Cybernetics, Sound Art and the Sacred

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In recent years I've been invited less to music festivals and more and more to scientific institutions. While I see this as consistent with an overt shift in my personal thinking as a composer and musician, I think it also signifies a more general shift that is taking place in the world of western musical practice. In many ways I have always been less interested in the expressive side of musical behavior and more interested in the questions that are raised by the mere existence of musical phenomena. I've now reached a point in my personal development where I'm no longer apologetic for this.

There has been what I consider to be a profound change in the world of music through the emergence of a number of new genres of musical form and research. Amongst these is a new research area tentatively termed Bio-musicology that attempts to understand the biological origins of music. A somewhat older research area that has come to be known as Acoustic Ecology, aims to understand the integrative role that sound has in our natural and urban environments. There is the whole genre called Sound Art that attempts to define acoustically based art forms that do not arise from a musical paradigm per se, such as text-sound composition, radio art, gallery type installation sound works, site-specific sound installations and performances, and soundscape recording. Tangential to these new forms, but informing them and being informed by them in essential ways, are two areas of science: Bioacoustics which studies the sounds made by non-human living organisms and Scientific Sonification, the aural equivalent to computer visualization techniques through which streams of data are made more direct and experiential to researchers and the general public.

good terms

Some commentators have seen the development of these new genres as directly hostile to traditional musical values, while many sound artists try to characterize what they do as unrelated to any musical practice or concern. One thing I hope to allude to in this book is that these new fields are a logical consequence of an evolution in musical practice rather than a break with it. If music in anyway reflects the evolving human condition, than we are probably right on target. This is what we should expect music to become in the 21st century.

While my own background and work has been woven through all of these fields, and I have scattered small contributions amongst most of them, my work addresses itself to two specific areas of questioning:

1) What does music contribute to our understanding of the question of mind? How is it structured and where is its locus?

2) What is accomplished by strengthening our aural sense within a culture that is visually dominant in that most of the metaphors that we use to construct and describe our experience of the world are based upon the sense of sight? What is gained or lost by a shift towards an aural perception of the world?

Before attempting to tackle these broad questions let me back up a bit and address this idea of what I mean by the questions that are raised by the mere existence of musical phenomena.

Let me be very clear that the purpose for music that I am going to refer to is only one small aspect of the total superabundance of music and musical phenomena. I have no interest in pitting what I do against the vast scale and diversity of musical realities nor am I delusional in imagining that I am in anything other than a minority position. I m only going to attempt to point at

some very broad generalizations about what music may mean that ask some difficult questions. In so doing I hope to be seen as asking more for tolerance of musical diversity than merely a source of criticism of current musical practice. One of the consistent factors in many people's lives is to reject musical phenomena that do not fit within their set of musical use preferences. I believe that music has always served, and always will serve, many masters. I'm just hoping that we might come to regard it as something more fundamental as an active agent in the world than many of us currently seem capable of imagining.

The variegated uses to which music has been put appear at times to be inexhaustible. From opera to hip hop, from therapy to dolphin communication, from selling laundry detergent to preparing troops for battle, from alarm clocks to torture mechanisms, music has been there. It is this very superabundance of use, purpose and meaning that convinces me that we really do not know what music is. It is truly one of the great-unsolved human mysteries.

Even a cognitive scientist of Steven Pinker's stature, who otherwise regards music as a form of "auditory cheesecake" that does not fulfill an evolutionary need, has said:

"I suspect that music still is a mystery, and we shouldn't fool ourselves into thinking that we understand it. I think it genuinely is an unsolved problem."

To drive this point even further into the ground, here is a lovely quote from the physician/writer Lewis Thomas:

"My... question, addressed at large to the world of biology, concerns music. Surely music (along with ordinary language) is as profound a problem for human biology as can be thought of, and I would like to see something done about it. A few years ago the German government set a large advisory committee to work on the question of what the next Max Planck Institute

should be taking on as its scientific mission. The committee worked for a very long time and emerged with the recommendation that the new Max Planck Institute should be dedicated to the problem of music-- what music is, why it is indispensable for human existence, what music really means—hard questions like that. The government, in its wisdom, turned down the idea, muttering something in administrative language about relevance, and there the matter rests."[2]

With these ideas as background, I would like to put my cards on the table in the form of a few controversial questions and assertions. While these are meant to be provocative, they also provide a kind of ecology of ideas for the reader to wander in.

