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Abstract:

A survey of ethnomusicological studies of traditional cultures from around the world shows that, although the specific functions attributed to music are diverse, a common thread is that they involve connecting us to our environments: social, physical, and/or metaphysical. After proposing this as a definition of musicking, I consider this phenomenon in the context of the work of Maturana and Varela (the Santiago theory of cognition) and their successors. Human musicking can be understood as continuing the development of processes essential to all living things in their interactions with their environments, in other words, as an emergent property of life itself.

Beginning with the ideas of autopoiesis, cognition and structural coupling, the Santiago theory explains that, with a sufficiently complex nervous system, organisms such as ourselves “bring forth” an interior world, and integrate or connect it with the external world that we bring forth through our senses. The nervous system, functions to integrate the brought forth worlds of all the living cells in our bodies. Musicking, because it engages sense (auditory perception), motor activity (sound production, entrainment) and our interior states (thought and emotion), appears to be an effective behavior in support of this integrative process; recent findings in neuroscience indicating the scope of connected brain activities in musically engaged subjects also support this idea. Furthermore, the often-noted effects of social cohesion and integration through musicking suggest the possibility, if we allow that social units might be understood as third-order autopoietic unities, that musicking has an important role at that level as well.

Thus, we may be able to explain the awareness expressed in traditional cultures that music is essentially connective, as mentioned above, on the basis of contemporary understanding of the biology of cognition.

The text that follows is a synopsis of the paper presented at the conference.

Over 80 years ago, John Dewey wrote, “Mountain peaks do not float unsupported; they do not even just rest upon the earth. They *are* the earth in one of its manifest operations” (1934, 2). Dewey’s point was that art too is a manifestation of the operations of life on earth, not “floating unsupported” in some abstract mental-only realm.

Evan Thompson makes a related point, writing:

From this perspective [of the self-organizing or autopoietic features of life], mental life is also bodily behavior and is situated in the world. The roots of mental life lie not simply in the brain, but ramify through the body and environment. Our mental lives involve our body and the world beyond the surface membrane of our organism, and therefore cannot be reduced simply to brain processes inside the head. (2010, ix).

My purpose in this paper is to explore music as an emergent behavior of our ecosystem, as a fundamentally ecological activity. To elaborate briefly on Dewey’s idea in less poetic terms, we are not disembodied floating intellects but living organisms and part of life on earth; the value and meaning of our musical activities can best be brought out in that context, and, at the same time, exploring our musical experiences may facilitate better understanding of mental life, as in Husserl’s work. This project draws on and links work by ethnomusicologists, neuroscientists, ecologists, psychologists, artists and philosophers, among others, some of which I will briefly outline below.

I have elsewhere (Golden 2016) proposed the following definition as a way of understanding musicking:

Musicking is an activity of human beings involving sound and time, the function of which is to facilitate and enhance our connection with our environment.

Environment here includes three mutually-related realms or domains: the social

realm, the natural/physical world, and, as understood in many cultures, the metaphysical or spiritual realm.

This definition is not as arbitrary as it might appear. A meta-analysis of ethnomusicological studies from cultures around the world reveals this as a common element in the descriptions of the numerous and diverse functions that music serves. I have elsewhere presented surveys of these studies (Golden 2011, 2016) so I will just summarize the findings here. First, while evidence for the connective function of music in at least one of the three domains is found in all the studies, it is not the case that all three domains are discussed in all cultures. Second, while the precise terms used to describe connecting to the environmental domain vary widely (from “identify or become one with” to “appreciate, manipulate, harmonize or communicate with” and so on), in each case, there is some sense of learning, exploring or establishing the relationship of people to their environments, and the sense of identity of the musicking humans is expanded into or integrated with the world around them. This is the reason for my use of “ecological” to describe this behavior. And third, while it may not yet be possible to “prove” the physical reality of connection to the environment, it’s clear from their described experiences that people around the globe *feel* music does this for them.

Looking to understand these phenomena from the perspective of contemporary ecology, I’ll consider them in light of what is commonly called the Santiago theory of cognition, the work of Chilean neuroscientists Maturana and Varela. This theory does not address music, but it grounds the processes that enable human musicking in understanding of, to use Dewey’s term, the “manifest operations” of all life on earth. I will summarize a few of the key points of the theory here, and refer readers unfamiliar with it to more extensive presentations elsewhere.¹

The foundation of the Santiago theory is *autopoiesis* (“self-making”), an original term which describes the essential pattern of organization and activity of all living beings. Life requires a semi-permeable membrane and a set of molecular functions which, utilizing materials from the environment, reproduce the very structures they embody. The organism is, at once, distinct from its environment, an operationally self-contained unity, and embedded in and interdependent with its environment. Further, the interactions among the components lead to the emergence of properties which none of the components manifest in themselves. I’ll return to the idea of the emergence of human musicking shortly.

Cognition, in this theory, is the embodied process by which all living things interact with their environments. Any autopoietic unity must “know” or “sense” its environment and respond to it with effective behavior. Cognition is thus essential for life, embodied and enactive, and emerges in a continuum across different life-forms. Recognizing that the world the amoeba knows is different from the one we perceive, the authors argue that each organism “brings forth a world” according to its own capabilities and autopoietic needs. They don’t argue there is *no* external environment, but rather that the *features* of the environment are determined by the perceiving organism. These ideas seem consonant with recent work by Donald Hoffmann (1998), here at UCI, and others.

“Structural coupling” is the Santiago authors’ term for the dynamics of ecological relationships. When there are recurring interactions between organisms, each can trigger changes in the other, but the internal structure of each organism determines the nature of its own changes. As long as the interacting organisms don’t disintegrate, they form a structural congruence, or coupling.

