communication +1

Volume 3
Issue 1 Afterlives of Systems

Article 10

September 2014

Hear After: Matters of Life and Death in David Tudor's Electronic Music

You Nakai
New York University, younakai@gmail.com

Abstract

In David Tudor's electronic music, home-brew modular devices were carefully connected together to form complex feedback networks wherein all components—including the composer/performer himself—could only partially 'influence' one another. Once activated, the very instability of mismatched connections between the components triggered a cascade of signals and signal modulations, so that the work "composed itself," and took "a life of its own." Due to this self-producing, perpetuating nature of his works, Tudor insisted on what he called "the view from inside," focusing more on the internal observation of his devices and sound than in materials external to the immanence of performance. When Tudor passed away in 1996, it became apparent that the sheer lack of resources outside the work—scores, instructions, recordings, texts—had made many of his music impossible to perform in his absence. The works that took a life of their own could not survive their composer's death partially because of his utter reliance on them to do their work. By connecting often mismatched resources obtained from extended research on Tudor, this paper presents modular observations that seem to offer certain perspectives on the issue of life and death surrounding Tudor's music. A comparison with developments in systems theory, most notably autopoiesis, outlines a mechanism for the endless life of sounds that compose themselves. Moving out of this theoretical reflection, a fieldwork report of an ongoing attempt to 'revive' some of Tudor's works is offered. This report demonstrates the observer shifting from one 'inside' to another—from an electronic circuitry inside a particular device, to a network composed of several devices, and further into the activation of a composite instrument. Meandering away from the archives, the composer's "view from inside" of his electronic devices is set side by side with recent insights of object-oriented ontology. A certain portion of this observation then feeds itself back to the perspective of autopoiesis, while others proceed to extract a distinct notion of 'life' out of object-orientation, this time in programming: an indeterminate 'waiting' time inherent in each 'object' that cannot be computed within a singular universal time. This latency embedded in objects that await activation correlates to the trajectory of the observer who is always in a transit from one 'inside' to another, finding different objects on each level of observation, and for whom, therefore, the delineation between life and death is always indeterminate. This view provides further explanation to the operative mechanism of Tudor's music,

wherein mismatched components sought to activate and influence one another, constituting an ‘electronic ecology’ endowed with a life of its own, but filled with partial deaths. The paper thus observes ultimately a parallel between the composer’s trajectory within his performances and that within his life, while attempting to reenact the complex nature of these said trajectories through the meandering manner of its own delivery.

Keywords
Electronic Music, Autopoiesis, Cybernetics, Object-Oriented Ontology

Cover Page Footnote
I am grateful to Ron Kuivila from Wesleyan University and Nancy Perloff from Getty Research Institute for kindly having accommodated my visits to their respective institutions.

Either one is alive or one is dead.

Niklas Luhmann

What is death for the beholder? What is death for the dying?

Humberto Maturana

1

The composer David Tudor passed away on August 13, 1996. Following his death, it quickly became apparent that a large part of his electronic music was gone with him. There were several works that he had passed on to other people—including *Rainforest IV* that members of 'Composers Inside Electronics' had been performing since the inception of the group following a summer workshop that Tudor led in 1973; or a later series of works employing the Neural Network synthesizer (*Neural Network Plus* and *Neural Synthesis*) that Tudor's then-assistant John D.S. Adams had learned from the composer just before his death. But the majority of Tudor's idiosyncratic compositions seemed utterly impossible to perform in the absence of the composer, who was their primary, and most times the only, performer. The evident obstacle was the sheer scarcity or utter lack of all the vicarious, primarily textual, materials that usually stand in as more stable proxies for the ephemerality of sounds—scores, instructions, descriptions, interviews, articles, and recordings. It was as if Tudor had deliberately restrained the production of materials external to his music. There were objects—a large number of instruments made by the composer and other people—but they remained esoteric (particularly to musicologists) and mostly inoperative. The only way to proceed seemed to carefully connect the limited and often mismatched resources together to form a chain of observation.

Tudor had turned himself into a composer of electronic music in the mid-1960s, after almost two decades of a remarkable career as the most virtuosic pianist of post-war experimental and avant-garde music. He worked closely with prominent composers at the time, such as Pierre Boulez, Karlheinz Stockhausen, Christian Wolff, and most notably, John Cage. Tudor as a performer was reticent, being inside the works of other eloquent composers who were more than happy to do the talking. But even after he started composing, Tudor refrained from writing or talking about his works. This ostensible quietness is often described as pertaining to the composer's nature by people who knew him: "It was very much David's nature; other people would talk about doing stuff, but David would do the

stuff."[1] Nevertheless, in the few occasions where he did talk about his works, Tudor also talked about why they needed no talking about them. In *Bandoneon!* (1966), his first substantial effort as a composer, Tudor used the instrument in the title, both as a sound source and as an interface to activate the distribution and modulation of sounds, switching of loudspeakers and lighting, as well as the projection of visual images by Lowell Cross. The program note claimed that the work, "when activated, (…) composes itself out of its own composite instrumental nature."[2] For *Rainforest* (1968-76), Tudor set out to build "an orchestra of loudspeakers, each speaker being as unique as any musical instrument,"[3] by attaching audio transducers onto various physical objects. The composer thought this "was a nice piece because it would teach itself."[4] It was as if these works, left to their own devices, took care of themselves, rendering all external language unnecessary and irrelevant. Or, in Tudor's own concise explanation: "it is they who are doing it."[5] Tudor's unwillingness to talk or write about his works was in this way partially conditioned by the very nature of the same works.

2

To describe in a generic manner, the nature of Tudor's music was based on modular electronic devices connected in chains to form complex feedback networks. Once activated, a signal would be distributed throughout the network, passing through various gain stages, filters, and modulators, before being fed back to repeat the process over and over again. The multiple channels of signals would be transduced and output from loudspeakers at different points of the network. These loudspeakers were often distributed across the space to particularize the perception of sound at a given location. The output sounds could then be fed back once more into the electronic circuitry either through microphones (acoustic feedback), or via Tudor the performer who would decide on his next maneuver based on what entered his ears. Not that accurate control was possible, for

[1] Phil Edelstein, Interview by author, Long Island, NY, November 19, 2011.
[2] David Tudor, "Program Notes for Nine 'Evenings (1966)," Los Angeles: David Tudor Papers, Getty Research Institute, Box 3.
[3] David Tudor and John David Fullemann, "'…performing is very much like cooking: putting it all together, raising the temperature' (May 31, 1984, Stockholm)," http://davidtudor.org/Articles/fullemann.html (April 1, 2014).
[4] David Tudor and Matt Rogalsky, "Interview with David Tudor by Matt Rogalsky (March 28, 1995, Tomkins Cove, NY)," http://davidtudor.org/Articles/rogalsky_inter2.html (April 1, 2014).
[5] David Tudor, "Note (circa 1975?)", Los Angeles: David Tudor Papers, Getty Research Institute, Box 19.

indeterminacy permeated Tudor's system on multiple levels. The sheer complexity of the circuitry based on parallel channels of feedback exceeded the capacity of the human performer to fully predict or control its behavior. As Tudor recounted, referring to his realization of Cage's *Variations II* (1960), in which he implemented electronic amplification to his piano constructing one of the earliest examples of an instrumental system based on complex feedback—"you could only hope to influence the instrument."[6]

A similar relationship based on indeterminacy also existed between the components themselves. Tudor often neglected the usual practice in the building of modular synthesizers to match the voltage or impedance between devices to ensure the clarity of signals.[7] Instead, he deliberately mismatched his components to obtain additional layers of noise/signal, describing the resulting relationship among components with the same verb he used to address the relationship between himself and them: "with a synthesizer you match up each component with the next one, so that each input can handle the previous output. I found out that if the components don't match, then the one component is able to *influence* the next, so that signals are created at many points within the circuit"[8] [emphasis added]. The whole network was thus carefully put together so that all components—including the human performer—could partially 'influence' one another, without any taking over universal control. Once activated, the very instability of partial connections within the feedback network incited oscillations of diverse character, triggering a cascade of signals and signal modulations.[9] The

[6] Ray Wilding-White, "David Tudor: 10 selected realizations of graphic scores and related performances (1973)," Los Angeles: David Tudor Papers, Getty Research Institute, Box 19.

[7] "Every time I've had to use the synthesizer, or a synthesizer component, I had something outboard to it that then would change the way it operates. It's mostly because all the considerations of the voltage, you know, where voltage needs to correspond to what the output signal level is—that's all coordinated. And if you manage to uncoordinated that, then you are in a completely different position" (David Tudor, "Workshop with students at Mobius, Boston, September 29, 1985," Los Angeles: David Tudor Papers, Getty Research Institute, Box2A, C75).

[8] David Tudor, "From Piano to Electronics," *Music and Musicians* 20 (August 1972): 26.

[9] For a more detailed and specific account of how Tudor's compositions operate, see Ron Kuivila's description of *Untitled: Homage to Toshi Ichiyanagi* (1972) (Kuivila, "Open Sources: Words, Circuits and the Notation-Realization Relation in the Music of David Tudor," *Leonardo Music Journal*, Vol. 14 (2004): 17-23). Upon a closer observation, Tudor's trajectory also reveals a certain shift in the nature of his works around the mid-1970s. His initial exploration into the electronic generation and modulation of sounds through feedback with no external input resulted in a proliferation of devices, which presented two problems: the sheer controllability of the composite instrument (the

composition, in other words, composed itself from within.

What is heard as music to the human ear is the sonic expression of these multiple components 'influencing' (or, hoping to influence) each other, both in space, and within the circuitry. And following the composer's own wording—as when he explained how with the instrumental loudspeakers of *Rainforest*, "the objects should teach you what *it* wants to hear"[10] [emphasis added]—the action on the receiving end of this chain of influences could be portrayed as 'listening,' or 'hearing.'[11] In Tudor's music, the human listener listens to components

---

degree of influence, so to speak), and its portability for tours with the Cunningham Company. As Tudor recalled, "I came to a situation where my hands were completely tied to the performance trying to do the generation," but on top of that, "I couldn't take four suitcases of equipment" (Tudor, "Workshop with students at Mobius, Boston, September 29, 1985"). The composer's solution to this double predicament was simple yet effective. He recorded the output of sound generation, and in performances used this recording as source material to be processed through a much more simplified circuitry. But this tactic had a significant side effect: it triggered Tudor to shift his focus from sound generation to modulation of pre-recorded sound sources. From the late 1970s, Tudor's music leaned towards the use of pre-recorded sound materials that went through multiple, parallel modulating channels—consisting mostly of noise gates, pitch shifters, various filters, and so on—which were then output from multiple speakers. Despite this change of focus narrated by the composer himself, it is my view that Tudor's general approach remained basically coherent. Just as the initiating signal that triggers the process of oscillation in a no-input setting cannot be determined in advance, nor it matters what its nature is, the properties of sound material to be processed was secondary to the processing itself: "it wasn't important which take it [sound source] was, it wasn't important where the take started, it just meant you had to have something to generate the process" (Tudor, ibid.). Whether external input was used or not, Tudor's focus was always on the behavior of the overall network of his components (moreover, the use of pre-recorded sound material had already appeared in *Pepsibird* and *Anima Pepsi* from 1970).