Proposition 1

I wonder if music might be our way of mapping reality through metaphors of sound as if it were a parallel way of thinking to the visually dominant metaphors of our speech and written symbols. I think that most musicians can relate to the idea that music is not just something we do to amuse ourselves. Music may be a kind of conserving strategy for ways of communicating that are only tangentially related to human linguistic structures. Many characteristics of the thing that we call music, throughout the evolutionary trajectory of our species, have been closer to how other forms of life may communicate.

I think music may be a conservation strategy for keeping something alive that we may now need to make more conscious, a way of making sense of the world that might help us to refashion our relationship to nonhuman living systems. I personally believe that we have yet to articulate the importance of music and the immense cognitive and social terrain that it addresses. The fact that we have yet to discover a human society without it says something very profound. Recent discoveries about the ability of music-making to alter the very hard-wiring of

brain development say even more. I have a gut intuition that music, as this vast terrain of human activity and inheritance of our species, may uniquely provide us with clues to our continued survival.

***Proposition** 2*

In many ways our most cherished uses for music and our assumptions about values of authorship, communicative intention, emotional expression and musical genius may be, in evolutionary terms, short-term aberrations. Despite the beauty and entertainment value that such assumptions afford our lives, they may even be distractions from a more profound significance for music.

From a much wider cultural and environmental viewpoint I believe that music has been a significant means through which humans communicate with, participate within, and give back to the larger systems of mind that comprise our natural and social environments. In the daily circumstances of life, we are surrounded with a fabric of sound that is the voice of a generative source. When we make music, it is to match this fabric that speaks to us. Most of human music making throughout our history has been outdoors. It hasn't been made in cathedrals or concert halls. That is a very recent circumstance. We may believe that we are somehow divorced from that generative source when we move indoors but I think that one of the meanings of music has to do with conserving that original intention. I believe that when we talk about the integrative and spiritual aspects of music, what we are really doing is trying to re-stimulate, or trying to find some recapitulation to these other levels of music as a communicative source with a living world.

Proposition 3

The meaning of music cannot be found within the mere structure of notes and/or their semiotic referents. There is no simple point-to-point correspondence of

communicative intent and reception, and the extent to which there could be, would betray its triviality. For myself, the familiar 19th century model of emotional and expressive communication through music has outlived its usefulness. Even though I probably never did accept it, I now consider it to be an extreme case of consensus-misplaced-concreteness. The attempt to identify objective content of expression within the musical object smacks of all the failed post-Kantian attempts to assign mind to a specific locus. Music is the same as mind, a distributed ecology of communal signification where meaning arises from the conditions of mutual conspiracy. Expression and meaning in music exist in the agreement to circumscribe a boundary upon a seemingly infinite set of superabundant associations and uses. In other words, how much you buy into the culture you are born into is not merely a matter of personal taste, but to assume that the meaning you have attributed to any music is a universal attribute is simply absurd.

I think it's obvious that when one listens to many of the recent forays into musical experimentation, many issues and problems arise. I think everyone would be more comfortable if there could be some kind of objective criteria for their musical experience that is perhaps physiologically based. It's not that I don't think there are aspects to our experience of music that are physiologically determined, I just think that we know next to nothing about them and that most such claims have crumbled under serious investigation. Knowledge about the hard-wired aspects of our cognitive perception is fascinating but doesn't necessarily map very well onto our actual experience of the world, especially with a phenomenon as tenaciously elusive and diverse as music.

Just how much of our assumptions about what we believe music to be are culturally determined and therefore colored by our culture's cherished belief in the privileged ideals of self-expression, emotional content, intentionality and authorship. My argument is not with the cultural value of these concepts but only with the almost ubiquitous insistence upon always identifying musical

experience with them. So what is left of music in the absence of these concerns and what can we learn from it?

One response to this question concerns a redefinition of the role of the listener: Music not only primarily consists of the perception of sound in time but it is the perceiver that is engaged in both organizing that perception and assigning it meaning. Beyond this is the realization that this capacity takes place regardless of the intention of a composer or the specific nature of sounds occurring in an environment. It is the nature of perception that is the fundamental ground from which all music arises and not its materials, structures or communicative intent. As Elaine Barkin says, "Listening is primary composition."

