# The Force of Noise, or Touching Music: The Tele-Haptics of Stockhausen's "Helicopter String Quartet"

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> Curiously, hearing is a way of touching and being touched by one's space. In intense experiences of listening, hearing cooperates with touch to recall the eyeless belongingness of intrauterine life, when we are given our own shape by the shape of that which surrounds and accommodates us, and early infant life when we are bathed and caressed as much by voices as by hands and fingers. — Steven Connor, "Noise"
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> Music is a genuine art of sound vibration. – Karlheinz Stockhausen, "We in Music are Like Physicists"
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> My love,/You are so far/Away, that/I can touch you. — Nausicaa Thelmboski "Prelude and Chorale for an Organ in Flames" (1923)
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> One touches on what one does not touch, one feels there where one does not feel, one even suffers there where suffering does not take place, when at least it does not take place where one suffers (which is also, let us not forget, what is said about phantom limbs, that phenomenon marked with an X for any phenomenology of perception). Jacques Derrida, *Spectres of Marx* (151)

**Apparent to the Touch**

The American composer John Adams writes "One needs the stimulation of the tactile contact with the sound" (191). He illustrates this point with a kind of tautology, for he says that Beethoven, when deaf, insisted on composing on the piano, "even if he had to lay his head directly on the sounding board of the instrument to receive the vibrations through his bones" (ibid.). The tautology results from the fact that tactile contact is not only something one needs with sound, but absolutely something one cannot avoid. Beethoven would have been able to feel the music in his bones if he could hear or not, but the reverse is not the case. The fact that the sound could not touch his ears, move the necessary parts of the complex system of the ear, rendered him deaf. Beethoven's deafness was due to a lack of tactility.

To touch a tympanum, to caress the cochlea, one needs the invisible touch of sound waves. The ear is actually a series of chambers and transmitters that pass along—or tele-project—sound waves that touch and move various sensitive receptors: bones, fluids, membranes, and hairs, before being passed along to the nervous system and the brain. The sound

itself cannot be seen except when rendered graphic through a mechanical process, just as the initial stage of hearing operates as a mechanical process. Later the mechanical energy of sound converts to hydraulic energy as the fluids play a larger vibratory role. Thus at its source, touch operates with and causes sound, and it is only through touch-at-a-distance that we have sound at all. The famous story of Edison's ears bleeding from his aural experiments makes visceral this tele-touch, which is not always a gentle stroke, no matter how pleasant the sounds, voice or music we might encounter.

The biological sense of touch, as with vision, is confined to surfaces. Anything that can be touched or seen is *de facto* a surface. In order to move beyond a surface to that which is not yet another surface, a different sense needs to be brought into play: sound. Sound provides the means to access invisible, unseeable, untouchable interiors. If we consider the import of vision to the general sensorium and metaphorization of knowledge, then the general figurative language of "insight" runs counter to surface vs. deep understanding of the world. Sound, it would seem, not vision or touch, would lead us to the more desired deep understanding of an object or text. In fact, our store of terms and concepts for hermeneutical processes is stocked full with surface vs. deep understanding of a text, much of it having to do with the English root "-ply," (from the Indo-European root "plek") meaning to fold. The act of folding implies a folded-in section, a section hidden from view by another surface. Hence there is a suspicion of the surface; there is something more there than meets the eye. Thus to render explicit (ex-ply/un-folded) what was implicit (im-ply/in-folded) in a text is a matter of making hidden surfaces visible or accessible. Steven Connor, in his BBC essay on "Noise" returns this formulation to our sensorium and its mechanics: "The ear resembles the skin in being the organ of exposure and reception. The eye investigates and acquires; the ear and the skin undergo and receive." And as with skin that loses its nerve ending, the ear can be touched without receiving or undergoing, without acknowledging it, as with poor deaf Beethoven. So although touch depends on surfaces, as does sight and even sound, it requires a surface capable of acknowledging, of knowing, of accepting the touch, whether as touch or as sound in order for sensorial information and stimulation to occur.

However a paradox emerges, for sound is also already touch. Although we are immersed in aurality, surrounded by its indivisibility and its pervasiveness, sound itself is composed of waves that physically and invisibly touch our ears and bodies. Hermann Helmholtz, a physician and possibly the most influential otologist of the nineteenth century, concentrated on the wave as the essential element of sound, thus making

a physical basis for sound central to various inventions that led to speaking machines, telephony, and sound reproduction. With a focus on waves, the secret interior that sounds lead us to can only be reached through the repetition of touches upon surfaces, sound waves upon receptors, surfaces repeating themselves endlessly as surfaces *and* as interiors. The result of this paradox is an even further undermining of received understandings of the senses as well as a muddying of the apparent transparency of them and the tele-technologies upon which they are based.

