

Sound and Time

Inflection and Innuendo

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I do not know which to prefer,
The beauty of inflections
Or the beauty of innuendoes,
The blackbird whistling
Or just after.

WHAT WALLACE STEVENS MEANS is that sound is rhythm, “The blackbird whistling / Or just after.” Sound is always thus articulated, punctuated, it starts and stops. He does not prefer one to the other, the blackbird whistling or just after, inflection or innuendo, because a sound does not go away when it stops, nor does it begin without dragging its genesis along. Innuendo persists in inflection, and inflection in innuendo. If innuendo—from *innuere*, to nod at—if innuendo nods at something, then this is precisely an inflection: attention, following the nod, is directed elsewhere, inflected or bent from its path to focus on something else. Of course, innuendo does not specify what that something else is; it leaves its object ambiguous, unheard, to be determined.

For its part, inflection seems to be all about sound. Though in music an inflection is usually a change in pitch, this definition must be expanded to

include alterations of all sorts in a sound. Not just pitch, but timbre, rhythm, voicing, tempo are all inflections and must be inflected to compose, perform, or hear a piece of music. Inflection shapes words to express gender, number, mood, and tense, twisting their vowels, prefixes, suffixes, so that they point to the words and world around them. Even this broad definition is too restrictive, for every word is inflected by its context; else we would need a different word for every difference of meaning. Inflection makes language possible in speech. Meaning becomes sonorous only by virtue of the articulation of sound; and sound must be bent to invite the listener to share in its meaning. In her turn, the attentive listener must bend her hearing just so, in concert with the sound she hears. Every sentence, every sound is thus an instruction, a set of directions to follow as best we can. To understand is to follow these directions by striking the poses they suggest, to practice an aural tai chi in which one bends one's listening this way and that according to the inflections of the sound. We do not all follow directions the same way even if they are the same directions, and it may take a few different attempts, different ways of inflecting one's understanding, before the instructions become effective. The difficulty of understanding is linked to a fundamental ambiguity of inflection: inflection is never fully articulate, can never instruct conclusively, because in language as in sound generally, inflection inflects innuendo. You begin to speak without knowing exactly what you will say; you begin with innuendo and you inflect. Do you express an idea by anticipating its entirety in thought before articulating it in speech or writing? Do you speak a sentence only after first choosing each word? Before you utter a word, have you planned each phoneme, each motion of lips, tongue, lungs, jaw, cheeks, throat? No. Idea, sentence, and word all begin in innuendo, and to inflect that innuendo is to invent a sound that may surprise the speaker as much as the listener. At least one image of semiotics is thereby disrupted: the speaker does not reveal a prior private knowledge to the listener but articulates the sound between them. Listener and speaker share the innuendo to be inflected, and the difference between them is not a matter of an understanding already held by the speaker and lacking in the listener but a matter of attitude: the speaker inflects sound spoken, the listener inflects sound heard.¹

Likewise, both composer and performer begin to write or play, at once knowing and not knowing what will come next. The composer hears a melody, a rhythm, a form before she writes it down, before she can even hum it. Paul Hindemith claims that the greatest composers know the entire piece in a flash of intuition; then it is just a matter of filling in the details almost by rote. Certainly, this intuition is not a complete and articulate piece, a conclusion foregone. Rather, it is the insight of knowing that one has an insight, the confidence that one need only begin com-

posing, and the composition will spill itself onto the page.² What flashes in the composer's intuition is innuendo, a nod, and a perceptive and well-trained intuition can follow this nod to find there a whole piece. Going into each performance, the performer leaves some part of the music not yet fully determined, something must be left for the performance, a modal or gestural indeterminacy, a feeling that is familiar but must be actively recalled each time, re-created to suit the occasion. The performer must follow an innuendo, which inheres in the piece of music, but also in the audience, the other performers, the atmosphere in the concert hall.

You have to react to the conditions of performance—the actual circumstances. You play differently in a different hall. The acoustics make a difference. The instrument makes a tremendous difference. You may be feeling more—I don't know—you may be feeling more worked up on this occasion—you feel something brighter is needed. You go into the music in a kind of unbuttoned way, and if you play something which doesn't fit absolutely perfectly, well, it doesn't matter too much. You've really got to be on your toes, to be alert to do something which occurs to you which may seem a good idea, and be prepared also to find that it doesn't absolutely work. But it wouldn't matter because then the thing is alive, it's got some vitality in it.³

Maybe the performance will be slightly faster tonight, maybe more legato. To heed the innuendo, the performer listens for new sounds in the piece and is surprised and pleased to hear something not there in the previous performance or rehearsal. To perform is to create monsters ("the thing is alive"), and one's ardent wish is that the monster should have a life of its own.

Innuendo inheres in the inflection that bends it, articulates it to produce a word or a note. Innuendo persists throughout, to connect each inflection to its history, to inject sound with the movement that draws out a sense of the sound, always in relation to other sounds (and silences) around it. But inflection also remains in innuendo, even after the lips are closed and the bow no longer touches the strings. Inflected sound persists as noise, as vibration, as heat, as entropy, as inertia; it dissipates but does not disappear. Always, the problem of sound is how to inflect innuendo, how to discover in the score—but also the concert hall, the audience, the other performers, and the noise surrounding the music or speech—just those elements that can be bent so as to bend the ear of the listener. And that noise, the innuendo, does not disappear in inflection but persists: not-whistling a constant undertone of the blackbird's whistle.

Composer Karlheinz Stockhausen demonstrates the mutual persistence of sound and noise, drawing, in his music, each out of the other. Noise, he

says, is an aperiodic vibration of the air, sound, a periodic vibration. He gradually removes the periodic elements of a sound to leave noise and then reintroduces regularity, to trace the fuzzy path that leads from inflection to innuendo and back. But noise is more than just a lack of regularity, for even noise has its rhythms.⁴ Neither the substance of sound nor its complementary background, noise punctuates sound. Each beginning and ending is a noise: the moment when the blackbird starts or stops whistling, the leading sound of a string plucked, or a column of air beginning to vibrate, the plosive *p* at the parting of lips. Inflection begins with a chaotic irregularity, a compact jumble of sharp and unpredictable vibrations that calms in an instant, selecting from among the irregular vibrations certain ones that repeat to define steady, enduring characteristics, fixed pitch and intensity. Vowel sounds are formed by maintaining a relatively constant ratio among three frequencies (*formants*) defining pitches. Breaking up the constancy of vowel sounds, consonants mark an abruptness and consist of singular pulses, brief and unpitched bursts of noise.⁵ It is as though sound has to be jump-started, to burst ecstatically out of noise. Stockhausen proposes that vowels are a constant background, a substrate, which is articulated and thereby given meaning only by consonants: “that is the function of consonants in our daily language, to clarify meaning.”⁶ Roland Barthes claims that consonants are too articulate to be musical, for music produces a different sort of meaning: “Music is both what is expressed and what is implicit in the text: what is pronounced [submitted to inflection] but is not articulated: what is at once outside meaning and non-meaning, [...]”

Even the symbolic notation and numerical indexes of acoustics cannot purge its ecstatic origins from sound, which rend a hole in the rigid fabric of physics. There is an uncertainty principle of acoustics—analogue to Heisenberg’s uncertainty principle for quantum mechanics—which holds that a sound cannot be fully determinate with respect to both frequency and time.⁷ That is, the more closely we determine the specific timbre or frequencies of a sound, the less precisely we can specify when the sound happens and vice versa. Only a sound with no beginning or ending has an exact frequency; every sound with a duration, every sound that starts and stops must include physically inexact frequencies, patches of noise describable by Gaussian distribution functions (bell curves), wherein pitch is defined statistically over a fuzzy range instead of discretely at a specific note. The most sudden events—where inflection leaps abruptly from innuendo or returns thus to it—these sudden transitions are inevitably marked by noise which obscures and even distorts them.⁸

The implication of the uncertainty principle is that frequency and time in sound are mutually dependent and ultimately inseparable. Acoustical en-

gineers, physicists, and others who work with mathematical representations of sound routinely treat time as an independent variable while air pressure or wave amplitude is considered dependent. Nonetheless, the uncertainty principle guarantees that this is only ever an approximation, which usually sacrifices the temporality of the sound by regarding it as an ideal periodic wave that neither starts nor stops. In reality, we must consider that just as sound compresses and rarefies the air, so too it compresses and stretches time. Time does not pass indifferently to sound but constitutes its material. We know already the intimate association of sound and time. We regard vision as instantaneous: Hindemith is not alone in claiming to see something in an instant, and we do not often consider that vision need take any time. A photograph captures a single moment, and only photographers routinely remember that an exposure has duration. On the other hand, everyone knows that sound requires some duration, at least a short one. Which is why sound is time's traditional vehicle: think of the bells of a church or a clock, the town crier, a wrist alarm. What good would be a clock alarm that gave only a visual indication of the chosen moment's arrival? Ticking marks the passage of time, by defining a duration (between ticks) while also suggesting the indefinite extension of this duration forward and backward. We hear time passing in a ticking clock, whereas to look at its face is to see the time only right now. If the face of a clock can indicate the passage of time, this is because the clock *says* the time and does not just show it. "What time does your watch say?" Children learn to *tell* time rather than to read it. Sound resists study in Western metaphysics because time is traditionally subordinate to space; it is hard to get a handle on sound because it does not sit still to be examined, motion constituting its very essence. Perhaps it takes a composer working *in* sound to investigate without metaphysical prejudice its temporal nature.

