptical entering the experiment. Most sessions had to be closed forcibly by shutting down the server. Part of this can undoubtedly be attributed to musical perfectionism, but several test subjects tried to sign up for additional experiments as soon as the session ended. The experience seemed to make both subjects and experimenter think about collaboration in a way that they had not previously.

6.7 Complications

There were several technical complications that hindered the effectiveness of the experiment. First, the limitations of pitch tracker were grossly underestimated. The tracker was only accurate on very slow, single note melodic lines, and when it failed it did not do anything musically graceful. Because it would have been musically misleading to the producer, it was not used in most of the sessions. There were a few sessions with keyboard players who used instruments that had MIDI outputs. This MIDI signal was sent directly to a sound module and triggered a similar sound which was mixed with the backing material and streamed to the producer. This provided valuable results, but they represent the minority of the session.

It was difficult to calibrate the system effectively partly because it was on a network and it was physically difficult to check signal levels in all places simultaneously. Also the head room was not know at each input, and difficult to establish.

There were also grounding problems because of the rather complicated array of audio equipment used to route the signal and the multiple computers with internal sound cards. This added an unintentional 60 Hz hum to most of the sessions. While annoying, most producers reported that it was relatively easy to just ignore it. Also, because inexpensive, internal sound cards were used extraneous high-pitched buzzes were introduced by proximity to the cpu. This was more noticeable on some sessions than in others. Only one producer commented on it, and he said he did not find it disruptive to the session.

Once the system was configured, it yielded a lot of insight into the collaborative process, as well as, insight into the experimental procedure. It required minimal adjustments during the session to change the networked obstacles dividing collaborators leaving the experimenter free to make observations.

7 The Sessions

It is difficult to characterize the data collected from observing collaboration during networked production. It is qualitative. Empirical measurements of audio signals and bit rates or assessments of musical performance based on some generally accepted criteria do not reveal how the technology supported or hindered collaborative tasks. Only the perceptions of the participants can reveal if the producer felt the session was under his control, that he had an impact on the performer s performances and that he succeed in obtaining performances appropriate for the production. Extracting these perceptions was the mission of the experiment. Consistencies between sessions point towards areas where technology can facilitate collaboration. These observations will certainly lead to a more informed prototype design, but perhaps of equal importance is the fact that this experiment showed where more research is needed.

7.1 Descriptions of Individual Recording Sessions

Since there were only eight recording sessions and each quite different, included below is a brief analysis of each interaction. Each report begins with a description of the instrumentation and the style of music recorded. This is followed by an assessment of the performer s performance and studio experience, and a summary of their perceptions revealed in the post-session questionnaire. Next is an assessment of the producer s experience followed by their perceptions of the session culled from the post-session questionnaire. Last follows observations made by the experimenter during the session and in a post-session analysis of the ICQ transcripts [7]. Quotes are taken from either session questionnaires or ICQ transcripts. Complete copies of transcripts of the ICQ

[7] ICQ archives sessions as a series of screen shots. The dialogs make more sense (and more accurately represent the exchange) if they are considered three lines at a time. Participants frequently type over one another. ICQ prioritizes the session host (the experimenter) in the chronology. Quotes of the ICQ chat are lifted directly from these transcripts.

communications are included in the appendices. All subjects names have been removed to preserve their anonymity.

7.1.1 Session One

7.1.1.1 Instrumentation and Genre

The first session was a recording of a solo cello piece composed by Bach. The performer recorded acoustic cello without the aid of metronome or click track.

7.1.1.2 Performer One

The cellist is a professional musician with some studio recording experience. He generally performs in ensembles. Although he is technically adept with computer/digital technology, he does not typically use computers for his own music productions. He has never used the Internet for any type of musical collaboration. He has collaborated on musical projects with this producer in the past.

Performer One found it difficult to type ICQ messages to the producer. It made him uncomfortable because he found he constantly readjusting his instrument. Generally, he found it unnatural to play his instrument and type to communicate. He says, it is difficult to put down the instrument for typing...the interaction through the keyboard is difficult Although he felt that the producer was attentive and observant to the musical content and each of his performances, the delay gave rise to a sense of disconnected-ness. He stresses, The distance doesn t matter, but the time delay does. Despite this discomfort, Performer One reports that he understood the producer s feedback clearly.

7.1.1.3 Producer One

Producer One is a professional musician with some studio experience. His production experience includes producing personal material and projects for co-performers. Although his experience self-producing is significant, he does not work as a professional producer. He has used the Internet to collaborate on musical projects in the past, and frequently uses computers for music production.

Producer One considered the collaboration successful. He had a strong sense of being able to impact the performer and his subsequent performances. He found it reasonably easy to make himself understood through written communication via the ICQ, and felt most of his feedback was incorporated into the recordings. His greatest frustration with the system was the absence of a purely musical means of communication. He says, Some musical comments are difficult to convey via text only. He wanted to sing examples to the performer, or at least be able to play melodic ideas on a keyboard or piano. The delay made it hard for him to zero in on specific sections of music. Sonic interference (hum) did not significantly impact his ability to produce. He could adequately find intonation problems through degraded audio signal, encoded signals, etc. When he heard the high fidelity recordings of the performances, they were as he expected. He found the coded audio (streamed audio) had been true to the high fidelity performances.

Although, Producer One found the experience to be a unique challenge, it was one that could be adapted to easily. For him, the most obvious obstacle was the ICQ, but he felt

confident by the end of the session that his ideas could be conveyed effectively. This working arrangement forced the producer to compromise more and trust the performer. The feedback he provided (to the performer) was necessarily less specific than it may have been in a standard studio. He says, I couldn t give picky comments I made comments over general phrasing and measure-length, but seldom on individual notes.

The network environment felt different than the recording studio. He found it hard to manage the session. His ability to gauge performer s feelings was inadequate. The ICQ did not provide the option to send one complete sentence at a time to the performer instead of the real-time, synchronous configuration. He thought complete sentences could convey a complete thought more clearly. After the session, he commented that he should have used the sound alerts in ICQ (beeps, etc) to get the performer s attention, but said he didn t think of it until afterwards.

7.1.1.4 Experimenter s Observations

Observations support these perceptions. The performer was clearly uncomfortable with the physical separation and the need to communicate by text. At the beginning of the session, he immediately tried to talk to the producer through the microphone (despite previous instructions to use ICQ). The performer expressed a sense of isolation, and was confused about when to start and stop. He repeatedly made sure the producer was ready before he started to perform.

<performer> Hello producer, calling producer

7.1.2 Session Two

7.1.2.1 Instrumentation and Genre

Session Two was a Rhodes piano recording. The performer recorded a Modern Jazz piece over a pre-recorded rhythm section (bass and drums).

7.1.2.2 Performer Two

Performer Two is an experienced amateur/semi-professional musician. He typically composes or records alone, although he has worked with his collaborator in the past. He has not used the Internet for musical collaboration, but he frequently uses computers for recording, editing, composing, etc.

Performer Two thought the session was moderately successful. While he felt the producer was attentive to his performances and understood the feedback he received, he was frustrated by the experience because he couldn t express his emotions to the producer adequately via ICQ. Performer Two reports, It s hard to express frustration. It was helpful to know the producer personally Also, the producer not having visual feedback made me uncomfortable when I was stopping playing. He couldn t know if I was resting or if I was getting bored of my own music. He found the need to type added an aggravating latency, and thought a spoken dialog would be more efficient. He was lonely and wanted visual contact and assurance from the producer.

7.1.2.3 **Producer Two**

Producer Two is a professional musician with a lot of studio experience. He is accustomed to working in ensemble settings. Although he has not previously used the Internet for producing musical projects, he uses computers regularly for music production. He felt the collaboration was reasonably successful. The performer was attentive to his suggestions, and incorporated most of them into the recordings. He felt, In terms of the overall pacing of the session, I felt like it actually went very close to the way it would have gone in a real recording studio. He found it easy to make his ideas understood through the ICQ.

The most noticeable difference between the traditional studio and the networked environment for this producer was time spent between takes. On the network it was longer than in a standard setting. Producer Two says, The main difference was not knowing if the performer was responding to my suggestions until the next take. Despite this the degraded quality of the audio stream did not impede the evaluation process. When working with a long (30 second) delay, the producer listened to the entire take before making comments or an assessment that left the performer waiting for long periods. Producer Two felt unable to gauge the performer s mood adequately without visual contact. He was also frustrated by the lack of the ability to stop a take while it was being recorded and use an exact reference point (time) to a locate a mistake or bad idea.

7.1.2.4 **Experimenter s Observations**

In contrast with the previous session, the keyboard player typed and played in quick succession. He would type comments during rests. He placed the computer keyboard on top of the Rhodes piano and consistently went back and forth between instrument keyboard and computer keyboard. When there was a minimal network delay between collaborators, the performer watched the computer screen for cues while playing.

Observations showed that the producer did not establish control over the written talkback. Both collaborators typed at the same time. There was no turn taking or natural pauses as in conversation. They both used a lot of email conventions like :-) to convey emotion or provide feedback. They established reference points by asking each other questions, then the performer played a few bars and asked something like, Where? Here? There was a tremendously strong rapport between the producer and performer, and the notable support was vivid in the ICQ dialog. The banter was an important factor in setting the mood of the session. It also allowing breathing time where the performer could physically rest and both collaborators could clear their thoughts and reduce ear fatigue caused by critical listening.

7.1.3 Session Three

7.1.3.1 Instrumentation and Genre

Session Three was a Rhodes piano recording of a Jazz standard. The performer recorded with a pre-recorded backing track with bass and drum.

7.1.3.2 Performer Three

This was the performer s second experimental recording session. Performer Three (previously Performer Two) is an experienced amateur/semi-professional musician. He typically creates music alone, but he has collaborated with this producer previously. With the exception of his earlier experience in this study, he has not used the Internet for music production, but regularly uses computers for music production.

Performer Three found this collaboration to be moderately successful. He felt the need to play longer segments of the tune than he would have normally in a conventional setting. In a recording studio, the performer can utilize naturally occurring down time, like when the engineers are setting up microphones or attending to a technical problem, to practice sections of the song or figure out chord changes. In the on-line session, that sort of down time was not available. The session was hyper-focused. It was as though the producer was present before he was ready to perform. He would have preferred to practice things alone while producer performed other studio functions. Performer Three claims, I felt I had to play through longer than I would have done alone I had to figure out the chord changes and things the producer shouldn t really care about.

He was also frustrated by the fact that he couldn t talk to the producer while playing. For him, what was hard: no real possibility to talk while playing. I had to stop and type But then I couldn t say, There is where I can t figure it out . Again, there s the need to reference specific sections of the music with accurate timings. He noticed less feedback from the producer as the delay was increased, or he sensed in himself a loss of the inclination to acknowledge the producer s feedback because the delay was too long. He had mentally moved on.

7.1.3.3 Producer Three

Producer Three is an avid amateur/semi-professional musician who self produces much of his material and produces for co-performers. He typically creates music with collaborators, and has worked with this collaborator previously. He uses the Internet for musical collaboration (including using Rez Rocket), and uses computers for music production on a regular basis.

He was moderately pleased with the session outcome. He felt the performer was only moderately attentive to his comments and suggestions, although he found making himself understood a relatively easy task. He estimates that the performer only incorporated his feedback about half of the time. He says, My comments as producer were necessarily more general in nature, but I had specific comments in mind. I found it difficult to direct the musician s attention to the relevant section (and his performance in that section).

While he felt that he retained control of the session s pacing, he was only able to provide very specific instructions when there was low latency. When the delay was increased to thirty seconds, he felt the producer s role was reduced to a cheering section. After the session he listened to the high fidelity recordings made on the performer s end. He found them much richer than was expected.

Producer Three also felt that he had to trust the performer more in the networked studio. The producer could make comments that were precise, but not necessarily timely. Producer Three is also accustomed to using body language to give feedback, and found that written dialog was inadequate to convey his sentiments. Nonetheless, he claims that being physically separated was not as disturbing as the delay, and extraneous noise in the signal and degraded audio quality was not as big an obstacle as the delay.

7.1.3.4 Experimenter s Observations

Negotiating the start of the session and takes was important in this collaboration. They established early on the differences in sound quality between them. Performer Three pointedly asked what the producer was hearing, What kind of sound do you have? Producer Three, You sound clear, but the bg (background music) is somewhat distorted. Producer Three also used to indicate that he was listening. The performer frequently seized control of the tape. The producer couldn t stop him from listening to past takes or the backing tracks.

Performer Three, who is partial to pointing out sections of music verbally, tried to send verbal cues while he performed. For example, he would type here while performing, but the producer was listening to a delayed signal and the cues were not particularly effective. The performer would also type para -verbalizations instead of opinions, like beeuuuuu , to indicate a section that he found unacceptable.

Producer Three was very open about his perceived sense of role shifting and transference of power with the increase in delay. He told the performer that his could provide support but not necessarily timely or specific commentary. Producer: Dude, it s a 30 second delay. Yes, the best I can do is give general feedback, but I ll try to make notes here

7.1.4 Session Four

7.1.4.1 Instrumentation and Genre

Session Four was a recording of an Avant Garde improvisation performed on digital keyboard. There was no backing tape, metronome or click track accompanying the performances. The producer and performer discussed the musical form and piece duration at the beginning of the session.

7.1.4.2 Performer Four

Performer Four is a professional musician with substantial studio experience. He typically works on musical projects with groups of collaborators. He has never worked with this producer before. He does not use the Internet for music collaboration, but uses computers for music production.

Performer Four found the collaboration moderately successful. He felt the producer was attentive to his performances, and found the producer s comments very clear. He wished the producer had a mechanism for interrupting him while he was playing to indicate a specific section of the music. He says, there should be a mechanism to interrupt me (the performer) and say, hey listen to this part that you played a minute ago, that s how I want you to do that part . The limitation of post-performance critiques for each take was insufficient.

7.1.4.3 **Producer Four**

Producer Four is a professional studio engineer/producer who predominantly records Classical music. He is accustomed to highly produced and structured, union sessions. While he does not use the Internet for music collaboration, he constantly uses computers for recording, editing, and processing. He felt the collaboration was moderately successful. While the performer was attentive to his suggestions, he felt it was moderately difficult to communicate clearly. He estimates that the performer incorporated more than half of his suggestions. His sense of control over the session varied. Producer Four says, I felt that I had control over the session, but the significant delay in the signal along with no time reference to compare our ideas with each other proved an obstacle. He wanted common reference markers to be able to comment on specific musical sections — time code or tape counters. In this particular instance there was no score that made measure references or exact musical events difficult to locate.

He noted, In a recording studio, the interaction of the producer and performer is very important. The producer often doesn t actually have to speak in exact terminology to get the idea to the performer. In the Internet session, the producer must be very clear and concise and articulate the exact thing he wants to say to the performer. In a standard studio, non-verbal communication is very powerful, on the network there is an increased demand on producer to be absolute in articulation and meaning.

The delay was harder to overcome than the poor sound quality for this producer. He felt the musical feel was lost between successive, long pauses. He noticed a marked change between the MIDI triggered performance and line out of the keyboard. The basic musical ideas were still conveyed, but it was noticeably different.

7.1.4.4 **Experimenter s Observations**

Observing this session revealed that typing speed is a factor in communication and production (skill). Because this was an improvisational piece the ability to change the length of the song was important. Although no accompanying track was used for this recording, it was obvious that these fluctuations could impact editing considerations, or necessitate the need to change click tracks quickly, adjust time code, etc. The form of the piece changed slightly between takes, as well. Producer Four indicated specific musical moments by referencing sections in relation to the downbeat (i.e. about 1:45 into it).

7.1.5 Session Five

7.1.5.1 Instrumentation and Genre

Session five was a violin recording of a Jazz standard performance. The performer recorded against a backing track that included piano, bass, and drums.

7.1.5.2 Performer Five

This was Performer Five s second experimental session. (He was also Producer Two.) He is a professional musician with substantial studio experience. He typically collaborates on musical projects. He has worked with his collaborator in the past. Although he does not general use the Internet for music collaboration, he uses computers for music production on a regular basis.

