

Pauline Oliveros and Quantum Sound

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It's about the human/machine relationship or interface—the power of technology to expand the mind. You find solutions to creative problems and those solutions lead you into new territory where new solutions have to be found. – Pauline Oliveros¹

From her earliest electronic works and meditations to the most recent performances of her Deep Listening Band, Pauline Oliveros ventures into new territory, situating herself on the cutting edge of the performing arts. Oliveros describes her vision of this “edge” as the “unknown of imagination for performers, improvisers, composers and instrument makers and the unification of all these roles” (“Quantum Improvisation” 7). The “edge” or the “border,” as she also calls it, is the very place where energy and possibilities emerge from new creative fusions of musical and instrumental forms where technologies of sound cross the borders between human and machine, performer and audience. It is from the “edge” that the revolutionary gestures of Pauline Oliveros have arisen and continue to influence.

Pauline Oliveros stands as a unique figure in the aesthetic world, integrating technology into the physical experience of human listening to achieve a transformative consciousness of self and world. Through her music, Oliveros creates possibilities for a revised reality that merges consciousness and the cosmos. Oliveros melds body, mind, and machine into sound experiences designed to enable a “new and ambiguous consciousness opening a new variety of choices. Ambiguous consciousness would mean the ability to perform in more than one mental state simultaneously in order to reach or bridge past and future as an expanding present” (“Quantum Improvisation” 9).

More than mere performance, though, the whole of Oliveros’ work rests on her concept of Deep Listening, or an expansion of one’s perception of sounds inclusive of the “whole space/time continuum of sound” (*Deep Listening*, xxiii). Deep listening is a musical paradox, an expanded consciousness through which performers and audience are composers and audience are performer, not so much in a cyclical relationship, but existing in a simultaneous and a symbiotic state. Oliveros explains

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¹ “Pauline Oliveros.” Interview by Cory Arcangel.

her multiple roles in a musical experience: “When I arrive on stage, I am listening and expanding to the whole of the space/time continuum of perceptible sound. I have no preconceived ideas. What I perceive as the continuum of sound and energy takes my attention and informs what I play” (*Deep Listening* xix). The musical experience that results, then, is “interactive music”:

It is interactive in the sense that participants take a share in creating the work rather than being limited to expressively interpreting pitches and rhythms. I have composed the outside forms, the guidelines for ways of listening and ways of responding. These forms and guidelines with appropriate application give the participants a creative opportunity to compose and perform simultaneously in collaboration with me and to expand their musicianship (*The Roots of the Moment* 5).

Deep listening is practice and performance, but even more, it is a heightened awareness of the vast musical soundscape of the universe. Listening begins with the physical ear, consciously giving attention to and focusing on the trajectory or sequence of sounds. Listening becomes deep when one can simultaneously target sounds and perceive the whole of the sound environment. Deep listening invokes a deep ethical dimension of the human experience, because it has the potential to trigger human intelligence, compassion and understanding, to cross the borders of introspection into the possibilities of challenging the serious ethical issues within the world today.

My interest in this essay lies in the scientific theories that underlie Oliveros’s “interactive music” and her theories of quantum improvisation and quantum listening that inform deep listening. I provide a basic discussion of these theories of the sound experience that I believe Oliveros has derived from the undivided wholeness theory of quantum physics. I also discuss the practice of quantum improvisation and quantum listening through examples, such as recorded performances *Timeless Pulse* (CD) and a DVD entitled *Recording Field, H*.

I must be responsible and acknowledge that Oliveros does little to explicate her quantum theory of music. The influence of Ki Mantle Hood is implicit, yet profound in her work. Dr. Hood, pioneer in ethnomusicology, presented a quantum theory of music in the early 1990s. Hood arrived at a concept of “partials” in sounds—that is, that every production of sound is unique because the relationship of the partials or elements that make up that production are always changing, although many of the partials remain the same. Hood devised a list of possible partials, including pitch and volume. According to Hood the uniqueness of the aggregate relationship of these partials dictates the “quality” of an individual sound, and this relationship creates a non-linear and discontinuous soundscape (to use Oliveros’ term)—one that is always in flux even though partials may remain constant and are continuously identifiable. Additionally, Hood advocates “consciously” listening to sounds in a “new way” and listening for the individuality of all sounds so as to effect both the production and the perception of the sound experience. Oliveros integrates Hood’s concepts into her own understanding of the unique elements of a changing soundscape and into her theory of quantum or deep listening.