Unified Time Structuring

Recognizing that temporality is not an indifferent abstraction when it comes to sound but a significant part of its very material, Stockhausen composes by seizing and manipulating three durations of sound, three scales of time. Certainly music is constructed from airwaves, vibrations of the air that determine sound's pitch and timbre, but it also involves crucially the vibrations of rhythm and of form. Wave, rhythm, and form: Stockhausen operates on each of these "temporalities," treating them as the stuff of his music. Sound as wave can be readily measured as a continuous variation of air pressure or a vibration of the air, and this increasing and decreasing pressure describes over time the shape of a wave. Sound waves define a relatively rapid

temporality involving vibrations faster than one-twentieth of a second and as fast as twenty thousand vibrations per second or more. The rate of this variation in air pressure we hear as pitch, while we hear the particular shape described by the rising and falling pressure as timbre or the texture of the sound. The second temporality, sound as rhythm, is a variation of accents, a pulsation felt as such in the sound. This temporality is slower, on a scale of one-twenty-fifth of a second up to sixteen seconds or so. We hear rhythm as sudden or sometimes gradual alterations in one or more aspects of a sound (pitch, timbre, amplitude, duration), but to constitute rhythm the occurrence of these alterations must be not so frequent as to constitute a pitch. Inasmuch as it defines a temporal scale, rhythm need not be regular or recurring, though we often reserve the term *rhythmic* for an alteration in the character of a sound that forms a repeating pattern, simple or otherwise. Finally, there is sound as form, in which structural or conceptual elements of sound are varied over time. This temporality spans larger durations, its periods lasting for at least a few seconds each. Any aspect of sound can contribute to the variation of form, including not only alterations in pitch, dynamics, timbre, duration, and rhythm, but complex combinations of these, as well as conceptual or semantic aspects of sound. So, a formal period might be demarcated by a shift in tempo, or by a change in lyrical content, from French to English, or free prose to rhyme, or consonance to dissonance. To hear the contrast and connection between one melodic phrase and another requires a human ear and a familiarity with the musical tradition of our culture. Likewise, all the factors that index elements of form—mood, intensity, tempo, density, verse versus chorus, etc.—rely on a trained hearing, or at least an interested ear.

Just as he amplifies the barrier between sound and noise, Stockhausen magnifies the boundaries of these temporalities to question their distinctions. He creates a sustained sound, then slows it down, until the periodic wave that constitutes its pitch and timbre can be heard as a rhythmic pulsation.⁹ He thereby melds the two temporalities, transmuting timbre into rhythm. He proposes further transmutations based on the same principle:

Suppose you take a recording of a Beethoven symphony on tape and speed it up, but in such a way that you do not at the same time transpose the pitch. And you speed it up until it lasts just one second. Then you get a sound that has a particular colour or timbre, a particular shape or dynamic evolution, and an inner life which is what Beethoven has composed, highly compressed in time. And it is a very characteristic sound, compared let's say to a piece of Gagaku music from Japan if it were similarly compressed. On the other hand, if we were to take any given sound and stretch it out in time to such an

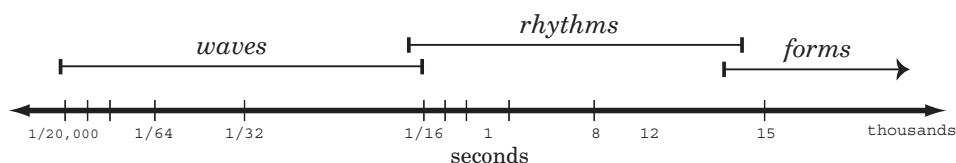


Figure 5. Unified time structuring.

extent that it lasted twenty minutes instead of one second, then what we have is a musical piece whose large-scale form in time is the expansion of the micro-acoustic time-structure of the original sound.¹⁰

A whole piece is hastened to the point where its sections take on a rhythmic pulsing. Even while Stockhausen was inventing these experiments, one of his primary influences, John Cage, had enmeshed two of the three temporal scales through his technique of prismatic composition, wherein a piece is divided into sections according to a specified form, which form also governs the internal structure of the sections themselves. (See, for example, Cage's "Lecture on Nothing" in *Silence*.)

Insisting on the unity of the temporalities ("unified time structuring"), Stockhausen emphasizes that they are not merely formally continuous but materially continuous. It is possible, after all, to treat any cyclic or wavelike form—such as variations in the rabbit population in England over time or the variable density of grass over the space in your yard—as a sound.¹¹ But such representation of a wave as sound demonstrates only a formal correspondence: any wave might as well be a sound wave and can be transformed into one with the right technology. On the contrary, Stockhausen's techniques underline a continuity that requires no transformation; only by acceleration and deceleration and without otherwise altering the material of the sound, he establishes the continuity of the rhythmic scale with the scale of vibrations in air pressure that it comprises. A rhythm is already made of sounds, their vibrations in the air constituting the rhythm in its matter.

Recognition of this continuity opens compositional resources formerly unavailable. Stockhausen composes not primarily notes or chords, but abstract properties, concepts derived from his analysis of the temporalities, which determine notes and chords only secondarily or not at all. *I can compose with a series of degrees of change* (Stockhausen 1989, 64). His piece "Momente" specifies four "moments" of form. Horizontality: *I could define how thick the line, the melody may be at any given place* (65). Verticality: *timbres, sound spectrums, chordal control, homophony* (66). Duration: *to deal with durations means to break the flow of time* (66). And Informal: *fairly vague, static, without direction; [...] they serve to neutralize the three main categories*

(68). For each performance, these properties are shuffled according to Stockhausen's prescriptions to create a composition that is only then derived as to its notes, words, and sounds. In "Kontakte," his temporal manipulations demand a more visceral composition technique, so he constructs a tape in the lab to accompany the performance, using methods necessarily brute to create and alter sounds on tape. (In 1959, computer synthesis was nascent, but unsophisticated and not readily available.) He adds waves together by layering tapes to construct a timbre, then peels off one-by-one the timbral components of the sound, leaving only a sine wave, the null timbre. He affects pitch-shifts by accelerating and decelerating tapes, a precursor of today's turntablism. Stockhausen's material and conceptual subjection of sound yields not melodic intervals or harmonic blocks but texture in waves, texture in rhythm, and texture in form.

And why stop at three temporalities? An entire piece, an oration, or the sounds of a day in the life are vibrations of the air and demand of perception different powers. These sounds each have unique timbres or rhythms, and so do a concert, a composer's oeuvre, a musical style, and every history of music. These are all rhythmic, structured, respiring. We hear a piece as part of a concert which has its own rhythm. A composer's entire oeuvre breathes and draws its breath in relation to culture and history, personal, familial, local, national, and global. "In a manifold sense, music uses time. It uses my time, it uses your time, it uses its own time."¹² Musical periods and epochs operate in complex polyrhythms, sketching a history in counterpoint to those of economics, politics, technology. These broader temporalities are not extensions by analogy, for, like wave, rhythm, and form, we hear such durations, grand and minute variations, concretely and without intermediary. How do you identify twentieth-century American music, or Russian Romantic music as opposed to the Western European variety? Which composition does not implicate its contemporary war or the vainglory of the king who commissioned it? Culture, politics, and history are audible in a piece of music or an Australian accent or a jackhammer. Jacques Attali demonstrates compellingly the inclusion of a culture in its music, paying special attention to economy and politics. The nineteenth-century organization of an orchestra—with a leader who represents the composer as proxy, sets the tempo and dynamics, establishes a hierarchy of "chairs"—all of this can be heard immediately in the music of the period. One hears the soloist set *against* the orchestra, her virtuosity a virtue only in a culture that recognizes and values individuality over, say, accord.¹³ (Attali notes that the virtuoso arises alongside democratic ideals that promote the individual and capitalist economics that reward individual accomplishment. There was no virtuoso when music celebrated only the glory of the King. Indeed, early West-

ern music is monophonic, each musician playing or singing the same thing. Many voices, one body, always His Majesty's.) In the adherence of the musicians to standards set by the conductor, one hears the hierarchical organization of the orchestra, whose members submit to the conductor (and to their training), as she submits to the composer, who submits himself to the compositional standards of his era. History inscribes these standards in the music, to define epochs (baroque, expressionist), periods (late Beethoven, serialist Schoenberg), genres (blues, a capella), etc.¹⁴ The orchestra is heard in its sections, and the physical organization of the players makes it nearly impossible to single out an individual; even from the front row, a discerning listener is hard-pressed to distinguish the second from the third violin. Not by accident, these sections and their hierarchy reflect a societal organization; such regularity, such organization would be impossible in a culture with a much weaker notion of centralized authority. One hears in a piece the very fact that it *is* composed, and this too bespeaks a history of music and of a socioeconomy that produces individuals who compose music. One hears the composer's voice in his unique style, which bears its own relation to history, a dialectic of convention and invention. Composed music is unified or totalized in the mind of the composer, who imbues the music with his personal relation to history and politics. How different this sounds from group music, where a fulcrum is at best momentary, and focus a constant struggle.