[10] David Tudor and Matt Rogalsky, "Interview with David Tudor by Matt Rogalsky (March 28, 1995, Tomkins Cove, NY)," http://davidtudor.org/Articles/rogalsky_inter2.html (April 1, 2014).

[11] The use of the verb 'listening' to address the workings of electronic devices has a long history in electronic music, and was already in use among some of Tudor's collaborators as can be seen in Gordon Mumma's wording that appears later in this paper. For a general survey of (more recent) musical systems that 'listen,' see for instance: Robert Rowe, *Interactive Music Systems: Machine Listening and Composing* (Cambridge, MA: MIT Press, 1993). As demonstrated in Rowe's title, the crucial point in the application of this verb to non-human devices is in its strict coupling with the ability to *respond* to what is 'listened,' in a complex, nonsingular (indeterminate) manner, and hence to 'interact' with the human performer accordingly. This acknowledgement of 'listening' via the observation of consequent response, or more

influencing and listening to each other—"it is they who are doing it." And when they did what they did, Tudor saw them as springing to life: "there is a point where a certain sound-world or a certain color conception can appear, an electronic set up that's hooked together with a certain idea. And all of a sudden you realize that it has a life of its own."[12] Similar observation employing the same wordings was even adopted by other composers to account for Tudor's music: "With David Tudor," Cage stated in 1987, "the components, the circuitry is the music, and it comes alive when it is performed."[13]

This attribution of 'life' to Tudor's music had one peculiar consequence: his performances were notoriously never-ending. For how could something that springs to life and composes itself once activated, end? Whenever Tudor performed with the Merce Cunningham Dance Company, which he regularly did throughout his career, it was customary for him to abruptly halt the music when the choreography reached its end. Matt Rogalsky recounts another anecdote demonstrating that finishing was not Tudor's concern: "at a Mills College concert in the late 1960s, (…) Tudor is said to have been cautiously questioned as his performance showed no signs of coming to a conclusion, while the hour was growing late: his response was to stand up and abruptly turn off the sound, with the comment 'I still had lots to do'."[14] It was this seeming indifference towards endings that took an ironic turn after 1996. The dedication to the immanence of performed life correlated to a certain disregard for the time and materiality outside the living present. The works that took a life of their own and knew no end in performances thus seemed to accompany the fate of their creator—who was also

---

accurately, via the perception of a nonlinear relation between input and output, connects to the tendency of programmers to observe subjectivity and affect in programming objects through their indeterminate 'waiting,' that will be discussed in section 9. It also extends, therefore, to the use of 'listening' based on 'cues' in the works of Christian Wolff, as described in footnote 42. The only non-electronic piece in the repertoire of 'Composers Inside Electronics' was Wolff 's *Changing the System* (1972), which Phil Edelstein from the group described as "a school for listening" necessary for performing Tudor's *Rainforest*: "that was the training ground, to a certain extent. And you know, David was never quite explicit about that as Pauline (Oliveros), or Christian was, but it was there, you had to be able to do it" (Phil Edelstein, Interview by author, Long Island, NY, November 19, 2011).

[12] David Tudor and Teddy Hultberg, "'I smile when the sound is singing through the space': An Interview with David Tudor by Teddy Hultberg (May 17-18, 1988, Dusseldorf)," http://davidtudor.org/Articles/hultberg.html (April 1, 2014).

[13] John Cage and Bruce Duffie, "Composer John Cage: A Conversation with Bruce Duffie (June 21, 1987)," http://www.bruceduffie.com/cage.html (April 1, 2014).

[14] Matt Rogalsky, "'Nature' as an Organising Principle," *Organised Sound* 15-2 (2010): 134.

the single component within the system responsible for initiating its activation—when *his* life came to an end.

3

Almost two decades have passed since the composer's death. When the current observer looks back from his viewpoint outside the immanence of Tudor's performances, the idea of creating compositions that compose themselves through chains of feedback conceived circa mid-1960s appears comparable to contemporary developments in cybernetics or systems theory in general. Tudor spoke nothing about it of course, and none of his notes show any interest in this regard. Discourses of cybernetics therefore seem to have laid *outside* the composer's concern. But they were certainly in the environment, and Gordon Mumma, a colleague musician from the Cunningham Company who worked on several projects with Tudor and built him several instruments, was well aware of the parallel. 'Influenced' by cybernetics, Mumma coined the term 'cybersonic' to address his self-built instruments from which he composed music that operated on feedback principles. For instance, in *Hornpipe* (1967), a cybersonic console attached to the hornist "listens (with microphone)" [15] and analyzes the resonances of the performance space from the sounds of the horn, creating an electronic analog of the same resonant characteristics. This "map of [the space's] resonant spectrum"[16] is later sent out from the loudspeakers once a certain threshold has been attained within the circuitry. Mumma described this process as a three-fold interplay between the human performer, the cybersonic console, and the 'personality' of the auditorium.

But both Tudor and Mumma went beyond the naïve premises of cybernetics. For at the core of their systems were factors of noise and indeterminacy that distorted any intention for regulated control of its operation. Sound was generated and modulated via the very failure of cybernetic control. The human composer-performer was accordingly seen not as a privileged observer who oversees the entirety of the composition but as a local component within the system; and machines, contrary to the cybernetic perspective, were no longer regarded as mere 'servo-mechanisms.' "If we admit of [sic] musical performance as social intercourse," Mumma wrote in his 'Notes on Cybersonics' in 1970, "then we may include the varieties of artificial intelligence in our musical ensembles: not merely for their sophistication and speed, but also for the contribution of their personalities. We may treat the artificial intelligence not as a

[15] Gordon Mumma, "Notes on Cybersonics: Artificial Intelligence in Live Musical Performance," Los Angeles: David Tudor Papers, Getty Research Institute, Box 38.
[16] Mumma, ibid.

slave, but as a collaborative equal in a democratic musical society."[17] This egalitarian view on machines and humans inside a musical system resembles not cybernetics, but 'cybernetics of cybernetics' that Heinz von Foerster and others were articulating circa 1970.[18] Contemplating on the role of the observer who inevitably enters and affects the operation of the system itself, von Foerster formulated the cybernetics of 'observing systems' as opposed to that of 'observed systems.' But the attribution of 'personalities' to electronic components (as well as the concert space), adds a further twist to this second-order cybernetics, by distributing the capacity for distinct observation (and listening) to all the components of the system. Not only the observer is included within the system, but his position is no longer stable nor singular since the other components return their gaze to him.

4

The difference between the observations of the observer and the system itself was theorized by one idiosyncratic theory of living systems that was developed in close relation to second-order cybernetics by Chilean neurophysicist and biologist Humberto Maturana and his former student Francisco Varela in the early 1970s: Autopoiesis. A simple observation formed the basis of their approach to living systems: there is always a gap between what an observer says about a system and the constitutive organization of the system itself. When this difference is thoroughly pursued, many characteristics endowed to living systems in previous theories are revealed to exist only inside the perspective of the observer and his domain of description. From here, Maturana and Varela made a radical move to dispense altogether with the perspective of an exterior observer. The list of things they excluded from the organization of living systems runs long: teleology, function, development, time, and even the notion of input and output of systems. When seen from its own standpoint, the operation of a living system is a closed network of processes of production (transformation) of components that produces the components that continuously regenerate the network of process that produced them—once activated, it might be added. Maturana and Varela stick to the forefront edge of the production process, describing happenstances only as they emerge and letting them go without retaining them in time: "the organism always behaves in the present."[19] The actual, physical components, along with the static,

[17] Mumma, ibid.

[18] See for instance: Heinz von Foerster, et al. eds, *Cybernetics of Cybernetics* (Urbana, IL: University of Illinois, Biological Computer Laboratory, 1974).

[19] Humberto Maturana and Francisco Varela, *Autopoiesis and Cognition: The Realization of the Living* (Dordrecht, Holland: D. Reidel Publishing Company, 1980), 24.

spatial relations between them—which autopoiesis calls 'structures'—are mere products of the process of production, and not the other way around. Maturana and Varela claimed that this notion of autopoiesis was the necessary and sufficient to characterize living systems.[20] It was not only that living systems are autopoietic, but any system that is autopoietic, is living.

Only a small adjustment is necessary and sufficient to describe Tudor's compositions that compose themselves as autopoietic systems, and thus as living: to regard not his instruments, but the sound/signal they produce through their listening processes, as components of the system. For the instruments, after all, are already composed and composited before the concert. What becomes spontaneously composed in performance is a processual network of generation, transformation, and perception of sound/signals that produces the sound/signals that continuously regenerate the same network. The perpetual life of listened sounds and sound listening forms a topological closure that can neither be reduced to the architectural space where the concert is held, nor to the physical configuration of instruments.

