

# CHAMBERS

BY ALVIN LUCIER  
AND DOUGLAS SIMON



# CHAMBERS

*This page intentionally left blank*

# **CHAMBERS**

**Scores by ALVIN LUCIER**

**Interviews with the composer  
by DOUGLAS SIMON**

**Wesleyan University Press  
Middletown, Connecticut**

Scores copyright © 1980 by Alvin Lucier

Interviews copyright © 1980 by Alvin Lucier and Douglas Simon

Several of these scores and interviews have appeared in similar or different form in *Arts in Society*; *Big Deal*; *The Painted Bride Quarterly*; *Parachute*; *Pieces 3*; *The Something Else Yearbook*; *Source Magazine*; and *Individuals: Post-Movement Art in America*, edited by Alan Sondheim (New York: E.P. Dutton, 1977).

Typography by Jill Kroesen

The authors gratefully acknowledge the support of a Wesleyan University Project Grant.

Library of Congress Cataloging in Publication Data

Lucier, Alvin.

[Works. Selections]

Chambers.

Concrete music.

Bibliography: p.

Includes index.

1. Concrete music. 2. Chance compositions.

3. Lucier, Alvin. 4. Composers—United States—  
Interviews. I. Simon, Douglas, 1947– II. Title.

M1470.L7255 789.9'8 79-24870

ISBN 0-8195-5042-6

Distributed by Columbia University Press

136 South Broadway, Irvington, N.Y.

Printed in the United States of America

First edition

**For Ellen Parry and Wendy Stokes**

*This page intentionally left blank*

## CONTENTS

Preface	ix
1. <b>Chambers</b>	1
2. <b>Vespers</b>	15
3. <b>“I Am Sitting in a Room”</b>	29
4. <b>(Hartford) Memory Space</b>	41
5. <b>Quasimodo the Great Lover</b>	53
6. <b>Music for Solo Performer</b>	67
7. <b>The Duke of York</b>	79
8. <b>The Queen of the South and Tyndall Orchestrations</b>	93
9. <b>Gentle Fire</b>	109
10. <b>Still and Moving Lines of Silence in Families of Hyperbolas</b>	127
11. <b>Outlines and Bird and Person Dying</b>	145
12. <b>Music in a Long Thin Wire</b>	159
Bibliography	171
Index	173



*This page intentionally left blank*

## PREFACE

I first met Alvin Lucier in 1968 when he came to Wesleyan University, where I was an undergraduate, to offer a course in new music. He was still teaching at Brandeis University then and traveled to Middletown, Connecticut, once a week from Waltham, Massachusetts. It was an exciting class that had a strong influence on my own ideas, and when I chose a subject for an honors thesis in 1969, I decided to write on Alvin's work.

At that time, I was most familiar with his piece **Chambers**. I had watched it taking shape in 1968 and had helped perform it more than once by the time I began my project, so it seemed a good candidate for my choice of subject matter. A major portion of the thesis was to be devoted to a careful, objective description of a single performance of **Chambers** at the Museum of Modern Art in New York, in which I had performed, and I felt I needed a block of personal information from Alvin to balance that. If the description of the piece were to be of a specific performance, the idea of a specific conversation, an interview, seemed a promising parallel. And so it was.

In December of 1968, we sat in the greenroom of the Slosberg Music Center at Brandeis, a very resonant, intimate space, and talked with each other. I have a clear memory of the effort involved in making oneself understood with a tape recorder running, but Alvin and I were both pleased with the results.

When we examined the transcription, we found more to please us. Alvin felt his ideas were stimulated and organized by the questions and enjoyed seeing his thoughts on paper. I appreciated that, and also found that his observations and, perhaps more importantly, his

mode of expression suggested several lines of inquiry in my thesis. We were soon excited about the possibilities of continuing the interviews, and we decided to conduct several more with an eye toward publication. Of the many we did, the best ones were always those devoted to particular compositions, and we grew to accept that as the organizing influence in the book.

Alvin is a stutterer, and so has always to be prepared to say something unexpected. I consider this his verbal signature. The kind of compositional decisions discussed here seem all the more revealing to me in the light of this enforced verbal flexibility. To me, Alvin's explanations of his acceptance of multi-level images in the realization of his ideas (the crickets in **Vespers**, the campfire in **Tyndall Orchestrations**) seem to be truly sympathetic to his verbal character.

I'd like to suggest that Alvin's scores, included here as the formal representations of his compositions, may be illuminated by the interviews, informal representations of the same procedures. They are about his music while they are like his music. With this in mind, the reader (who perhaps will also have the opportunity to attend one or more of Alvin's performances) may in fact *experience* a significant portion of a working artist's reality over an extended and productive period of his career.

Douglas Simon  
New York—1978

# CHAMBERS

*This page intentionally left blank*

## **CHAMBERS (1968)**

Collect or make large and small resonant environments.

Sea Shells

Rooms

Cisterns

Tunnels

Cupped Hands

Mouths

Subway Stations

Bowls

Shoes

Hollows

Caves

Suitcases

Ponds

Stadia

Water Spouts

Bays

Tombs

Conduits

Canyons

Boilers

Pots

Ovens

Barrels

Bulbs

Bottles

Cabins

Wells

Bells

Capsules  
Craters  
Empty Missiles  
Cacti  
Beds  
Webs  
Pools  
Boats  
Cones  
Funnels  
Bones  
Stills  
Gins  
Draws  
Tubes  
Theatres  
Cars  
Springs  
Flumes  
Trees  
Others

Find a way to make them sound.

Blowing  
Bowing  
Rubbing  
Scraping  
Tapping  
Moving  
Fingering  
Breaking  
Burning  
Melting

Chewing  
Jiggling  
Wearing  
Swinging  
Bumping  
Dropping  
Orbiting  
Creaking  
Caressing  
Bouncing  
Jerking  
Flipping  
Levitating  
Hating  
Skimming  
Ignoring  
Talking  
Singing  
Sighing  
Whistling  
Walking  
Snapping  
Cracking  
Snoring  
Boring  
Praying  
Loving  
Spraying  
Bowling  
Channeling  
Freezing  
Squeezing  
Frying



Exploding  
Poking  
Screwing  
Lowering  
Shaking  
Impeding  
Dancing  
Others

Sounds of portable resonant environments such as sea shells and cupped hands may be carried out into streets, countrysides, parks, campuses, through buildings and houses, until outer limits are reached where minimum audio contact can be maintained by a player with at least one other player.

Sounds of the outer environment encompassed by the players may be heard with reference to the sounds of the portable resonant environments carried by the players. Sounds of determinate pitch in the outer environment may be heard in simple or complex relationships to the pitches of the portable resonant environments. Sounds of indeterminate pitch in the outer environment may be heard to take on the pitch, timbral, dynamic, and durational characteristics of the sounds of the portable resonant environments.

Sounds of fixed resonant environments such as cisterns and tunnels may be made portable by means of recordings, or radio or telephone transmission, and carried into inner or outer environments. When carried into inner environments, such as theatres into beds, the sounds of the now-portable resonant environments may either mingle with or take over the sounds of the inner environment. When carried to outer environments, such as boilers into parks, the sounds of the now-portable resonant environments may be treated as original portable environments.

Mixtures of these materials and procedures may be used.

Increasing and lessening of any characteristics of any sounds may be brought about.

How did I happen to write the piece? Well, it happened in various stages . . . let me see . . . I remember a film of a Jules Verne book, I think it was a Jules Verne book, something like **Twenty Thousand Leagues Under the Sea**, or one of those books. There's a wonderful scene where men have built an underwater boat, and to get from the shore to the boat, which is moored under the water, several of them are walking along the floor of the ocean with huge conch shells over their heads, as if filled with air. This was nineteenth-century science fiction and the image struck me as something wonderful, walking on the floor of the ocean with those conch shells. I thought of making a piece with instruments, tubas or French horns, in which the players would do something like that, just an idea. And then I thought of actually getting conch shells, huge ones which I could make into bass instruments, conch shells three or four feet high, bass shells, and the openings could be bowed.

About that time Pauline Oliveros invited me to San Diego to perform **Whistlers**, a piece in which I tried to get ionospheric sounds in real time with a radio receiver and antenna. There's something about California, being from the East, palm trees and all that, so I asked Pauline, "Can we get any conch shells?" and she answered, "Well, we'll see." Every day we drove along the ocean front, and we used to pass a funny little store that had a sign that said "Sea Shells." One day I asked her to stop the car. The store was filled with hundreds of seas shells of different kinds and sizes, and the man who owned the store said, "You know, people who live in the Islands have blown conch shells for centuries." Where did I just see in a film, someone blowing a conch shell?

## **Lord of the Flies?**

Tibet! I heard a recording of Tibetan chants on which they played conch shells. Now how do they get conch shells up in Tibet? But that's one of their instruments anyway. So I thought it would be wonderful to make a piece using conch shells as musical instruments, either blown, or bowed, or struck. It struck me as very beautiful that the organisms that produce these gorgeous shells are somewhere down on the bottom of the ocean. What a wonderful origin of a musical instrument, to have it be made for a functional purpose, to protect some animal. When the animal dies, it is a remainder, there it is, it's left in the world, and it's such a beautiful thing it should be put to some use.

My first idea was just to have people blow them. I wouldn't compose it very much but would let the natural pitches of each horn, of each shell, be themselves, although for the sake of some change you could let the players vary the pitches a little by putting their hands in the shells, the way French horn players lower and raise the pitches of their horns. I remember that two of the shells that I bought were almost an octave apart but not quite, so they were slightly out of tune and produced beautiful beats, and I was perfectly delighted to let the chords or simultaneities that the shells produced when played together depend on the pitches of the shells themselves and not on anything I did. I thought of asking the players to spin slowly so that the sounds from the openings of the shells would be beamed out in different directions. Then I expanded that idea to have the players actually disperse.

When we first performed it in La Jolla, we did it outside without any announcement but in an environment with people going here and there. The players began playing in a circle, changing their pitches slightly, turning their horns this way and that, spinning around slowly, and then at a given signal, dispersing outward from the central circle to outer points in the environment, moving as far as they could from one another until they reached the threshold of hearing at least one other shell. At that point, the whole area through which they had moved had been described by the sounds of the shells. By the end of the performance, the players must have moved almost a half mile apart.

Later, when we did it in Steinway Hall in New York, we didn't have that wide open situation. We started inside and moved downstairs and went outside onto Fifty-seventh Street. And what I discovered was that by concentrating on the pitches and timbres of the conch shells, the environmental sounds—buses, trucks, people talking, other urban sounds—got perceived in terms of the sounds of those shells. For example, you're trying to hear another shell player who's aiming his or her shell at you or who's trying to keep in contact with you. Then, as you hear trucks pass, the sounds of the tires take on the pitch of the conch shell on which you're concentrating. It's the old idea of the percussion instruments in the orchestra. The bass drum will take on the pitch of the fundamental of a chord that the orchestra is playing. I was also struck by how space intrudes its personality on the sounds that you produce. We're all aware of that, if not consciously, subconsciously. When we talk here, our voices aren't the same as they are in other rooms—they just aren't—because the space

does all kinds of processing due to its dimensions and materials. I became very aware of that in **Vespers**, the piece I did with those echo guns in which you make the audience hear the acoustic characteristics of the performance space. Good performers have always known these things, for example if the reverberation time is such-and-such, it affects the speed at which you play.

When I was asked to write a score of **Chambers** for publication I decided to expand it. I wanted to make it bigger in the sense that it would imply more, so I extended it to include any resonant environment, large or small, that performers could use to produce or alter sounds in the same way that this room we're in alters our sounds. If a room can intrude its personality on whatever sounds occur in that room, then any other size environment can do the same thing, so for the sake of performing I decided that performers could collect resonant objects into which they could put sounds, and the acoustic characteristics of the objects themselves—shells, pots, pans and so forth—would alter the sounds with their own characteristics. I was making a lot of rooms, but bringing them down to a size with which you could perform. But I didn't say you'd have to use only those objects that you could carry into a performance; you could use environments that you'd find outdoors such as oceans, caves, and football stadia.

You know if you're at a football game you're always impressed by the sound. I used to play in the Yale Band, and we used to form ranks inside the entrance to the Yale Bowl. Everyone would be tuning up and of course the reverberation of that place! Then when we started playing and marched out onto the field, the sound situation changed completely. That experience later gave me the idea that

you can do almost anything in a performance of this piece as long as you think of it in terms of physical environments that alter sounds because of what they are.

When we did it at the Museum of Modern Art we used, as you remember, little pots, paper bags, suitcases, ashcans, all kinds of resonant objects; then the problem was to find portable sounds that you could put into them. We used small battery-operated cassette tape recorders, transistor radios and mechanical toys that would operate on their own power, anything that you didn't have to plug into a wall.

*Did you feel as if you wanted to tell the audience about resonant environments? Was that a reason for doing the piece?*

Yes! I want them to open up their ears to their environments, I certainly do, more now than before I did this piece. I hear a lot of reverbs now when I listen to TV or the radio, or listen to someone walking on the street. I perceive more now than I ever did, sounds coming from walls, the echoes from them, or when you walk down from the administration building here, how the sounds of your footsteps change when you pass, or when there's a tree or a wall and then you pass the wall and go into an open space, how your footsteps change because of the architecture all around.

*Do you feel better about using . . . we used a teapot with a radio in it. . . .*

What? A teapot?

*We used a teapot in the performance.*

Oh yes.

*Do you feel better about using a found environment like a teapot, as opposed to something you could build, perhaps with specific characteristics?*

Yes, I like found environments more. You can find teapots all over the place, and when you go to a town for a performance, you don't have to bring all your resonant environments with you. One could conceivably build an environment that would do something specific to sounds but I'm not interested in that. I don't want to change anything. I simply want to find out what these environments do to sounds, so it's to my advantage not to make them but to take what I can find, and in that way each performance will teach me something.

*Do you feel any different toward the objects being used because this is happening in a concert situation?*

Oh yes—your idea about a pot. The little teapot now becomes an instrument or part of an instrument, like part of an oboe. You now think of the teapot as something else.

*How do you feel toward the audience in a piece using found objects; do you expect the audience to feel different toward the objects too?*

Well, I like pieces that are odd, that do something that you don't ex-

pect them to do. It's extremely odd to hear a Beethoven symphony coming out of a little pot. You don't perceive all of it because the pot is so small that the low frequencies don't get played, but I like that situation very much. A Beethoven symphony implies a large space, the orchestra has a hundred players and it's tape recorded in a big hall, but when it comes out of a two-inch loudspeaker, it's very strange, when you think about it. On the other hand, to try to recreate an environment and put it into another one is like taking something that belongs somewhere and putting it somewhere else, so you make connections between things that you wouldn't ordinarily make. Doesn't an artist do that anyway? Well, some artists do, I don't know about all. Some of art is that you make connections between things that no one else would ever make.

*But are you interested in making connections that only Lucier would make between objects? Or are you taking advantage of connections between found objects? For example, radios happen to fit into teapots.*

Right! That's the reason I used the radio, because it goes into the teapot.

*But you probably wouldn't be tempted to reduce a Beethoven symphony to a little transistorized device unless it had been done before, or unless people carried around transistor radios.*

I would never have thought of it, no.

*Are you trying to tell the audience something beyond what they hear?*



Yes, I'm trying to make them . . . it's just an extension of what you do when you're a little child at the beach and you put a shell up to your ear and hear the ocean. Then you stop. You don't do that as you grow older. Your ear stops doing that because you've got to think about other things, how to make a living and how to speak to people, how to communicate verbally. I guess I'm trying to help people hold shells up to their ears and listen to the ocean again.

# VESPERS

## VESPERS (1969)

for any number of players who would like to pay their respects to all living creatures who inhabit dark places and who, over the years, have developed acuity in the art of echolocation, i.e., sounds used as messengers which, when sent out into the environment, return as echoes carrying information as to the shape, size, and substance of that environment and the objects in it.

Play in dark places, indoors, outdoors, or underwater; in dimly lit spaces wear dark glasses and in lighted spaces wear blindfolds. In empty spaces objects such as stacked chairs, large plants, or human beings may be deployed.

Equip yourselves with Sondols (*sonar-dolphin*), hand-held echolocation devices which emit fast, sharp, narrow-beamed clicks whose repetition rate can be varied manually.

Accept and perform the task of acoustic orientation by scanning the environment and monitoring the changing relationships between the outgoing and returning clicks. By changing the repetition rate of the outgoing clicks, using as a reference point a speed at which the returning clicks are halfway between the outgoing clicks, distances can be measured, surfaces can be made to sound, and clear signatures of the environment can be made. By changing the angle of reflection of the outgoing clicks against surfaces, multiple echoes of different pitches can be produced and moved to different geographical locations in the space. Scanning patterns should be slow, continuous, and non-repetitive.

Move as non-human migrators, artificial gatherers of information, or slow ceremonial dancers. Discover routes to goals, find clear pathways to center points or outer limits, and avoid obstacles.

Decisions as to speed and direction of outgoing clicks must be made only on the basis of usefulness in the process of echolocating. Any situations that arise from personal preferences based on ideas of texture, density, improvisation, or composition that do not directly serve to articulate

the sound personality of the environment should be considered deviations from the task of echolocation.

Silences may occur when echolocation is made impossible by the masking effect on the players' returning echoes due to the saturation of the space by both the outgoing and returning clicks, by interferences due to audience participation, or by unexpected ambient sound events. Players should stop and wait for clear situations, or stop to make clear situations for other players.

Endings may occur when goals are reached, patterns traced, or further movement made impossible.

For performances in which Sondols are not available, develop natural means of echolocation such as tongue-clicks, finger-snaps, or footsteps, or obtain other man-made devices such as hand-held foghorns, toy crickets, portable generators of pulsed sounds, thermal noise, or 10 kHz pure tones.

Dive with whales, fly with certain nocturnal birds or bats (particularly the common bat of Europe and North America of the family Vespertilionidae), or seek the help of other experts in the art of echolocation.

Activities such as billiards, squash, and water-skimming may be considered kindred performances of this work.

Based on the work of Donald R. Griffin.

*This page intentionally left blank*

When was **Vespers** written?

Let's see, I got the idea for it in 1967, and like most of my pieces I thought about it for a long time before I actually made the final realization. I thought it was final, but the other day as I was resting in the middle of the gym, I started listening to the footsteps of a runner as he ran around the oval track. At first you'd hear a single echo, but then as he circled and got in a different place, the echo would begin to multiply—not really multiply but add—so that there would be three echoes for every step. This gave me the idea that perhaps I should keep the idea of the piece open. That's a funny thing for me to say because in the original version, you know, the one with the Sondols, I don't care about the speed at which the players play. I'm not interested in what goes out, I'm only interested in what comes back. But if I ever made a version of **Vespers** using runners, I would want to have runners of different styles and speeds—long distance runners, milers, sprinters. Whereas the Sondol version is for anyone to play, I'm beginning to feel that I ought to utilize the specialties that people have.

*I know that one of your instructions in playing the Sondols is rather than to play in a certain way, just not to change the way you play too quickly.*

The reason is so that the players are not self-conscious about trying to make the outgoing pulses interesting. I always tell them that if I wanted to make interesting rhythmic figures, I'm certainly prepared to do so. Often I find that people who have never played a musical instrument before, people I get off the street, so to speak, a few hours before the concert, do the best job because they don't have

preconceived ideas. You see, I want to make the space be the interesting thing, not the personalities of either myself or the people playing it; what goes out into the space, therefore, has to be neutral.

*It's a curious performance piece though, because the point of it, it seems to me, is the way the environment responds to the ticks from the sound guns, and yet the sound guns themselves are such an unusual product. The idea is very general, playing your environment, but the instrument that you use is very specific.*

Yes, but I don't enjoy stipulating that one has to use Sondols, I'd like to leave that open. They're very expensive anyway. I don't mind sending them around, but I only have four of them and that means that only four people can play the piece at the same time. Do you know these little tin toys called "crickets"?

*Oh, clickers.*

I think they're called "crickets" after the insects. They make beautiful sharp sounds which, although not terribly directional, produce fairly clear echoes from reflective surfaces. A few years ago I bought a thousand of them to use in performances because I thought audiences might enjoy participating. The first time I tried using them was at the Concord Academy for Girls in Massachusetts. I had been asked to give a lecture-demonstration and thought that it would be educational for the girls to participate. The night before, I had instructed four of the girls how to use the Sondols. My plan was to have them start performing and at a certain point the girls with the "crickets" would gradually join in. During the performance, a trans-

formation took place from the very sharp pulses of the Sondols to the more diffused echoing sounds of the “crickets.” The texture changed from one in which you could hear isolated echoes to one in which you could hear the room begin to ring or sing.

Later that year I tried it in Helsinki. While my four Sondol players were playing, I passed out a hundred or so “crickets” to members of the audience who then began playing them. And while many of them understood that the piece was about echoes and echolocation, some students from the conservatory who were there started making banal rhythmic figures. Instead of trying to hear the room, they played childish patterns. After the program was over, we packed up all our equipment and went into the town. It was early spring in Finland, that period of time when the sun finally comes out after a long period of darkness, and as we walked through the streets of Helsinki, we could hear people, singly, or in groups of two or three, playing their “crickets.” It was beautiful. Perhaps they got the point of the piece more after the concert than they did during it.

*The piece brings to mind all sorts of animal features and it's whimsical to use cricket toys because they do sound like real crickets, but just how naturalistic were your ideas? Did you have animal ideas before you found out about the sound guns or vice-versa?*

All I remember is that I did—oh, I remember how it all happened! Mary was trying to find a studio where she could work on her sculpture. She put an ad in one of the Cambridge underground newspapers saying she wanted to form a communal studio and she got an answer from a fellow who had an empty garage. We both went over to see him. I started to talk with him and he mentioned that he



worked for Listening Incorporated, an electronics company in Arlington, Massachusetts that was involved in sound research and deciphering dolphin speech. He told me that they were developing, among other things, small, hand-held echolocation devices for boat owners, acoustic engineers, and the blind. He loaned me a prototype of one of these devices, called Sondols, and I began experimenting with it, learning how to interpret the echoes it made off objects and reflective surfaces. At about that time, I began reading **Listening in the Dark**, Donald R. Griffin's wonderful book on acoustic orientation by animals and men. He describes how bats and other nocturnal creatures survive exquisitely by identifying objects and obstacles by the echoes that come back from them. They can discriminate between the sounds that go out and those that come back, which carry information about the environment. Actually, the title, **Vespers**, comes from the North American bat of the family Vespertilionidae.

