WESLEYAN UNIVERSITY

THREE PIECES

by

Nicolas Collins

A Thesis submitted to the Faculty of Wesleyan University in partial fulfillment of the requirements for the degree of Master of Arts

Middletown, Connecticut

May 1979
CONTENTS

NICHE, performance 1978

NICHE, installation 1979

ANDS

Notes on the Thesis
NICHE

performance 1978

Architecture considered as reflection and extension of body.

A network of ropes and pulleys translates the performer's position into the shape of a canvas tent. A feedback system, instigated by the tent's creaking, detects and reveals in sound the changes in the acoustical character of the space that accompany any motion of the canvas. The performer walks, creating a sequence of personal architectural spaces.

Preparation

Acquire sails, awnings, tarpaulins, drop cloths, old tents, or any other large pieces of canvas or similar heavy, tightly woven fabric. Join the pieces together to form a single sheet approximately the size of the performance area. Spread it out and center it on the floor. Tie ropes to each of the corners and to any number of points on the surface of the sheet. Fasten a pulley to the ceiling directly above each rope.

Pass the ropes through the pulleys and raise the sheet to form a tent. Attach additional pulleys to the ceiling, walls, and floors, wherever needed in order to run the ropes from the sheet, up to the ceiling, out to the walls, and back into the center of the space at floor level without obstructing the raising and lowering of the tent. Arrange the ropes and pulleys with radial symmetry, so (c) 1979 Nicolas Collins
that the paths from the walls to the center resemble the spokes of a wheel.

Fasten one-inch iron or brass rings to parts of your body (for example: tie one to your belt, lace one onto a shoe, strap one onto a wrist). Tie a snap to each rope. Clip one snap onto each of the rings. When you walk through the space the tent will "follow" you as the ropes raise and lower its various sections. Adjust the lengths of the ropes to maximize both the accessible walking area and the excursion of the tent. You may tie off some of the ropes at the ceiling or at the base of the walls to create fixed points of support, but leave at least four lines moveable. Disconnect them from your body and snap them all onto a single 2"-3" ring. The tension of the ropes should equalize so as to center the ring and support the tent at a median height.

Attach a contact microphone or phono cartridge to one of the pulleys. Mount a shotgun microphone in a desk stand near the center of the floor and aim it at an angle up towards the ceiling of the tent. Connect the microphone cables to a 7 1/2 i.p.s. tape head delay with compressors or limiters. Mix the outputs of the delay and send the signal through an amplifier to a tweeter speaker. Place the tweeter face up under the tent at least six feet from the shotgun microphone. Place the delay unit and amplifier at the periphery of the space where they can be reached when you are
attached to the ropes.

The creaking of the miked pulley "seeds" feedback between the speaker and the shotgun microphone. The response of the tweeter limits the feedback to mid-range and high frequencies only. At these frequencies canvas acts like a solid wall which reflects and absorbs sound. Movement of the tent effectively changes the size of the room as "seen" by the feedback. By locking on pitches whose wavelengths are integral to some dimension of the tent, the feedback will monitor closely any such change. The directionality of the shotgun microphone increases the system's sensitivity to small movements.

Prior to the performance tune the gain controls carefully so that the feedback is not continuous. The contact microphone should trigger both sustained feedback and damped ringing, depending on the shape of the tent. Then shut off the electronics and begin the performance out of silence.

Performance

Walk to the center ring. Detach the ropes. Snap them onto your rings. Move to the edge of the space. Turn on the electronics.

The position of your body at any moment is reflected in the shape of the tent, which is in turn described by the sound. Use
your kinaesthetic and aural intuitions to guide the construction of a personal architectural space or the evolution of a series of spaces that together form a comfortable architectural "rate of change".

Walk slowly across the floor. Move that part of your body connected to the miked pulley only in order to initiate feedback—do not move it while feedback is sounding. Generally move slowly enough to be able to detect and evaluate the slightest change in the acoustics of the tent, but occasionally perform sudden, disjunct actions. Generate difficulty by turning and tangling yourself in the ropes, leaning to the point of losing your balance, crouching beneath low portions of the tent, working at the limit of a rope’s movement, etc.

