

THE ART OF DAVID TUDOR
1963–1992

80737-2 [7 CDS]

DISC 1 [TT: 60:38]

1. John Cage (1912–1992)

Variations II (1963)* 21:18

David Tudor, piano, live electronics

2. Christian Wolff (b. 1934)

For 1, 2, or 3 People (1964)** 24:47

David Tudor, baroque organ, live electronics

3. David Tudor (1926–1996)

Bandoneon ! (A Combine) (1966)*** 14:15

David Tudor, live electronics

* Recorded February 17, 1963, Ann Arbor, Michigan (ONCE Festival)

** Recorded on tour with Merce Cunningham Dance Company in 1972

*** Recorded October 14 or 19, 1966 at *9 Evenings: Theatre & Engineering*, 69th Regiment Armory, New York City

DISC 2 [TT: 53:53]

1. *Anima Pepsi* (1970) 23:37

2. *Pepsibird* (1970) 18:25

3. *Pepscillator* (1970) 11:37

David Tudor, live electronics

Recorded in the Pepsi Pavilion, Expo '70, Osaka, Japan, 1970

DISC 3

John Cage/David Tudor

Mesostics re Merce Cunningham/Untitled (1972) 55:17

(simultaneous performance) John Cage, voice; David Tudor, live electronics

Producer: Hans Otte

Recording Supervisor: Jobst Philipp

Engineer: Friedrich Wilhelm Schnakenberg

Recorded on May 8, 1972 at the Pro musica nova festival in the hall of Radio Bremen (Sendesaal von Radio Bremen)

DISC 4 [TT: 70:09]

1. *Weatherings* (1978)* 36:25

2. *Phonemes* (1981)** 33:35

David Tudor, live electronics

*Recorded September 14, 1991, Paris

** Recorded November 29, 1992, Tel Aviv

DISC 5 [TT: 72:22]

1. *Rainforest IV* (1973)* 46:41

Composers Inside Electronics: John Driscoll, Phil Edelstein, Ralph Jones, Martin Kalve, David Tudor, live electronics

2. *Webwork* (1987)** 25:29

David Tudor, live electronics

* Recorded January 1980, Moderna Museet, Stockholm

**Recorded March 17, 1988, New York City

DISC 6 [TT: 67:15]

1. *Rainforest IV* (1973)* 38:21

Composers Inside Electronics: John Driscoll, Phil Edelstein, Ralph Jones, Martin Kalve, David Tudor, Bill Viola, live electronics

2. *Virtual Focus* (1990)** 28:43

David Tudor, live electronics

* Recorded January 1980, Akademie der Künste, Berlin

**Recorded October 6, 1990, Paris

DISC 7

Neural Network Plus (1992) 60:30

David Tudor, Takehisa Kosugi, live electronics

Recorded June 5, 1994, Lisbon, Portugal

Q: You work as a composer and you work as a performer. Do you divide those two things?

A: I don't, no. Unless there is a formal structure the performance is like performing the possibilities which are in front of you. And so what's in front of you becomes the composition. And then going on from that, you choose among the possibilities what you want to appear, and then it's the task to make those things appear. So if they don't appear at one time, they might . . . then you try another time. The initial choice is, how much variety you wish there to be. So you try to make it happen or you try to arrange for it to happen.

—David Tudor¹

Introduction: The arc of David Tudor's musical life

The sprawling electronic music career of David Tudor may be impossible to adequately represent with any set of recordings. The reasons for this are several. First, Tudor's art was about live performance. Studio compositions are few. The majority of unreleased Tudor recordings as found in various archives are mainly documents of live performances, and are radical reductions of his performance practice. Any multi-channel concert situation—such as that ensured by the Merce Cunningham Dance Company, which toured with as many as twelve channels of amplification—is reduced to two channels for home listening, thus we must wonder exactly what perspective we are listening from. Also, many live recordings from Cunningham performances (particularly in the 1980s and 90s) were made directly from the mixing board, bypassing the acoustics of the performance space altogether. In a live situation, Tudor would pay close attention to the resonances of the venue; any recording which does not acknowledge the space is lacking a critical dimension. Another limitation in documenting Tudor's performance practice is the fact that every performance was unique: way stations along a continuum. According to those who worked closely with him, through months of touring with the Merce Cunningham Dance Company and the opportunity to perform the same works night after night, Tudor was never “finished.” Changes were continuously made according to taste or necessity or curiosity. This suggests that reliance on any one recording as the definitive document of a piece may be mistaken. Still, we can't have a comprehensive experience of all performances of any particular work, so we make do—and with the present collection we do quite well, listening to high-quality recordings curated by Tudor's colleagues and offered in their entirety rather than as excerpts. This is important: Tudor's performances tend to evolve slowly, so a short excerpt can give only a limited view on the work. Here we have full performances lasting half an hour or even longer.

Throughout the 1960s, Tudor's identity morphed seamlessly from interpreter of mainly acoustic music to composer-performer of predominately electronic music. This set of seven CDs goes beyond any previous attempt to document that process of transformation, and Tudor's subsequent three decades of experimentation and creation. His approach was famously hermetic, and the “score diagrams” which he created are merely documentation of specific instances of his setups. The diagrams offer fascinating suggestions of process but nothing certain as to sonic identity, and certainly nothing which would describe time-based approaches to performances

¹ David Tudor, “Interview with John David Fulleman, Stockholm, May 31, 1984” [online]. Available from: <http://davidtudor.org/Articles/fullemaan.html>

with his table-tops laden with devices. The equipment itself is another layer of puzzle: sometimes his devices are recognizable in diagrams or photographs as commercially purchased processors of one kind or another, but just as often they are unique and anonymous homemade constructions—usually with unlabelled inputs/outputs and controls. After all, who needed to know how they worked, besides the composer-performer? An intrepid researcher might still examine them, but some are corroded and cannot be powered up—nor is there any guide to the interactions between them. And even when the functions of a box can be imagined, there is no guarantee that it was employed in the “normal” manner: John Driscoll has described how devices were occasionally used “backwards,” with outputs used as inputs and vice versa; he has an anecdote of how one of Tudor’s devices was beloved *because* it was failing, producing a unique sound.²

Partly because of the inscrutable, thorny nature of his electronic music practice, and its lack of available documentation, Tudor is frequently first remembered as a pianist, responsible for premiering works by many composers and particularly the “New York School” of John Cage, Earle Brown, Morton Feldman and Christian Wolff. This is the virtuosic role for which he is best-known from the early 1950s through the mid-1960s. By the end of the 1960s, Tudor had embraced the title of composer and ceased to focus on the piano as his primary instrument: “No matter how much fun it might be to play a traditional instrument, I no longer feel the compulsion to do so.”³ He then concentrated on production of “live-electronic” works which explore terrain all his own: a soundscape of electronic music often hostile to those encountering it unprepared. It is marked by a love of the harsher boundaries of music/sound combined with a devotion to subtlety in live performance, particularly spatial distribution. But Tudor was exploring this terrain well before his first formal presentation as a composer-performer in 1966: as a realizer of others’ indeterminate scores, his approach was to distill the composers’ instructions and draw up fixed notations to follow in performance—effectively making important compositional decisions and defining realizations in which indeterminacy remained only as sonic detail.^{4 5 6} For a work like John Cage’s *Variations II* (1961), the detail could vary tremendously from performance to performance, but the overall structure was essentially fixed.

Do you have any new material? he’d ask, meaning a piece and meaning (quietly) that he too would be making that piece (exceptional examples: John Cage’s *Variations II* on the Columbia recording, my *For 1, 2 or 3 People* on another of those Columbia recordings produced by David Behrman in the 60s). . . . His actions, performing, were absolutely clear and decisive, no matter how indeterminate the material.

—Christian Wolff ⁷

² John Driscoll, “Electronics & Cooking (In memoriam David Tudor).” *MusikTexte* 69/70 (April 1997), 78–79.

³ David Tudor, “From Piano to Electronics.” *Music and Musicians* 20 (1972), 24–26.

⁴ James Pritchett. *The Music of John Cage*. Cambridge: Cambridge University Press, 1993.

⁵ James Pritchett, “David Tudor as Composer/Performer in Cage’s *Variations II*,” *Leonardo Music Journal*, 14 (2004), 11–16.

⁶ John Holzaepfel. “David Tudor and the Performance of American Experimental Music, 1950–1959.” Ph.D. thesis, City University of New York, 1994.

⁷ Christian Wolff. *Christian Wolff: Writings and Conversations*. Köln: Edition MusikTexte, 1999.

Tudor's own music, as he began to identify as a composer in his own right, seems to represent a desire to turn away from these fixed forms. Structure remained, particularly where performance duration was limited by an accompanying external activity such as dance, but much of his music has the character of tapping into an endless stream, often without regard for conventional musical dramatics. This might have been observed at a Mills College concert in the late 1960s, where Tudor is said to have been quietly approached as the hour grew late: was he planning to end soon? His response was to stop abruptly, saying "I still had lots to do."⁸ Something similar was regularly heard in performances with the Cunningham Company, when the end of the choreography would bring a frequently unspectacular end to Tudor's sounds.