In medical discourse today, touch is often referred to as a "somatosensory system" or "somatic senses" to take in the number of mechanisms and processes involved with touch across the entire corporeal apparatus. All of the other senses find fixed spots on the body, somewhere specifically located on or in the head. Though we often refer to touch primarily as resident in the fingers, touch, however, operates in a disseminated manner, literally covering the remainder of the body, as well as the head. Touch is dispersed, enveloping and encompassing. When airwaves touch the ear, we call the effects "hearing" or "sound," and the disseminated, expansive operation of touch makes it more pervasive than the other senses and structurally supportive of them.

The shaky ground of empirical assertion and power becomes even less firm under foot when we understand that sound is touch. The division of the sensorium into distant and proximate categories (distant: sight, hearing, and smell; proximate: touch and taste), becomes difficult to maintain once sound's absolute dependence on touch becomes manifest. Such a concept has ramifications for notions of distant and proximate sensory knowledge, the place of the self in the empirical and sensorial world, and the way we parse perception. Part of the world as currently constituted by tele-technology-dominant information provokes just such a blurring, but is based on an assumption, to a certain extent, of the solidity of categories and the time-space relations from which they emerge. The degree to which sound-is-touch disturbs sensorial taxonomies and places yet another X on the phenomenology of perception, to paraphrase Derrida on phantom limbs (Spectres 151). Further, our notion of the tele- and its inherent afar is also placed in question when the distant and proximate sensory information become disturbed. What becomes afar, how far is afar, and what is thus rendered proximate or inscribed as distant all become increasingly difficult to discern with the simple observation that hearing is touch.

But once we make this observation, we can safely say, also, that music is touch, and it is the gift of tele-touch (or telehaptics) that we encounter with any musical performance. This article considers the ways in which sound operates as a prosthetic supplement to touch, and vice-versa, in Karlheinz Stockhausen's "Helicopter String Quartet," first performed in

Amsterdam in 1995. This rather outré Stockhausen piece, I argue, is an extended meditation on and performance of the tactile that is the base of music, and which is music properly speaking. Stockhausen's piece foregrounds a range of topoi, ideas and technologies: distant and proximate, broadcast media and performance, isolation and tele-technologies, sound and amplification, air and ground, sound production and sound reproduction, touch and music in all sorts of ways. The nature and the specifics of the performance, which require a string quartet to perform "live" in four separate helicopters with the music broadcast to an audience listening and watching the piece through speakers and on video monitors, seemingly makes it impossible for touch to play its traditional performance role in classical music beyond its most rudimentary elements. And yet, if we can hear it, undeniably there is touch. The physical apparatus of the helicopter blades proves essential to Stockhausen's composition/performance agenda, and the myriad set of invisible or unseeable sounds that result from touch that is both proximate and distant, actual and tele- are mobilized to understand the inherent synaesthesia operative in the complex relationship between touch and sound, between the blurring and slurring of the senses despite the assumed neatness of the sensorium.

Classical musicianship depends heavily on tactility, with the individuality of a performer essentially articulated through different forms of touch upon a keyboard, bow, fret board, reed, mouthpiece, sticks, etc. The shape given to sound through an instrument demands a force to make the sound, and touch to give it shape, character, space, and form. The lexical palette for describing musical performance in this domain is dominated by literal and metaphorical formulations of touch in relation to sound. The distant sense of sound becomes articulated by and through the proximate sense of touch. Recording, broadcast, simulation and virtuality further underscore the distance between performer and audience, an issue that Stockhausen addresses with his Helicopter Quartet. In effect, the performance becomes an exploration of the almost tautological concept and phenomenon we can call "musical haptics." Stockhausen's instructions provide very specific information about the placement of the helicopters, cameras, microphones, monitors, and musicians, allowing a sustained engagement with the contexts in which teletechnologies, music, and touch operate. Because music uses the language of "touch" to produce "voice/voicing," especially in the act of composition and performance, touch becomes the means and voice (literal and metaphorical) of the product. However, in Stockhausen's quartet of strings, machines and multiple projections, touch as the means and sound as the product come to the fore in order for us to engage the sensorium in a newly complicated manner. It should perhaps be made clear that Stockhausen understood his quartet as doing something rather different. He considered it as part of his

larger project that gestured toward the fundamental relationship between and interdependence of utopian futures for music and human existence, which will be discussed later in the paper. Suffice it to say we will be reading Stockhausen against his intentional grain, to discern a piece that displays the various nexuses of sound and touch as they pertain to music, sound, and reproduction—nexuses grounded in the uncertainties of the perceiving subject and the role of the empirical in knowledge formation.