Contrary to Maturana and Varela's attempt to exclude any trace of an external observer in accounting for systems, however, the existence of an autopoietic system depends largely on what the observer defines as the 'component' of a system. Rather than being an accurate description of living systems, the autopoietical approach is primarily a heuristic device. That is to say, the observer's choice for what to describe as an autopoietic system is a choice, and therefore never neutral. The gain of connecting autopoiesis to Tudor's music (or more accurately, to the account of his music) is not so much in what it enables, but in what it fails to explain. Maturana had begun his introduction to the book *Autopoiesis* with a poem that the biologist wrote when he was a first year medical student. The poem—which the author admits is "not a very good one"—starts by posing two questions: "What is death for the beholder?/What is death for the dying?" It ends with a single proposition: "And life without death is only emptiness."[21] But the theory he developed as a scientist did not reflect his concerns as poet. Death is the ultimate outside of the autopoietic closure, strictly correlated to external observation. As far as system itself was concerned, it would simply live permanently until it did not. Life without death is a tautology and thus empty (of meaning), indeed: "Since the relations of production of components are given only as processes, if the processes stop, the relations of production vanish."[22] Next to this issue of death (the impossibility thereof) was another, similarly ordinary phenomena that autopoiesis just could not describe: the

[20] Maturana and Varela, ibid., 82.
[21] Maturana and Varela, ibid., xi.
[22] Maturana and Varela, ibid., 79.

multiplicity of autopoietic systems that gather together to form an aggregate system. Maturana and Varela spent more than a decade trying to explain how an operationally closed living system which knows no outside or inside could find its other, and conjoin to form another system like itself without losing its autopoietic nature.[23]

The external observer can clearly see how these two conundrums of autopoiesis are coupled. For death and multiplicity are both phenomena that can only be observed from a view outside a given, singular living system. The multiplicity of systems is the multiplicity of exteriority from where an observer can account for their deaths. The autopoietic account of Tudor's music thus fails to describe the difficult yet inevitable ending of performances, as well as the difference between one work and another. For Tudor's music did reach a halt every evening and the composer always composed a new work. The question is never quite as simple as whether a system is autopoietic and thus living. The question is rather which system is to be described as autopoietic, when, and why. And the particularities of the answer necessarily pertain to an observer who is free to make that choice because he is free from the choices themselves.

5

In 1976, Tudor wrote a short manifesto-like text entitled "The View from Inside," for the program note of his concert with 'Composers Inside Electronics':

> Electronic components & circuitry, observed as individual & unique rather than as servomechanisms, more & more reveal their personalities, directly related to the particular musician involved with them. The deeper this process of observation, the more the components seem to require & suggest their own musical ideas, arriving at that point of discovery, always incredible, where music is revealed from 'inside,' rather than from 'outside.'[24]

The words which describe electronic components as non-subservient and the gaze that sees their personalities, accord well to Mumma's 'Notes on Cybernetics.' But

[23] Niklas Luhmann solved this puzzle by simply regarding the social system as an entirely different autopoietic system whose components were not humans, but communication. Humans were not components of society, but rather formed its "environment." See for instance: Niklas Luhmann, "The Autopoiesis of Social Systems," in *Sociocybernetic Paradoxes: Observation, Control and Evolution of Self-Steering Systems*, eds. F. Geyer and J. Van d. Zeuwen (London: Sage, 1986), 172-92.

[24] David Tudor, "The View from Inside (1976)," Los Angeles: David Tudor Papers, Getty Research Institute, Box 19, Folder 11.

the topological trope here addresses the depth of observational process of circuitry, and not the immersion into sounds with a life of their own. This view from inside, in other words, is the view of the 'composer' who delves into his components to discover a new music through his observation, and gives a name to a particular musical idea to distinguish it from another. In this way, he produces a unity of 'composition' that cannot be reduced to the instantiations of its performed life. And as a composer he will indeed produce many of them throughout his life.

The earlier description of the nature of Tudor's composite instruments was generic. It was intended as such to form a correlative to the level of observation that saw the interminable life of sounds. But there is an 'inside,' located outside of the autopoietic process of production. And Tudor's observation of 'life' oscillated between these two insides. "There's always a certain point where the work that you do to realize these musical ideas, all of a sudden it has a life of its own, and that's the point where I decide that it's my musical composition. When it's living for itself then I feel, 'Okay, I can sign my name to that.'"[25] In a peculiar manner, the composer obtained a work that belonged to him at the very moment it left his hands. Then, relieved of his duty, the composer would become a performer within his composition that now lives for itself: "when the process is really living, I can set to work and not really worry about it"[26] But before this life is fully composed, the observer encounters components quite other than autopoietic sounds within Tudor's 'view from inside': electronic objects.

6

There are two primary archives for Tudor's materials. One is the David Tudor Papers at the Getty Research Institute (GRI) in Los Angeles, storing 177.5 linear feet of his paper documents which include sketches, schematics, notes, diagrams, letters, magazine cutouts, photographs, articles, recipes (Tudor was a virtuosic cook of Indian food), realization scores from his pianist days, as well as recordings from tapes that Tudor owned. The other is the World Instrument Collection at Wesleyan University which has assembled more than 500 of Tudor's electronic instruments and equipments.[27] These are a mixture of devices,

[25] David Tudor and Bruce Duffie, "Presenting David Tudor: A Conversation with Bruce Duffie (April 7, 1986, Chicago)," http://www.bruceduffie.com/tudor3.html (April 1, 2014).

[26] Tudor and Duffie, ibid.

[27] There was a significant amount of instruments at the basement of Merce Cunningham Dance Company, but these have been surveyed and transferred to Wesleyan in April 2012. The Cunningham Dance Company also holds a substantial amount of

many made by Tudor himself, some by others (including Gordon Mumma, John Fullemann, and John Driscoll), along with a large number of commercial equipments (mostly guitar pedals that the composer heavily used from the late-1970s onwards). Going back and forth between California and Connecticut, I have been conducting research with aims to 'revive' some of Tudor's works.[28] Inside each archive, one must switch back and forth materials on at least three levels to discern the operative mechanism of each composition: A) the individual instruments, B) the composite instrument formed by connecting multiple instruments, and C) the performance of it all. Different materials exist on each scale of observation, the details of which I am relegating to footnotes here.[29]

---

documentation of their works over the years which include many of Tudor's compositions.

[28] This project, which began as a personal endeavor, is now coupled with a larger project led by John Driscoll from 'Composers Inside Electronics.' My investigation on the *Weatherings* material was initiated under this context, especially through exchanges with Phil Edelstein. I thank Driscoll and Edelstein for their generous support and encouragement on my research. I have chosen to limit my description to my own trajectory and findings in this paper, however, since the group project is quite diverse and still at its preliminary stages for me to give a generic account from my individual perspective.

[29] Some of important categories of documentation in the archives are as follows:

Rogalsky's List: As for the instruments at Wesleyan, there is a comprehensive list of devices that Matt Rogalsky painstakingly put together in 1999. The state of preservation differs greatly from one instrument to another: some are utterly dysfunctional, other still operative. Many of the custom-built devices remain unknown as to their function. Rogalsky's essential document compiles, whenever possible, the presumed function, designer, related composition, date, and a description for each device. It also includes a note on the sounds that came out when it was activated (though often times with no results, or just noise). For several relatively simple instruments, Rogalsky also wrote down their interior circuitry. Inside the Getty archives, a vast number of sketches for miscellaneous schematics exist, along with cutouts of articles from popular electronics magazines. My research has identified many of these as corresponding to the Wesleyan instruments.

Diagrams: Since the late 1960s when he started composing his own works, and throughout the next decade, Tudor created neat block diagrams for the connection of components. The difficulty with these diagrams is twofold. First, the components are marked by idiosyncratic symbols or with equally enigmatic acronyms. Secondly, the composer was known to constantly change his components from one performance to another, even when performing the 'same' piece. So not only the accurate identification of each component is questionable, the notion of identity is in itself an issue. But these two issues might be complementary: the level of abstraction attained by the unconventional symbols in the diagram is in a way a practical method to notate the variety of actual, physical components that can fill in that particular function. The true omission of these

Rather than giving a general description of the materials, I choose to offer a 'field report' drafted from the localized perspective moving inside the archives, with a focus on a singular piece.

Instigated by exchanges with John Driscoll and Phil Edelstein from 'Composers Inside Electronics,' I delve into the materials of *Weatherings,* a work from 1979, which accompanied Cunningham company's dance *Exchange*. A diagram showing the configuration of components is contained in the 'Weatherings' folder of the Getty archives (Box 3, Folder 38). [Figure 1]

---

diagrams actually lies elsewhere: it does not depict the placement of loudspeakers which was crucial for Tudor's works, nor any other details concerning the implementation of the work within the physical space.

Matrix Maps: For most of the pieces after the 1980s, Tudor seemed to have abandoned the diagrams. Instead he made a list of inputs and outputs to the matrix switcher. D'Arcy Gray has addressed these lists as "Matrix Maps" (D'Arcy Gray, "David Tudor in the Late 1980s: Understanding a Secret Voice, " *Leonardo Music Journal* 14-1, (2004): 41-48). Matrix switcher allowed Tudor to control and rapidly shift the connection of any input to any output, and was used as the kernel of almost all of his compositions from this period. Matrix Maps are more specific in their information, but therefore less definitive, and do not convey the sense of relatively fixed configuration as the diagrams do.

Sound Sources: Tudor alternated between works of no-input—in which components chained into a feedback network would operate as a giant oscillator, triggering sounds from inside its circuitry—, and works that used recorded sound sources, which were input to the chain of components for various modulation. There is actually no distinction between these two types of works when the entirety of the performance is seen as a system and the performer as one of its component. For then, what he does, including the playing back of a taped sound source, pertains to the internal operations of the system. In other words, the existence of input and output is correlated to the scale of observation, and what is observed as composition. But for the observer trying to revive Tudor's pieces, the identification of sound sources is absolutely necessary. In many cases this can only be achieved by a close listening to available recordings of performances. In some rare occasions, one can find a list of tapes that Tudor wrote down for a particular performance. The specific maneuvers Tudor conducted to 'influence' the other components and to keep the sounds going during the performance is very difficult to discern. There are only a couple of notes describing what he did at what time during a particular performance can be found—presumably written out after the concert, listening to a tape recording. In all other cases, the trajectory of a performance can only be followed through a comparative listening to the various recordings.