Neurons, as living cells, detect changes in their environments and alter their own internal states, triggering change in the cells to which they are connected. In complex organisms, neurons interact with three different environments: the external environment (as senses), the motor system, and (mostly) with other neurons. Of particular importance to human evolution has been cephalization, the concentration of interconnected neurons at one end of the organism; this results in tremendously increased structural plasticity -- the “*realm of possible states of the organism*” (Maturana and Varela, 1998, 175; italics added). The intense interconnectedness of a complex nervous system opens “new dimensions of structural coupling for the organism, by making possible in the organism *the association of many different internal states with the different interactions* in which the organism is involved” (1998, 175; italics added). In other words, organisms with sufficiently complex nervous systems bring forth a complex internal world along with the external world, and, significantly for this study, link them together.

Structural coupling among single-celled organisms can form 2nd-order autopoietic unities (*metacellulars*), and interactions among more complex metacellular organisms can form 3rd-order autopoietic systems, or societies. While Maturana and Varela are cautious about wholesale application of the principles governing simple organisms to large-scale systems such as societies, we might argue that there is a homologous relationship; as 2nd-order unities preserve the autopoiesis of the individual cells and conserve the network or system of organization of the metacellular, 3rd-order unities can function to preserve the autopoiesis of their component metacellulars, and conserve their own system of organization, which we might recognize as culture. Imagine here a band of humans working to keep the individual members alive and

preserve and pass on their way of doing so. We see many emergent behaviors among social species that function in this way.

In linking the Santiago theory back to music, I want to highlight a few points and then briefly explore possible implications of this linkage.

First, the understanding that our abilities and behaviors, including those engaged in musicking, are part of a continuum encompassing all living things precisely supports Dewey's argument that the mountain peaks of art are not separate from the earth.

Second, structural coupling explains how recurring interactive behavior can modify and develop the internal structures of the organisms involved, especially in a nervous system with a high level of plasticity. This suggests that musicking may be understood as an activity that takes advantage of structural coupling to enhance and conserve various human potentials, both neurobiological and social. This requires a bit of elaboration. Gerald Edelman's theory of neuronal group selection argues that, while the initial anatomy of the brain may be determined by inherited genes, the network of synapses is formed and strengthened by the neurons' own activity, which in turn is "selected" by behavioral experience (Edelman and Tononi 2000, 82-86). The reciprocal connections among groups of neurons, which Edelman calls "reentrant organization," enables the synchronized, coordinated activity that ultimately forms the basis for the "brought-forth" inner world.

Recent research in neuroscience supports the notion that musical behaviors influence brain development, especially in connectivity between different brain areas (Golden 2016).

Musicking engages multiple systems – auditory, temporal, motor, emotional and so on – and in

particular, inter-hemispheric connections across the corpus callosum. In other words, musicking modifies our neural networks in the direction of reentrant connectivity.

Another aspect of structural coupling involves the importance of early “proto-musical” interactions between infants and caregivers, especially mothers. The altriciality of our species makes the development of the attributes we consider most human all the more dependent on behaviors such as musicking (Cross 2003). Along with the continuum of cognitive abilities, the attractiveness of musical behaviors that enhance development of brain functions suggests that human musicking emerges from characteristics of life itself.

My third point involves returning to my definition (musicking connects us to our environments) and the aforementioned ethnomusicological research. If, following the Santiago authors, we understand this “us” to be our brought-forth inner worlds, and the environments to be the brought-forth outer worlds, we can see how the diverse but related concepts discussed earlier are not just metaphorical cultural ideals in the poetic or artistic sense, but also expressions of neurobiological phenomena. Human musicking is not “floating unsupported” but manifests the particularly human operations of life in our ecosystem.

More specifically, musicking is an active and intentional engagement with our surroundings. As living things, we are always connected, even if passively or unawares, to our environments. Musicking serves a more intentional process, in which we actively seek to explore, to know, to *connect with* the three domains of the environment, by linking them with our inner states. For our species, of our five sensory channels, the auditory seems particularly well-suited to this active process. It is a two-way channel (incorporating both perception and direct conscious production of sound), deeply connected to our emotions, among the earliest to

develop, operational over great distances in the environment, and functional day and night, waking or sleeping.

Complex properties emerge from the combinations and interactions of elements in a system. The various processes and abilities that enable musicking (e.g., entrainment or vocal learning) have emerged in combination in our species (Tomlinson 2015). Without needing to argue about adaptation vs. exaptation, or that music is our *only* connective behavior, musicking has emerged from the increasing complexity of living organisms in our ecosystem in a way that both fits and fosters our development.

By way of conclusion, I want to suggest two potentially significant implications of the perspective that when we engage in musicking, we connect with, participate in or contribute to a larger unity, social, physical or metaphysical.

First is the notion that musicking may be a vital practice to healing the rifts, social and ecological, that plague and threaten our world today. As Penelope Gouk notes:

There is, it seems, an inescapable relationship between the way we configure our inner and outer worlds, not only as individuals but as larger communities and even nations. “Music” (and all the activities this term may encompass) is itself a powerful expression of that configuration, as well as a means of altering it (2001, 23).

And second is a way of thinking about aesthetics and music in general, with implications for all aspects of musicking. In an interview with Michael Lambert, composer David Dunn said:

For me, the aesthetic response is what Gregory Bateson referred to when he said “beauty is the pattern that connects.” I interpret that to mean that the aesthetic response, the perception and apprehension of beauty, becomes a sort of resonance: we see and feel our own individual mind expand to include something that we previously didn’t assume to be part of us (1989).

¹ Maturana and Varela (1980, 1998) introduced and developed the theory, and Golden (2016) provides a fuller summary than is possible here.

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