Oliveros also possesses a high level of mathematical understanding, demonstrated, for instance, in her use of algorithms to control the parameters of her EIS, or electronic accordion. Her explanations of her application of quantum theory to her work, though, overall remain rather sparse. I will attempt in this paper to accurately interpret the work and writings of Pauline Oliveros the composer, musician, and theoretician as I seek to elucidate her quantum theory of music in light of the work of noted quantum scientists.

The Oliveros Musical Universe

Pauline Oliveros is quick to note in her writings and interviews that she has spent nearly her entire career engaged in a relationship with music technology. Oliveros's deep interest in sounds began with the unique instrument she chose to develop her musical talents—the accordion. “Little did I realize in 1942 that my fascination with the accordion at age nine would continue to this day and that I would re-tune and use the accordion with recording and electronics as I do now” (“Tripping” 2). She majored in the instrument in college, but her development of the awareness of sound and her search for ways to harness the effects of this awareness began with her experiments with technology in the late 1950s: “I stuck a microphone in my window and started recording whatever was happening,” she says. “Then I'd listen back and realize I hadn't heard everything” with naked ears. “So I gave myself the practice of 'listen to everything all the time' and 'remind yourself when you're not.' And I've been practicing that ever since. . .” (Kaliss).

Her career began with tape delay, or the production of sound loops to extend the sound production possibilities of her accordion. In the 1960s she developed the Expanded Instrument System (EIS), which is a series of delays and audio controls connected to foot pedals that allowed Oliveros to manipulate the sounds of her accordion. She continues to change the EIS technology, most recently converting the original analog system to digital, so that any human or animal sound production can be sent to “digital processors (software) that create multiple voices through delays, modulations, reverberations and other modifiable acoustical parameters. For example the ratio of dry to wet signal, phase relationships and other parameters as well as spatial shape and movement can be controlled” (“Sounding the Border” 9). The EIS provides a dynamic fluidity for sound production and experience, and Oliveros views the EIS as a cybernetic extension of her own body. “I have attempted over the years to enhance my musical understanding, abilities, and performance as a human by using the musical tools that are available to me as an extension of my body. As I continue to adopt new technologies as tools, I am participating in transhuman activity” (“Tripping” 1).

Oliveros experiments with various electronic productions of sound. Few of her performances would be complete without computers, but her technical forays are much broader. In the 1990s, for instance, Oliveros experimented with video technology in order to “make musical connections with long-distance partners”

(Arcangel). She has since evolved into using more complex versions of the Internet, including Internet2 at Rensselaer Polytechnic Institute for “telematic” music production (long distance music collaboration over video/telephone lines), where she currently teaches and directs her Deep Listening Institute. One of her recent projects called “Deep Listening Convergence” involved 45 musicians in “virtual residency” using Skype (Arcangel).

One might easily characterize Pauline Oliveros as the “grand improviser.” I derive such a title from her statement: “I see and hear life as a grand improvisation – I stay open to the world of possibilities of interplay in the quantum field with self and others – community – society – the world – the universe and beyond” (“Quantum Listening” 2). From her earliest tape delay experiments to her latest collaborations on Skype and her iPhone, Oliveros composes with a quantum interpretation of the sound waves interacting within the field of the acoustic environment. According to Nick Herbert, “quantum waves...are oscillations of possibility” (72). Her first foray into the application of quantum theory was with her work with synthesizers, composing with sine wave oscillations such pieces as *Alien Bog*. Her more recent work has evolved into the use of complex digital synthesizers which employ impulse waves; in 2006 Oliveros released her “Lion’s Eye/Lion’s Tale,” a frenetic and mesmerizing piece played by a gamelan ensemble and its digital counterparts, weaving “polymetrical, polyrhythmical patterns” of perpetual motion sometimes “at speeds ranging up to 1800 per minute” (*Deep Listening*).

Quantum Listening

Deep Listening takes us below the surface of our consciousness and helps to change or dissolve limiting boundaries. (“Quantum Listening” 6)

Oliveros uses quantum theory to understand what happens in the acoustic environment at the “edge” of sound experience. Because Oliveros stresses the unity and wholeness of the acoustic environment, I will attempt to characterize her theory and practices based on the quantum concepts of those thinkers such as David Bohm, who interpret quantum theory in regard to wholeness and implicate order. In particular, I understand Oliveros’s attraction to the undivided wholeness interpretation, since some of its most significant proponents, such as Bohm and Fritjof Capra (*The Tao of Physics*), interpret the quantum universe through an intersection of mystical experience, strongly influenced by Buddhism, and quantum mechanics.

