

David Tudor's *Rainforest*: An Evolving Exploration of Resonance

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ABSTRACT

Why do you want to work in nature?

Well, it's part of my being. It's a question I can't answer because I can't get away from it. I think all of my work has a strong connection to nature ... it seems to me that the way I use the technical medium, it's just more of what's already there. I don't see, for instance, what's unnatural about a parabolic reflector. They exist in nature already, perhaps not in perfect forms, but neither am I after a perfect form.¹

Of the electronic works of David Tudor, none would seem to be better-known than *Rainforest IV*, his large-scale performed installation of the 1970s. Yet although it has received widespread and well-documented public performance, *Rainforest*'s germination in the mid-1960s in elements of *Bandoneon!* (1966) and evolution over a period of ten years - through versions *I* (1968), *II* (1968-69), *III* (1972) and *IV* (1973), to *Forest Speech* (1976) - have not yet been adequately assessed. Its roots reach back into the 1950s and work with contact microphones and amplification in the music of Cage, Nilsson, Stockhausen and others; its conflation of the natural and the artificial is provocative and the essential technical concept of the piece - a transducer affixed to an everyday object, causing it to resonate - can be seen (and heard) as a metaphor for a less earthbound process of transformation, and an expression of Tudor's personal mysticism. Sonic resources used to activate the transducers are variously electronic (live or otherwise), bio-electronic (gathered from research laboratories), or sounds of living things actively gathered in the field; frequently sounds in all these categories imitate each other.

The open-ended nature of Tudor's text instructions for the large ensemble piece *Rainforest IV* demands player consensus on "correct" performance practice. Tudor's "student group" of multidisciplinary artists Composers Inside Electronics (earlier *Pnumbral Raincoast*) organized itself around realizations of the piece as well as support for each others' work as composer-performers. Its dynamic structure and ideals are reflected in the group's performances of *Rainforest IV* - ever-changing, yet sonically consistent - and in the process of "learning to play" with David Tudor the original CIE members have come to individual and collective insights into various levels of his art, from mundane technical matters to etheric spiritual concerns.

With specific attention to the above issues, the proposed paper will follow *Rainforest*'s trajectory chronologically. Rogalsky will focus on the early history of the work and its full development as a 1968 commission for the Merce Cunningham Dance Company, which led to the version performed with John Cage in 1972 on their last European tour as a performing duo. Driscoll, a founding member of Composers Inside Electronics and one of Tudor's closest collaborators throughout the 1970s and 80s, will explore *Rainforest IV* from its unexpected blossoming in 1973, through the formation of CIE, to *Forest Speech* (1976) which might be considered a postscript to the *Rainforest* series. He will also reference an incomplete collaborative work with Tudor incorporating rotating focused loudspeakers and plans for a permanent installation of *Rainforest*.

¹ From interview with David Tudor, *Island Eye Island Ear* proposal for Boulder Island (Saranac Lake, Adirondacks), May 25 1979. In accession No. 980039, Box 21 Folder 9, Getty Research Institute.

FULL PAPER

Rainforests I, II and III

Matt Rogalsky

For me, the key word in the title of this joint presentation with John Driscoll is “Evolving.” As we survey David Tudor’s electronic music career in retrospect it’s important to remember that the specific instances which we call his “pieces” or “works” could just as well, and perhaps more correctly, be viewed as a points on a continuum. Certainly this is the case for the works in his *Rainforest* series, which stretches for a decade over four “versions” and in which I include, as an experimental prelude, his 1966 *Bandoneon!*, and as a kind of postlude, *Forest Speech* from 1976-79.

The most convincing arguments for approaching Tudor’s work from this perspective are the recurring comments I have heard in interviews and discussions with his colleagues: that his performance practice was based on experimentation and constant change; that it was a rarity for a piece to be assembled exactly the same way twice; that Tudor’s score diagrams, while giving some idea of the principles at work in his compositions, are definitely not to be mistaken for blueprints which might define an “authentic” performance setup.