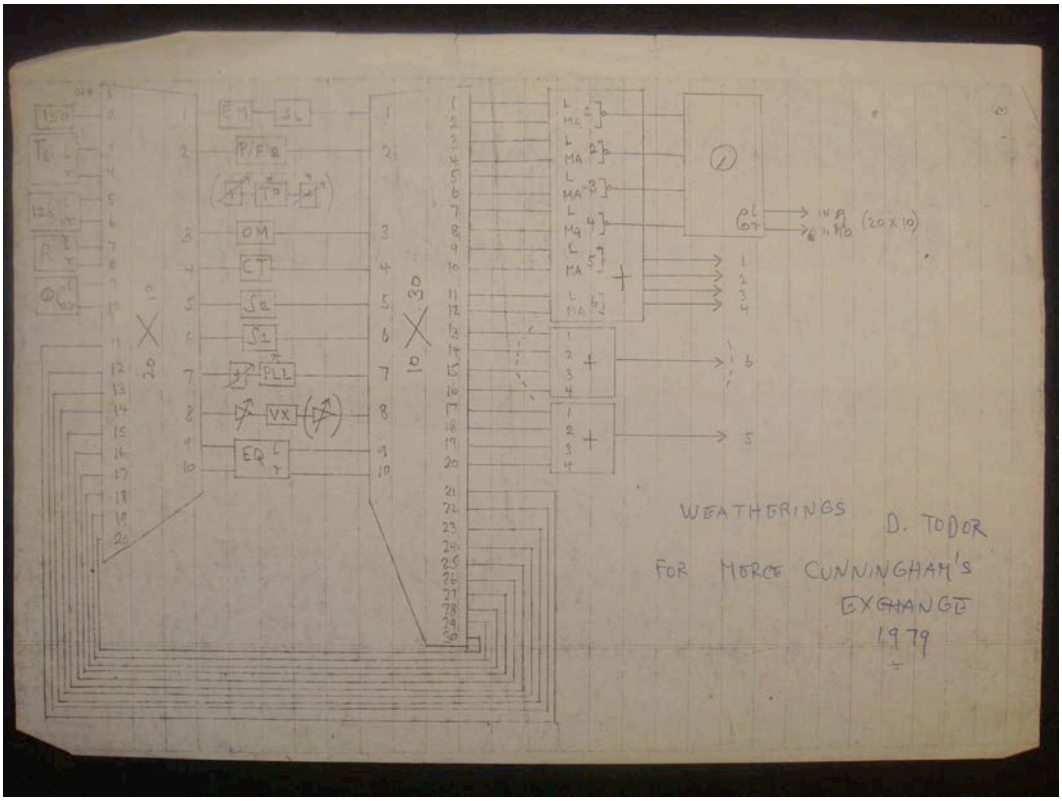

Figure 1 - Weatherings (1979), Diagram (Box 3, Folder 38)

The Getty Research Institute, Los Angeles (940039)

The components, consisting mostly of commercial devices, are laid out around two matrix switchers—one with 20 inputs and 10 outputs, and the other with 10 inputs and 30 outputs. Matrices allowed Tudor to control and rapidly shift the connection of any input to any output in performances, and were used as kernels of almost all of his compositions from this period. There are 4 tape recorders going into the inputs 2 to 8 of the first matrix switcher, and 10 devices inserted in between the two matrix switchers. 10 outputs from the second matrix feed back into the input of the first, while the rest goes into 6 loudspeakers through 3 mixers. 4 outputs from one mixer are panned and routed back into the first matrix switcher. The 10 modulating devices between the two matrices are marked by acronyms. Some are easy to discern (such as "EQ" for an equalizer), others are enigmatic. In order to identify the less obvious components, I go through an inventory of Tudor's equipments dated 'July 1979,' found in another part of the archive (Box 30), presumably drafted for custom declaration when the composer

toured with the Cunningham company. [Figure 2] By comparing the names of components listed in this document with the acronyms, I am able to decipher most of them ("EM" = Maestro Envelope Modifier, "SL" = Electro-Harmonix Silencer, "TP" = Electro-Harmonix Talking Pedal, "OM" = Electro-Harmonix Octave Multiplexer, "CT" = Electro-Harmonix Clone Theory, "S1" and "S2" = Paia Synthespins, "PLL" = Phased-Locked Loop).

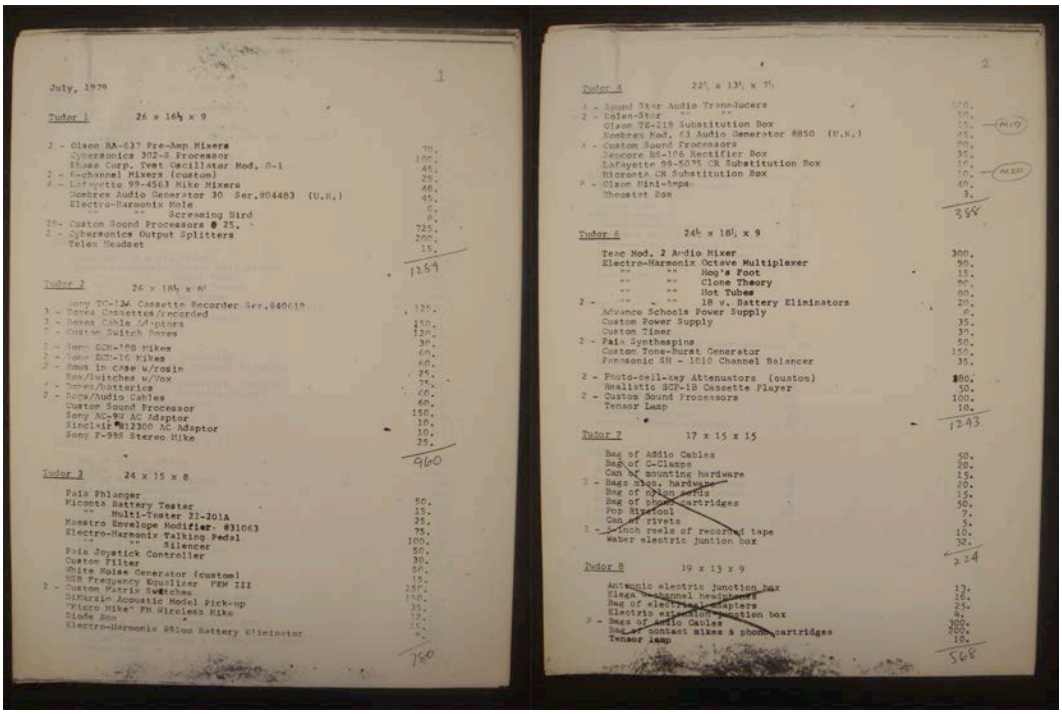

Figure 2 - Equipment List from July 1979 (Box 30)

The Getty Research Institute, Los Angeles (940039)

At this point, one component remains unidentified: "P/F," which is inserted in between output 2 and input 2 of the two matrices. No device from the inventory seems to correspond to these initials. So I assume it must be one of the "24 custom sound processors." But the search reaches a halt here. Days go by without any advancement. But then, one day, as I go through a completely separate section of the archive (Box 43, folder 6), I notice instruction notes for several components that were used in *Weatherings,* such as 'the Silencer' or 'Clone Theory.' Close to these notes, I find several cutout pages from a 1970s kit manual that contains schematics and board layouts for building a 'Phaser/Flanger'—"P/F." [Figure 3]

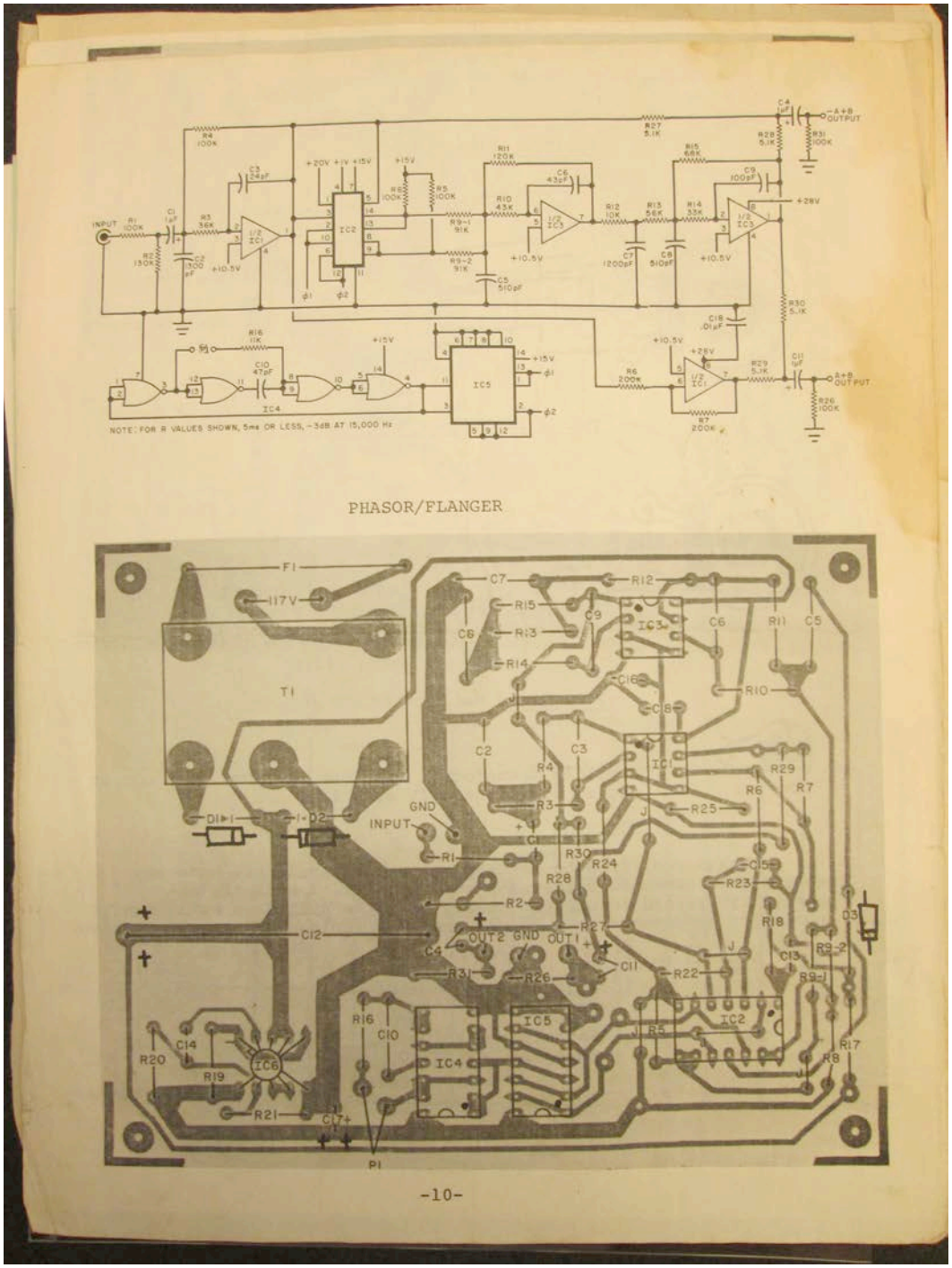

Figure 3 - Phaser/Flanger, Schematics (Box 43, Folder 6)

The Getty Research Institute, Los Angeles (940039)

I then try to identify if there is any device out of all the instruments at Wesleyan that corresponds to this particular 'Phaser/Flanger' circuit. By comparing the board layout with actual circuit [Figure 4], I manage to locate the box: It is the instrument labeled '0039,' which had previously been assumed to be a filter. [Figure 5] In fact, when I check the RCA jack inputs and outputs on the back of the device, I see that they are labeled "P/F OUT -A+B," "P/F IN 1" and so on. [Figure 6] Since a phaser/flanger delays the input signal and mixes it onto the signal itself to produce a sweeping effect, the "D OUT" "D IN" labels stand for the 'delay' function. The peculiar algebra ("OUT A+B") corresponds to another function of the phaser/flanger, which can simulate stereo sound from a mono source, by sending a phased output derived by adding the delayed signal to one channel, and sending another output derived by subtracting the delayed signal to the other. From the way Tudor had written out the algebras, I deduce that the same device must be the component notated as "a-b/a+b" in the diagrams of *Toneburst* (1975) and *Pulsers* (1976-78)—two works immediately preceding *Weatherings*. [Figure 7] In both cases, the "a-b/a+b" box receives one input and outputs two, thus matching the function of simulating stereo from a mono source.