*If your purpose is sound, a bat is a useful creature to imitate because his purpose is entirely useful. He wants to play his environment so that he can move around in it.*

Yes. It's not to leave our environment now to go under the ocean or into outer space, where we could find ourselves without information coming into our eyes. In that case, we would have to rely on our ears and we haven't done that very well as far as I can see. So **Vespers** is in part an educational piece. You'd be surprised how many people don't know about echoes; some very fine musicians have been at performances and they think it's about phase relationships. They just don't hear the echoes, and I want people to hear those echoes.

*They don't always sound like what you usually think of as echoes; I mean, sometimes it's the timbre of the click from the gun that seems to change. I know when I was performing the piece I wasn't especially aware of a return click for every outgoing click because it's much too complex; what you do hear is that what seems to be coming out of the gun changes as you move it to different areas in the room.*

Yes. I know that if four people are playing in the same space, the echo situation is so complex that the players cannot read their own echoes; therefore, they have to stop. So the task that I set them, that is, to orient themselves in space and to move from one place to another, regulates the texture of the piece; I don't have to compose that.

*So again it imitates the usefulness of a bat's equipment. You perform the piece in the most practical manner; when you can't do what you're trying to do, you don't do it.*

Right, I am satisfied not to compose terribly much but to let the space and the situation take over. In other words, I don't intrude my personality on a space, I don't bring an idea of mine about composition into a space and superimpose it on that space, I just bring a very simple idea about a task that players can do and let the space push the players around. In that way, I always learn something about a space and never forget one in which I've done the piece. It's as if I take very slow audio photographs of that space.

*The Sondols have their task to perform and they do it with clicks that sound like insects. In the versions of the piece where you handed*

*out the little toy clickers, what relationship do they have to the people playing? Are they sort of a responsorial chorus from the environment? How are they supposed to respond to the mix in the air?*

To the what?

*To the mix of the ticks in the air.*

Well, I remember last September Mary and I drove down to North Carolina from Ann Arbor, and as we were going through Kentucky, we stopped at a gas station. Out back, there was a whole field filled with cicadas, I think they were cicadas anyway. They were producing a great deal of noise and I don't know what intent they had, whether it was social or sexual. Even so, I enjoyed the situation that thousands of them were producing these marvelous sounds at the same time. I also remember a bush I used to pass by. One day, it was August, I heard an insect in it, maybe a cicada or some other insect, but anyway it was alone and was producing a tremendous amount of sound, which echoed within the bush and off a cement wall, and I couldn't help but superimpose my idea that it must have heard the echo that came back. Now perhaps its sound was for another use, but with my understanding of echolocation, I thought that, well, I'm sure it heard that echo. So whether the single insect in the bush or the thousands in the field were actually involved in the process of echolocating, I got the idea of having members of audiences participating in some way. It would do two things: one, relieve the anxiety or tension built up during a performance in which there are only four Sondol players and, two, while each person wouldn't actually have an experience in echolocating, the room would buzz and ring in the same way that that field in Kentucky seemed to ring.

*Would you agree that the bias of most people who feel themselves familiar with music toward expecting instruments probably hides the point of the piece from them? They expect the sound guns themselves to be of interest, when what you're trying to do is to elucidate the particular place they happen to be.*

Well, after performances people come up and play with the Sondols, a situation that I like very much, but one of the first things they do is put their hands over the loudspeakers and pretend they're playing a trombone or some other brass instrument. They make wah-wah sounds or speed the pulses up and slow them down in rhythmic effects; they try to do old things with new means. Perhaps that's strange for me to say because I'm tuning in to a very old activity, bats and other nocturnal creatures have been using echoes for years, so I'm more old-fashioned than anybody.

*It seems a very social idea, a friendly idea, to have the audience be able to do something too.*

Yes.

*Do you think that the time will come when you can give a concert and the audience won't be anxious, when they can accept it that an aspect of the concert is taking advantage of the social situation of being together, and so won't feel left out?*

I think so. It seems to work pretty well when I explain the piece before the performance, that is, when I tell the audience what is going to happen and how it's going to happen. But even so, there's often anxiety when a blindfolded performer bumps into something.

Once in Zagreb, Mary Ashley got completely disoriented and ended up in a corner, but if the audience understands that, they will feel concern. I'd like to keep that in the piece.

*Do you think that audiences that get uncomfortable perhaps feel they're not getting any information from the music and are therefore gathered together for no purpose?*

Perhaps if they don't hear the echoes very much. I just did the piece in Cambridge for the Harvard School of Education, and for the first time, an audience that wanted to participate didn't make banal rhythmic patterns. Individuals in the audience made clucking vocal sounds that imitated the sondols fairly accurately, and it didn't bother me.

*You mentioned that you wanted as neutral a sound as possible . . .*

Right.

*. . . from the clicking guns, and of course the patterns they make when they're being played together are indeterminate, so it might seem as if you're not getting any intentional information from the guns. Yet you can form a clearer picture of the environment because they're not trying to tell you stories.*

Right.

*So I wonder what you think about the concept that musical performance is sending messages, because in this case, though no specific message appears to be sent, it's paradoxical in a way, you do obtain specific knowledge about your environment.*

Well, you know the old story about art as communication!

*What do you think about that story?*

We composers always denied it, but if you make a picture in sound about the space you're in, you're telling people something. The performers are spread out in the space when they start, and each of them can tell the others where he or she is and what the echo situation is in that geographical location. The audience receives the same information, so I suppose you'd have to say that **Vespers** is a communication piece.

*It's curious that by giving up your prerogative as a composer of sending information, you're allowing the environment to reveal itself.*

Exactly.

*By having minimal content in your end of the process, you're performing a service for the audience.*

Right, that's what I try to do.

*And what's also strange is that audiences who aren't satisfied with that state of affairs feel cheated because they think you're not giving them information.*

They would say that I'm not communicating. Perhaps I'm not communicating but the particular room that they're in, is. And I think people should find out about that, don't you?

*This page intentionally left blank*

**“I AM SITTING IN A ROOM”**



## **"I AM SITTING IN A ROOM" (1969)**

for voice and electromagnetic tape.

Necessary Equipment:

- 1 microphone
- 2 tape recorders
- amplifier
- 1 loudspeaker

Choose a room the musical qualities of which you would like to evoke.

Attach the microphone to the input of tape recorder #1.

To the output of tape recorder #2 attach the amplifier and loudspeaker.

Use the following text or any other text of any length:

"I am sitting in a room different from the one you are in now.

I am recording the sound of my speaking voice and I am going to play it back into the room again and again until the resonant frequencies of the room reinforce themselves so that any semblance of my speech, with perhaps the exception of rhythm, is destroyed.

What you will hear, then, are the natural resonant frequencies of the room articulated by speech.

I regard this activity not so much as a demonstration of a physical fact, but more as a way to smooth out any irregularities my speech might have."

Record your voice on tape through the microphone attached to tape recorder #1.

Rewind the tape to its beginning, transfer it to tape recorder #2, play it back into the room through the loudspeaker and record a second generation of the original recorded statement through the microphone attached to tape recorder #1.

Rewind the second generation to its beginning and splice it onto the end of the original recorded statement on tape recorder #2.

Play the second generation only back into the room through the loudspeaker and record a third generation of the original recorded statement through the microphone attached to tape recorder #1.

Continue this process through many generations.

All the generations spliced together in chronological order make a tape composition the length of which is determined by the length of the original statement and the number of generations recorded.

Make versions in which one recorded statement is recycled through many rooms.

Make versions using one or more speakers of different languages in different rooms.

Make versions in which, for each generation, the microphone is moved to different parts of the room or rooms.

Make versions that can be performed in real time.

*This page intentionally left blank*

*What's your attitude toward a performance that consists of playing a tape?*

Well, all of us who have made pieces with electronics started with tape because it enables you to play with sounds in ways that no other medium does, but you soon get tired of that because live performances are more interesting than taped ones. Tape led us to discover things about sound that had hitherto been unknown and prepared us to go on and do more interesting things without it, but we always kept tape as a way to store sounds to bring into a live performance.

Now in **"I am sitting in a room,"** I didn't choose to use tape, I had to, because in order to recycle sounds into a space, I had to have them accessible in some form. Tape, then, wasn't a medium in which to compose sounds, it was a conveyor, a means to record them and play them back one after another in chronological order. Without tape I wouldn't have been able to do the piece.

*When you worked on materials for the piece, there was never a moment until all those generations had been spliced together that the piece was complete.*

Yes, because the form is linear and cumulative; it changes from generation to generation until it reaches the point of diminishing returns. And it's funny because if I had consulted an engineer, he or she would probably have found a way to get the end result in one process, one fast process, or one generation. There are ways to by-

pass erase heads on tape recorders or make large loops which could get the end result very quickly, but I was interested in the process, the step-by-step, slow process of the disintegration of the speech and the reinforcement of the resonant frequencies. Actually, when Mary and I visited the Polaroid Company in Cambridge—Mary, as you know, did a visual analog to the tape by subjecting a Polaroid snapshot to a similar reproductive process—the art director, when he saw the end result, said, “I could do that in one step.” He just didn’t understand that what we found interesting was the gradual process itself. Often, people don’t understand the process. They think that the same speech is dubbed from one recorder to another and each time the quality of the copy degenerates a little bit. But it’s not that at all, it’s playing the speech back into the space. The signal goes through the air again and again; it’s not processed entirely electronically, it’s also processed acoustically.

*You’ve discarded one of the goals of electronic information storage. By reproducing the thing acoustically so many times, all the parameters that manufacturers strive to achieve in their tape recorders, such as linear frequency response, are bypassed.*

Actually, I used two Nagra’s in the original version. I recorded fifteen generations of the same text and you don’t hear much distortion or disintegration of the tape matter. In fact, the machines did a marvelous job of maintaining it.

*What I meant to say was that an engineer would probably say you’ve done a poor job of reproducing the sound. Of course what you had*

*in mind from the start was to get out of the machines, to submit the material to a purposely non-neutral medium on its way to being re-recorded.*

Yes, the space acts as a filter; it filters out all of the frequencies except the resonant ones. It has to do with the architecture, the physical dimensions and acoustic characteristics of the space.

As you know, every musical sound has a particular wavelength; the higher the pitch, the shorter the wavelength. Actually, there's no such thing as "high" notes or "low" notes, we simply borrowed those terms from the visual world to describe something we didn't understand. A musical sound as it is produced on an instrument, in a column of air or a vibrating string, causes oscillations at a certain rate of speed. For example, the A that an orchestra tunes to vibrates at 440 times per second and can therefore be considered "faster" than the middle C on the piano that vibrates at about 262 times per second. But as those sounds move out into space they can be observed as various-sized wavelengths, so you can see how directly the dimensions of a room relate to musical sounds. If the dimensions of a room are in a simple relationship to a sound that is played in it, that sound will be reinforced, that is, it will be amplified by the reflections from the walls. If, however, the sound doesn't "fit" the room, so to speak, it will be reflected out of phase with itself and tend to filter itself out. So by playing sounds into a room over and over again, you reinforce some of them more and more each time and eliminate others. It's a form of amplification by repetition. Thinking of sounds as measurable wavelengths, instead of as high or

low musical notes, has changed my whole idea of music from a metaphor to a fact and, in a real way, has connected me to architecture.

My first impulse was to use various musical instruments playing a wide variety of sounds, but I tossed that idea out because it felt too “composery.” Instead I decided to use speech; it’s common to just about everybody and is a marvelous sound source. It has a reasonable frequency spectrum, noise, stops and starts, different dynamic levels, complex shapes. It’s ideal for testing the resonant characteristics of a space because it puts so much in all at one time. It’s also extremely personal. And since I’ve been acting in George Manupelli’s **Dr. Chicago** films, I’ve started paying attention to the characteristics of my speech which are original to my personality and don’t sound like anybody else’s; you know I’m a stutterer. So instead of trying to invent interesting speech patterns, I discovered that I have interesting speech patterns anyway; I don’t have to invent them. Of course I have invented, when you think about it. A person who stutters or who has a lisp invents that or makes it up; it’s not put on him from an external source. And while not everyone stutters, everyone has a certain amount of anxiety about speech. I’ve met many people who think they stutter. Bob Ashley, for instance, thinks he stutters. I wouldn’t say so, but if he thinks he does, perhaps a lot of people think they do, and in that case, I feel that I’m in touch with people.

I am not as interested in the resonant characteristics of spaces in a scientific way as much as I am in opening that secret door to the sound situation that you experience in a room. For example, I made a preliminary version of “**I am sitting in a room**” in the Brandeis University Electronic Music Studio, a small, bright, somewhat anti-septic room in which I never enjoyed being very much. It was filled with electronic equipment, and one wall consisted of several large

glass windows. The resonant frequencies got reinforced very quickly after the fifth or sixth generation, resulting in harsh, strident sounds. But the version I did at 454 High Street, in Middletown, took a longer time because it was a softer, friendlier room with a wall-to-wall carpet and drapes on the windows. When I first moved into the apartment I never dreamed that I would come to enjoy wall-to-wall carpeting, but I soon learned that if you do have it, people enjoy sitting on the floor. After some of the evenings we've had there, people have even gone to sleep on the floor, which they would never have felt like doing in the Brandeis Studio. Anyway, the carpet and drapes cut down on the production of the resonant frequencies so they took longer to achieve, but it gave us a more beautiful result. Didn't we get a different set of intervals in the Brandeis Studio than we got in this room? Do you remember what they were?

*We got two sets of fifths in both of them but they were much more complex in this version.*

Did you notice that tunes seem to start? Every room has its own melody, hiding there until it is made audible. You know, I feel as though we're in the same situation as composers were when they first began perceiving overtones. Musicians were always aware of their effects, I think, but timbre was mysterious until someone could demonstrate their existence. Now we're just beginning to compose with architecture in mind, and I'm very pleased to be in on these first experiments.

*Is it an extension of the idea of personal relevance that you chose the particular text you did?*



Well, the text that I wrote and used in the Middletown recording was personal to me, but was also meant for anyone else who wanted to use it. I guess I was suggesting that everyone's speech has irregularities. I also said in the finished score that other texts may be used. Perhaps that was a mistake because I don't want what goes into the space to be too poetic. I want it to be plain so that the space becomes audible without distractions; that's why I decided to describe the recording process so that the audience could more easily understand what's going on. I guess you could say that the score is built into the performance.

*I'm interested in how far your idea about the piece extends into the mechanics of achieving it. In other words, if someone uses one of the other procedures you mentioned, a loop for example, can you accept that as really the same piece?*

Well, the piece is subject to many versions; I heard of a twenty-four-hour one made in a chapel in Oberlin, Ohio. Now I've been asked to make a version for the Pepsi Pavilion at Expo '70 in Osaka. The Pavilion is a large dome with interesting acoustics, and David Tudor and Gordon Mumma designed the sound system. It has loudspeakers deployed all over the space, arrays of microphones, and a flexible mixing console. I'm planning to use it to pick up and record the voices of the people walking through the Pavilion, and then to recycle them back into the space from many separate loudspeakers. But I must admit that I prefer the monophonic version; it more clearly reveals the features of the processes that I find fascinating. First of all, there is the superimposition of two very simple repetitive

processes, tape recording and talking, but the mixture of these two ordinary activities in an acoustic space, with amplification by repetition, yields an extraordinary result, the evocation of the resonant frequencies of the space. Even though the form is repetitive as far as the recording and recycling procedure is concerned, the listener hears something quite different, and that is the climactic point at which the speech goes from intelligibility to unintelligibility, or from words to music. What's beautiful is that this point is different for each listener; it's kind of a sliding fulcrum on a moveable time scale. The rate of transformation isn't constant either. For the first few generations it moves at a seemingly constant pace, then, in one or two generations, the movement speeds up, then slows down again. It seems to operate on its own set of rules. It's very mysterious.

When Mary did the visual part, she took a Polaroid snapshot of the chair that I sat in when I made the tape and subjected it to a copying process in which she copied the original, copied that copy, and so on. And because it was virtually impossible to align the copying camera and the pictures absolutely accurately, a slight error in size crept in, so that every time she made a copy, it made the image slightly enlarged. But of course the size of the picture stayed the same so the image began to move off the picture. There was a dark shadow behind the lamp which grew on each reproduction, until finally the fifty-second one is completely black; the shadow behind the lamp grew until it took up the whole image. Some dirt got on the reproductions too, and what you think you see at the end is a star map. And indeed, a friend of mine who was at one of the performances said the last slide looked just like "Job's Coffin," which is apparently a part of the stars.

*This page intentionally left blank*

# **(HARTFORD) MEMORY SPACE**

*This page intentionally left blank*

## **(HARTFORD) MEMORY SPACE (1970)**

for any number of singers and players  
of acoustic instruments.

Go to outside environments (urban, rural, hostile, benign) and record by any means (memory, written notations, tape recordings) the sound situations of those environments. Returning to an inside performance space at any later time, re-create, solely by means of your voices and instruments and with the aid of your memory devices (without additions, deletions, improvisation, interpretation) those outside sound situations.

When using tape recorders as memory devices, wear headphones to avoid an audible mix of the recorded sounds with the re-created ones.

For performances in places other than Hartford, use the name of the place of performance in parentheses at the beginning of the title.

*This page intentionally left blank*

*Perhaps a good way to start would be to ask what “memory space” means in the title.*

Well, it’s an awkward title because it’s just putting together three words, three ideas in which I was interested. One was the idea of space, not so much articulating it as I did in **“I am sitting in a room”** or **Vespers**, but simply in asking players to go to an outside space and observe it. The word “memory” was used because the players would have to remember it as accurately as possible. I was interested in the time delay, the lag between when they went out to observe the space and when they came back to play it. What would happen in the meanwhile? What events or experiences would the players have that would change or influence or alter their perception of the original sounds? And the first word, “Hartford,” was simply the place in which the first performance took place.

I had had an unpleasant experience in downtown Hartford a few years before when filmmaker Takahiko Jimura and I went there for a concert. Two men had tried to steal an amplifier from the back seat of my car. We were having hamburgers in a luncheonette and could see them plainly through the plate glass window. It was broad daylight. To stop the crime, I simply walked across the street toward the car, slowly enough to give them time to move away from it gracefully. After that incident I began thinking, along with so many other people, about the frightening quality of our urban environments. I started thinking about survival in a hostile environment and how certain insects, fish, and animals imitate the physical characteristics of their surroundings in order to survive. Then I remembered the street musicians in Rome and how their playing changed one’s feelings about living in a city. So I mixed these ideas of animal mimicry



and street music and decided to make a piece for players in which they would have to disguise themselves, go into an unbenign environment, and play in such a way as to blend in sonically and socially with the sounds around them. They would have to imitate the environmental sounds directly and cut the art out of their playing. Then I modified that idea and decided to make a safer piece with environmental sounds as source material.

*How do the artistic re-creation and the urban environment relate to one another?*

You mean how do the players relate to one another?

*No, how does the re-created environment relate to the original environment?*

Well, it's supposed to be as faithful as possible to the original, insofar as it's possible to re-create it on conventional instruments. I hoped that there would be spin-off from this procedure, I hoped the players would extend their technical resources, that is, extend what they were able to play on their instruments. For example, if a cellist were trying to imitate the sounds of automobile tires, and she heard a predominance of high harmonics, she would have to play *sul ponticello* or in some more unconventional way. She would then have learned something about the sound of tires and something about what she can do with a bow and a string. You see, I was asked to provide a piece for students at a conservatory, which pleased me. It had been a long time since I had written anything for instruments, and I thought it was too bad to be a composer and to have all these

young people who want to play their instruments and not have anything for them to play, but the thought of composing a score in the traditional sense was, for me, out of the question. I was thinking that good players like to play difficult things, good players enjoy difficult tasks, and this would be an impossible task, but the attempt to accomplish it, if only partially, was an interesting thing, and a challenge that I thought these young players might find interesting.

*There's an odd correspondence between the artistic event and the urban environment. If you think of the urban environment as the threatening place, the artistic re-creation of the environment eliminates the threat.*

Right.

*So the artistic situation must be . . .*

Yes, but you don't need the camouflage anymore . . .

*Right, because it's a friendly place . . .*

. . . because you're in a concert hall.

*How does the composer fit into this whole thing?*

Well, my ideas about composition don't have anything to do with the environments into which they went. If I had composed anything it would just get in the way. Also, I had to warn the players against improvising because that would get in the way, and I didn't want

anything to get in the way. I envisioned the piece for some future date when people's brains would be more developed than they are now and they could remember all the audio events. It would be inconceivable to expect a player now to remember an hour's worth of sound activity because there's just too much going on, so I gave them alternatives. One was to make some kind of visual sketch, or to go several times to the same place and get a general idea, or to concentrate on just a few events. Of course, I really would have been pleased if they could re-create the whole thing. Another alternative was that they could record these events with a tape recorder, come back to the concert hall, and with earphones on, use the tape as an audio score. In other words, the player would play his or her instrument by imitating the tape. It struck me that tape is now memory; you can store information on tape just as you can store it in your brain, only it's more accessible. So tape for me was a substitute for using your brain to remember.

*If you strip away the urban environment, so you're suddenly performing in the concert hall, it's actually a visual transposition also. You take away the buildings and what you have is a clean white concert hall.*

Actually we didn't play the piece in a concert hall, we played it in an art gallery in which an artist and his students had made an environment with objects taken from the city, although he wasn't doing what we were trying to do. I guess I wanted the players to learn something, and I thought that if they all played, it would be like looking at a map. Each of the players had gone to a different geographical place in the environment and when they came into the

performance and played everything simultaneously, it was as if you had a composite sound map, a displaced remembrance of the downtown.