Follow a pre-determined path across the floor or devise one as you go. Terminate the performance at the end of the path. Shut off the electronics. Disconnect the ropes from your body and snap them back onto the center ring. Leave the space.

Alternate Performance Realizations

Two or more persons attach themselves to the tent and attempt to construct their mutual image of an ideal space.

The tent weighs as much as the performer, who works suspended in mid-air beneath it.

Use other sound systems to detect and describe acoustical changes within the tent.
Photographs by Mary Lucier of a performance of NICHE at the Kitchen, New York City, April 1978
NICHÉ

installation 1979

Niche operates as a dynamic model of sound activity. It responds to the changes in loudness within it: large changes are translated into large, sudden movements; small changes yield small, slow movements.

A tent of sails is suspended from several points. Ropes run through pulleys from two points on the tent to a pair of winches, each of which has an electromagnetic clutch and brake. Through a set of relays a microcomputer directs the winches to hold, raise slowly, or drop suddenly either section of the tent.

With a microphone and an analog-to-digital converter, the computer measures the loudness of sound beneath the tent several times per minute. It stores each value of loudness in its memory. After each measurement it compares current value to the previous one. If the current number is slightly larger than the previous one, the computer raises one section of the tent; if the number is considerably larger, it drops that section. If the number is slightly smaller, the computer raises the other moveable section; if the number is considerably smaller, it drops that section. If both values are equal, the tent remains stationary. Sensing circuitry signals the computer to release the appropriate winch when either section has been raised to its upper limit.

(c) 1979 Nicolas Collins
Occasionally the computer will transform a sequence of stored values into a string of sound. As the computer continues to acquire data, it can produce longer and longer strings.

The extent of movement after each measurement, the time between measurements, and the pitches and durations of the strings are all calculated by the computer from the data it accumulates and from scaling factors set by the programmer.

The canvas acts like a solid wall to mid-range and high frequency sound. Movement of the tent significantly affects the acoustics within it.

One can use Niche as a performance space for another musical work. The sails will develop shapes reflective of the dynamic structure of the performance, and, if the piece is acoustically responsive, movement of the tent will in turn affect that piece's character.

Special thanks to: Thomas Hale, Martha's Vineyard Shipyard; Richard Young, Wesleyan University Machine Shop.
NICHE

Program, March 1979

Synertek VIM 1 Microcomputer

Zero Page Program Variables

01  large change value
02  small change relay on-time scaling
03  large change relay on-time scaling
04  wait scaling
05  upper limit release time
06  audio frequency range scaling

Zero Page Registers

10  count index
12  current difference
14  current value
15  wait register
22  difference, for string boundaries
24  value, for string boundaries
30  string begin address
31  string end address

Input-Output Memory Locations

1810  Analog-to-Digital converter
AC00  relays
Program (2)

Constants for Relay Control

#00 equal, off
#10 smaller
#20 very much smaller, release B
#40 larger
#80 very much larger, release A

Memory Used

01-31 zero page
200- 3EE program
500- 5FF accumulated data

Main Program

200  EA EA EA     NOP
203  EA EA EA     NOP
206  EA EA EA     NOP
209  78 D8 EA     INITIALIZE
       |       |       SEI, CLD
20C  20 86 8B     JSR ACCESS
20F  A9 00 EA     count
       |       |       LDA#00
212  85 10 EA     STA count index
215  A9 FF EA     relays
       |       |       LDA#FF
218  8D 02 AC     STA DDRB
21B  EA EA EA     NOP
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<td>A9 DC EA</td>
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<td>8D 10 18</td>
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<td>251</td>
<td>AD 20 18</td>
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<td>263</td>
<td>85 14 38</td>
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<td>F9 00 05</td>
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<td>269</td>
<td>85 12 EA</td>
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<td>F0 2E EA</td>
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<td>90 16 EA</td>
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<td>275</td>
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<td>278</td>
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<td>28D</td>
<td>A9 10 EA</td>
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Program (5)