Tudor and "Nature"

In 1985, John Cage and David Tudor were interviewed together at the ICA in London. At one point, Cage stated: "David is related to everything else." Tudor agreed: "And a nature boy, besides!"⁹ "Nature" frequently appears as a touchstone in Tudor's statements and interviews. Cage's professed aspiration was "to imitate nature in her manner of operation"—from Coomaraswamy, after Aquinas and Aristotle¹⁰—but Tudor took what was arguably a more radical stance: identifying *as* nature. Billy Klüver of Experiments in Art and Technology, the organization which enabled Tudor's first commission as a composer, questioned him: "Why do you want to work in nature?" Tudor responded, "It's part of my being. It's a question I can't answer because I can't get away from it."¹¹

Tudor's work as composer-performer is peppered with clues as to this relationship with nature, as well as the extent to which his music was an expression of this relationship. He described his first major work as an electronic music composer, *Bandoneon !* (1966), as being *uncomposed*. The bandoneon, which Tudor came to love through the early recordings of Astor Piazzolla and other Argentinian composers, was heavily processed through a complexity of circuits inviting the "self-multiplying . . . rebirth of white noise." Tudor wrote that "when activated it composes itself out of its own composite instrumental nature."¹² The strategy of developing pieces for which the "score" was in fact a physical arrangement of devices representing a range of improvisatory sonic possibilities became a Tudor signature.

David Tudor . . . often multiplies his circuits and wiring to the extent that, once all the amplifiers, preamplifiers, speakers, mixers, generators, consoles and microphones are connected and turned on, he can no longer entirely keep track of where and how the sound appears.

—Christian Wolff¹³

⁸ Martin Bartlett, personal communication, 1992 (undated).

⁹ David Tudor and John Cage, "Interview with Dick Witts at the Institute of Contemporary Arts, London." (London: National Sound Archive, 1985).

¹⁰ Edward J. Crooks. *John Cage's Entanglement with the Ideas of Coomaraswamy*. Ph.D. thesis, University of York, 2011.

¹¹ David Tudor, "Interview with Billy Klüver" in "Island Eye Island Ear proposal May 25, 1979 for Boulder Island (Saranac Lake, Adirondacks)." Los Angeles: Tudor Papers, Getty Research Institute, acquisition no. 980039, box 21 folder 9.

¹² David Tudor. "Program notes for *Bandoneon !*" in: *9 Evenings of Theatre and Engineering* program book. (New York: Experiments in Art and Technology, 1966)

¹³ Wolff, 1999, 62.

Tudor's own characterization of it was that he "could only hope to influence" the instrument—he could not predict the nature of the sounds that would result from a particular action.

—James Pritchett¹⁴

It seems to me that the way I use the technological medium, it is just more of what's already there.

—David Tudor¹⁵

Creating a situation where the number of variables exceed the performer's ability to control them all, and where altering one part of the system causes an unbalancing of the entire "organism," was a key feature of Tudor's work as a composer-performer. It is here that we can see both his embrace of "nature" and of chance—but chance conceived of differently than Cage imagined it. The composer is not standing back to appreciate the mountain; he *is* the mountain, or at least is *on* the mountain, ready to explore all its aspects.¹⁶ Working within such unstable systems ensured a freshness in music-making, inviting improvisation but denying opportunity to fall into familiar tropes. At the same time, each titled composition still has a specific character which differentiates it from others, and unique arrangements of devices requiring their own strategies for sound generation and processing. Tudor once said, "I let it play itself as much as I can, but if it doesn't, then I interfere."¹⁷

Tudor and electronic feedback

Tudor was exploiting, as early as the mid-1960s, what in the 1990s was reinvented by a younger generation of experimental musicians as the "no-input" electronic instrument: all sound is generated through internal electronic feedback networks. Residue of noise in the system, combined with multiple gain and equalization/phase shift stages, offers the performer a broad palette of semi-controllable possibilities ranging from pulsing, chattering, semi-regular rhythms to squeals and wails. Tudor's "no-input" systems were constructed out of discrete devices strung together in chains, with their final output directed back to the chain's input. This approach differs from more conventional use of electronic devices as signal generators, or processors for some kind of predetermined input signals.

Tudor worked with feedback systems by modifying small amplifiers into oscillators to make "animal-like and bird-like sounds"¹⁸ for the first of his *Rainforest* series.¹⁹ It was a later opportunity, however, which led to a work which fully exploited the possibilities of electronic feedback. This was *Pepscillator* (1970), one of a number of pieces realized in Osaka, Japan, during the 1970

¹⁴ Pritchett, 2004.

¹⁵ Tudor, 1979.

¹⁶ Matthew Rogalsky, "'Nature' as an Organising Principle: Approaches to chance and the natural in the work of John Cage, David Tudor and Alvin Lucier." *Organised Sound* 15 (2) (2010), 133–136.

¹⁷ Tudor, 1984.

¹⁸ Tudor, 1984.

¹⁹ David Tudor, "'I Smile When the Sound is Singing Through Space': An Interview With David Tudor by Teddy Hultberg in Dusseldorf May 17 & 18, 1988" [online]. Electronic Music Foundation. Available from: <http://davidtudor.org/Articles/hultberg.html>

World Exposition. The whimsical title is of course a reference to the venue where the work was created: the Pepsi Pavilion, a corporate pavilion designed by Experiments in Art and Technology (which had also commissioned Tudor's *Bandoneon !* four years earlier). *Pepscillator* is one of four documented pieces Tudor created at the pavilion, all of which made extensive use of its Gordon Mumma-designed sound-modifiers. Mumma built considerable processing power into the system: each of its eight channels offered frequency and amplitude modulation, as well as a high-pass filter section.

I had asked him [Mumma] to make a modification system with a view toward its being able to be used by any person who was performing . . . that system was supposed to consist of twenty channels, but I got beaten down to eight. One of the ideas involved was to be able to switch amongst loudspeakers. So there were actually 37 loudspeakers, which could be programmed to have eight different spatial patterns, if you wanted to do that. So, he made eight channels of modification. Of course one of the first things I did was to see: "can these be used without any input?" So I chained them together in various ways and, lo and behold, there they were, oscillating.

—David Tudor²⁰

Other works made by Tudor at the Pepsi Pavilion include *Anima Pepsi* and *Pepsibird*, both documented in the present collection. These are "remix" works exploring distribution of prerecorded material sent through the Pavilion's network of 37 speakers, moving along programmable pathways. *Pepsibird* calls for a live mix of ten source tapes derived primarily from laboratory recordings of sonified neural activity in humans and animals, plus a processed recording of a nightjar. Tudor's notes on the piece point to modification of the source recordings via Mumma's console processors, within limits.

Anima Pepsi was conceived as a live mix of nine source tapes, with a distribution scheme the same as *Pepsibird*. Whereas *Pepsibird* had to do primarily with "interior" spaces of neural activity, *Anima Pepsi* (the title comically echoing *anima mundi*—the "vital force . . . conceived of as permeating the world" according to Merriam-Webster's definition) is a blend of field recordings of "exterior" animal and insect sounds, including some insect sounds which became Tudor favorites and reappear in compositions of later years. This includes a recording of mosquitos in a jar recorded at the E.A.T. office, as well as "fly on flypaper," "wasp chewing," and "beetle walking." A recording of human sounds including whistling was also part of the animal mix, noted in Tudor's description as "funny tape."²¹

Following the Pepsi Pavilion and *Pepscillator*, subsequent experimentation with processes of gain and phase shift led to the chaining together of many more devices, culminating in *Untitled* (1972). This piece conceptually contained so many elements that Tudor broke it down into two separate activities, "Source Generation" and "Performance Processing." Tudor stated "there wasn't any possibility of performing that in a single operation. It was like sixty components with their associated possibilities, pots and switches and so forth. So I broke that chain and I took recordings of it several times. I then used that material at random. Then I made an output chain where I

²⁰ Tudor, 1984.

²¹ Tudor, 1970.

could perform, and that chain resembled what was in front of it, except that the two lines coming in had feedback loops in common with the outputs.”²² Thus, the performance of the piece was made possible by use of a library of prerecorded source material, which in performance stood in for excessive numbers of devices which would have been required to do it live: “It was not that it was too complicated, it was simply too difficult.” Tudor recalled the piece as “one of the high points in my electronic music career . . . even for me it was unimaginably wild.”²³

This version of *Untitled* was performed numerous times in Europe in 1972, in a double presentation with John Cage declaiming his *Mesostics Re: Merce Cunningham*. Tudor remembered the premiere of this duet, the recording of which is included in the present collection, fondly: “John and I . . . were both amazed. John’s idea was that the character of the mesostics would be best realized by him, as it were, in a single breath, and that he should shout it. . . . So it really came out wild. It was so unpredictable, it was just wonderful. It’s the kind of thing that couldn’t be done again.”²⁴

Tudor and acoustic feedback

Simultaneous with his experiments in electronic feedback, Tudor created work based on *acoustic* feedback. Acoustic feedback sounds are also produced from “no-input” situations, simply from placing a microphone in proximity to a loudspeaker amplifying the microphone’s signal: usually this is undesirable. At the Pepsi Pavilion, however, Tudor deliberately engendered feedback tones by facing a highly directional microphone into the space, and turning loudspeakers in different locations on and off to obtain sounds which were turned into complex groans and cries through Mumma’s sound modification console. This piece was simply and descriptively called *Microphone*. But Tudor’s use of acoustic feedback in his own work came much earlier, in *Bandoneon !*, and that had been preceded by many years of experience with such feedback as a key element of his realizations of Cage’s works of the early 1960s such as *Cartridge Music* (1960) and *Variations II*.