The historical events that have led Western music to this realization are summarized by Sean Cubitt: "Music and information dominate the hearing of the twentieth century, and their dialectic has only recently begun to evolve a third mode of hearing, the soundscape. Music from Russolo to Cage strips itself of inessentials---melody, harmony, counterpoint---to encompass all hearing, transferring the musician's mode of listening to the sounds of the world."[3]

While this capacity to hear the soundscape as music is probably the most modern of ways of listening, it is probably also one of the most archaic. I think of it as a classic example of what Arthur Koestler called, a "draw back to leap." New evolutionary strategies often need to pull back to a less specialized stage of development for new mutations and adaptations to form. To amplify what I proposed earlier: I think that music may simultaneously represent an intuition to a future communication modality that may afford us a certain necessary survival adaptation and a conserving action for keeping alive a mode of communication that is similar to the way that other forms of life actually think. For example, Gregory Bateson came to believe that dolphin communication probably had more similarity to human music than to human speech. While I agree with Chomsky that human language is a unique species-specific

adaptation, I don't think music is. I believe it to be an aspect of a much more generalized behavior that we share with other forms of life.

Given what I have discussed about the superabundance of how music as a human activity has been used, what do I consider to be its fundamental functions?

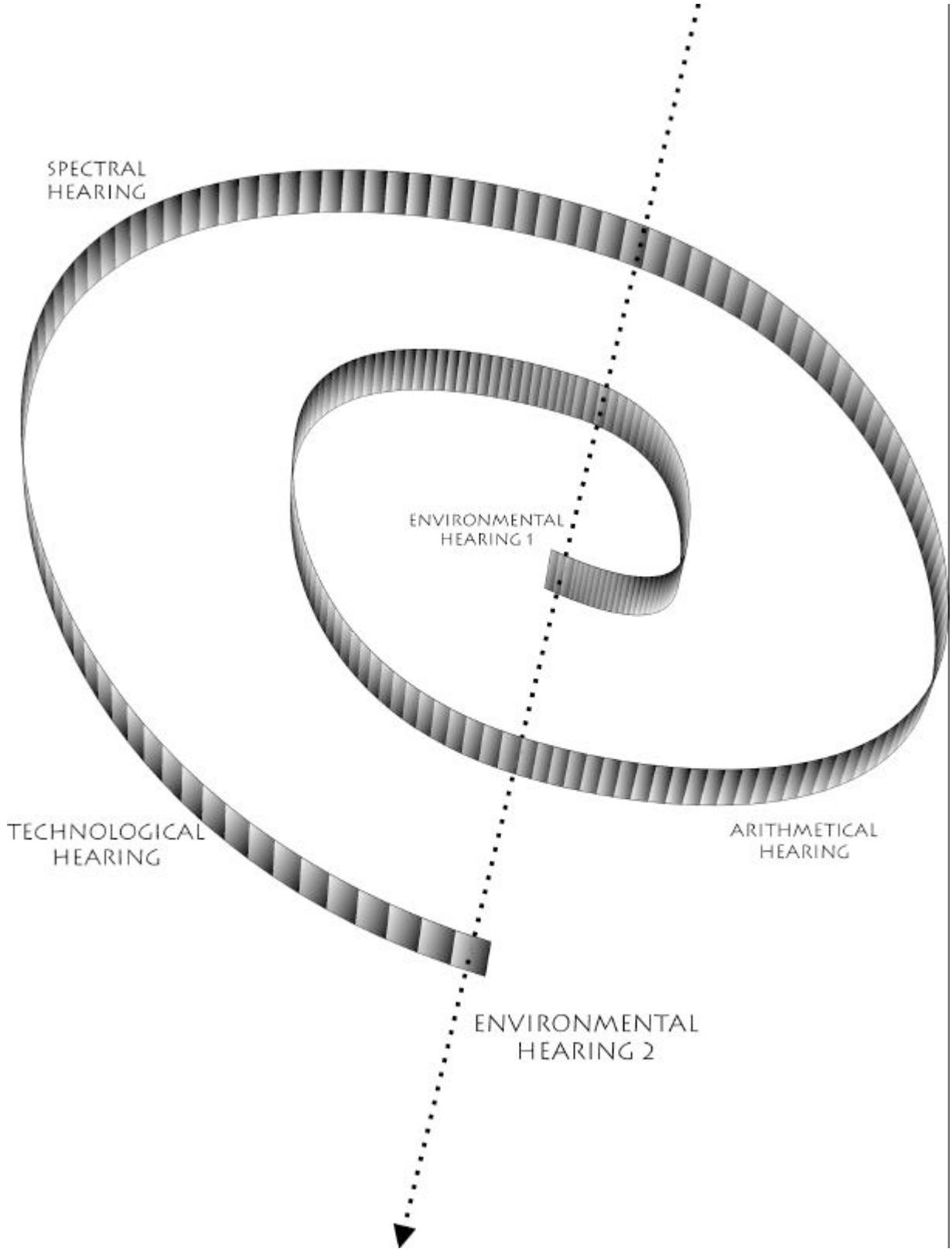
Simultaneously:

> 1) to evolve our capacity to structurally-couple with our surrounding environment through our aural perception, and contrarily,
>
> 2) a significant force for defining the boundaries of group affiliation and affirmation of the cultural status quo.