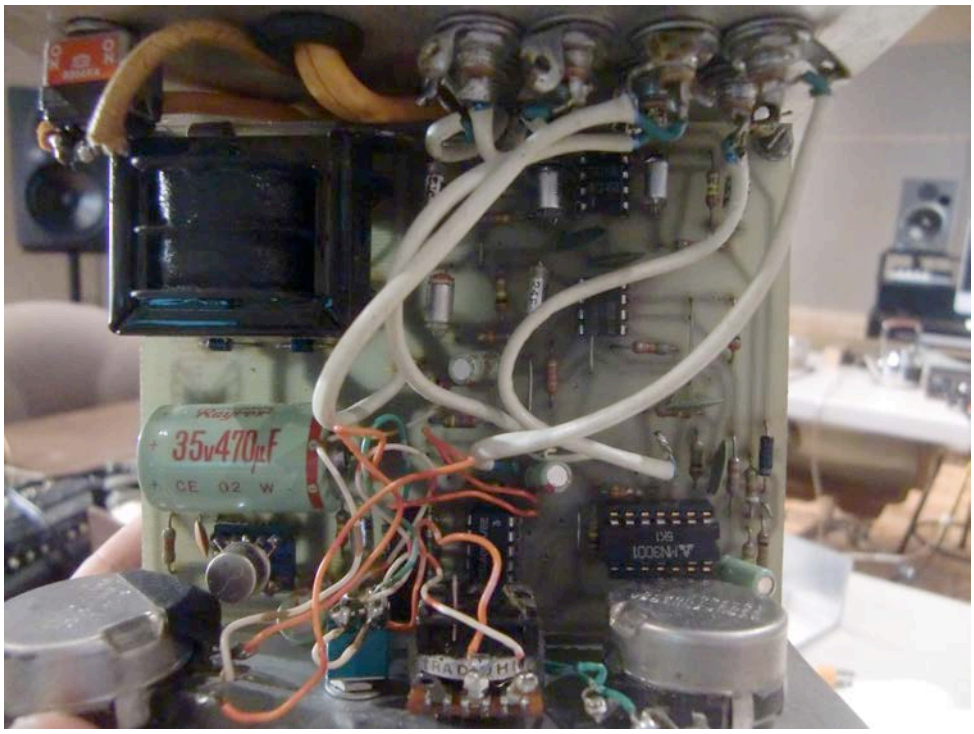

Figure 4 - Phaser/Flanger (Instrument '0039'), Circuit

World Instrument Collection, Wesleyan University

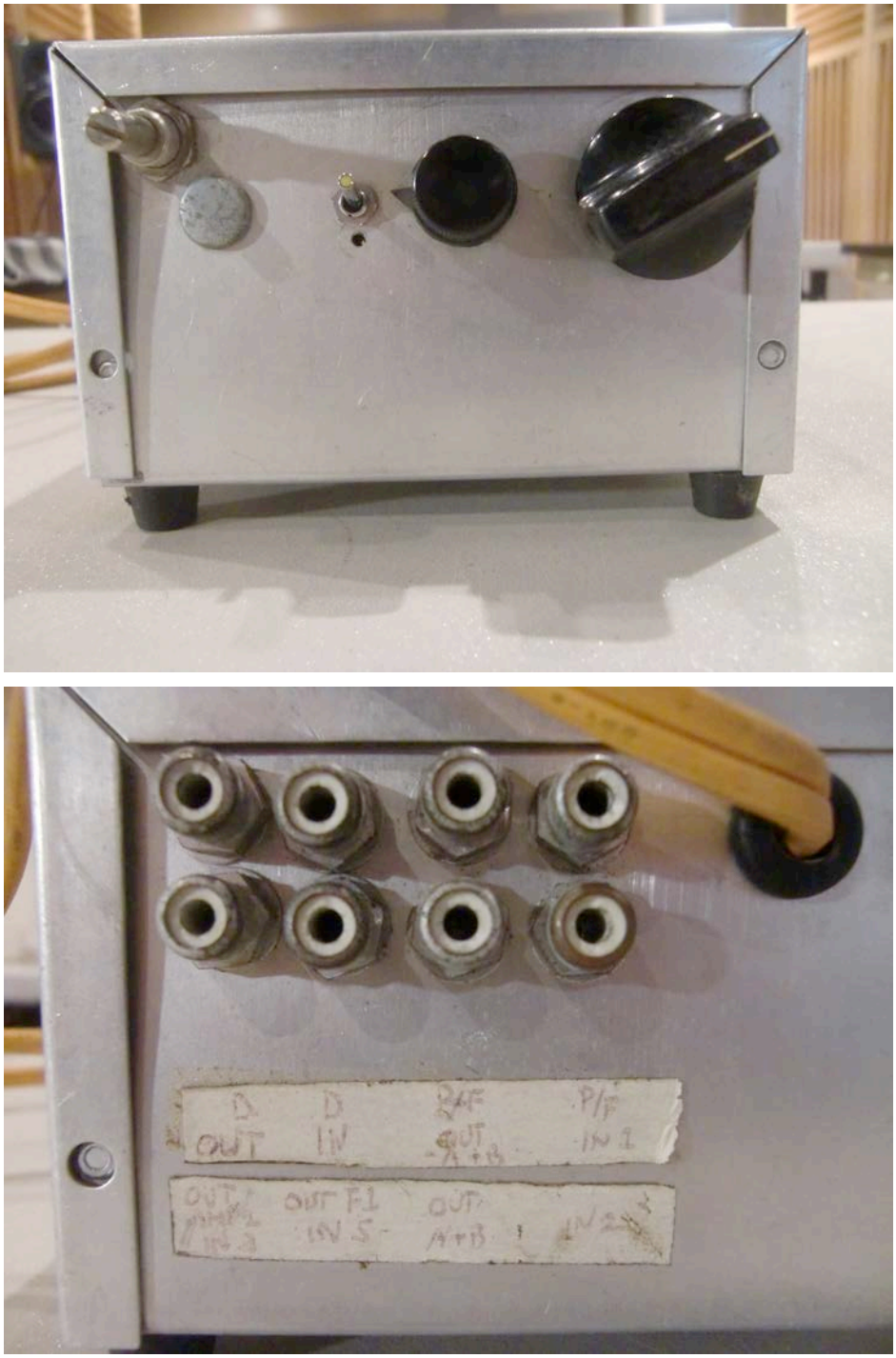

Figure 5 and 6 - Phaser/Flanger, Front and Back
World Instrument Collection, Wesleyan University

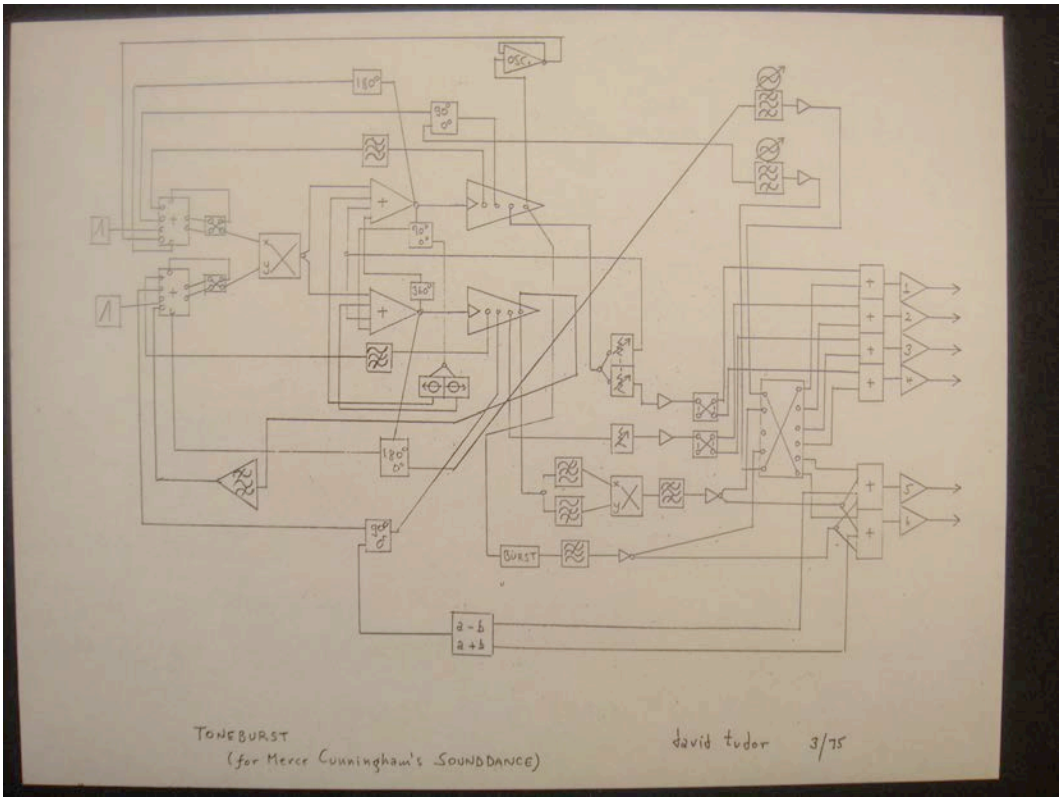

Figure 7 - Toneburst (1975), Diagram (Box 3, Folder 34)

The Getty Research Institute, Los Angeles (940039)