Feedbackground: Tudor’s realizations of Cage and Wolff

In Cage’s *Cartridge Music*, which employs phonograph cartridges as contact microphones to greatly amplify very quiet sounds, “All events, ordinarily thought to be undesirable, such as feedback, humming, howling, etc., are to be accepted.”²⁵ In the case of *Variations II* however, Cage’s score did not mention *any* specific sounds or timings. Ron Kuivila has described the piece as a “meta-score . . . Tudor’s realization of this piece comes very close to being a composition in its own right.”²⁶

The work, like several other Cage compositions of the same era, depends on the performer’s interpretation of graphic materials printed on transparencies. In *Variations II*, the score materials are six straight lines and five points, all printed on different sheets. The performer makes a random arrangement of these and then by measuring between dots and lines, derives data

²² Tudor, 1984.

²³ David Tudor, “David Tudor interviewed by Joel Chadabe, Tomkins Cove, Sept. 8, 1993” [online]. Available from <http://davidtudor.org/Articles/chadabe.html>

²⁴ Tudor, 1993.

²⁵ John Cage. *Cartridge Music*. New York: Editions Peters, 1960.

²⁶ Ron Kuivila, “Composer Inside Electronics.” *MusikTexte* 69/70 (1997), 43–45.

corresponding to all musical parameters. James Pritchett states “it is not an exaggeration to say that *Variations II* encompasses any piece of music that could possibly be created. All that is required is that the parameters of the music be identified and measured in the proper way.”²⁷ Nominally Cage’s virtuosic performer, Tudor was thus responsible for every sonic detail in performance of this piece—effectively placing him in the role of co-composer.

My realization of *Variations II* evolved from a decision to employ the amplified piano, conceived as an electronic instrument, whose characteristics orient the interpretation of the six parameters to be read from the materials provided by the composer.

—David Tudor²⁸

Pritchett draws from a 1990 Tudor interview to describe this “electronic instrument,” which included conventional microphones above and below the piano, contact microphones attached to the piano or to stiff coils of wire which were used to play inside the piano, and—as with *Cartridge Music*—phonograph cartridges with various objects inserted, “used both as amplification devices and as ways to activate the instrument . . . the signals from these various microphones were mixed together, amplified, and played through speakers in the same space as the piano.”²⁹ This was clearly a situation ripe for production of multiple feedback paths, especially as the strings of the piano were left free to resonate throughout the performance. The complexity of the entire system, Pritchett suggests, represents one of Tudor’s characteristic “overload” situations: Tudor said he “could only hope to influence” the instrument, since varying one parameter could cause an unbalancing of the entire system, and set it howling.

An equally unique and “electronic” approach to performance with an acoustic instrument is heard in the realization of Christian Wolff’s *For 1, 2 or 3 People* (1964), included in this collection. The piece is graphically notated as a network of relationships between performers: each musician must intently listen for cues to begin or end their sounds in relation to those of other players. The making of a sound may lead to one or more other sounds, in a cascade of responsive events. There is plenty of room for performers’ personal expression, as most events are notated quite generally: “high in some aspect”; “a sound in some way dissonant with what immediately precedes”; “a harmonic”; “a sound made by tapping or touching or tracing or the like,” and so on. If only one person performs the piece, their sounds may be made in response to other sounds in the environment, or arrived at through careful consideration of “other notes given on a page . . . to provide something to coordinate with.”³⁰

Tudor recorded this piece in 1968, in a session with sculptor Richard Lippold’s baroque organ. He made a double-layered performance in which layer one had Tudor playing at the keyboard while the other was constructed from sounds made with “unusual techniques analogous to the prepared piano, including the removal of certain pipes, partial opening and closing of vents, percussive playing on the pipes and the use of contact microphones to pick up and amplify small

²⁷ James Pritchett, “David Tudor’s Realization of John Cage’s *Variations II*” [online, 2000]. Available from: <http://www.rosewhitemusic.com/cage/texts/Var2.html>.

²⁸ Pritchett, 2000.

²⁹ Pritchett, 2000.

³⁰ Christian Wolff. *For 1, 2 or 3 People*. New York: Edition Peters, 1964.

sounds.”³¹ David Behrman, who produced the recording for CBS records, recalled the session was followed by “lots of intense hours of editing with DT in the Columbia editing rooms on the night shift, and that there was a large amount of recorded material, most of which ended as outtakes, and that David was very particular about what he wanted to use.”³² The outtakes were used by Tudor in his 1970 live performance version of the piece for the Cunningham Company, with the dance *Tread*, a 1972 recording of which is included here. All the highly distinctive sounds of the 1968 LP release are present, remixed into a new and much longer realization of the piece.

Emergence as a composer: Rauschenberg and *Bandoneon !*

In 1964, three years after his version of *Variations II*, Tudor created what he retrospectively identified as his first original composition. Entitled *Fluorescent Sound*, it was made as accompaniment to Robert Rauschenberg’s performance work *Elgin Tie*, presented at the Moderna Museet in Stockholm. As with *Cartridge Music* and *Variations II*, this piece also employed contact microphones, amplifying the tiny bell-like sounds of fluorescent lights flickering on and off. Tudor and Rauschenberg worked and traveled together at the time as part of the Cunningham Company, and Rauschenberg seems to have been an important link for Tudor to the realm of technological artmaking. Not only was Rauschenberg then seriously invested in live performance, he was also creating sound-based, audience-interactive sculptures and installations—extensions of his 1950s three-dimensional painting/sculpture hybrids which he designated “combines.” The impact which Rauschenberg’s work had on Tudor may be judged by Tudor’s use of the term for the 1966 work which formally launched him as a composer in his own right.

The full title of *Bandoneon !*—the exclamation point is the mathematical symbol for “factorial”—is *Bandoneon ! (A Combine)*. It was presented in October 1966 as part of E.A.T.’s *9 Evenings: Theatre and Engineering* series, now remembered as a historic, occasionally catastrophic, adventure in early media performance, and contains the kernels of practically all his subsequent work: acoustic feedback; the electronic feedback of overdriven/oscillating amplifiers; audio-controlled visual displays; and the use of found objects as loudspeakers, exploited as acoustic filters for electronic sounds. All this was controlled by Tudor sitting calmly in the middle of a technological circus with bandoneon on his knee, seeking the “rebirth of white noise.”³³ Microphones attached to either side of the instrument sent his sounds to a number of destinations—a projected visualization of the signal realized by Lowell Cross, and hardware developed by engineer-collaborators Fred Waldhauer and Robert Kieronski which allowed Tudor to control switching of sound through a network of twelve large loudspeakers placed around the immense 25th St. Armory. Stage lighting levels were similarly audio-controlled. Waldhauer described how Tudor activated the entire space as a single, gigantic instrument:

... as David played a certain note, for example, one light would become brighter and dimmer in response to the volume of the tone generated. Another note would change the sound level of one of a dozen altered bandoneon signals in a similar fashion.³⁴

³¹ Richard Teitelbaum, Liner notes for LP *Music of Our Time: A Second Wind for Organ*. Odyssey 32 16 0158 (1968).

³² David Behrman, personal communication, January 11, 2013.

³³ Tudor, 1966.

³⁴ Fred Waldhauer. “Proportional Control System,” article (1966) included with *Experiments in Art and*

A reset button on the bandoneon allowed Tudor to mute all sound instantaneously, and hear just the resonance of the huge room. Billy Klüver, a Bell Laboratories engineer and E.A.T. founder, spoke about Tudor's enchantment being able to "play the armory":

I remember standing on the balcony one day next to David and he was actually measuring the echo time on the armory itself, and that turned out to be six seconds, which of course was a treasure for David because he used that six seconds absolutely to the hilt . . . He played the armory, the whole hall . . .³⁵

Also resonating in the midst of all this were four "transducer-speakers constructed from materials of specific resonant frequency."³⁶

From *Bandoneon !* into the *Rainforest* series: Transforming electronic sounds acoustically

Tudor had since 1965 been pondering a "dream-vision of an orchestra of loudspeakers," each having its own distinctive resonances.³⁷ By 1966, Tudor had acquired special transducers (intended for home stereo use, embedded in walls) which made the *Bandoneon !* loudspeaker-objects possible. These were in effect prototypes for the loudspeaker-objects that followed in 1968's *Rainforest*, and all subsequent versions of *Rainforest*. In *Bandoneon !*, the objects were mobile: each was mounted on a wireless, remote-controlled cart navigated independently by a human operator. "My idea was that they would be sent around the room, that their sound would circulate. The audience was on three sides, so they would come close to the loudspeakers," Tudor said.³⁸

After all, what is a loudspeaker? At present it's a reproducing instrument, but my feeling all along has been that you should regard it as a generating instrument. All musical instruments work by generating sound waves, and so does a loudspeaker, so if you regard it from that point of view your whole notion of how to construct one would have to change. Why shouldn't there be a thousand or more ways of building loudspeakers? . . . Every sculptured loudspeaker has certain special characteristics, so my problem becomes that of finding what sound I can put in so as to reveal the unique properties of the material.