Observing the stream as particles rather than waves, we can clearly hear that the compositions which Tudor named – these points along a continuum – do have quite specific sonic identities. And the existence of *Rainforest IV* implies that there must be *Rainforests I, II and III*. But identifying these versions has not been a clear-cut process and has brought me back again to a more holistic perspective. Tudor said in a 1988 interview broadcast in Germany, “my preference is to use modular materials which can change from piece to piece. And also it enables me to expand a piece by adding components to it which were not in the original formation.”

As the first half of this joint presentation I wish to look at the development of the small-scale versions of *Rainforest*, between 1966 and 1972, prior to the workshop in New Hampshire in 1973 which led to the creation of *Rainforest IV*, the large-scale group version. “Small-scale” refers to the scale of the loudspeaker objects, and for versions 1 to 3 of *Rainforest* this means of a size which permits packing in a suitcase, for ease of touring.

The first version of *Rainforest* was commissioned by the Merce Cunningham Dance Company in 1968, for an initial fee of \$500 plus \$25 per performance. But the piece has its origins in *Bandoneon !*, the work Tudor created for the 9 Evenings of Theatre and Engineering in October 1966. We could look even further back than this; Tudor’s interest in the resonance of physical objects probably has its origins in the experience of performing such works as John Cage’s *Cartridge Music* (1960), which depends on the basic idea of revealing sonic characteristics of everyday objects. The work which Tudor identifies as his own first composition, *Fluorescent Sound* (1964), is basically a creative extension of the *Cartridge Music* principle: the amplification of small sounds.

According to interviews, Tudor was interested from 1965 in finding a means of making objects reveal their own resonant characteristics, rather than using them as instruments to be played manually. He put it this way: “one didn’t have to think of the generation of electronic music from signal source to the reproducing output, but one, instead, might just as well start from the other end and go back and arrive at a signal source.” Tudor described this revelation as an instantaneous “dream-vision of an orchestra of loudspeakers, each speaker being as unique as any musical instrument.”

The type of audio transducer which Tudor discovered could resonate physical objects in the way he imagined, is basically a speaker without a cone, which could be attached to a wall or a door to turn it into part of a home hi-fi system. 1966 was apparently a year of enthusiasm for the idea of such a device; among Tudor’s papers we find a *Popular Mechanics* article from June of that year describing to the home hobbyist how to “Build a FANTASTIC CONELESS LOUDSPEAKER! Here are the complete plans that you asked for after reading about this amazing speaker in our December issue.” Also found in the Tudor collection is a copy of the same article from a September 1966 Portuguese edition of the magazine.

That year, audio transducers were not only available to hobbyists willing to spend hours painstakingly constructing them; they were commercially available as well. These were apparently descended from a design developed for underwater use by the US Navy. Tudor obtained a number of the commercial transducers and they became integrated into his contribution to the 9 Evenings, *Bandoneon !*, as “instrumental loudspeakers” mounted on four radio-controlled carts which roamed the space during his performance. Sound was directed to twelve conventional loudspeakers in addition to the roving carts, which were used for “spatial variation.”

The carts had been developed for choreographer Deborah Hay’s 9 Evenings performance piece, and Tudor’s borrowing of them apparently caused some friction; according to Robert Kieronski, one of the Bell Labs engineers working with Tudor, Tudor saw the gadgetry assembled for the series as a communal pool of resources to be drawn upon by all – a view not shared by some of the other artists. Of the resulting disharmony when Tudor began borrowing things, Kieronski says “Billy, of slightly socialist leanings ... did not adjudicate the fray. ... Cage was happy with the chaos. Nobody bothered Rauschenberg.”

