

## EMERGENCE AS A PARADIGM

### "SONOLOGICAL EMERGENCE" AND ITS COMPOSITIONAL IMPLICATIONS

#### Emergence

the array of properties (or behaviours) of a system, which cannot be explained in terms of the component parts and their local interactions

morphology of complex dynamic systems: shifts in complex system behaviour

epistemology of living and cognitive systems: how cognition is born of low-level processes  
(physiological, chemical, biological)

phenomenal (observer-independent, "realism") ?

or epiphenomenal (observer-dependent, "constructivism") ?

Gestaltic principle : the whole is MORE than the sum of its parts

Ecological principle (Morin) : the whole is LESS than each single part (downward causality)

sonological emergence (examples)

- Tartini's 3<sup>rd</sup> sound (in general: differential tones, 2<sup>nd</sup>-order beatings)
- counterpoint (perception of *texture*)
- modern orchestration
- additive synthesis (Stumpf's "musical consonance", Stockhausen's "klangmixturen" in *Studie II*, Risset's & others' auditory paradoxes, McAdams' "fusion" and "formation of auditory images")
- granular synthesis (Xenakis, etc.)
- ecological modeling of complex auditory events (Bregman, Warren&Werbrugge)
- site-specific sound art practices (room-dependent live sound installations)

- synchronic** : hierarchical structure, "levels" (conditions of existence)  
**diachronic** : change in behaviour, "enactement", adaptation (conditions of form)  
**genetic** : combination of the former two in one and the same process  
(existence and form CANNOT be separated, one breeds the other)

### **synchronic emergence**

particle components of a micro-level process interact among them in a way that exhibits macro-level properties (emergent properties)

- emergence happens at a certain scale of observation
- musical example: Iannis Xenakis' *Analogique A et B* (1958) ("2<sup>nd</sup>-order sonorities")

### **diachronic emergence**

the local dynamics in the micro-level process causes *changes* in macro-level properties, following from turbulence or any other input from external conditions

- *noise* is turned into *sign* or *signal* (symbolic emerges from a subsymbolic dynamics);
- current interactions have consequences on later interactions in a feedback loop
- musical example Alvin Lucier's *I am sitting in a room* (1970)

### **genetic emergence**

the synch and the diach are not separable, and their combination involves a mutual (positive or negative) interaction, permanent and continual

- new resources (noise) are sought for in the environment
- current interactions have consequences on later interactions
- the environment is now an intergral part of the system dynamics  
(ecosystems, self-organizing systems [Ashby, von Foerster], autopoietic systems [cybernetics of the living: Maturana & Varela])

## **Audible Ecosystemics** pieces:

Impulse Response Study

Feedback study

Background Noise Study

Untitled sound installations

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### **structural coupling**

recursive, permanent two-ways interaction with the environment, fostering synchronic and diachronic emergence)

upward and circular causality, positive feedback ("weak notion of emergence")  
(subject is external (?), emergence is phenomenal)

downward causality, constraints, negative feedback ("strong notion of emergence")  
(subject is internal, emergence is epiphenomenal)

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### **organizational closure**

no part of the ecosystem (system + environment) can be dropped with either killing the system or forcing it to mutate (genetically)

IDENTITY, class invariants, permanent binding links

- in musical terms: TIMBRE (form-of-sound), FORM

### **structural openness**

within the closed organization, innumerable system states (spatial & energetic configurations) can take place

AMBIGUITY, difference, history (which puts at risk, and therefore qualifies, identity)

- in musical terms: NOISE ??? SPACE ???

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a system showing emergent properties is a process "neither random, nor computable"  
[Varela]

- it consists in a deterministic chains of causes and effects (feedback, feedforward)
- it consists in recursive nonlinear interactions, which can hardly be integrated, calculated

**space** (ambience) is the medium of existence (the medium where energy is found for the system existence to be maintained, and for changes to take place)

it bears traces of a system's (or observer's) past interactions with it, and actions on it:  
by interacting with the environment, a system interacts with its own history

**noise** as the seed of a self-organizing dynamics (noise as a source for organization and variation) [Atlan, von Foerster]