—David Tudor³⁹

Tudor's post-operative note for *Bandoneon !* states that "the performance method [was] single performer feedback, which also obviated the need for any compositional means."⁴⁰ The idea of

Technology archival material provided from the personal archive of Anthony Gnazzo.

³⁵ Billy Klüver, interview with the author on May 8, 2002, Berkeley Heights, NJ.

³⁶ Tudor, 1966.

³⁷ David Tudor, interview with Larry Austin, April 3, 1989, Denton, Texas [online]. Available from: <http://davidtudor.org/Articles/austin.html>

³⁸ Tudor, 1993.

³⁹ Tudor, 1972.

⁴⁰ David Tudor, *Bandoneon !* work notes 1966. Obtained from the Estate of David Tudor prior to deposit of Tudor papers with the Getty Research Institute.

the music “composing itself” out of the complexity of the system, as Tudor described in the *9 Evenings* program book, is a concept which he carried forth throughout the rest of his life as an electronic music composer.

The *Rainforest* Series and Composers Inside Electronics, 1968–1982

After *Bandoneon !*, Tudor’s next commission as composer in his own right came the following year, with Merce Cunningham’s invitation to create a piece for a new dance, *RainForest*. Cunningham created it as a “nature study,”⁴¹ with influences from his reading of anthropologist Colin Turnbull’s *The Forest People*, as well as his memories of the rainforest environments of the coastal Northwestern United States. Tudor adopted the title from Cunningham’s dance and applied it to his own new work. Tudor said that when he received the invitation from Cunningham to make a new piece, the specialized transducers he had made for *Bandoneon !* were “lying around, so I might as well put them to use,”⁴² and in March 1968 the new dance *RainForest* was premiered, with Tudor’s *Rainforest* as accompaniment. Unlike the loudspeaker-objects in *Bandoneon !*, which were heard directly without additional amplification, those in *Rainforest* were amplified by means of contact microphones, *Cartridge Music*-style: sounds transformed by passing them through the objects were re-amplified through a conventional sound system. This model was continued through all subsequent versions of *Rainforest*.

A number of reviewers have commented over the years on the naturalistic qualities of Tudor’s sounds with Cunningham’s dance—a “weird repertoire of bird calls and animal murmurs” in the words of one who witnessed a 1992 revival⁴³—but at its premiere, judging from D.A. Pennebaker’s film of the event, the music of *Rainforest* was nothing to be mistaken for a realistic or even impressionistic rainforest soundscape. Tudor’s own instructions for duet-style performance of the piece suggest a minimalist approach which Pennebaker’s film documented: “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).”⁴⁴ *Rainforest* at its premiere was substantially drone material: simple oscillators transformed by the acoustic filtering of eight objects. These were small items which Tudor could easily pack for touring and quick setup: a cymbal, a wooden flour box, a metal sheet, a wooden tray, a Slinky-type metal coil, a metal cash box.

Tudor used similar-sized objects in two other versions of *Rainforest* presented between 1969 and 1972: version II, which employed John Cage’s voice to activate the speakers and of which little documentation remains; and *Rainforest III*, which was presented across Europe in 1972 as a double performance alongside Cage declaiming his text *Mureau*. For version III, the sounds Tudor chose to filter through his objects were all drawn from his Pepsi Pavilion library.

Rainforest IV is undoubtedly Tudor’s most resilient and widely-known work, because of its relative simplicity of description and realization, and because it was created collaboratively with a large group of younger artists and musicians who sustained it with and without him through an initial

⁴¹ David Vaughan. *Merce Cunningham: Fifty Years*. New York: Aperture Foundation, 1997.

⁴² Tudor, 1984.

⁴³ Steven Smoliar, “Merce Cunningham in Brooklyn.” In Richard Kostelanetz, ed. *Dancing in Space and Time*. London: Dance Books, 1992, 77–91.

⁴⁴ David Tudor, Option list for *Rainforest*, ca. 1968–70. Obtained from the Estate of David Tudor in 1996, prior to deposit of Tudor papers with the Getty Research Institute.

era of intensive presentations which lasted a decade. Since Tudor's death in 1996, members of the same ensemble have regrouped several times to again present *Rainforest IV* (and in 2009 even developed a re-imagined *Rainforest V*). Since 1976, this group, with floating membership but continuity of a few key performers and organizers, has called itself Composers Inside Electronics (CIE).

Friend, colleague, teacher, master, collaborator.

—Phil Edelstein on David Tudor⁴⁵

David never led the group, unless it was to a particularly good restaurant.

—Ralph Jones on David Tudor⁴⁶

CIE and Rainforest IV

Composers Inside Electronics developed out of a workshop led by Tudor in June–July 1973. Part of a series of workshops organized by New Music New Hampshire which featured other prominent faculty including David Behrman and Gordon Mumma, Tudor's class was billed as “Rainforest: Experimental electronic workshop in sound transformation without modulation: building and performance.” Tudor has said that after the three versions of *Rainforest* between 1968 and 1972, he was ready to “give the piece away.”⁴⁷ The group to whom Tudor gave the piece included John Driscoll, Phil Edelstein, Linda Fisher, Ralph Jones, Martin Kalve, and Bill Viola, all of whom maintained close contact with Tudor after the workshop. They presented their collaboratively reinvented version of *Rainforest* again as early as March 1974. In 1973 the younger group were in their twenties; Tudor was forty-seven. Their adoption of Tudor as a guru figure, and the subsequent development of CIE, is perhaps unique in the history of electronic music.

The group of six was diverse: Bill Viola, now thought of as a pioneering video artist, was at the time predominantly focused on audio art; Linda Fisher was an accomplished composer-performer and member of the early synthesizer band Mother Mallard's Portable Masterpiece Company; Martin Kalve had studied composition at SUNY Buffalo with Lejaren Hiller, Julius Eastman and others and had been working with electronic sound since 1969; Ralph Jones had also studied composition with Hiller and Eastman, and with Robert Moog as a private student of electronic music circuitry; Phil Edelstein was a graduate of SUNY Albany where he had studied electronic music with Joel Chadabe and in 1971 co-founded the Albany-based intermedia performance organization Electronic Body Arts; and John Driscoll came to the Chocorua workshop with a background in interactive sound sculpture and an interdisciplinary arts degree also from SUNY Buffalo.

Arriving at Chocorua in sweltering heat with twenty-three other workshop participants, these young artists found David Tudor set up in an attic space, where he had put together a demonstration of his loudspeaker-object concept. John Driscoll recalls “David didn't communicate much about it, and that's the magic of this whole project. If you got everybody together and asked what David told us about the project it might be about five sentences.”⁴⁸ A

⁴⁵ Phil Edelstein, Notes on David Tudor and *Rainforest*, 1996. From the personal archive of Phil Edelstein.

⁴⁶ Ralph Jones, interview with the author on May 25, 2001, Fairfax, CA.

⁴⁷ Tudor, 1984.

⁴⁸ John Driscoll, telephone interview with the author on May 20, 2000.

sine wave sweep from low to high brought out the resonant frequencies of Tudor's demonstration object, and Bill Viola recalls it would "vibrate and physically rattle, giving off a loud, complex array of sound frequencies, or otherwise fall still and quietly reproduce only the originally pure sound source. David performed this task silently, with the utmost concentration on the object and the sound."⁴⁹ This was sufficient instruction for the class participants to realize the potential of the concept; Tudor also instructed them that this version of *Rainforest* was not to include simple oscillator tones as he had used for his demonstration, nor should it include "pre-composed" musics. Inviting the students to seek out interesting objects to be tested as acoustic filters, Viola recalls they tried "anything we could find around the small converted farm/inn where we were staying—old bedsprings, barrels, cookie sheets, wood planks. Someone blew out two transducers by trying to resonate the bathroom plumbing under the toilet."⁵⁰

What surprised Tudor was the appearance, in the group's barn workshop space, of large objects hauled back by the participants. Linda Fisher recalls the group's enthusiasm for the challenge of "can we excite these things? Can we excite something bigger and get it going?"⁵¹ Viola remembers that "people started bringing back bedsprings and oil drums and stuff, and suddenly it scaled up, right before his eyes . . . we started hanging it from the rafters, and the large-scale installation was born. I don't know if he had really anticipated that or not."⁵²

The change in scale also transformed it into a work of sound sculpture, with as strong a visual aspect as sonic: some of the sounding objects were "compound objects" formed by connecting two or more separate items to resonate together. John Driscoll, with his sculpture background, found this especially rewarding, visually and sonically.