**Stockhausen's Helicopter String Quartet: The Music of Helicopters (and its obsessions)**

Stockhausen's "Helicopter String Quartet" calls for a string quartet, four helicopters with pilots, equipment for audio and visual transmission and, crucially, a mixing board operator who controls the sound levels of the musicians and the flying machines circling outside the performance hall (http://www.stockhausen.org/helicopter_intro.html). The helicopters, by supplementing the string players, function as an antiphonal quartet, after a fashion. Through the use of microphones, mixing board and sound operator, the helicopters combine with the electronically-amplified acoustic instruments, while enabling the traditional instruments to remain louder than the rotating blades. The nearly 22-minute piece requires the four string players be transported above the concert hall where the audience and monitors reside, each player ensconced in his/her individual helicopter.

The main part of the playing on the strings entails tremolo in interchanging and overlapping glissandi, which provides an explicit avant-garde gesture. Path-breaking experimentalists Luigi Russolo and George Antheil both introduced machines into their music via glissandi because of the ease with which they could produce this effect when contrasted with acoustic fretted instruments. Especially useful to both early twentieth-century composers was the siren. In this instance, the siren is replaced by helicopters and amplified strings. Stockhausen wants to have the punctuated sound of the rotor-blades, and not simply the uniform drone of the turbines, to be audible over the string playing. Thus acoustic and electronic/mechanized instruments take turns deploying the avant-garde gesture of glissandi originally accorded solely to machines. The acoustic converts to the machinic and vice-versa. All the sounds are mediated by electronic reproduction/transmission, and made accessible to the audience solely through the speakers positioned within the performance hall, which is bereft of live performers. The mediation highlights the inversion of analogue and electronic sound production operative in all aspects of the piece, such that the copter blades and the traditional string instruments operate as equals, as far as the sound source is concerned.

The blades and their role in the score remind us that the most basic material of sound, as Hermann Hemholtz postulated in the nineteenth century, is "the vibration of air, leading to frequency, amplitude, duration and other finer ones: colour, attack" (Lyotard 168). The vibration of air proves essential to the helicopter quartet, as it would for any music, of course. But for this piece, its essential nature is foregrounded. The vibrations of air are explicitly modulated, extended, repeated, transformed and performed through military technology, a repertoire that includes the blades touching and cutting the air. The punctuated sound of the rotor-blades comes from their punching the air, rather like the ear is punched by the touch of airwaves that create fluid waves in the cochlea. From rotor blade to mixing board to amplified sound, the performance becomes an allegory of sound production as touch. In the premiere of the work, recorded visually as well as acoustically (see Scheffer), the electronically generated sound runs through and emerges from an old military mixing board Stockhausen uses to manipulate the sounds he sculpts. What the audience experiences results almost solely from the sound operator at the mixing board, despite the existence of a very strict score and precise metric timings.

In the studio rehearsing the piece for its initial performance and then in the concert hall, Stockhausen with his hands on the faders of the mixing board makes "the music fly around the room" (Stockhausen qtd. in Scheffer) through the speakers. He controls the entire performance with his touch on the mixing board and brings to the fore the telehaptics central to the work. The quartet seemingly renders irrelevant, if not impossible, the touch so important to live classical music performance. The players must perform as an ensemble though they are distanced from one another by the helicopters and brought into contact via electronic connections. Stockhausen's performance instructions, coupled with the strategic use of teletechnologies, actually make touch and distance the central points or insights of the piece. The combination of concerns and problematics foregrounded by the composition and performance makes touch both distant and proximate, as sound is, reminding us of the tactile that makes music possible. To this end, the piece neatly exemplifies the deep ambiguity of the phrase "*plus d'un toucher*" with the performance providing both "more than a touch" as tele-technologically outfitted, and "no more a touch" due to the ineluctable separations between the performers, between musicians and audience, and the oddly mediating role of the sound mixer. Stockhausen cleverly makes touch at a distance, music at distance/sound at a distance, the site of inquiry with his elaborate display of—indeed complete explosion of—chamber music performance.