*Do you expect the audience to feel differently about the downtown after hearing the piece?*

Yes.

*Are they actually experiencing the downtown in some way when they hear the piece?*

They're hearing it once removed, somewhat like a copy or a photograph is a more or less faithful image of a real thing, although the photograph is a real thing. The performance was a real thing too; it was a musical event.

*In what way do the performers and the audience share the experience? Are they sharing the same experience, or are the performers telling something to the audience?*

I don't know about that. I was concerned, though, that the performers didn't share anything among themselves before or during the performance, since they weren't supposed to improvise. I wanted them to stick as closely as possible to their remembrance of the environment, so I isolated the players from one another. It was as if each of them were on an island but the audience could see and hear all those islands. The islands could be parts of the town, or places in the streets, and the audience would see and hear a composite of

which the individual players were only a part. But even though they tried to play it as faithfully as they could, I'm sure that they influenced each other, because nobody's absolutely perfect, and players are influenced by any sonic activity around them. And that situation I find all right, too.

*Then how social is the idea of a performance of **(Hartford) Memory Space**? In what way is it a social event if the players are separate from one another in what they do?*

Well, they do come together and they each have a part in a larger thing. People come and witness what these performers are doing and can go from one performer to another. You go from one street to the other and you hear different things at each street. If I ever made a recording of this piece, I would have microphone handlers walk around from one player to another so you would be able to visit one player at a time, each representing one part of town.

*Did Ives' music have anything to do with this idea?*

Well, I suppose it's somewhat like pieces such as **Central Park in the Dark** and **The Housatonic at Stockbridge**, but they're programmatic. Art is in those. The idea is not to imitate, but to give an artistic impression of a particular place. My idea is to cut that art out and to just have the direct imitation.

*Suppose the players hear music in the environment, do they try to re-create the music? What kind of music do they make out of music?*

Well, we had that problem with conversation. The players said, "If we hear people talking, can we talk?" But the idea was to have the conventional instruments do all the work. The idea of what is conventional on an instrument came into play too, because what is conventional on an instrument changes all the time. Players now use electronic aids in performance, but I didn't want them to do that. I wanted them to use what I think is almost an obsolete state of affairs, the instruments of the nineteenth-century orchestra. I wanted to find a way to put those in my art because so many electronic composers imitate conventional instruments with electronic devices and I was thinking of reversing the situation. I would have players imitate an environment which is pretty much electronic and mechanical by playing their own old-fashioned acoustic instruments.

*But you're not trying to imply that people can't survive in the urban situation, even though you've taken away their powers of speech.*

Well, if they imitated speech by speech then there wouldn't be any medium displacement and I wanted **(Hartford) Memory Space** to have to do with that, with imitating one set of sounds with another. And the fact that I'm imitating a contemporary set of sounds with old instruments was a parallel to having a time lag between the players' observation of the sounds and their performance of them. In both cases, it was a question of time delay.

*It seems as if the purpose of the players, first in the urban situation and then in the concert hall or museum, is to become the environment.*

Right. It's the old story about prehistoric man, who when he was afraid of an animal, drew pictures of it on the wall and thereby controlled his fear of the animal, if not the animal itself. At first, most of the players said that they found the sounds of the city disagreeable, but by the end of the performance, they all agreed that they enjoyed them because they had to take them seriously. They learned to deal with them by playing them.

# QUASIMODO THE GREAT LOVER



*This page intentionally left blank*

## **QUASIMODO THE GREAT LOVER (1970)**

for any person who wishes to send sounds over long distances through air, water, ice, metal, stone, or any other sound-carrying medium, using the sounds to capture and carry to listeners far away the acoustic characteristics of the environments through which they travel.

Use one or more microphone-amplifier-loudspeaker systems to lengthen the distance over which the sounds may be sent. In large, single places such as prairies, glaciers, or ocean basins, use single systems of great power or several weaker systems in series. Connect small, separated spaces such as rock formations within faults, detached railroad cars on sidings, or the rooms, foyers, and corridors of houses, schools, or municipal buildings with relays of systems, adding shorter distances to make longer ones. For example, the spaces of a three-story American high school may be connected by a four-stage system in which the performer's first stage is located as far from the listeners' last stage as possible and in which the microphone-amplifiers of each stage are placed as far as possible from their respective loudspeakers. If the first stage microphone-amplifier is located in a classroom on the third floor, its loudspeaker may be placed outside the classroom door facing down the corridor at the end of which is located the second stage microphone-amplifier whose loudspeaker may be placed facing down the stairwell to the corridor below at the end of which is located the third stage microphone-amplifier whose loudspeaker may be placed in the first floor lobby in which is located the fourth stage microphone-amplifier whose loudspeaker may be placed inside the gymnasium/auditorium. All sounds that move through this system, from loudspeaker to microphone and so on, are processed by the physical characteristics of the classroom, corridors, stairwell, lobby, and gymnasium/auditorium. Longer distances and further processing may be brought about by deploying additional relay systems in libraries, laboratories, cafeterias, offices, and boys' and girls' locker rooms.

The distance from one system to another should be maximum, depending on the sound-sending power of each system or on the physical limits of the given environments. Whole systems, however, should span enough

distance so that, given the medium, the sounds must travel for at least one second of time through that medium, or for a shorter time provided that the environment is of such a quality that it is capable of processing the sounds in the time given to the extent that they are perceived as being of different origin by the listeners at the last stage of the system.

Isolated from the listeners at the last stage, sing or whistle, or play any large or small musical instrument through the system.

Using the music of the humpback whale, *Megaptera novaeangliae* of the family Baleanopteridae as a model, compose a repertory of simple sound events such as single pitches of short or long duration, simultaneities of various densities, upward and downward sweeps, and sounds with different envelope shapes, or compound events made from combining two or more simple events to produce such combinations as accelerating or decelerating pulse trains, upward sweeps followed by tones of short duration, or motives seemingly modal in character.

Extensions or modifications of the range, timbre, envelope, or duration of any sound by electronic, mechanical, or any other means may be made at the performer's first stage only. Further extensions or modifications should be made only by the environment or environments through which the sounds travel.

Design formal structures with sets of successions of sound events in which each event within a set is subject to gradual, repetitive, and cumulative variation with respect to pitch, timbre, amplitude, envelope, or any other aspect of sound and time in order to amplify in time the relationship between the original sound event, its change, and the environment through which it travels. Starting anywhere on a minimum-maximum continuum, vary one aspect of the sound event and move to an extreme situation with respect to this aspect. For example, a sound of short duration may be lengthened, little by little, so that the reverberation time of the environment may be perceived, at first in terms of the discrete sound events and their echoes, then with more and more complete overlappings, until finally the lengths of the events are too long for either practical performance or measurement. In each subsequent set, vary one other aspect of the sound event, retaining throughout that set the extreme situations

arrived at in the preceding sets, taking care not to reverse the direction of a variation between two adjacent sets. When the variation of one type of sound event has been exhausted, move to sets of successions in which an additive procedure is followed, that is, where one sound event is followed by another, those two repeated and followed by a third, those three repeated and followed by a fourth, and so on.

Performances may be considered finished either when all the variations of sound events have been exhausted or when it is felt that all the acoustic characteristics of the given environments have been fully explored, tested, and articulated.

Multiple systems may be constructed in series or parallel that crisscross or interweave with one another, loops may be made to re-cycle sounds through the same spaces, and sounds may be sent through two or more systems of dissimilar media in order to discover their acoustic characteristics, their ability to process the sounds that travel through them, and the relationship between the speeds of sound in each.

Two or more players of similar or dissimilar instruments may send sounds through one or more systems from one or more geographical locations. For example, a trio of double bass players, isolated from each other in separate Quonset huts, may send sounds via interlocking relay systems out into canyons and cafeterias, across lawns, through wooded areas, administrative offices and aquaria, and onto a glider park.

Systems may be set up in public or private places on permanent or semi-permanent bases for people to move through and use freely. Ambient sound events such as footsteps, door slams, and explosions may also be welcomed for processing.

*This page intentionally left blank*

*I know you've spent some time just recently preparing a score of **Quasimodo**, and I wanted to ask what sort of relationship composing music and preparing scores enjoy in your professional activity.*

Well, I'm in the middle of the score now, or I should say I've just begun. I'm finding it difficult to proceed because I'm not yet sure in my mind about what I want or what can or cannot serve the purposes of the piece; **Quasimodo** can be performed in a variety of large, unusual spaces, and I'm still experimenting with ways to set up the equipment. Then, and this sounds like an old-fashioned idea, I always want to let things gel, because if you try to finalize them too soon, you aren't taking into account other things that might enter your experiences later. Earlier in my life, I would not have wanted really to finalize things, but now I do. You want to get certain pieces out of you and off your mind even though they're not quite done, especially since you can build into the final score all the conditions in which the piece doesn't have to be final, you can specify those parts of the piece that are still open to experiment. But I don't want to leave it open in every area, only some areas, because if I left it open in every area, it wouldn't be the piece that it is.

*I notice you use the word "compose" as opposed to what one would expect, "realize." Did you really consider the piece to be still in the process of composition during those different performances?*

What I think you really mean is: "What relationship did the performing of the piece and the making of it have to your present project of composing the score?" They're rather different in many ways because I'm adding things to the score that I didn't think of when

we first performed the piece. It was just a physical idea then, and the possibilities that came up were dependent on the actualities of the performances—when we were doing them, how much equipment we had available. There were only certain possibilities open to us. Now, when I try to write out the prose score, I don't merely want to make a description of what I've done so far because it would be confined to the corridors of buildings, and I've often dreamed of doing it in steel, or in rock, or in earth, or underwater. And of course I haven't had time to try those, but I can imagine them and leave room for them in the score. In traditional scores you write down what you want someone else to do . . .

*Before the fact.*

. . . before the fact. I'm composing it after the fact of those performances we did, but before the fact of many other versions I want to do.

*Is there any emotional difference for you between the performances after the score and the performances before the score?*

Did you say "emotional"?

Yes.

Well, when I first performed it in Clinton, New York, I used whistling sounds. My first idea as I got before the microphone at that first stage in the relay system was to make vocal sounds, but I decided against that because they sounded awkward and grotesque. They

sounded too psychological; the upward and downward sweeps sounded like moaning.

*You wanted to avoid human expression.*

Yes. So I used whistling sounds, perhaps because whistles are simpler wave forms than vocal sounds, and it seemed to me that we needed something simple at the beginning of the microphone-loud-speaker systems if we were to capture the acoustic characteristics of all those corridors and stairwells. If we had started with complex sounds, there would have been too much confusion at the end. Now I have no scientific evidence to prove that; it just seemed to me that whistling sounds were appropriate.

*Were you improvising while you were whistling?*

Yes. . . well, I said yes and now I say no. It's the old problem that we've talked about so much: if you improvise, it's your past and your personal preferences and your ideas about what sounds should or can be that you're thinking about. I like to pose myself the problem of deciding about the sounds on the basis of the physical tasks that they have to do, and in the case of **Quasimodo**, it was to travel through environments to test them. It would have been stupid of me to impose my personal ideas about sounds because my personal ideas don't have anything to do with the spaces. I had an idea of what kind of sounds to use; I then tried to get a process started so that I wouldn't have to think about it anymore. If I had a procedure that I could follow cold-bloodedly, then I wouldn't have to think about where my next sound was coming from. I chose a simple repe-



titive process with which the player could alter various aspects of sound—timbre, pitch, duration, envelope—one at a time and little by little, so no opportunity for the articulation of the environment would be missed by having to make artistic choices. For example, sounds of short duration are suitable for hearing echoes and delay times. If you used only one sound to test these characteristics, you would get only one little answer back, so you couldn't be sure what the whole situation was. But if you repeat the sound, lengthening it each time, then as overlappings occur, you would begin to hear all the aspects of the delay situation.

*Well, let me ask a different question. You've made it clear that even if you were improvising, you weren't engaged in a process of self-expression, but do you think that working out these problems that you've set for yourself can aid you in other processes of thought? In other words, can there be a therapeutic effect to working out these environmental, external problems?*

Therapeutic effect?

*In the sense of solving personal problems?*

Well, I've always been drawn to music that tells you about the way things are or can be. And insofar as **Quasimodo** is concerned with the influence of space on sound, one is bound to learn something about that when performing the piece. Also, if the practical part of the piece is successful, that is, if the relay stations pick up and send the sounds clearly and without distortion and thereby connect one space with another in a long chain without apparent seams or faults, that directness of purpose could be a metaphor for one's life.

*When you were composing the score, were you attempting to compose the words by a process parallel to the composition of the piece? Was there a conscious attempt to produce a parallel structure between the important aspects of the piece and the way the score was . . .*

You mean was I trying to make the score in the same way that I made the piece?

*Either that, or would you hope that reading the score would be analogous to experiencing the performance?*

Reading the score of **Quasimodo**, or any other piece of mine for that matter, can never be analogous to experiencing the music because the scores make no effort to show the passing of time. When you read the score of a Mozart string quartet, for example, you follow the continuity in the same direction as the music flows. But a score of mine doesn't show that; it presents ideas and procedures but leaves the continuity open. In making the score, I'm trying to write clear linear prose that describes a complete situation, that has balance; one thing should lead to another, the punctuation should be correct. I enjoy doing that very much, perhaps because it's difficult for me, like trying to play a sport well. I'm trying to make it very clear and simple and pristine.

*Are you concerned about transforming what is essentially a general concern into a personal statement?*

No, it's just that I don't want the formal design to be so perfect or. . .

*Closed?*

. . . so closed or so, well, beautiful that it would lead people to think that it was more important than listening to sounds travel through environments. That is the essential idea and I wouldn't want it to get confused with any ideas about form.

*Is there an attempt in the score to help the performer in the way that a traditional score does?*

Yes, the score for **Quasimodo** is a guidebook of sounds suitable for acoustic testing, with suggested procedures for putting them together. It uses written words instead of notes or graphs because notes and graphs are time-dependent; since there is no reason to arrange the material in any particular order, **Quasimodo** may include all the possibilities inherent in it.

*Somewhere before, perhaps in conversation with me, you mentioned that many people found that they enjoyed the piece after you had told them what inspired it.*

Yes, they became sympathetic. I first heard the sounds of the humpback whales in 1969 in Santa Barbara, California. Composer Daniel Lentz, who was then on the faculty at the University of California, had invited me to be Regents Lecturer for a month. While I was there, Dr. Roger S. Payne came to give a lecture-demonstration and play his recent recordings of whale music. I, like everyone else, found it very beautiful. What struck me more than the sounds, however, was the ability of whales within a species to communicate

with one another over tremendously long distances, across ocean basins in some instances. They do this by echoing their sounds within a specific temperature layer in the sea so that the sound doesn't get absorbed into the bottom of the ocean or dissipated out through the surface. I was very impressed by that. So instead of imitating the sounds of the whales, or using Payne's recordings, I imitated the feature that struck me strongest, their amazing long-distance sound-sending ability. You know, the title, **Quasimodo the Great Lover**, is a pun. It has partly to do with whales and partly with music, but it's so atrocious that it makes me upset to think about it!

*Who is the piece written for? Is it for the benefit of the audience?*

Well, my first idea was to make it for large instruments, double basses or tubas; since whales are the largest living things, I wanted to use the largest musical instruments. But then, as I experimented in different spaces and decided to use whistling sounds, or sounds of high frequency, it seemed appropriate to include any or all other instruments. Whales have an amazing repertoire of high frequency sounds anyway. So it became a piece not so much for a performer with a specific instrument, but for any player who wants to do it. And as far as the audience is concerned, they listen to it at the final relay stage, that is, after the sounds have been duly processed by all the acoustic spaces in the system, but I also stipulated in the score that, in some cases, the relay systems may be opened up for persons to walk through, contributing their own sounds to the performance. When you open it up, then it's for just about everybody.

*This page intentionally left blank*

# **MUSIC FOR SOLO PERFORMER**

*This page intentionally left blank*

## **MUSIC FOR SOLO PERFORMER (1965)**

for enormously amplified brain waves  
and percussion.

The alpha rhythm of the brain has a range of from 8 to 12 Hz, and, if amplified enormously and channeled through an appropriate transducer, can be made audible. It can be blocked by visual attention with the eyes open or mental activity with the eyes closed. No part of the motor system is involved in any way. Control of the alpha consists simply of alteration of thought content—for example, a shifting back and forth from a state of visual imagery to one of relaxed resting.

Place an EEG scalp electrode on each hemisphere of the occipital, frontal, or other appropriate region of the performer's head. Attach a reference electrode to an ear, finger, or other location suitable for cutting down electrical noise. Route the signal through an appropriate amplifier and mixer to any number of amplifiers and loudspeakers directly coupled to percussion instruments, including large gongs, cymbals, tympani, metal ashcans, cardboard boxes, bass and snare drums (small loudspeakers face down on them), and to switches, sensitive to alpha, which activate one or more tape recorders upon which are stored pre-recorded, sped-up alpha.

Set free and block alpha in bursts and phrases of any length, the sounds of which, as they emanate from the loudspeakers, cause the percussion instruments to vibrate sympathetically. An assistant may channel the signal to any or all of the loudspeakers in any combination at any volume, and, from time to time, engage the switches to the tape recorders. Performances may be of any length.

Experiment with electrodes on other parts of the head in an attempt to pick up other waves of different frequencies and to create stereo effects.

Use alpha to activate radios, television sets, lights, alarms, and other audio-visual devices.

Design automated systems, with or without coded relays, with which the performer may perform the piece without the aid of an assistant.

Edmond Dewan, Technical Consultant



*I think we would both agree that the kernel of **Music for Solo Performer** is the performance of brain waves. If you accept that, I'd like to ask what sort of ideas you have about the piece as a whole.*

Well, the fact that it is a performance of live brain waves instead of a structured tape manipulation piece was a very crucial decision for me. It all happened when I was teaching at Brandeis. I had made the acquaintance of Edmond Dewan, a very imaginative physicist who was on the faculty at Brandeis but who was then working for the Air Force doing experiments with brain waves. They thought that certain pilots who were prone to epilepsy were blacking out when the speed of the spinning propellers got to a crucial point; I could be wrong about this, but I think it was sixteen times per second. When the sunlight would shine through the spinning props, it would lock on to something visual in the brain of the pilot. They had asked Dewan to try to investigate that, so he was doing experiments with brain waves. And it's very funny because he had offered his equipment to one or two other members of the faculty at Brandeis, suggesting that they might be interested in making pieces with brain waves, but no one took him up on that.

This was 1965. I had been at Brandeis for just a couple of years, and I was at a point in my compositional life where I didn't have any good ideas. I was conducting the Chamber Chorus and I had done some electronic music in Italy when I was on a Fulbright there, but I hadn't really found anything that interested me; I certainly didn't feel like composing instrumental music. Dewan described to me this phenomenon that had to do with visualization, that by putting yourself in a non-visual state, it would be called a meditative state now, you could release the potential of the alpha that is in your

head. It's a very small amount, but it would become perceptible, at least to an amplifier. The idea of it just struck me very strongly, probably more for theatrical or visionary reasons than for sound or musical reasons, because I didn't know what it was going to sound like. Actually, it doesn't sound like anything because it's 10 Hz and below audibility; it isn't a sound idea, it's a control or energy idea. And it's amazing because most of my colleagues at Brandeis said, "Oh, that's a wonderful idea. You ought to tape record it, speed the sounds of the brain waves up, slow them down, reverberate them, filter them"; they all wanted me to make a conventional tape piece with this idea. To realize that the electronics comes from your brain, from inside every person, that every person has a little electronic studio inside his or her brain, then ask you to make a classical tape collage piece that's cut and spliced just . . . well, they all urged me to do that. The reason you love violin music is that someone is doing the playing, it's not the timbre of the violin. That's in there and is a part of it, but that's not why music for instruments is interesting, it's because a person is playing it. So the poetic part of the piece was that at any given moment in time, some person, male or female, is sitting in a medical center with electrodes on his or her scalp, and an analysis is being done of his or her brain waves to determine whether he or she is going to live or die. This gave me terrific anxiety, you know, because all around me were compositional people who wanted me to use technique, all of the things that you learn—contrast, pacing, texture, things of that kind. I had to eliminate those in order to get at the poetry of the piece, which demanded that a solo performer sit in front of an audience and try to get in that alpha state and to make his or her brain waves come out, to emerge with enough energy to drive an amplifier and do the piece.

Now if I had composed a tape piece, it would have been just another tape piece except for using brain waves. On the other hand, there are composers who have done it differently; instead of making tape pieces with brain waves as source material, they use brain waves to control electronics. They're doing synthesizer pieces with alpha or other waves as control signals.

So I was in the middle of that. And the anxiety I had was the anxiety not to compose but to take the existing situation, the one that every doctor knows and every person having an EEG knows, and displace it, taking it right out of the hospital and putting it into the concert hall. Then it becomes art, or at least what I thought was art. I got a lot of criticism about that from colleagues of mine who found it a boring idea, who thought it didn't amount to anything because it was just brain waves. Alpha itself is below audibility; it's too low to hear as a pitch, but that high energy, those bursts of alpha, would come bumping through the loudspeakers, making the grille cloth on the speakers bump, and I got the idea of using that energy to couple the loudspeakers to instruments. I used gongs, tympani, bass drums, anything that loudspeakers could vibrate sympathetically. So the idea is that alpha, which is produced without the person making any physical motions except the opening and closing of the eyes, which you don't really have to do if you can non-visualize with your eyes open, the idea is that that small amount of energy . . . see, it takes amplification very, very seriously. When I thought of using the alpha energy to drive the percussion instruments, that was the point at which the idea became a piece, when it went into a musical realm.