At this point, I have identified all the abbreviations of components in the diagram. But two pieces of information are still lacking to connect my findings to actual performance: the identity of sound sources played from the tape recorders, as well as the temporal outline of performance. As I go through folders in Box 4 at the Getty archive, which assembles unidentified sketches and notes, I come across a list of sound sources (and EQ settings) for *Weatherings* (Folder 11). [Figure 8] The abbreviations of sound sources are not difficult to decipher, and are all included in the recordings stored at GRI: "W. CHG SLO" = Wasp Chewing Slow, "W. CHG N" = Wasp Chewing Normal, "BK" = Brooklyn Kids, "EM" = EEG modulated, "AL. A/F N" = Alpha Amplitude Modulation/Frequency Modulation Normal, "Dd. AL." = Demodulated Alpha, "M, t.t. N." = Mosquito in test tube normal. In another folder nearby (Folder 7), I find a note taken by Tudor while listening to a recording of a *Weatherings* performance. [Figure 9] It lists up timings for the playback of various sound sources, activation of components, and

description of events. The corresponding recording might be the performance at Ohio State University on May 6, 1981, also archived at GRI.[30] Several things do align—especially notable are the entry points for 'modulated EEG' (at 5:50), and 'Demodulated Alpha' (which happens not at 9:45 but around 10:08). But the correspondences seem to decrease towards the latter half of the recording, so it may have been from another, similar performance (or the Ohio State University performance could have partially followed this note).[31]

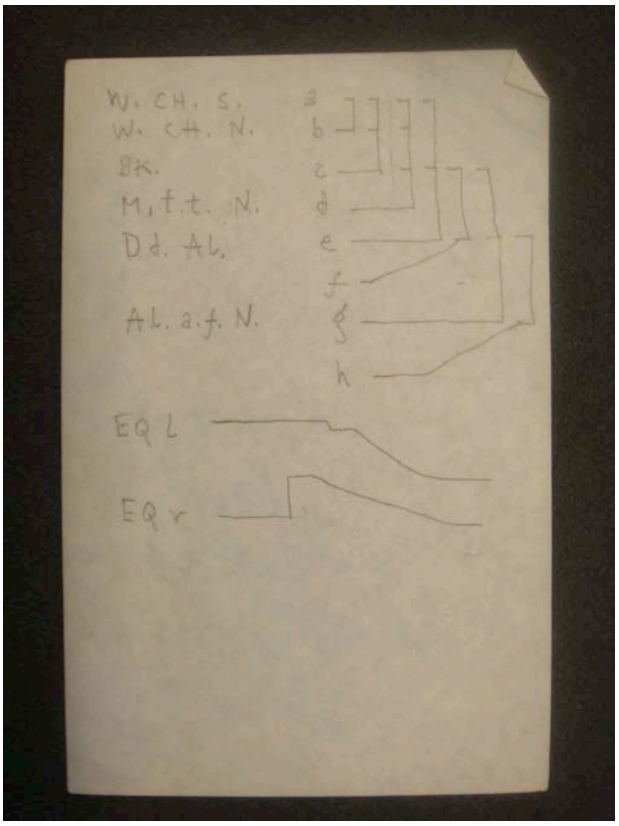

Figure 8 - Weatherings, Tape Sources (Box 4, Folder 11)

[30] David Tudor, "Weatherings, [Ohio State University], 1981 May 6," Los Angeles: David Tudor Papers, Getty Research Institute, Box1A, C12. Digital version available on the GRI website: http://hdl.handle.net/10020/980039_c012 (April 1, 2014).

[31] It was customary for Tudor to not only to vary his performances of a given piece from one concert to another, but also to constantly switch his components. Therefore, the definitive status of a block diagram must always be questioned and examined in comparison to many other diagram sketches, some of which also display intermediary stages from one piece to another.

(940039)

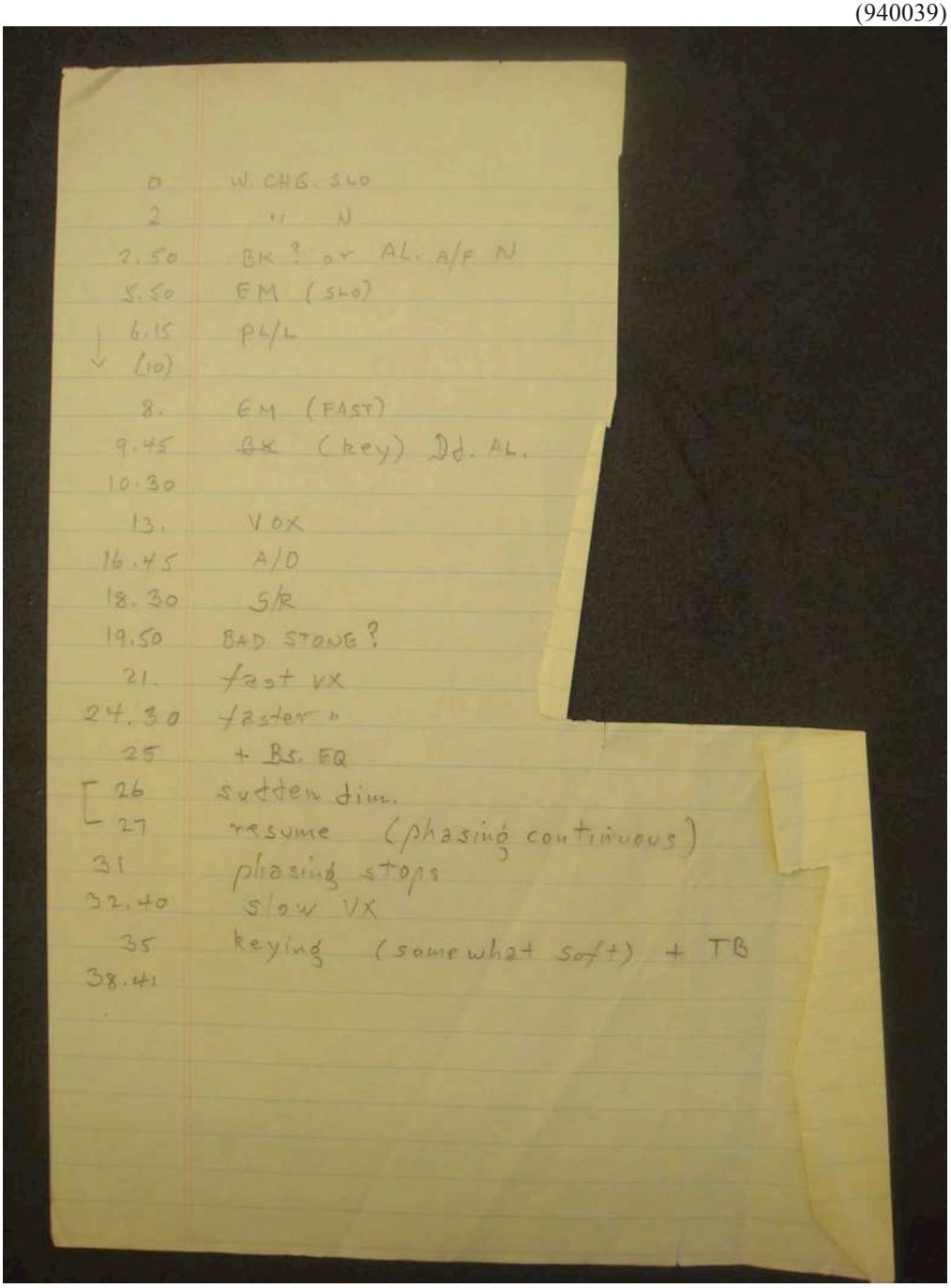

Figure 9 - Weatherings, Time Table (Box 4, Folder 7)

The Getty Research Institute, Los Angeles (940039)

7

These meanderings portray a difficulty of sorts. Along with the gaze that moves through different scales of observation, the identification of what an 'object' is constantly shifts. And life and death are matters correlated to this movement.[32] The view from inside a specific device sees a network of electronic components—resistors, transistors, capacitors, transformers, ICs, potentiometers, and so on—some of which might be dead and others living. Observation on this level has its corresponding documentation in the form of schematics, connection diagrams, kit manuals, notes that list up resistor values or IC part numbers. Once outside of the device the observer now sees the network composed by this and other devices. Components are now on the level of devices such as mixers, modulators, oscillators, amplifiers, loud-speakers and so on, that one traces through with the aid of block diagrams, matrix maps, or photographs of Tudor's tabletop settings. Firing up components would constitute yet another domain of interiority.

[32] People often speak of instruments as being either alive or dead, depending on their general popularity or abandonment. Edmond Johnson traced the remarkable revival of the harpsichord starting from around the turn of the twentieth century, carefully analyzing the metaphors of life and death used to portray the fate of an instrument: "Whereas it might seem strange to speak of an instrument as having acquired an 'independent life,' the harpsichord's peculiar history had long attracted similar patterns of speech. As far back as the middle of the nineteenth century the instrument's abandonment was described in terms of death or even extinction, and during its subsequent revival the harpsichord's modern history has been written with terms borrowed liberally from the lexicon of rebirth and resurrection. Indeed, the last two centuries have seen the instrument widely represented, both verbally and pictorially, with figurations that invoke either life or death" (Edmond Johnson, "The Death and Second Life of the Harpsichord," *Journal of Musicology* 30, no. 2 (Spring 2013): 181). The facility of this figure of speech in relation to harpsichords is derived directly from the ease with which an observer can differentiate a harpsichord from other instruments, if not families of instruments, through their mechanism, sound, history, associated music, usage, and/or definition. Harpsichord is not a piano, and it is certainly not the *Goldberg Variations*. But Tudor's work complicates this schema, or rather, exposes its inherent indeterminacy. For in Tudor's music, the notion of 'instrument' can refer to individual devices, or the configuration of devices; as the notion of 'work' may encompass the configuration of instruments, and/or the performance. Moreover, the boundaries between one scale and another are not always clear. Just as several different instruments are chained to create one work, several works may use one specific instrument repeatedly (like the 'Phase/Flanger' which appears in *Toneburst*, *Pulsers* and *Weatherings*). The configuration of components often changed from one performance to another, while remarkably similar assemblies of instruments were given different titles and hence identified as different works.

The trajectory of observation thus decomposes compositions. The boundary between inside and outside is defined by scale and not space. Once the observer is 'inside' an object of a particular scale, the object disappears (or turns into the 'environment') and new objects appear in its interiority. Once 'outside' of it, an object withdraws from contact, concealing an interior not visible from the exterior and thus inexhaustible to observation. The existence of objects on multiple scales, in other words, renders a view from inside (of a certain object) to become, at the same time, a view from outside (of another object). Observation sets scales just to cross them over and turn them indeterminate by its own movement.