An important issue offered by the quartet, in fact, centers on conceptualizations of proximity as it pertains to sensory stimulation and

understanding. The overt reliance on teletechnologies capable of making the distant proximate—the video cameras, television monitors, sound transmitters and loudspeakers—serves to further isolate the audience from the musicians and the musicians from each other. The quartet becomes an exploration of space and the senses, of isolation and conjoining, of the means by which we separate and merge sonic and corporeal domains. The musicians do not hear each other, while the video/TV screens stacked up on top of each other, repeating the same image of isolation, reinforce the point that each is sealed in his/her helicopter, only capable of interpersonal interaction through electronic prostheses, and then only within the performance hall. The players interact only through the tele-technologies of the cameras, the microphones, and the mixing board and only in the auditorium, thus providing an ironic commentary on the nature of the musical communication essential to one of the most intimate of chamber music ensembles: the string quartet. Seated nowhere near each other and in fact swirling high above the earth, the quartet members attempt to bridge a distance that would exist even if seated with their knees touching: the distance of bodies. (The whimsy and humor of the piece belie some of Stockhausen's more grandiose claims for it, but are clearly evidenced in the sheer chutzpah of it.) For the audience, outfitted as they are with the results of all of these tele-technologies, the performance in the helicopters is both private and voyeuristically accessible. Only in the auditorium and only for them do the players and the piece come together. Much as sound is supposedly a distant sense and touch a proximate one, Stockhausen's piece reminds us of the relative interpretations of these senses and their spatial domains, for the distance of sound remains entirely dependent on the intimacy of touch. The string quartet has become distant and proximate at the same time, remote yet intimate, distant and near.

Similarly the ambiguous relationship of space to sensorial certainty extends to the concepts of inside and outside, a divisible difference often detectable by touch. The piece provides a series of inside/outside relationships, starting with string players who begin the performance physically inside the hall but not musically inside it. They then move outside the hall into the helicopters where they produce music from inside the machines, producing sounds coupled with the rotor blades outside the cockpit where they sit and play. Further, all of these outsides and insides are then brought electronically inside the auditorium where the players appear and are heard through the video monitors and the sound speakers. The audience experiences the distant/proximate relationship as complementing the attendant notions of outside/inside with the players and the music being both at the same time. Once again, controlling the ebb and flow of electronically produced sound and images is the sound controller, Stockhausen in the video-documented performance (see Schef-

fer), seated inside the hall controlling it all with the touch of his fingers on the fading sliders and mixers. To further underscore the relativity—as well as the complexly layered dimensions—of inside/outside and proximate/distant relations, the string players, after touching down to earth again, re-emerge from their respective machines to the sounds of the rotor blades and turbines slowing (rather like the metronomes in Ligeti's "Poem Symphonique") and re-enter the performance space where their music has just played but they have not been, except by tele-proxy. The general movement of the piece as embodied by the musicians is one of inside-out (physically), then outside-in (via teletechnologies and audio haptics) and then outside-in (physically), thus slyly commenting on presence and performance.

Almost from the outset of his career, Stockhausen claims he has been interested in creating "musical spaces around human beings," with the human firmly in the center of all of his technological innovations. "For me," Stockhausen says in an interview, "the directions and speeds of the sounds are just as important as the pitches and the durations." (http://www.stockhausen.org/Physicists.pdf) He wants the audience to be surrounded completely by music/sound, to be fully immersed in sound, continuing the effects of nineteenth-century panoramas while also anticipating the priority of immersion in new media, which derives this desire from sound and its relationship to space.[1] Another Stockhausen piece, "Invasion," exemplifies this nicely. In it, the musical performance takes place outside the hall (again) and is heard amplified inside the hall from several sources: a cube of clustered speakers suspended above the audience (a cube of eight speakers he called "an octophonic setup"), a ring of speakers surrounding the audience, and from a few people roaming about the hall with speakers strapped to them. Again via a mixing board, sound goes up and down in diagonals and spirals, creating a complete immersion in the music: a triumph of sound, music and technology over space, but a triumph likely to be seen by its composer as a spiritual as well as a technological reshaping. For in spite of Stockhausen's long-standing and explicit use of military-generated technology (and even military-inspired titles, such as "Invasion"), his use of these technologies is for the joyous occupation of space by music. Without going into elaborate detail of Stockhausen's complex techno-spiritualism, it is worth noting that all of the control allowed by this technology is geared for his transcendental project of the liberation of music from all of the objects of the world. Stockhausen perceives his music as transcendent and liberating: rather like an odd amalgam of space-race faith in whiz-bang technology, Heidegger's argument for the capacity of technology outside of techno-science's enframing stultification to enable truth-as-aletheia (as process

and unfolding) and new-age spiritualism. However in order for it to be so, the touch of tele- technologies is required. Thus his engagement with space through aurality and touch has metaphysical and transcendental dimensions to it. As Stockhausen himself says of the work: "the piece literally flies away" (qtd. in Scheffer).