*There's a wonderful contrast. The performer is performing live but not only isn't he physically manipulating the sound-producing ele-*

*ments in the piece, he can't move. If he moves, he loses the alpha state and there is silence. Is that an element of the theatrical appeal?*

I didn't think of it as such, but it did mean I could be very still in a musical performance. You know, most music is busy, the players have to move, the actions of a pianist, for example, are important, but in this piece electronics allows you to go directly from the brain to the instruments, bypassing the body entirely.

Most people thought the material was too simple, and I began to think I was some kind of charlatan. I suppose it appeared that I just took Edmond Dewan's brain wave apparatus and went into the Rose Art Museum and did a concert, but there was a lot of work involved in getting the medical equipment to work for music, the amplification system designed—I think we had sixteen channels—and the instruments chosen and deployed. Even doing all that, which is just as complex as doing any other kind of music, it just didn't seem enough, and I felt anxious. Now if I had decided to make a tape piece and gone through all those technical motions, I may have felt more comfortable, but I finally did what I thought was the most honest thing. I tried to be very accurate about what the piece really meant: one person, alone, sitting very, very quietly, releasing a flood of energy which permeates the concert space. And to me, that was a beautiful idea, much more so than making a tape piece.

*I think that's clear when you consider some of the alternative suggestions you mentioned. Most of them focus on the "problem" that the material you're working with is sub-audio; you can either use it as a control for other things or you can speed it up to make it audible. Instead, you accept it as is and use it as an impulsive force*

*to play musical instruments.*

Yes, but I also did those two things that you just said I didn't do. You see, one of the inaccuracies of the title is that it's not really for solo performer. You need someone to run the amplifiers, to pan the sounds around, to turn on one loudspeaker and then turn on another, and I've always, except once in Stockholm, done it with another player, an assistant. In the score that I wrote, I stipulated that someday, when electronics became what it's now become, you could have an automatic switching arrangement, such that so many bursts of alpha would be a code to a switching device, and the alpha could control itself without an assistant.

*In the meantime you have someone to turn the pages.*

Right, at that time we didn't have that sophisticated switching arrangement. Also, I had pre-recorded brain waves sped up into the audio range, and at certain times during the first performances I would have an assistant engage a switch so that as a burst of alpha came through, the tape recorder would be turned on and you'd hear a higher phantom version of the alpha. So I did use pre-recorded tapes, and I did use alpha as a control signal, but they were used as extensions of the idea and were not the essential idea.

*This piece really has a theatrical flavor. How much of that had you done prior to this piece?*

Earlier in Rome, in 1962, I had done **Action Music for Piano**, for which I had made a very elaborate score that described the gestures of the pianist, extraordinarily exaggerated movements of the hands

and arms and elbows. So when **Music for Solo Performer** came along, I was prepared to do that, to accept the theatrical, although when I use the word “theatrical,” I feel cheapened somehow.

*Because it isn't play-acting, it's real.*

Well, in one sense, everything is theatrical. Do you know the . . .

*Shakespeare saying?*

“All the world's a stage”? No, I was thinking of the Borges story, **On Universal Theatre**. It's a marvelous story in which people ride bicycles, smoke, mail postcards; they don't do anything they wouldn't do otherwise, but they know they're doing it. If as you're doing everyday things, you think that they aren't everyday things, you'd be in the ultimate theatrical setting. So, in **Music for Solo Performer**, all I did was take the EEG situation as a whole and, by doing that, make a celebration of the event.

*When the person is producing the alpha in performance, he or she is overcoming an obstacle, and the compositional mentality utilizes that in a positive way as a philosophical statement, the idea that the situation in the room is an extension of one's brain.*

*There are a number of paired oppositions in this piece when you start to think about it—the spatial distribution of sound controlled from one point, the performer producing sound by not moving, the unconscious control of sound. The more you go into the piece, the more strange twists you can find.*

I don't think I would have done the piece if it were possible to

change the alpha by changing emotional states. One of the first things that anyone ever asks me is : “Can you change the quality of the alpha by having another thought, a different kind of thought?” They want to think that if you get angry the alpha will go up or if you get sad it will go down. And of course, that isn’t the case at all; it just goes on and off, the 10 Hz pulses are irregular because it’s difficult to maintain a perfectly meditative alpha state. Those bursts of alpha that go through the amplifier and drive the loudspeakers, the complexity of the signal and the fact that it is making the cone of the loudspeaker work to resonate objects, or membranes on a drum, or the cardboard in a box, those live, physical events are the composition of the piece to me.

I used to get letters from people asking about such things as formant structure and biofeedback and I just didn’t know how to answer them because the piece isn’t about that. I remember when I was in school it became very fashionable to regard music as a series of problems to be solved. The musical journals were filled with titles such as “*Pitch Problems in So-and-So,*” or “*Problems of This-and-That.*” The only problem I have in composing is to get the imagery, the idea and sound-image right, and if I had tape recorded this piece . . .you know, there’s a way to explain it in terms of accuracy. By tape recording it, you lose the life of the sounds because the dynamic range of tape isn’t that good. Also, at that time we were concerned with letting sounds be themselves and it seemed to me that to cut and splice was not the way to let alpha be itself.

*It’s a matter of choosing not to control.*

Yes, I remember we discussed the proportions that have existed in

previous music. The ideas of contrast and balance come from another place; they have nothing to do with alpha. It's so wonderful because the minute you say it doesn't, you find that you've done exactly that; I did have contrast between the gongs and cymbals and drums. Perhaps I chose percussion because I used to be a percussion player. I remember when I was young, studying drumming, I started practicing on a rubber pad and then moved to a snare drum. You didn't need anything else, you didn't need pitches. And after all, alpha's really a rhythm; scientists call it alpha rhythm.

*It's low enough to be considered rhythm as opposed to pitch.*

Yes, and although theoretically it is a continual pattern of 10 Hz, it never comes out that way because it stops when your eyelids flutter or you visualize a little and it tends to drift down a little bit if you get bored or sleepy. So I exploited that rhythmic idea and extended it to the drums. It was very natural for me to make a percussion piece; to have tried to make it a pitched piece in some way would have seemed bizarre and grotesque. It's funny, to me sharp contrast is a banal idea. If you look at a painting with contrasting foreground and background, it just doesn't seem right somehow. When you think about it, it is a very easy idea; if you don't know what else to do, you just do something different from what you did. It seems to me that the most interesting differences are small ones, slight subtle changes.

*Differences that don't break the thread.*



Right, it's trying to get the maximum information out of the least contrast. Those big emotional changes you find in a Beethoven sonata, for example, worry me. They seem childish; you're happy one minute and sad the next. And when people say that electronic technology is cold, they really mean that it doesn't have those self-indulgent emotional changes.

The elevator here at the Gramercy Park Hotel is an example. I go up and down it very often and I've timed the response from when you touch the button, a beautiful, light, touch-sensitive one, to when the door closes. It's usually from three to four seconds. And you'd be surprised how many people don't even want to wait that long; they think something is the matter and start pushing the button sharply and repeatedly. Now the time response of the elevator was designed by somebody, some very sensitive engineer or group of engineers who decided what would be a graceful timing, not too fast and not too slow, and generally the people who are impatient with it are not in a graceful state when they get in. I almost want to tell them that the elevator is more graceful than they are. The time response of that elevator, if you were to pay attention to it, if you were to surrender to it, would be therapeutic because your mood or feelings would change between the time you got into it and the time you got out; the ride down is very, very beautiful. I think if you let the elevator teach you something, you could step out of it feeling more graceful.

# THE DUKE OF YORK

## **THE DUKE OF YORK (1971)**

for voice and synthesizer(s).

Two persons design a musical performance in which one of them, the synthesist, uses an electronic music synthesizer or equivalent configuration of electronic equipment to alter the vocal identity of the other, the vocalist, who selects and orders any number of songs, speeches, arias, passages from books, films, television, poems, or plays, or any other vocal utterances including those of non-human intelligences, in ways determined by his or her relationship to the synthesist and the particular purpose of the performance.

Performances may be used to strengthen personal ties, make friends with strangers, or uncover clues to hidden families and past identities.

In strengthening personal ties, one, with the help of the other, selects examples that either or both have known and remembered since childhood, arranging them in the order of their emergence in their awarenesses. In making friends with strangers, the vocalist selects examples that the synthesist might have known and remembered, based on assumptions as to race, color, date and place of birth, manner of speech, dress, hair style, or any other outward sign, arranging them in the order that they might have emerged in the synthesist's awareness. In uncovering clues to hidden families and past identities, vocal examples of any kind may be arranged in any order or in temporal or geographical clusters. Examples may be taken from letters, diaries, memoirs, musical works, or biographies of real or fictitious persons.

The vocalist sings, speaks or utters the examples to the synthesist through a microphone and amplifier system. He or she may read from script or score, memorize, or listen through headphones to a record player or tape recorder upon which are stored the examples in their chosen order. Separations between examples are determined either by the length of time it takes to change each record or by the natural spaces that are formed by turning pages, splicing, or collecting and recording examples.

The vocalist learns to mimic recorded examples as perfectly as he or she can, without interpretation or improvisation, in order to partake of and

communicate to the synthesist as fully as possible the vocal identity of the recording artist represented by each example. All aspects of the sound images including those produced by recording techniques and other special effects should be regarded by both performers as much a part of the remembered or imagined identities as such vocal considerations as inflection, articulation, timbre, breath control, projection, and vibrato. During those parts of examples in which the recording artists rest or where it is impossible to follow, the vocalist either imitates the accompanying parts or leaves gaps. Whole examples, not parts of examples, should be used.

In cases of vocal identities for which there are no recorded examples, the vocalist tries to imitate the vocal identities as he or she imagines them to be.

The synthesist alters the vocal examples as they arrive from the vocalist, trying to make them sound as much as possible like the originals as he or she remembers or imagines them to be. Any disparities that arise between either performer's remembrance of original examples, their imitation, re-recording, or cover versions, should be regarded as inherent discontinuities in space or time. In uncovering clues to hidden families or past identities, the synthesist composes a set of examples designed to sketch biographies of persons other than those sketched by the vocalist. The separate sets of examples are then performed simultaneously.

Within each example, the synthesist makes one or more alterations of any aspect of sound including pitch, timbre, range, envelope, vibrato, and amount of echo. Alterations, once made, may not be lessened but may be increased from example to example to produce a continually changing composite vocal identity made up of many layers of partial identities.

In performances involving more than two persons, the synthesizers may be played separately or linked together.

Sounds made by the synthesizer itself should be considered its attempt to establish continuity or to express its inability to cope with the situation.

*This page intentionally left blank*

**The Duke of York** seems to me to deal with adjustments to memories . . .

Yes.

*. . . and the reinterpretation of material as it relates to memory experiences. The person operating the synthesizer seems to try to re-create past experiences by making sense of the data she's receiving. The piece also has to do with transmitting meanings and assuming roles.*

Well . . . a long time ago, I wanted to make a jukebox for an art exhibit. I thought of recording or collecting sounds on a batch of 45 r.p.m. records. People could then put nickels in and mix four or five sounds at the same time; I could also make some money. Then . . . no, I won't tell you how I got to the title because it's a pun and I like to keep puns to myself. I didn't invent the pun, Bob Ashley did, but I don't think he remembers it. I started thinking about the singers that are so powerful in our society. To tell the truth, my wife is something of an expert on popular music; she knows all the singers and all the songs and who sang the original versions and who sang imitations of them, and in that regard, I'm an ignoramus. But we were married. So I thought, "Well, if Mary loves that kind of music and those singers, she must have stored in her mind a very complex composite personality made up of partial personalities of all these people." So I decided to compose a piece in which I would imitate those singers whose vocal identities were so strong in Mary's mind; I would try to sing their songs as well as I could, to steal—really steal—their vocal identities and to communicate to her, to try to strengthen our rela-

tionship. Now, as a sympathetic idea, I thought that she could try to help me fulfill this task by changing the sound of my voice with a synthesizer. In a crude way, she could try to make me sound like those singers, based on her remembrance of what they sounded like. It would be complicated because what she would remember of their vocal identities might be changed by the passage of time. It's an impossible idea.

Then I expanded the idea to include not only popular songs but any vocal utterances taken from poems, plays, operas, or any real or fictitious written material that might serve as a connector between two people. Theoretically, you could imagine that you had something to do with all the vocal utterances that were ever made and that you might bring yourself back to another place and time. You could try to imitate all those sounds and communicate with another person who would have them in her background someplace. Then I thought that if you made constructions of historical events that occurred before tape recording, an historical play for example, you might treat that as being as authentic as what that play represented. For example, Shakespeare's **Julius Caesar** could be thought of as a supplement, or a superimposition, or a correction of the original, the only difference being that it's separated in space and time. If you could push space and time around, you could superimpose that play so that when Shakespeare was stabbed—excuse me, when Caesar was stabbed—the difference between the original event and Shakespeare's event would be an interesting place to be, between those little discrepancies. You could superimpose all of these, which is what I'm doing in the piece. You see, it's a way to exploit recording; it's as if it's a gift from God to us to preserve things and then to re-create them.

*But mainly to re-create them. You can't just rely on the fact that they're stored.*

Right.

*It's an attempt to make them as immediate as possible.*

Right. If you make a movie that is a remake of another movie, it is as authentic as the original, and the original is as authentic as the original event on which that movie is based.

*Is it possible that a performance of **The Duke of York**, dealing as it does with serious questions of the reconstruction of information, is as authentic as those processes as they occur in the day-to-day lives of the audience? There's also a connection to be made there because the audience is privy to these serious questions between two people, and in the more expansive form of the piece you talked about, the entire race has to deal with it. The same processes are happening in each member of the audience as well.*

I imagine that would happen.

*Is the synthesizer the complete technical facility for this piece, or can you conceive of something that could do a better job?*

Well, I composed **The Duke of York** specifically for synthesizer for a number of reasons. One was that it had become the American idea of what electronic music is, a small, portable performing instrument for popular consumption. There are a lot of them around these



days—the Moogs, the Arps, the Buchlas—and a lot of people to play them. You see, when I first made electronic music in the RAI Studio in Milan in 1960, I worked in what has become the classical electronic music studio, consisting of a large configuration of test equipment—audio oscillators, amplifiers, noise generators, things of that sort. You either had access or didn't have access to an official studio; it was an elite situation, but the American idea is that electronic music should be accessible to everyone. Secondly, a synthesizer is a real-time instrument. Voltage control has eliminated the need for splicing. The classical European studio depended on splicing techniques; there was no way to make real-time pieces, so most of the works were collages of some sort. **The Duke of York** is not a collage piece; I didn't want any editing. The vocalist is responsible for whole songs, not parts of songs, and the synthesist has to react quickly without too much time to think. So the synthesizer was good for that. But I think the real reason I used it was that it was called a synthesizer, probably from the old RCA synthesizer that was designed to imitate the sounds of musical instruments. I had always hated that idea. It had seemed to me a waste of time to try to synthesize the sounds of perfectly good acoustical instruments with a new technology. But since **The Duke of York** has to do with the layering of one identity on another to make a composite image, I thought that the notion of synthesis was justified. I gave the synthesist a non-musical task; she doesn't make changes according to ideas of musical timbre, for example, she makes choices according to ideas of identity. In doing so, she really creates something synthetic, a composite identity of a real or imaginary person. I guess I thought that's really what a synthesizer should do.

Actually, I gave the synthesizer a task it can't do; it begins to break

down. One of the rules is that an alteration can be made and added to but not reduced. For instance, if you add reverb to an example, you can't bring the pot back down for the next example except by control once removed, that is, by altering a component that alters that first component. For the first song you might change the timbre in some way, for the second you might add reverb, and for the third you might do something else. Finally, you've had so many planes, one identity over another identity over another one, that pretty soon the situation gets so saturated that the person operating the synthesizer can't handle it very well. Also, the synthesizer itself begins to do all sorts of insane things because it is not designed to deal with that, and I wanted that situation also.

*There's a nice contrast, as in most of your pieces. The vocalist presents his material in whole parts, but they follow one another. The synthesist's contribution is to make layer upon layer. It's a different idea.*

It's another formal idea, yes.

*And even though it's a duet, the players are in series instead of parallel. The vocalist's material comes through the work of another player.*

*May I ask you a specific question about your own performance of the piece? I've seen it twice and both times there's been a Latin text. Now, where does that come from?*

Well, most of my pieces are built on physical or acoustical principles that you can talk about—alpha waves, echoes, resonances, things

of that kind. But they become interesting, for me anyway, when you can't talk about them anymore. This piece is a probe into the remembrances of a person or a number of persons, into their own past or personalities. That's an internal thing, isn't it, all those flashing, fleeting thoughts you have when you're alone as to who you are or what your image of the world can be. It's either that personal or internal investigation or a probing into what other cultures regard as religion, specifically reincarnation. We have psychological ideas but other cultures don't; they have religious ideas. And even if these probes are not true, even if they're absurd and off the track, still, for me, they're a more interesting way of getting material than by using musical judgments. So to answer your question more precisely, for particular reasons, or particular memories, it comes to me that the reason I went to Rome on a Fulbright was not only the attraction of Italy for an artist, but the idea that perhaps I had unfinished business there. Now, it's confusing in my mind as to what that means, but if I believed in reincarnation, and if I had the desire to go to Rome, then I might assume that I had been a Roman at some other time. And even if I weren't, it's still a beautiful source of imagery out of which to make a piece.

Now, to be still more specific, when I was in Rome, I lived in a single room on the Vicolo della Campana, and if you looked through the window, you could see the Tomb of Augustus. I regarded that as a sort of pun because my middle name is Augustus. Somewhere in my family that name came up; my grandmother named my father that and he, in turn, named me that, but you can't ignore the fact that an Augustus was a Roman emperor, or if not a Roman emperor, then somebody in Rome. Later on, I happened to find a letter from the Emperor Augustus to his wife Livia about her grandson Claudius.

The text had empty spots in it; it was incomplete and I liked that because it spaced it very nicely. The fact that I have a speech impediment matches that because sometimes I have to stop talking and let a word empty out. So, I wanted to use that letter as a time delay and I thought it would be a beautiful text. Also Latin is a dead language; I didn't think that anyone in the audience would understand it, at least not all of it. It was beautiful source material, it seemed to me. Also the gap, the time spanned, the whole idea that you're re-processing that in the present seemed right.

I often follow the Latin text with an aria from a Berlioz opera, and you know my connection to Berlioz: he went to Rome too. Then I might use an old Johnny Ray song that I thought the synthesist might have an idea about, and follow that with the sounds of the whales. Everything in the piece has to do with distance; the whales are in the ocean and send sounds such a long way, the Johnny Ray song uses that artificial reverberation to achieve a spatial effect. I even think of the synthesizer as a geographical place.

*Where these things could come together.*

Where these things could come together, yes.

*And yet the piece is no more about reincarnation than, for example, **Vespers** is about echolocation. You've mentioned the "musical realm," that point at which simple ideas suddenly start giving rise to their own ideas and their own meanings; reincarnation is the simple idea. What happens when there is more than one synthesist?*

Then it's like a divining rod with two prongs on it, a double-branched

thing. One synthesist could be processing the vocal sounds in one way and the other in another way. I made the stipulation that they could be linked together so that they could cross and interweave with one another, but we've never done it like that.

I thought of it as an opera. You know, in an opera, there's so much disguise and terrible mistakes are made when a person doesn't realize it's the other person. Sometimes the whole conflict of an opera is based on an error like that. I had the idea in my mind that if you imitate someone else, you want to partake of his or her identity, and this piece seeks an identity connection between at least two people. I also had it in mind that there's a single source of life, the idea of the single cell splitting into two and then four and then eight, geometrically. This piece, however, would work back the other way. If you could do it infinitely, everyone would process that sound according to every memory they ever had, thereby going back . . .

*To where they had a connection.*

. . . to where they had a connection; it's a grandiose idea. But in its simplest form, with a single vocalist and one synthesist, it's personal; it's communication between two people that the audience can share. If you look at the score of **The Duke of York** and think of the imaginary ways in which the piece could be done, it could include everybody who's ever lived on the earth.

It has kind of a therapeutic aspect also. You know the story about the woman who had amnesia. They played every popular song they could think of for her, based on her looks, age, and who they thought she was. They went back into her past starting with children's songs,

and slowly but surely, they connected with her. She would remember a song and it would give her memories, you know how a song can bring you back to a particular time and place, and so they finally got her out of that state. There's another story that Bob Ashley used to tell about a totally paralyzed man who couldn't respond to anything. Well, one night he was watching television or listening to the radio, and all of a sudden, out of a clear blue sky, he began to sing! And he sang along with the song that was going on and when it was over, he just stopped and went back to the paralytic state. And every so often, after long periods of time, a song would come on and he'd just begin to sing that song, but that's all he could do. His wife spent years playing the piano for him, hoping that as a song that he recognized would start he might sing and perhaps recover his memory. It was a touching story. I don't know how it came out, but it was an idea in the piece. I've only done it with people I know pretty well, and my idea is that there's an underground current in that piece that connects people in ways that they never would otherwise.

*It's not just a matter of establishing common ground, but that the ground that is common is the most powerful.*

Theoretically, you could imagine that you had something to do with all the vocal utterances that were ever made and that you might bring yourself back through time to when you were a small animal. I was thinking that this piece could be a symbol of that, that you could learn to imitate all those vocal utterances and try to communicate them to another person who might have those in her background somewhere. When Mary and I do the piece, she says it scares her a little because I try so hard.

*This page intentionally left blank*

**THE QUEEN OF THE SOUTH and  
TYNDALL ORCHESTRATIONS**



## **THE QUEEN OF THE SOUTH (1972)**

for players, responsive surfaces, strewn material, and closed-circuit television monitor systems.

Sing, speak, or play electronic or acoustic musical instruments in such a way as to activate metal plates, drumheads, sheets of glass, or any wood, copper, steel, glass, cardboard, earthenware, or other responsive surfaces upon which are strewn quartz sand, silver salt, iron filings, lycopodium, granulated sugar, pearly barley or grains of other kinds, or other similar materials suitable for making visible the effects of sound.