The four instrumental loudspeakers were, according to Tudor’s notes:

- 1) aluminum sheets (suspended ca. 15’)
- 2) steel tray with vibrating appendages
- 3) 2 14” wooden planks mounted at 90°
- 4) plate glass (push-pull driven)

Other notes describe materials considered:

sheet rock
 glass
 wood: masonite
 barrel
 metal: bronze thundersheet
 furniture
 try: metal pipe const.
 fibreglass
 jointed metal const.
 Piano

Here we get a sense of Tudor going through the learning process which all subsequent *Rainforest* “initiates” have experienced. Not all materials make good resonators; it’s a process of trial and error to come up with a handful of good ones out of a wide range of apparent possibilities. Tudor described *Rainforest* as a piece which “teaches itself,” and here we see him as its first student. I find it surprising that one of the four loudspeaker-objects was plate glass – in a 1995 interview I conducted with Tudor he specifically told me that “Early on ... I avoided glass.” – but then there are theatrical considerations at play here which perhaps allowed a tradeoff between dramatic visual presentation and an ideally resonant speaker-object.

Following on the 9 *Evenings*, the loudspeaker-object idea was laid aside for a number of months until Merce Cunningham commissioned a piece from Tudor for his new dance *Rainforest*. In Tudor’s words,

...Merce Cunningham asked me for a piece. Well, I have those things lying around, so I might as well put them to use. So, the first thing I did was to work on an amplifier to run them. I made an eight-channel amplifier with small capacity. And I made objects which I could travel with. And they were so small they didn’t have any sounding presence in the space, so I then amplified the outputs with the use of contact microphones.

The use of contact microphones on the transduced speaker-objects in this first version of *Rainforest* harkens back to *Cartridge Music* and *Fluorescent Sound*. It also raises the question of exactly where the sonic identity of a *Rainforest* object is to be found; the (in)fidelity of *Rainforest* objects depends not only on the objects themselves but

as much on the frequency response of each stage of transduction. The transducers do not transmit bass frequencies efficiently; the piezoelectric phono cartridges originally used for pickups have good bass response but roll off quickly in higher frequencies. All of these limitations contribute to the overall sonic presence of a *Rainforest* object, which of course is ultimately dependent on the choice of sound materials to be transduced through it.

Gordon Mumma recalls that while Tudor was developing the piece, he didn't have a name for it, and when he heard that the dance was to be called *Rainforest*, he said "Now there's a title." So any connection between the title of the piece and its sonic content is, apparently, coincidental. However, in a later description of Tudor wrote "The composition was implemented thru the construction of special insts. [instruments], which can be manipulated to produce sounds resembling those of nature," and in an interview in the 1980s Tudor described *Rainforest I*'s sound sources as "oscillators that made animal-like and bird-like sounds." Thus connections to a (imaginary) natural soundscape do exist even in this strictly electronic version of *Rainforest*.

An anecdote from Jean Rigg in March 1970 illuminates these connections – or their boundaries – further. Tudor was not touring with the Cunningham Company; he was in Japan at the time working on the Pepsi Pavilion at Expo 70 in Osaka. Rigg wrote to him:

...we got to the aviary in Pittsburgh, Gordon [Mumma] w/ tape recorder, and John [Cage] ... and I got in to an amusingly heated battle over whether or not Gordon's aviary recordings belonged in that night's performance of *Rainforest*. Well, I don't know what was amusing about it except maybe to find myself in heated battle with John in the first place. Anyway, it was finally agreed that the recordings were, to use David Behrman's tactful description, "too literal."

The piece was intended to be done as a duo, "piano-four-hands" style in Mumma's words, with each player taking responsibility for four objects and sharing access to a single mixer. Mumma says of the style of interaction that:

I was surprised to see how often David just sat aside, not doing anything except perhaps a level adjustment. He would listen carefully, sometimes taking notes (when there was enough light), and then re-enter so that we were working together, or I might "step aside", in particular when David got lots of sound going.

Mumma recalls that from 1970 Tudor began making source tapes of electronically generated sounds to replace the hardware oscillators, in order to facilitate performance by others (specifically John Cage) without deep technical knowledge of his setup. The piece was also occasionally performed as a solo when the Cunningham Company was especially short-staffed of musicians, in which case "the sounding materials of *Rainforest* were somewhat simpler, but not dramatically so, because when we performed together we always left room for what the other was doing."