Despite the obvious formal and technical experimentation of the Helicopter Quartet, with its outlandish premise of placing a string quartet in helicopters, with the flying machines themselves incorporated into the music, as well as all the visual/audio technology required for its performance and the incursion of high tech boldly into the traditional acoustic and analogue space of classical chamber music—in spite of all of its performative and apparent innovation, the goals behind the work are deeply conservative, even romantic. Anticipating and helping to lay the groundwork for the kind of futuristic cheerleading that so colors certain strands of high tech discourse today, Stockhausen participated in and helped articulate visions of a spiritual future that overcomes the constraints of the physical and biological world through technological enhancement of the individual, the community and space. Frances Dyson says of his work specifically, as well as of the larger movement he helped foment, that "experimental music and audio art often express the techno-utopic and dystopic narratives rumbling beneath the sheen of modernity and have often been associated with both the posthuman, and the inhuman" (146). The subtle reference to Lyotard's lectures on aesthetics in Dyson's formulation of the discursive terrain this experimental music occupies indicates the kinds of intellectual and philosophical resistance to and scepticism of both the utopic and dystopic claims being made in post-war experimental culture and artistic production. For every Stockhausen proclaiming such visionary possibilities of technological liberation ("We are all transistors in the literal sense … a human being is always bombarded with cosmic rays which have a very specific rhythm and structure, and they transform his atomic structure and by that his whole system—let's forget about always dying bodies, so to speak, in order to be reborn in a different form" [qtd in Dyson 147]), there is always a Lyotard there to temper the claims.

In this reductive formulation, Stockhausen and Lyotard provide metonyms for the debates surrounding the ever-increasing incursion of techno-science into the individual body, the body politic, the *sensus communis*, and the shared noetic world of cultures. However the materiality out of which techno-utopic/dystopic claims could be constructed demands an ongoing reconsideration of empiricism, as well as of the sensorial foundations for epistemology and ontology. The technological innovations of

the late nineteenth and early twentieth centuries provided the material means for reformulations of how we understand the empirical bases of an ontological system, and what is at stake is the perceiving subject.

**Of Wax Cylinders and the Static of Touch/and the Rubato of Sound**

The story of sound reproduction would have always been the story of tele-tactility: of the aural world rendered differently by allowing the vaporous medium of air to be modified in storable and reproducible form. The vibrating air that makes sound can and does make other movements that can be graphically or physically manifested. In terms strictly of sound reproduction, Jonathan Sterne codifes the situation in a way that is as reductive as the formulation postulated here: that sound is touch. Both formulations relate to Hemholtz's assertion that vibration is sound, which is but one step from understanding sound as touch-at-a-distance. Sterne states that all sound reproduction can be understood through a series of transducers that convert sound into some other form and then back into sound once again (22). Because the mechanical principle behind this simple model of sound reproduction resides in the human middle ear that was itself used in labs for analogue sound reproduction experiments and apparatus, Sterne calls the process "tympanic." The mechanics of the tympan in the ear is the already-given of sound production as well as sound reproduction. Implied in its mechanical operation is the unseen hand of touch, for it is through the force of touch on the biological structure and its mechanical manifestations that the transducers can function. With the ear, this shift can be found in the movement from mechanical to hydraulic power operative when the sound waves pass from the tympanum to the cochlea. The biological nomenclature of the ear provides a poetics for the sound-equals-touch formulation that can also be understood as mechanics: a biomedical-mechanico-poetics that grounds sound and sound reproduction in the tactile.