Surfaces may be excited by making sounds through nearby loudspeakers, directly coupled audio transducers, or directly on or very near the vibrating media themselves.

As the strewn material responds to the disturbances caused by the musical sounds in the vibrating media, observe, while playing, continuous variations of concentric radial patterns in round surfaces, parallel diagonal patterns in rectangular surfaces, increases in the number of elements with increases in frequency, whole movements or migrations with increases in amplitude, interference phenomena, visible beats, and imperfectly formed patterns caused by the peculiarities of both the musical sounds and the vibrating media.

Make musical activity either to discover in real time the visual images characteristic of the identity of the performing ensemble with respect to the time and place of the performance, or make pre-determined patterns including lattices, networks, labyrinths, flows, currents, rotations, bridges, streams, beams, heaps, eddies, dunes, honeycombs, imbrications, cells, textures, turbulences, vortices, layers, figure-eights, lemniscates, spirals, rings, rivulets, trees, branches, pools, dendrites, bushes, balls, pigeon eggs, quadratoids, tetragons, pentagons, hexagons, flowers, hollows, ram-parts, figurines, walls, peaks, pillars, columns, volutes, annuli, fissures, plates, rams' horns, crypts, spicules, worms, webs, clouds, storms, spherules, zebras, plumes, embryos, rills, buttes, mesas, groves, fountains, swastikas, mandalas, crowns, crosses, scapulas, beads, medallions, topologies

of near or far environs, plaids, tweeds, road signs, floor plans, tapestries, diamonds, Stars of David, gardens, corals, sunbursts, faces, angels' wings, fans, berms, gullies, washes, mosses, daisies, weaves, signs of the zodiac, almonds, clock faces, calendars, moons, planets, mirrors, demons, gems, stigmata, sanctuaries, playing fields, wheels, whales, palms, ferns, cypresses, blindfolds, ladders, urns, Adams and Eves, cisterns, sepulchres, tongues, dragons, toads, eagles, swans, fishes, dishes, rooms, tombs, hosts, hats, animal tracks, fossils, footprints, rugs, bones, and ghosts.

From time to time, apply fire and ice to the vibrating surfaces to change their temperature environment and thereby alter their characteristics.

Make liquid versions using water, glycerine, mercury, plasma, heated raolin paste, or other viscous liquids to bring about hydrodynamic phenomena including frequency-dependent site locations, constant directions of eddy-rotations, amplitude-dependent rotation speeds, the creation of Lissajous figures, and anti-gravitation effects which occur if sounds remain constant and the vibrating media are tilted or held vertically.

Take sounds from the vibrating media by contact, vibration, or air microphones in order to discover and amplify changes in the original sounds due to the physical characteristics of the media through which they travel and for purposes of single- or multi-channeled playback during performance or recording on electromagnetic tape.

Use closed-circuit television monitor systems in fixed closeup positions to verticalize and enlarge for the players and audience the visual images made by the players' sounds on the material-strewn surfaces.

All musical considerations including pitch, timbre, lengths of sounds, texture, density, attack, decay, and continuity are determined only by the real-time decisions necessary to the image-making processes.

Based on the work of  
E.F.P. Chladni (1756 - 1827) and Hans Jenny (1904 - ).

Commissioned by and dedicated to Gerald Shapiro and the New Music Ensemble, Providence, Rhode Island.

## **TYNDALL ORCHESTRATIONS (1976)**

for singers, players, and dancers with sensitive flame,  
Bunsen burners, glass tubes, and recorded birdcalls.

One person, sitting at a small table in the middle of the performance space, lights and adjusts the flame of a propane-fueled Bunsen burner, sensitive flame apparatus, or other specially designed glass- or metal-tipped device, to a point just below flaring.

Any number of singers, talkers, and players of acoustic or electronic musical instruments, positioned at different distances far enough away from the flame so as not to disturb it by air currents from their voices or instruments, explore the phenomenon of responsivity of a gas flame to sound by singing, talking, and playing in such a way as to cause the flame to jump, duck, and bend in pre-determined or spontaneous shapes. Singly, or in duets, trios, or larger groupings, the performers may discover pitch, timbre, envelope, and dynamic combinations that create real and imagined images in the burning flame.

One or more dancers may move slowly from different directions toward and past the flame, shaking bunches of keys, ratchets, rattles, or other hand-held sound-producers to discover directionality, if any, of the flame's responsivity to sound.

From time to time, single or grouped examples of pre-recorded birdcalls may be played to disturb the flame in unexpected ways.

The amount and quality of the sonic activity should be regulated by the ability of the flame to respond.

In large spaces, a closed-circuit color television monitor system, the camera in fixed, closeup position, may be used to enlarge the flame for viewers.

As accompaniment to the above or as a separate activity, any number of other players, sitting at separate tables around the performing space, insert lighted Bunsen burners up into vertically clamped glass tubes and, by centering the burners inside the tubes, altering the heights of the tubes above the flames, and regulating the flow of gas to the burners, explore the sounds produced by the action of the flames in the tubes, cre-

ating rhythmic patterns with pops caused by low flame flickers and sustained, tunable, resonant pure tones caused by higher, smoother flames.

Reinforce resonance phenomena among tubes by unison tunings, create rhythmic patterns by beating caused by near-unison tunings, and spin interference patterns through the performance space at speeds and in directions determined by the tunings and geographical locations of the tubes. From time to time, adjust the flames to null points and overdrivings, creating silences and noisier, less stable effects.

Depending on the resonant frequencies of the tubes, try to disturb the sensitive flame.

Based on the work of John Tyndall (1820 - 1893), natural philosopher.

*This page intentionally left blank*

*I'd like to ask about two pieces, **The Queen of the South** and **Tyndall Orchestrations**, in which visual material associated with the performance of the piece is presented to the audience. In both cases, there's a translation from one mode to another, from sound to visual material and back again, and the boundary where that translation takes place is an effective point at which to attend the process. In **The Queen of the South**, for example, you can see the movement of the grains where sound becomes vibration. In **Tyndall Orchestrations**, sound waves affect a flame. And as I understand it, there's a quasi-improvisatory process on the part of the players, or there can be, and yet they're part of a feedback process because they're attending the visual material, as is the audience. So the visual is not an accompaniment, it's a stage in a complex process. Would you agree with that?*

Well, it was a very simple idea. I thought of it as a way to allow players to be free, but wanted to arrange it so that they didn't improvise. I've said this several times before, that improvisation isn't what people think it is. In baroque times, for example, it meant putting together formulas, rhythmic or melodic motives, in a modular way. When you improvise, you call on your past, so only parts of it are spontaneous. If you listen to a jazz player, he often repeats the same thing; if he didn't, he wouldn't have a style. And since we've been moving toward a non-written musical language, whose quality and feelings can't be written down in the conventional way, I wanted to make a situation where the players would have not a stylistic constraint, or a constraint that I, the composer, would put on them, but one that comes out of the natural materials with which the music is made. If you're to play a piece in which the task is to put sounds

into a material and experience the modes of vibration of the sound in that material, as in **The Queen of the South**, or to make sounds in such a way as to cause a flame to move, as in **Tyndall Orchestrations**, you have two choices. One is to make any sound that you already know how to make, or any music that you know, and see what it does to the materials; in that case, you're making *son et lumière*. That's the first thing that everybody suggests I do, to plug in a Beethoven symphony, for example, and see how the flame jumps. Or to avoid that simple-minded situation, you can do something more simple-minded: ask a player to pay very close attention to what occurs in those situations and use those occurrences as a—I was going to use the word "score"—use them as a procedure with which to continue making the sounds.

*So it would seem that the physical phenomena take the place of a musical tradition.*

Yes.

*The audience isn't seeing a light show to go with the musical work; it's all the same process.*

Yes. In both scores, I've stipulated that a closed-circuit television monitor system be used if necessary. In **The Queen of the South**, the strewn materials are on flat plates on the floor, that's the only way to do it, and when the piece is played, it's difficult for a large audience to see what's going on without the video. But needing closed-circuit video on the vibrating materials is actually a blessing in disguise. You make the imagery available to the audience, but what

happens along with that is that you defy gravity, you turn the plates up on their axes, you change the spatial relationships, you show something that is physically impossible. And secondly, by translating the image to video, you're turning a mechanical phenomenon into an electronic one. An art historian friend of mine, Dick Field, when he saw the piece, pointed at the plate on the floor and said, "That's not art," but when he looked at the video monitor, he said, "but that is!" So by the simple necessity of making it accessible to the audience, you transfer it, or translate it one step up or down, you remove it from being merely a physical demonstration. By translating it into another medium, you make it art.

*Would you have thought of doing the piece this way if you hadn't wanted to produce a piece for players at the same time that you learned about the physical phenomena?*

You mean . . . I don't quite understand that.

*Well, there's the operation of the Chladni plate, for instance. That in itself isn't a piece and it might not inspire a piece; the fact that it could be used as guidance for players and that you wanted to offer an opportunity to players to perform would have to occur at the same time to produce a work like this.*

I saw it as making composite imagery, several people playing together into one medium and producing cooperative pictures. Chladni imagery tends to demonstrate the clearest situation, the patterns are symmetrical given the regularity of the system; in other words, the plate has to be absolutely flat and the materials should be flaw-



less to enable you to get symmetrical patterns. But the marvelous thing about performing ensembles is that they're not symmetrical and have a great many flaws.

*If we agree that the artistry comes from the translation of the movement of the material onto the video monitor, are there physical phenomena that interest you at the moment that haven't become pieces because there is no form in which to cast them?*

Yes, I always have several ideas in my head that may or may not come out as pieces. I have to wait until the ideas clear themselves out to understand how to use them. But often, if I really understand the principle of the idea, the making of the final work is fast. **Bird and Person Dying** was fast; I had the idea and the equipment and I was lucky. I'm almost afraid that the Tyndall piece hasn't achieved what I really want it to achieve to become a piece. So far I have the sensitive flame working, I have players playing into that flame to make images, and I have other players making accompaniments using related phenomena with flames in glass tubes. It does have a lovely quality; externally, anyway, it evokes imagery that I find beautiful. I'd like to achieve imagery internally, but sometimes singers and players don't have enough control to make the flame assume images that I would like it to; I'd like the flame to turn into birds and flowers and things of that kind. It seems very hard to do because once a flame is disturbed, it doesn't stay there, it bounces back, and I've refused to use electronic sounds in this piece. Sine wave oscillators at certain frequencies can easily pin down the flame, but it's too pure, too scientific, it's too much of a physical demonstration. I would much rather have the inept efforts of the players. The imagery of a whole performance, however, with a singer sitting

alone in the dark, a sensitive flame, four players around her with Bunsen burners in glass tubes, and an occasional birdcall coming out of the dark, pleases me very much.

*Could the performance of the piece produce visual results that you wouldn't accept?*

No, I'm perfectly willing to accept any visual results. When you look at a flame, you can see that different parts of it burn in different ways. There are blue parts and yellow parts and different colors. Now, by singing a loud sound, you can make the flame flicker and bend and you can even put it out. If you focus on small things, you can make the middle of the flame move down but keep the outsides relatively still. You can bend one side of the flame slightly by making small sounds. The anxiety of the performers to make large disturbances in the flame has been a problem, but if they're willing to work with small changes, I'll accept the audible results. Enlarging the flame on a video screen will change the scale enough so that the players won't feel impelled to make big changes for the audience. With the video, they'll have that degree of subtlety.

Now, forget all that for the moment, forget that I want to be accurate and honest about the images and sounds and the results that are produced. I asked Joan La Barbara, who is singing the piece this week at the Diplomat Hotel, to experiment with one of her very extraordinary vocal techniques, a complex, warbling trill, that not only makes the flame move very beautifully, but whose sound image seems appropriate to the piece. It sounds like Sioux Indian music in a way, and it seemed that, by putting aside my ideas about the accuracy of the sound and the result, to ask her to do something with that external imagery was finally more honest.

It's funny because there have been two types of performers that have done the piece in ways that I liked. A few weeks ago, at York University in Toronto, Ellen Band and Jacqueline Humbert sang the piece together. They are untrained singers and found it difficult to move the flame by conventional means of voice production. But they were very good performers in other ways, so I suggested that they try something extreme and they started producing squeaks, high-pitched complex squeaking sounds, which began disturbing the flame in more interesting but less controllable ways. They sounded like animals. This was Canada and we had been talking about Canadian imagery—the tundra and things of that kind. One of them sat in one place in relationship to the flame, the other sat in another, and it was dark and you couldn't tell where the sounds were coming from or what they were. It was just beautiful, the evocation of that wilderness imagery.

*In **Tyndall Orchestration** we've discussed the elegance of this concept of a process and the fact that it is a closed cycle, yet there's an opportunity for some sound images that seem unrelated to the material in the piece, namely the bird sounds. I'd be willing to guess that it wouldn't necessarily have to be bird sounds, but how do you account for the presence of something like that in the piece?*

It's got to do with the expected and the unexpected. I guess I predicted that the players would produce a searching quality with a continuity and a formal structure that I wouldn't like. I thought that the continuity might be improved by having one or more players or two or more players play, so that one kind of sound would disturb the flame in one way and the other would disturb it in another way, but

that double disturbance can get you into ensemble playing, which always seems to have a kind of crescendo-like form. It starts simply, one player, then two at once, and it seems that there's a natural form in that kind of playing which is dramatic, getting to peaks and going into valleys, and I think I just simply stuck in another image, recorded birdcalls, to break up that continuity and change the shape of the flame in unexpected ways. I play them very loudly, and there's a practical reason for that: the louder they are, the more effectively they disturb the flame. The recordings I use are of Western birds; I don't know how they differ from Eastern birds, but the first several calls are raucous. They're jays, bluejays, not very pleasant birds anyway, and when they come in, it destroys the pristine, pretty quality of the single singer or singers with players; I guess it brings out the violent side of the flame. You can see it as a candle or camp-fire flame, but there are also flames that burn things down, there are forest fires, and the noise that birds and animals would make fleeing a forest fire might have something to do with that. But even though I said that birdcalls may disturb the flame in unexpected ways, when you watch it and pair your experience with the sound and what you see, you almost think that the flame is assuming the shape of the bird that is making the call. It's almost a miracle. I suppose it's similar to a Rorschach test where you see things that are not actually there. In **The Queen of the South**, when two or more people make sounds into the plates at the same time and there are irregularities in the system, if the plate is not absolutely flat, say, or there's an irregularity in the wood, you get images that are not symmetrical. We got an antelope one night, and in Albany we produced a bird, a large bird that took up the whole plate. Every once in a while we get peace signs; that's easy to understand because they're symmetrical.

*Have you talked with the performers about their impressions of participating in these pieces?*

Well, I know that Ellen and Jackie enjoyed it a lot. Joan has yet to perform it in public, but she said to me last night that she feels very comfortable.

*Could you identify the artistic abilities you would like the performers to use? I'm assuming there are things that they could do that electronic sound generators couldn't.*

I think . . . in **Vespers**, for example, the Sondols and the activity of echolocation were so matched, the Sondols were the perfect instrument, that there was no problem in the sound image or the visual image to the whole idea of the piece. In **The Queen of the South** there were problems because instrumental players and singers can't sustain sounds for a very long time. Stringed instruments can, I suppose, but to make that sand really move on a piece of plywood or plexiglass, you need electronic sounds. I did the piece originally for the New Music Ensemble in Providence, and I encountered the same problem there that I did later in the Tyndall piece: the players tended to do things that they already knew how to do. But it was still interesting because it put them in a difficult situation that made them change their idea about what sound can do. In both pieces, sound has a task, sound is an agent to do something, to make something physical happen. When I did **The Queen of the South** on videotape in Florence, I used the same oscillators that I used in **Still and Moving Lines**, and I find that those sustained, continuous oscillator sounds, once you get them started, don't relent, they don't have to breathe,

they can really push the grains of sand around on the plate. Also, they're not audible until they get into the material. If you have a violin playing, the audience can hear the mix of the live violin and the processed violin as it goes via an audio transducer into the metal or plywood, and I've never enjoyed mixing real sounds with processed ones. But if you use a sine wave oscillator, it's inaudible, it's in an electronic circuit, it's only audible when it comes out through the plywood, and that I like very much. Now in the **Tyndall Orchestrations** I can't find a way to do that since the sounds have to travel through air to get to the flame. I have to use live sounds, and since I do, the piece is susceptible to the same problems as **The Queen of the South**. By asking the singers and players to move into a non-musical realm, getting as far away as possible from sounds that are like those in other music, I'm making a translation in imagery in the **Tyndall Orchestrations** that I made using electronics in **The Queen of the South**.

*Another aspect that you've hinted at is that there's no real starting point for the kind of material used in doing these pieces; you can't choose the material and then inject it into them. The only thing that really works is a constant audition of the material as it's being processed by the system.*

Yes, and you know, only an ox is consistent. The ideal thing would be to set up a system, the flame system for example, and then leave the players to solve it. That would be the perfect way, to let the performers do something beautiful. But even though you'd want that pure situation, the situation can't be pure because it's a performance piece and there are practical problems to be solved. For example,

the flame is not particularly sensitive if air conditioning is on, or when there are traffic sounds, so you have to change your idea of purity. It's a subtle change, it's the line between *son et lumière* and something beautiful. But by limiting what the players do, by editing out beforehand those things that you don't want, you're almost doing *son et lumière* but you're using your prerogatives as an artist.

# **GENTLE FIRE**



*This page intentionally left blank*

## **GENTLE FIRE (1971)**

Collect, on tape, examples of ambient sound events such as those made by

Screeching brakes  
Chattering guests  
Warring gangs  
Rioting prisoners  
Stalling motors  
Colliding meteors  
Orating politicians  
Arguing lawyers  
Heating kilns  
Shooting rifles  
Coughing engines  
Droning turbines  
Squealing tires  
Maneuvering tanks  
Drilling squads  
Buzzing saws  
Landing jets  
Drilling rigs  
Dripping faucets  
Knocking radiators  
Dragging tailpipes  
Hawking newsboys  
Squeaking shoes  
Tapping canes  
Wailing sirens  
Spurting blood  
Roaring trains  
Hissing cats  
Rattling snakes  
Raging fires  
Snarling dogs

Collapsing mines  
Bursting bombs  
Burning houses  
Sinking ships  
Nagging wives  
Snoring husbands  
Braking trucks  
Crashing planes  
Diving bombers  
Ripping fabric  
Tearing paper  
Falling trees  
Breaking windows  
Shattering glass  
Gnashing teeth  
Spraining ankles  
Stretching muscles  
Snapping vertebrae  
Flooding rivers  
Erupting volcanoes  
Gushing wells  
Flaming burners  
Spinning wheels  
Reaming rotors  
Crumbling cakes  
Snorting hogs  
Tolling bells  
Rasping coughs  
Gnawing rats  
Scratching claws  
Fracturing bones  
Stampeding herds  
Laughing hyenas  
Scraping forks  
Sinking boats

Horns in fogs  
Freezing bogs  
Ringing phones  
Slipping cogs  
Fraying cables  
Groaning tables  
Popping corn  
Skidding bikes  
Howling mikes  
Humming choirs  
Closing banks  
Rolling logs  
Bawling brats  
Creaking doors  
Rotting tombs  
Stabbing knives  
Heaving seas  
Slipping discs  
Slamming drawers  
Digesting food  
Melting snow  
Whirring blades  
Scolding maids  
Scalding kettles  
Steeping tea  
Cracking ice  
Clicking dice  
Splitting diamonds  
Limping legs  
Draining dregs  
Frying eggs  
Marching bands  
Swelling glands  
Sizzling steaks  
Crashing boors

Embarking tours  
Drying lakes  
Rising bread  
Dying ponds  
Drooping fronds  
Hardening arteries  
Clogging drains  
Eroding cliffs  
Boring drills  
Spilling oil  
Sliding hills  
Driving piles  
Turning stiles  
Hammering jacks  
Belching furnaces  
Stomping boots  
Splintering bats  
Sputtering fats  
Roaring crowds  
Moaning victims  
Clanking chains  
Pelting hail  
Springing traps  
Ringing alarms

Using an electronic music synthesizer or any equivalent configuration of electronic components, process these examples in such a way that they become transformed into what could be perceived as sound events of different origin such as those made by

Ocean waves  
Wind in trees  
Flowing streams  
Boiling tea  
Cooing doves  
Droning bees

Jumping fish  
Walking spiders  
Crawling babies  
Purring cats  
Crying loons  
Hooting owls  
Laying hens  
Snapping turtles  
Swaying palms  
Barking dogs  
Cracking ice  
Falling rain  
Squeaking shoes  
Buzzing saws  
Hatching eggs  
Bouncing balls  
Passing ships  
Rocking boats  
Squirting clams  
Clicking stones  
Croaking frogs  
Warbling birds  
Howling wolves  
Cackling geese  
Running water  
Perking coffee  
Whooping cranes  
Thumping rabbits  
Cawing crows  
Scolding squirrels  
Clattering hoofbeats  
Flapping wings  
Burning embers  
Crackling fire  
Whistling kettles

Snapping twigs  
Crunching snow  
Chewing beavers  
Swimming tuna  
Sounding dolphins  
Spouting whales  
Blowing gales  
Popping corn  
Tooting horns  
Neighing horses  
Baaing sheep  
Mooing cows  
Blowing breezes  
Drifting sands  
Rising bread  
Pitching hay  
Suckling pigs  
Billowing sails  
Jingling coins  
Straining loins  
Draining pipes  
Murmuring pines  
Humming birds  
Lofting passes  
Escaping gasses  
Flowing gowns  
Combing tresses  
Dragging carts  
Playing parts  
Ascending balloons  
Laughing girls  
Frowning clowns  
Running boys  
Chanting braves  
Blooming flowers

Mowing lawns  
Nuzzling fawns  
Sprouting chives  
Quaking aspen  
Spinning tops  
Wringing mops  
Swishing tails  
Hammering nails  
Opening jails  
Laying rails  
Emptying pails  
Stacking bales  
Wiring speakers  
Frying eggs  
Making beds  
Painting reds  
Buttering muffins  
Erasing errors  
Assuaging terrors  
Stopping bottles  
Screwing corks  
Entering ports  
Swaying dancers  
Healing cancers  
Cheering teams  
Jumping beans  
Splitting jeans  
Waving queens  
Scuttling crabs  
Honking geese  
Winding tape  
Hanging crepe  
Smacking lips  
Bumping hips  
Creaking ships



Clapping hands  
Marching bands  
Rattling bones  
Hewing beams  
Rubbing towels  
Turning cogs  
Nibbling mice  
Passing floats  
Weaving strands  
Watering hoses  
Easing throttles

For example, snarling dogs become crunching snow; crashing planes, laughing girls; and maneuvering tanks, ocean waves.