2A8  8D 1F A4  STA Timer
2AB  20 68 03  sense  JSR SENSE
2AE  2C 1F A4  Test Timer
2B1  10 F8 EA  BPL sense
2B4  CA D0 EE  DEX, BNE time on
2B7  A9 00 EA  off  LDA#off
2BA  8D 00 AC  STA relays
2BD  EA EA EA  NOP
2CO  A5 10 EA  STRING  LDA count
2C3  25 12 EA  AND difference
2C6  85 22 EA  STA string diff.
2C9  A5 10 EA  LDA count
2CC  25 14 EA  AND value
2CF  85 24 EA  STA string val.
2D2  C5 22 EA  CMP string diff.
2D5  BO OD EA  BCS v</d
2D8  85 30 EA  v</d  STA begin address
2DB  A5 22 EA  LPA string diff.
2DE  85 31 EA  STA end address
2E1  18 90 09  CLC, BCC increment
2E4  85 31 EA  v</d  STA end address
2E7  A5 22 EA  LDA string diff.
2EA  85 30 EA  STA begin address
Program (6)

2ED E6 10 EA increment INC count
2F0 20 B0 03 JSR WAIT 1
2F3 EA EA EA NOP
2F6 EA EA EA NOP
2F9 EA EA EA NOP
2FC EA EA EA NOP
2FF EA EA EA NOP
302 EA EA EA NOP
305 EA EA EA NOP
308 EA EA EA NOP
30F EA EA EA NOP
311 EA EA EA NOP
314 A6 30 CA SOUND LDX begin address, DEX
317 A5 14 EA fc lo LDA value
31A 8D 06 A8 STA TIL-L
31D A5 12 EA fc hi LDA difference
320 25 06 EA AND fc scaling
323 8D 07 A8 STA TIL-H
326 8D 05 A8 STA TIC-H
329 EA EA EA NOP
32C A5 06 38 time LDA fc scaling, SEC
32F ED 07 A8 SBC TIL-H
332 3D 06 05 AND 500, x
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<td>DEY, BNE sr</td>
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<td>DO D4 EA</td>
<td>BNE time</td>
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<td>LDA#silence</td>
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<td>359</td>
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<td>STA SR</td>
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<td>35C</td>
<td>20 B9 03</td>
<td>JSR WAIT 2</td>
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<td>35F</td>
<td>4C 4E 02</td>
<td>JMP LISTEN</td>
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**Subroutines**

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<td>SENSE, LDA IFR</td>
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<td>irq, LDY release time</td>
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Program (8)

377 90 CA EA
37A AD 01 AC  ca1
37D A9 80 EA
380 30 04 EA
383 A9 20 EA  cb1
386 8D 00 AC  store
389 A9 40 EA  time
38C 8D IF A4
38F 2C IF A4  test
392 10 FB EA
395 88 DO FI
398 AD 01 AC
39B AD 00 AC
39E 20 72 89
3A1 4C B7 02
3A4 EA EA EA
3A7 EA EA EA
3AA EA EA EA
3AD EA EA EA
3B0 A6 10 EA  WAIT 1
3B3 BD 00 05
3B6 20 FA 82
3B9 A5 12 EA  WAIT 2
3BC 85 15 EA

BCC cb1
LDA ORA
LDA#release A
BMI store
LDA#release B
STA relays
LDA#40
STA timer
Test timer
BPL test
DAY, BNE time
LDA ORA
LOA ORB
JSR BEEP
JMP off
NOP
NOP
NOP
NOP
LDX count
LDA 500, x
JSR OUTBYT
LDA difference
STA wait register
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<td>3CB</td>
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<td>20 6A 89</td>
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Photographs by Nicolas Collins and Meredith Gang of an installation of NICHE in the South Gallery, Wesleyan University, March 1979
Photographs of an installation of

NICHE at Media Study/Buffalo,

October 1978
ANDS

for two pairs of players

with coincidence-detecting circuitry

ANDS combines basic concepts of musical instrument, structure, and form into one set of circuits. The structure of any particular performance is determined by coordinations between the players and the circuit. The form of the piece results from relationships that develop among the players in performance. The primary score is the circuit itself.

