Self-Organization and Semiosis in Jazz Improvisation

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ABSTRACT

The complex systems principle of self-organization provides a new way of understanding the behavioral dynamics behind the emergent, spontaneous exchanges of musical performance. In biological self-organization, energy is expended in the form of work which operates to maintain order in a system, collectively constraining the possible behaviors the components of the system can exhibit. When two self-organized systems become closely coupled they form a synergistic, teleodynamic system, such that in a circularly causal manner each system’s work helps to maintain and self-sustain one another’s behavioral dynamics. The semiotic exchange between two improvising jazz musicians can also be understood as forming a synergistic, teleodynamic system, with musicians expending energy in the form of musical ‘work’ that operates to mutually constrain the semiotic form of their own and their co-musicians playing behavior. In more specific terms, the two musicians form a higher-order autopoietic system that both creates and maintains the collective order of the co-playing musicians via the nonlinear, self-organizing dynamics that characterize non-equilibrium dissipative systems. Here the authors introduce this self-organization framework and describe its implications for developing new theories of musical semiotics that adequately address the spontaneous and emergent nature of improvised musical performances. The authors also describe how corresponding methods of non-linear time series analyses can provide the tools necessary for explicating the dynamical processes that shape such complex social exchanges.

Keywords: Embodiment, Improvisation, Non-Linear Time Series Analysis, Self-Organization, Semiotics, Thermodynamics

SELF-ORGANIZATION AND WORK IN BIOLOGICAL SYSTEMS

In this paper, we attempt to understand semiosis in terms of self-organization. Unfortunately, nearly every discussion of self-organization invents its own terminology, which can lead to significant confusion. Here, we will mostly follow the conception of self-organization developed by Terrence Deacon in his 2012 book, Incomplete Nature. We will, however, avoid

DOI: 10.4018/IJSSS.2014070102
his idiosyncratic terminology as much as possible. Our aim, and Deacon’s, is to show how we might account for meaning, starting from thermodynamics.

Everything in nature, and presumably everything in the universe, follows the laws of thermodynamics. According to the second law of thermodynamics, closed physical systems will tend toward an equilibrium state that is maximally disordered. This law can be understood using two intuitive examples: food coloring that enters a glass of water as a single, highly ordered droplet gradually spreads to color the entire glass; the carbon dioxide that animals exhale does not hang around their faces, but dissipates through the entire room. For order or organization to be maintained—that is, for a system to remain at a non-equilibrium state—energy must be expended or dissipated. For instance, take the vortex that forms when a toilet is flushed. The order that characterizes the water vortex only lasts until the potential energy from the water in the tank is expended. Expending energy to maintain the vortex, or to maintain any organization for that matter, reflects work (in the technical sense used in physics). What this energy expended as work does is both order and constrain the possible ways in which the components of a system can behave, so that, to continue with our example, almost all of the water molecules move in a helical pattern instead of any of the other possible ways they might move. In open non-equilibrium systems, therefore, when work is being done, energy is being expended, and this energy dissipation creates constraints on the components of the system that last only as long as work is being done to keep these constraints in place. The constraints allow for organization to exist, including the kind of self-organization one sees in the vortex in a flushing toilet and in the many other examples of spontaneous order described in the literature on self-organization and complexity. (Note that Deacon calls these systems ‘morphodynamic’; most everyone else calls them ‘self-organizing’ or ‘complex’ or ‘dissipative’.)

A common question that is asked by those who initially learn of the second law of thermodynamics is: how can there be so much biological order on Earth (i.e., humans, animals, plants, etc…) if all systems evolve towards an equilibrium state that is maximally disordered (i.e., has maximum entropy)? Isn’t this order in violation of the second law of thermodynamics? The short answer is no. This is because the earth and all biological systems are not closed systems, but rather are open to a flow of energy. Indeed, the Earth’s surface is constantly bombarded with energy from the Sun, with this constant influx of energy keeping the surface of the Earth in a non-equilibrium state, enabling ordered phenomena such as bacteria, oak trees, and Elvis impersonators. However, it is important to keep in mind that self-organizing systems such as these are always temporary, and use up the energy and dissipate the constraints that enable their existence over time (sometimes on a short or sometimes on a long time-scale). The vortex dissipates the potential energy; trees use up the nutrients in the soil; Elvis impersonators eat all the cheeseburgers; and so on.

Sometimes, as is the case with all living things, multiple non-equilibrium dissipative self-organizing systems maintain one another’s constraints. The paradigmatic case of this, discussed in detail by Maturana and Varela (1980, 1987) is the cell. The self-organizing network of reactions that are the cell’s metabolism, among other things, maintain and repair the cell wall. At the same time, the cell’s wall is a selectively permeable boundary around the metabolism,
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