Tudor's description of *Rainforest* dated 1968 (but written in 1972, I believe) cites these four possible realizations:

1. Use only signal generators, any kind, as inputs, At least eight will be required. Vary the waveforms. (Note that simpler waveforms generally produce more complex results).
2. One (speaking) voice only as input; the instruments acting as filters. The outputs can be mixed down to two for this version.
3. As (2.) but with up to eight voices, singing or speaking. Four to eight output channels.
4. Various taped materials used as input. Limit these to two at any given time, distributed among the eight channels.

Option 1 is *Rainforest* for the Cunningham dance. We have already seen that it was subject to at least several variations in realization.

The next two options are intriguing because they seem together to constitute *Rainforest II*, and yet there does not appear to be any specific record of their performance as compositions in their own right. Tudor later stated, "In the second version I wanted to use a vocal input to the system." Gordon Mumma recalls that, as part of Cunningham *Events* – dance performances made up of scenes from numerous other Cunningham dances, collaged seamlessly together, with "free" musical accompaniment – Tudor experimented with processing John Cage's vocalizations.

These experiments were overlaid with contributions from the other company musicians. There are no specific musical credits given for *Events*, so it is impossible from Cunningham Dance Foundation records to establish what the musicians were doing for any given performance. However, I have found no record of options 2 and 3 above receiving performances as concert works, so if they were performed at all – and I assume they were, since the list of options is so specific – it seems likely that they were realized by Cage and Tudor as *Event* contributions.

If the versions with vocal input are *Rainforest II*, then the version identified as option 4 in the above list is *Rainforest III*. Certainly option 4 describes the technical characteristics of the version which was developed as a double performance with John Cage and toured throughout Europe in the summer of 1972. Several documents in Tudor's papers support the identification of this version as *Rainforest III*.

The “various taped materials” of option 4 were drawn from an extensive sound library which Tudor, Ritty Burchfield and geographer Peter Poole gathered together in 1969 and 1970 for use in EAT's Pepsi Pavilion at the 1970 World's Fair in Osaka. From the UK, Poole brought recordings of deer and birdsong. At Jet Propulsion Laboratories, recordings of satellite data communications were gathered. A US Navy laboratory in California provided recordings of neural activity. Some of the first recordings of whale song were also included. Some sounds were recorded by the team including a vivid one of mosquitoes in a jar. The tapes had to be “rescued” when PepsiCo decided they would take over control of their pavilion from EAT. Peter Poole recalls a 3 AM phone call from artist Robert Whitman saying “Gotta get the tapes out!”; they were accosted by a policeman as they threw tapes over the pavilion perimeter. Ritty Burchfield remembers smuggling other tapes out a few at a time, in the pavilion cleaners' carts.

Tudor made four significant sound pieces for the Pepsi Pavilion, and the library of tapes continued to be an important resource throughout the rest of his career, appearing in numerous compositions and used as source material for *Events* performances with Merce Cunningham.

According to Tudor's diagrams for the 1972 version of *Rainforest*, designed for simultaneous performance with John Cage reading his text *Mureau*, only four loudspeaker-objects were employed, with input from two stereo cassette decks for four separate tracks of audio source material. Pickups on the objects amplified their resonances into a four- or eight-channel conventional sound system (John Cage did not share Tudor's system but had his own four-channel loudspeaker setup solely for his live and prerecorded vocalizations). A preparatory list of sound sources per object identifies a selection of laboratory brainwave recordings, water sounds, “vibes” (earth vibrations), and a favourite nightjar recording. A recording of the premiere performance of this version at Radio Bremen has recently been released on New World Records, and in the mix we can aurally identify other Pepsi sounds as well: a beetle walking, a wasp chewing, the mosquitoes buzzing in their jar.