Other than the pinna, which is Latin for feather and feathered (both noun and adjective), and cochlea, which comes from the Greek *kokhlias*, meaning snail, as well as spiral covering, the majority of the anatomical terms for our ear indicate the element of force and touch that result in sound. For example, the incus is Latin for anvil, or that into or upon which one strikes (akin to terms for "to forge"), and malleus, related to mallet and malleable, is the Latin meaning to hammer and to change. The malleus thus etymologically embodies the transformation of touch (hammer) into sound—the malleable nature of the senses, especially hearing, residing in the very term itself. Similarly the incus indicates the near alchemy wrought by the anvil and the hammer, forging new shapes and solids

from heat-infused liquids. It too indicates touch, sound and transformation as integral to the anatomical term. Most interestingly might be the term Sterne mobilizes for his mechanical operation: tympan, Latin for both drum and to beat. It is noun and verb, object and the action/force exerted upon it, cause and effect. With the term tympan, the process of hearing clearly depends on touch, on force, in order for sound to reach the brain via the eighth cranial nerve and noted as sensory input at a conscious level; however it is not noted as touch, but as sound, as hearing.

The tympanic operation of the transducers allows for the stilling, storing and reanimation of vibrating air, of air that can touch, of touch that yields sound. Early analogue sound recording and reproducing machines bear out the biomedical-mechanics of sound's capacity to emerge from touch and to recreate touch in such a manner as to reconstruct sound. Further, they provide a means to interpret and understand hearing as simultaneously distant and proximate, and thus useful for reading Stockhausen's helicopter quartet as an extended exemplification of sound-as-touch and the role that sound reproduction plays therein. The whole range of analogue sound reproduction devices from the second half of the nineteenth and early part of the twentieth centuries turn sound into tactile/visual objects through the tympanic, itself a prosthetic extension of the human ear, as the name indicates. The list of these machines and the many imaginings related to them have been detailed extensively by Friedrich Kittler, Sterne and many others, and needs no rehashing here. However a few pointed examples can help contextualize and articulate the means by which Stockhausen takes advantage of a genealogy of sound production and reproduction that undermines the stability of the sensorium.

The earliest sound recording device was the Martinsville phonautograph, predating Edison by some twenty years by capturing sound in written squiggles for the first time in 1857. Perhaps inspired by that early telehaptic wonder, the telegraph, Martinsville's machine operates pretty much as its name indicates: by automatically (auto) writing (graph) sounds made in its vicinity (phono). To do so, a membrane vibrated in response to the touch of speech, and a bristle attached on the other side traced lines onto smoked glass. The machine made it possible to write and render visible the invisible world of sound, and helped lead to Alexander Graham Bell's experimentations with a machine he also named the phonautograph, a direct precursor of the telephone. This machine famously used an actual middle ear from a human in replacement of Martinsville's membrane to vibrate in response to sound and inscribe the sounds, using a stylus that responded to the sound waves and etched the vibrating response on glass. Bell and Blake's machine was but one of many that used actual

human parts in the construction of machines intended to prosthetically outfit the body. Only a small series of minor analogical alterations and applications was required to move from the empirical investigations into sensory organs in the eighteenth and nineteenth centuries to machinic and electronic prosthetic extensions of the senses, including those for sound and hence touch[2] (see Bishop and Phillips 2010). As we find with the phonautograph, the principal for sound reproduction that Sterne calls "tympanic" results in the force of touch materializing in written marks.

Bell and Blake developed their machine to help the deaf to visualize sound, thus aiding them in the attempt to aurally simulate the speech of those who can hear. The significance of studies into hearing and its loss, as well as the travails of speech for mutes, provide the medical and technical bases of sound reproduction. In other words, to slightly modify Kittler, sound reproduction has its origins in deafness. The Stockhausen helicopter quartet calls for and provides an enforced, artificial deafness of the string players– a deafness caused by their isolation from one another. As with these early hearing machines, technology saves the day by sealing and then enhancing the sense of hearing through the headphones that allow the players the tele-phony of telehaptics. The audience occupies a position similar to that of the musicians; they are isolated from the external aural world, opting for individualized soundscapes cut off from an outside and modified by electronic prostheses. In the instance of the performance, though, Stockhausen offers the crafted soundscape to a community, an audience, not to individual performers, and despite his utopian designs, the piece operates as a reminder of the densely complex phenomenology of quotidian sound and interaction. The entire performance provides an allegory of musical production in relation to its reproduction, and sound in relation to its analogue, electric and electrical manifestations. But it gestures to more: the materiality of sound, how it has been modified, what it means to the individual perceiver-qua-subject, and the relation of subjects to objects (including other perceiving subjects).