The new version of *Rainforest* differed from others in its openness: admitting of any number of performers, any number of objects, and any sound sources (remembering the simple restrictions already mentioned), to be performed live for an indeterminate duration, without score. On its first performance on July 26, 1973 in the barn at Chocorua, it was entitled *Sliding Pitches in the Rainforest in the Field*, combining *Rainforest* with acknowledgement of David Behrman's *Homemade Synthesizer Music for Sliding Pitches* and the name of the workshop venue, the inn "Stafford's in the Fields." This title was not used for any subsequent performances, however. Tom Johnson wrote in *The Village Voice*:

It kept Tudor and his assistants interested for five and a half hours . . . They just seemed to enjoy keeping the sounds going for those who wanted to stay, and for those who would come back later on. I suppose they were also having an enjoyable time feeding various sounds into various objects, testing how the objects responded to different things, trying to find resonant frequencies, and listening to subtle variations.⁵³

⁴⁹ Bill Viola, "David Tudor: The Delicate Art of Falling," *Leonardo Music Journal* 14 (2004), 49–56.

⁵⁰ Viola, 2004.

⁵¹ Linda Fisher, interview with the author on February 20, 2003, Ithaca, NY.

⁵² Bill Viola, interview with the author on July 2, 2000, London, UK.

⁵³ Tom Johnson. *The Voice of New Music*. Paris: Editions 75, 2002.

The long duration of the first performance set a standard for this new *Rainforest* as a “performed installation.” As with earlier versions, each resonating object had a contact microphone attached, for subtle sound reinforcement, but the primary sound sources were the objects themselves. Sound sources among the performers ranged from circuits constructed in Behrman’s workshop, to modular analog synthesizers, to shortwave radio, and field recordings. Tudor himself worked substantially with material from his Pepsi library, which Viola recalled amazed him as “nature meeting nature” as the field recordings were filtered through the loudspeaker-objects.⁵⁴

Rainforest IV retains to this day a distinctive identity despite a multitude of sound sources, and an improvisational long-duration performance structure. Part of that identity is inherent in the transformative qualities of the objects: electronic sounds can easily be mistaken for “natural” ones, and vice-versa. A great deal relies on the sensitivity of the participants as good listeners and improvisors, and contributors to an “electronic ecology,” as Tudor sometimes described the piece.

After the workshop, Driscoll, Edelstein, Fisher, Jones, Kalve, and Viola stayed in touch with Tudor and other members of the Chocorua group, and the first subsequent performance of *Rainforest* took place in March 1974 at the Everson Museum in Syracuse, NY, with Bill Viola organizing. The core group of Rainforesters remained closely connected and presented the piece with Tudor sixteen times in 1974–76, before taking the name “Composers Inside Electronics” on the occasion of touring *Rainforest IV* to Paris in October 1976.

The 1976 Festival d’Automne was a prominent occasion not only for Tudor and *Rainforest*; the group of six, plus the addition of Paul DeMarinis, were all invited to present work of their own, as well as several pieces by Cage and other composers, in a series of Paris concerts. The name of the group was decided upon by Tudor and Driscoll to describe its members’ relationship with their instruments—circuits often home-made or -modified—reflecting “David’s fascination with how electronic components take on their own personalities and suggest musical directions derived from intense experimentation with them,” in Driscoll’s words.⁵⁵ The new name for the group stuck with them, following successful runs of *Rainforest IV* at the Musée Galliera and L’Espace Pierre Cardin.

In all, *Rainforest IV* was presented in twenty-eight venues between 1973 and 1982. Tudor was absent from only two of these, while representation from the rest of the CIE group fluctuated depending on availability of performers and funding. One of the highlights of this period was a short European tour in January of 1980, including a presentation at the Moderna Museet, Stockholm (where Tudor had in 1964 created *Fluorescent Sound*), and another in Berlin as part of the seminal sound art exhibition *Für Augen und Ohren*. High-quality recordings of performances in both cities were made, and the Berlin document was made available as an LP in 1981. It is worth noting that the release of the LP marked the first time that the large group version of *Rainforest* had been identified by Tudor as version four.⁵⁶ The recording from that out-of-print album is now re-released with the present collection, along with an equally excellent and previously unreleased document from Stockholm. These are the first releases since 1981 of extended, unaltered CIE *Rainforest* recordings. Both are in binaural format, best listened to with headphones to get a sense of 360-degree immersion.

⁵⁴ Viola, 2000.

⁵⁵ John Driscoll and Matt Rogalsky, “David Tudor’s *Rainforest*: An Evolving Exploration of Resonance.” *Leonardo Music Journal* 14 (2004), 25–30.

⁵⁶ David Tudor, *Rainforest IV*. LP. Gramavision (1981). GR-EB 1.

Changes in table-top modes of action

John David Fulleman, Tudor's sound engineer in the Cunningham Company from 1976 to 1980, has identified *Weatherings* (1978) as the point where he perceived a shift in Tudor's table-top electronics practice. He notes that Tudor's earlier works reflected his engagement with the "mysterious force" of electronics, and were "based on his ability to assert just enough control over the equipment to get through a concert," while toward the end of the 1970s, Tudor's mastery of the medium allowed him a more traditionally composerly role: "He could now manipulate time and space, and work with pitch and tempo; he could build circuits to test a theory or explore phenomena. His interest is still in the creation of an instrument—an electronic situation—that he can play in concert, but there is less and less likelihood that the instrument will confound him."⁵⁷ *Weatherings*, like many other works from this point through to the end of Tudor's life, involved source recordings chopped into fragments with noise gates, and many possible parallel signal processing chains and feedback circuits orchestrated through matrix switches (*Weatherings* involves two of these switches, one having twenty inputs and ten outputs, the other having ten inputs and thirty outputs), and heavy reliance on sound spatialization in performance. "From what I remember of the rehearsals," states Fulleman, "the idea was to get the sounds to fly in space. We re-angled speakers, and listened a lot from many locations . . . David made music of the space."⁵⁸

Likeness to voices

Ron Kuivila has noted several Tudor works which together form a stream focused on "electronic sounds attaining vocalic identities."⁵⁹ To generalize, these pieces focus on short sounds isolated by audio gating techniques and filtered in a number of different ways to create the sense of vocal formants. *Forest Speech* (1976/78), a coda to the *Rainforest* series, was first created as a solo work for performance with Cunningham Company *Events*, and later reinvented as a group performance piece for CIE. Tudor described the process at work in this piece as "Synthetic voicings, explosive bursts. Formant resonances, produced with the natural comb-filtering action of 'Rainforest' instruments, are used to create vocal illusions."⁶⁰ Into the 1980s, another "vocalic" work was *Phonemes* (1981), the principles of which also informed *Dialects* (1984) (which originally had the title *Likeness to Voices*). Tudor's fascination with vocal timbres may well have come out of his collaborations with Cage during the latter's "performance poetry" years—recall *Rainforest II* and *III* and *Untitled* performed in conjunction with Cage's expressionistic spoken word pieces in the early 1970s.

Phonemes (1981)—another Cunningham commission, for the dance *Channels/Inserts*—is described by two sets of processes: one in which source material is reduced to fragments using a vocoder as a sound gate, and one in which the same source material triggers a percussion synthesizer with variable envelope parameters, producing a range of very short to very long sounds. Using a matrix switch allowing any of a number of inputs to be connected to many outputs, Tudor directed the modified source materials to numerous parallel processing streams: several different

⁵⁷ Tudor, 1984.

⁵⁸ John D. Fulleman, personal communication, December 31, 2012.

⁵⁹ Ron Kuivila, 1997.

⁶⁰ David Tudor. Notes for *Forest Speech*, 1978 [online]. Available from http://davidtutor.org/Works/forest_speech.html

varieties of high- or low-pass filters, including “auto-filters” which have a filter envelope controlled by the amplitude of the input signal, and phase-shifting devices which also have the effect of modifying the balance of low and high frequencies. “I use the principle of making the sound outputs different enough that you could not recognize them as being generated by the same signal . . . if I take short sounds and lengthen them and I use long sounds on the vocoder and shorten them, I have two processes which can overlap . . . Listening to the combinations, it reminded me of speech,” Tudor said.⁶¹ The final output stage shown on Tudor’s score diagram for *Phonemes* is four channels of sound, sent to speakers surrounding the audience.

I’d like to see the whole social situation change in regard to electronic music. . . . I think that we’re already creating an audience which appreciates the fact that it’s unique and there’s no other way that they can hear it, except to be there.