Performer Five felt the session was moderately successful, despite the fact that it was slightly uncomfortable playing against the guide tracks. There was a sense of disconnection between him and the music on the backing tapes. Performer Five could not predict if the physical presence of the producer could have alleviated that disjointed feeling. In general, he found his producer to be attentive to his performances, and clearly understood his feedback. He observes, I think a standard recording studio environment has a lot more feedback — not just the producer being in the room, but also, the rest of the band, the engineer, and any friend can chime in with comments about the song and give suggestions. The producer s comments (even across a network) helped significantly. The system may be annoying at times making us wait, etc, but still the help of another musician to get inspired and help with new ideas, etc was great.

7.1.5.3 Producer Five

This was Producer Five s third experiment, but his first time in the role of producer. (He was Performer Two and Performer Three.) He is an amateur/semi professional musician with some studio experience who usually creates music alone. He has worked with his collaborator prior to the experiment, While he has not used the Internet for musical collaboration prior to this experiment, he does use computers for music production. Producer Five felt the collaboration was successful. He thought the performer was very attentive to his suggestions. Producer Five felt it was easy to make his ideas and opinions understood. However, later in the questionnaire he comments, The delay was too long to influence the performer. I tried to anticipate and encourage without knowing what was going on, but I don t know if that was helpful. None the less, he felt the performer incorporated more than half of the suggestions.

He noted an inability to communicate clearly during a performance/recording. He says, It was hard to communicate in real-time during the recording. It wasn t so hard in between takes. He missed visual cues and facial expressions especially while the performer was performing. He felt MIDI did provide some very basic information about structure, but there was not enough resolution to make any critical low level assessment of the performance. In general, Producer Five suspected that working this way (over a network) would require more production time than a standard, face to face setting.

7.1.5.4 **Experimenter s Observations**

During this session, Producer Five made sure the performer was always aware of the delay and audio obstacles. For instance, the following appears in the transcript of their ICQ conversation:

> <performer> we re rolling!
> <producer> I m waiting!
> <producer> there s about 30 S
> <producer> Good start!

Collaborators also made comments as they listen critically to the play back. Even though the playbacks were not synchronized they discussed the performance as they listened. Both parties typed feedback while recording to maintain contact, support, and a sense of connection. The performer indicated the starts of takes as a warning to the producer and reiterated what was about to be performed. Producer Five didn t consider session pacing, and relied on the experimenter to keep track of the time.

The most unique characteristic of this session was the studio banter and particularly the way the experimenter was dragged into the dialog.

> <performer> it s hard to change moods too much, for instance.
> <producer> I know it s a style in itself It s hard to change it
> with the section you have
> <performer> ok?
> <producer> Think of a girl :-)
> <performer> ok :-) :-)
> <performer> Hey Nyssim, come here!
> <performer> :-)
> <nyssim> I don t think that s in the spirit of the experiment. I ll check
> with COUHES (Committee on Using Humans as Experimental
> Subjects)
> <performer> damn!
> <performer> :-)

This banter seemed to happen for two reasons. First, the incorporation of a third person perhaps reinforced the social dynamic of the producer-engineer-performer configuration. Also, the exchange took on a flirtatious tone expressed in the context of musical feel and inspiration. While the notion of dragging an (unseen) woman into the dialog to shape psychological mood is not unusual in the studio environment, it was amazing that even physically separated, across a network, and via ICQ that the producer-performer-engineer relationship might shape the dialog and the social interaction. It served to break the tension and create a bond between producer and performer by bringing in a third, an other.

7.1.6 Session Six

7.1.6.1 Instrumentation and Genre

Session Six was an improvised Jazz/Rock recording of an electric guitar played through an amplifier. A microphone picked up the amplifier signal. The performer used no backing tracks, click track or metronome.

7.1.6.2 Performer Six

Performer Six is a semi-professional musician with some studio experience. He typically creates music with collaborators. He has not worked with this collaborator in the past. He has never used the Internet for music collaboration, but typically uses computers for music production.

Performer Six felt the session was successful, and that the producer was attentive to his performances. He found the producer s feedback clear. Previously, he had experienced studio sessions where there was no visual contact between collaborators, and felt the networked environment was only marginally more difficult. Performer Six notes, I have been in sessions where the only communication was via headphones, so this seemed only one step removed. He found it difficult to focus on specific sections of a piece. It might have been a different story if there were specific spots to work on. It seemed like it could be difficult to hone in on a trouble spot; for instance if I were nailing a riff and couldn t get one line, or nuance at a certain point. The certain point could be hard to locate.

The delays did not seem to hinder the sessions. He says, Actually, the time delays did not impair the session. He found them akin to the technical delays that occur frequently in standard settings. He comments, I ve had to deal with various technical delays, adjusting mics, tape rewinding, etc. So this seems fine. From the performer s perspective the minimalist interface was adequate. Although he had the sense that it could be difficult for the producer to make himself understood clearly. Alternatively, he found the process enforced an efficient distillation of ideas on the discourse.

7.1.6.3 Producer Six

Producer Six is a professional musician with studio experience and a former professional recording engineer. He generally works in ensembles. He has used the Internet for music collaboration in the past, and uses computers for music production. Producer Six found the session reasonably successful. The performer was attentive to his suggestions. Although he felt making his ideas clear was moderately difficult, the performer still incorporated more than half of the suggestions. He thought he had control over the session pacing, but the delay hindered the conveyance of timely feedback. He felt his comments lacked detail, and feared that the comments were not taken in the appropriate context because of the delay. He notes, I felt it was hard to give nuanced expression of what I liked and didn t like. I drew lots of smiley faces :-) for the former and let the latter pass. When I did give feedback, I was very aware that it was for things that the performer had played 30 seconds prior, so it might not make sense to him, unless he understood the delay.

To accommodate the environment, he consciously used production techniques appropriate for capturing live performances instead of those used to record in a pristine, studio setting. I didn t try for fine-grained feedback I treated the recording like a live session — not one where you can tell the musician to change — you just capture what s played.

7.1.6.4 Experimenter s Observations

It was obvious in this session that some sort of signal or message to indicate what is happening on either end (i.e. starting, listening, etc.) would have helped tremendously. Negotiating who controlled the record button was problematic. There was a pervasive awkwardness of performer waiting for producer, and producer unsure about if/when the performer had started.

7.1.7 Session Seven

7.1.7.1 Instrumentation and Genre

Session Seven was a Jazz standard recording performed on a digital piano. The performer recorded over backing tapes that included drums and bass.

7.1.7.2 Performer Seven

Performer Seven is a professional musician with substantial studio experience. He typically works in ensembles. He has not worked with this producer in the past. He has not used the Internet for music collaboration previously, and does not use computers for music production.

Performer Seven felt the collaboration was successful, but was not very satisfied with the musical results. He was slightly uncomfortable playing against the guide track, and prefers playing with other live musicians. He felt the producer was attentive to his performances, and found the producer s feedback very clear. Although he found the comments of the producer useful, he wanted the presence of co-performers.

For this performer, the delay had a greater impact on the collaboration than the physical distance. He couldn t rely on the producer for musical cues (counting choruses, etc.) as he would normally in the studio. Performer Seven observes, The effect of time (more than distance) was felt a few ways. I had asked the producer to count choruses and give me cues along the way, but we found that was difficult, as he was hearing things 30-45 secs after the fact. Also, I find it easier to converse vocally, aside from the time and effort required to type, one gets more depth and nuance from face-to-face conversation.

7.1.7.3 Producer Seven

This was Producer Seven s second experimental session. (He was Producer One.) He is a professional musician with some studio experience as a performer and in the role of producer for co-performers. He typically creates music with collaborators. He has used the Internet for musical collaboration before participating in this experiment, and uses computers for music production.

He felt the session was mostly successful and that the performer was attentive to his suggestions. It was moderately difficult for him to make his ideas understood, but the performer incorporated more than half of his ideas. Using written dialog (ICQ) actually aided him in organizing his thoughts. He saved up comments during the take and then unloaded them in between takes.

Producer Seven felt that he did retain control over the session. However, he attributes this success in part to the format of the piece. The fact that it was a Jazz standard made it easy to let a whole take run and then make suggestions — capturing a live feel.

Even distorted audio was fairly easy for this producer to assess. He suggests, It s pretty easy to get a good sense of musical feel even with a degraded audio signal. The acoustic (line-level) output of the piano was much more expressive than the MIDI signal. The keyboard seemed to have a greater dynamic range than the MIDI generated counterpart. The velocity did not seem to have enough resolution. Producer Seven admits, The most difficult obstacle to work with was the MIDI instrument. Even though it wasn t a real piano to begin with, the acoustic output of the keyboard was *much* more expressive than the MIDI signal I really couldn t tell you what the MIDI takes sounded like it was that different from the acoustic signal. There really does seem to be an impedance mismatch between the controller and the synthesizer. This surprised me. I thought MIDI allowed for better control. It is important to note that there was no pre-production time allotted for optimization of the MIDI mapping between the controlling keyboard and the sound module used for the producer s stream. The general sense is that producers felt more comfortable with audio than MIDI triggered performances. However, methods for improving the MIDI performance were not explored in this experiment.

Producer Seven was able to work around short delays and still anticipate and cue musical events. He notes, The time delays made the interaction more deliberate, and less spontaneous.

7.1.7.4 **Experimenter s Observations**

It was notable during this session that the Producer held the floor by typing fast. This helped him make his point before getting sidetracked by the performer. The performer would play small snippets of music — noodle — before the start of every take, and this cued the producer that a take was about to begin. The Producer wasn t alerted to false starts which was problematic because he devoted critical listening time and energy to takes that didn t get past the first few measures. Noise at the end of takes was also problematic. With the delay, the producer heard bad endings, too late. Sometimes the performer immediately started another take. Two takes passed before the technical problem could be solved.

With the longer delay, the producer was unable to conduct or cue musically which was needed in this session. The collaborators established a system for co-determining the start of takes and then slated them via the ICQ. The producer made sure the performer knew if he was still listening, etc. or available to discuss the take. During takes he marked choruses as he received them

<producer> 1
<producer> 2
<producer> 3
<producer> 4
<producer> 5

Under high latency conditions, he made sure the performer knew when the signal reached him.

<performer> let s go
<producer> I m all set!
<performer> take 5
<producer> OK. Sounds good.
<performer> I ve changed the mix on the band, so the bass will seem deeper (and hopefully easier to hear).
<performer> didn t like it
<producer> OK
<producer> (I still haven t heard take 5)
<performer> take 5.5
<producer> Heh heh. I just got it.

By establishing takes and delay time, collaborators were better able discern each other s points of reference.

7.1.8 Session Eight

7.1.8.1 Instrumentation and Genre

Session 8 was a classical, solo violin recording. No backing tape or metronome was used.

7.1.8.2 Performer Eight

Performer Eight is a professional musician with substantial studio experience. He typically collaborates on musical projects, but has never worked with this collaborator before. He has not used the Internet for music collaboration prior to this experiment, but generally uses computers for music production. This was his third time participating in Internet recording sessions. (He was Producer Two and Performer Five.)

Performer Eight felt the collaboration was moderately successful. He felt the producer was very attentive to his performances, and that his feedback was very clear. The presence of another musician provided support and new musical ideas. Even though the piece was familiar to him before the session, he benefited from the presence and opinions of others.

The session was similar in almost every way to a standard recording session except for the delay, and no verbal feedback. I actually felt I was getting the same kind of attention to details from the producer that I would have in a studio. Producer Eight had asked the performer to practice specific section while the stream was transmitted with the long

delay to the producer. Performer Eight like the fact that this producer assigned him rehearsal tasks to utilize down time cause by latency.

7.1.8.3 **Producer Eight**

Producer Eight is a professional musician and professional recording engineer/producer. He typically collaborates with others on musical projects. He has used the Internet for music collaboration previously, and uses computers for music production. This was his second Internet Recording Session. (He was Producer Four.) He thought the collaboration was moderately successful. The performer was attentive to suggestions, but it was reasonably difficult to make his opinions clearly understood. Nonetheless, the performer incorporated most of his feedback in subsequent takes.

He felt that he was in control of the session s pacing, but that it was generally difficult to pace the session. He found it difficult to move the session along because I was listening to the last take while the performer sat and waited. The delay made it difficult to repeat short sections and maintain a feel over sequential takes. He had no problems changing the performer s attention. However, to compensate for the delay which was eating into the session s time, he consciously directed the performer ahead to work on other sections while he was still listening to the previous take. In a typical studio session, these delays in feedback from the producer allows the musician to lose their focus and thus become inconsistent in their playing. A new set of management skills needs to be developed by the producer in order to make the session successful. The producer asked the performer to do several takes of a particular section without waiting for producer feedback.

7.1.8.4 **Experimenter s Observations**

Some unique techniques were observed in this session. At the start of the session the producer established the delay time. The producer took on the responsibility of explaining the network obstacles to the performer and thereby created a vehicle for better collaboration.

> <producer> OK. Just to let you know, I am about 30 seconds behind

The performer typed comments as the producer was listening back. The producer was effected by those comments straight away.

> <performer> are you still wayyyaaaaay behind me?
> <producer> I m really behind but that was a good take for a bunch of spots
> <performer> definitely need a few things still, though @!
> <producer> we need to look at bar 12 for notes and phrasing

It was better than instant feedback. It was *preview* feedback.

If there wasn t a consistent acknowledgement over the ICQ that both parties were engaged in the dialog, the flow of the conversation became disjointed. The producer paused his typing to let the performer interject. It was obvious that this producer was

thinking ahead in terms of how to best use the environment to accomplish his tasks. He used the delay in his favor to multitask.

7.2 Expectations and Preliminary Findings

All the sessions did have several tasks or characteristics in common: establishing a recording strategy, asserting managerial control, negotiating the start of the session and each take, strategies for compensating for latency, and communication styles. The most unexpected finding was that despite the severity of some of the obstacles placed between producer and performer in no session did the collaboration cease entirely. Although all participants varied in which aspects of the network environment challenged their ability to produce, all were able to sustain a musically meaningful dialog.

7.2.1 Establishing a Recording Strategy

Each producer established a strategy for recording at the beginning of the session. Some producers modified their technique as they became more familiar with the networked environment or to compensate for particular obstacles. Producer varied in their approach of the production task. Some examples where producers were conscious of their explicit production approach were sessions One, Three and Six.

> Producer One: I chose to work on longer sections or complete takes, since the 30 second delay made working on smaller sections impractical.
>
> Producer Three: I had to put a great deal of trust in the musician. My comments needed to be precise, but not necessarily timely. This is a big shift from the way I usually have done producing in the past. Normally, a look or a glance could convey more than my lines of typing did this time. Smiley faces just don t cut it. :-)
>
> Producer Six: I treated the recording like a live session.

Some worked with the performers during a practice stage before attempting a complete take/recording. Others pressed for successive takes until both performer and producer were satisfied with the performance. Still others chose to break pieces down into sections, and record short segments (that could presumably be edited together later). All these techniques are consistent with behavior in a standard studio setting.

7.2.2 Asserting Managerial Control

All producers had to assert some sort of managerial control over the session. Some tried to win the performer s confidence by demonstrating a capacity to understand the performers musical influences. For example,

Session Four:

> <producer> I m just going to ask you a few questions about what style of music and what your thoughts about comparisons to other

musicians that I can compare it to.
<performer> sure. OK
<producer> So, is this going to be a little out (Jarrett) or really out like Zorn

Session Six:

<producer> yep. There, you ended. Half Hillbilly, half Alex de grassi?
<performer> AL
<performer> I reckon so
<producer> Are you a de Grassi fan by any chance?
<producer> There s an old album of his, Slow plow Circle, which is a must for any solo guitarist, IMHO.

Others accomplished this by presenting methods for using session time efficiently as in Session Eight. Producer Eight developed the strategy of asking the performer to practice while he was still listening to the previous take.

Session Eight:

<producer> while I m listening to the last take why don t you look at bar 12 the same way and then play a complete take from the top

Additionally, he presented the performer with practical ways to break down the performance.

Session Eight:

<producer> Ok lets start by breaking this down into smaller sections to work on.

7.2.3 **Negotiating the Start of the Session and Each Take**

Collaborators negotiated the processes of beginning the session and marking the start of each take. Some producers marked the beginning of the session with clearly delineated tasks. Others had a more casual approach. They waited for the performer to start and then provided comments.