8

The strange relationship between the observer and objects thus observed can be connected to recent theoretical endeavors of Graham Harman. The tenet of his so-called Object-Oriented Ontology (OOO) is that objects withdraw from all relations—with humans, as well as other objects. Harman sees this withdrawal as constituting the 'inner life' of objects that is secluded from all external access, and inexhaustible to external observation. All relations between objects and humans, and among objects themselves are thus never direct, and must always be formed through a 'vicarious causation'—mediation by and within a third object. But relations never reach the internal life of an object, and only serve to distort its realities: "We distort when we see, and distort when we use. (…) It is not human consciousness that distorts the reality of things, but relationality *per se*."[33] This ontological schema could perhaps be connected to Tudor's music to explain the role of objects which serve as the infrastructure for the life of sounds that compose themselves. Sounds as well as signals emerge as distortions through the mismatched and indirect relations that components enter into. More accurately, sound/signal is distortion that *is* the relation, and thus constitutes the third object through which components can encounter. And as an object, it also withdraws from the perception of any other object-component. If this withdrawal of sounds from the components is seen as constituting a life of its own, then autopoiesis can happily take over the story from there.

In fact, the philosophy of object orientation reads much like autopoiesis written in reverse. They first of all share the same premise: a strict closure on the side of objects (machines) with inner lives that in no way can be reduced to the description of the observer. From there, they pace in contrary directions. Whereas autopoiesis delves into the closure to depict its operations from within, OOO adheres to the position of the exterior observer. On one side there is only a view

[33] Graham Harman, "Vicarious Causation," *Collapse* II (London: Urbanomic, 2007): 193.

from inside to account for living systems, and on the other, there is only a view from outside to contemplate objects with inner life. Accordingly, the continuity that is life is defined in extreme positivity (tautology of the view from inside) in autopoiesis, which OOO flips around to a dedicated negativity (irreducibility to the view from outside). Once the basic frame of description is thus set, application follows suit—the condition of interiority and exteriority is generalized. Thus, OOO distributes the status of external observation to all objects, whereas autopoiesis reflects on the act of cognition as a production process that produces its own components. True, the biologists proceed with more caution, since they had started their inquiry by the paradoxical move of abandoning the status of the observer. For the philosopher who never really left his ground, the observer becomes an unexamined premise in the composition of his narrative. Consequently, the sensitivity to the gaze of observation and language of description in autopoeisis becomes coated by an utmost indifference in Harman's philosophy.

This withdrawal *of the observer* leads to an explosion of what the philosopher can account for. Harman's objective is an inquiry into "an ontological feature of objects *in general*,"[34] which is to say, "the basic structural features shared by *all* objects"[35] [emphasis added]. But the generic totality here is more a matter of definition than observation. Admitting that 'marbles' "may not be 'marbles' for anyone but humans or playful kittens," Harman nonetheless provides a peculiar excuse to his generalization: "we need a nickname for the united object that we draw into our games."[36] But if they are not 'marbles' for anyone but humans or kittens, why the presumption that they are "unified objects" at all? The simple answer is because the philosopher *defines* 'objects' as such. Claiming that all objects in general conceal an inner life that cannot be accessed from the outside, does not release them from their correlation with humans—it merely turns the relationship into one that is defined negatively. The general and negative realism of objects is thus consumed under the transparent and determinate authority of the observer and his language of speculation.

The secret withdrawal of the observer in Harman's account is staged explicitly in Maturana and Varela's writing. But as they leave behind the domain of description, they leave it intact. The line between the exteriority of the observer and the interior of the observed system is maintained as forever determinate, providing a space in which the philosopher may later dwell. The view from inside and the view from outside are thus not only contrary, but also complementary. But the position of the observer is neither here nor there. It is not as stable as

[34] Harman, ibid., 205.
[35] Harman, ibid., 204.
[36] Harman, ibid., 205.

object-oriented ontology claims, and not as easily dismissible as autopoiesis desires it to be. Observation stays neither in nor out. It proceeds by decomposing the very boundaries between inside and outside that it composes—decomposing objects into environments, and composing environments into objects. The interiority of observation is this view that traverses and oscillates indeterminately between a view from inside and a view from outside. And the indeterminacy of the observer is that of objects, for observation is the distorted relation between one thing and another. The immanence of life is located neither inside an object nor inside a process, but inside the oscillation between processes and objects. The view from inside, in other words, is a matter of time.

9

Maturana and Varela attempted to dissect the 'influence' of the observer in their description by reducing the time of systems to its minuscule, singular point of operation: the atemporal present. But object orientation offers a contrary path to the same problem (the relativization of the notion of time introduced by the observer) by opening up the time of objects to its maximum diversity and multiplicity. This path was cultivated not so much by the philosopher of our century, but by computer scientists and programmers of the past century working around the same time as Tudor or Maturana and Varela, from whom Harman presumably derived the name of his project ("Of course, philosophy is about opinion and engineering about deeds"[37]).

Object-oriented programming was a revolutionary approach in computer science primarily developed by Alan Kay circa 1970. It replaced the previous top-down programming paradigm with a method of computing that arises from the interaction of closed smaller elements called 'objects' which encapsulated a certain useful structure. Kay imagined each 'object' as being "a recursion of the entire possibilities of the computer."[38] Thus, the difference of scale between the computer as an object and objects within computers is again entwined with the movement of the observation. "In effect, he started out to build a computer language that would enable the programmer to look at the host computer not as a serial instruction follower, but as thousands of independent computers, each one able to command the power of the whole machine."[39]

---

[37] Alan Kay, "The Early History of Smalltalk," *ACM SIGPLAN Notices*, Vol. 28, No. 3 (March 1993): 71.

[38] Kay, ibid., 71.

[39] Casey Alt, "Objects of Our Affection: How Object Orientation Made Computers a Medium," in *Media Archaeology: Approaches, Applications, and Implications* (Berkeley, CA: University of California Press, 2011), 287.

As the notion of whole became distributed among the various objects, a new conception of time emerged. Instead of the linear universal time that proceeds step by step aligning the program from outside, time now had to be embedded inside each object. As Casey Alt noted, this idea of assigning different times to each object is most apparent in the notion of 'late-binding.' In comparison to the method of 'early binding' in which all the variable name linkages are determined before the execution of the program, 'late binding' leaves the reference linkage of each object undetermined until the run-time of the program. As a result, "late binding allows the object to remain open and 'wait' for messages."[40] This 'waiting' creates "an internal, subjective duration specific to each individual object," which "opens up the ability for programmers to infuse their programming objects with affect."[41] What accords life to objects here is neither its continuous operation nor its eternal withdrawal. It is the indeterminate duration of 'waiting' that cannot be computed within a singular universal time.[42] There is latency inside the object, between the input and output, as there are temporal gaps between objects. Life is conditioned by a state that would be difficult to distinguish from dormancy or death to an observer with no patience.

[40] Alt, ibid., 294.

[41] Alt, ibid., 296.

[42] The operative mechanism of object-oriented programming, as well as the analogy of workers building without a universal plan, have a striking resemblance to the music of Christian Wolff. In his works from the 1960s, Wolff set up an intricate system of cues, wherein the performers' playing of a certain material was conditioned by the perception of a particular sound event. A whole composition, in other words, structured by individual performers waiting for the occurrence of a given particular position and relation. Naturally, the mismatch between what is played and what is heard renders the whole performance indeterminate. It is always possible for a performer to mishear his cue, or the performance to halt because all performers are waiting for each other's sound. Wolff's compositions were closely connected to Tudor. The system of cues, which forces the performer to make decisions in real time, was partially created in order to cope with Tudor's tendency as a pianist to prepare and determine all the details of his performance in advance. Tudor in return singled out the importance of Wolff's music, even after he turned to electronic music: "Christian Wolff never delineates a universe. He deals with possibilities which one could use if one wanted to. That's what is so beautiful about his pieces, because they don't express a composite view " (Tudor, "From Piano to Electronics," 25). As mentioned earlier, in footnote 11, the only non-electronic piece in the repertoire of 'Composers Inside Electronics,' was Wolff 's *Changing the System* (1972).

10

This view of objects in wait not only modifies the general, determinate negativity of object-oriented ontology into a specific, indeterminate mechanism; it also adds a critical twist to the account of autopoiesis. Towards the end of his paper 'Biology of Cognition,' which preceded his collaborative endeavor with Varela by three years (but later included in the same book), Maturana gave an analogy to the difference between the actual operation of living systems and that described by the observer:

> Let us suppose that we want to build two houses. For such a purpose we hire two groups of thirteen workers each. We name one of the workers of the first group as the group leader and give him a book which contains all the plans of the house showing in a standard way the layout of walls, water pipes, electric connections, windows, etc., plus several views in perspective of the finished house. The workers study the plans and under the guidance of the leader construct the house, approximating continuously the final state prescribed by the description. In the second group we do not name a leader, we only arrange the workers in a starting line in the field and give each of them a book, the same book for all, containing only neighborhood instructions. These instructions do not contain words such as house, pipes, or windows, nor do they contain drawings or plans of the house to be constructed; they contain only instructions of what a worker should do in the different positions and in the different relations in which he finds himself as his position and relations change.
>
> Although these books are all identical, the workers read and apply different instructions because they start from different positions and follow different paths of change. The end result in both cases is the same, namely, a house. The workers of the first group construct something whose final appearance they know all the time, while the workers of the second group have no views of what they are building, nor do they need to have obtained them even when they are finished. For the observer both groups are building a house, and he knows it from the start, but the house that the second group builds lies only in his cognitive domain; the house build by the first group, however, is also in the cognitive domain of the workers.[43]

[43] Maturana and Varela, *Autopoiesis and Cognition*, 53-54.

But this analogy distorts autopoiesis' longing for the purity of circular production. For if the thirteen workers, in the absence of a universal program, only follow instructions that are activated when and only when a particular position and relation is attained, then there is nothing to determine in advance how long the building process will take. The particular situation necessary to trigger the next action may not occur for an indefinite amount of time. The workers must then simply wait. The production process might still be in operation, but at a speed too slow that it escapes cognition. Life defined by waiting renders the very distinction between life and death indeterminate. Maturana probably did not consider autopoietic systems that would take years to produce the next production. Although a perfectly logical possibility that is derived from his own analogy, the idea of a living system that only breathes (so to speak) once every decade or every century goes directly against the biologist's tendency to imagine the life of systems from the temporal length and speed of his own life. Autopoiesis did away with the primacy of physical space by accounting for spaces of autopoietic systems via topology. But the same kind of abstraction was never considered for temporality.