It is certainly contentious to claim that an entire history of culture is heard in a piece of music (or a speaking voice, or a fax machine) in the same way that the pitches and words are heard. More mystic than scientist, Stockhausen has been challenged by acoustic physicists regarding his assertion of the material continuity of the temporalities of music.¹⁵ Acousticians point out that if one slows down a sustained sound, so that the air vibrates more and more slowly, the pitch will not become a rhythm but will simply drop out of audibility. There may be a small window of frequencies where one can hear a very low pitch as a rhythmic woofing sound, but below these frequencies it will just be unhearable by human ears. A single sound stretched out over the course of days does not become an epic symphony as Stockhausen would have it but is perceived exactly as that other slow vibration of barometric pressure, the weather. (In this sense, meteorological variations of pressure are "sounds" of extremely low pitch and huge wavelength. We might feel them in our joints and in the vegetable prices at the supermarket, but is this hearing?) In other words, the material continuity of the temporalities of sound cannot be understood on the model of a single material substrate taken at different durations. The three temporalities are not material analogs, identical but for scale, as though time could be sculpted in sound by starting with a larger or smaller block, making the same

motions in any case and simply choosing one's hammer and chisel to scale. Though rhythm is certainly a variation of air pressure, one will not hear it except by attending to "pieces" of sound that are already more complex, more involved than the compression and rarefaction of the air over time: pitch, density, intensity, timbre, attack, etc. To make a waltz rhythm, tap 1-2-3 repeatedly on a drum, or play bassnote-chord-chord on a guitar, or alter the timbre of a sound on the guiro so that it repeats, rough-smooth-smooth-rough-smooth-smooth every couple of seconds. But ears hear nothing when one compresses and rarefies air pressure, *updown-updown-updown*, at this same tempo. Each temporality is a material motion of the air, but one will never arrive at rhythm or form, or even timbre and pitch, by considering only these vibrations, this material.¹⁶ Unified time structuring is not a naïve confusion prompted by the common material (air pressure) of all sound. Instead, the three (and more) temporalities are materially intertwined, constructed each from the others. Stockhausen well knows that an effective composition is built in this way at many levels, of many times, and includes an understanding of their relations. What sorts of relations do we find among the temporalities?

Persistence of Audition?

If we examine sound only as air waves, the temporalities will never be distinguished: the differences between 5×10^2 Hz (wave), 5×10^{-2} Hz (rhythm), and 5×10^{-5} Hz (form) are of degree, not of kind. To find the differences of kind among these temporalities, we must acknowledge their close relation to perception. Temporalities are paces at which things move and their thresholds index powers of perception. "The ranges of perception are ranges of time, and the time is subdivided by us, by the construction of our bodies and by our organs of perception" (Stockhausen 1989, 95). For example, each temporality corresponds to a different autonomic system: we feel rhythm in a manner only distantly related to the specific timbre or frequency of the notes. And one does not generally tap one's foot in time with the change in the key signature of a piece. Hearing a paragraph is not just a longer version of hearing a sentence. Pitch discernment, foot-tapping, the beginning and end of a dance or a shift in one's seat, a change in one's breathing, thinking, and feeling; what alteration, gross or subtle, might not mark a sonic temporal boundary?

We can dispense quickly with the hypothesis of parts and wholes. Form is not created just by putting rhythms together in patterns, even if we mean something very general by *rhythm*. Form is not exclusively about the rhythms *inside* it, but about larger forms: movements, pieces, concerts, and their connections to politics, economics, biography. It would entirely fail to express anything if it dealt

only with rhythms as its parts. Form—whose pace is that of the linguistic idea, paragraph, chapter, parable—form tends most often to the conceptual, the logical, the linguistic. It can tell a story, dramatize an argument, praise or critique. This is as close as music comes to representation, the call and response, the tension of the shift from major to minor, the alienation of an unresolved dissonance. Whereas timbre's connection to history is more diffuse, more micropolitical. Timbre is sound's signature: the quality of a voice that makes the *Hellos* of a thousand people instantly recognizable; that part of sound that announces its origin in a Yamaha DX-7, a Samick piano, a hollow-body electric guitar played through a clean British amp. One hears in the timbre of a guitar its lineage in the string family; one hears a whole history of problems and their unique solutions in the guitar.¹⁷ How to project enough sound? How to make a broad range of pitches technically realizable by the player? How to fit a human body? How to accommodate cultural habits of posture, of propriety, of property? What materials are available? Will this be a sacred object? Does it have to sound the same every time? Will it be mass-manufactured? How much training will players undergo? Each of these concerns is already economic, political, biological, technological, and we have not even mentioned the necessarily mutual evolution of different instruments, questions of complementarity of timbre, pitch range, and dynamics. Will this instrument accompany a voice? Solo over an orchestra? Be played through an amplifier? The instrument "is literally composed and manufactured by culture."¹⁸ There is a history in timbre of culture, just as there is a history in rhythm of the body's articulations and gestures, breath, heartbeat, elbow, sex. Words are rhythm through-and-through and rhythm shares its long history with language.¹⁹

Consider the role of the downbeat. It orients all the instruments, as well as the players and listeners. The orchestra gathers in semicircular rows, all facing the conductor, who becomes a focal point. He focuses and distributes like a prism the will of the composer and the constraints of style to the other performers, primarily by keeping the beat. He generates this standard by his emphatic gestures, which each performing body mimics in some of its parts. The standard is not just a tempo but serves as the criterion of correct participation in the music. The conductor standardizes identity, both the identity of the piece, which is recognizable as the same piece at each performance, and the identity of the performers, who submit their individuality to the conductor. Individuality is then a remainder: the difference between a given performance and an ideal *average* one. It is whatever the performer *adds* to the piece, a contribution not mandated by the standard of identity. Everyone bears an analogous relation to the center, everyone participates in roughly the same way. On the other hand, where there is no downbeat, individuality rules identity, and

any coordination is entirely voluntary. Each finds her own way of participating, for the whole is not governed by a hierarchy from the top down but by an elective construction. This populism is part of Steve Reich's fascination with African percussion, which requires no leader and so achieves at its best a spontaneous and precarious ensemble, where the individual does not cease being creative when he becomes part of a group. As we will see, twentieth-century Western art music employs numerous techniques to purge itself of the tradition of transcendent composer and his representative in the conductor. Serialist composers subjugate their wills to the rule of the series, algorithmic composers program computers to generate music according to a formula, minimalist composers eliminate large form in favor of a simple repeating figure, free composition attempts only to have no rule, conceptual composers write pieces that are different every time. Still, this distinction between traditional conducted music and recent unconducted music is far too stark; the conductor does not maintain a rigid control over the instruments and the performers do not give up their spontaneity when they follow the conductor. The identities of the players and even of the piece are always problematic. Is it the same piece with period instruments as with modern ones? Is it the same piece when it is rearranged, recorded and played back, transcribed for piano, played much slower or faster, or in rehearsal?²⁰ And twentieth-century techniques *also* demand the performers' submission to the composer, as Steve Reich's musicians become automata, mechanically hammering out patterns on African percussion instruments, entirely at the mercy of the process that defines the composition. The relative proportions of collaboration and identity, indexed by the strength of the downbeat, are not accidents of the music but fragments of culture that are heard there. To hear the place of the individual is to hear a history and a politics. *1940s*: Trombones disappear from the jazz ensemble, saxophones rise to prominence, and the audience quits dancing. *1970s*: Digital technologies escape from the laboratory and even rock musicians prick up their ears to study more carefully the timbre of sound. *1950s*: Teenagers with money to spend stake out an autonomous domain, the charts do not so much track music sales as promote them, and music becomes an industry.

All of this history is *compressed* in the sound but not ground to a uniform consistency in the process. The compressions of perception are asymmetrical, and point by virtue of their involved history to other compressions, particularly those just past and those just to come. A rhythm already involves the next beat, and to hear the rhythm is to be in the middle of it, hearing its history at each moment, hearing at once the beats that came before and the beats that are still to come. "[A]t the deepest level, [...] in developed music no event is purely itself, but receives its

meaning from what is absent—from the past and the future—which it then influences in its turn.”²¹ Even the rigid rule of the conductor’s downbeat can never be a total standard, for to play music is to hear the past and the future, before and beyond the downbeat. The sonata form persists widely in Western music as the standard against which other standards are measured. But sonata form calls on particular powers of perception: to hear a chord prolonged (Schenker) in the chords that follow it, to hear a melody as already a small sonata, with a building tension that finally resolves, to feel the center of the tonic and the displacement of the dominant. These events demand of hearing a compression that hears them together.

The compression involved in meaningful hearing does not take place on its own; hearing is an activity, not a passive reception. (We must therefore rethink the difference between listening and hearing, which is usually understood as active versus passive.) Derived from hearing, the temporalities of sound are things that we *do*, extraordinary powers of perception and the perceptive body. The body must compress time, it draws into a singular moment an interval of difference, “brings all the beats between ‘one’ and ‘one’ into a group.”²² To feel a rhythm means to feel the entirety of a beat all at once, even while anticipating the next beat. The space between one beat and the next is not itself a metrical or metered interval; to the listener, performer, conductor, and composer, it is rather a pulse, a moment that does not lose its integrity when divided. Once entrained, the perceptive body can hear the rhythm even when it is not being played.²³ And not only rhythm is an act of the body; each temporality demands a compression of sound, to grasp percepts that do not divide without changing their natures. The most rapid temporality requires the most dramatic compression: in an instant, one hears a fast and regular fluctuation of air pressure as a constant and indivisible pitch. Perception of timbre, too, needs a compression, for one hears not its acoustical equivalent, the aggregation of a number of pitches, but a uniform and steady texture.²⁴ The ear does not hear difference but subsumes all the difference, all the variation in air pressure, as a quality of sound. Form calls for still other compressions, draws other bits of history into its web. Like timbre and rhythm, though, it is the perceptive body that conducts the compressions of form, viscerally expecting, for example, the resolution of a dissonance or the triumphant return of the theme. The listening body’s rhythms—its breath, its motions, its attitude—betray the formal divisions in a piece of music.