Awareness of the form is necessary for performance. This awareness can best be attained through some direct experience with the instrument and the structure. Someone who understands the circuit-as-score should design rehearsal instructions that will expose the players to the factors that shape the piece.

The instructions for the first rehearsals can be task-like and relatively mechanical, so that the players may develop a feeling for their instrument and its controls. Later rehearsals should shift the players' attention to the circuit's structuring of time and to their possible roles within that structure. (An example of an instruction set for such a rehearsal is included in this notation.) Finally, the performers' understanding of their ability to play with each other through the circuitry signals their readiness to perform ANDS. At this point they begin to use the circuit as a score for a kind of ensemble activity in which no single player "leads," "follows," or (c) 1979 Nicolas Collins
otherwise dominates any moment of the piece. The current rehearsal instructions may now be treated as a general format, or supplementary guidelines, for performance.

Most of the ANDS circuitry is housed in a 3''x5''x8'' aluminum box. Four control devices are attached to this central unity with five-foot long sections of ribbon cable. Two of the controls are small keyboards, which are used by the players in Pair 1; each contains four momentary switches, a miniature condenser microphone, and two potentiometers. The other controls are two strips of four potentiometers each, which are played by Pair 2. The outputs from the central circuitry are connected to seven channels of amplification. The speakers are distributed throughout the available space.

Coincidences between the keyboards in Pair 1 change the output channel assignment of two Phase-Locked-Loop Oscillators. The rate of radical change in the sound texture of the oscillators reflects the density of the performers' activity.

Coincidences between rhythmic patterns controlled by the players in Pair 2 change the tuning of a digital oscillator. Non-coincident patterns alter its timbre. The transformations in the oscillator's sound reflect trends in the rhythmic interplay within the pair.

An additional circuit controls the final output of ANDS in response to coincidences between the two pairs of players.
Pair 1

Each player can depress any combination of the four momentary switches (A, B, C, D) on his/her keyboard. Coincidence between Player 1 and Player 2 occurs when they press A1 and A2, or/and B1 and B2, or/and C1 and C2, or/and D1 and D2. A coincidence assigns each performer's Phase-Locked-Loop Oscillator (PLLO) to output channels corresponding to the switches depressed at that moment. For example: Player 1 presses A, B, and C; Player 2 presses B and D; coincidence is detected between B1 and B2; PLLO-1 is sent to channels A, B, and C; PLLO-2 is sent to B and D. The channel assignment is held until the next coincidence.

Each PLLO alternates between two modes of operation after every eight pressings of the switches on its keyboard. In the "tracking" mode it attempts to lock in frequency and phase with any sounds it detects through the microphone mounted in the keyboard. It creates complex patterns as it tries to track the output of the other PLLO, the other sounds of ANDS, ambient sounds, and its own square-wave output. These patterns vary with the PLLO's channel assignment, and are also affected by the room acoustics. When the PLLO changes to the "holding" mode, it initially locks on the pitch it is producing at the moment of the change and then slowly drifts upward in frequency.

When the outputs of the two PLLOs are sent to the same channel they are mixed digitally, so that they are not heard as two
separate sounds but rather as a single complex one. Each of the four output channels employs a different mixing circuit, and so sounds different from the others.

Each keyboard has controls to adjust the sensitivity of the microphone and the tracking speed of the PLL circuit.

**Pair 2**

Each performer manipulates four potentiometers connected to a circuit that generates pulse sequences in complex periodic patterns. Three of the pots influence the rhythmic pattern and tempo; the fourth primarily affects the timbre of the pulses. The two circuits are completely independent, each being controlled by one player, and each having its own channel of output.