My contention is that music as a human activity has reflected and influenced a variety of heterarchical transitions through several dominant cultural modalities of how we focus our aural perception, all of which are grounded in a few apparent fundamental physiological truths. In addition, within the western musical context, these phases have been more or less closely coupled to the state of mathematical and scientific knowledge. The current state of much musical practice continues this co-evolutionary scenario such that we now witness the almost complete collapse of prescriptive formal theoretical models or so-called "common practice." Instead we see a shift toward an integration of form and function that is organically determined through the compositional specification of systems and networks that give rise to behaviors reflecting current ideas of emergence, self-organization and biological autonomy. In other words, rather than musical composition as the specification of fixed details of structure over time, it now becomes the design of: a generative system of sufficiently high-dimensional complexity from which rich sonic behaviors can

emerge. This is often accompanied by an increased role for the listener as active participant in how these systems unfold.

A schematic way of representing this is through the following parsing of western music history based upon changing modalities of how culture informs physiological focus and response. Each new level conserves aspects of previous levels:


SPECTRAL
HEARING
ENVIRONMENTAL
HEARING 1
TECHNOLOGICAL
HEARING
ARITHMETICAL
HEARING
ENVIRONMENTAL
HEARING 2

Changing Modalities of Hearing

Environmental Hearing 1: hearing the soundscape as meaningful signification for survival through direct communication with the physical environment. While music evolves as a means to communicate with both the human and non-human environments, it is an active communicative agent that mediates between them.

Arithmetical Hearing: number as pattern made audible. Pythagorean mysticism forms the basis for number theory as ancient science. The ancient Greek concept of harmony (armonia) signifies the arrangement or ordering of sounds with respect to melodic relationship between their pitches (a scale or mode expressed in numerical ratios). Acoustic science begins with the role of the monochord as a scientific instrument through which number theory is made apprehensible and underlying patterns in nature are made real through sound.

Spectral Hearing: articulation of Rameau's "Sonfundamental" gives rise to the notion of "common practice." Rameau: "The source of harmony does not subsist merely in the perfect chord or in the 7th chord formed from it. More precisely, it subsists in the lowest sound of these two chords, which is, so to speak, the harmonic center to which all the other sounds should be related... all the properties of these chords depend completely on this harmonic center and on its progressions." Rameau's insight derives from the idea that there are harmonic partials present in any musical tone. This understanding becomes the basis for the familiar triadic-tonal harmonic theory of the common practice period and inspires its formalization in Fourier's physics.

Technological Hearing: ascendancy of the scientific mode of listening through instrumentation that predominantly begins with Helmholtz. The specification of an acoustical basis for the perception of consonance and dissonance arises through an emphasis upon beats and timbre (constructive and destructive

interference of wave fronts). This influences the expansion of musical sound parameters other than pitch and contributes to the eventual collapse of tonality as the primary central organizing principle. By the mid-20th century there is a growing emphasis on the unique spectral qualities of all sounds and the eventual emancipation of noise as musical resource.

Environmental Hearing 2: the aesthetic innovations of Cage and others solidify the idea of hearing the soundscape as music. The emancipation of noise continues with new manipulative electronic audio tools, and concepts of chance and indeterminacy that loosely correlate to scientific breakthroughs of self-organization, emergence, and complexity. A draw-back-to-leap is implied through the expansion of scientific modes of listening such as bioacoustics and sonification that recapitulate hearing the soundscape as meaningful communication.

Music and Mind

This is probably the appropriate time to return to this question of mind and mental structure. If my use of the term is to be anything other than a mere heuristic device then I must provide some sort of definition.

What I have to offer by way of a definition of mind is the cybernetic epistemology of Gregory Bateson. I have yet to come across an argument that either negates or improves upon it. So, not so simply put, Bateson proposes:

'I suggest that the delimitation of an individual mind must always depend upon what phenomena we wish to understand or explain. Obviously there are lots of message pathways outside the skin, and these and the messages they carry must be included as part of the mental system whenever they are relevant.