This should be enough to disfirm the hierarchical model of parts and wholes: rhythm compresses elements of pitch and timbre, but these do not become the constituents of rhythm by being compressed in it. And timbre’s parts are neither the sine waves that are its mathematical equivalent nor a single period of its

wave representation. It is true that each temporality gathers into its duration elements of the other temporalities to suggest a loose hierarchy of organization, like town, county, state, region, nation. But sound would never have the subtle and awesome power it wields if it adhered to strict hierarchy. For the biunivocal relations in a hierarchy—each level relating to the next one up in the same way—can only ever produce one effect, the transcendent one. Planes arranged hierarchically would allow only homogeneous relations between each plane and the next higher. Every compression would be effectively symmetrical, and sound could never matter, could never point. But the temporalities do not relate each to each in a hierarchy. Compression does not gather together into a uniform whole but collects heterogeneously, making an asymmetrical, weighted duration that spills over its edges to implicate past and future, history and anticipation. Each compression is unique, its operations related to but not statically defined by the other temporal spans. Each compression includes its own difference.

We must therefore correct our earlier claim that the ear does not hear difference in compression. The ear does hear difference but hears it in value or quality; we hear the difference that makes a difference. We compress sine waves to gather a history of timbre into the character of the sound. Only because this compression is asymmetrical, heterogeneous, does a particular timbre point toward the next note, the next sound, and elsewhere, to its origins, its culture, its material. The asymmetry allows the ear to hear each note and each sound as significant, as moving and as part of a motion. We do not hear a bunch of notes that we aggregate to make a rhythm but already hear the rhythm in the motion of the note, its leaning or intention (intensity). To hear form is also to compress, since one hears a melodic line even before its collection of notes, one feels the differences between the drive in the chorus of a song and the suspension in the verse, and one knows without any analysis the imminent ecstasy as a twelve-bar blues approaches the final bar of its form. The body does these things, and it does them by hearing a history, recent and ancient, in the present.

[Artists] do not juxtapose instances of the figure, but rather each time combine an element of one instance with another element of a following instance. They introduce a disequilibrium into the dynamic process of construction, an instability, dissymmetry or gap of some kind which disappears only in the overall effect.²⁵

In their chapter on double articulation, Deleuze and Guattari discuss an animal's relation to the various milieus in which it is found: the animal demonstrates affective thresholds that divide the milieu according to powers of the body.²⁶



Figure 6. An example of Schenkerian analysis. The top staves are the original first few bars of the “very slow” movement from Beethoven’s Piano Sonata Op. 10 no. 2. The bottom staves represent the fourth and final stage of the Schenkerian reduction of these same few bars. Adapted from Thomas A. Pankhurst, *Schenkerguide.com: A Guide to Schenkerian Analysis*, <http://www.schenkerguide.com/stagefour.html>.

These thresholds connect perception to the milieu and so also connect affects of the body to forces of the environment. We hear and do in concert with environmental forces: conservative forces of energy storage, counterforces of resistance, resonant forces to amplify and direct energy. Perception is not passive, but affective; in perception, the body behaves itself, acting on and reacting to its environment.²⁷ Perception compresses, and in so doing it makes the difference between one temporality and another. The body thus draws lines through perception, articulating a range of behaviors or affects and generating the indexes that mark time.

In other words, the body must remember. To hear pitch and timbre, one must remember the last few vibrations of the air. These few milliseconds are compressed, drawn together, their internal difference extinguished, covered, or crossed by the compression. One does not hear a variation of air pressure, a difference over time, but only the effect of this difference, the steady quality of pitch and timbre. To hear the fill at the end of a four-bar drumbeat is not just to hear that brief, halting rhythm but also to remember in hearing the steady three-and-one-half bar pattern that led up to it. Schenkerian analysis elevates to a basic principle (“fundamental

structure”) the method of *prolongation* of a note or chord by placing other notes amidst its occurrences. Both the term *prolongation* and its notation in music suggest that one hears the note throughout its prolongation or perhaps that one hears it in its recurrence as having never really gone away. Memory hears the note or chord prolonged in notes and chords different from it, but memory’s job is to forget this difference.²⁸ A D at the beginning of a melodic phrase might travel up to E or down to C# before returning to a D at the end of the phrase; Schenker claims that we hear throughout this motion no genuine departure from D, but only a difference internal to the D, as though E were just a tension of the D which bends but does not leap. (That is why only small motion is really considered prolongation.) Perception remembers to forget, to forget a difference even while retaining that forgotten difference as a symptom of memory and a quality of the sound. The difference forgotten is essential to hearing, for the structure of forgetting in memory gives time its direction and points hearing toward the future. The compression of a beat, a rhythm, a melody, a verse, a pitch, or a timbre does not create a homogeneous block of time-sound but a singularity, a weighted hearing that is open to the next moment precisely because it retains the last ones. This is the paradox of memory: one hears the recent in the current, the past in the present, not an aggregation of past instants but the whole past compressed into the now. Hearing is the fulcrum at which sound’s past leans into the future. One forgets, but one remembers what one has forgotten, one remembers it not as an explicit and conscious difference, but as the asymmetry of the sound, the arrow of time, a history in hearing.²⁹

Perhaps this explains why so many people are content to listen to music without regard for the fidelity of the reproduction or the ability of the playback system to produce definitive sound pressure levels and a sense of acoustic space. Most people do not bother to listen to music but instead only want to be reminded of it, for “the pleasure of mere recognition.” Stanley Cavell points out that sound is essentially indirect, that it comes from a person or place but does not reach us without leaving that person or place. “[I]t is the nature of hearing that what is heard comes *from* someplace, whereas what you can see you can look *at*.”³⁰ We hear all the time things that are not there before us, the person on the other end of the phone or the woodpecker hidden in a grove. Sound involves a mental reconstruction of its origin, it requires the perceiver to relocate it there where it comes from. Since we are all used to listening to what is not there, we are hardly troubled by the ontological problems of recording and playback. We refer to what we hear as “the flügelhorn” whether it is Clark Terry before us or just a CD of his playing. We are not terribly bothered by a poor recording since we are used to constructing from memory the reality of the

object “in our heads.” To hear is to remember, to recall, not to witness. Sight, on the other hand, is a matter of looking at something that is evidently there. Were it not there, we wouldn’t be able to see it or, rather, look at it. To see is to be in the presence of the object under regard. Thus, we take for granted the difference between a visual reproduction (photograph) of a scene and the actual scene before us. Though one might regard a photograph as an authentic viewing experience *of that photograph* (as opposed to, say, a reproduction of that photograph), one never regards it as an authentic viewing experience of the photographed scene. But to play a recording on a stereo *is* considered an authentic listening experience, not just a document of something that happened previously. In either case, one hears the sound of the flügelhorn, which does not seem to require the presence of an actual flügelhorn. (Cavell wonders whether there is some visual analog to the sound of an object, like the “sight” of it? Its sight or image is not very separate from the object itself.)

So you need a memory to listen to music. How will you know what to feel next, why would you feel anything without a sense of what has come before? “A note or chord has no *musical* significance other than in relation to preceding or following events. To perceive an event musically (that is, to recognize at least part of its music function) is to relate it to past events.”³¹ The previous *Pierre Boulez* chord, the previous phrase, the previous section, movement, piece, performer, composer, period. Is it enough to remember the previous sound? The previous peak in air pressure? (But air pressure is in a variation so continuous that it has no *previous*. How do you choose which Fourier transform to look at? Or which regularity to attend to?) It is not always the same memory that is called upon. Traditional Western music relies on a linear and discrete memory, a memory that draws from the sound a universal history and a set of conceptual differences. It operates by comparing one section to another, noting similarities and differences and taking its cues from them. Form conforms to standards, and the lines that divide one formal unit in a piece from another are clear to the ear and in the score. “This was the process characteristic of classical Western music: actual memory of real objects and ‘angle of hearing’ checked at major points in the structure—in other words, an a priori awareness of the formal schemes employed by the composer, a sort of common fund shared by the musical consciousness of a whole society.” Classical European musical form is, as Wim Mertens says, teleological and narrative, even representational.³² One *interprets* the music, guided by the common fund or musical vocabulary shared by the culture. Motifs play characters, which interact and undergo alterations throughout the narrative. The narrative itself is linear and objective, with marked events in series that serve as hinges for the changes to the characters.