Session One:

<producer> OK
<producer> [Performer], let s start from the top and play the piece once straight through

Session Three:

<producer> ok, I ll start the tape, and we ll just start when we start.
<producer> cool?

<producer> here it comes

In most sessions, collaborators used take numbers to indicate the start of a recording. The responsibility of marking these takes alternated between producer and performer from session to session and sometimes within a single session.

7.2.4 **Strategies for Compensating for Latency**

Both participants, but particularly the producer, had to actively strategize a means to handle the delay and establish with the performer the fact that they were not hearing the same thing at the same time. The ICQ transcripts showed that some producers felt their role in the collaboration was substantially diminished by excessive latency. The most successful strategy emerged in Session Eight.

Session Eight:

<producer> while I m listening to the last take why don t you look at bar 12 the same way and then play a complete take from the top

Others constantly signaled the performer to them know they were being heard. Some used to indicate they were listening to the performance. Others marked the number of times the performer had played through the entire piece with numbers.

Session Three:

<producer>
<producer>
<producer>

Session Seven:

<producer> 1
<producer> 2
<producer> 3

The producers also needed to specify that what they were hearing was not the same as the performer.

Session Six:

<producer> I gotta tell you that what our friend Nyssim is doing is making it sound really amusing. At least I think that s her and not your guitar.

The producer needed to find a way to reference specific sections of a recording either by time, musical form, measure number, etc. Both collaborators needed to be able to discuss specific sections, measures, and notes.

Session One:

<producer> Tempo was better. You still took off a little bit around 50. Some of the notes got a little muddy. Can we try it one more time from 33? But this time stop at 61.

Session Two:

<producer> Also, in the second phrase of the melody there s supposed to be a F instead of that E-flat?

Session Four:

<producer> in the first take you played some very nice parts in what I would call the second theme (About 2:45 1:45 into it)

7.2.5 **Communication Styles**

Both participants needed to develop a comfortable communications style using the ICQ. Collaborators used many email conventions like smiley faces. Some used back slashes to indicate the end of a turn to make up for the lack of verbal cues. Sometimes a back slash or an ellipsis indicated continuance. The written dialog needed to be quite precise in order to convey musical ideas effectively. This challenged many producers who are accustomed to more informal communication or rely heavily on visual cues. Producers could not generalize about the location of a problem. Negotiation by analogy to other recordings or pieces was common. Some participants typed in lower case characters while others were grammatically more formal. Producers tended to be more formal that performers.

7.3 **Inconsistencies Between Recording Sessions**

The technical limitations of some of the set up components caused inconsistencies in the how each recording could be processed before it was streamed to the producer. The greatest liability was the poor performance of the pitch tracker that rendered the pitch to MIDI conversion completely useless for most of the sessions. The differences between producing with an audio stream versus a synthetic version of the performance were apparent in only a few sessions. The only reliable data on this difference came from sessions using keyboards where MIDI data could be taken directly from the instrument. Fortunately, those few sessions revealed much about the difficulties of producing with a MIDI stream.

Another limitation of the experiment was that while the participants were diverse they still represent a fairly small sample of types of musical collaborators. A broader spectrum of collaborators needs to be studied who have more varied production experiences, have different preferences regarding the work environment, and who hold expertise in a variety of musical genres. Also, although participants played varying instruments and genres and all received at least some formal Western musical training, all were fluent in

English. (There were two non-native speakers). This curtails the scope of the research because it makes it fairly easy for all collaborators to establish a shared context.

7.3.1 Impact of Experience and Familiarity

It was obvious that differences in both production experience and recording experience and familiarity with their collaborator significantly impacted each session. Producers accustomed to rigorous and detailed production environments (like union sessions) were more likely to develop production techniques on the spot. This skill set seemed to give them a greater flexibility while retaining a standard for professionalism, and it enabled them to accomplish many tasks without the aid of specific supporting technologies. For example, when Producer Four wanted to make references to specific sections, he used times based on the down beat. This same producer in Session Eight directed the performer to practice the next section while he listened critically to the last take.

Familiarity with the other participant also impacted the collaborations. Similarly, performers who had worked face-to-face previously had a set of pre-determined reference points which helped sustain a positive working atmosphere, and this prior knowledge helped the producer predict what aspects of the production maybe problematic or tiring for the performer.

7.4 Generalizations About On-line Production

The network supported music collaboration in these sessions. Given the intentional limitations of the system and the lack of experience in networked production of all the participants, it is not surprising that many collaborators were unable to overcome many of the difficulties of on-line collaboration. Overall, fewer particulars were addressed. Musicality could be negotiated but not in fine detail. This is symptomatic of the delay and a lack of adequate reference points and not the physical distance separating collaborators.

Latency restricted the focused intensity generally found in a standard studio. The sense of performing in front of one another was diffused somewhat, and the experiment made no provisions to penalize collaborators for poor recordings. That could affect both the production techniques and performances.

Production on-line will probably take longer not just because of latency but because the richness of the discourse is restricted by the communication technology. Facial gesture and body language communicate a lot of nuance. At first, production techniques are likely to be extremely concise which may make it a difficult medium for semi-professional musicians to use.

Several things were observed in nearly every session that need to addressed either through technological development, production strategies or a combination of the two that will make networked collaboration artistically and socially meaningful, efficient, and acceptable to professional music producers.

7.4.1 **Referencing Specific Sections of Music**

Collaborators needed a mechanism for referencing specific sections of music and the recording. They needed some sort of common time code reference that would enable them to say something like, at 1:33 there s a note out of tune. Some types of music, like Classical music, will lend themselves to using measure numbers as references, but many will not. When addressing technical problems rather than musical problems, collaborators frequently use a reference time rather than a musical structure to locate the feature.

Similarly, producers sought ways to cue performers for upcoming musical sections. This task was easily accomplished with short delays but exceedingly difficult with longer delays. It was always difficult for the producer to cue with extreme accuracy. They often cued early because they knew the performer was listening ahead. Also, the specific mechanisms for cueing used in this experiment were dubious. They typed directions just before they thought the performer would hear that section. If the performer was looking away from the computer monitor, he missed the typed cue.

7.4.2 **Interrupting Performances**

Both the producers and performers missed a channel of communication through which the producer could interrupt the performance. The inability to interrupt wasted time. If the performance was going poorly or took the wrong approach, an entire take went by before the collaborators could move on. This unnecessarily fatigued the performer and contributed to a loss of focus. Additionally, the inability to interrupt also contributed to ambiguity in critique. Producers were unable to draw the performers attention to the specific sections they had just performed.

7.4.3 **Overcoming Physical Separation**

This loss of visual contact and the physical separation also created complications. Many participants admitted a sense of loneliness that reportedly detracted from the quality of their production experience. Many producers found it difficult to gauge their performer s mood, attention span, etc. Visual cues are the primary source of this type of information in a standard studio setting. The ICQ chat seemed to provide insufficient feedback. Producers either did not think to ask performers how they were feeling over the ICQ, or they deliberately avoided it for some reason. It is unclear whether this is the result of a lack of experience on the producers parts, or if this avoidance was an intentional production decision. Interestingly, several producers reported that they were forced to trust the performer more than they would have in a face-to-face production.

Also, it appeared that collaborators wanted or needed to be made aware of network delays and sonic obstacles dividing them. Producers that reminded the performers about the obstacles and qualified what they were hearing seemed to run more productive sessions. This process of reiteration also seemed to create a bond between collaborators. To some, it became a game or amusing challenge to make music no matter what obstructed collaboration.

7.4.4 **Musical Communication**

Collaborators missed a purely musical form of communication. Some noted the desire to sing musical examples or play them on a keyboard. They did not sense the need for a way to jam (or play together) merely the ability to articulate a melody or chord change. That type of communication is extremely dense and efficient and not easily replaced in the production paradigm.

In the keyboard sessions, it was obvious that the producers detected a marked change between the keyboard s analog audio output and the MIDI triggered performances. More information is required to determine if substantial changes to the MIDI mapping between controller and sound module could change this phenomenon. However, initial observations indicate there is a strong preference for audio (even poor quality audio) over a synthetic performance.

7.4.5 **Latency**

All participants reported a noticeable decline in their ability to collaborate or produce through long delays. Only crude estimates of network delays were calculated during the sessions. However, the difference between the best transmission time and the intentionally delayed signal was always thirty seconds.[8] Participants based their comments on the perceived difference of collaborating under these two grossly defined conditions. It appeared that collaborators felt like they were engaged in a real-time discourse with latencies of up to about nine seconds. After this point, producers started to feel as though their ability to produce lessened. Nine seconds is an estimated figure based on the experimenters observations and reports from the producers. (Many producers noticed that they could hear the performer s typing in the Real Audio stream. Some timed the pause between typing and the beginning of performances.) Until additional experiments can be run where latency is monitored closely, it can not be considered very accurate. It is, however, obvious that thirty seconds or more latency significantly challenges the production process. Some of the producers had the following observations:

> Producer One: No delay — easiest (most like a recording session) Communication was near, real-time, so collaboration was much more inter active and dynamic Delay — audio quality was still good, but interaction/collaboration was much more difficult.
>
> Producer Two: The 30 — second delay basically just slowed down the session, as I found that I was unable to decide much about a take until after I d heard the entire thing.
>
> Producer Three: The most difficult obstacle was the 30 second delay. At that point I felt that I had very little control over the situation (or influence).

[8] This thirty seconds does not account for any minor fluctuations that may have been introduced by the Media Laboratory s internal network.

Producer Four: The interactions of the producer and musician is very different because of the [long] delay. It requires the musician to stop and start after large delays, and musical feel can be lost.

7.5 Unexpected Results

There were some unexpected findings. The pervasiveness of the social characteristic of a recording session were incredibly powerful even without physical or visual contact. The absence of the engineer (and potentially the absence of band members and friends) seemed to color the participants perceptions of the experience. The experimenter was frequently included in on-line banter even though participants were told her role was as an observer.

It was predictable that many participants, especially the performers, would find the interfaces cumbersome. It was surprising, however, that a few performers integrated the computer and the ICQ into their performances almost seamlessly. The best example of that was the Rhodes piano player who put the computer keyboard on top of the piano and typed in between melodic phrases (Session One).

Another unpredictable phenomenon was that every single participant informally expressed either enthusiasm or they exuded passion about some experience they had during the sessions. Many said it had made them think about collaboration in ways that they had not, or that the experience made them conscious of the role of technology in production in a way that they had not been previously. Some were genuinely surprised by their own changes in perspectives. For example, one producer reported being very comfortable with the idea of using MIDI to trigger a keyboard performance before the session. After first listening to the mix of the keyboard s output with the rhythm section and then switching to a MIDI triggered sound module with the rhythm section, he felt there was a substantial change in his ability to produce. He appeared certain of these new findings, and has subsequently spoke about it with other musicians.

7.6 Future Experiments

Preliminary findings indicate where further research and experiments are needed to refine understanding of how technology supports networked collaboration during production. Identifying that point at which the delay interferes with the sense of real, time collaboration is of paramount importance. At this point collaboration begins to feel like asynchronous communication.

More observations must be made to analyze the differences between producing using a synthetic performance versus an acoustic signal. Based on this experiment, synthetic performances appear insufficient for collaboration, but those findings need confirmation.

Pairs of collaborators should be given more time during the session and be allowed to do multiple sessions. This would reveal how producers adapt to the environment over time. Producer/performer pairs observed over a series of collaborations would show how the musical relationship evolves over time and potentially how technology could fortify these changes.

7.7 Evaluation of the Procedure

In retrospect, there were several experimental procedures that should have been designed differently. Interviews instead of questionnaires (or in addition to questionnaires) would have made it easier to obtain immediate reactions and deeper level perceptions. Given opportunity to speak about their experiences, participants would have free associated more, and re-evaluate or modify their comments as the revealed their thoughts. The formalized process of writing, while perhaps forcing them to be articulate, reduced the amount of data that potentially could have been collected.

Questions were intentionally vague to avoid leading the participants or biasing their thoughts about what they value or find significant in a recording session. Conversely, more specific questions may have challenged them to think harder about the aspects of production that influence their qualitative determinations of success and suggest areas of consideration.

Two technical components affecting control over the quality (poor or high fidelity) of the audio stream need improvement. First, audio remained in the analog domain until it was converted into the computer running the Real Audio Producer application. Sound quality would have been improved significantly if the audio had been converted to a digital signal at some earlier stage. Also, a more sophisticated mixing console with a great number of output busses and sends would have led to a more elegant signal routing scheme. A system with fewer components would have help to alleviate various hums and grounding problems.

Delays remained fairly constant for long periods of time. Less predictable delays that vary over the course of the session may have led to a deeper understand of the impact of the delay on collaboration. Similarly, the ability to create greater variations in sound quality and artificially add more dropouts might have changed some producers opinions about the compromise between latency and poor sound quality.

A more complex and challenging production task would test the limitations of communication and might also impact the producers sense of control and effectiveness. Also, forcing producers to work with unfamiliar genres, pieces and instruments or increasing the language barrier between collaborators, may allow us to see more of the production issues faced in a standard studio in the network environment.

Some of the data appeared irrelevant by the end of the experiment. Although each participant had been interviewed and selected based on musical and studio experience, the entrance questionnaire was intended to serve as a base line for each participant s background. While familiarity with computers does impact the participant s ability to use the interface, prior Internet music collaboration experience did not seem to impact the experiment much nor did those participants use different production techniques.

7.8 The Success of Experiment and Findings

The observations made during the Internet recording sessions impart a multi-tiered understanding of networked collaboration. It showed several established production strategies and techniques applied to collaboration in a networked environment. Some of these techniques require no technical support whatsoever. They exist purely as modes of communication for effective artistic discourse. Techniques dependent on the technologies that support them surfaced in the networked sessions, as well. There were few familiar recording tools available to collaborators in this experiment. This simplified observation of how the technology made the collaborative task possible. Additionally, these sessions provided insight into what it means to collaborate in near, real-time. While this type of exchange is not directly analogous to face-to-face collaboration, the experiment strongly suggests that networks are an employable medium for artistic expression.

8 Designing Collaborative Systems

In near real-time collaboration the co-performance aspects of recording music are diffused. Internet collaboration provides studio musicians with greater social facilitation than when working independently, but the social interaction in an on-line recording session is less intense than in a standard studio environment. Geographic obstacles, however, do not necessarily need to diminish artistic and social cohesion between networked pairs of collaborators. Network technology that supports the production process engages collaborators in the task of co-creation.

8.1 Prototype Design

The experiment findings suggest the proposed Internet Recording system described earlier would not be conducive to high-quality recordings or intricate artistic exchange. The overly optimistic reliance on MIDI or other forms of performance representations was the most glaring problem with the previous design. That system also lacked several features that appear to be essential for effective collaboration. Assuming that the basic streaming model is retained, there are five primary areas that must be addressed to refine the prototype proposal: the design of a communication systems that support both a standard written dialog and purely music forms of communication, synchronization, management tools, latency and quality of service, and the network configuration.

8.1.1 Communication

The chat-room style communication system seemed to provide a sufficient avenue for discussion while being simple to use. Producers reported that communication via ICQ forced them to be extremely concise with their comments. This attribute could be construed as a benefit in production where time restrictions are common place. Potentially, the chat room could be tailored to the production process. A specialized interface might allow producers (and performers) to choose between an instantaneous messaging system and one that enables users to send a complete sentence at a time. This

might buffer the tension created by the need to be more articulate in network collaboration.

There are other ways the chat-room could be augmented to enhance the exchange. None of the producers in the experiment sessions used the alert sounds provided by the ICQ software. (One producer commented on his oversight.) Alert sounds could be a simple way to catch the performer s (or producer s) attention. Furthermore, if these sounds were audible to the user but kept separate from the recorded audio, they may be useful for cueing or stopping a performer during a recording. This is similar to the way that the talkback in a standard studio is fed to the performer s cue mix but not mixed with the recording.

The physical separation made it difficult for collaborators to figure out what the unseen partner was doing at any given moment (i.e. playing, listening, or resting). Some simple signaling system akin to the red recording light found in many studios could provide a lot information without using up chat-room discussion time. For example, the system might send constant updates to each collaborator s computer indicating the status of each participant (i.e. listening , recording , paused , etc.).