—David Tudor⁶²

1980s/1990s: Final years

Webwork (1987), for the Cunningham dance *Shards*, is one of another set of related pieces which former Company musician D’Arcy Philip Gray has referred to as Tudor’s “web series”: three primary compositions consisting of *Web for John Cage* (1987), *Webwork*, and *Web for John Cage II* (1988), as well as a fourth connected work, *Five Stone* (1988). According to Gray,⁶³ these four pieces share an identical technical setup, and the first three share the same prerecorded source material, created by Tudor using a decorative brass and gold spider’s web played in various ways. A review of a 1989 New York City performance of *Web for John Cage II* describes Tudor using the web as a live performance instrument: “For 71 minutes, Mr. Tudor tapped the web and fondled the spider, and used a selection of brushes and a sponge to make the device yield different kinds of sounds.”⁶⁴

According to Rob Miller, Cunningham Company audio engineer from 1987–1991, the source sounds for *Webwork* were very similar to those used to trigger the gating devices which allowed the source sounds to be heard—and the triggering sounds had been recorded by Tudor using army-surplus hydrophone-type microphones which he had buried in his back yard “about two feet down.”⁶⁵ Tudor is quoted in a program note stating that the sound source for the piece was “obtained from sea-sounds recorded underwater, which are subsequently fragmented to give the most minute impulses. These impulses activate a chain of electronic components, producing a variety of sound transformations, which can be changed instantaneously. The performance process is, in part, like weaving through a warp having many colors.”⁶⁶ All of this may be true, but interestingly, the recording of *Webwork* included with the present collection also reveals Tudor’s use of his Pepsi tape library yet again: around the 21-minute mark, we can hear the

⁶¹ Tudor, 1988.

⁶² WBFO, interview with David Tudor, John Driscoll, Ralph Jones, and Martin Kalve of Composers Inside Electronics, “Plastic” [title of show] with host Mark Fruehauf, December 5, 1978. Recording of broadcast obtained from the personal archive of John Driscoll.

⁶³ D’Arcy Philip Gray, “David Tudor in the Late 1980s: Understanding a Secret Voice.” *Leonardo Music Journal* 14, 41–47.

⁶⁴ Allan Kozinn, “Electronic Homage to John Cage,” in *The New York Times*, April 23, 1989.

⁶⁵ Robert E. Miller, personal communication, December 11, 2012.

⁶⁶ Vaughan, 1997.

distinctive sound of “fly on flypaper”—which certainly would fit with the spider’s web theme.

Rob Miller recalls that the *Webwork* setup for performance with the Company involved Tudor “flying” the fragmented sounds of his source material through an array of effects via his typical matrix switch arrangement, before sending them to speakers surrounding the audience via four stereo auto-panners, each set up to move sounds back and forth between two speakers. Miller remembers Tudor structuring his performance so that initially sounds were heard only through speakers at the base of the stage, with more and more speakers gradually introduced as the complexity of sound also increased. This emphasizes once again the spatial dimensions of Tudor’s practice which is radically reduced for listening in the stereo format.

Virtual Focus (1990) has an especially interesting history, as the commission for another Cunningham dance, *Polarity*, as well as a work with a unique life that continues today. The piece was designed to be directly responsive to dancers’ movements in a way that was seldom explored in the Cunningham Company:⁶⁷ from the orchestra pit, Tudor aimed radar and sonar devices onstage and derived rich streams of pulses from the performers’ motions,⁶⁸ which could be used as triggers or directly processed through a large number of effects. The recording included in this collection is from one of these performances. What is very unusual about the piece, however, is that it still exists intact as an instrument created by Tudor, thanks to the vision of UK artists and collectors Adam and Carolyn Barker-Mill.

The Barker-Mills had heard Tudor’s music with the Cunningham Company on a number of occasions and traveled to New York City to experience his 1990 collaboration with Jacqueline Matisse Monnier at the Jack Tilton Gallery, *Volatils with Sonic Reflections*. This piece employed the radar and sonar technology of *Virtual Focus*, in combination with mobile-like sculptures by Monnier which turned gently about, radar and sonar reflections creating pulsed sounds like those Tudor derived from the dancers’ movements. Then, in October 1990, Tudor and Monnier visited the Barker-Mills home in Southampton where they were commissioned to create a similar “performed installation” as part of festivities celebrating Adam’s fiftieth birthday. Over the period of a week, Tudor worked with Rob Miller to assemble a version of the *Virtual Focus* table, while Monnier constructed new *volatils* of sheet zinc from a local scrapyard.⁶⁹ Both her sculptures and the table of electronics Tudor assembled remain together and intact to this day; Tudor drew up a score diagram based on the Southampton table and it remains the best description of *Virtual Focus* available.

By this phase of his career, Tudor was not using many esoteric hand-made or -modified sound processors: most of the items on the *Virtual Focus* table are stock devices still available as guitar effect pedals, while the radar and sonar units were assembled from hobbyist kits. Everything was interconnected via Tudor’s standard matrix switch and sound spatialization was again given special attention, with both stereo and quadraphonic panners used to spread sounds throughout the four-channel sound system hired by the Barker-Mills for their outdoor party. Adam Barker-

⁶⁷ Other examples of such musical interactivity with Cunningham Company dancers would include Cage’s *Variations V* (1965), in which dancers triggered light sensors as they moved, Gordon Mumma’s *Loops* (1971), which involved amplification of Merce Cunningham’s breathing and heartbeat, and Mumma’s *Telepos* (1972) in which telemetry belts worn by dancers transmitted information about their movements.

⁶⁸ Robert E. Miller, personal communication, February 6, 2013.

⁶⁹ Adam Barker-Mill, “David Tudor’s Sound Table.” *MusicWorks* 73 (1999), 24–25.

Mill wrote that “Fine weather meant that the guests could walk about in the open and take in the amazing impact of David’s piece as the sound reverberated around the walls at dusk. At one point there seemed to be a contest with noises from the docks nearby.”⁷⁰

Among Tudor’s final works were pieces which again explored the remixing and processing of field recordings and “no-input” feedback instruments. The latter include *Neural Network Plus* (1992) and *Neural Synthesis* (1992–94), both the outcome of a collaboration with engineers Forrest Warthman and Mark Holler which offered Tudor a new way of engaging with feedback.⁷¹ His sound world and way of interacting with electronics was fundamentally an analog one: the digital “computer music” realm held little interest for him. In 1987 Tudor said “I can guarantee you that even if I did have a computer involvement, in the sense that it is programming the performance, that I would interfere with it. It is important to me that the audience senses the presence of a live musician. It makes all the difference in the world.”⁷² It was not until 1989 that he began a computer music project which resulted in two major works—but significantly, the sounds produced by the “Box 1” and “Box 2” synthesizers he helped design were made by a new microchip featuring *analog* circuitry. Box 1 was the only version of the synthesizer which Tudor had the opportunity to explore extensively before his death in August 1996.

Forrest Warthman approached Tudor after hearing him perform with Merce Cunningham in Berkeley in 1989 and asked if he would be interested in a “computer system capable of enveloping and integrating the sounds of his performances.”⁷³ Discussion and experimentation followed, and in 1990 Mark Holler, then of the microchip manufacturer Intel, suggested to Warthman the use of a new prototype processor he had helped develop. The new processor was a neural network, a device simulating the brain’s neural patterns. Each neuron was modelled as an analog amplifier, the output of which could be sent to any other neuron or back to its own input, in a feedback loop. For Tudor’s sound-making purposes, only sixteen of an available sixty-four neurons were used, set up in feedback modes. Whereas a purely digital model of an oscillator might have offered a predictable and repeatable selection of sonic states, the analog neural chip offered uncertainty and a rich sonic palette recalling earlier works such as *Untitled*. As Warthman explained, “Near the onset of oscillation the neurons are sensitive to inherent thermal noise produced by random motions of electron groups moving through the monolithic silicon lattice. This thermal noise adds unpredictability to the synthesizer’s outputs, something David found especially appealing.”⁷⁴ Box 1 was only semi-controllable, with a performance console that allowed access to feedback parameters, and up to fourteen channels of sound output.

Tudor’s first foray into “computer music,” *Neural Network Plus*, was commissioned as accompaniment for Cunningham’s first computer-assisted choreography, *Enter*, premiered at the Opéra de Paris in November 1992. For reasons of reliability, the Box 1 synthesizer was rarely used in live performance, however, and was not played at the premiere: instead, Tudor created numerous 30-minute source tapes⁷⁵ using Box 1, which he and fellow Company musician

⁷⁰ Barker-Mill, 1999.

⁷¹ Forrest Warthman, Liner notes for CD *Neural Synthesis Nos. 6–9*. (New York City: Lovely Music, 1995) LCD 1602.

⁷² David Tudor, interview with Bruce Duffie, Chicago, April 7, 1986. Recording obtained from the interviewer, and transcribed by the author.

⁷³ Warthman, 1995.

⁷⁴ Warthman, 1995.

⁷⁵ John D.S. Adams, personal communication, February 16, 2013.