Characters are introduced in the exposition, developed in the development, and the consequent tensions are generally resolved in the recapitulation.³³ Wishing to purge music of teleology, to eliminate the last traces of romantic expression, Boulez distinguishes another kind of composition with a different sort of memory and new conventions. He adheres to a total serialism, in which series of timbres, pitches, durations, dynamic values, etc., determine the nature of each note in the piece. Prior to writing down the composition, the composer chooses the series (of timbres, durations, etc.) according to rules that largely eliminate the composer's intention from the ultimate sound of the piece. For example, the composer initially decides on a series of durations (e.g., half-note, then sixteenth triplet, then dotted eighth-note, etc.), and then composes a piece sequentially by always assigning the next duration in the series to the next note (or rest) in the piece. (The series is considered a loop, with the first element always following again after the last.) Each characteristic of the "next" element is determined by some such predetermined series, a series of pitches, a series of dynamics, note durations, timbral indications, etc. The composer creates the various series, then the composition writes itself. In a total serialist composition, there is no transcendent organization, no sense of beginning-middle-end, no development, no story. Memory is not called on to compare large sections with each other. Instead, memory attends to the immediate, comparing each sound to itself, to its neighbors, and to whatever sound. Memory loses its hold on a linear and continuous time as, without the organization into formal structures, each element represents only itself and context shrinks indefinitely. One hears the universal and the singular in the same moment, the timeless and the atemporal.³⁴ Boulez attempts to present sound per se, sound decontextualized or unadorned. Without a narrative, sounds are free to get out of line, to draw on extraordinary temporalities, breathtaking affects, and saturated percepts. The dissolution of a formal context places greater emphasis on the sound itself, to the point where some composers write only one sound to offer listeners a close-up or "microphonic" perspective of timbre: a smooth sheet of sound as a singular universal, a composition whose variation is entirely internal to the sound. As such, the twentieth century saw an increasing attention to timbre, as formal elements were flattened into immediacy or immanence.³⁵

Wishing to examine sounds from the "inside," La Monte Young began experimenting with "long durations" as a student. Under the influence of Fluxus artists in New York, he wrote the same piece thirty times: *Draw a straight line and follow it*. Another piece ("Composition 1960 #7") simply instructs that a two-note chord is "to be held for a long time." Eventually he would write pieces that combine his interest in long dura-

tions with his ideological commitment to nontempered tunings. According to Young, by playing notes whose frequencies are ratios of whole numbers, one ensures that the piece will be effectively the same each time it is performed. For two centuries, standard Western tunings have guaranteed an irrational frequency relationship in every interval but the octave.³⁶ To achieve such irrational tempered tuning requires an in-principle impossible precision so that the chord will never be exactly the same from one performance to the next. The consistency from one performance to the next is not so much an end in itself but testifies to the perfection of the sound. Young wishes to “penetrate the inner essence of the sound,” and he finds this essence in the exact relationship of one tone to another simultaneous tone.³⁷ Again, the context of the sound disappears, for the piece does not vary over its duration, or does not spread its variance out over time, but compresses it into each moment of the singular and universal chord.

Listening is tending to become increasingly instantaneous, so that points of reference are losing their usefulness. A composition is no longer a consciously directed construction moving from a “beginning” to an “end” and passing from one to another. Frontiers have been deliberately “anaesthetized,” listening time is no longer directional but time-bubbles, as it were.³⁸

Young recognizes explicitly the universal singularity of each of his pieces. On the one hand, he titles not just each piece, but each performance, and stamps it with its time and place: “*90 XII 9 c. 9:35—10:52 PM NYC, The Melodic Version of the Second Dream of the High-Tension Line Stepdown Transformer from The Four Dreams of China.*” On the other hand, he believes that each performance is not the creation of a new sound, but only the instantiation of a persistent and universal dream, the dream of an ancient tortoise, whose dreams give rise to all of sound. “They are primitive sounds that do not remember ever to have started and that are perpetuated in the Dream House project.”³⁹ Memory shrinks to a moving point, an immanent action, which marks only accidentally and contingently the beginning and end of a piece, for the same piece, the same sound is taken up whenever the piece is performed, “modes of vibrational structure [...] repeated exactly from performance to performance” to “trigger the same moods every time.”⁴⁰ In total serialism, too, the beginning and end are arbitrary, since the series are themselves arbitrary and the order in a series random or indifferent.

This makes some sense (and there are other explanations⁴¹) of Young’s obstinate refusal to release recordings of his own work, especially the many tapes he has of Dream Syndicate performances with Tony Conrad et al. Why would

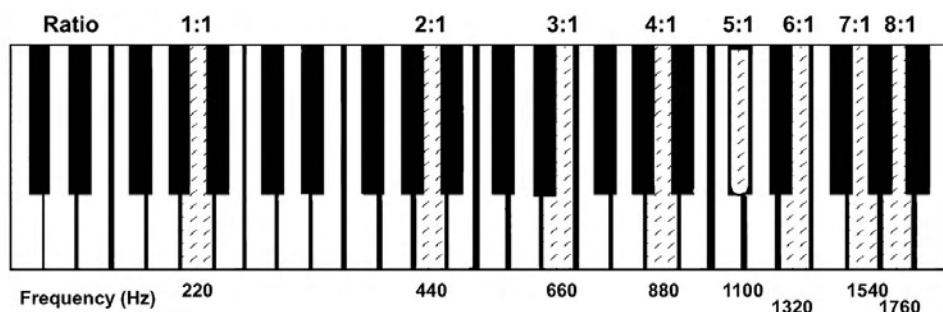


Figure 7. A well-tuned piano. Because this is a nontempered tuning, the intervals and frequencies shown here only approximate the way pianos are ordinarily tuned. For example, on today's concert piano, the note G, which here corresponds to 7:1, would be tuned to 1568 Hz, not 1540 Hz. The G on the piano in the illustration would sound flat to our well-tempered ears when playing in the fundamental key of A.

one need a recording, when every performance is the same, so that one may as well instantiate the piece again, here and now? What recording could do justice to the crystalline perfection of the lived event of a rationally tuned chord? Perhaps Young is attempting to reject memory altogether, to deny memory its relation to the piece, which then remains outside of time. A mass-produced recording treats the piece necessarily as something with a beginning and an ending, voiding its singularity by reproducing it in a mass medium and stripping it of its universality by placing it on the store shelves among thousands of other recordings. Though the molar memory of form is denied in Young's pieces, the molecular memory thrives in the moment of performance. Even in his compositions that vary and incorporate large forms, one hears already the entire piece in a single chord. The universality of a rational tuning comprises the whole key, all the notes at once. Writing of Young's "Well-Tuned Piano," Robert Palmer notes both the singular quality of the sound and the universality in the tuning, for the whole piece resounds in its opening chord: "The sound of the piece is so novel that one has trouble recalling it after the initial impression has faded, but as soon as one approaches the upstairs room and begins to hear the chord floating softly under the door, something extraordinary happens. One begins to recall, in detail, the sounds and structures of the entire composition."⁴² For Young, even the horizontal line of melody is just harmony's vertical, stretched into duration: time as a suspension of eternity, reality a turtle's dream prolonged.

Young's fascination with whole-number frequency ratios (*just intonation*) and their relation to memory is an ancient theme translated into California New Age. That great champion of the whole number, Pythagoras, postulated the

music of the spheres, a rarefied sound, too rarefied to hear, produced by the rational perfection of orbiting heavenly bodies. Modern acoustics updates this myth, retaining a special place for rational tunings. For an instrument does not produce a single (fundamental) tone without also sounding its harmonics, all the tones bearing whole number frequency ratios to that fundamental tone. It is the relative amplitudes of the various harmonics that determine the timbre of the sound. In other words, to sound a note on the trumpet or didgeridoo is to sound not just that one tone but simultaneously another tone an octave higher (2:1), and another tone a fifth higher still (3:1), and two octaves (4:1), two-octaves-and-a-third (5:1), etc. In Figure 7, when the lowest highlighted key, an A at 220 Hz, is struck, the strings will vibrate to produce sound not only at 220 Hz but also at 440, 660, etc., as though all the other highlighted notes were being played simultaneously. The relative amounts of each harmonic determine whether it sounds like a trumpet or cornet, clarinet or oboe, Fender P-Bass or J-Bass. (See Figure 8. Timbre also includes changes in the character of a sound over time. We recognize a guitar not only from the harmonic spectrum of its steady vibration but also from the sudden and noisy attack when it is plucked.)

Acoustics thus supports the claim that every note already sounds an entire nontempered scale. Even a sine wave, once given life in a room, will excite its harmonics in sympathetic bodies. A sympathetic tuning will align an instrument's various notes (strings, columns of air, membranes, etc.) with each other so that simultaneous or successive notes share significant portions of their frequency spectrums and chords sound perfectly harmonious, with no beating or roughness in the sound.⁴³ La Monte Young knows that whole-number frequency ratios are the closest we can come to hearing for ourselves the music of the spheres.⁴⁴

The ear does its part to promote rational tuning. Pitch discernment is based on the harmonics of a note rather than its fundamental. Psychoacoustics experimenters use synthesis techniques to generate sounds with a "missing" fundamental, sounds that are only harmonics. Test subjects nevertheless identify the pitch of the note in terms of its absent fundamental, which is not actually being sounded; the ear recognizes the fundamental by hearing the third through fifth harmonics. We hear sounds that are not there by hearing harmonics that are.