The undivided wholeness interpretation of quantum theory reveals that although measurable, the universe exists of an implicate order or a total structure that enfolds upon itself with an infinite fluidity of multiple possibilities, each possibility existing as an abstraction of the totality of reality. Bohm explains: “*What* is always a totality of ensembles, all present together, in an orderly series of stages of enfoldment and unfoldment, which intermingle and inter-penetrate each other in principle throughout

the whole of space” (233). For undivided wholeness quantum physicists, such as Bohm, the implicate order is “...not to be understood solely in terms of a regular arrangement of *objects* (e.g., in rows) or as a regular arrangement of *events* (e.g., in a series). Rather, a *total order* is contained, in some *implicit* sense, in each region of space and time” (188).

Undivided wholeness theory revolutionizes orthodox ontology. With this radical change, all structures come to be understood in completely new ways. David Bohm discusses, for instance, radical changes in language structure, necessitated by the fact that language as constructed within the framework of a classical physics worldview is by necessity itself atomistic and fragmentary. For Oliveros, then, undivided wholeness revolutionizes musical structure. Music is no longer merely human notation, machine calculations, or even merely vibrations and sensations of sound. Music is “a multi-dimensional, dynamic process unfolding as a relationship between an individual or a group of individuals, and sound vibrations” (*Software For People* 130).

This dynamic process of music consists of an infinite number of possibilities of experience beyond the three-dimensional understanding of our experience reality, especially if one follows the wholeness theory of reality into the understanding that our observed dimensions are mere projections of a “higher dimensional reality” (Bohm 238). At this point then, one can understand how Oliveros’s holistic perspective of the sound experience has led her to name her theory of music “quantum listening,” which she defines as “listening to more than one reality simultaneously” (“Quantum Listening” 1). In fact, Oliveros further defines quantum listening as listening to listening (“Quantum Listening” 15). Intentionally a circular definition, Oliveros understands music as phonons, or quanta of light energy, intentionally enfolding themselves into the fabric of the total order of the universe. True to her grasp of the dynamic nature of relationships within the quantum universe, the definition of phonon Oliveros renders can only be found on *Wikipedia*: “the tiniest particles of sound. Phonons are to sound as photons are to light. It takes billions of phonons to make up a sound. Phonons oscillate, echo, reverberate etc. at the sub atomic level in the quantum soup.” Oliveros’s circular language, which unmistakably draws from Ki Mantle Hood’s theory of unique sound partials, demonstrates that the sounds are not elements that can be explicated and thus measured and understood in terms of classical physics of sound. For Oliveros this would mean that at the point of explication, individual sound particles would cease to change—they would be interpreted from a specific, static state. Instead, Oliveros poetically describes the sound environment as a fluctuating totality in which “[e]ach listener by the act of ‘listening’ affects the field and thus the form. The form affects the listener in a dance of reflections in the space between” (“Quantum Listening” 16).

The dancer Tomei embodies Oliveros’s metaphor in *Recording Field, H*. This DVD is Pauline Oliveros’s first collaborative improvisation effort with *interface* (Curtis Bahn, Tomie Hahn, and Dan Trueman), in which the musicians engage in free improvisation using custom-made instruments, including sounds that Tomei produces through her movements as they are sensed by special devices attached to her body

(Curtis Bahn created these sensing devices.). As the liner notes indicate, Tomei performs in “Streams” as a “dreamlike apparition” who merges technology and flow of information with liquid states of being. Tomei gracefully surges in fluid, sensual movements, often stretching through her arms, hands and legs as though the sounds are flowing into the whole of the universe. Her light costume embodies the metaphor of reflection, light off of water; the sounds seemingly bounce from her body, “affecting the field and thus the form,” as noted above. As a robot or anime-like character, “Pikapika” (even the name is reminiscent of anime characters), Tomei dances at angles, producing staccato sounds and movements. Concurrent, rippling visuals appear on an adjacent whiteboard, reflecting her movements as an infinite fluctuating totality of the sound experience. As Oliveros notes in “Sounding the Border”: “All technologies are an extension of bodily functions usually greatly amplified...Musical instruments enable forms of music beyond the basic universals” (5).