Unfortunately, the New World release of this excellent recording, documenting one of the major (and most pointedly egalitarian) collaborations between Tudor and Cage, has muddied the waters where identification of the various versions of *Rainforest* is concerned. Tudor's contribution is (mis-)identified as *Rainforest II*, and Elliot Schwartz's liner notes give a mistaken description of the piece, stating that Cage's vocalizations were used as the primary input to Tudor's loudspeaker-objects. As far as I have been able to ascertain, from Tudor's notes and diagrams, and from available recorded evidence, that was never the case on this 1972 European tour. Schwartz's notes read “warbling sine-wave oscillators are used for *Rainforest I* ... but, by contrast, *Rainforest II* is designed for vocal input.” I can agree with this general description, but unfortunately *Rainforest II* is not the version documented on the CD!

To be too obsessive about getting the version numbers right is to risk losing sight of the broader picture: that of a musical practice based on constant modification and innovation. David Tudor found it useful to retrospectively organize the *Rainforest* series in this way, which suggests that each version represents a significant stage in the development of an idea. But Tudor's own vagueness, even apparent indecision about how to number the series, says much about how *Rainforest* resists such pigeonholing.

Rainforest IV

John Driscoll

Following below is the description that was used repeatedly in describing *Rainforest IV*. As Matt Rogalsky has mentioned above, the titles of the different versions were not as evident as one might assume. The use of the title *Rainforest IV* did not appear in print until negotiations with René Block over the *Rainforest* LP that he produced on Edition Block in 1981. The first use of the *Rainforest IV* title was for the installation at the Holland Festival in 1982.

Rainforest IV is an electro-acoustic environment conceived by David Tudor and realized by the group Composers Inside Electronics. Each composer has designed and constructed a set of sculptures which function as instrumental loudspeakers under their control, and each independently produces sound material to display their sculptures' resonant characteristics. The appreciation of Rainforest IV depends upon individual exploration, the audience is invited to move freely among the sculptures.

General Description

The work is improvisational by nature and typically performed by a minimum of four performers continuously for between 3-6 hours at a time. A minimum of 16 sculptural speakers are used with an upper limit of forty. The work has been installed in approximately 36 different locations (museums, universities, performance centers and even Pierre Cardin's fashion studio), with over 125 individual performances to date.

The character of a *Rainforest IV* performance is an informal social environment where visitors are encouraged to wander around and physically interact with the work (including placing your ear against the sculptures, feeling the vibrations in your hand or against your head, and even biting an object allowing the sound to travel through the bones in your head.) Performers are also free to move about during the performance to monitor the sculptural speakers and engage in discussions with the audience. Chairs are placed at the performers' tables to encourage this interaction. David requested that two particular audiences be invited when possible – the blind and children.

Origins of *Rainforest IV*

Rainforest IV was technologically a direct outgrowth of the earlier *Rainforest* versions using low powered amplifiers, electronic and tape source signals and sound transducers fastened to objects. However, the characteristics distinguishing Rainforest IV from other versions are:

- the creation of a visual and sonic environment with from 16 to 40 suspended sculptural speakers
- the size of the sculptural speakers (some as large as 12ft x12ft)
- the duration of the performance (typically 3-6 hours),
- each sculpture projects a strong acoustical presence in the space
- use of a vibration pickup to amplify the resonant frequencies present in the sculpture through speakers creating a harmonically shifted reflection of what the audience hears directly in the object,
- the collaboration of multiple performers (Composers Inside Electronics) in the creation of the sculptural speakers, sound materials and the visual environment

Rainforest IV evolved out of a workshop that David presented at the New Music in New Hampshire Festival (Chocorua, NH) in the summer of 1973. The first performance titled *Sliding Pitches in the Rainforest in the Field* took place in a large barn and lasted for approximately five hours. The "Sliding Pitches" part of the title came from joint circuit building workshop by Gordon Mumma and David Behrman, and the "in the Field" came from the name of the Inn at which the Festival was held (Stafford's in the Field). The sculptures included a metal bedspring, a huge wine barrel, toilet floats, cast iron wagon wheel rims, a stainless steel milk container lid, lawn sprinklers, a copper still, styrofoam box, a large metal cable, and more. The performers included: John Driscoll, Phil Edelstein, Linda Fisher, Martin Kalve, Greg Kramer, Susan Palmer, David Tudor, and Bill Viola.