La Monte Young's music provides a unique experiential link to a primordial evolutionary basis for human sensations and perceptions. [...] La Monte Young has carefully studied the current psychoacoustic place and volley theories of hearing, after having created and musically explored "missing fundamental" tones—tones which are not physically present in the auditory stimulus, but which are supplied by the human ear, nervous system, and

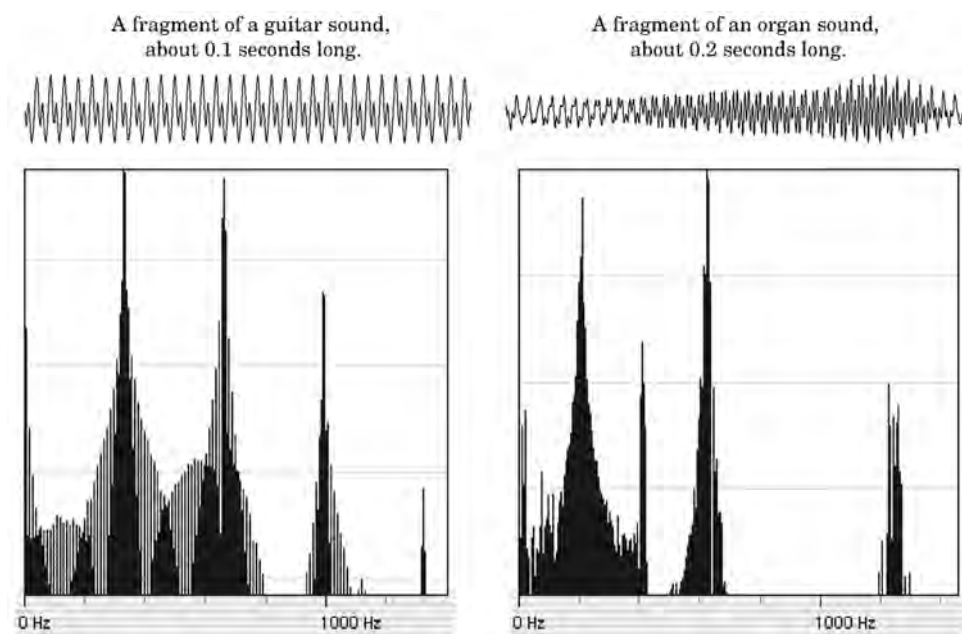


Figure 8. Spectra of sounds. The left column shows a guitar waveform and its spectrum. The right column shows an organ waveform and its spectrum. The waveforms are graphs of amplitude (air pressure) over time. The spectra are graphs of amplitude (energy) over frequency, averaged over the entire short duration of the waveform. For each spectrum, the first (*leftmost*) peak represents the frequency of the fundamental. Other frequency peaks are spaced at regular intervals because they are multiples of the fundamental.

brain. These induced auditory experiences are in turn rooted in millions of years of neurophysiological evolution, representing in their own way certain fundamental constants of human biology.⁴⁵

The rational tunings in La Monte Young's music manifest these fundamental forces of sound, acoustic and psychoacoustic universals. These forces make sound and make sound effective, so to hear them is to hear the cosmic origin of sound itself, the differential force that sets sound in motion.⁴⁶ To expose still other sides of these forces, John Cage eliminates the foreground of sound entirely, drawing the background into the foreground, most famously in "4'33"," but also throughout his oeuvre, which includes a judicious use of silence and an increasing emphasis on performance as a "happening." The elimination of the foreground would be to no avail were the background hypostatized thereby, for one would then have just a new foreground. However, what we discover

is that the background does not sound like the foreground. What shall I listen to? What shall I attend to? How (in what sense) is this music? Cage would be delighted with this self-conscious confusion. He wants desperately to rid compositions of every shred of intention and so eliminates his own intention, his self, through aleatory and Zen techniques, which constitute his very methods of composition. He tosses yarrow sticks (*I Ching*) to determine which of sixty-four elements will come next in a piece and so composes "Music of Changes." He offers prepared nonsensical answers to questions from the audience at his lectures and gives impossible instructions to performers. He thereby foils the listener's intention by foisting uncomfortable and irresolvable questions on us, setting before us an interrogatory music, a problematic music which poses hearing any number of koans. Consequently, "one may give up the desire to control sound, clear his mind of music, and set about discovering means to let sounds be themselves rather than vehicles for man-made theories or expressions of human sentiments." Stripped of intention, sound no longer triggers responses from the standard catalog of emotions, no longer refers to the human activities of manufacture, performance, etc. The composition loses all relation to representation and denies its human origins in favor of a universal or cosmic origin. Sound ceases to signify and presents only that nonhuman force that drives sound per se, the any-sound, whatever sound. But Cage is quick to note that this unintentional, inhuman hearing is not the same as indifferent hearing or deafness. To hear without presupposition and context is not to hear without interaction or without care. "[S]ounds, when allowed to be themselves, do not require that those who hear them do so unfeelingly. The opposite is what is meant by response ability."⁴⁷ One still hears difference, sound is still pointed, but now out-of-joint, no longer pointing along a two-dimensional line with a universal history and a determinate future. It is up to the listener to hear this way, to be able to respond, to be responsible. Cage thus calls for a new hearing and a new listener.

This is how music makes a difference, by demanding something of the listener, by directing memory to construct new subjects of hearing. Here is music's entrée into the political, the social, and the economic. Here is how music rouses a crowd and soothes the savage beast. Stockhausen means it when he says that sound changes people, that whatever you hear alters you irrevocably and without the intermediary of ideology. "Whenever we hear sounds we are changed: we are no longer the same after hearing certain sounds, and this is the more the case when we hear organized sounds, sounds organized by another human being: music."⁴⁸ He knows, too, that sound draws its transformative power from manipulations of memory.

“Play a sound with the certainty that you have an infinite amount of time and space,” demands one of his compositions, once again directing memory away from the historical and into the immanence of the sound. What sounds do we censor as less than crucial, before even making them? What forces do we hold in reserve, waiting for the right moment? Stockhausen teases out these forces, asks his performers to make explicit those connections between sound and time that they usually push into the background. His piece, “Connections,” makes a list of rhythms and instructs the player to follow them: Play a vibration in the rhythm of your body, your heart, your breathing, your thinking, your intuition, your enlightenment, the universe. “Mix these vibrations freely,” he says. The result is the juxtaposition in sound of the personal and world-historical experiences of the listener and performer.

Stockhausen’s compositions challenge the traditional divisions of musical time by connecting them to other extramusical rhythms. Memory must grasp new durations, operate across temporal distances both vast and fleeting. This

Steve Reich contrasts starkly with pre-twentieth-century European art music, which usually assigns memory an unambiguous role by giving hearing distinct phrases in familiar lengths to compare to each other. However, even

the existence of a discernable elementary unit does not prejudge the role of memory in a piece. Whereas La Monte Young, Tony Conrad, Phill Niblock, and others sustain a single note or chord to get inside of it, their fellow minimalists Steve Reich, Terry Riley, and Philip Glass repeat an internally differentiated motif and alter that motif over the course of a piece. Each composer uses particular techniques of differentiated repetition, but these techniques overlap and borrow from each other. Phase shifting involves at least two sources of sound (instruments, tape recorders, etc.) playing the same phrase (rhythm, melody, sentence, etc.) at the same time. One of these two sources is shifted in time so that it no longer aligns with the other. The shift can be continuous (e.g., Reich’s “Come Out” and “It’s Gonna Rain”), so that as it progresses, the original phrase is heard to stretch or thicken, then become an echo, then morph into an incomprehensible jumble of pitches, beats, chords, or phonemes. A continuous phase shift dis-articulates the sound, turning a voice inside-out to expose the sonic material of speech and eliminating the distinct boundaries between notes and beats in a musical phrase to demonstrate the priority of a motif over its parts. For one still hears the motif, not as the sum of its parts but as a lump or clot of sound. The force of sound is discovered thereby to operate in temporalities both more supple and more gross than the words, notes, or beats. Instead of a continuous shift, phase can also jump by discrete rhythmic values, one part leaping ahead of its twin by, for example, an eighth-note at a time (Reich’s “Clapping Music”) so that the

ear discovers new rhythms and new melodies resulting from the staggered overlap of a motif with itself (Reich's "resulting patterns").

Other minimalist techniques for differentiating repetition abound: a single repeated phrase can be altered by augmentation, substitution of rests for notes or vice versa, dynamic reemphasis, the introduction of a new theme, transposition, inversion, etc. (Many of these techniques predate the American minimalists, and Olivier Messiaen deserves particular recognition for his inventiveness.) In any case, it would be a mistake to understand the fundamental repetition in such a piece as the repetition of the elementary phrase. For repetition is not first of all an external method imposed on the phrase to turn it into a composition. Rather, repetition is the principle of the music before any phrase is repeated: each note, each phrase is already a repetition. That is why even La Monte Young's held chord is a repetition: its principle is repetition. His justly intoned chord is born of repetition (the repetition of harmonics, the repetition of timbre), and the tortoise's dream is not an original instance repeated in the performance, but indicates precisely that there is no original, that the original is already a repetition.⁴⁹ Like Young's held chords, the effect of repetition in Reich, Riley, and (usually) Glass is to present a smooth surface to the ear, to eliminate the distance between foreground and background, so that the ear can no longer orient itself with respect to molar boundaries or objective points of reference. One hears the cosmos open up to envelop the listener.⁵⁰ It is thus not a matter of a certain number of repeats. Reich does not repeat a phrase so that we might hear the phrase repeated but so that we might hear the repetition itself. Repetition as a cosmic force, the principle of sound, generating each tone, each phrase, each performance, each piece. Total serialism proceeds exclusively by the repetition of composed series, but even keen listeners are hard-pressed to hear these individual series. We hear instead just their quality, that singular character of total serialism that *is* the sound of repetition. (Though one can hardly discern the series, serialism is nevertheless readily identifiable by ear, and different series produce aurally distinct results.⁵¹) Reich aims constantly to reveal the forces at work in the music, to render the process of composition sonorous, "to hear the process happening throughout the sounding music."⁵² Repetition is heard not just from one element to another, but the compositional principle of repetition emerges from behind the scenes into perception. New music repeats according to an internal principle: the immanent alteration of the figure or the accidental variation in performance of a single note. "[E]ven if you try to play the same thing over and over, it will always be different."⁵³ Repetition is a repetition of difference, so memory grasps it only by crossing that difference, covering it with a singular sonic quality.