11

Artworks are created precisely to wait in the stead of humans who cannot. They are vicars that stand in for our impatience. To use Christopher Wood and Alexander Nagel's formulation, "The work of art 'anachronizes'"[44]—it is always belated, and it constantly lingers. But by dropping out of time and effacing the very notion of contemporaneity, "it points forward to all its future recipients who will activate and reactivate it as a meaningful event." Thus, the life of works in wait is a life that starts as an afterlife.[45]

---

[44] Christopher Wood and Alexander Nagel, *Anachronic Rennaissance* (Cambridge, MA: MIT Press, 2010), 13.

[45] It is for this reason that the perspective of media archaeology is pertinent, for instance when Wolfgang Ernst observes that technical media reveal their essence only in their operation, which can be 'activated' at any historical moment as long as they are functional. "There is no 'historical' difference in the functioning of the apparatus now and then. (…) 'Historic' media objects are radically present when they still function, even if their outside world has vanished. Their 'inner world,' is still operative" (Wolfgang Ernst, "Media Archaeography: Method and Machine versus History and Narrative of Media," in *Media Archaeology* (Berkeley, CA: University of California Press, 2011), 241). But the condition of waiting is not unique to technical media as Ernst claims, and the notion of media that he speaks of must be generalized. Even a Greek vase is not merely an archaeological object, but also a technical artifact that awaits activation.

The correlation between the (after)life of works and the possibility of their activation is, however, coupled with the indeterminacy of the observer who is always preoccupied with his own life, always in transit from one inside to another at its own pace—from one life to another, and thus from one death to another. Objects and art works are always partially dead because the observer (human and non-human) cannot wait, or waits for too long. In other words, death is an effect produced by the mismatch of speeds between systems. But so is sound, as noted above. That is why the lethal indeterminacy of observation and objects permeating the afterlife of Tudor's compositions outside the living present of his music, turns out precisely to be what operated *inside* his performances as they sprung into a life of their own. Latencies within, and in between, components and their partial influences upon each other (mutual listening processes) compose the atemporal and perpetually living present of autopoietic sound systems.

Tudor often claimed that the objective of his compositions were to discover the 'nature' of electronic components. The program note for *Untitled*, declared the piece as being "part of a never-ending series of discovered works in which electronic components are found to be natural objects."[46] A similar description was used to address the instrumental loudspeakers of *Rainforest*: "Each output mechanism has its own bias. So I must see what its properties are as a natural phenomenon, and not spend my time making it do something against its nature."[47] Each electronic component, each output mechanism (once composed), has its own nature, an "internal, subjective duration specific to each individual object," that can be 'discovered' (and perhaps 'influenced') through their use. Tudor's composition brings together objects of various natures with different speeds and latencies to form "an electronic ecology."[48] And this was an ecology, like any other ecology—constituted by deaths and processes of decomposition, partial and distributed around the network; difficult to see through, but with plenty to hear.[49]

---

[46] David Tudor, "Program notes for Untitled (1972)," Los Angeles: David Tudor Papers, Getty Research Institute, Box 3, Folder 35.

[47] Tudor, "From Piano to Electronics," 26.

[48] "Electronic ecology" was a term often used by Tudor to describe *Rainforest*. See, for instance: David Tudor, "Program notes for Composers Inside Electronics' concert at Fstival d'Automne Paris (1976)" Los Angeles: David Tudor Papers, Getty Research Institute, Box 19, Folder 11.

[49] There is a curious tendency that can be observed among theories of operationally closed systems such as autopoiesis, to resort to metaphors of sound and music to overcome a particular conundrum inherent in their theoretical disposition: namely, the plurality of closures, and the relationship between one closed system and another. The sonic domain, in other words, has continuously been summoned to articulate the mechanisms

12

The music that sprung to life once activated also died every night—whether at the discretion of the performer or not. The composer would then simply pack his instruments and take them home, continuing to observe the lives of electronic components in the past and after life of sounds, waiting for them to reveal a new musical idea to him. From one inside to another, and from one life to another, he proceeded. And we have tried to recompose his steps in our observation. For an observer to account properly, albeit always tentatively, for endings, it must move out from the particular inside it finds itself in. We thus end, tentatively, on that note.

---

that remain hidden to visible articulations. Leibniz, for instance, employed the concept of 'Echo' in his letters to Bartholomew des Bosses to explain the paradoxical nature of 'Composite Substance'--an aggregation of supposedly autonomous and singular monads (Gottfried Wilhelm von Leibniz, *The Leibniz-Des Bosses Correspondence*, translated and edited by Brandon C. Look and Donald Rutherford (New Haven, CT: Yale University Press, 2007), 337). Biologist Jakob von Uexküll used the imagery of 'symphony' or 'score' to account for the relationship between numerous 'Umwelten,' a self-contained semiotic world that a given species uniquely creates and inhabits (Jakob von Uexküll, "The Theory of Meaning," *Semiotica* 42, 1 (1982): 25–82). Following this lineage, Niklas Luhmann introduced the term 'resonance' to theorize the mechanism of environmental problem--an issue wherein the behavior of social systems directly affects, and is affected back from, its environment, and thus one that is by nature difficult to articulate through autopoiesis, which regards systems as having no input nor output (Niklas Luhmann, *Ecological Communication*, translated by John Bednarz, Jr. (Cambridge, MA: Polity Press, 1989), 15). The force of these musical and sonic metaphors, however, should not be regarded as demonstrating the sheer transcendence of sound that overcomes the boundaries of systems, but rather as merely indicating the different types of articulation that can be formed via sounds, which may serve to relativize the visual primacy of systems theory.

Bibliography

Alt, Casey. “Objects of Our Affection: How Object Orientation Made Computers a Medium.” In *Media Archaeology: Approaches, Applications, and Implications*, edited by Erkki Huhtamo and Jussi Parikka, 278-301. Berkeley, CA: University of California Press, 2011.

Cage, John and Duffie, Bruce. “Composer John Cage: A Conversation with Bruce Duffie (June 21, 1987).” http://www.bruceduffie.com/cage.html (April 1, 2014)

Ernst, Wolfgang. “Media Archaeography: Method and Machine versus History and Narrative of Media.” In *Media Archaeology: Approaches, Applications, and Implications*, edited by Erkki Huhtamo and Jussi Parikka, 239-255. Berkeley, CA: University of California Press, 2011.

Gray, D'Arcy. “David Tudor in the Late 1980s: Understanding a Secret Voice.” Leonardo Music Journal 14-1, (2004): 41-48.

Harman, Graham. “On Vicarious Causation.” *Collapse II*. London: Urbanomic, 2007: 187-221.

Johnson, Edmond. “The Death and Second Life of the Harpsichord” *Journal of Musicology* 30, no. 2 (Spring 2013): 180-214.

Kay, Alan. “The Early History of Smalltalk.” *ACM SIGPLAN Notices*, Vol. 28, No. 3 (March 1993): 69-95.

Kuivila, Ron. “Open Sources: Words, Circuits and the Notation-Realization Relation in the Music of David Tudor.” *Leonardo Music Journal*, Vol. 14 (2004): 17-23.

Leibniz, Gottfried Wilhelm von. *The Leibniz-Des Bosses Correspondence*. Translated and edited by Brandon C. Look and Donald Rutherford. New Haven, CT: Yale University Press, 2007.

Luhmann, Niklas. “The Autopoiesis of Social Systems.” In *Sociocybernetic Paradoxes: Observation, Control and Evolution of Self-Steering Systems*, edited by Felix Geyer and Johnnes van der Zeuwen. London: Sage, 1986.

Luhmann, Niklas. *Ecological Communication*. Translated by John Bednarz, Jr. Cambridge, MA: Polity Press, 1989.

Maturana, Humberto and Varela, Francisco. *Autopoiesis and Cognition: The Realization of the Living*. Dordrecht, Holland: D. Reidel Publishing Company, 1980.

Mumma, Gordon. “Notes on Cybersonics: Artificial Intelligence in Live Musical Performance” (unpublished manuscript). Los Angeles: David Tudor Papers, Getty Research Institute, Box 38.

Rogalsky, Matt. “‘Nature’ as an Organising Principle.” *Organised Sound* 15-2 (2010): 135-136.

Rowe, Robert. *Interactive Music Systems: Machine Listening and Composing*. Cambridge, MA: The MIT Press, 1993.

Tudor, David. “Program Notes for Nine Evenings (1966).” Los Angeles: David Tudor Papers, Getty Research Institute, Box 3.

Tudor, David. “Program notes for Untitled (1972).” Los Angeles: David Tudor Papers, Getty Research Institute, Box 3.

Tudor, David. “Note (circa 1975?).” Los Angeles: David Tudor Papers, Getty Research Institute, Box 19.

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

Tudor, David. “The View from Inside (1976).” Los Angeles: David Tudor Papers, Getty Research Institute, Box 19.

Tudor, David. “Program notes for Composers Inside Electronics’ concert at Fstival d’Automne Paris (1976).” Los Angeles: David Tudor Papers, Getty Research Institute, Box 19.

Tudor, David and Fullemann, John David. “’…performing is very much like cooking: putting it all together, raising the temperature.’ (May 31, 1984, Stockholm)” http://davidtudor.org/Articles/fullemann.html (April 1, 2014)

Tudor, David. “Workshop with students at Mobius, Boston, September 29, 1985.” Los Angeles: David Tudor Papers, Getty Research Institute, Box2A, C75.

Tudor, David and Duffie, Bruce. “Presenting David Tudor: A Conversation with Bruce Duffie (April 7, 1986, Chicago).” http://www.bruceduffie.com/tudor3.html (April 1, 2014)

Tudor, David and Hultberg, Teddy. “’I smile when the sound is singing through the space’: An Interview with David Tudor by Teddy Hultberg (May 17-18, 1988, Dusseldorf).” http://davidtudor.org/Articles/hultberg.html (April 1, 2014)

Tudor, David and Rogalsky, Matt. “Interview with David Tudor by Matt Rogalsky (March 28, 1995, Tomkins Cove, NY).” http://davidtudor.org/Articles/rogalsky_inter2.html (April 1, 2014)

Uexküll, Jakob von. “The Theory of Meaning.” *Semiotica* 42, 1 (1982): 25–82

von Foerster, Heinz, et al. (eds) *Cybernetics of Cybernetics*. Urbana, IL: University of Illinois, Biological Computer Laboratory, 1974.

Wilding-White, Ray "David Tudor: 10 selected realizations of graphic scores and related performances (1973)." Los Angeles: David Tudor Papers, Getty Research Institute, Box 19.

Wood, Christopher and Nagel, Alexander. *Anachronic Rennaissance*. Cambridge, MA: MIT Press, 2010.