This first realization of the work was probably as much a revelation to David as it was to the other performers for a unique visual and sonic environment was created. This performance set the stage for the evolution of the work over the next 28 years. David stated in interviews that his intention at Chocorua was to “give away” the *Rainforest IV* work. This desire goes to the heart of a long collaboration which grew into an extended family of associates known as Composers Inside Electronics.

Composers Inside Electronics Group (CIE)

Following the Chocorua performance, more *Rainforest IV* installations took place with the core group at: the Everson Museum, SUNY Buffalo (1974), York University / Mills College / The Kitchen / Fort Worth Art Museum / DeSaisset Art Gallery / LA County Museum (1975). The performances at York University and at the Fort Worth Art Museum (1975) involved both David Tudor and John Driscoll giving workshops with students and then performing with the students. This led to installations in 1976, at the Houston Contemporary Art Museum and the Walker Art Museum with the core group.

David formed a performance group which became Composers Inside Electronics (CIE) in order to present a series of 13 performances and four installations for the Festival D’Automne at the Musee Galliera in Paris (1976). The group name evolved from discussions between David and John Driscoll, and reflected David’s fascination that electronic components have their own personality and suggest musical directions derived from intense experimentation – therefore Composers Inside Electronics.

This newly formed group (Paul DeMarinis, John Driscoll, Phil Edelstein, Linda Fisher, Ralph Jones, Martin Kalve, and Bill Viola) became the collaborative nucleus for *Rainforest IV* and have performed the work for well over 500 hours total. Over the years a number of different composers/performers joined in performances including David Behrman, Cynthia Black, Nick Collins, Russel Frehling, Takehisa Kosugi, Virginia Quesada, Prent Rodgers, Ann Sandifur, Richard Teitelbaum, and Andrej Zrajic.

Origins of the *Rainforest IV* Sound Sources

Questions continually arise about the selection and origin of the sound materials used for *Rainforest IV*. Each performer is responsible for producing the sound materials for the particular sculptural speakers they construct. These sound materials have covered the gamut from electronically produced to highly amplified natural sounds (ie. a fly walking on paper). The only restriction David ever spoke about is there should not be any pre-recorded musical material used, though at one point in the installation at the Walker Museum, as a spoof, we played the tape that signaled the closing of the gallery through all the sculptures simultaneously.

The source material created is motivated by the unique set of resonant characteristics that each sculptural speaker presents. After investigation, the composer creates material which will tease the resonant nodes into strong vibration creating responses that are highly non-linear. It is the equivalent of tickling someone – a little input at just the right spot creates great output. The resonance nodes of the sculptural speaker contribute to what is heard as much as the original sounds, and in some cases influences the result even more. It is possible to put a sound in which is unrecognizable coming out of the sculpture. For example, David occasionally used two transducers out of phase to create results that did not exist in the source material.

There are no coordinated starting points and ending points to the work other than the scheduled durations of the performances. The work relies upon the performers listening to each other and responding in kind. Given the duration of the work it is possible to create large shifting sound characters which evolve over extended periods interspersed with short duration local sound events unique to one object.

Because the work is performed for up to five continuous hours by up to 10 independent performers it is never musically the same performance to performance. Therefore, it is very much an improvisational coordination of the sound materials, but one that has become extremely familiar and ingrained in the performers. Since there is no single point of view the work is never heard the same by any audience member, nor by any of the performers since they are

arranged in different parts of the space. This is why performers occasionally walk about testing the sonic balance and density in other parts of the space.