In Reich, as in Young, Cage, and total serialism, the boundaries that mark the piece and give it a distinct place in a linear time sequence are missing. The internal principle of repetition does not identify a first instance of a motif, and its smooth surface presents no cracks where it might begin or end. As such, when the piece does begin or end, it seems to do so arbitrarily or in the middle. Moreover, Reich arranges his pieces so as to collapse the distance between a melodic line in the foreground and a harmonic motion in the background. In "Music for Eighteen Musicians," each instrument plays its own line, which moves enough to constitute a proto-melody while remaining sufficiently static to serve as a harmony and rhythm. When these lines are played together, the ear is free to choose any number of resulting patterns, melodic lines built by taking a note from one instrument and then a second note from a different instrument in the same register, and so on. Reich invites the listener to construct her own melody out of the music, while the harmony too is somewhat ambiguous, consisting only of the superposition of multiple melodies. He sometimes deliberately brings one resulting pattern into the objective foreground by doubling it with an independent instrument. That is, he chooses a melodic line already available in the conjunction of different instruments and assigns a new instrument to play it. Usually, this instrument begins softly and builds in dynamics, so that the foreground lifts slowly and imperceptibly from the background and then drops back again. Paradoxically, the effect of this doubling is to remind the listener that she is free to choose what to listen to, that the music does not impose a hierarchy of instruments or musical ideas but presents itself on a plane where any element can be brought into the foreground simply by a shift of focus. No part of the performance is authoritatively sanctioned as more significant or particularly demanding of attention so that, in collapsing the distinction between foreground and background in the music, Reich also collapses the distinction between the sounds that are part of the music and the ambient sounds of the concert hall. When the listener is given license to listen to anything whatever, then there is no longer a basis for deciding what counts as music and what counts as noise. The blurry boundaries demarcating the beginning and end of the piece collapse this distinction even further. Reich himself is no better placed than the audience members to distinguish the essential from the accidental in performances of his compositions. Like the serialists before him, Reich relinquishes the decisive power of compositional authority in favor of a mechanical process: "I accept all that results without changes."⁵⁴

In fact, he goes beyond mere acceptance to celebrate the contingent moments in his music. Though his compositions frequently employ a steady pulse, "it is actually tiny micro-variations of that pulse created by human beings,

playing instruments or singing, that gives life to the music.”⁵⁵ Each repetition of a motif includes microtonal and microrhythmic variations, as players cannot strike notes with exactly the same force, tuning, and timing from one iteration to the next. These glitches or imperfections act synergistically in ensemble performance, where *microphonic* individual alterations complement each other, to determine a *macrophonic* phenomenon; the uncoordinated dynamical inconsistencies of many players might bring a particular resulting pattern to the fore, or slight variations of timing might create an overall sense of tension as the whole piece is felt to slow down almost imperceptibly. Reich lays bare a musical conflict that inheres in every tradition, but most notably in Western classical music, between the ideal composition represented by the score and interpretative deviations from the score by conductors, musicians, technology, circumstance, fashion, etc. To render sonorous the musical force of this conflict, essential to the actual production of sound, Reich pushes the poles to extremes. On the one hand, the ideality of the composition is utterly ossified by his mechanical methods of composition: “once the process has been set up it inexorably works itself out.” Every variable is accounted for, “all the note-to-note details and the overall form” are immediately composed by the process that generates them. On the other hand, precisely because the process is laid bare, we hear even more clearly the “slight irregularities in performance,” the contingent elements that the Western tradition tends to overlook or ignore in its treatment of music.⁵⁶ One hears the process of the composition and, more important, one hears the musical force of this process in its tension with the vicissitudes of performance. To submit the composition to a process is to establish “a direct contact with the impersonal,” to imbue the work with those cosmic forces that motivate and can be heard in it.

Alvin Lucier arranges a room with a microphone feeding a tape deck and a second tape deck feeding a speaker. He sits in the room and records a brief text onto tape by reading into the microphone. This tape is then transferred to the second tape deck and Lucier’s short speech is played back through the speaker. The recorded sound of his voice is rerecorded through the same microphone onto a second tape. This second tape is then likewise played back and recorded onto a third tape. The process is repeated thirty or forty times. The resultant composition, “I Am Sitting in a Room,” is just the successive playback of each tape, starting from the original speech recording. Each iteration excites more of the room’s vibrations, accentuating or exaggerating certain pitches in the original speech and attenuating or damping other pitches. The text-speech slowly slides from articulate words to a continuous hum of pitch, and eventually—even where there was a silent pause in the original, say, between two sentences—the noise

of the tape and the room is selectively reinforced to produce an unbroken and perpetually evolving chord from an exhausted organ. Each room, says Lucier, has its sonic character, those pitches it chooses by virtue of its shape and other acoustic affects. The room is called upon to participate in a memory-machine; the room's memory, which interacts mnemonically with the voice, the recorders, the microphones, etc., becomes sonorous. Every sound is shaped by both the means of its production and by the space wherein it propagates. Lucier calls forth this space, this sonic signature whose repetition brings the room and equipment to the attention of hearing. The room remembers, and the ear hears this memory in the composition. Again, memory is not primarily comparative but productive; the room remembers *in* the sound, placing there its aural stamp. In the terms of acoustical engineering, the room is a complex filter, accentuating some bands of energy, damping others, and altering the phase (time shift) and the pitch (frequency shift) of any sound caught in its space. Moreover, the complex effects of the room vary widely over that space so that the precise locations of the speaker and microphone in the room crucially determine the sound of the recordings, and alternate locations would likely generate wholly different results.

Lucier captures in his composition the force of memory, as it conjugates time and space. His method of composition is the magnification of the *reverb* or reverberant character of sound, which lies at the junction of time and space. Reverb reminds us that sounds are never instantaneous but always heard over time in a duration. Reverb also reminds us that sounds do not reach us from an unambiguous source; we do not receive a transmission directly from the speaker or instrument. Instead, the whole room, the entire space becomes an instrument, which spreads out and shapes the sound in myriad ways. Sound is where time and space collide, where a room is mapped in compressions and rarefactions, sound translating space into time.⁵⁷ (Bats and submarines both effect the reverse translation, using sound to map time into space. Recordings, particularly vinyl records, lay time out over space, imprinting a duration into the spiral groove of a record. We might say that recording is a reflux or distillation in which time is boiled off, for time must be added back in to get sound, in the form of a steady motion of the turntable or tape heads, or the crystal clock in digital recording. Attali bemoans this distillation, for it makes possible the stockpiling of sound as a material possession.⁵⁸ Modern consumers collect sound in the form of records and CDs, storing up time they never make use of. Ownership of time as commodity takes precedence over the productive expenditure of time listening to or making music.)

Lucier's experiment confirms that memory's job in perception is to forget. For the room, while imparting its sonic signature, dis-articulates the text-speech even while remembering it. His words lose their definition progressively with each iteration until speech becomes music. But neither the room nor Lucier's process introduces this music into speech as something new, for the pitched notes in the final iteration can only consist of frequencies already in the speech to begin with, frequencies excited by the room. Speech is made to yield the music already in it while the room invites this music by spreading out the edges of the sounds, successively flattening the inflections, smoothing the consonants to give rise to a drone that one might hear in the music of Young or Charlemagne Palestine. The room effectively forgets inflection, crushing inflection into the innuendo whence it came. The most articulate sound is washed into the hum of noise. Lucier's stutter, a rhythmic punctuation in the original text-sound, becomes first a continuous consonant roll and, eventually, only another smooth glissando of pitches, open vowels streaming through virtual organ pipes, which render a stutter all but unthinkable. This is another molecularization of sound, a pulverization of words in order to instill a spatial memory of them, to bleed them into each other. In this sense, Lucier's reverberant technique places before the microphone the event at every juncture of sound and noise. His piece explodes the transition from inflection into innuendo, the dissolve at which sound melds into noise, inviting its close observation. Lucier and Stockhausen thus share an artistic goal but proceed by very different means.