Negotiating the start of the session and the beginning of each take also seems to be consistently problematic. Status signaling would help clarify when to start or if a recording has started. In addition, time stamping or labeling the chat-room discussions could compensate for confusion created by latency. Text lines in the chat-rooms could be added to identify comments based on take numbers. For example, a tag could be automatically inserted after each carriage return like <take 4> That was mostly good, but it seemed to go out of tune a little towards the end.

Clearly the performer always has the ability to play to the producer, but the reverse also needs to be true. A musical white board may be useful for quickly illustrating orchestration changes or changes in the musical form. Music notation is not easy to generate either by hand or notation software. Although notation is an effective accessory, the complication of generating music graphically makes it inefficient as a primary source of musical communication. MIDI may prove to be sufficiently accurate and simple to transfer to make it a good format for musical communication from producer to performer. The producer could stream (or transfer) standard MIDI files to the performer. These files along with some sort of sound sample on the performer s computer could be used to render the producer s musical ideas. Alternatively, short, low-quality snippets of audio could be sent to the performer. These perhaps could be incorporated into the chat-room in a way that is similar to voice attachments in email.

By incorporating all these elements cohesively into the communication system, it preserves the complexity of the studio talkback system in many respects. Most of the production decisions that would be discussed verbally could be transmitted through an enhanced chat-room. Also, the ability to interrupt and cue is preserved. This design approach compensates for some of the visual communication from tracking room to control room through the status signals.

8.1.2 **Synchronization**

There are several synchronization issues to consider. First, in the recording studio, the tape machines counter numbers (TAC) or pre-recorded time code provides collaborators with time-based references for sections of tape. These timings do not always start at zero or reference actual time, but increments are always consistent. Hard disk recording systems provide the same thing through timings based on the exact duration of the audio file. Collaborators need the markings to make reference to specific sections in a recording. Common time code enables collaborators to specify specific moments in the recording whether or not the song divided by measure or form.

There must be some musical foundation for collaboration and synchronization. The notion of employing (musical) templates and backing tracks is consistent with standard production procedures. However, this technique limits the system s flexibility by creating a static musical foundation. Unlike the conventional studio, substantially alteration or re-mixing of the backing tracks is difficult during on-line sessions. One way to compensate for this loss of control is to keep the background and overdub audio files separate on the producer s computer. Separation would enable producer and performer to have different cue mixes and the producer to listen to tracks in isolation. Control over the mix improves both collaborators ability to listen analytically and critically.

Separating the overdub from the backing track poses several problems. It necessitates the inclusion of common time code for both performer and producer for each recording. Collaborators need this anyway to compensate for the loss of time-based reference points. Time stamping (or striping) the performer s performance before it is streamed to the producer would provide consistent markers. Two separate streams would need to be transmitted from performer to producer, or a static file of the backing tracks could be stored on the producer s computer requiring only the overdub to be streamed during the sessions.

During the experiment, the Real Audio stream ran for the entire duration of the session. This reduced the performer s engineering responsibilities. No one in the experiment scenario really controlled the record button. Separating the overdub from the backing tracks adds the additional burden for the performer of starting (and stopping) the stream at every take. If the backing tracks are saved once to the producer s computer, the same time code must be used repeatedly for each new overdub recording or a new offset must be calculated for each take. If both the overdub and backing tracks are to be streamed, they must be striped with common time code each time.

8.1.3 **Management Tools**

Without tools to facilitate session management the standards of professional production will not be met. It is crucial that the producer has the ability to interrupt a recording and direct the performer s attention. As mentioned earlier, it may be possible to incorporate this feature into the chat-room by using alert sounds. However, if that proves unfeasible, alternative signally methods must be sought.

Returning control of the record button to the producer could alleviate a lot of awkwardness in networked collaboration. Clearly, the producer can not control the performer s computer, but the producer can signal the performer s computer. The application could allow the performer to automate the record and stream functions. The system on the performer s side could listen for specific signals from the producer that could trigger an armed recording device to start as soon as it receives a start message. While this adds additional latency by forcing the performer to wait for the producer s record signal, it relieves some of the performer s technical burdens. It could also impact the pacing of the session dramatically by allowing the performer to stay focused on performance. Simultaneously, it would help the producer focus the performer s attention on sections that need work. Obviously, there are some security issues involved in giving someone on a network permission to control functions of another computer. The inclusion of any such feature should be accompanied by the option to override the function.

It is not obvious how technology will help the producer detect and alleviate the sense of loneliness that may be experienced by the performers. It may be up to the producer to find more effective ways to communicate his presence, and create the common ties that bond collaborators in a recording session together. It is unclear which channels of communication will best suit this purpose. Even a poor quality video stream may strengthen collaborators sense of connection. Inevitably, the performer s and the producer s sense of isolation will impact the session.

8.1.4 **Latency and Quality of Service**

Observations made during the experiment imply that collaborators in the production environment will tolerate a fairly lengthy delay. (Approximately nine seconds) System designers should also consider the fact that the audio stream is the signal most likely to suffer from the greatest latency, and it is also the signal that should be prioritized. In the experiment, some confusion was cause because the ICQ was instantaneous and the audio was significantly delayed. Producers in the experiment reported that they would find trading sound quality for minimized delay reasonable. Ideally, it is preferable to offer the best possible audio quality given the network conditions at any particular time. The system should keep the latency consistently to tolerable levels while providing the best quality audio that can be transmitted under those constraints. A system that monitored latency and adjusted quality of service dynamically could optimize network conditions at any moment without disrupting the artistic exchange.

8.1.5 **Network Configuration**

The experiment used a central server to archive the performer s audio stream and transmit the live stream to the producer. This did work well for the experiment. However, it would be preferable to un-tether collaborators from a central server. Point to point communication would empower the music creators by removing the reliance on an additional service provider. Further, it would reduce security risks created by having a third party archive recorded material.

The system could make use of both synchronous and asynchronous forms of communication. The application of either technique should be determined by the need for immediacy in any given task. [Hollan and Stornetta, 1992] Indeed, the environment would benefit from channels of communication that did not pull the users attention away from their immediate task. Collaborators would fatigue from a plethora of signals and streams given no prioritization. This is uncharacteristic of the production paradigm. In the studio, collaborators multitask, shift attention, and collect information at different times to fulfill their roles in the production process. For, example, a tool that transmits short MIDI or audio samples from the producer to the performer does not necessarily need to be synchronous. The producer and performer can continue the dialog while a file is transferred. In this way, the architecture of the system provides users with the information they need at the pace they need it, and helps to maintain the momentum of the session.

8.1.6 **Interface**

The simplistic interface used in the experiment was non-problematic. Most participants had little difficulty switching between mixing console and computer or instrument and computer. Participants used familiar studio devices (DAT recorder, mixing console, etc). It would certainly be disruptive and overly complicated to require users to open and close various applications to accomplish different tasks. It does not seem unreasonable to ask them to switch between various windows or screens to use or adjust various features. Average computer users do this routinely switching between word processors, email, audio players, etc. For example, playback functions and recording functions can be overtly divided. It is likely that collaborators would want to keep chat-room communication boxes visible at all times. Clear delineation of tasks to individual windows may enhance multitasking. Ultimately, this layering of tasks may enable the development of a system that allows participants to easily slide between roles. For, example, the tasks of the producer could be constrained to producer windows and the performer s tasks confined to performer windows. There may be tool redundancy, but this arrangement creates flexibility and clarity by providing collaborators with the set of tools best suited to accomplishing their immediate task.

Some performers, especially musicians who play large acoustic instruments, will want to keep their hands free. A text to speech interface for the chat-room dialog may improve freedom of movement. However, it seems unlikely that the computer keyboard could be eliminated entirely from the process. Listening to previous takes and starting and stopping the backing tracks and the recorder would require at least some minimal typed commands.

The experiment sessions also revealed that a mechanism for marking the beginnings of recordings with identifiers, or slating[9], and retrieving takes based on take number would increase efficiency. Recording engineers generally use take sheets to keep track of recordings and locate performances over the course of the session.

[9] Slates are generally audio tags. The producer or the engineer records their own voice speaking the number of the take.

8.1.7 Expanding the System

Additional features would make the systems more like the studio environment. Particularly, the features of multi-track recording devices are essential to many production techniques. Tape machines allow producers and recording engineers to punch in (or replace) very small sections of a recording — as small as a single wrong note. The ability to juxtapose multiple takes makes it easy to listen critically for potential edit points. On multi-track devices, individual performances can be combined before post-production editing by bouncing between tracks (recording from the recording device to another track on the recording device). The ability to bounce tracks sometimes make subsequent overdubs easier to perform.

As mentioned earlier, the multi-track format makes monitoring flexible. Backing tracks can be adjusted to suit the needs of the performer on a take by take basis. Also, the ability to add signal processing to the overdubbed performances can help the producer assess the material. The ability to add signal processing to the performer s cue mix or to take control of the volume, panning, and balance of the performer s cue mix extends the producer s ability to facilitate successful performances.

Ultimately, the need will arise to expand the system so that it can accommodate multiple musicians. First, the issue of multiple performers in a single location collaborating with a remote producer must be addressed. After developing interfaces that support clear communication and co-creation in this scenario, attention can be shifted toward the problem of multiple collaborators each in different locations.

One imperative design question remaining is how the recording engineer fits into the networked scenario. In the producer-performer scenario the art of recording has been divided between collaborators. The bulk of the burden rests on the performer s shoulders, and unfortunately it is the performer who most likely to be least familiar with recording technology. While the proposed system is likely to produce adequate recordings, it is unlikely to yield truly beautiful recordings unless the skills of the engineer can be reincorporated.

8.2 Machine Listening

Machine Listening, or the notion of making computers musically intelligent participants in musical creation or exchange, will be essential to the development of robust collaborative systems. Algorithms used to analyze the performer s performance could extend the producer s ability to listen where he can not hear because of distance and latency. A producer would never turn over production decisions to the computer. However, beat tracking, harmonic analysis, etc. would give the producer indicators of technical and/or music problems before he heard the take. Based on this information a producer may decide to interrupt the performer. This could prevent fatigue, conserve studio time, aid in identify musical problems, and keep collaborators focused. Some minimal engineering responsibilities might be similarly allocated. For example, recordings could be monitored for consistent recording levels, overall dynamic range, distortion, or other sonic anomalies that might not be caught with lower audio quality streams. Affective computing techniques may also provide a tool for assessing the

performer s mood, and help the producer compensate for communication venues lost with the physical division.

8.3 Design Conclusions

Music production is about musical nuance, artistic interpretation, social interaction, and the application of technology to the shaping of sound. Any tool that professes to support this complex paradigm must support the intricate tasks that make the process. An Internet-based recording system does not need to replicate every tool found in a recording studio, but it must facilitate the same tasks performed in geographically restricted collaborations. Furthermore, it must accomplish this in a way feels intuitive to the musical mind.

8.4 Other Applications of the System

Networked collaborative systems increase opportunities for music educators for many of the same reasons that make it suitable for recording collaborations. There are fundamental parallels between the role of the producer and the role of the music educator. The technology designed for one is likely to support at least some of the tasks of the other. Networked collaboration can provide a sense of connected-ness and the ability to communicate about music at a high level of detail while retaining purely musical modes of communication. Music education shares these features. Systems for on-line teaching would need to significantly improve upon the bi-directionality of the audio streams. Unlike the production paradigm where fairly low quality musical examples may be streamed from producer to performer, educators must provide a higher quality example for their students.

Networked music education is portable. Teachers are able to provide better support for traveling (or touring) students. Access to a greater pool of teachers expands opportunities for students by providing greater access to specialists. Likewise, teachers have greater chances for finding students. This enlivens conventional methods of music education, and helps to preserve styles, genres and repertoire by expanding students educational resources beyond physical confines.

8.5 Conclusions

Internet-based collaborative tools hold the potential for complex artistic exchange. This expands what is expected from the music production process, and marks a change in the recording paradigm. Familiar techniques will not forge the recordings of the future. It appears to be the end of the age of repetition, as we know it. The music recording and production paradigms will grow to make use of new technologies.

In many ways this growth is a returns to their roots. So many of the techniques that make up the fundamental aspects of production came from the experimental music studios that produced Music Concrete. Schaffer experimented with technology to expand the palette of sounds available, and extended the creative process to embrace technology and use it like an instrument for composition. Modern recording technology can be characterized by the way it is applied to sample, repeat, combine and manipulate sounds through signal

processing and mixing. Similarly, the role of computers and digital technology has inextricably infiltrated into the areas of contemporary music composition and production to facilitate these very processes.

Future technology embraces these fundamental ideals. However, unlike the past, one personal computer provides the power to record, synthesize, process, and distribute music. Historically, the expertise of many was required to accomplish just a small, computer-processing task. Now the individual tackles even complex productions. However, artistic community is still an integral part of the creative process. As musicians reliance on the computer as a tool for creation increases, it must be remembered that these computers are connected to the Internet. Computers may provide a key for expanding the sonic palette not only through a variety of synthesized textures or signal processors, but through the addition of new, human sounds. At the end is the beginning. In a sense, we return to the experimental music studio, but find this place where art, sound and technology merge more accessible, more powerful, and geographically unrestricted. These are recording studios without walls.

Appendix

ICQ Chat Session Transcripts

The names of the producers and musicians have been removed to preserve anonymity. ICQ archives sessions as a series of screen shots. The dialogs make more sense (and more accurately represent the exchange) if they are considered three lines at a time. Participants frequently type over one another. ICQ prioritizes the session host (the experimenter) in the chronology.

Session 1
Saturday, June 10, 2000

<nyssim> Session 1
<producer> Yes
<producer> I am ready
<producer> Are you streaming yet?
<musician> yes
<nyssim> Is everyone here?
<producer> What I'm getting sounds synthetic...
<nyssim> How's that?
<producer> Play more, please
<producer> I'm definitely getting synthetic stuff
<producer> There. Fixed
<producer> I get a big buzz every once in a while
<producer> Is the mic getting tapped or something?
<producer> Or is Now I only get one channel
<producer> Yes
<nyssim> Is it distorted? I'm working on levels?
<producer> Oh. Maybe that's it
<nyssim> How's that
<producer> Still pretty distorted. Plus I'm only getting one channel
<producer> Now I have both channels
<nyssim> now?

<producer> But there's still some distortion

<producer> Especially low notes

<nyssim> Hmm... Can't here it here. Will adjust it

<producer> Distortion is only on the left channel

<nyssim> Now?

<producer> Left channel still very buzzy

<producer> Right channel is fine

<nyssim> Listen on headphones

<producer> Oh, it's clean on the headphones

<nyssim> Levels okay?

<producer> Levels are kind of low

<nyssim> now?

<producer> It Looks like one of our monitors is whacked.

<nyssim> How are the levels?

<producer> Levels are still a little low, but acceptable. Peak is at -12

<nyssim> [producer]

<nyssim> Now?

<producer> Too much!

<producer> (pretty hum-my too)

<nyssim> Now?

<producer> But I guess I can live with that.

<producer> Good

<nyssim> Great!

<nyssim> Session 1 - Go!

<producer> DAT on

<producer> OK

<producer> [Performer], let's start from the top and play the piece once straight through

<producer> Ready?

<producer> Are you typing something? I can't see it, but I can hear it :)

<producer> Hello?

<performer> OK. Is my DAT on? OK. Let's go.

<producer> Beautiful

<performer> I'm done. Did you get it? I would like to listen to it.

<producer> How do you feel about it?

<performer> Thanks. I can hardly tell. Can I listen to it right now?

<producer> Um... Nyssim, I have a problem. I can see [performer] is typing but his text isn t appearing.

<nyssim> Yikes! Maybe we need to restart the session. You have a 3 way session, yes?

<nyssim> [performer] on..

(ICQ chat session re-started)

<producer> Yes, Yes. Now I can see it

<nyssim> Okay, now?

<producer> Yes. Seems to be working

<producer> Yep!

<producer> OK

<producer> Sure. We Do

<producer> Oh. :)

<producer> Sounded good over here.

<producer> What's the problem?

<nyssim> Let's just continue. [Performer] wanted to listen....

<nyssim> Fixed. Cue-ing problem.