When both circuits coincide by producing a pulse at the same time, they shift the frequency of a digital oscillator to the next pitch in a sequence of pre-set tunings. After every eight non-coincident pulses, the oscillator is similarly shifted to the next in a sequence of different timbres (which includes silence).

Additional counting circuitry divides the performance into four major sections. During the first section the digital oscillator operates in a low frequency range. In the second it produces high frequencies only. Its waveform becomes extremely complex in the third section, and in the last the oscillator is silent. A transition from one section to the next occurs every time a predetermined
number of pulses has been counted.

The sequences of pitches and timbres, and the pulse-count and tunings for the sections are all programmed with trimpots and a matrix on the circuit board.

Output Circuitry

Every time coincidences occur simultaneously in Pair 1 and Pair 2, a circuit randomly selects one of four possible output modes: 1) only Pair 1 is audible (four channels on); 2) only Pair 2 (three channels); 3) both pairs (seven channels); 4) neither pair (all channels off). The output mode is held until the next double coincidence.

A switch, mounted on the box containing the central circuitry, overrides the random control. It directly selects either pair's output for the purpose of practicing or "tuning" either circuit. It is also used to initialize the circuitry at the beginning of a performance by selecting Pair 2's output and resetting all counters and sequences.

Sample Rehearsal Instructions

Prior to the rehearsal, the rehearsal director programs the matrix, selects tunings for the sensitivity and slew controls of the PLLOs, and sets Pair 2's pulses to a slow rate. The performers are told that the piece is divided into four sections, which are marked by changes in the range of Pair 2's digital oscillator. The circuitry is initialized.
Section 1. Only Pair 2 is audible. Only Pair 2 plays. The oscillator is in the low frequency range. The players evolve a sequence of rhythmic patterns. The pause between any changes in the rhythm should be long enough to allow the pattern of the oscillator's tunings and timbres to establish the character of the current rhythmic interplay. The two players should seek cross-rhythms that produce significant changes in the oscillator's behaviour. They should gradually increase the speed of the pulses to an average rate of one pulse per second by the end of this section.

Section 2. The oscillator's shifting to the high frequency range signals Pair 2 to stop playing and Pair 1 to begin. Each full coincidence between the pulses and the keyboards will randomly select any one of the four output modes. Whenever Pair 2's pulses are audible, the players in Pair 1 should play "in time" with them—they need not attempt to synchronize exactly with the pulses, but should scale their tempo accordingly. When the pulses are inaudible, the players are free to explore the effects of other gestural styles. They should attempt to allow several occurrences of each output mode within this section.

Section 3. This section begins as soon as Pair 2's oscillator is heard producing the complex timbres of its third tuning stage. Both Pair 1 and Pair 2 play. Pair 1 should mark the transition by tuning the sensitivity and slew controls of the PLLs to new settings,
and by adopting gestural styles that are significantly different from those of the preceding section. Pair 2 should play the rhythm and speed of the pulses with the intent of varying the rate of the changes among the various output modes.

Section 4. As soon as it is clear that Pair 2's oscillator is in its last, silent stage, the players should perform whatever actions are necessary to achieve the "Pair 2 only" output mode. After waiting in this state for several minutes, the players should try to effect the silent mode. The piece ends once silence has been established.

The players and director should discuss the piece after it has ended. They should address themselves to the following questions in particular: Did the players perceive any causal relationships within the piece? Did they have any sense of control over the sounds and shape of the piece? Did they adopt particular performance roles? Did any player or either pair tend to dominate the piece? How would the players describe the ensemble of the piece? How might they try to change another runthrough based on the same set of instructions? How might they change the instructions for another rehearsal? Are they ready to perform the piece?
Circuit Board 2
NOTES ON THE THESIS

In October 1976 in Berlin I read in "Bauwelt" (a German architectural magazine) an article by Peter Lebrecke and Ralf Kurer which described the use of acoustic "tents" in churches. Loosely-woven fabric absorbed mid-range and high frequency sound; tightly-woven material reflected it. When hung low over the nave, canopies of either material reduced the effective volume of the church and cut down the reverberation time sufficiently to make the space suitable for conferences. The following spring in Florence I saw such tents in use in the church of St. Lorenzo.