Adorno notes that already in Berg sound is molecularized to give it the smoothest consistency. Where Webern heads in the direction of the molecular with his pointillist techniques, Berg presses the sound even beyond a point, smashes the sound into ever smaller parts, "minimal distinctions," so that any parts might fit together, any juxtaposition become available. "The initial atomized material is fragmented still further, insofar as that is at all possible. The entire set of compositional interconnections arises in Berg from such dividing and subdividing. Thanks to this everything pushes up against everything else." The music proceeds entirely by immanent self-determination; any influence might be chosen, and no principle guides its progress. Such a music forges a new relation to history by allowing direct contact between the personal and the global. "The only listener to take it in properly will be the one who follows its flow from one bar to the next, following wherever it chooses to lead him. The attentive listener must expand and contract with the music, instead of listening attentively for correspondences." The good listener must relinquish her will to the music, yield to its

directions, follow its inflection without anticipation; such a listener will become along with the music, becoming musical herself. Berg's music denies historical determination in favor of a will, which is not so much harmonious as problematizing. That is, the music is not homogenized or leveled in the exercise of an immanent will, for it is a will to difference, which never resolves itself. Adorno is particularly fond of Berg, for his music emphasizes both the lost possibility of a reconciliation between individual and culture but also the double-edged blade of this radical alienation. When sound is thus freed of history, any relation becomes possible, any events, any percepts might confront each other there in the music. Adorno notes the paradox that underlies this new relation to history, culture, and critique: On the one hand, "[Berg's] formal devices organize the flow of the music without imposing themselves upon it from above or outside."⁵⁹ But in the same paragraph, Berg's sound is said to be "unmistakably characteristic, never just results." His unique sound happens neither by accident nor by an imposition of the composer's will; the music must therefore compose itself. Berg's role is to atomize the sound enough for the subtle forces of history and harmony to take effect, to tease from the sound enough force to push itself forward.

Adorno's analyses typically tempt an allegorical interpretation. For example, he takes tonality to represent the harmonious accord of a culture, and departures from tonality to represent the alienation of the individual in relation to that culture. He reads this dialectic of subject and object in every aspect of music (see Figure 9). How will the music defer to current and traditional musical standards and how will it subvert them? *Theodor Adorno* The linear organization of traditional European art music has a universal history that elevates the objective and individuates the subject according to this objective model of identity. The subject, represented in music by a motif, is whole, interacts with other subjects, and demonstrates both continuity and development over time. It can stand in a harmonious or ironic relation to its culture, but there can be no radical alienation for a subject itself objective. To express genuine alienation of the subject from society is to make a point in music where memory is separated from its condition, where the piece proceeds only by immanent experimentation and not by the guided motion of an intact and global memory.

But Adorno defies both representation and allegory, for his analysis demands always new criteria for a new piece and cannot be applied formulaically or mechanically. "Aesthetic objectivity is itself a *process*, of which anyone who conceives of the work of art as a force field is aware."⁶⁰ A force field is affective, it operates, and so compresses new histories, new forces at *Jacques Attali*

object	subject
form	content
social	personal
belonging	alienation
homogeneity	heterogeneity
the contributions of history	the self-expression of the composer
adherence to convention	insistence on invention
determination from above	immanent self-determination
the odyssey and return of a theme	the fragmented wandering of same

Figure 9. Adorno’s dialectical representations.

every turn. What makes it possible for Beethoven’s late string quartets to capture the truth of their milieu is not the same as what makes it *impossible* for Schoenberg’s free atonal pieces to capture the truth of his. “The criterion of the social truth of music today is the extent to which it enters into opposition to the society from which it springs and in which it has its being—in short, the extent to which it becomes ‘critical.’” Truth is a question of critique, and critique only thrives under a constant re-examination of its object.⁶¹ Adorno challenges the cultural theory of music and then meets that challenge by finding in the music under consideration just those forces it makes sonorous, those events, those pieces of history and fragments of persons, those affects and percepts that inhere in a given piece or oeuvre or style. One of Attali’s foremost theses is that music condenses or compresses elements of its context, and it does so so effectively that it prophesies an outcome of the cultural context. “Music is prophecy. Its styles and organization are ahead of the rest of society because it explores, much faster than material reality can, the entire range of possibilities in a given code. It makes audible the new world that will gradually become visible, that will impose itself and regulate the order of things; it is not only the image of things, but the transcending of the everyday, the herald of the future.” Music plays out a dialectic of forces in a society, all the forces that shape composition, performance, and perception, forces of history and economics, forces of science and a self-reflective art. These are the forces that subtend culture, and music accomplishes the prophetic precisely because it dramatizes the interactions of these forces. “The code of music simulates the accepted rules of society.”⁶² If, as Attali claims, music is capable of a faster-than-life dramatization of the interplay of forces, then this is because of the pulverization of those forces. Their fine consistency allows a more intimate contact in sound, and the surfaces where forces meet are more supple and slippery. A century is compressed into five minutes of sonic duration, and forces from opposite sides of the globe clash in an immediate contact that does not sacrifice their

complexity and subtlety. The molecularization of sound in music breaks down forces without reducing their intensities, providing a forum or stage on which the tragedies, comedies, histories, and romances of a culture can play themselves out, a microcosm in sound as perfect and detailed as the macrocosm whose forces it condenses.

We might say that music addresses problems. “Whatever happens musically nowadays is problematic in the full sense of the word, that of a task that cries out for a solution, and one, moreover, in which the difficulty of finding a solution is inscribed in the problem.”⁶³ The forces compressed in sound cry out as they crash headlong or rub against each other like cats; and their cry answers to the problem of their collusion. Sound is a problem posing itself while working itself out. Inflection bursts ecstatically from innuendo, a tectonic ridge thrust into audibility in the clash of terrestrial forces. Water flowing down a mountain: which paths will it take? Gravity, landscape, geology, meteorology, biology, happenstance, these forces and countless others struggle in a war without warriors to solve the problem of their *ensemble*, a momentary and radically contingent solution to a problem that only evolves but does not dissolve. Percepts and affects are the force fields in a concert or a comment or a composition. What strange torsions will these fields undergo at their juncture? Whorls of noise, time fractals, new dimensions, discontinuities, impossibilities. One hears in the sound of the river a pebble in the riverbed, and the boatman’s song too furrows the river’s path which carries his echo along its banks and into its future. We earlier wrote of the interaction of temporalities as problematic. Timbre, pitch, rhythm, form, each answers to problems of physics, sociology, and neurology. Each temporality compresses percepts into a complex knot of relations, not only drawing strands of time into continuous durations but tying them together in an unstable tangle. And this complexity defies representation, demands always a new listener. A representational memory could never bring forces together into a problem, for representation eliminates problematic motion in favor of the identity of a static solution. Only because memory is perceptive and affective, because memory lives in sound, can it capture the forces of history and culture alongside the demands of the room and the ensemble; a representation could never be supple enough, fluid enough, to pose anything but the shadow of a problem. Theories of sound based on indexical measurement, or any method that stays on a single plane to analyze sound, cannot find room on that plane for sound’s rich meaning. Of course, meaning seeps onto many planes; everyone hears only part of the elephant.

Representation has never been adequate, for sound has always been problematic. We must therefore reconsider the distinction drawn above between twentieth-century and other Western music. Though the above examples reference

techniques of twentieth-century music, their analyses address characteristics that are essential to music and sound per se. Sound does not evacuate its internal repetition when organized by the molar repetition of a large form. Bach's preludes and fugues repeat figures that change according to a structure in harmony, rhythm, and form, but the repetition still supplies its own reason and so is not merely a result. Berg lays bare the immanent self-determination of his music, but music *always* operates in immanence: "It would be most annoying if it did not aim to say the most important things in the most concentrated manner in every fraction of [its] time."⁶⁴ Sound does not tarry in wait for the twentieth century but challenges the authority of form at every turn, drawing according to the demands of the moment whatever history it will. Mozart sometimes designates formal divisions within a movement by changing from one style of accompaniment to another, say from a species counterpoint to an Alberti bass. These techniques often prescribe even the minute details of the accompaniment. The history of music supplies to Mozart these techniques and governs their use to create a standard structure that builds tension through harmonic motion. But this tension and the sections that construct it are only effective inasmuch as they generate their motivation intrinsically, offering sonic reasons beyond formal requirements. Even Mozart, for whom composition came easily, had to start his compositions with a problem. What piece of music, what sound does not pose and respond to problems? Everyone claims to hear Beethoven's struggle, Wagner's torment. But having heard these, cannot you now hear Hildegard's ecstatic frustration at her earthly limits? Or Debussy's aching discipline? Bob Dylan protests not just with his words but with his voice, instrument, and body. Glenn Gould, Itzhak Perlman, Keith Jarrett, and Joe Cocker are twisted, contorted by the forces they engage when they make music. Bathing in electromagnetics, today's musicians hunch over keyboards and mouses (!), searching for something new in sound. Every composer, musician, and listener introduces into the mix a new set of problems, unheard-of forces. The twentieth century invented plenty of new approaches to sound, explored and exploited it in ways formerly impossible, but sound was always and remains always problematic, at the conjunction of new and different forces. To forge within monophony the differences of homophony, heterophony, and polyphony; to select just that part of polyphony that constitutes counterpoint; to liberate the harmonic line of counterpoint from melody, achieving harmony's autonomy; to stray from the Church modes into uncharted tonalities; to release music successively from the grip of melody, then harmony, then form, opening new dimensions of sound to explore. Each of these moments in the history of Western music advances not by the discovery of a new property of sound but by the creation of a new difference where there was formerly

continuity. The genealogy of music—which will be repeated in every sound as the spark that leaps from innuendo to inflection but will in vain be sought in sound's prehistory—this genealogy begins by marking a difference in time, separating out temporalities, pitch from rhythm from form. Music innovates by opening gaps, by cracking; the composer's pen and the musician's fingers and lips are pliers, which wrench open or tear the existing fabric of music, enlisting countless forces in their service. Sound's history is thus intertwined with technology, as new tools make possible new sounds. What takes place at the intersection of electricity and sound, computers and sound?