<producer> Oh. Ooops

<nyssim> He's listening

<producer> Good

<producer> Let me know when you're done listening

<performer> hello. It's me, [performer], the cellist. Remember me? Where is my producer. Hello, looking for a producer. I'm so lonely here. Everybody there? Can I listen to the recording now? Fine, I go ahead. We discovered a little problem with the recording. I don't think I played that bad. It sounds very scary.

<performer> OK I'm done.

<producer> Cool. Did Right. Heh heh

<producer> It got a little funny in some places

<producer> Uh o?

<producer> Yes. Did you mean to accelerando quite so much?

<performer> There are some problems in the middle and Int during the cadence I forgot counting completely it seems. DO you agree? Should I play from say 33?

<producer> OK. Also, maybe after the bunch of sequences (40-60), make a little more of the cadence in 61.

<producer> That's it for now. let's start at 33.

<nyssim> Turn your DATs on, please

<performer> No I need to keep the tempo straight into the arpeggios. OK Anything else? Here we go.

<producer> Yes I am here.

<producer> I think there's a bit of latency between the audio and

<performer> Did I keep the tempo? Hello Producer. Calling producer. Fine.

<producer> Tempo was better. You still took off a little bit around 50. Some of the notes got a little muddy. Can we try it one more time from 33? But this time stop at 61.

<nyssim> The next time he plays, it will be with a delay...

<producer> Better. (tempo wise)

<producer> Nyssim, how much time do we have?

<producer> Oh, never mind...

<producer> No, it was good. I think it was very good.

<producer> Heh heh. It was fantastic!

<producer> I'm thinking,///./....

<producer> Can we go back to 19, and go from 19 to 24? I just want to bring that sequence out a bit more.

<performer> Sure. OK. Here we go. Ha ha. Sorry. but? Please be a little bit more enthusiastic. Getting there. Take your time.

<producer> Yes. It's somewhat disconcerting.

<nyssim> Remember, ICQ will be instant, but audio delayed.

<producer> Understood. OK.

<producer> I'm still waiting to hear it...

<producer> Thanks. Just hoe mw much delay its there?

<nyssim> There was distortion on that take. I think it should be okay now.

<nyssim> 30 sec delay

<producer> No. I could still hear most of it.

<producer> Good. Let's try the whole thing again?

<performer> Fine I understand there is a delay now. Fine. I go ahead and play. I'm done.with the measures. Up No surprises I think. Should I do it again?

<producer> (with the delay it's hard to do little snippets)

<producer> Just a few more things:

<producer> Right, tempo from 50-60

<producer> Also, just the tiniest bit of intonation on the double stops, specifically 79 and 81 and 86 (the trill).

<producer> :)

<producer> Ma Thanks.

<producer> OK!

<performer> Fine. I try to keep the tempo. 81 I should get right. It's C major after all. I'll also pay attention to the other ones. Here we go. Stop talking to me.

<producer> That's ok... I'm still listening

<performer> Sorry I screwed up. Starting from about 56 I sort of lost it. I'm afraid should I start 45?

<producer> Yes. Let's start from 45.Nys

<producer> Wait. Nyssim, I'm getting pops over the audio here. Is there something?

<nyssim> Yeah, I can't get it too much better, but I'm working on it

<producer> OK. Not a problem. [performer], let's start at 45.

<producer> Great!

<producer> Sounds food good!

<producer> Nyssim, how much more time do we have? Should we go to MIDI?

<nyssim> Session will end in 5 minutes, The pitch tracker isn't picking up enough nuance to torture you with...

<producer> Are you sure? I OK

<nyssim> Yes. This went better than I thought anyway.

<nyssim> So let's just do one more take or exchange - how ever you want to close the session

<producer> Yes. Let's do one more take from the top, if that's OK.

<performer> Fine I go ahead. I'll play now. I'll do it one more time while you are listening.

<producer> The last one sounded great.

<producer> Um, in 71, can you start the scale with more of feeling more of an upbeat? It sounded this time almost like you were starting on the beat.

<producer> Well, that one is conspicuous, since it start is the sequence of scales. Just see what you can do. It sounds great... Really!

<producer> Go ahead when you're ready.

<producer> Um, I'm not hearing anything//....

<producer> Level is extremely low.

<producer> ok. It got a little better.

<nyssim> Yeah, I think it's about to crash, I'm having problems boosting them.

<performer> Sure. Any more requests? I'm afraid that's happening in more thanan one place. Right? OK. I'm ready.

<performer> \

<nyssim> No, as soon as [producer's] done, let's call it a session

<producer> OK.

<producer> OK. Done.

<nyssim> Session OVER!!! Thanks.

<producer> I'm stopping recording.

<nyssim> Come back here when you can.

<producer> OK.

<performer> Sorry. Complete Failure. I do it again. Are the levels ok now? fine too.

Session 2

Tuesday, June 13, 2000

<producer> Hello!
<nyssim> Hi

<performer> hi

<nyssim> Is everyone getting ICQ?

<producer> Yes

<performer> hello

<producer> Are you still figuring out how many times the CD goes through?

<nyssim> Producer - is audio okay?

<producer> yes, the audio is good.

<producer> thanks

<nyssim> Okay We're just arranging a chair, then we can start

<producer> sounds good

<producer> I'm ready when you are.

<nyssim> Please start your DATs

<performer> I'm ready

<producer> DAT started

<producer> Nyssim, can you make your font a little bigger?

<performer> DAT started!

<nyssim> How's this?

<producer> better, thanks!

<producer> OK, that sounds good.

<producer> just go through it as a warm up first...

<producer> Did you figure out how many times it goes through the song?

<performer> I'll play through it once

<performer> I 'll change the volume of my Fender Rhodes

<producer> You're switching your mix there?

<nyssim> A little, is it okay? Just trying to give you a reasonable balance. You can make requests

<producer> it sounds like the balance is pretty good now.

<performer> How does it sound to you?

<performer> Beeeee

<producer> Let's think about the form of the song...

<performer> I can't play! :)

<producer> it sounds good so far...

<producer> how about one chorus of chord vamps, no melody...

<producer> then the second chorus comes in with the melody on top of that same (simple) chord vamps...

<producer> think you can do that?

<performer> Yeap...

<performer> Should I start from the beginning?

<producer> let if t finish this time through, still just warming up, then start over with that in mind...

<performer> Okay it just ended.

<producer> cool

<performer> I'm going to start over

<producer> the audio is slightly behind the icq stuff....

<performer> First chords...

<performer> Then simple Chorus...

<producer> so, since there's 8 choruses total, let's do 5 improv choruses and then the head again...

<producer> sound ok?

<performer> right? Hey, let me know when I should go back to the melody...

<producer> ok

<performer> I will forget! :)

<producer> I'll try to tell you when the end of the 7th chorus is coming....

<performer> Shout very loud!

<producer> :)

<producer> he he

<performer> There we go!

<producer> ok

<producer> ready when you are

<producer> I think this is the last time for improv....

<producer> HEAD!

<performer> OOps!

<performer> I missed it...

<performer> I suck!

<producer> that's all right....

<producer> I wasn't sure if I warned you in time of r not...

<producer> are you already starting over?

<producer> oh ok...

<producer> I think it went pretty good.

<performer> What do you think?

<producer> we should do something with the improv section though too...

<performer> The all thing was pretty bad anyway!

<producer> maybe start with the nice downwards run you put in at the end of the melody (you know in the on e bar of rest) -- and use that to start the improv stuff?

<performer> Okay I see, but I would think that a good F to start with would sound cooler... What do you think?

<producer> Also, I think an F right on the downbeat?

<producer> that definitely puts it in to place...

<producer> would you rather do the melody right on off the bat?

<performer> And I', m not sure about the chords at the beginning...

<producer> yeah, you're probably right.

<performer> Well it's a little strange to just put chords for the whole thing. In the original recording, they usually have an intro, but we don't...

<producer> true.

<producer> it makes it kinda hard....

<producer> i guess maybe just starting into the head is the best move the.....

<performer> :)

<producer> Also, in the second phrase of the melody, is there not supposed to be a F instead of that E-flat?

<producer> no, before that phrase....

<producer> the second long held note (like the very first note of the song, only the second time it happens).

<producer> the 5th bar of the song on my chard has a F natural in stead of the E-flat that is in the first bar....

<producer> that's all I'm saying.

<producer> yes

<performer> Where here? After that? Like that right?

<performer> That was a mistake...

<producer> ah

<producer> cool

<performer> I didn't play for a while...

<producer> tell me before you start the background track again... I paused my DAT....

<performer> Me too

<producer> ah, ok

<performer> Ready?

<producer> ok

<performer> OK

<nyssim> Not necessary. You can let the DATs roll there's plenty of tape...

<producer> hey, I just had an idea....

<producer> how much of an intro do you think we could fit over the top of the guy saying "1, 2, 1,-2-3-4"?

<performer> I'm not an expert of intros :)

<performer> I can try

<producer> just play that part of the CD a few times and see what you can fit over it...

<producer> if it doesn't work, no big deal, but it might be cool! :?)

<producer> ok

<producer> copy and paste....

<nyssim> (you can cue to the end of the last track - but I didn't say that...)

<producer> from the CD you want to give it a try?

<nyssim> yes rewind"" the CD to the end of track 5 you'll have a 2 sec lead

<performer> But how do I know when to start? :)

<performer> I'm going to suck!

<producer> no you're not@@!!!!

<producer> you don t sound bad at all here!

<performer> Funny!

<producer> no, groovy, man!

<performer> That was fast!

<producer> what was fast?

<producer> hhmmmmm....

<producer> now that I heard that little intro....

<producer> maybe it's not really possible to play something over the count-in...

<producer> especially since the beginning of the song would usually have 2 bars rest before it....

<performer> Let's give up on that at least for now! :)

<producer> yeah, I agree.

<producer> it's not worth the effotrt... but thanks for trying. it would be cool to just record you'rer own intro without worrying about splicing it together live, then we could splice the intro on to the song later.

<performer> I'm getting tired... :)

<nyssim> Pitch tracker went to Jazz heaven :-(After next break the producer will be 30 seconds behind the performer

<producer> I like the nice mellow stuff,,,.....don't try to platy too much...

<performer> Okay...

<performer> But it 's boring after a while...

<producer> it's deceptively slow, isn'tit@!!?>

<producer> liked the last chord!

<performer> The tempo is slightly slower than what I like..

<producer> yes.

<producer> I can tell you would like to play it faster....

<producer> if I could speed it up it would....

<performer> Let's get in the slow mood...

<performer> I need a joint... oops!

<producer> we can either take the suggestion of switching to cantaloupe island, or (he he) me too@!11!!!!

<performer> Did I tell you how great I thought Barry's group was :)

<producer> you could also just play your own version of watermelon man without the CD....

<nyssim> You can change to Cantaloupe Island if you want

<producer> yeah, I heard Tod's group was better though...

<nyssim> I heard that too...

<producer> or we could play watermelon island?

<performer> Should we try again?

<producer> or canteloupe man?

<nyssim> Producer - remember what you are hearing is 30 secs old.

<nyssim> Yep.

<producer> wow! this is going to be hard not hearing stuff you do till half a minute later!

<performer> Hey I'll try once again... Okay?

<producer> ok

<performer> Let's go

<producer> You're on!

<producer> (rolling)....

<nyssim> How's the buzz in producer land?

<producer> the buzz seems to be a bit louder that n before, but tolerable....

<producer> Feels like you're slowing down into the grooove..... baby@@!!!

<producer> roll; me a fat one!!!! :>

<performer> oops I missed the end again...

<producer> I guess I really won't be of much use to tell you when the end is from here....

<producer> because you're still playing the middle of the song as far as I am concerned.... :>

<producer> it actually sound s like the best take so far, though@!!

<performer> Yeap but we would need a lot of cut and paste! :)

<performer> I didn't play funky chords in the lower range this time...

<producer> well, maybe that would be an okay thing to do, after all the background tracks are exactly the same, and if there's a pause in you're playing it should work fine!

<performer> Maybe I should try now...

<performer> It's just a little slow for me...

<producer> yes, you should definitely keep the funky chords@!

<producer> yeah, I can tell

<producer> I would be annoyed with the tempo as well.

<performer> I'll try another take... What do you think?

<producer> sounds good, just put in the chords again, and keep it mellow. That way the groove is preserved.

<performer> You're right...

<performer> Thanks Mr Producer!

<producer> ok, let's hear it!

<producer> thanks Mr Musician!

<performer> How much are you getting paid again?

<producer> $220/hr!!!

<nyssim> A bundle

<producer> how about you????

<performer> Same thing...

<producer> jeez, you're getting ripped off!!!

<producer> you're worth WAYYYYYYY more than that@!!

<performer> It think the guy who's going to edit that should get the maximum!

<performer> Let's restart....

<producer> no, this take will not require many editing whatsoever! :>

<nyssim> With my stippend?! that will be about 3 cents an hour

<producer> ok

<producer> he he

<producer> from the top, musician!

<producer> restarting ?

<performer> oops

<producer> oh well, at least you got in once!

<performer> I was right, but I wanted to do it twice! :)

<nyssim> We're pretty close to an hour. So, finish up what you want and let's call it a session

<performer> What do you suggest at this point?

<performer> :) he he he

<nyssim> We can call it a wrap if you 're satisfied

<nyssim> Relatively speaking

<performer> I'm not satisfied, but I'll never be...

<producer> I think we have two good takes, (the last two)some of them are better in one place some better in another....

<producer> but sure, if you want one more pass at it, I'm sure we can use the material to splice together one cool take!

<performer> Let's make another one...

<producer> anything you want to do differently?

<performer> Okay...

<performer> Hummmm... almost everything...

<performer> I guess I need to coordinate get each part at the right place!

<producer> well, like I said, they each have their strong points, but the last 2 takes are pretty good in their own right!

<performer> Okay... Let's just try another one...

<producer> sounds fine to me...

<producer> just don't worry about trying to make it perfect, or it'll never happen!

<performer> I suck totally.

<producer> keep playing!

<producer> you're just losing a few phrases....

<producer> your ideas are cool, though!

<performer> \

<performer> :)

<producer> what we need is a hands free interface to this ICQ thing, then you could tell me what's going on as you play -- it gets in the way to shave to stop playing when you type!

<producer> (not to mention, I sure that my typing this wouldn't be distracting you in the least... ha ha hah)

<performer> Okay At least I have an end :)

<producer> Cool!

<producer> I'll let you know when I hear it@!!

<producer> (hasn t gotten here yet!_()

<nyssim> Okay, end session, I can't pay you anymore :-)

<producer> CONGRATULATIONS, [PERFORMER]!

<producer> you have graduated!

<producer> ok

<producer> see you soon!

<performer> WHAT!?

<nyssim> That was great. Mister Producer guy, can you come back to the office with your questionnaire (don't fill it out yet)

<producer> should I stop the DAT?

<producer> stopped

<nyssim> Yes, please stop the DAT

<performer> Okay... I'll fill out my questionnaire... Maybe I'll do better at that...

Session 3

Monday, June 19, 2000

<producer> hey there
<producer> do you read me?

<producer> hey [performer].

<producer> ok. I'll do the same.

<nyssim> HI: Are you there? We're still filling out papers over here...Do you have a rhythm section coming through?

<producer> oh yeah baby

<nyssim> How's the level?

<producer> good, I think.

<producer> no buzz to speak of.

<performer> Can you hear me?

<nyssim> Okay, as soon as [performer's] ready we'll get you a balance

<producer> hey there

<producer> hear ya

<performer> How is the sound?

<producer> I see [performer's] cursor moving, but no text.

<performer> Hummm.....

<producer> mix is nice.

<nyssim> Can you see his ICQ?

<producer> I have a window, no text.

<producer> talk [performer] dude

<nyssim> Hang on we'll have rejoin

<producer> got [performer] window

<nyssim> Can you see him now?

<performer> hello!

<producer> and text

<producer> ok.

<performer> Okay

<nyssim> Great. We can start the session...Have fun

<producer> ok, where are we in the background here...

<performer> I'm still trying to get the changes...

<performer> It

<producer> ok, I'll start the tape, and we'll just start when we start.

<producer> cool?

<producer> here it comes...

<producer> you burn, man.

<performer> Okay It's over...

<producer> ok. I stop tape now.

<producer> ok, rolling.

<performer> Well... I'll have a hard time to stay in the chart...