In much the same mode as the phonautograph, Etienne-Jules Marey's tambour (or drum) of the 1850s was outfitted so that pressure on one membrane of a drum moved the opposite membrane, attached to a stylus for writing on paper, turning any sound/motion into graphs. This medical device was often attached to stethoscopes, and was an important innovation, enabling sounds or movements of the functions of the body to be registered in graphs. Marey's analogue tambour was used into the 1950s, when it was phased out by electrical and then electronic monitoring devices, each mimicking touch in simulated form. In all of these machines, though, we witness the beginnings of most of the pieces of the puzzle that Edison eventually put together in his phonograph, as did Berliner in his gramophone. They were not alone, as many others were working along the same lines at the time. Sound reproduction was, as they say, in the air.

Kittler quotes Alfred Jarry's prose-poem apostrophe to the gramophone that says "O my head, my head, my head. All white underneath the silk sky: They have taken my head, my head—and put me into a tea tin." (28) Jarry captures the anxiety some people felt over sound reproduction machines, over the detachment of the physical senses from the body, and the potential storage and reanimation of them at a later time-space moment, even if the subject is not present or even still among the living (as with the famous painting of Nipper and "His Master's Voice"). However the technological capacity for extending the senses while simultaneously removing them can also be seen as liberating, as gesturing toward freedom from the constraints of that old Enlightenment trap of Cartesian dualism. These ways of reading the bio-technical landscape can be found in a work such as Stockhausen's "Helicopter Quartet."

According to the position Stockhausen metonymically stakes out, technology of this type reaffirms the human subject and its capacity for transformation and transcendence by providing the intellectual and physical means to think through the possibilities of radical change. In this scenario, technology helps subjects place objects in the scene. This reinforces a comforting story, a common-sense tale of agency, subjects, action and technology that allows us to fulfil our desire as autonomous actors. The autonomy of the subject remains wilfully in place in this technophilic perspective, despite the fact that it is increasingly difficult to maintain the divisions between external and internal relations, and between technology and the subject. (This is a point da Vinci makes wittily in his notebook drawings, comparing a water clock and a human oesophagus by superimposing the ghostly image of the chest cavity and its internal workings on his design for a water clock.) And perhaps unwittingly, it is a point Stockhausen makes with his quartet.

The numerous early sound reproduction devices and their contemporary digital avatars reinforce one of the unstated, non-transcendental messages of Stockhausen's quartet: sound is always telehaptics. This message makes his piece, at one level, a sprawling display of the tautology that sound-at-a-distance is but proximate touch, though we don't necessarily classify it as such. Through explicit reanimation of the stored sound (here, conducted in "real time" via real-time tele-technologies created largely for the military) Stockhausen's piece offers an extended engagement with all of the steps of sound reproduction as reducible to touch—a return to a body that we cannot transcend or elude, and a return to a sensorium we consider secure and stable but which is founded on blurred categories that are slurringly synaesthetic at their very base, as are the senses they are meant to taxonomize.

The sliding between sensorial categories exemplifies what in musical performance is called *rubato*, from the Italian for "stolen." It refers to the discretion given to musicians to "steal" part of the duration of one

note and give it to another, thereby allowing him/her to speed up or slow down the tempo as s/he sees fit, and enabling the individual touch of a performer to emerge. *Rubato* manifests sympathetic borrowing of time and intensity, of current. The rhythmic flexibility, pace, and alteration of vibrations that fall under its provenance allow for the extension and contraction of notes for nuance. Although it is an expressive technique most frequently associated with the Romantics—especially Chopin—C.P.E. Bach and Mozart wrote about it, and baroque recitatives feature it. *Rubato* has to do with rhythmic flexibility achieved through direct variation in touch and sound.[3]

The dawn of contemporary music more or less wiped out *rubato* as something too nuanced and old-fashioned for current tastes, but one can detect the spirit of it in Stockhausen's "Helicopter Quartet," especially in the interplay of the stringed instruments, the rotor blades, and the *Sprechgesang*. The key for our discussion, however, is displacement and transfer, as with the senses of sound and touch, and how they seem to operate. The tele-technologies that allow us access to the performance are based, as were the early sound reproduction machines, on borrowing, displacement and transfer. There is a sleight-of-hand operating within the teletechnologies and the senses upon which they are based. These teletechnologies extend, augment, dull or replace the senses: an element is lifted from one thing and transferred to another nearly contiguous thing. The conflation of sound production and sound reproduction in the performance of this quartet reinforces the larger notions of *rubato,* and signals to the audience covert agendas in relation to supposedly stable categories of perception and expectation. Having sound production also be simultaneously sound reproduction, and only accessible as reproduction though "live performance" retells the story of aural technology's return to the body, which has been transformed through technology, just as the technologies themselves have been altered in their interactions with the body.

