

### 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.

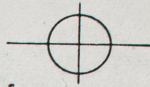

Performances may be used to strengthen personal ties, make friends with strangers, or uncover clues to hidden families and past identities.

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.



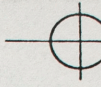
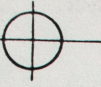
**The Duke of York** seems to me to deal with adjustments to memories. . . .

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.



**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, pearled 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, ramparts, 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 for 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.



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



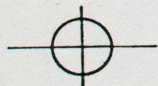
into a material and experience the modes of vibration of the sound in that material, as in **The Queen of the South**, or to make sounds in such a way as to cause a flame to move, as in **Tyndall Orchestrations**, you have two choices. One is to make any sound that you already know how to make, or any 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.

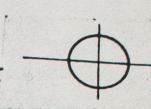
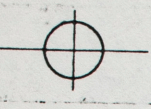
*The audience isn't seeing a light show to go with the musical work; it's all the same process.*

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



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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?*

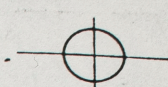
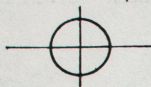
You mean . . . I don't quite understand that.

*Well, there's the opération 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-

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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

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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 Orchestrations 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?*

38 B/98

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 campfire 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.

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*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,

39 B/102

67



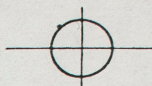
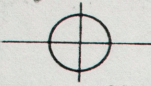
they can really push the grains of sand around on the plate. Also, they're not audible until they get into the material. If you have a violin playing, the audience can hear the mix of the live violin and the processed violin as it goes via an audio transducer into the metal or plywood, and I've never 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**.

40/105

*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 (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



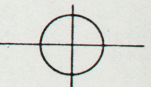
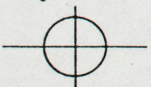
Clapping hands  
Marching bands  
Rattling bones  
Hewing beams  
Rubbing towels  
Turning cogs  
Nibbling mice  
Passing floats  
Weaving strands  
Watering hoses  
Easing throttles

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

insert  
...  
ben  
dots  
/



**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. . . .*


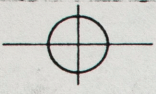
Yes!

*. . . this odd combination of things.*

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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 Levi-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.


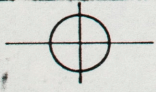
*Was there an urge, particularly in **Chambers**, to exhaust every thought in your head about locales for resonance?*

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

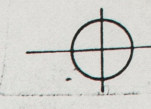
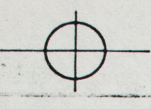
*But how do you stop?*

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.

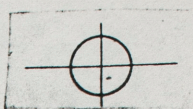

I'm trying to get at another idea about **Gentle Fire**, a parallel idea, and that is if you make an analogy between two things, you're not only saying that one of them resembles the other, you're saying that the identity of one is concealed in the other. It's as if all things are the same, but have 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.

42B/114

*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-

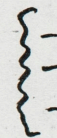




days that we have to find ways to get along with each other. At the grossest level, we're trying to find ways not to bump into each other. So instead of making music in which one instrument plays against another, the idea of contrast or competition, we're shifting to ideas of simultaneity, or similar 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,

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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.

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**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.



and still to moving sound geographies with sine waves.

You know that if you have a simple sound wave and a reflective sur-

*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?*

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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

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

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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. And 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 audible; 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 like that suggestion; I would rather 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.

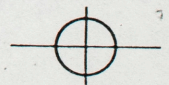
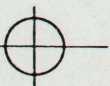
But since I began to measure Narrye for wavelengths that would fit her body, I've been thinking about making silhouettes or holograms of bodies in space with sound. It would be complicated because you would get multiples. Wavelengths don't occur just in space, they repeat themselves, so you'd create.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

*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 (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 wave lengths 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.

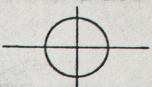
### BIRD AND PERSON DYING (1975)

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

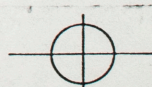
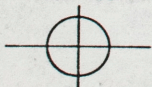
Route a binaural microphone system with long cables through amplifiers with limiters to one or more pairs of loudspeakers. Place an electronic bird or similar sound-producing object anywhere in the performance space. Plug it in. Set the amplifiers' volume levels so that the sounds of the twittering bird, 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 over-driving. 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 two-dimensional, or if it's a linear idea. Most all 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 (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 due to 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.

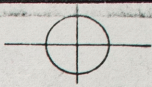



*In Music on a Long Thin Wire I've had a better chance than in most of your other pieces of the last several years to watch a composition take shape, to watch the technological and intellectual parts of the piece find a balance. And of course last night was an important performance of the piece, probably 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 returned, 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-



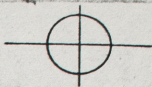
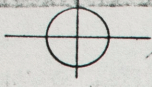
sizing the ideas behind the pieces. I guess I'd rather publish the ideas than the details because my work is not often practical for most performers anyway. It's unreasonable to expect people to set up the configuration for **Music on a Long Thin Wire** every time they want to do the piece, and I also 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.