<performer> :)

<nyssim> You can just let tape roll for the whole session - no need to stop unless you needed to listen

<producer> I hear the buzz now, but it's minimal.

<performer> I'll start as soon as I start recording.

<performer> playing :)

<producer> ok, my ears are awaiting

<performer> How's the sound out there?

<performer> How's the piano?

<producer> slight buzz, low at 60 hZ, silence otherwise.

<performer> no?

<producer> mix is good.

<producer> all i hear is the buzz at this very sec.

<producer> ahh, now I hear some rambling.

<producer> ok, are you gonna solo without background?

<performer> OK, let me try to figure out the piece and you tell me how it sounds... Just from a sound point of view... I'll probably stop once in a while to catch the train...

<performer> I'll start the background

<producer> ok, let's get a start measure so we can gauge it... start on measure 3?

<producer> bingo

<producer> smooth

<producer> hah, I still hear you playing..

<producer> ah, ok, so It'a bout a 9 sec delay.

<producer> heck of nice run.

<performer> I missed that

<performer> Okay, I'm going to start over...

<performer> I'm lost

<producer> ok. What would be cool is if you can go for a bit like establishing the tune, then get all funky.

<performer> Yeap

<performer> but they have a weird change for the C that I can't never quite get...

<producer> you wanna practice again?

<performer> There is no real end... I have to start the chorus earlier...

<producer> you know what might be cool is if you le that change roll, like stop and listen, then fine in to some lick right after the change. Cause the background is pretty groovy.

<producer> hmm.. Which measure is that?

<performer> I see... But I expect a big C and it never comes... They play G bass on a C chord... I have to put this C chord, but I miss the time...measure...

<performer> Oh and I forgot to tell you... I miss a note on my piano... the middle C is broken. hummmm

<producer> ahh. doh! inconvenient.

<performer> Let's start again...

<producer> well, that helps with the C/G

<producer> ok.

<producer> ahh ha I hear that.

<performer> no no

<performer> no!!!!

<performer> They’re wrong...

<producer> that’s okay. Oh, I see what you mean.

<producer> ahh, yes. well, can you dig that/ i mean can you roll with it?

<performer> I don’t get it

<performer> Let me get the melody right during the chorus, so that I can understand it ...

<producer> ok . take your time. this is like jamming with stubborn musicians.

<performer> what?

<producer> huh.

<producer> I think that they are like faking you out.

<performer> once again....

<performer> I missed it again...

<producer> lemme hear it..

<performer> This is where I expect a C...

<producer> yes, well, you can vamp there i think and it will still sound good.

<producer> nice work.

<producer> you’re gettin it.

<producer> sounds good to these ears.

<performer> I ’m having a hard time...

<performer> :)

<producer> here’s a thing to help: it’s only a mistake if it sounds bad.

<performer> :)

<performer> right.

<producer> otherwise, it’s _jazz_ man.

<performer> I’ll try again...

<producer> do or do not. there is no try.

<producer> I think you’re sounding good.

<producer> [great, thanks]:

<nyssim> I’m going to pop in the delay at the next break. That adds another 30 seconds between you. It’s beenflakey today. You will definitely get more buzz and lower sound quality, but if it’s too unbearable let me know

<performer> What are you talking about :)

<nyssim> That’s the end of the last take

<performer> Okay, sir producer... I got the 2 first pages? right...

<producer> ok, mad buzz now.

<performer> I think they

<performer> Why

<producer> interesting feedback. Kind of ghostly.

<performer> I will try to get the rest now.

<performer> Fun... It’ll cover the mistakes... :

<producer> you’re gold, man.

<performer> Once again

<nyssim> Are you still getting that ghost image?

<producer> nope.

<producer> oh wait, sorta. it's faint

<producer> hmm, I get no background. only [performer].

<producer> ok, here it is..

<nyssim> You should have lost the rhodes for a few secs. Hows that?

<producer> oh wait wait wait it's -- it was out of sync.

<producer> background is a little faint

<producer> ok, now they're in sync.

<nyssim> Is the buzz tolerable?

<nyssim> Sorry :-(

<producer> buzz is tolerable.

<producer> hey, do your worst!

<producer> interesting distortion.

<producer> kind of cool. bass.

<performer> I was trying to fallow...

<performer> From the beginning again...

<performer> beeuuuuuu

<producer> listening.....ok., i thought that sounded alright. remember : DYNAMICS.

<performer> what kind of sound do you have?

<producer> you sound clear, but the bg is somewhat distorted.

<performer> Okay

<producer> the important thing is that I hear [performer] clearly. and I do.

<nyssim> I'll try to fix the background. The ghost is still there but quite. If I can't knock it out, I'll switch back to normal mode

<performer> Okay, I'm not so sure about that...

<producer> listening...

<producer> ...

<producer> ...

<producer> ...

<producer> better dynamic s that time..

<producer> ...

<producer> ...

<producer> ...

<performer> I'm still listening what they do, so I can't really let go...

<producer> I hear ya. cool thing would be to let them go a bit, then slliiiiddee on in , maybe play some lower bassy notes..

<performer> to what

<performer> hey... Tell me when I off, when it sucks or when it's good...

<performer> unless there is a big delay...

<performer> Actually I can figure out from that...

<performer> hummmm that 's kinda long huh?

<nyssim> Yep LOONNGGG

<producer> due, de, it's a 30 second delay. yes. the best I can do it give general feedback, but I'll try to make notes. here..

<performer> I just restarted!

<producer> wow, long delay. very nice transition from chorus to solo. I'm listening for dynamics.

<producer> maybe pretend like the bass is a soloist that wants to be heard every once in a while..

<producer> very nice turnaround.

<performer> Tell me ..it really sucks...

<producer> excellent bassy musings. I'm telling ya.

<performer> I always miss this change...

<producer> ok, that part where you let the change roll and then came in kind of worked, kind of didn't, but we can go with it.

<performer> One last time...

<producer> hit it T.

<performer> I give up!!!!

<performer> OVER

<producer> no way, man. That had it all. dynamics, bassy musings., "mistakes." everything.

<nyssim> Five minutes till the end of the session. So, this next take will be the last. You can wrap up what ever you want. (By this last take, I mean the next one...)

<performer> I think the guy who 's in charge of editing will have a lot of work again :_)

<nyssim> Not at all my good man :-)

<producer> it's spun out. stopping tape.

<performer> I turned off mine...

<nyssim> Mr. Producer guy. Can you turn off your DAT and come back to the office. You can leave everything else the way it is.

Session 4

Tuesday, June 20, 2000

<performer> why do you appear to be away? ;)
<nyssim> Hi:

<performer> looks like it :)

<producer> I m here

<nyssim> Everyone seeing each other?

<nyssim> The two of you can talk about what you're going to record...

<performer> well.. i guess i can just play some improv music we can outline some parts of it if you wish,...

<producer> I m just going to ask you a few questions about what style of music and what your thoughts about comparisons to other musicians and that I can compare it to.

<performer> sure. ok

<performer> ok :)

<producer> So is this going to be a little out (Jarrett) or really out like zorn

<performer> well the style is I guess something of a mix between (tell me if you don't know who I'm talking about)..keith jarrett, kenny barron, john zorn, and some things alike...probably a little closer to jarrett (as on a synth being really out with an acoustic piano sound can be a rather disastrous ;))

<producer> ok

<nyssim> Are you ready to start the session?

<producer> seems fine

<performer> sure,

<nyssim> Please start the DATs

<producer> ok

<producer> how long do you think that the piece will be ?

<nyssim> And go for it...

<performer> nyssim what do you think? I can play from 2 minutes to 40 minutes or whatever, so tell me what the length

<nyssim> roughly 5 minutes gives you enough to work on, but gives you enough time to do several takes in an hour

<performer> ok then

<nyssim> It doesn't need top be exact.

<producer> Are we planning to do some editing of the material in the future ?

<nyssim> You can producer as though it will be edited, but you can't do punch ins per se. It's okay to approach the session that way though

<nyssim> (it can be edited later)

<producer> I think for the first go round that you should just play .

<performer> ok so should I keep an eye on the icq while playing so that I can see what I'm do told? ok.

<performer> shall I start?

<producer> sounds good

<producer> take 1

<nyssim> [Producer], if you get al lot of clipping let me know.

<producer> ok

<producer> I m getting clipping on all the peaks

<producer> much better

<nyssim> Okay, I have to stop you...[Performer] could you lower your out put a bit, I'm still clipping

<producer> He is not supposed to be looking away

<producer> sorry,

<nyssim> We'll have to fix this in between takes...

<performer> k

<performer> ah ha I was supposed to be looking ;)

<producer> Looks like I'm about 230 sec behind

<performer> now i am going to slam the keyboard for nyssim, so be looking out ;)

<producer> [Performer]

<nyssim> That sounds better here. Were you still clipping [Producer]?

<producer> It sounds better now

<performer> okay, [Producer], what did you want to say?

<nyssim> Okay we can resume. That 30 secs is off the Network, it's not me screwing around :-)

<nyssim> Go for another take if you want

<producer> The basic form seems to be broken down into 4 parts is this the basic idea

<performer> hmm, I haven't thought of it that way as for me it is more an energy level thing - I have some idea may it be some melody or rhythm and then I think how I can take it and tell a story with it, kinda like that :)

<producer> how do you think when you come up with a basic kernel do you have any way of finding the same feeling familiar feeling again

<performer> i am not sure i understand you completely - do you mean if I were to take another take now with the same kind of melody would I do the same structural composition or you mean something else??

<producer> exactly

<producer> the basic contour of the

<performer> yes I probably will do something that has the same melody in its kernel (if that's what we want) but it will sounds different because I of course had no clue what I am going to play before I touched the notes).

<producer> I understand and that is exactly what I am looking fore

<performer> ok let's do it then?

<producer> Take 2

<performer> nyssim can I start?

<nyssim> Yes

<performer> ok

<performer> :)

<nyssim> I'm going to switch to MIDI/synth send to you Mark - should clear up some buzz, etc

<producer> I m still listening to the take

<producer> ok [performer]

<performer> yes?

<producer> that had some very nice parts to it do you

<producer> Do you feel that it is stands alone like a complete thought or do you feel that it had sections that you didn't feel that the flow was solid

<performer> thank you first of all for the compliment.

<producer> I had the same feeling here

<producer> it was more disjunct compared to the later sections

<producer> in the first take you played some very nice parts in what i would call the second theme (About 2.45 1.45 into it)

<producer> where there was some nice melodic sections continuity

<performer> as to the flow, yes I thought that the first part wasn't as well connected to the rest as I intended to. I agree I think I know the part you are talking about.

<performer> hmm, ok, would you think it will be better if the melody is something that serves a more "uniting" role? so to say?

<producer> no I'm not looking for a "head"

<performer> I get you :)

<producer> It was more the feeling of the line moving forward

<producer> Shall we do another take and try to apply some of this

<performer> sounds good to me, nyssim?

<nyssim> You don't need to ask...ready when you are:-)

<producer> Take 3

<performer> nah, that I didn't like.

<producer> again, There were moments where things came together but I agree, I t seemed a little "light"

<producer> too much melody,

<performer> not sure if it's melody or not, but it wasn't didn't have a sense of direction, it just stood there and then went nowhere ;)

<performer> he heh ;)

<producer> I'll use the dreaded term Yanni like":)

<producer> yea why don't ewe try something a little longer say 7 or 8 min to see if we can develop a sense of completion rather than feeling like we have to stop

<producer> top

<performer> ok shall we try again? Sure ok

<producer> take 4

<nyssim> It's closing in on an hour. So, we can wrap up here, but if you want to finish something up go ahead

<producer> ok nyssim here is a question for you

<producer> I want to listen to some of the stuff we did at the top of the session to see about editing

<producer> do I ignore the technical probs

<nyssim> Yeah, just listen for musical issues

<producer> [performer],l

<performer> ok. yes?

<performer> sure

<producer> I'm going to go away for about 3 min to listen to one thing

<producer> [performer]

<producer> I was just listening to some of the stuff from the first take and it is very interesting how that relates to the last take

<performer> actually it possible y can be mixed together in some way, what do you think?

<nyssim> We do have to stop - sorry....

<nyssim> [producer], could you come back here with all your paper work. You can leave everything the way it is in there

<performer> ok we will talk. thank you [producer] :)

Session 5

Wednesday, June 21, 2000

<producer> Hi

<nyssim> We're just tuning here...

<nyssim> Good. He's just tuning to the CD

<performer> good...

<performer> I 'll find which track on the cd...

<producer> I can hear the music now.

<producer> wow

<nyssim> Let me know how the mix is...

<producer> Sounds good so far...

<performer> more tuning required...

<producer> Okay

<nyssim> Remember to start your DATs. It's okay to just let them run

<performer> ok

<producer> DAT started

<producer> Good sound...

<performer> DAT recording

<producer> How can you tune and type at the same time?

<performer> that would be a cool skill....

<producer> There is a long delay...

<performer> all right, I don t really know the way to start...

<producer> Play it once.

<performer> but probably just running through the song a couple of times to get it..

<performer> ok

<producer> Is there an intro?

<performer> just the "1-12-1-2-3-4" thing...

<performer> ok

<producer> I would start straight! No intro then!

<nyssim> There was a long delay last night too. That's our ML network. If it's very long, I won't add 30secs later. Keep me posted

<performer> yeah, we know that is too hard to try to overlay an introo on that...

<performer> ok

<producer> It's not necessary either

<performer> I'll give it a shot.

<producer> Go!

<producer> Just starting now!

<producer> There is already 30 s

<producer> Wow it 's f... fast

<producer> Stop Turn off grappelli's track and try now!

<performer> how many

<performer> they do it a lot of times on the cd!!!!

<performer> yeah

<performer> it's weird

<producer> oopps I'm still waiting for the end...

<producer> Don't speak, it's cheating!

<performer> I guess the best thing to do is just see about making a shorter version somehow...

<producer> hummm

<performer> maybe trying it with a fadeout in the mix later?

<performer> I dont' know...

<performer> didn't is t seem kind of long?

<nyssim> I can boost the CD if you want, just ask. I can change the mix

<producer> I can hear you slightly louder than the rest. It's fine for now but not for the final version of the recording.

<performer> ok

<producer> yeap a little long. You would need a break with another instrument... Don't you have a trumpet ?

<performer> well, maybe the thing to do is see if the other song (scrapple from the apple) is shorter?

<performer> let's try it once and see...

<performer> that's true....

<performer> I guess that is a good suggestion!

<producer> It’s up to you. You could also change style in the middle. Do longer lines with less notes.. :)

<performer> well, I still want to hear the other song..

<producer> And also a little part with double notes...

<performer> yeahb both good suggestinosoninos! ons!

<producer> Okay...

<performer> so, once through scrapple?

<nyssim> you got it

<performer> cool

<producer> A little more CD would be nice... Not too much though... Thanks

<performer> I’ll start it.

<producer> swing man!

<producer> nice....

<performer> i don t know...

<performer> it seemed a bit more manageable... slower and maybe not as long?

<performer> true

<producer> First it’s a little slower so it gives you more possibilities...

<nyssim> mix okay?

<producer> Not bad...

<performer> probably the best thing to do is switch to scrapple, then?

<producer> violin sounds a little aggressive...

<producer> scrapple Okay.

<performer> ok

<performer> I’ll give that a try.

<performer> ok

<producer> Could you play the melody. Stop for a second, and start the solo with a few notes and long strokes before you start to play faster...? No double notes for the beginning.

<producer> As Like something mellow.... just to mark the change...

<producer> Yeah! great idea.

<performer> I’m thinking it might be good to throw in a few other hints at stupid pieces like "flintstones" or something ::>

<performer> yeah

<producer> Especially because you’re the only one playing... let go to fun stuff....

<performer> it is hard to be a solo jazz violin...

<producer> You’re doing well! :)

<performer> yeah yeah

<performer> :)

<producer> come on... I thought it was still grappellii playing...

<performer> so

<performer> no way, man! He’s like FRENCH and stuff.... !

<producer> That ’s true!

<producer> :)

<performer> :)

<performer> ok

<performer> so my lowly California style doesn’t quite compare... I’m a bit too aggressive.

<producer> It sounds more like.... I don't know... The Beach boys?

<performer> (ok, a lot too quite a bit too aggressive)

<performer> ())

<performer> you're saying I sound the Beach boys?