Takehisa Kosugi⁷⁶ remixed through additional output processing—mostly guitar pedal-type effects and panning processors, for “maximum spatial differentiation” according to John D.S. Adams, Company sound engineer from 1991–95.⁷⁷ Adams recalls that the source tapes were recorded by Tudor in the pit at the Opéra, resetting Box 1 every half hour to create a diversity of material, continuously unfamiliar in performance.

After the premiere he did make a few more source tape recordings so he never became familiar with the sounds. This was key, to not “memorize” the source tapes so you would instinctively anticipate certain types of sounds. When something happened that he wasn’t expecting to hear, this was a good performance. There were certain source tapes that had specific qualities of material on them. This was OK to know in advance!⁷⁸

“We always carried Box 1 with us but didn’t always fire it up,” recalls Adams. “When Tudor wanted to challenge himself, he would bring out the Box to perform live. I’d help him set it up in advance so it was producing some sort of interesting sound. It didn’t always work out and he would sometimes abandon it.”⁷⁹ The Box 1 recordings were also used for realization of Tudor’s *Neural Synthesis* series of pieces, created at the Banff Centre in 1993 with Adams engineering and co-producing.

David Tudor’s electronic score pops, bubbles, squeaks, barks, whinnies and honks in one surprising outburst after another. “Enter” lasts just about an hour. It is an hour well spent.

—Jack Anderson, *The New York Times*⁸⁰

Tudor’s move toward simpler technical setups, less customized and idiosyncratic hardware, and more prerecorded source material is part of a process which John David Fulleman observed began in the late 1970s. What ought also to be remembered is that in the last several years of his life, Tudor experienced a series of strokes which reduced his mobility in performance. Less cumbersome tables of devices were necessary, and in at least one case an earlier very complex work (*Toneburst* (1975) for Merce Cunningham’s *Sounddance*) was reinvented by Tudor as a live remix of material on CD, not dissimilar to the way *Neural Network Plus* relied on a library of prerecorded improvisations. This fortunately did not reduce the sonic impact of the work, however much it differed from the “live-electronic” aesthetic defined by Tudor in previous decades.

After Tudor ceased touring with the Company in 1995, Kosugi and other Company musicians continued to perform his work. With the disbanding of the Company at the end of 2011, the live performance of Tudor’s music with dance, should another company license Cunningham’s choreographies, is in question. Merce Cunningham and John Cage always insisted on live music,

⁷⁶ Takehisa Kosugi joined the Merce Cunningham Dance Company at Cage and Tudor’s invitation in 1976 and took up the role of Music Director following Tudor’s passing in 1996.

⁷⁷ John D.S. Adams, personal communication, 1999 (undated).

⁷⁸ Adams, 2013.

⁷⁹ Adams, 2013.

⁸⁰ Jack Anderson, “Revival of ‘Rune,’ an Exception.” *The New York Times*, March 11, 1995.

and Tudor insisted on multi-channel electronic sound distribution; specifications with Cunningham archival “dance capsules” suggest that licensees of his dance works will be permitted to use recordings of Tudor and others performing their music decades earlier, and to deliver that sound via much less elaborate sound systems. As David Tudor was quoted earlier in these notes, “It is important to me that the audience senses the presence of a live musician. It makes all the difference in the world.” Luckily, Composers Inside Electronics has seen a resurgence of activity since his passing, with inclusion of new members from a still younger generation of composers, and part of its mandate is to revisit and continue to reinvent Tudor’s music as a live performance practice.

We must hope that David Tudor’s work is treated with understanding and respect, and as a living practice rather than something which can be adequately represented in historical recordings. Those historical recordings, almost eight hours of which are offered here, are of great value, however: some works are certainly unrecoverable and will likely never again be played—at least, not the way Tudor made them sound. This collection captures his touch and sensitivity and offers an expansive, previously unavailable view onto more than three decades of Tudor’s astonishingly original work as an electronic musician.

—Matt Rogalsky
January/February 2013

Matt Rogalsky has been working as an artist/composer/performer of live electronic music performance and sound installations since 1985. His practice is informed by study and re-creations of late 20th century electronic works by other composers, including David Tudor, whose Rainforest series was the subject of a 2006 PhD dissertation (City University, London). Rogalsky is currently based in Kingston, Ontario, where he also teaches in the School of Music at Queen’s University.

Gordon Mumma: With Tudor the Organist

David Tudor's activities as an organist in the 1940s have been well documented by John Holzaepfel: his early fascination with his father's church performances on the reed-organ, his studies with organist H. William Hawke, his appointments as assistant organist at Philadelphia's St. Mark's Episcopal Church and, at the age of eighteen, as organ instructor at Swarthmore College. As Holzaepfel rightly observes, "his career as an organist seemed well under way."⁸¹ But Tudor's evolution from organ to piano—to become one of the prime piano virtuosos of new music from the 1950s—has obscured the continuing importance of the organ in Tudor's development as a composer of live electronic music in the 1960s and beyond.

Tudor's broad range of the diverse organ repertoire spanned several hundred years. Hearing him segue smoothly or dramatically from a Buxtehude toccata to toccatas of Widor and Reger revealed his imagination in combining seemingly disparate sound sources in his live-electronic music of later years. His encounter with the organ music of Olivier Messiaen in the late 1940s had profoundly changed his thinking about recent music. In a 1986 interview with Bruce Duffie, Tudor recalled: "I loved all the music I learned to play, and I still do. I used to play the organ, and I find that I listen to it very, very seriously."

Tudor's serious engagement with the organ continued throughout his life. During our performance tours with the Merce Cunningham Dance Company, particularly in Europe, Tudor would occasionally suggest that I accompany him on a visit to a nearby church that had a unique historic organ. When access to the instrument was possible, he would put on his specially designed, thin leather-soled organ shoes, which he carried along in a little bag. He would begin by feeling out the instrument, testing the locations and sonorities of the stops and working the pedals for their physical responses. Then from memory he would launch into segments of the organ repertoire chosen according to the time and place of the instrument. There may have been some aspect of remembrance of things past, but equally evident was Tudor's vivid curiosity about sound sources and their interplay in space and time. He thrived on the time delays between keyboard activation and resulting sounds, the sound-motions to separate ranks of pipes, the reverberation and cross-resonances of overlapping sounds in the unique acoustics of each venue, and the vast possibilities of timbre and attack—what all organists work with, particularly in large spaces.

Tudor prized the unique character of each instrument. During a free half-day in Hamburg in 1966, between sessions for the NDR filming of the Cage/Cunningham *Variations V*, we visited the St. Jacobi church to see the famous late-seventeenth-century Arp Schnitger tracker organ. It was a baroque four-manual instrument that had been partially destroyed in World War II bombings, still being restored but very playable. The panels of stops, each stop with a decorative chimera, had some names unfamiliar to me, but not to Tudor. He performed excerpts from his early organ repertory, exploring their contrasts of timbre and placement.

Back at the NDR studios later that day and still speaking about that wonderful organ, we were overheard by someone who said that we must also see their Welte-Funkorgel. It was a special organ designed in 1930 to produce "orchestral" sounds for radio and theater performances. The large collection of stops fascinated Tudor for its many sound possibilities. Tudor played fragments

⁸¹ Holzaepfel, program essay to *David Tudor and Gordon Mumma*, New World Records 80651-2 (2006): p. 3.

of Rimsky-Korsakov's "Flight of the Bumblebee," a staple of theater organ repertoire, adding ornate sound effects. Elsewhere we visited an early Welte Recording Organ, an automatic player organ notable for its use of paper "player-rolls" related to the technical mechanisms of the Welte player-piano.

Tudor's lifelong fascination with the complex timbre relations of wind-driven resonating pipes and reeds was augmented in the mid 1960s by his introduction to the bandoneon. This bellows-driven instrument, with its resonators of wind-driven reeds, was technically a distant cousin of the small reed-organs of his childhood—with the distinction of portability and close physical connection between its sounds and the performer. As with the organ, each bandoneon was often unique, with a wide range of dynamics, articulation gestures, and sustaining durations, as well as a broad spectrum of sonorities, harmonics, and sub-harmonics.

His bandoneon soon became a sound-maker to be processed often with electronic means, a fertile compositional field for Tudor after 1965. The instrument also features in Tudor's commissions from others (Pauline Oliveros, Stanley Lunetta, and myself) and in his own theatrical *Bandoneon !* (1966), an interactive sound and visual collaboration with Lowell Cross's elaborate system. By 1968 Tudor developed his own resonating physical wooden and metal objects activated with his developing electronic audio resources in the "instruments" of his *Rainforest* project.

Many aspects of Tudor's creativity have roots in his early experience with the historical organ cultures and repertoire. The "structured improvisation" central to organ performance practices was fundamental to Tudor, and with it the idea of the "composer-improviser" who rearranges and further develops sound materials retrieved from past experiences. From his years as an organist Tudor had also developed prodigious skill in multi-layered thinking involving simultaneous overlapping of contrasting layers of sound sources. The extended resources of timbre and sonority, and the properties of time delay and spatial sound placement of the organ nourished the sound environments of his *Bandoneon !*, *Rainforest*, and the ongoing Merce Cunningham Dance Company collaborative *Events*.