Evolution of the Sculptural Loudspeakers

The creation, design, and construction of the sculptural speakers is also left to each individual composer. The use of specific sculptures will vary greatly from installation to installation based upon:

- who is performing (each composer maintains their own collection of objects)
- the scale and nature of the performance space
- balancing the sonic properties of various materials (metal, plastic, glass, etc.)
- the number of performers

Because of the varying backgrounds of each composer some sculptural speakers may be found objects while others may be more elaborately fabricated sculptures. The simplicity or elaborateness of the sculptural speakers was never dictated in the collaboration and over the years has accommodated a wide range of sculptures.

The repertory of available sculptures increases exponentially as more installations of the work take place. Many have been unique to a particular installation and are retired because of difficulty to transport them due to size or weight. Some objects do not produce the optimum result and are also retired. A number have persisted and became almost “classic” sculptures that appear and re-appear, sometimes growing larger and mutating with time.

Installations at the LA County Museum and the Walker Art Museum lent themselves to the creation of new sculptures because of easy access to the Disney surplus in Los Angeles, and Honeywell/3M surplus in Minneapolis. These sites proved to be a treasure trove of exciting and unusual objects including a large 5 ft. diameter disk from an old hard drive and a large flat sheet of mica. David created a humorous sculpture he referred to as the “whisker disk” out of surplus 3M cardboard disks with plastic whiskers sticking out that vibrated very sensuously when the right audio was introduced into the sculpture.

Creating the Visual Environment

A critical aspect of the collaboration is the arrangement of the objects in the performance space creating both a visual and sonic environment. Once a sponsor indicates interest in the work a site visit is usually necessary to verify that the space can accommodate the requirements of the work. Some sites have presented unique challenges (20 some suspension points at the DeSaisset Art Gallery were individually drilled into the concrete ceiling and a suspended grid was custom-constructed at the Musée Galliera in Paris). Others sites allow easy installation like the Clark Theater at Lincoln Center with its pipe grid for suspending both the sculptures and theatrical lighting.

Numerous issues are considered in the installation of the work including:

- can the public move through the space easily?
(some objects are staggered to create open paths through the environment)
- are there strong enough anchor points above for the heavy sculptures?
(this often dictates the positioning of the large sculptures)
- how strong an acoustical presence does the sculpture have?
(the garden sprinklers are traditionally hung high so that the audience can simultaneously hear objects above them and next to them.)
- will they stand up to strong physical abuse?
(a fragile object of David’s used four slinkies and was always hung out of reach for obvious reasons)
- can multiple listeners interact with the object at the same time?
(numerous objects have worked well this way; the toilet ball floats, the 55 gallon drum often had couples or individuals inside while others were listening on the outside, a gourd with fishing pole blanks often had

multiple visitors biting on them, a long copper strip suspended high above and arcing down to floor level accommodated many people at once)

- is there a good dynamic balance in the placement of the objects?
(considering size, shape and sonic properties of the different materials)
- can the sculptures be dramatically lit?
- (some performances due to their duration evolve from daylight into artificial light) The most striking use of light was created by the lighting designer Beverly Emmons at the Lincoln Center installation in 1998.
- can the work be reasonably installed and disassembled?
(installation normally takes between 1-3 days and striking the work approximately 1 day)
- will the amplified sound of the vibration microphones have enough space to create a sonic shadow of the acoustical objects without overtaking them?

Because of John Driscoll's sculptural background the task of organizing the space often fell to him, or sometimes it was done in collaboration with Phil Edelstein, with input from all the performers.

Conclusion

Looking back, the various versions of *Rainforest* present a unique and stimulating vision of David's exploration of resonance. In testament to the scope of this vision, *Rainforest IV* is still actively being performed 28 years after its inception, and a new group of performers have emerged to carry the work forward. The 1968 version of *Rainforest* is also currently being performed by the Cunningham Dance Company.

In the fall of 1995, a student version of *Rainforest IV* was presented at Bard College. David Tudor was in attendance, though at this time he was blinded by a stroke and in a wheel chair. While John Driscoll was wheeling David around they stopped at one particular sculpture which tickled David's interest and he turned to John and said "See, this was the reason we did this."