<performer> that s hard to do on violin, I bet!

<producer> well, you know playing the violin on the beach kinda thing....

<performer> ah

<performer> that I've done.

<performer> :>?)

<performer> ok

<performer> should i play more?

<producer> GO!

<performer> cool

<performer> we're rolling!

<producer> I'm waiting!

<producer> There's about 30 S

<producer> Good start!

<producer> Stay in the tempo! I like that...

<producer> Cool!

<producer> some 16th of notes... you can do it...

<producer> triplets :)

<performer> so, I forgot one thing.....

<producer> What?

<performer> FLINTSTONES!

<performer> :)

<producer> oops

<performer> ok, so I forgot many things...

<performer> like how to play...!

<nyssim> I'm gonna pop in the MIDI converter for one take. It's not too accurate but very cool...

<performer> yes, but I can't seem to remember when that comes.

<producer> And you could replay the melody too before the end...

<producer> No it sounds really good.

<performer> i cu

<producer> I know that's kinda hard...

<performer> I guess the melody is not absolutely critical, but have you noticed how many times it goes thorough?

<performer> I've been forgetting to even count that!

<producer> It's not critical but it 's good since it's already long.

<performer> hmmmm

<performer> well, I'll try to guess, maybe?

<producer> nope They don't say on the book?

<performer> except if I guess too soon, then I'm left with more backing tracks and that sucks.;

<producer> At least try to play it... Maybe twice if it's not the end and finish with a fun thing in case there is more :)

<performer> yeah, that's a good plan!

<performer> finish with a fun thing, that's my goal in life!

<performer> :)

<performer> you want to hear more?

<producer> What about slides... ? Maybe it's cheesy?

<producer> Yeah more...

<performer> you want to and to hear

<performer> ok, yeah, you're right they're dangerous...

<performer> too much and they turn into moldy cheese,

<producer> and in MIDI! :(:)

<nyssim> (Just once - try it)

<producer> :)

<performer> so, the MIDI Thing is on!!!

<performer> should I play the whole thing in double-stops? :)

<nyssim> er-no

<performer> sorry, nyussssim!

<performer> cool

<producer> Okay I liked the beginning. And the break before you attack the solo.

<performer> I'll try it again, whenever you're ready.

<producer> :)

<producer> I'm ready

<producer> I still have 30s to bother you...

<performer> kinda...

<producer> Do you read the screen while playing?

<performer> but not all the time.

<performer> I say ww some of it last time.

<performer> why, are you going to start saying things about my mother???!?!?

<producer> Imagine it's 30s late... :)

<performer> :)

<performer> ok

<performer> I'll start now.

<producer> GO

<producer> There is like a funny echo now?

<producer> No that's okay...

<nyssim> The ornette version!!!!

<producer> wooow it's out of tune. even though the melody sounds okay

<producer> :)

<nyssim> It wasn't that bad before - never mind

<producer> That was interesting.

<producer> good!

<producer> I like the changes in rhythm

<producer> followed by fast regular lines...

<producer> try some 16th :)

<producer> cool 3 triplets

<producer> YEAH!

<producer> Hey [performer] did I tell you we're going to pick up a girl before Ed's party?

<producer> Just wanted you to know!

<producer> If I'm disturbing you, let me know...

<producer> You should think of going back to the melody...

<nyssim> I'm going to pop in the delay...

<performer> ,juhmyuhymygnoooo

<performer> oops

<performer> missed the melody again!!!!

<performer> what is this distraction technique???

<producer> ooops I forgot...

<performer> you're supposed to Produce, not Deduce!

<producer> I wanted to put you in the mood!

<performer> :)

<performer> ok

<performer> so it can help

<performer> but she has nothing to do with the song... :?>)

<producer> Girls always have to do with the song...

<performer> ok, then it'sNyssim who put me in the mood!

<performer> :)

<producer> I seeeeee....

<performer> (sorry Nyssim)

<nyssim> I always wanted to be in a Bird tune :-)

<performer> hehe

<performer> so what do you think?

<performer> i know it has lots of points that are pretty messed up....

<producer> In general it's goood!

<performer> changes between rhythm?

<producer> I think I'd try some more strong changes. And you can take breaks... But sometimes it can go fast and never seem to end....

<performer> true

<performer> that's the problem with bird tunes (and my limited repertoire)

<producer> changes between rhythms, styles, moods...

<performer> ok

<performer> that's good

<performer> the rhythm section kinda locks me in, though.. ugh.

<producer> You can do it...

<performer> it's hard to change moods too much, for instance.

<producer> I know it's a style in itself... It's hard to change it with the section you have...

<performer> oh well, let me try again.

<performer> ok?

<producer> Think of a girl :)
<performer> ok :) :)
<performer> Hey Nyssim, come here!
<performer> :)
<nyssim> I don't think that's in the spirit of the experiment. I'll check with COUHES
<performer> damn!
<performer> :)
<performer> ok
<performer> ready?
<producer> GO
<performer> we're off!
<nyssim> Don't forget you're delayed (even more)
<producer> wooow
<producer> That'll be fun!
<producer> still waiting...
<producer> Okay!
<producer> I need more CD and less violin...
<producer> I can't hear the CD almost...
<producer> cool
<producer> Nyssim, can you fix it?
<producer> Okay it's better already...
<nyssim> Sorry, no band for a moment
<nyssim> How is it now?
<producer> It's good...
<producer> Violin is still a little louder...
<producer> goood [performer]!!!
<producer> zing zing zing
<producer> nice
<performer> well well!
<performer> I actually caught the last half of the melody! :)
<producer> I will get it soon...
<performer> hehe
<performer> annoying to not be able to keep up, eh?
<producer> There were really nice stuff !
<producer> Okay it's over...
<performer> well, it has sections in think I liked -- but overall it was kinda poor.
<producer> no no no
<performer> yes yes yes
<performer> oh well
<producer> It's very fun
<performer> yes it was fun
<producer> It's very alive

<performer> I wouldn't mind trying that once more if we have time....
<nyssim> About 10-12 mins to go.
<producer> Sounds good to me@!!
<performer> ah
<performer> cool!
<performer> more than once!
<performer> let's just go again, ok?
<producer> Okay
<performer> any quick suggestions?
<producer> hummmmm
<producer> I liked the 16th :)
<performer> ok
<performer> I'll start
<producer> take breaks
<producer> And build patterns when you restart... That will help you to not get bored...
<producer> Starting
<producer> Nice break
<producer> swing baby
<producer> I like that...
<producer> You fly...
<producer> Think of returning to the melody...
<performer> hmmm maybe I should have looked a bit earlier about your last comment:> :)
<producer> oops :)
<performer> you heard the whole thing yet?
<producer> Nope...
<performer> I heard the bass part go to half time right at the end, but by then it'skinda too late!
<producer> yeah That's right!
<producer> yeap.. over now!!!
<performer> ok
<performer> I know I can do that one better
<producer> What can we do now?
<performer> that must have been the worst take yet.
<performer> I think I'm getting worse!
<producer> I heard very gooooooood lines... really!
<performer> well, the ideas were sometimes there, but execution wasn't what I wanted this time....
<performer> once more?
<producer> Kinda tired?
<performer> yeah, maybe
<performer> but yeah, let's try again.
<nyssim> This will be the last take...
<producer> Go for once more...
<performer> maybe ok

<producer> LAST TAKE!!!!

<performer> that's good,

<performer> I better nail it! :)

<performer> ok

<performer> deeeeep breath...

<producer> Especially the end... We have good half at least...

<performer> ok, now I'm ready; :)

<producer> I'll try to warn you!

<performer> cool

<performer> I'll try to keep an eye out...

<producer> There is even more...

<nyssim> About 45 secs

<producer> I'll count!

<performer> but you'll probably have a hard time with 30secs delay!

<performer> sheezsh!

<performer> ok

<performer> ready, set GO!

<producer> Tell me when you go press!

<producer> Didn't start but I'm sure it's sounds great!

<producer> Nice

<producer> Coool

<producer> 1st WARNING!!!!!!!!

<producer> cool!

<performer> good timing on the warning -- only a few bars late!!!

<producer> I can hear now

<producer> That was good

<performer> cool

<performer> time to finish up.

<nyssim> We'll have to wrap it up.

<producer> perfect!!!!

<producer> I'm coming back

<nyssim> [producer], can you come back here to fill out the paper work. You can just leave everything the way it is...

<producer> Okay.

<producer> DAT STOPPED

<performer> DAT stopped

Session 6

Monday, June 26, 2000

<producer> yo [performer]?
<nyssim> Hi everyone there

<producer> IC Nyssim. Hi.

<performer> Hi there

<producer> Good - all here.

<nyssim> Can every one see everyone

<performer> Yup

<nyssim> Okay. You can start whenever you want. You two decide how and when to begin. If you need me to adjust the mix, [producer], just ask

<performer> [Producer] I'm think I'm in tune and good to go

<nyssim> Oh and start the DATS please...you can let them run

<performer> Aha. pressed play, and it's going

<producer> Okay.

<producer> Okay - I've not started my DAT yet, but let me check a think or two with mark: Sounds good in here, I'd like to check levels first. So just , play, play soumpin'.

<performer> Word. I'll start quiet, and get louder

<producer> Perfect. Fire when ready, gridley.

<performer> OK?

<producer> I'm on a long delaaay — but yep -looks good.

<producer> So let's starts. Rolling here...

<performer> OK

<performer> Voila.

<producer> hang on....sweet so far...bravo.

<producer> Let me figure out how to ID that on the DAT and we'll do more. Bear with me.

<performer> How do you write an index? Nyssim?

<nyssim> Actually, on the portable you can not index on the fly. You can keep times if you want

<producer> O I thought it would do it if I nebber mind - lissen to nyssim.

<performer> I'm doing it by hand .. we're at 8:34

<nyssim> You're times will not be synch'ed...

<producer> I'll do same. Sorry for the pause. So , you want to do something else? That was fun so far. Okay. Ready when you are.

<performer> Sure

<performer> Any suggestions?

<producer> Um, how about slow and chordy?

<performer> Word homes.

<producer> ??

<performer> rolling?

<producer> Roollling. Thanks.

<producer> liking this. more.... :)

<nyssim> Just so you know, [performer] can not listen to the first take...his DAT was misbehaving.

<performer> Rats

<performer> thanks

<producer> yay!! That was sweet.

<producer> Do you want to take a minute to work on the DAT?

<nyssim> Fixed now. He should have most of the second take.

<producer> OKAY.okay. [performer], any preferences yourself?

<performer> I think Nyssim fixed it...?

<producer> Let's do something really , um, abstract. I heard some of your effects earlier when setting up - do you have a favorite setting that you'd like to let influence your playing :)>?

<performer> Oh shucks, I'm happy either way.

<producer> YEAH!!! I'm game. Stand Let me get a level first (and please remember there's a delay.). Just play loud for a moment...

<performer> Yes but it's very obnoxious. I'll try it out, and feel free to call "Uncle!"

<producer> Got it. Works for me. Shall we roll?

<performer> sure

<producer> Rolling.

<producer> yes yes yes :)

<nyssim> [Producer] - the next take will be synth (analog synth sound it sounds more musical than the dist gtr sound)

<producer> COOL. (Nyssim - Is there a way to make the font bigger on your ICQ window? It's a bit teeny...)

<nyssim> OK?

<producer> [performer] - nice..

<producer> Nyssim - thanks.

<producer> Okay. Mark - do you do anything with open tunings?

<performer> Some stuff, some elaborate chords I try to throw in there every now and then. Any tuning you have in mind?

<producer> No, I've been a fan of guitarists who invent their own tuning s and then make music around the results...

<performer> Well, then, I'll come up with something now. Suggestions?

<producer> Nothing lower than C in the bass :)

<producer> You can do a simple DGDGCD if you're into simple quiet lots of fifths.

<producer> I gotta tell you what that what our friend Nyssim is doing is making it sound really amusing. At least I think that's her and not your guitar.

<performer> In the time between when I played and when you heard, I went for a c - sort of thing. I guess I should hit up all my Kitaro riffs?

<producer> Cool - yes. I'll roll when you say you're ready.

<performer> Good to go

<producer> Rolling...

<nyssim> [producer] - the tracker can't handle decaying notes :-(I'm gonna switch back...

<producer> I noticed. Whew...

<nyssim> Ah well...

<producer> Oh - THAT's what it sounds like!:)

<nyssim> I told you it wouldn't be easy..

<producer> It was also a monophonic synth patch, as far as I could tell. Through the synth was amusing, without it's actually pretty.

<performer> done

<producer> Almost done at this end. I' liking it.

<producer> Ah. Nizee....

<performer> It's alright -- I may have bit off more than I can chew with that tuning

<producer> I hope you get to hear the synth'd version.

<performer> Yeah, that in mono ouch

<performer> Thanks

<producer> yeah. MI think the chord stuff is you do is really lovely. Would you like to do another improv in a more traditional tuning?

<nyssim> Don't worry about the pitch tracker...

<performer> Sure. Maybe I should try a more single note thing for Nyssim?

<producer> I'd say stick with the chordy stuff. MM, more harmonics?

<performer> All right then

<performer> Was that comment or suggestion? the harmonics?

<producer> Oh - it was a suggestions. I just now heard you tuning using harmonics - pure coincidence, I swear... ":)

<performer> That's right, the lag, the lag.

<performer> You'll be happy to try some harmonics stuff. Nope

<performer> Tuned enough now, so ready

<producer> Let me know when you've tuned and are happy to go. Okay.

<producer> I am rolling...

<performer> moody...

<producer> :) :) ...

<producer> I'm loving it! (still...:)

<nyssim> [producer]- after this take you'll be an additional 30 secs behind and worse audio quality...

<producer> Oh boy - ,more delay. But [performer], that was really, really lovely.

<nyssim> Nyssim knows but she's evil...

<performer> Thanks. Gosh. Golly. I'm flattered

<performer> mwaa haa haaaaaa

<producer> It will be a bit harder for me to sync up, since I'll be further behind (I wonder if Nyssim knows that the RA server is alreay about 30 seconds behind, as far as I can judge:)

<producer> Count Cholcola!!

<producer> So maybe something more up tempo? What if you tune the E down to a D and riff on a D tuning for a bit?

<performer> I'll whip out whatever hillbilly I have in me

<performer> ready

<producer> Sure. (I ll just count ceiling tiles until I hear sound come out of these speakers! Evil Nyssim!)

<producer> Rolling...

<producer> Okay. I'll ignore the notes I have yet to hear.

<performer> Sorry, I thought I was more in tune than I am

<performer> wow. I guess I'll wait till it catches up to you?

<producer> I'll start rolling now. again now. Rolling...

<performer> OK, I play now

<performer> Wow. That's some delay

<producer> yep. there . you ended. half hillbilly, half alex de grassi?

<performer> AL

<performer> I reckon so...

<producer> Are you a degradssi fan by any chance?

<producer> There's an old album of his, Slow plow Circle, which is a must have for any solo guitarist, IMHO.

<performer> Actually, I've only heard a couple pieces here and there

<performer> Well al right. I know more Derek Bailey then De Grassi

<performer> He's *very* abstract.

<nyssim> You won't catch up...

<performer> SO what next chief?

<producer> Hmm - I'll have to find this Derek fellow then. Abstract is gppd/(oops) is good.

<nyssim> You have 5 mins left. So, one more take or you can finish up any way you want...

<producer> [performer], is there something you want do again/.more of?

<performer> Whatever you want

<nyssim> (How would you bridge those pieces together in an edit, R)

<producer> Hmm. (Spin the mental dial) O

<performer> OK. The only effect I have is distortion, but I'll avoid the metal sound if possible (it's a quirky pedal)

<producer> I'd treat them as separate pieces, really. I'd like to see if you [performer]: as a set of restrictions to work with, how about [1] some effect or other [2] slow, sustained notes and whatever you can fit in between. Okay, may be no distortion if you prefer. But at your discretion.

<producer> Ready and rolling...

<performer> ready

<producer> yeep!

<performer> here goes

<performer> ends on C

<producer> ...yum.//..Nice! (I'm chkuckling).\

<producer> If we had time, I'd have you take that one over again since it almost flows perfectly. But call it a wrap.