Record these transformations on tape in any sequence on any number of channels, using any manner of mixing, overlapping, or fading, taking care only that the process of change from each original sound event to its final state of transformation is slowly, gradually, and clearly heard.

Deploying microphones in remote places, bring about these transformations in real time by the human manipulation of the synthesizer or with the help of self-governing control systems.

Based on these procedures and experiences, design for your personal use and store in your mind an imaginary synthesizer with which, when used in conjunction with blocking, masking, and pattern recognition techniques, you can willfully bring about such transformations at any time in any place without the help of external equipment.

*I want to talk to you about three scores, **Chambers**, **Gentle Fire**, and **The Queen of the South**, the connection being that all three contain lists of images that the performers are intended to use. The form of the scores of **Chambers** and **Gentle Fire** is that of columns of images that are generated from the idea, but you've laid out the score of **The Queen of the South** in paragraph form, even though there's a similar sort of list. Is there some intention in that?*

I'm trying to remember what I was thinking when I did that; I think it was because the list of images in **The Queen of the South** wasn't as long as those in the other pieces and, therefore, I didn't think it should be in a column but in a paragraph. I wonder if it's got anything to do with the fact that the images emerge on a plate and not chronologically?

*That's interesting; you'd want a field of images.*

A field of images instead of a column. In **Gentle Fire** you go from one image to another, you transform one sound event into another. Have you seen the computer printout of that? There are 120-odd images in one column and 120-odd images in the other. We programmed the computer to pair them up in all possibilities and it comes out to more than 14,000.

*There's also a difference between **Chambers** and **Gentle Fire** in that one takes the images and compares them, and . . .*

Yes, I was just thinking, as you said that, that in **Chambers** and in **Gentle Fire**, the images are my own, I made them up, whereas in

**The Queen of the South**, many of the images, at least at the beginning, come from Hans Jenny's book, **Cymatics**. I actually took some of the images right from the book, and because I was ashamed of that, I tried to hide them in a paragraph. Do you know how I got the images in **Gentle Fire**? I used rhymes. I would think up several images and then make a rhyme with the one before. If I went away from the piece for a while—hours, days, however long—I'd go back and look at the list again, and the next image I'd put down, number forty-seven, for example, might rhyme with number one, or one of the first few on the list. So you've got all these rhymes and the form is not exactly cyclical, because it has no order, but most of the rhymes come from ones that started before.

*I like the idea of the images being generated by an idea, either rhyming or, in **Chambers**, all the different environments that you could possibly think of. Some of the lists remind me of dreams . . .*

Yes!

*. . . this odd combination of things.*

Yes. Do you know what it reminds me of? It reminds me of the early scientific activity by such groups as the American Philosophical Society in Philadelphia, which was founded by Benjamin Franklin, Thomas Jefferson, and others. They were amateur scientists who loved to make lists of what they found in nature in the new country. Or the Lewis and Clark expedition, for example, would return from Oregon with lists of all the flora and fauna they had seen on their journey. Their task was to get it all in; I like that idea.

*I remember reading Lévi-Strauss' studies of primitive societies. You'd think they would categorize their environment functionally, but actually, in some societies, there are more names for species and finer distinctions than in our own science.*

For me those lists were ways of making beautiful scores. I thought of them as poetry.

*Was there an urge, particularly in **Chambers**, to exhaust every thought in your head about locales for resonance?*

Yes, the urge is there, but then you realize that you can't do it.

*But how do you stop?*

I tried to include the most beautiful ones I could think of, more to give the idea of the quality of those environments than to exhaust the possibilities. Did you know that in **Gentle Fire** some of the images in one column are also in the other column? The first column has images that are supposed to be unpleasant, and those in the second are supposed to be pleasant, but I can't decide whether some are pleasant or unpleasant, so I put them in both. If you paired them up together, I don't know how you'd deal with them. Perhaps you could just change your mind about how you felt about them and the exchange could be made mentally.

I feel guilty about **Gentle Fire** because one of the ideas is that you can learn to tolerate noise and pollution. You design an imaginary synthesizer in your head with which you transform unpleasant sounds into pleasant ones. Now, that's a nice idea, but why wouldn't I prefer

to take political action to stop noise pollution instead of allowing it to happen, merely dealing with it in a dreamy way?

*I think of other places in our interviews and in your pieces where the same issue comes up. In **Chambers**, when the shells are played outdoors, you learn to hear the traffic in a new way because there's a new correspondence. In **(Hartford) Memory Space**, I remember you talked about going back into the streets and playing; that would be political.*

Perhaps, but it has no point of view. I'm not clear about how I feel about it.

I'm trying to get at another idea about **Gentle Fire**, a parallel idea, and that is if you make an analogy between two things, you're not only saying that one of them resembles the other, you're saying that the identity of one is concealed in the other. It's as if all things are the same, but have different outward appearances, and the transformation from one to another is an active process in which truth is determined, but you're at different values along the way. I've been thinking of composing a piece for two instruments in which one of them would imitate the other and vice-versa; you could use electronics in between, until you got to a point where you couldn't tell one instrument from the other. You would wed the identities of the players through their instruments.

*Is that to learn what's behind or within our wall of appearances?*

I don't know. This is difficult. It's got something to do with the way things are changing. There are so many people in the world now-

days that we have to find ways to get along with each other. At the grossest level, we're trying to find ways not to bump into each other. So instead of making music in which one instrument plays against another, the idea of contrast or competition, we're shifting to ideas of simultaneity, or similar identity. You know, in **The Duke of York**, I was really trying to imitate and become, in a spiritual way, a composite identity consisting of several identities. I guess it's my Catholic upbringing—transubstantiation . . . oh well.

I seem to be thinking much more in terms of visual imagery these days; **The Queen of the South** depends a great deal on the visual representation of the sounds. But I'm also working toward imaginary imagery, that is, an imagery that is not actually seen, but is in the minds of the players as they play. In **World Music for Bowed Stringed Instruments**, for example, that new piece that I tried out the other night in Amherst, I was at a loss as to what to tell the players to do. The piece is a trio for stringed instruments of diverse cultures, a Western violin, an Indian *sarangi*, and a Javanese *rebab*, and is supposed to be a comparative study in timbre in which the instruments are fed into an electronic filter. By playing various pitches at different dynamic levels, each player can determine some of the timbral characteristics of the others' instruments. Before the concert I decided to have them play into a closed low pass filter which they could open up to various degrees by playing softly and loudly, creating sound profiles of different shapes. I told them to think of creating imaginary mountain ranges. If they played softly, the mountains would be old and low; they would try to make domes. But when the energy was high and they played more loudly, the mountains would be new and jagged, with sharp peaks. Actually, the sounds that came out of the first few performances were more like the tearing of fabric,

as if the grill cloth on the loudspeakers was being ripped. The piece is not finished yet. I'm still unclear about it, but it uses that visualized imagery about which I'm thinking a great deal now.

*Could you ever conceive of yourself, as a composer, not liking the audible form of your ideas?*

Yes, I can conceive of that; since the wavelengths of sound are so long in comparison to other media, light for example, sound can't provide us with as much information. Animals that use sound to make pictures of the objects around them operate in frequencies much higher than we can hear. In order to sense small objects, they have to use sounds of short wavelength. So I could seriously consider a kind of information-collecting piece that would require sounds too high for us to hear.

*What would happen if you couldn't think of a way to present your ideas in audible terms?*

Well, then you'd do something else. You could print them, I suppose, or talk about them, or you could describe an—what's the word?—an "imaginary" situation in which these events would be audible. Inaudible material is not available to us physically, but perhaps someday we'll be able to bypass our ears and send signals that are beyond our range of audibility directly to the brain. Some time ago I worked with a device called a Neurophone, which was designed to send sound directly to the brain via the nervous system. It didn't work very well, except by bone conduction, so I never did anything with it, but my idea was to attach pairs of electrodes to the

armrests of chairs in a concert hall. The audience could hear the music—electronic, perhaps brain waves—directly, without its having to travel through air.

Right now, though, I'm thinking about a piece which would perhaps use a computer, in which I would simulate an environment, a room for example. I would describe the space, the length and breadth and width of it, and put into it a simulated set of frequencies that would activate its resonant characteristics. Then I could program into the room imaginary objects. For example, I could hang paintings on the wall which would influence, perhaps in a very small way, the resonant frequencies, or the reverberant qualities of the room. By changing a single variable, I could continuously or discretely change the sizes of those pictures, or even the amount of paint on them, thereby changing the whole sonic situation in a very subtle way. Or I could drop into the room an object too small for the eye to detect, but of which the computer, using its extremely fine computational ability, could take note. I'm also imagining that the ear in the simulated room would be able to hear very high frequencies. I could send the ear flying up into various parts of the room, up into corners for example, where it could explore very tiny imaginary frequencies bouncing along the walls. Normally all of this would be inaudible to us; my task is to make it accessible. And even if I can't do that physically, I can imagine that I can, and make pieces that symbolize that.



*This page intentionally left blank*

**STILL AND MOVING LINES OF SILENCE IN  
FAMILIES OF HYPERBOLAS**

## **STILL AND MOVING LINES OF SILENCE IN FAMILIES OF HYPERBOLAS (1973 - 74)**

for singers, players, dancers, and unattended percussion.

Create standing waves in space caused by constructive and destructive interference patterns among sine waves from loudspeakers. With single sine wave oscillators, amplifiers, and pairs of loudspeakers, design sound geographies for dancers consisting of troughs and crests of soft and loud sound that form in outward-arching, symmetrically mirrored hyperbolic curves between the loudspeakers, the size and number of which are determined by the frequencies of the sine waves and the distances between the loudspeakers. Add loudspeakers, creating additional sets of hyperbolas, some of which intersect. When necessary, clear pathways for dancers by slightly changing the frequencies of the sine waves, shifting the locations of the hyperbolas.

Any number of dancers discover troughs of quiet sound along axes of pairs of loudspeakers which they may follow, changing directions, if they wish, at intersections. If bumps of sound occur due to reflections from walls or other surfaces, search for open paths or wait for troughs to shift.

Play any number of sine tones, simultaneously in chords or clusters, or sequentially, through any configuration of loudspeakers. Any number of singers sing long pure tones in near-unison above or below the given sine tones so as to produce audible beating, forming continually variable rhythmic patterns. Sing within intervals, beating upper pitches at one speed, lower ones at another, creating double rhythms.

Closely tune any number of oscillators, causing hyperbolas between loudspeakers to spin in elliptical patterns through space at speeds determined by the tunings and in directions toward the lower-pitched loudspeakers. Balance oscillator and amplifier volumes to achieve maximum and minimum amplitudes including silences, if possible, during beating cycles.

Play any number of brass and wind instruments in such a way as to create and spin hyperbolas toward and away from your instruments and sounding loudspeakers. Pluck any number of stringed instruments, including electric guitars, to create series of beats, the speeds and numbers of which are determined by the tunings and amplitudes of the plucked sounds and sine tones.

Deploy any number of snare drums (metal snares) anywhere in space. Search for resonant frequencies of the drums and spin hyperbolas of those frequencies across them, the crests of which cause sympathetic vibrations, creating rhythmic patterns determined by the speeds of the beatings.

Parts of this work may be performed singly or in any combination simultaneously, in any order.

*This page intentionally left blank*

*I'd like to ask you about your new piece, **Still and Moving Lines of Silence in Families of Hyperbolas**. What struck me the first time I heard the idea, standing waves and variations on them in a space, was that it reminded me of tile designs in floors. You've just come back from the land of tile, Italy; was there a visual image that began the piece for you?*

Well, if not visual, spatial. The piece exists almost completely on a spatial plane. What's important is the making of simple to complex and still to moving sound geographies with sine waves.

You know that if you have a simple sound wave and a reflective surface, under certain circumstances, depending on the frequency of the sound and the distance between the source of the sound and the reflective surface, you can create standing waves. If the wavelengths of the frequencies are in simple proportion to the size of the room, then the sound bouncing off a reflective surface returns in synchronization with another wave as it's going out, and it amplifies itself. It's as if the reflective surface were a second source at the same frequency which interferes constructively with the first to produce a rise in amplitude. If the distance between the sound source and the reflective surface is not in simple proportion to the wavelength, then you get destructive interference; as the wave bounces back, it interferes with the wave that goes out. Under ideal circumstances, if it were  $180^\circ$  out of phase, it would attenuate the outgoing wave and completely eliminate it. You never get an ideal situation in a room because you're surrounded by reflective surfaces and because sound propagates all over, it doesn't go out in a line, it goes out concentrically, so you get reflections from all over. And if it's a highly reflective room, it's as if there were a great many loudspeakers or sound sources all over the room, and the standing waves become very complicated.

I've been working on a version for dancers in which I design simple sound geographies with standing waves. I can predict where they're going to occur, and the dancers can find and walk in the silent spots, or should I say silent lines. In that way, I can use the standing waves as a kind of guidance system.

But first I have to tell you that the lines go out between the loudspeakers in hyperbolic curves. You can see how that happens because if you have one sine wave coming from two loudspeakers, at certain points in space it takes a longer time for the wave from speaker A to get to where the wave from speaker B is. If the wave is half a cycle out of phase with the one from speaker B, it interferes destructively, and you get a silent point. If the wave from speaker A is a full cycle out of phase with speaker B, it interferes constructively, producing a loud spot. Perhaps you can see that there's an infinite number of these points in families as you move farther out from the loudspeakers and that they form curves, specifically hyperbolas.

Now you can see that if you knew the distance between the loudspeakers and the frequency of the sine waves, you could determine where the hyperbolas would occur, and that by increasing the frequency, you could increase the number of curves. If you want to make a thin, sparse, widely spaced geography, you place the loudspeakers far apart and use low frequencies. Two speakers sharing the same frequency give you one set of functions. If you add another speaker anywhere else in the space, you will generate a new set of lines which will cross the original set. Say you have speakers A, B, and C in any configuration in the space. You would have simple hyperbolic curves between speakers A and B, A and C, and B and C. You can see then how simple it would be in a dry space to make a

sound maze in which dancers could move. They could walk or dance down one line made by speakers A and B, then if they hit another curve, made by speakers A and C for example, that cut across the first curve, they could cross to and follow it. That's the simplest situation, but there's a whole other set of things that can happen.

The most obvious one is that if you have two speakers fed by two oscillators, all you have to do is untune one a bit and you can move the hyperbolas around in space. You can physically move the crests and troughs in elliptical patterns around the space at speeds controlled by the distance between the loudspeakers and the frequencies of the oscillators. Now, they don't spin from speaker to speaker as in panning, but you can see that those points of silence are going to have to readjust themselves as the two speakers go into and come out of synchronization.

*In which case, an immobile audience will be able to hear them go by.*

Yes, each person in the audience perceives the waves moving by at a different time. One other fact I have to tell you is that the direction of the movement is toward the low speaker. For example, if you have one oscillator at 1,000 Hz and the other at 1,001 Hz, the hyperbolas will move toward the 1,000 Hz speaker. If the amplitudes of each oscillator are equal, you achieve the maximum beating effect, and I have had cases in dry spaces where we've gotten null points, quiet points at which waves cancel, that are almost completely silent. That's hard to achieve because you're ordinarily in a more or less reverberant space. One of the tasks is to use your ears to measure



the amplitudes and get the widest degree of beating. I've had sound level devices show me variations of 12 or 15 db where both oscillators are at the same amplitude. Another task is to find the point at which both oscillators are exactly in tune. One will drift out of tune and the beating will spin to the left, for example, and you have to bring it back slowly so that it gets to the null point again—I'm speaking now of frequency nulls—or tune it to the other side so that you get a kind of see-saw quality. In one of the versions, I deploy four snare drums anywhere in the space so that as the crests spin by each drum, it vibrates. In that way, the audience can clearly hear the movement. And if I have two pairs of oscillators you can see how I can make twos against threes, sevens against eights, all kinds of rhythmic patterns, by simply changing frequency.

I've done versions of **Still and Moving Lines** with wind instruments or the human voice in which I simply have players interact with the oscillators; in other words, the players act as oscillators in a way, playing with very careful tuning. For example, if you have one oscillator coming from one loudspeaker, a wind or brass player can play above or below that pitch and create beats toward or away from the speaker. Then I can bring in the same oscillator frequency from another speaker, in another direction, so he or she is beating toward or away from that one—do you see what I mean? He or she can beat in one direction with respect to one speaker and in the opposite direction with respect to another. Then all the player has to do is vary his or her pitch below or above where he or she was to invert the directionality. If the locations of the sounds are varied, the players will find themselves creating new spinning configurations. I love to use the players unamplified because then they're really in an environmental situation. With a singer it's particularly beautiful because it's a study in vibrato. Can

you visualize a singer singing against an oscillator without vibrato, creating beating at certain speeds? Then if she adds vibrato, her frequency changing according to the speed of her vibrato, she creates an unstable situation. As her pitch goes up, the beating gets faster, and as her vibrato speeds up . . . well, you can see the complexity.

*In a perfectly dry space, you could create a static situation with the standing waves very apparent to a member of the audience crossing the room, but you want to contrast that situation with some sort of moving element to make the static situation apparent; that is to say, the static situation isn't apparent to a member of the audience who isn't moving, so you have to employ dancers, or something else, to display the lines of silence.*

Right. Do you know those water-skimmers that are on ponds? They move abruptly to send out waves which echo off the shore of the pond and come back to them, telling them where they are. I've been thinking about a version of **Still and Moving Lines** using strings, plucked strings. I've tried it with electric guitars at Clark University in Worcester, and it seems to work rather nicely. We set up four speakers, each with the same oscillator sound coming out of it, but at different volumes. I thought of it as a crude description of the outlines of a pond. In other words, it would be as if the speaker with the lowest amplitude were the farthest edge of the pond, and that with the loudest would be the nearest. As a string player plucked close to the pitch of this electric pond, theoretically, the number of beats would depend on both the amplitude and frequency of the plucking in relationship to the amplitude and frequency of the oscillators. My idea is to have the string players measure the distance

between where they are located in the performing space and the apparent location of the loudspeakers. If you have more than one player, the situation gets even more interesting.

*Have you tried to make an explanation before now of your intentions in the piece?*

I have pages of prose that are sketches for a score, but the more I do the piece, the more ideas I get. I have all the theoretical ideas, I know all the rules, but I recently had a marvelous experience with the singer Joan La Barbara. We were rehearsing the piece for a Paris performance and I had ideas of using different vowel and consonant sounds to give us different harmonic structures, but when Joan got in the physical situation, the rules broke down; all my theory didn't really amount to anything. Joan is a beautifully trained and very aware singer; I mean, she's a type of new performer now that can go into a piece like this without any qualms. So I simply explained to her the principles and she immediately understood and started, well, improvising—I suppose I can use the word "improvising." Then I would ask her what she was doing and she would explain it; it was very beautiful and very direct and much less "composerly" than if I had designed it on paper first. So I'm tossing away a lot of scientific ideas I had and am depending more on an aware player's response. And it's wonderful because it has explained to me what the piece is. When we were practicing in the Merce Cunningham Studio in Westbeth, I gave her one oscillator sound coming from the four loudspeakers, and one of the first things she did was to move around in the space just a little bit with her eyes closed and her ears really open. You had to notice the position of her body, the way she was

moving. What she was doing was finding the acoustical center of the space, which of course is not the same as the physical center because you can't balance the loudspeakers exactly. It reminded me of a scene in one of the Castaneda books.

Do you know the Castaneda books? I think they're very important, not so much for their occult qualities, but for the information that one should be aware of one's surroundings and that one can receive omens, information, from sound or visual events in one's surroundings. In one of the books, Don Juan asks Carlos Castaneda a question, or vice-versa, and a bird comes in, or a crow flies by, which gives the answer. And early in another book, Don Juan tells Castaneda to find a particular "spot" in which he feels strong and happy before they can talk. Castaneda spends all night doing that, trying to find a mystical—well, I don't know what kind of place, but it would have to be a place where certain energies seem to be focused. That search is important for us now since many of us seem to be moving away from nationalistic considerations to global, ecological, and geographical ones.

So Joan was finding a place for herself in which she felt comfortable. And I was never sure whether that was in a crest or a trough. She would be receiving constant sine tones from the loudspeakers, and what she did when she sang was to beat against these tones, alleviating the constancy of the sound waves. She said she felt as if she were pushing the wave away from herself, which you know is physically impossible. By trying to alleviate that constant pressure, she probably added to it, but her effort gave the illusion of pushing it away. She worked very quietly and very slowly. By singing close to the pitch, and then going under it and over it, she would change the beating in very slight ways around where she stood. Then I would introduce

another frequency, above the original for example, and she would sing between the two of them. Now you can see that if she were singing between them, she would beat the lower one in one direction and the higher one in another direction, and if you're sitting in the audience, you receive those changes of pressure at different places in different parts of the audience.