Beyond his roots as an organist, Tudor's experiences as a pianist—a soloist, in chamber music, accompanying other musicians, dancers—and his later collaborative work with other composers, performers and electronic technicians contributed to the breadth of his evolving achievements in the electronic-music arts.

Christian Wolff: Thinking of David Tudor

David, about to play my *For Prepared Piano* in Darmstadt (I think in 1956), quietly remarks to the audience that because the piano has no third (sostenuto) pedal, he'd have to do something a little special. He used his left elbow to depress two keys silently making certain harmonics possible (fingers of the left hand still in use).

He didn't talk much, but when he did, it was worth all of your attention.

He was quiet, completely unassuming, but not in the least diffident. He was mysterious, surprising, and every now and again mischievous.

He spent a year working on Jean Barraque's piano sonata, then decided the music wasn't working and cancelled its performance.

His attention to the smallest detail was remarkable. When recording was done on magnetic tape and editing involved cutting and splicing, he might spend hours fixing the decay of a single note inside a flurry of others, a tape cut of maybe a sixteenth of an inch.

Do you have any new material? he'd ask, meaning a piece and indicating, quietly, that he too would be making that piece. Some exceptional examples: John Cage's *Variations II* and my *For 1, 2 or 3 People*, the first somehow transforming the piano, with just contact microphones, into a live electronic instrument, the second using a baroque organ, contact microphones and real-time overdubbing.

Nothing was too hard for him, he liked it that way. My music, *For Pianist*, for instance, he said was a conundrum. He was devoted to John Cage's work from the start (1950). So much invention, John's and his. His actions, his playing, were absolutely clear and decisive, no matter how indeterminate the material.

Stefan Wolpe asked him to play musical examples for a lecture in Darmstadt (1956). David, unhappy with the lecture—a long series of thumbnail sketches of numerous American composers with short musical examples tacked on to each, when my music was characterized by its having lots of silence, David played a bit that had the most possible notes in it that he could find.

When I was about to go into the army in 1959, John and David took me out for an elegant farewell lunch at an Italian restaurant on Mulberry Street in New York. On the way there David insisted we stop at a Chinese general store (we were passing through Chinatown) from which he returned with a supply of Tiger Balm for me: that'll fix anything that might ail you, he said, and reported that the old storekeeper had told him if you put it on your penis it will drive the women wild.

He liked being amused.

One recalls his extraordinary capacity for minute, controlled dynamic differentiations when playing the piano. Listening to the softest passages everyone would be straining their ears to the utmost, watching David's every move. Sometimes he was so quiet you wondered if you were only imagining the sound as you watched the movement of his hands at the instrument, with their characteristically sharply defined gestures. I once asked him whether he ever made a move only pretending to make a sound. He smiled and raised his eyebrows: yes. David had a sense of theater, quietly self-effacing though he appeared, and, of course, always an especially keen ear for sound.

For that early sixties music he spent more time preparing it at a table with pencil and paper than at the keyboard.

We were once talking about the limitations of the piano as an instrument (when he still mostly just played the piano): yes, he said, just one ugly sound after another.

In a class he was conducting at Darmstadt (in 1960) David had suggested that some of us prepare a performance of John Cage's *Cartridge Music*, even though the necessary phonograph cartridges were not available, nor in fact any means of electric amplification. We worked up something with objects that would serve as resonating chambers and, as best we could, did a performance for the class. That day the eminent Theodore W. Adorno had come to the class. After our performance he got up and spoke at considerable length, and complicatedly, about what he considered the implications of this music might be. When he finished, David looked at him and said, "you haven't understood a thing."

In Groningen (1994), David, Takehisa Kosugi, Nicolas Collins and I put together a piece (*Or Four People*) I'd made for us and the occasion—we had just half a day to prepare it. For rehearsal we each worked on our parts independently and simultaneously, making quite a lot of sound. At the concert the performance was long, almost an hour, very sparse, with lots of silence. At one point there was a wonderful repeated thudding sound. David hadn't seemed to be playing much at all, but I thought he was the only one who could have produced it. Afterward I found out that the sound was some kids kicking a soccer ball against the outside wall of the auditorium. When we had finished the piece David asked us why the rest of us hadn't made more sound. Generally, especially in his own work, I think, he liked a dense, rich array of sound.

At the performance organized by Petr Kotik of *Atlas Eclipticalis* (all 86 parts) at Carnegie Hall in New York (1992) David simultaneously played *Winter Music*. It was a 90-minute version. David, not at all in good health, played heroically and beautifully. After the concert he remarked that he had had trouble reading the music (his eyesight was bad after a heart attack) and that sometimes he had to just go ahead and play without reading the music. He figured out, he explained, what he had to play by ear and his memory of what the music was supposed to sound like and then played that.

For a performance in Cambridge, Massachusetts in 1965, of John Cage's *Variations IV* which required a quantity of recordings (of anything whatsoever), David went to check out Holly's (then my fiancée) record collection. He picked out various items and, seeming pleased at the idea, was about to add a recording of Robert Frost reading his poems, when Holly firmly shook her head, no. He laughed. At that same concert we—John, David and I—were to play for the first time my *Trio II* for piano four-hands and percussion, a very difficult piece, especially the percussion part, so David volunteered to play it.

He liked to solve problems, and not just musical ones; to be of use, without attracting attention. He liked to do his work while you did yours, all part of the same project. He always paid attention to what others were doing and took care, if he possibly could, to see that you could do best what you needed to do. You almost didn't notice how he made all the difference.

David Tudor (1926–1996) was born in Philadelphia; his first professional activity, at age sixteen, was as an organist. He became a leading avant-garde pianist, with highly acclaimed first performances of compositions by contemporary composers, before moving in the mid-Sixties to the composition and performance of “live electronic music.” In the early Fifties, at Black Mountain College and in New York, he formed relationships with radical artists with whom he continued to work during his entire career—John Cage, Merce Cunningham, Robert Rauschenberg, Christian Wolff and others. He became the pianist for the Merce Cunningham Dance Company and he and John Cage toured during the Fifties and early Sixties with programs of Cage’s works. In the late Fifties he also had an important presence at Darmstadt, where he worked with and influenced Karlheinz Stockhausen, Cornelius Cardew, and other members of the European avant-garde. His own compositions began to appear in the mid-1960s: *Bandoneon !* (1966), a composition for New York City’s Nine Evenings, a project of Experiments in Art and Technology (E.A.T.); design and composition for the Pepsi Pavilion, Expo ’70, Osaka, Japan, also an E.A.T. project; and, from 1974, as a founding member of Composers Inside Electronics, a music ensemble whose members perform compositions for which they have built the electronic circuitry. Tudor’s first composition for the Cunningham Dance Company was for Merce Cunningham’s *Rainforest* in 1968. On Cage’s death in August 1992, Tudor assumed the post of Music Director of MCDCC. Tudor’s last work for Cunningham was *Soundings: Ocean Diary*, the electronic component of the score for *Ocean* (1994). He died in Tomkins Cove, NY, on August 13, 1996.

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Produced by Paul M. Tai

Digital mastering: Paul Zinman, SoundByte Productions Inc., NYC

Box cover art: *Rainforest IV*, Neuberger Museum, SUNY Purchase, 1981. Courtesy Phil Edelstein.

Design: Bob Defrin Design, Inc.

For 1, 2, or 3 People, *Neural Network Plus*, *Phonemes*, *Virtual Focus*, *Weatherings*, and *Webwork* are live recordings taped during and in connection with performances by the Merce Cunningham Dance Company. The tapes are archived as the Merce Cunningham Dance Company Collection Sound Archive, The New York Public Library for the Performing Arts, and are used with the kind permission of The New York Public Library, Astor, Lenox and Tilden Foundations and the Merce Cunningham Trust.

Individual support and foundation grants (CDF board members Molly Davies, Jacqueline Matisse Monnier, and Benedicte Pesle; The Andrew W. Mellon Foundation, the National Endowment for the Arts's Save America's Treasures program, and the Ford Foundation) allowed the Cunningham Dance Foundation to organize and digitize the Cunningham Sound Archive before the recordings were transferred to the New York Public Library. That project, engineered by Stephan Moore and Jesse Stiles with the assistance of David Behrman, John King, Takehisa Kosugi, Gordon Mumma, and Christian Wolff, enabled New World Records to release *Music for Merce 1952–2009* in 2010.

This recording was made possible by a grant from the Francis Goelet Charitable Lead Trust.

Special thanks to The New York Public Library, Astor, Lenox and Tilden Foundations; Jean Rigg of the David Tudor Trust, Allan Sperling of the Merce Cunningham Trust, Julie Martin of Experiments in Art and Technology (E.A.T.), John Driscoll and Composers Inside Electronics, Marita Emigholz of Radio Bremen, D.J. Hoek and Northwestern University Music Library, James Klosty, Gordon Mumma, Matt Rogalsky and Christian Wolff.

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