<nyssim> :-(we don't we'll have to wrap up here

<producer> N: Should I pop the DAT tape and meet in 40'11?

<performer> Should

<performer> Nyssim, should I press stop on mine?

<nyssim> If you could just stop the DAT. You can leave everything as is but come back here for the questions, etc...

<producer> I'll be right there./

<nyssim> [performer] - yeah. Thanks

Session 7

Tuesday, June 27, 2000

<producer> Here I am
<producer> Hey Nyssim, I'm still getting a tiny bit of the delayed signal (30 second delay?)

<nyssim> Why don't the two of you decide what you're gonna work on

<producer> OK

<producer> Hi [performer]! What do you want to do first?

<performer> Hey [producer]

<performer> I think I'll try "doxy", a Sonny Rollins tune (in Bb)

<producer> Cool. This is with the backing track, right?

<performer> Yes

<nyssim> Please start your DATs

<producer> OK. Let's have a go at it. You let me know when you're ready.

<producer> Just take it through once, and don't worry if you mess up or anything.

<performer> I'd worry if I didn't.

<producer> :)

<producer> I'm all ears.

<nyssim> [producer] - levels okay?

<producer> Yep. levels good.

<performer> OK here we go....

<producer> Very nice!

<performer> Take 1.

<producer> I like how it got adventurous in the middle.

<producer> Heh heh. Yeah, he kind of wanders....

<performer> Thanks, but I may want to fire the bass player.

<producer> Unfortunately, we can't change him :0)

<performer> Well one of did anyway.

<producer> Let's do another take. Just a few things... to think about:

<producer> I like how you came back to the melody at the end. I suppose that's pretty standard.

<producer> I think around the 4th or 5th choruses, you can really go all out. Just do You got pretty adventurous, but I'd say you can go even more.

<producer> I think it might also be cool to do one or two choruses with really big contrasts within the chorus. Do you know what I mean?

<producer> Last thing, just try to watch the rhythm., I know the it kind of sucks having to stick to the recording, but unfortunately, we can't change it :)

<producer> But it sounded really great!

<producer> (ok, I'm done_))

<performer> OK

<producer> Right. Not a lot of interaction there :)

<performer> A lot of it has do to do with trying to get a feel for the keys and the band, and of course there's know room for group breathing

<producer> The book says it's 8 choruses. I can cue you. Can you read this while playing?

<performer> So I'll give it a shot again. Also I wasn't sure when the tune was going to end, so I think I came down one chorus too early

<producer> No problem.

<performer> Yeah that's a good idea. Normally I wouldn't take that many (in fact I'd be kind of pissed off at anyone who did) It's hard to have that much to say.

<producer> Heh heh. Clearly this is a practice recording. :)

<producer> OK. That'll be number 6. I'll let you know.

<performer> Oh yeah - let me know when I have two three choruses left, if you can keep track.

<producer> Ready when you are.

<performer> Cool - let's go.

<performer> this time for real.

<producer> OK :)

<producer> Nyssim, it's gone.

<producer> 3

<producer> #4

<producer> (four left after this one)

<producer> #5

<producer> (three left after this one)

<producer> THREE LEFT

<producer> TWO LEFT

<producer> Last one!!

<nyssim> [producer] - sorry about the phantom...It's ???

<producer> Woops. My bad.

<performer> oops.

<producer> Nyssim, are we delayed?

<producer> That's OK.

<nyssim> [producer] - next time synth patch instead of keyboard out

<producer> OK. Were we delayed that time?

<nyssim> Not delayed - just the internal network - can be up to 30 secs without my help..

<nyssim> synth next

<producer> OK. Hold on.

<performer> Oh well, I think I screwed up turning on the dat anyway,

<producer> Unfortunately, because of network delays, my cueing isn't going to help, I think.

<producer> My cures were probably too late, right?

<performer> Aha!

<producer> Oh well,. I'll do try to anticipate.

<producer> If it looks like I'm crazy, ignore me. ":";)

<performer> ok MAYBE maybe try just hitting

<performer> 1

<performer> 2

<performer> 3

<performer> 4

<producer> Gotcha. Makes sense

<performer> 5 etc as each chorus beings, so It should show up before to long.

<producer> OK. Heh heh. I'll do my best.

<nyssim> He's the son of a record exec you know :-)

<performer> Also try to catch the bass players attention.

<producer> There was some great stuff in the last take. Try let's try it again.

<performer> Thanks, let's try again.

<performer> Ready?

<performer> take 3...

<producer> Yep. Let me OK.

<performer> by the way- I don't know if this is something you need to think about, but when I've done studio stuff I will count it of like 1

<producer> It's pretty easy to edit him out later.

<performer> 1 2 1 2 - 2 - 1 - 2 - 1 - 2 - 12.. and not say 3,4 to give a space before the sound. We have the guy counting off for you, so can you start rolling after that, or something?

<performer> OK just something I was thinking,

<nyssim> You two don't have to worry about editing...good point though

<producer> Good point. Thanks.

<performer> I know, I'm not getting paid to think,,,,...shut up and play

<producer> Heh heh.

<producer> I'm all set.

<producer> 1

<producer> 2

<producer> 3

<producer> 4

<producer> 5

<producer> 6

<producer> 7

<producer> 8

<performer> take 3.

<producer> coda

<producer> Heh heh. IT wasn't that bad!

<performer> well that sucked. take 4.

<performer> Too muck thinking, not enough listening and feeling.

<producer> Well, it I'm hearing a different piano sound than you are. I'm definitely feeling the limitations of MIDI.

<producer> Yeah. I think I'm getting sound about 15 seconds behind you.

<performer> I had some time problems. Also the chorus counting seemed was behind, almost a full chorus, so I think that threw me off.

<performer> OK

<producer> Sorry about that.

<performer> Actually that shouldn't be your job.

<producer> Do you want me to keep doing it? It's easy for me.

<producer> OK. Let's try it again?

<performer> sure.

<performer> take 4 whenever you're ready

<producer> I'm all set. :)

<producer> 1

<producer> 2

<producer> 3

<producer> 4

<producer> 5

<producer> 6

<producer> 7

<producer> 8

<performer> go man go.

<producer> Cool.

<producer> Go for it.

<nyssim> [Producer]- you'll be an additional 30 secs behind at the next take...about 45 secs it looks like

<producer> OK. Thanks. I'm still getting a little leakage.

<producer> Oh wait, it won't matter, since I'll be getting the whole delayed signal now. Never mind.

<producer> Ready for another go at it?

<performer> I'm gonna take a quick listen to the tape.

<performer> ok

<producer> I'm going to be way behind you this time (~45 seconds), so it's probably not worth me counting off verses.

<producer> I really liked what you did towards the end. Unfortunately, I don't get the full dynamic contrast over with the MIDI instrument. But I'm going to assume it sounds good.

<performer> take 5 - any suggestions?

<producer> :)

<performer> I, like that idea.

<nyssim> this will be pno output just delayed

<producer> Um, One suggestion, maybe do one verse almost block chord-style??

<producer> Go with what feels good. If you feel it, go for it.

<performer> I keep trying to get to that, but it has to feel natural, or it won't sound natural, it gets a forced feeling...but I'm working on it.

<performer> let's go...

<producer> I'm all set!

<performer> take 5

<producer> OK. Sounds good.

<performer> I've changed the mix on the band, so the bass will seem deeper (and hopefully easier to hear).

<performer> didn't like it

<producer> OK

<producer> (I still haven't heard take 5)

<performer> take 5.5

<producer> Heh heh. I just got it.

<producer> All set.

<nyssim> We're gonna have to call it a session there.

<performer> you're not missing much

<producer> I'm still getting audio.

<nyssim> Any last comments - when you're done listening...

<producer> OK. I'm done. Yeah, that was great@!!

<producer> I'm happy with that one!

<performer> I can live with that one, I think...maybe I should listen to it (or not?)

<nyssim> Great job. [producer] can you come back here to answer questions etc.

<producer> Yep. I'll log out now.

Session 8

Wednesday, June 28, 2000

<nyssim> Everyone here?
<producer> Yep

<performer> hello!

<performer> so you can hear me already?

<nyssim> How's the mix

<performer> hmmmm

<performer> Nyssim, should I play more?

<performer> ok

<nyssim> Yes, please. [producer] can you reconnect to the server,. If you use the pull down menu on Real audio, It should be the first choice

<producer> I don't seem to hear anything there we go

<performer> ok

<producer> ok why don t we start off with a complete take

<nyssim> Please start your DATs, too

<performer> I'm not warmed up really, so this will probably just be a run thought....

<performer> ok

<performer> I'll start mine y DAT now...

<performer> DAT started.

<nyssim> [producer] let me know about levels as this take starts

<producer> ok

<performer> are we all ready ?

<performer> sure, I'll start typing as soon as I finish...

<producer> yes just let me know when you have stopped so I can figure out the delay

<producer> Ok Take 1

<performer> ok, here we go!

<performer> I don t think I'll repeat the last half....

<performer> it just seems to bee too long, and besides, I screwed up ... :)

<producer> Ok Just to let you know, I', am about 30 secs behind

<performer> ok

<performer> I guess that we'll just have to wait until you've heard everything before deciding what to do next, then....

<producer> Ok lets start by breaking this down into smaller sections to work on

<performer> good idea....

<producer> Lets start at the double bar and concentrate on the section from bar 70 or so to bar 95

<performer> we have bar lines and of course there are the two halves with repeats... which I'm not so sure are needed

<performer> ok

<performer> that s good... are you a back expert?

<producer> as for repeats lets not do them and we'll figure them out in editing

<performer> I'm questioning the A-flat in bar 72 - because in bar the last half of bar 71, b - because in bar 13 there is the same set of notes, but with an A natural....

<performer> it threw me off - but maybe it's right... I don t know

<performer> any rate, I'll play it as written, and assume it is right, then we can pitch shift it up later, if it's wrong (NOT!) haha

<producer> Why don t we play it both ways for safety

<performer> ok

<performer> I'll start at the double bar now and play till bar 95

<performer> sound good?

<producer> good for me

<performer> ok

<producer> me take 2

<performer> that's a weird place to stop... but fine for now;

<performer> I am feeling like the strings of 6 notes in a row that are slurred would be easier to play at a faster tempo....

<producer> What is the tempo that is marked ?

<performer> Presto!@

<performer> maybe it should be a lot faster!

<producer> Think of the 1 in one instead of 6

<performer> yes, that will help!

<performer> maybe I should try it for a bit - not the whole thing, just enough to get a feel for the faster tempo - what do you think?

<producer> Ok from the same place to the repeat take 3

<performer> ok

<producer> and if you could give me the double triple stop from the previous sec that will help for editing

<performer> ah

<performer> I had started already when I saw what you were writing....

<performer> next time I can do that!@!

<producer> ok that seemed to have a better feel

<performer> it actually seemed like it just flowed easier too...

<producer> it is always easier to play these things a faster

<producer> why don t we take the same thing again and concentrate on the articulation in the section from bar 102 till the end

<performer> ok

<producer> seemed to be a little unsure in a couple of spots

<performer> true, I even swallowed a few down beats - i hate it when that happens, they get stuck in my throat!!! :)

<performer> so should I start with the last 2 bars bars before the double bar?

<performer> sure, no problem!

<producer> yes it will make it easier for editing if i have the least a note before the bar I need to edit on

<performer> let me know when you'reready@!!

<producer>

<producer> Ok take 4

<performer> take 4

<performer> that was bad - I definitely have to throw that take out!!

<producer> not the whole take there were a couple of spots that seemed together well

<producer> we need to look at bar 71 for the note and articulation and around bar 83 things seemed to pull back a little

<producer> .

<performer> I guess the difficulty in bar 71 is getting a smooth shift of positions... I can try and make that transparent, and in 83 I guess it just is getting to let it relax a bit too much...

<producer> why don t you try that spot and

<performer> ok, just let me play in t a couple times I'll just go from bar 66 to bar 76

<performer> that was the a natural..... it's hard to avoid, for some reason my finger really wants to go to an A natural, not an A flat!

<performer> hmmmm

<performer> I'll have to practice more to get it completely smooth....

<performer> if I pause on the first note of bar 71 longer, it makes it easier to do a smooth shift, but then messes with the flow of things....

<producer> why don t we just try to get it the best we con and then try to do another take

<performer> look

<performer> sounds good.

<performer> one more a bit more practice.... just a second..

<performer> ok

<performer> I can try another take when you're ready....

<performer> should we continue working on the last half of the piece, or try the whole thing?

<producer> We have used about half our time at this point, but the bigger problems seemed to be in the last half so I am going to spend a little more time on it.

<performer> sounds good to me!

<producer> Ok take 5

<performer> ok

<performer> take 5!

<performer> ooops. sorry, wrong song.

<performer> let's try that again!

<performer> :)

<producer> I haven t heard it yet

<performer> that's ok, I'll start the real one now.

<producer> false start

<performer> well, I'm sure that you're still hearing me, but I'm done now...

<nyssim> The next take will have an additional 30 sec delay and lower audio quality

<producer> that was good there are only a couple of spots that I really need now.

<performer> yeah, it hmmmm I'm not sure where to start....

<producer> if we could find a good place to start before bar 107 and concentrate on bars 112- 120 that would be good.

<performer> ok

<performer> what do you think about starting in bar 95 or so?

<producer> what ever is good for you

<producer> take 6

<performer> ok

<performer> here we go

<performer> well, still has a few things I didn t like, but maybe better...

<performer> good

<producer> yes but we covered the spot that I really needed in bar 112-115

<producer> why don t ewe take it from the top and stop on the first bar of the second half. no repeats

<performer> ok

<performer> do you want me to play the first bar of the second half, or just stop at the double bar line?

<producer> play the bar so I can edit

<performer> ok

<producer> take 7

<performer> sounds good, I'm ready

<performer> take 7 - oops

<performer> take 7.1

<performer> are you still wayyyaaaaay behind me?

<producer> I'm really behind but that was a good take for a bunch of spots

<performer> definitely need a few things still, though@!

<producer> we need to look at bar 12 for notes and phrasing

<producer> bar 30 you know why

<producer> and bar 42

<performer> yes, I agree! that's again the same type of problem as we had in bar 71 - in fact that is the place with the note discrepancy too!

<producer> ok lets take it from the top one more time

<performer> ok here we go!

<producer> Take8

<performer> take 8

<performer> not sure I fixed many of them.....

<producer> ok

<producer> lets take it from the pickup to bar 24 and concentrate on bar 42 and the abAb nat in 30

<performer> sure, give me a minute...

<producer> before we start why don't you practice those spots a couple of times and then do a take from bar 24

<producer> ok

<producer> ?

<performer> ok

<nyssim> yes he is....

<performer> I'm probably as ready as I'll be tonight to try those spots...

<nyssim> Five minutes left

<performer> ok

<producer> while I'm listening to the last take why don t you look at bar 12 the same way and then play a complete tale from the top

<performer> ok

<performer> I'll try a take from the top.

<performer> take 9

<performer> that might be a better take than the other two....

<nyssim> Finish up what you want and then let's call it a session

<producer> ok we just need to cover bar 12 and we have it just

<producer> just rehearse it until it feels good and then take it from the top

<performer> ok

<performer> practicing...

<producer> nyssim

<performer> ok

<nyssim> yes??

<performer> I'll play from the top to bar 20 or so...

<nyssim> You must be listening...I'll end when you say quit, but that should be soon-ish

<performer> ok

<performer> ?

<producer> do I get to listen to this or

<producer> yes

<producer> does this count as overtime for union purposes, ;)

<performer> hey, I want overtime too!!!!

<performer> STRIKE!

<performer> nyssim, you have to pay us more!

<performer> heehhehe

<nyssim> I'll have to make it up to you some other way... Surely you'll need a guitar overdub on something.

<performer> nyssim, you have phone call

<performer> should I answer it?

<nyssim> Naw

<performer> ok

<producer> ok for our purposes here today I think we have covered everything

<performer> yes, I think we should turn the table s on Nyussssim, it's time to get atasetstes of your own medicine!@ :)

<nyssim> Okay, [producer] can you come back here to do paper work..

<performer> where's your ourguitar@????

<performer> sounds good

<performer> thanks!@@#@@! you, [producer]!!

<nyssim> I packed it up to be moved - oh and buried it so no one would ask me to play in public.

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