Having previously composed some pieces involving the acoustics of static architectural space, I became interested in using similar tents to construct a flexible architecture whose acoustics would vary as it moved. On Cape Cod over the summer of 1977 I collected old canvas and dacron sails. For me the curves of the hung sails evoked images of the vaulting of Antonio Gaudi and the tensile structures of Frei Otto. I settled on using a feedback system to reveal acoustical changes, and by January 1978 worked out the performance version of NICHE included in this thesis.

I began working with a microcomputer in May 1978, and soon began to apply it to the task of manipulating the sails. I wanted to design an architecture that was physically responsive to people within it. The focus of early versions of the installation project
was still on illustrating the acoustical changes inside the moving tent, which were closely monitored by feedback networks similar to that of the performance version. Recently I have been more concerned with emphasising the ability of the computer and sails to reflect sound activity already taking place; I prefer to let the acoustical variation either be experienced directly through attentive listening, or be revealed by its influence on a separate, acoustically sensitive work performed within the tent (such as ANDS).

ANDS grew out of an interest in the early pieces of Christian Wolff and the realization that his basic concept of "coordinations" was implicit in certain types of logic circuitry. Initially I tried using "coordinating circuitry" in conjunction with traditional acoustic and electronic instruments, but I was dissatisfied with the lack of coherence between the two. Later I decided to combine a structure for group coordination and some sound producing devices into one electronic instrument, which would not be controlled directly by any single performer, but instead would bring out an image of the group as a whole. I built one such duet in April 1978 and another the following December. In January 1979 I added a third circuit board to combine the two duets into ANDS, for four players.

I have performed NICHE (1978) at the Merce Cunningham Dance Studio, The Kitchen Center for Music and Video, Media
Study/Buffalo, and Wesleyan University. Various realizations of the installation of NICHE, some done in conjunction with Ron Kuivila, have been presented at Media Study/Buffalo, Millennium Film Workshop (NYC), and the South Gallery of Wesleyan University. Versions of ANDS have been performed at The Blind Lemon (Berkeley), The Concord Hotel (Kiamesha Lake, N.Y.), 80 Langton Street (San Francisco), Experimental Intermedia Foundation (NYC), Footprints (Manchester, CT.), Media Study/Buffalo, and Wesleyan. Jon Barlow and Joseph Reed have recorded the Pair 1 duet from ANDS.

My thesis show consisted of an installation of NICHE in the South Gallery from March 26 to April 1, and a performance of ANDS under NICHE in the gallery on March 29. The performers were Jon Barlow, George Barth, Joseph Reed, and Roger Solie.

The photography in this thesis is by Meredith Gang, Mary Lucier, and myself. Linda VanMeter printed my photographs.

I would like to thank several people for their help on this thesis: K. Lea Crawley of Falmouth, Mass., and Thomas Hale of the Martha's Vineyard Shipyard, for contributing sails; Richard Young of the Wesleyan Machine Shop, for aid in making the winches used in NICHE; Meredith Gang, Mary Lucier, and Linda VanMeter, for photographic work; Rich Gold and Paul DeMarinis, who introduced me to the microcomputer; Susan Tallman, designer and
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editor; Jon Barlow, George Barth, Joseph Reed, and Roger Solie, who performed, advised me on notation, and edited; Ron Kuivila and, especially, Alvin Lucier, who gave needed compositional criticism.

N. C., April 1979
Nicolas Collins

New Pieces
with sails, microcomputer, and players

installation / March 26-31
performance / Thursday March 29 8:00

South Gallery / Center for the Arts