Recording Field H also contains two instrumental pieces—the ironically named “035” max” and the title piece, “RECORDING FIELD, H.” “035” max, a measurement of voltage or transmitter output power, becomes the conduit, not the limit itself of an array of sounds. According to the video liner notes, the interactive music of *interface* exists as “musical conversations” between musicians, instruments, and listeners. The ensemble’s name itself, *interface*, speaks to the relationship between electronic instruments, computer software, and the musicians who inventively and spontaneously create musical conversations; there is a natural flow between the improvisatory manipulation of the instrument and the constant monitoring of the effects through laptop computers. Oliveros perceives *Recording Field H* to be a conversation “into the future” (liner notes). This conversation simultaneously changes and influences change with every listening experience. Each conversation generates creative force—each sound and movement a metaphor for the energy emerging in and from the dynamic time and space of the performance. Indeed, the metaphor is a “new vocabulary” (liner notes), a new language spoken within the universal musical consciousness of the moment.

Underlying Oliveros’s quantum theory of music is the unification of listening, composing, and performing. Here we can see how Oliveros has evolved from her early work with such technologies as a tape delay, in which the tracks are aggregate atomistic objects, and the composer, performer, listener, even technicians are separate entities, and their actions would be measured by classical physics according to their composition of discrete elements. For Oliveros, though, listening, composing, and performing are not separate aggregates of atomistic particles; instead, these acts and their attending actors can be understood on the quantum level as existing as patterns, still of a “certain relative autonomy and stability” (Bohm 14), but not acting autonomously, but rather as patterns of movement that are different aspects of an undivided wholeness that is the reality of our universe. As Fritjof Capra explains: “the new physics [quantum physics], in particular, implies a shift from isolated building blocks, or structures, to patterns of relationships” (“Encounter”). If, then, the

acoustic environment is the whole of natural and produced sounds, or an inclusive ecology of sound, which is also inclusive of sound experience (although, the sounds ontologically exist in abstract, regardless of whether they are “heard” or not), then the acoustic environment is an “undivided whole movement” (Bohm 60), and the various acts of listening, composing, and performing can only be abstracted as relatively invariant sides or aspects of this movement.

Quantum listening, then, is the whole of soundscape and sound experience; it is musical process that can be understood and measured as “formative activity in undivided wholeness of flowing movement” (Bohm 14). And, out of this flowing movement emerges tremendous energy. Oliveros believes that “when one is listening to the whole field of sound without focusing on any one sound but expanding to include all sounds that can be heard – sounds seem to become interrelated rather than chaotic or meaningless” (“Quantum Listening” 15). The interaction of these sounds creates a field of energy, a force field in quantum interpretation. Capra explains: “The quantum field is seen as the fundamental physical entity; a continuous medium which is present everywhere in space. Particles are merely local condensations of the field; concentrations of energy which come and go, thereby losing their individual character and dissolving into the underlying field” (Capra 77). In Oliveros’s theory

the field of sound can be felt as potential force . . . The field assumes meaning (potential force) and is transformed by the listener. The listener is also transformed by the field. If one is not listening in this expanded way then the form disappears into the background of consciousness—the field disappears—is meaningless, attention narrows, the potential lessens. (“Quantum Listening” 15)

For instance, energy builds from the open droning of Part 1 of *Timeless Pulse: Live At CNMAT 2002*. The dissonance keeps one on edge, actively responding to each sound that comes and goes through the evolving field of music. Sharp electronic sounds open *Timeless Pulse*, accompanied by ringing bells that emerge and fade along with gong reverberations. Slowly, various other instruments join the sound field, as the performers respond to the waves of sound, sensing when to enter with an accordion riff, tinkling chimes, and light rhythms from a snare drum. As Oliveros has noted in liner notes to a different recording, but seemingly appropriate here:

it is not so much about the instruments as about the energies of the music that comes from the intensity of listening — listening as close to 'now' as possible. we know that our consciousness is delayed by a fraction of a second that the brain interprets as now — however the body is instantaneous in its perception. thus the phenomena of playing and becoming conscious of what has played — been played — is a continually surprising experience in such improvisation (“Accordion/Koto”).

One’s skin and body ripples with the tinkling chimes, and one’s breath becomes uneven, waiting in anticipation of a brief clarinet-like trill or the soft tap of the remo tubano drums. Dissonant or percussive crescendos emerge at unanticipated moments, causing the energy to wax and wane. A cymbal crash heightens consciousness, then moments of silence allow for shifting and refocusing.