One of the things we decided was that her voice should be inaudible; she should use it to move sounds, not to create them. In Paris she stood for twenty-five or thirty minutes and sang, mostly inaudibly, but nobody in the audience budged because they knew that she was doing something, even if they didn't know she was singing. Some people thought she was a dancer, standing and moving very, very slowly. It was as if the piece were a riddle. She started it off and nobody understood what she was doing, but by the end of the piece, when the drums began sounding, the audience could hear the waves spinning by. All my thinking and all my calculations about frequency, wavelength, amplitude, and so forth didn't really amount to anything until she started to sing in the piece, and just having a wonderful musician like that helps you compose.

*Well, you both received inspiration from the scientific phenomena that were the basis of the piece.*

Right.

*It's rather like a travelogue, isn't it? The waves move past.*

Yes, the amazing thing about it is that it's so simple, but it was so difficult to get to the simple point. To make those waves move so

that they're obvious to people is a very simple thing, but it took me a long time to figure out how to do it. Now I can dispense with the calculations and do it by ear, which is another nice thing.

*Do you think the static situation is more or less comfortable for an audience? It's probably less interesting because it isn't apparent. The more you use to show what's going on, the more interesting it would be.*

Well, dancers can use the static situation but not the moving one because the speeds at which the hyperbolas spin, even if you keep them slow, are really too fast for dancers to follow. What was beautiful was the way Narrye Caldwell danced in the Paris performance. We chose a frequency such that I knew exactly where the hyperbolas would be in the space, between two of the speakers, and I simply asked her to move across the space following one of the troughs and to stop whenever she couldn't proceed. There were two possible reasons she wouldn't be able to proceed: one was if reflections from the walls made the hyperbolas unclear and the other was that I asked Gordon Mumma to interrupt her by playing the Horn from time to time, confusing her by spinning the hyperbolas around so she would have no guidance. I forget the frequency I used, but the wavelengths of the sounds were from two to three feet long so she had that width in which to move. On either side of her was a wall of sound, a crest on one side, a crest on the other, so she would move from side to side, testing the width of her pathway.

She walked with a kind of uncertain wobble that was very beautiful to see. When Gordon would start playing, she would have to stop. I said that when that happened, it was all right for her to do some sort

of movement that was whole for her. She chose to do *t'ai chi*; she's been doing it for some time and she does it very beautifully. When she was no longer able to move forward, she would do something circular, or something inward, and it was beautiful, this contrast between the inept, uncertain movement and the very certain trained movement. Then Gordon would stop playing and she would continue moving across the space. I had made the hyperbolas with the two speakers behind her, so that she would move out and away from them toward the middle of the room. When she got to the middle, I turned off her back speakers and turned on two speakers in front of her so that she would move forward in a new set of curves. It was a mirror; she moved in a mirror pattern. Her original movement was straight out and to the right, then when I gave her the other speakers, she would move to the left on a curve in between so that she traced a wing-like form. That gives me all kinds of ideas to make patterns. There was a mirror image, and there was a wing image, in a very simple way, and people saw that, they actually saw that.

*Do you think of the pattern that results as an explanation of the space or of the piece?*

Yes, absolutely.

*The original image is geographic. One thinks of geography as not having any particular message, but people appreciate geography. And as they perceive it, they can translate it into other images.*

David Behrman suggested that I have the dancer put up little flags where she finds standing waves, or make some sort of lasting visual

trace, but I didn't take that suggestion; I would rather have the ephemeral indication of the dancer herself.

I've been struggling with a piece that I did as accompaniment for an entertainment that Viola Farber recently choreographed for Town Hall. It's called **The Re-orchestration of the Opera "Benvenuto Cellini," by Hector Berlioz**. Now that the opera is available on cassette tape, I can use it easily, and my idea was that I would play the tape of the opera and use my speech as a means of controlling the resonance and filtering and envelope of the music. The result would be neither the Berlioz opera nor my speech alone; the correspondences between the resonances of the music and my voice would produce a different sound event, which I thought might be the voice of Berlioz. It's like alchemy; it would take many operations of the same thing to produce a new result.

But since I began to measure Narrye for wavelengths that would fit her body, I've been thinking about making silhouettes or holograms of bodies in space with sound. It would be complicated because you would get multiples. Wavelengths don't occur just in space, they repeat themselves, so you'd create . . .

*Series of people.*

. . . a series of people, and the mystical qualities of that are obvious, you know, saints having visions.

*The Heavenly Host.*

The Heavenly Host, yes. I could take a measurement of a person, translate the proportions in terms of wavelengths into sounds, and



create a silhouette of that person in various places in the room. Perhaps I could change the scale of it, or move it, or spin it. It would be very hard to do but I can conceive it. What I'm saying is that this gets me into a spiritual realm, sound making spiritual things. Much of my work has been making audible that which is inaudible—brain waves, echoes, resonant frequencies of rooms—and it strikes me that the Berlioz piece, even though you would think it's a departure for me, not being environmental, is re-creating an identity. We don't have Berlioz' voice anymore, but we have his art, we have his music, and it has all the timbre and harmony and rhythm, all the shapes. If you considered his music as idealized speech, maybe I could . . .

*You're going to find the correspondences between your speech and his . . .*

Right.

*. . . but his speech is in a body of music. What do you expect to find?*

Well, I could make the voice of Berlioz come out, I could put on tape the voice of Berlioz.

*You could find out who he is.*

What his voice sounded like, anyway. That's not so far away from the silhouette idea. Ideally, I could make bodies appear.

*And of course, the basis of the piece isn't confined to a performance.*

*There's a static situation in every room wherever there's a source of sound. Is there some connection between these room-sized geographies and travelling experiences?*

Travelling in an idealized way, perhaps. Since the hyperbolas move elliptically and I can move them at different speeds and to different places, right away the imagery of the motion of the stars or the planets comes into play, or simple, physical images such as see-saws or fulcrums, things of that kind. And when the dancers move across the space it reminds me of the migrations of animals. Bob Ashley says that it reminds him of fish in a fishbowl. Wouldn't it be wonderful if a piece of art could clarify some physical phenomenon that people are investigating?

*Is your interest in the piece headed toward the simpler manifestations or are you going to pursue the more complex ones?*

Well, even if I hadn't had Joan, Narrye, and Gordon to work with for several hours, my piece would have been complex in its score, but the pragmatic simplicity you have when a performance is imminent and players help you prepare the work, that's a beautiful state of affairs because it makes the music physical and not abstract. And even though I've pared down certain aspects of it, the complexity is still there because physical phenomena are always complex. When Joan sings in a room with those oscillators going, and an audience is there occupying space, and there are paintings on the wall, the situation is complicated enough. I would eventually like to make realizations in which many players, singers, and dancers perform at the same time, so that every player would be in as complex a situation

as that of the water-skimmer. If the water-skimmer is alone in a pond, it's in a very simple condition, but the minute you add another skimmer, the first one has to perceive echoes from the edge of the pond, with all that that entails, plus echoes from the second water-skimmer. That's the situation, the natural situation, that I want the piece to achieve.

# **OUTLINES and BIRD AND PERSON DYING**

*This page intentionally left blank*

## **OUTLINES (1975)**

of persons and things, for microphones,  
loudspeakers, and electronic sounds.

Position any number of loudspeakers behind persons and things. Through the loudspeakers mix clusters of sine tones of short enough wavelengths in relationship to the sizes of the persons and things so as to create audible diffraction patterns around and in front of them.

Persons may move in front of and out away from stacks of loudspeakers, creating moving sound shadows. Microphone handlers may scan the things with directional microphones routed through amplifiers to loudspeakers.

These two activities may be performed separately or together, in which case the diffracted images may be heard acoustically mixed.

## **BIRD AND PERSON DYNING (1975)**

for performer with microphones, amplifiers, loudspeakers and electronic sound-producing object.

Route a binaural microphone system with long cables through amplifiers with limiters to one or more pairs of loudspeakers. Place an electronic bird or similar sound-producing object anywhere in the performance space. Plug it in. Set the amplifiers' volume levels so that the sounds of the twittering bird, picked up by the microphones, can be heard through the loudspeakers, and feedback, controlled by the limiters, occurs.

Stand anywhere facing the bird. Listen to it, wearing the binaural microphone system, a miniature microphone in each ear. Walk in very slow motion, passing the bird and/or loudspeakers, mapping the acoustic characteristics of the space in terms of the pitches, intensities, and shapes of the encountered strands of feedback. Turn, dip, and tilt your head to make corrections and fine adjustments and to move the sounds of the twittering bird from loudspeaker to loudspeaker. Stop from time to time to catch and hold single and multiple strands of feedback so that interactions, if any, between them and the twitters can more clearly be heard. Search for phantom twitters, including mirror images above and below the originals, caused by heterodyning.

Use the directional properties of the binaural system to localize these phenomena for listeners.

*I'd like to ask some questions about your three most recent pieces, namely **Still and Moving Lines**, **Outlines**, and the piece you described to me that's as yet untitled. While I was thinking about them and forming some questions, it occurred to me that there are some interesting similarities between them. One might be that in both **Still and Moving Lines** and **Outlines** you use essentially neutral sound sources, ones that are very simple and not at all the subject matter of the pieces, but these sound sources, being neutral, allow what is of interest to become apparent to the audience, in one way or another. And it seems to me—you perhaps will disagree—that the sound source in the bird piece, while not as simple as the others, is similar in being arbitrary; it's an object that works according to its own rules. So, I'd like to ask if you're aware of continuing interests that would account for the similar propositions with different approaches that we find in these three pieces?*

I am, yes. While you were asking this question it struck me that the first two, **Still and Moving Lines** and **Outlines**, I composed by design. I had ideas about certain sonic phenomena and I had to work to find a way to realize them in each of the pieces. In the first piece, **Still and Moving Lines**, it was standing wave phenomena and being able to spin the standing waves around, and in **Outlines**, it was being able to display the diffraction outlines of an object caused by sound. The third piece, the bird piece as you say, I discovered by accident. It was given to me in various ways. The piece involves an electronic bird, the kind you can buy in stores for use as a Christmas tree ornament. It consists of a plastic ball with a loudspeaker and a simple electronic circuit inside, and it makes a kind of bird-like sound. You simply plug it in. It was sent to me by Doug Kahn, a young California



artist whom I have never met. I guess he sent it to me because of some interest he must have had in my work; it came in the mail one day out of the blue. He said it was part of "A Dream Aviary," but that in my case he would call it "A Dream Alviary." I was delighted to get it; it was a very charming gesture for somebody to make. So the sound source of the piece was a gift. For about a year, I kept the bird in my kitchen and would plug it in and listen to it from time to time. I noticed that when I got near it, the sharpness, or loudness of the sound would cause what I believe to be combination tones in my ears—you know that phenomenon; I heard phantom sounds that the ear produces because of overdriving. And I knew that somehow or another I'd be able to use this sound quality in a piece someday. It was a new sound in my life.

Another coincidence, there are two more, was that I had in my possession that binaural microphone system that I asked you to buy for me. As you know, it consists of two miniature microphones, one for either ear, so that when you record something, you make a realistic replica of how your ears spatially perceive the sound. For a stereo recording, you simply put microphones so many feet apart; the binaural system depends on the diffraction and reflection effects of a human or dummy head and ears for its life-like results. And I knew when I bought them that I wouldn't use them just for recording; I knew I would use them in live performances. If you connect them to a sound system and wear them in your own ears, you can pick up and amplify whatever you hear. Then if you move from right to left, you can pan your personal sound field from speaker to speaker.

The other coincidence was that a student of mine, Nicolas Collins, had been making pieces with feedback. I've never made pieces using feedback in that way, between microphones and loudspeakers, and

I think that his work opened me up to it. Now what is interesting is that the pitch and volume of the feedback is determined by where the microphones are in relationship to the loudspeakers. Since the mikes are on your own ears, if you move an inch, or a foot, it's going to create different kinds of feedback of different pitches and intensities. It seemed to me that these things coincided in a beautiful way, the gift of the electronic bird, the binaural mikes which you could wear on your own head, and my involvement with Nicolas Collins' work.

I decided to try to make a piece out of these materials. My first idea was simply to plug the bird in anywhere in the space and stand facing it, with two speakers on either side. Then if you turned your attention away from the bird to the right or the left, you could pan the sound. It would just be a beautiful, simple kind of panning, and I was perfectly willing to let that be the idea of the piece. If you walked through the space, you'd change your physical relationship to the bird, but the bird itself would stay still.

*And the audience would hear both.*

The audience would hear both. Then I thought, well, if you had *speakers far enough away from you, in the balcony, say, you could* create time delays. That was going to be the idea of the piece; that's what was going to alter the sound of the electronic bird. But accidentally, I fell into something different. It was the day after Thanksgiving, and as I was doing the piece in the Wesleyan University Electronic Studio, feedback started between one microphone and a loudspeaker. The bird was chirping, it repeats the same thing over and over again, and the mixture of the pure feedback and bird sounds

began to produce difference tones in my ears. I found that if the feedback was above the pitch of the bird, it would sweep from high to low. That's because the third, or resultant sound, was made up of the difference between the two original pitches. I found I could play with trying to create two or more strands of feedback, altering the bird sound in new and more complex ways. So now I find I have a piece involving a very simple electronic configuration. All I have to have is the electric bird, two loudspeakers, two amplifiers, and the binaural mikes, and by simply moving to different points in space, I can produce a great complexity and variety of modulation of the original sounds.

*What you're doing is putting your own sonic perspective back into the room . . .*

Yes.

*. . . so it becomes part of the room again.*

Right. There was an article recently in **Scientific American** about indigo buntings and how beautifully they orient themselves as they fly from north to south. They fly thousands of miles nonstop by looking upward at the constellations. It seems that they have some sort of timing device with which they can compensate for the rotation of the earth, which changes the relationships of the stars. These birds are just amazing navigators; they inspired one of my images, though it doesn't really have much to do with the piece now, which was to move and turn such that the panning would change the relationships of the sounds in the loudspeakers with respect to the static

bird sound. Now it was just an idea; there's no concrete way for me to use that, but it got me started, it got me standing up in the space.

In the first two pieces, the sounds, as you said, are very simple, they're simple sine tones, but in the third piece, the sound source isn't a neutral one at all, it has a lot of information in it.

*But it's arbitrary.*

Yes, I don't know what to do when I write the score, I wouldn't want to demand that anyone who does the piece use that same type of electronic bird.

*It seems as though the three pieces are connected then, but that each explores a different aspect. In **Still and Moving Lines** you produce a pattern in a room that's stationary during one part and moving in another. When it's stationary, you use a visual portion, dancers, to display the pattern; when it's moving, you don't need the dancers because the audience, in effect, is moving in relation to the pattern.*

Right.

*So that's one thing. In **Outlines** you've got a microscopic analysis of the situation with a single-point microphone; you can explore one point at a time in linear fashion, you can scan the interference effects of the canoe, or whatever other object you use, in the space. In the bird piece you've got still another way of doing it, the binaural perspective, which is an all-over effect and even affects the environment further because it comes back into it. It's a more complex situation.*

Right. In **Outlines** I have to be very careful about what is fixed and what is not. In all three pieces I'm very careful about dealing with that. In **Outlines** if I use the canoe, or any other fixed object, I either have to move what perceives the outlines or move the sound source. I thought about moving the loudspeakers behind the object, but I can't do that without having it ugly and awkward; in other words, I haven't found a way to move the loudspeakers behind the canoe gracefully, so I move the—what's the word?

*The perceptor.*

Yes, the perceptor, which is a single microphone. Now in the second version of **Outlines**, which I use simultaneously with the first, I have a person standing in front of a stack of loudspeakers, so that whenever that person moves, you begin to hear the outline move. You hear what you hear as compared to what you heard just an instant ago. I'm assuming the audience stays in one spot. The canoe I scan with a directional mike; in that portion of the piece I'm moving the audience.

*It strikes me as being similar to weaving, where you have a basic fabric but with variations in it.*

Isn't that funny? I was thinking of that word today in the automobile. In **Still and Moving Lines** I suggest that the dancers move *in* the standing waves, not move across them or improvise and disturb them. The idea is not to get the grossest effect. In **Outlines** I still haven't solved the problem, but I would be careful to use a dancer who would do no dance steps, because you don't want to do anything

that doesn't belong there. It's not a dance piece, and it's not improvisation in front of a stack of loudspeakers, it's to hear sounds diffract around a person's body. Now in **Outlines**, when we performed it a couple of weeks ago, I was going to ask the dancer to move slowly away from the speakers, out of that sound field, and into the field where I was scanning the canoe. I was going to ask her to walk from point A to point B, which would make it a goal-oriented kind of piece, but I decided against that. In the bird piece I've been thinking that because it has to do with feedback which occurs differently in different places, I either have to go with the indigo bunting idea (they make a bee-line, or should I say a bird-line) or let the player who's wearing the microphones explore the space and make a tracing of it that could be any shape, even circular. I thought of it as weaving.

*There's one other thing I wanted to mention: you use imagery in a way that isn't obvious, it's as though the piece weren't built around the image. Sometimes you work with scientific facts, yet there's always more to it than that, and what's there isn't daunting to an audience. It's often very comfortable and engaging at the same time that the scientific part is interesting.*

Well . . .

*And another thing is that often the piece will not convey any intentional information. If there's any sense to be made of the piece, it's sense that the audience has to make of it. It doesn't hand over the information, it provides material with which you find something out.*

Right.

*You've always had to face that problem of balance in making a piece.*

Somebody asked me the other day if I weren't afraid, since the mikes are open and amplified, that someone in the audience would decide to intrude on the piece by making sounds. I answered that those risks are what make new music so exciting. One could make a beautiful, quiet tape of that piece and play the tape, but isn't it much more immediate and exciting, isn't it what we want, to put the audience in a situation which they know they can interrupt or change? If part of the piece is that you have live microphones, and the audience is aware of that, and that they are live also, isn't that a kind of tension you might want in a performance?

*It's very easy to separate yourself from the performance. You can talk, you can whisper. It's a shock to find that the performance has encompassed you and that you're a part of it. Do you think about perspective when you design these pieces? It struck me that perhaps in the new piece you're displaying a perspective with the binaural microphones. You're playing with the moving perspective in **Outlines** too, and you can make it seem as though the audience is able to move around the patterns of hyperbolas in **Still and Moving Lines**. Did those things occur to you as you were composing the pieces?*

I always seem to fail in thinking up an idea—I don't know how to say this—if it's a two-dimensional, or if it's a linear idea. Most of the music we know is two-dimensional in conception; it's written on a

page, or moves from left to right in time. Now when you go from chant to polyphony, you have the illusion of depth, or another dimension, but it's only an illusion as in a painting. You can paint in perspective, but it's not really there; you're still on a flat, two-dimensional surface. And I think it's built into my work that I don't succeed very well when I'm thinking in two dimensions; it's always more interesting when I'm thinking in terms of three-dimensional space. It's as if I've completely shifted into another gear. I just can't think of writing a melodic line. Mixing sounds doesn't help much either; that's simply another way of reassembling old materials. Sounds for me have to move not only up and down, but in and out, and across space somewhere; they have to live in space. In the bird piece the pitches occur according to where I am; they are determined by how far away I am perpendicular to the loudspeakers. I can't change the feedback in any other way; I can't change the pitches by playing a higher or lower key or string; I have to move spatially.

*Have you ever worked on a project that seemed promising but never got anywhere until you entered that other dimension?*

Well, I know that I'm usually not satisfied with a piece if it doesn't do that. That's not exactly true, is it? Let's say that for a while I haven't been satisfied, and the work that I'm doing now seems to be almost entirely geographical. That's why it's getting hard for me to play my work in conventional auditoriums, where the seats are fixed and the audience is supposed to focus on something happening on stage. I find it almost impossible to work in those situations.

*Do you expect a time when you won't be able to do your pieces*



*even in an open space?*

I don't know.

*Do you think you'll ever be composing music that won't be able to be performed? I don't.*

No, I don't either. I'm too interested in the physical nature of sound and its relationship to human beings. And I have such confidence in myself as a performer that I know I can find ways to persuade audiences to listen; I can be so attentive to the task at hand that they will be willing to go along with me. The other night I discovered that by just tilting my head an inch or two, I could change or even stop the feedback. Do you know how robins turn their heads to listen? I think that people like to watch that. So I use my personal performances to show them that I'm paying attention.

*And you are concerned that they understand that there's something happening.*

Yes.

*It isn't just playing a recording.*

There's a definite relationship between the act of performance and what the sounds are.

# MUSIC ON A LONG THIN WIRE

## **MUSIC ON A LONG THIN WIRE (1977)**

for audio oscillator and electronic monochord.

Extend a long metal wire (#1 music wire or equivalent) across or lengthways down a performance space. Affix both ends to the far edges of the tops of tables or other similar platforms and tighten them with clamps, hanging weights over pulleys, or other tension-creating devices. Route the ends of the wire to the outputs of an amplifier, forming a current-carrying loop. Insert wood, metal, or other resonant bridges under the wire at both ends. Set a large magnet down on the table at one end of the wire; adjust the height of the wire so that it passes directly between the poles of the magnet. Attach microphones to the bridges and route them through amplifiers to loudspeakers.

Drive the wire with a sine wave oscillator, causing it to vibrate from the interaction between the current in the wire and the magnetic field across it, in ways determined by the frequencies and amplitudes of the driving signals and the length, size, weight, and tension of the wire. Design musical performances consisting of a series of any number of phrases which explore the acoustic properties of a single vibrating wire. Before each phrase, silently and freely choose a single oscillator frequency which will remain constant for the duration of that phrase. Within each phrase, however, raise and lower the volume controls of either the oscillator or the amplifier or a combination of both, in slow scanning patterns, causing the size of the excursions of the vibrating wire to vary, altering the tension of the wire accordingly, producing nodal shifts, echo trains, noisy overdrivings, rhythmic figures at low frequencies, phase-related time lags, simple and complex harmonic structures, larger self-generative cyclic patterns, stops and starts, and other audible and visible phenomena. At the end of each phrase, the length of which is determined by the nature of the sonic material in that phrase, reduce the volume to zero in order to silently retune the oscillator frequency for the next phrase.