The elementary cybernetic system with its messages in circuit is, in fact, the simplest unit of mind; and the transform of a difference traveling in a circuit is the elementary idea. More complicated systems are perhaps more worthy to be called mental systems, but essentially this is what we are talking about. The unit which shows the characteristic of trial and error will be legitimately called a mental system.

We get a picture, then, of mind as synonymous with cybernetic system —the relevant total information-processing, trial-and-error completing unit. And we know that within Mind in the widest sense there will be a hierarchy of subsystems, any one of which we can call an individual mind.

The individual mind is immanent but not only in the body. It is immanent also in pathways and messages outside of the body; and there is a larger Mind of which the individual mind is only a subsystem. This larger Mind is comparable to God and is perhaps what some people mean by "God," but it is still immanent in the total interconnected social system and planetary ecology."[4]

I think that it is fairly obvious how significant Bateson's ecological model of mind as emergent to basic information systems has been towards how we might redefine our relationship to the non-human living world. It is probably not so obvious how relevant it is to understanding our future relationship to our networked technologies and machines.

It is precisely at this nexus between mind, ecology and technology that I wish to assert the potential role of the aspects of music that I have been alluding to. This is also the specific content of my own work with sound: to recontextualize the perception of sound as it pertains to a necessary epistemological shift in the human relationship to our physical environment and the nonhuman world, whether that world is living or machine. My belief is that there is an important role for the evolution of an art form that can address the phenomenon of sound

as a prime-integrating factor in the understanding of our place within the biosphere's fabric of mind. The same applies to our burgeoning technosphere.

When considering the current human predicament of still behaving according to a pre-cybernetic epistemology, it seems clear that we require new modes of experience that can both recover those aspects of human integrity rooted in a fundamental sense of connectedness with the non-human living world, while allowing us to integrate them with our rapid expansion of mind through machine. These demands not only require a heightened awareness of the role of art and the artist but of the very metaphors we use to organize reality.

Neuro-physiologist Francisco Varela has pointed out that visually based, spatio-temporal metaphors are perhaps the worst for describing the denseness of interpenetration of phenomena that gives rise to the world. When we predominantly speak of the world in topological terms, we impose a fixed time/space relationship on the rich dance of living things. We constrain our understanding of the true interdependence of life. In Buddhism the concept of Sunya (a Sanskrit word translated as "emptiness") describes the complex chain of connection that forms the world. Each "thing" is so densely connected to everything else that it resides nowhere. We cannot isolate the thing from all the states of matter or energy that preceded it or to which it will become. Music is perhaps one of the best means we have for thinking about this fabric of mind that resides everywhere. The experience of sound as a vibrant plenum reminds us of the profound physical interconnectedness that is our true environment. Music may be one of the most direct means we have for experiencing and practicing participation in a larger system of mind, redefining the boundary of self to include larger pathways of interaction with the world.

After asking these provocative questions, I wish I could give some definitive answers but I can t. I have a few hunches to go on and these have been the signposts that I have often followed in my creative work. One of these is a sense

that music is a tool that we have been collectively fashioning for a very long time and along the way have tried out for various uses. While it seems to have fit well to many circumstances, it still remains at the periphery of our consciousness, awaiting any definitive purpose. But that may be the crux of my argument. While music evolves with us, and is without doubt a measure of what makes us human, it may also be a measure of how we can remain connected to larger patterns of life and mind, and a measure of what we have yet to imagine ourselves becoming.

Notes:

An early version of this essay was first presented as a public lecture for the Santa Fe Institute public lecture series in 2001. It was subsequently revised and presented as part of the humanities lecture series at the Cranbrook Art Academy later that year. Parts of the current version were later added from material presented at the Integration of Form and Function Symposium, Institute for Advanced Study, Budapest, Hungary, 2003.

Much of the material that forms the argument for historical changes in the modality of hearing is inspired by the work of James Tenney on the history of consonance and dissonance. My reframing of aspects of these ideas is obviously a gross simplification and should not be interpreted as a representation of Tenney's elegant concepts. Any weaknesses in my conceptualization are mine alone.

1. Pinker, Steven, How the Mind Works, W.W. Norton, 1997.
2. Thomas, Lewis, Late Night Thoughts on Listening to Mahler's Ninth Symphony, The Viking Press, 1983.
3. Cubitt, Sean, Online Sound and Virtual Architecture, presented at the Seventh International Symposium on Electronic Art (ISEA 96), Rotterdam, the Netherlands, September 1996.
4. Bateson, G., Steps to an Ecology of Mind, Ballantine Books, 1972.