In 1993, improvisational musicians George Marsh (percussion), Pauline Oliveros (accordion), David Wessel (computer realized sound), and Jennifer Wilsey (percussion), formed Timeless Pulse while in a residency at the Pauline Oliveros Foundation in 1993. They improvised the self-titled CD *Timeless Pulse* in 2002 using a variety of instruments ranging from log drums to accordion to a Macintosh Computer. The CD is an unedited digital recording of a live performance, providing interactive opportunity for each subsequent listener. The calculated response, to use Oliveros's words, of every participant, performer and listener, creates a unique field of sound every play of the CD. Even the sounds from the CD can vary according to the technology the listener uses, along with the listener's physical environment and state of mind. The field of sound, then, stretches far beyond the initial production of the *Timeless Pulse* CD in 2002; the field of sound encompasses both time and space, or perhaps even better, times and spaces, in that in every listening experience, the improvisation takes on new form, a new consciousness, a new reality for each participant, even merging past performance with present experience to create future possibilities sound experiences.

Throughout *Timeless Pulse*, a sense of continuity underlies the performance with undulating tones produced by various instruments, one sound overlapping the other—rolling cymbals, random accordion chords, and piercing electronic sounds from David Wessel's Buchla's Thunder Controller; one feels at once thrust into the future (I think of sci-fi movies where someone falls into a whirling spiral only to find themselves in a new time/space continuum!). The opening of the last of the three sections of *Timeless Pulse* is an increasingly layered field of sound; first computer realized sounds emerge, then one by one percussive sounds expand the vibrating soundscape. Percussive soundwaves created by rolling cymbals, accordion tones, and interjected hollow exclamations from blocks and sticks interact with the pulsating electronic sounds, demanding an intensive awareness of the interconnectedness of all life within the sound environment. The dynamic weaving of sounds defies culturally-constructed hierarchies, valuing instead difference and relationships. Caterina De Re has observed that in Oliveros's improvisational pieces "difference is not the point, rather, listening differently in order to hear a more expansive sound art" (*Deep Listening* 78). *Timeless Pulse* challenges musicians and audiences alike to rethink the definitions and value of the sound environment.

One can experience the sounds of three of the Timeless Pulse members at DRAM and in videos on *You Tube* of the *Timeless Pulse Trio: Afternoon Jam Session (1 and 2 and 3)*. These videos capture the improvised movements of Oliveros on accordion and George Marsh and Jennifer Wilsey on percussion. The added dimension of the performance space—note the opening view on YouTube of a bookshelf containing *The Tao of Physics*, along with the 2-D experience of video on one's screen, enhance the already-fluid sound environment, as the listener responds to the visual stimulation simultaneously with the effects of the various sounds, ranging from those from the instruments to the cars that go past one's windows while listening.

Sounding the Borders

Oliveros is ever experimenting with new instrumentation, new facets of performance, and new approaches to deep listening. For instance, in one of her most recent essays, she discusses the difficulties of merging computer technology with her accordion: “When using the computer with my accordion I am working with a representation of my intelligence. The interface of keyboard and mouse is crossing the border and is often as frustrating as encountering a customs officer. In my current research I am seeking to work with a neuroscientist to help sort out new possibilities” (“Sounding the Borders” 6).

At her Deep Listening Institute in Kingston, New York, Oliveros annually offers a number of training workshops leading to certification in deep listening. Other projects at the Institute include training on Adaptive Use Musical Instruments (AUMI) software, which is designed to help musicians with disabilities play traditional musical instruments, and The Telematic Circle, an ongoing interest group that “uses and develops applications for telepresent music performances. The group supports the creation of new art that specifically addresses broadband transmission systems as a new medium” (*Deep Listening*). All of Oliveros’ current work reflects her belief that music should be for all people all of the time.

Pauline Oliveros continues to challenge traditional theories of sound and listening, traditional concepts of composition and performance, and classical interpretations of consciousness and cosmology. Her interactive music continues to push deep listeners to the “edge” of musical experiences. She busily and enthusiastically embraces her role as exemplar of what one might consider a “quantum” performer—always composer, player, and listener simultaneously:

We are interacting with a powerful resource and sharing with billions of musicians who have preceded us, who are simultaneous with us and who will succeed us. We can help others to learn to listen and participate by listening as a lifetime practice. As musicians we listen to make finer and finer distinctions in tone, sound and rhythm. It is the slightest nuances that accumulate and refine one's aesthetics. If we also listen to include more and more of what might seem to be background noise we perceive relationship to place. All sound, including so-called background sound, brings information and connection. This is true for our daily lives as well (“The Roots of the Moment”).

Pauline Oliveros remains a visionary of sound in the 21st century, still imaginatively transforming the possibilities of sound experiences by continuing to redefine “the responsibilities of the composer, the performer and listeners by asking that everyone share creatively in the listening process which is the gateway to creativity” (*The Roots of the Moment* 9).

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