Pick up the sounds of the vibrating wire with the microphones on the resonant bridges and amplify them for stereophonic listening through loudspeakers. Light the wire so that the modes of vibration are visible to viewers.

Commissioned by the Crane School of Music, State University College at  
Potsdam, New York, for the Live Electronic Music Ensemble, Donald Funes,  
Director.

*This page intentionally left blank*

*In Music on a Long Thin Wire I've had a better chance than in most of your other pieces of the last several years to watch a composition take shape, to watch the technological and intellectual parts of the piece find a balance. And of course last night was an important performance of the piece, probably the most ambitious one you've tried. Do you feel as though this piece has reached completion? Is it going to change much more, or do you see elements in it that might reach a new balance in further performances?*

No, I don't think it's going to change much more, but I have to settle one last question, which is whether or not there's a critical length for the wire beyond which it doesn't yield musical results. The first experiments we did, as you remember, were on short wires; we used guitar strings that were only three or four feet long. Then we stretched longer wires along the edge of the table in the shop to about, what, eight feet? In subsequent performances, the lengths were determined by spatial or visual considerations.

In Potsdam, New York, where I first performed the piece publicly, I stretched the wire quite long, but we began cutting it, little by little, to try to solve a problem we had, or thought we had, with the resistance of the wire in relation to the amplifier driving it. Later, at a pair of concerts with Bob and David in Alfred, New York, I extended it to twenty feet, and that seemed to work beautifully. Then last night at the Diplomat Hotel we decided to use the entire floor space of the ballroom, and made the wire, as you remember, exactly thirty-six feet long. And that led to a problem. A half-hour before the concert we thought we had lost the signal from the pickup at one end of the wire, and began to take it apart; it didn't dawn on me that actually there was no problem there at all. The wire was so long

that the activity at one end wasn't nearly as strong as that at the other—perhaps it had to do with where the magnet was—but when you suggested that I change the pitch slightly, the nodes shifted, and we got sound at that end. Perhaps thirty-six feet is too long. And it's funny because you would think the longer the wire, the lower the sounds would be, but during performances in which I've extended the wire up to eighteen or twenty feet, I've gotten at times the most beautiful, silvery, high, complex sounds. Last night, the very last frequency I selected was around 20 Hz. The wire was vibrating very slowly at that frequency, but then those high harmonics mysteriously began to come in.

I first got the idea for the piece in the acoustics lab at Wesleyan. We were observing the normal modes of vibration of single wires that fit our laboratory tables, but when I began thinking of making a piece of music, I felt I had to change the scale. A short length of wire would look like a laboratory experiment, but if you thought of it as a sound sculpture, your imagination could take that wire down the length of a room. I had to be prepared for not knowing what it was going to sound like, although in my imagination I knew. I had an intuition that it would sound amazing. You don't want a laboratory wire to sound amazing, you just want it to divide into parts so you can prove, for example, that an octave is a natural interval.

*You want a clear result. You've mentioned the change of scale that the imagination suggests; I can imagine an impossibly long wire doing impossible things.*

Yes, someone suggested that I stretch a wire across the two towers of the World Trade Center, but I replied that Philippe Petit, the

tightrope walker, had already done that. You know, at one point as I was working on the piece, I strung some colored beads along the wire so you could more easily see the nodal patterns as the wire vibrated. I thought of it as a one-dimensional visualization of sound in which it can only go forward and backward, but it isn't really one-dimensional because the wire vibrates up and down and from side to side. It even goes in circular motions. It would have to, wouldn't it, because of the flux field of the magnet?

*Yes, which reminds me that Peter Zummo, after he'd seen the piece, said the first thing that came to his mind was the hitch-hiking gesture, the "left-hand rule" for current through a wire and the field around it. But he also said that the image didn't last very long as the piece went on.*

I wouldn't have thought of that in a million years!

*Well, the technical details suggest some appropriate imagery. The wire is part of a circuit, but it does nothing; there's a current running through it, but nothing interesting happens until you introduce a magnetic field. Then it starts to perform.*

Don Funes, the composer at Potsdam who commissioned the piece, said he thinks of the magnet as an electronic bow. I think of the whole system as a disassembled loudspeaker.

*That rising melodic gesture at the end of a phrase, as the driving signal is turned down, is intriguing. And it's unexpected that a change in the amplitude of the signal can produce a change in pitch.*



Well, that's because as you put less energy into the wire it unstretches slightly and its natural vibrational modes have more effect on the remains of the forced vibration caused by the audio signal. But there's another interesting effect. If you've chosen a frequency close to a resonant frequency of the wire, it vibrates very efficiently, but if you then choose one away from a resonant peak, the wire has trouble responding and the volume decreases. I think of it as a cross-referencing system in which volume can vary pitch and pitch can vary volume, but for two different reasons. The causes and effects are so complex that they defy prediction or analysis, and this gives the piece a personality.

*It's a piece that requires a sensitive performer.*

Yes. You know, David Rosenboom is amazing in that respect. Recently he invited me to York University in Toronto to give a concert of my works including **Music on a Long Thin Wire**. We decided to ask four or five student musicians to play; when I go to a college to perform, I feel as if I should use the students there. After all, they're there for an education, and the best way to learn about something is to take part in it.

Anyway, I was anxious about getting the wire to vibrate and to make beautiful sounds, so I thought immediately of using a bank of oscillators; I thought I needed the variety. But on the afternoon of the concert we had trouble getting the students together to rehearse, so David and I decided to perform the piece ourselves using only two oscillators, one for him and one for me. We planned to play one at a time but wanted two oscillators so that we could overlap one another as we retuned, hiding each other's silences. While I was set-

ting up **Tyndall Orchestrations** in another part of the performing space, I could hear David playing his oscillator into the wire, and I was struck by the sensitivity with which he tuned the system. It seemed that the more he reduced the power, the more efficiently it vibrated. It was paradoxical. I guess there's a natural plateau above which the wire refuses to handle more power; below that point, it accepts what comes into it and interesting things start to happen. At one point, David achieved a state in which the wire would start and stop vibrating of its own accord; it would go through long cycles of marvelously complex harmonic changes.

*We've talked about providing an opportunity for players to operate in a musical context without the constraints of a musical tradition by substituting instead the constraints of a performing system, as in **The Queen of the South** for example. You perform many of your pieces yourself; to what extent do you consider yourself a composer-performer?*

Well, performing my own music, as well as that of my friends and of other composers, is an extremely important part of my life. There is great joy in it. It used to be that a composer would write a piece and then hope that someone would want to play it, but now, particularly since most of our music is not written down, or at least doesn't depend on being written down to be performed, we have the alternative of going out and performing it ourselves. I value that alternative highly, but I still feel the need to write descriptions of the pieces, to make scores; the question is, what kind of scores? I have to decide whether to write them in a practical way, making them easier to distribute and perform, or in a more general or visionary way, empha-

sizing the ideas behind the pieces. I guess I'd rather publish the ideas than the details because my work is not often practical for most performers anyway. It's unreasonable to expect people to set up the configuration for **Music on a Long Thin Wire** every time they want to do the piece, and I also don't want to clutter up the score with too much specific information about clamps, the kind of wire, the power of the magnet, and so forth. If I give them general information about how to do it, some will figure it out for themselves. Others will at least be struck by the idea and will compose similar pieces of their own. I would consider that a compliment.

I guess my work is more concerned with ideas than music. Joan La Barbara calls my music "supermusic." She said that my pieces massage her brain, that when they get started they push her almost to the edge of anger, but the imagery assuages it. She is forced to think so hard when she listens or performs, I don't know whether she was referring to her own part in **Tyndall Orchestrations** or not, that she enters a "supermusical" state.

*I can't help but think that there are still other ways to use your ideas. We have interviews, performances and recordings of your music, and the scores themselves. Perhaps your audience is going to be distributed among listeners, readers, and thinkers.*

Well, I'm extremely pleased when my musical ideas find social uses. I heard that **Vespers** is being used in England in courses for the blind, and a few years ago I designed a special version of **Still and Moving Lines of Silence** for the Lions Gallery of the Senses at the Wadsworth Atheneum in Hartford. It was going to be a maze through which you would walk, following troughs of sound. They rejected

the proposal on the grounds that it was too difficult for very young visitors, but it might have happened. And of course I have my dream of an architectural space inspired by my and other composers' ideas of what would be necessary and beautiful for the performance of our music. A real building might be the result of that dream, but I can't predict that; it just has to happen.

*If you consider your works from the **Music for Solo Performer** of 1965 to the **Music on a Long thin Wire** of 1977 and the different materials used in those pieces, do you see a connecting thread?*

Yes, it's an interest in the poetry of what we used to think of as science. I don't have any idea what attracted me to that idea; there's nothing in my background that would have predicted it. If anything, I was brought up to believe that my interests in the world were purely "artistic" and that any scientific endeavor was beyond me. I never thought I could fix anything; I could never understand how a radio worked, for example. I was never very successful in physics, or any science class for that matter. I always thought that the world was divided into two kinds of people, poets and practical people, and that while the practical people ran the world, the poets had visions about it. I felt the scientific point of view only skimmed the surface; artists were really the brightest people on earth. Now I realize that there is no difference between science and art.

My first approach to music was that "artistic" one, but I wasn't very successful at it. I could never settle down enough to learn to play the piano very well, though I did compose several successful student pieces for conventional instruments. I didn't get inspired until I started investigating simple natural occurrences. Some composers

find inspiration in words, in setting texts to music, or in politics, or drama, or in more abstract relationships, but I can't seem to get into those. I don't seem to be interested in the ensemble idea either, everybody playing together. I wish I were. I seem to be a phenomenologist in some ways; I would rather discover new sound situations than invent new ways to put materials together. Whenever I think of changing direction, of making something more popular or attractive to a larger audience, I lose interest very quickly, so I follow my instincts and continue making pieces with brain waves, echoes, room resonances, vibrating wires, and other natural phenomena, and try to put people into harmonious relationships with them.

## SELECTED BIBLIOGRAPHY

- Griffin, Donald R. *Echoes of Bats and Men*. Anchor Books, Garden City, New York, 1959.
- Griffin, Donald R. *Listening in the Dark: The Acoustic Orientation of Bats and Men*. Yale University Press, New Haven, Connecticut, 1958.
- Jenny, Hans. *Cymatics: The Structure and Dynamics of Waves and Vibrations*. Basilius Presse, Basel, 1967.
- Kock, Winston E. *Sound Waves and Light Waves*. Anchor Books, Garden City, New York, 1965.
- van Bergeijk, Willem A., Pierce, John R., and David, Edward E., Jr. *Waves and the Ear*. Anchor Books, Garden City, New York, 1960.

*This page intentionally left blank*

## INDEX

- Action Music for Piano** (1962), 74  
Air Force, U.S., 70  
Albany, NY, 105  
alchemy, 141  
Alfred, NY, 163  
alpha waves, 69-76, 87  
American Philosophical Society,  
Philadelphia, PA, 120  
Amherst, MA, 123  
amplification, 73  
Ann Arbor, MI, 24  
architecture, 11, 35-37, 169  
Arlington, MA, 22  
Arp synthesizer, 86  
Ashley, Mary, 26  
Ashley, Robert (Bob), 36, 83, 91, 143,  
163  
Augustus Caesar, 88  
Band, Ellen, 104, 106  
baroque times, 99  
bats, 22, 23, 25  
Beethoven, Ludwig van, 13, 78, 100  
Behrman, David, 140, 163  
Berlioz, Hector, 89, 141, 142  
binaural microphones, 147, 148,  
150-53, 156  
biofeedback, 76  
**Bird and Person Dyning** (1975) (the  
bird piece), 102, 148 (score),  
149-53, 155, 157  
birdcalls, 104, 105  
Borges, Jorge Luis, 75  
brain waves, 69-74, 142, 170  
Brandeis University, Waltham, MA, 70,  
72; Chamber Chorus, 71; Electronic  
Music Studio, 36, 37  
Buchla synthesizer, 86  
Bunsen burner, 96, 103  
Caesar, Julius, 84  
Caldwell, Narrye, 139, 141, 143  
California, 7, 149  
Cambridge, MA, 21, 26, 34  
Canada, 104  
canoe, 153-55  
Castaneda, Carlos, 137  
Catholicism, 123  
**Central Park in the Dark** (Charles Ives),  
50  
Chladni, E.F.P., 95, 101  
**Chambers** (1968), 3-6 (score), 10,  
119-22  
cicadas, 24  
Clark University, Worcester, MA, 135  
Claudius, Roman emperor, 88  
Clinton, NY, 60  
collage, 71, 86  
Collins, Nicholas, 150, 151  
combination tones, 150  
communication, 27, 90, 91  
composition, 8, 23, 37, 47, 59, 60, 63,  
75  
computers, 119, 125  
conch shells, 7-9  
Concord Academy for Girls, Concord,  
MA, 20  
contrast, 71, 77, 123  
Crane School of Music, State  
University College, Potsdam, NY,  
161  
crickets, 20, 21  
**Cymatics** (Hans Jenny), 120  
dancers, 128, 132, 133, 138-40,  
153-55  
Dewan, Edmond, 69, 70, 73  
difference tones, 152  
diffraction, 147, 149, 150, 155



Diplomat Hotel, New York City, 103, 163  
 distance, 55, 65, 89  
 dolphins, 22  
 Don Juan, Yaqui sorcerer, 137  
 downtown, 49  
**Dr. Chicago** (George Manupelli), 36  
 dreams, 120  
**Dream Aviary** (Doug Kahn), 150  
**Duke of York, The** (1971), 80-81 (score), 83, 85, 86, 90, 123  
 echoes, 11, 16, 17, 19, 21-27, 87, 142, 144, 170  
 echolocation, 16, 17, 22, 24, 89  
 EEG, 69, 72, 75  
 ensemble playing, 105, 170  
 epilepsy, 70  
 Expo '70, 38  
 Farber, Viola, 141  
 feedback, 99, 150-52, 157, 158  
 Field, Richard (Dick), 101  
 Fifty-seventh Street, New York City, 9  
 Finland, 21  
 Florence, Italy, 106  
 Franklin, Benjamin, 120  
 Fulbright Scholarship, 70, 88  
 Funes, Donald (Don), 161, 165  
**Gentle Fire** (1971), 111-18 (score), 119-22  
 geography, 89, 131, 132, 140, 143, 161  
 Gramercy Park Hotel, New York City, 78  
 Griffin, Donald R., 17, 22  
 Hartford, CT, 45  
**(Hartford) Memory Space** (1970), 43 (score), 50, 51, 122  
 Harvard School of Education, Cambridge, MA, 26  
 Heavenly Host, The, 141  
 Helsinki, 21  
 heterodyning, 148  
 holograms, 141  
**Housatonic at Stockbridge, The** (Charles Ives), 50  
 Humbert, Jacqueline (Jackie), 104, 106  
 humpback whales, 56, 64, 65, 89  
**"I am sitting in a room"** (1969), 30-31 (score), 33, 36, 45  
 identity, 80, 81, 83, 86, 87, 90, 122, 123  
 limura, Takahiko, 45  
 imagery, 101, 102, 104-7, 119, 120, 123, 124, 140, 155, 168  
 improvisation, 47, 49, 61, 62, 99, 136, 155  
 indigo buntings, 152, 155  
 Italy, 70, 88, 131  
 Ives, Charles, 50  
 Jefferson, Thomas, 120  
 Jenny, Hans, 95, 120  
 Job's Coffin, 39  
 jukebox, 83  
**Julius Caesar** (William Shakespeare), 84  
 Kahn, Doug, 149  
 Kentucky, 24  
 La Barbara, Joan, 103, 106, 136-38, 143, 168  
 La Jolla, CA, 9  
 Latin language, 87, 89  
 left-hand rule, 165  
 Lentz, Daniel, 64  
 Lévi-Strauss, Claude, 121  
 Lewis and Clark Expedition, 120  
 Lions Gallery of the Senses, Wadsworth Atheneum, Hartford, CT, 168

Lissajous figures, 95  
 Listening Incorporated, Arlington, MA, 22  
**Listening in the Dark** (Donald R. Griffin), 22  
 lists, 119-21  
 Livia, wife of Augustus, 88  
**Lord of the Flies** (William Golding), 8  
 Lucier, Mary, 21, 24, 34, 39, 83, 91  
  
 magnet, 160, 164, 165, 168  
 Manupelli, George, 36  
 map, 48, 49  
*Megaptera novaeangliae* of  
     Baleanoperidae, 56  
 memory, 45, 48, 91  
 memories, 83, 91  
 Merce Cunningham Dance Studio,  
     Westbeth, New York City, 136  
 Middletown, CT, 37, 38  
 Milan, Italy, 86  
 mimicry, animal, 45  
 modes of vibration, 100, 164, 166  
 Moog synthesizer, 86  
 Mozart, Wolfgang Amadeus, 63  
 Mumma, Gordon, 38, 139, 140, 143  
 Museum of Modern Art, New York  
     City, 11  
**Music for Solo Performer** (1965), 69  
     (score), 70, 75, 169  
**Music on a Long Thin Wire** (1971),  
     160-61 (score), 163, 166, 168, 169  
  
 Nagra tape recorder, 34  
 Neurophone, 124  
 New Music Ensemble, Providence, RI,  
     95, 106  
 noise pollution, 121, 122  
 North Carolina, 24  
 nineteenth-century orchestra, 51  
  
 Oberlin, OH, 38  
 Oliveros, Pauline, 7  
**On Universal Theatre** (Jorge Luis  
     Borges), 75  
 opera, 90, 141  
 Oregon, 120  
 Osaka, 38  
 oscillator, sine wave, 102, 107, 133-36,  
     143, 160, 166, 167  
**Outlines** (1975), 147 (score), 149,  
     153-56  
  
 panning, 150-52  
 Paris, 136, 138, 139  
 Payne, Dr. Roger S., 64  
 Pepsi Pavilion, Expo '70, 38  
 performing, 158, 167, 168  
 perspective, 156  
 Petit, Philippe, 164  
 Philadelphia, PA, 120  
 poetry, 72, 121, 169  
 Polaroid Corporation, Cambridge, MA,  
     34, 39  
 political action, 122  
 Potsdam, NY, 161, 163, 165  
 Providence, RI, 95, 106  
 psychology, 88  
  
**Quasimodo the Great Lover** (1970),  
     55-57 (score), 59, 61-65  
**Queen of the South, The** (1972), 94-95  
     (score), 99, 100, 105-7  
  
 RAI Studio Fonologico, Milan, Italy, 86  
 Ray, Johnny, 89  
 RCA synthesizer, 86  
 reincarnation, 88, 89  
 religion, 88  
**Re-Orchestration of the Opera**  
     **"Benvenuto Cellini,"** by Hector  
     Berlioz, The, 141

resonant environments, 3, 6, 10-12  
 resonant frequencies, 30, 34, 35, 37,  
 125, 142, 171  
 reverberation, 10, 11, 87, 89, 133  
 rhymes, 120  
 Rome, 45, 74, 88, 89  
 rooms, room acoustics, 10, 21, 23, 24,  
 30, 31, 35-37, 131, 170  
 San Diego, CA, 7  
 Santa Barbara, CA, 64  
**Scientific American**, 152  
 scores, 59, 60, 63, 64, 167  
 sensitive flame, 96, 97, 102-5, 107  
 Shakespeare, William, 75, 84  
 Shapiro, Gerald, 95  
 silhouettes, 143, 144  
 sine waves, 128, 131, 132  
 Sioux music, 103  
 Sondol, 16, 17, 19-26, 106  
*son et lumière*, 100, 108  
 space, 9, 10, 20, 23, 27, 33-36, 38, 45,  
 57, 62, 65, 133, 135, 157  
 speech, 36, 38, 51, 141  
 splicing, 31, 86  
 standing waves, 128, 131, 132, 135,  
 149, 154  
 Steinway Hall, New York City, 9  
**Still and Moving Lines of Silence in  
 Families of Hyperbolas** (1973-74),  
 106, 128-29 (score), 131, 134, 135,  
 149, 153, 154, 156, 168  
 Stockholm, 74  
 stuttering, 36, 89  
 synthesizer, 72, 80, 81, 83-87, 121  
*t'ai chi*, 140  
 tape, 33, 58, 71-74, 156  
 tea pot, 11-13  
 theatricality, 73-75  
 therapeutic effect 62, 90  
 Tibet, 8  
 tile, 131  
 time delays, 51, 155  
 Tomb of Augustus, Rome, 88  
 Toronto, 104, 106  
 Town Hall, New York City, 141  
 transformation, 114, 118, 119, 122  
 translation, 101, 102, 107  
 transubstantiation, 123  
 Tudor, David, 38  
**Twenty Thousand Leagues Under the  
 Sea** (Jules Verne), 7  
 Tyndall, John, 97  
**Tyndall Orchestrations** (1976), 96-97  
 (score), 99, 100, 104, 107, 167, 168  
 University of California, Santa Barbara,  
 64  
 Verne, Jules, 7  
**Vespers** (1969), 10, 16-17 (score), 19,  
 22, 27, 45, 89, 106  
*Vespertilionidae*, 22  
 vibrato, 134, 135  
 Vicolo della Campana, Rome, 88  
 video, closed circuit, 95, 96, 100, 101,  
 103  
 videotape, 106  
 visual material, 99; representation,  
 123; results, 103  
 voltage control, 86  
 Wadsworth Atheneum, Hartford, CT,  
 168  
 water-skimmers, 135, 144  
 wavelength, 35, 124, 131, 138, 141  
 weaving, 154, 155  
 Wesleyan University, Middletown, CT:  
 acoustics lab, 164, Electronic Music  
 Studio, 151

Westbeth, New York City, 130

**Whistlers** (1967), 7

Worcester, MA, 135

**World Music for Bowed Stringed**

**Instruments** (1972), 123

World Trade Center, New York City,

164

Yale University, New Haven, CT: Band,

10; Bowl, 10

York University, Toronto, Canada, 104,

166

Zagreb, 26

Zummo, Peter, 165