**Tele- and Heli-, or Music and Touch in the Space Age**

> Behind each player, the earth can be seen
> through the glass cockpit of the helicopter.
> – Stockhausen, instructions for
> performance of the Helicopter Quartet

Prefixes prescribe our conclusion. The interplay between the teletechnologies and helicopters in Stockhausen's quartet questions the taxonomy of the sensorium and its implications for the perceiving subject and its approach to empirical knowledge. We turn to these prefixes because in the elements "tele-" and "heli-" reside an extension of the biomedical-mechanico-poetics that grounds sound and sound reproduction in the tactile, with implications for the Stockhausen piece.

The element "tele-" is the Greek prefix meaning afar. When shortened to "tel-" it means to complete, or to perfect, as with a goal (e.g. with *poesis*, but which *praxis* does not necessarily possess) and gives us teleology. It is also related to "teli-" which comes from the Latin *telum*, which is a dart or a missile. The trajectory of events in teleology would then be akin to a dart or missile in a parabolic arc heading toward a target. "Heli-" comes from the Greek *helissein,* meaning to roll and relates to *helix,* which is a roll, a spiral, or entwined thread. Thus when we put these two prefixes together, as Stockhausen has done so provocatively, we find a trajectory initiated from afar with a goal, a teleology, which is inadvertently rolled by the very conditions and materials that make it possible, and twisted into missing its utopian mark. The goal of subject transformation and liberation through music and teletechnologies spirals out of control by the loss of the subject's empirical stability within the interaction of sensorial extensions, and by further synaesthetic leakage of sensorial categories.

Stockhausen's attempt to free the string quartet from the confines of the concert hall and allow them to take flight, literally, provides an analogy for his larger liberatory agenda regarding music, technology, and the perceiving subject in the space age. The helicopter quartet is dedicated to all astronauts, in whose number he would also include the audience. However, the electronic-audiovisual transcendence is short-lived: 22 minutes to be exact. The players and pilots and sound/video technicians return to earth. They touch down. The teleology implied in escape velocity that would forever transform the perceiving subject cannot be maintained perpetually, and we return. Indeed Stockhausen's directions indicate that the video cameras keep the earth below consistently in the frame during the flight and performance, indicating not so much what has been left behind as that which we invariably cannot leave behind. The arc of techno-utopian release is twisted in the twinned-helix of the corporeal frame of the subject and the sensory apparatus (organic and/or prosthetic) to which sound and hearing must always be attached if the subject is to exist at all. That feathered portion of the outer ear, the pinna, allows flight to touch us, but precludes our own flights from ourselves, despite Cartesian desires.

This is not to say that the subject remains a static and stable entity, as some "body essentialists" might claim—just the opposite, in fact. For the teletechnologies required for telehaptics of sound indicate that no originary perceiving subject exists, and that prosthetic extensions do not necessarily improve the senses they modify, or reveal their inherent, universal nature. They simply mediate. Further, they underscore the instability of the empirical upon which the perceiving subject is constructed, the "prosthesis" at the origin of the subject: a complex interplay of proximate and distant, external and internal sensory information that our senses

shape just as they are shaped by and transform the technologies they mediate. Stockhausen's "Helicopter Quartet" perhaps inadvertently undermines his larger project, but yields a far more interesting set of issues about the shaky foundations of epistemology than simple transcendence and transformation would allow. The earth remains in the video frame, no matter how beautifully the helicopters swirl, the players play, or the sound mixer conjoins. On the one hand, Stockhausen's touch is too heavy when it comes to the utopian project, and too delicately guiding on the other when it comes to the fragility of the perceiving subject. The piece embodies and performs music and touch in the Space Age while allowing us to ask who is touched, how, by what means, and what becomes of that "who" after the touch.

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## Notes

1. For an extended discussion of the role that sound and music play in constituting immersion as the primary phenomenological experience of new media, see Frances Dyson's *Sounding New Media,* 2009.
2. A long examination of the many and varied links between early explorations of the senses in the 18th and 19th centuries, avant-garde aesthetics of the early 20th century and current military technologies can be found in Bishop and Phillips, 2010.
3. I would like to thank Lin Li for her elaborations on *rubato* that helped shape this discussion.