First-, Second-, and Third-Order Cybernetics for Music & Mediated Interaction

Norbert Herber
First-, Second-, and Third-Order Cybernetics for Music & Mediated Interaction

Point of Departure

"What is musically possible given the capabilities of contemporary media technology?"

Contemporary media = web, games, mobile devices

Process more; store less

Dérive Entre Mille Sons
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Cybernetics

Regulation, control, and organization

Applications that effect the organization of musical material
Personal Trajectory: Roy Ascott

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Personal Trajectory: Brian Eno

(No Pussyfooting) (1973)  
Discreet Music (1975)  
Music for Airports (1978)  
Bloom (2008)  
Trope (2009)
Personal Trajectory: Brian Eno

Generative Music

"...the responsibility of the artist becomes inventing a system that produces his work, rather than just producing the work."
–Brian Eno (Darko 2009)
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First-Order (1⁰) Cybernetic Systems

Gordon Pask describes first-order systems as "...classical black boxes and negative feedback..." (1996: 355)

Heinz von Foerster has referred to him, stating that "...the observer enters the system by stipulating the system’s purpose" (2003a: 285).
# First-Order (1\textsuperscript{o}) Cybernetic Systems

<table>
<thead>
<tr>
<th>TITLE (GENRE)</th>
<th>MUSICIAN</th>
<th>1\textsuperscript{o} SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>In C</em> (experimental)</td>
<td>Terry Riley</td>
<td>Elastic structure; sequential progression through the set of 53 phrases</td>
</tr>
</tbody>
</table>
| *Paragraph 7 of "The Great Learning"* (experimental) | Cornelius Cardew | Instructions for piece: "do not sing the same note on two consecutive lines"  
"sing any note that you can hear" otherwise, "choose your next note freely" (Eno 1976: 3) |
| *Music for Airports "2/1"* (ambient) | Brian Eno       | Tape phasing structure at intervals of 21"  
17" 25" 18" 31" 20" 22"                                                                 |
| *Dérive Entre Mille Sons* (amergent) | Norbert Herber  | Generative instruments: Shuffler(), DeckOfCards(), Seq(), End2End(); spatial arrangement of audible zones |
Second-Order ($2^0$) Cybernetic Systems

"...the observer enters the system by stipulating his own purpose"

–Heinz von Foerster (2003a: 285)

The observer’s purpose is often experimental

A system is, "...not a thing, but a list of variables. This list can be varied, and the experimenter's commonest task is that of varying the list...that gives the required singleness."

– W. Ross Ashby (1956: 40)
## Second-Order (2º) Cybernetic Systems

<table>
<thead>
<tr>
<th>TITLE (GENRE)</th>
<th>MUSICIAN</th>
<th>2º SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>In C</em> (experimental)</td>
<td>Terry Riley</td>
<td>Phrases composed loosely in key of C; progression advances at performer's discretion</td>
</tr>
<tr>
<td><em>Paragraph 7 of &quot;The Great Learning&quot;</em> (experimental)</td>
<td>Cornelius Cardew</td>
<td>&quot;accidents that are at work&quot; such as &quot;'unreliability' of a mixed group of singers,&quot; &quot;beat frequency,&quot; &quot;resonant frequency&quot; of the room, &quot;preference&quot; or &quot;taste&quot; of the individual performers (Eno 1976: 4)</td>
</tr>
<tr>
<td><em>Music for Airports</em> &quot;2/1&quot; (ambient)</td>
<td>Brian Eno</td>
<td>Pitched sounds are phased at various intervals to produce shifting tonalities over time</td>
</tr>
<tr>
<td><em>Dérive Entre Mille Sons</em> (amergent)</td>
<td>Norbert Herber</td>
<td>Sound palette assigned to generative instruments and linked to individual sonic zones within a spatial layout</td>
</tr>
</tbody>
</table>
"Much comes from little."
—John Holland (1998: 2)

Small scale interactions produce unpredictable and unexpected outcomes on a large scale.

Biological & Artificial Life (A-Life)
A-Life and Biological Life

A-life seeks to synthesize life; real life processes but made of a different substrate

Humberto Maturana & Francisco Varela (1980): *Autopoiesis*

GREEK:
αὐτός = self; ποιεῖν = to make (creation or production)

The product of any living thing is itself; there is no separation between the producer and the produced.

Autopoiesis is a useful concept to describe the unique behavior of emergent systems. But...

…can music or a musical system be autopoietic?
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Autopoiesis & Reciprocal Perturbations
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STRUCTURAL COUPLING
(by H. Maturana and F. Varela)
Third-Order (3*) Cybernetic Systems

**STRUCTURAL AURAL COUPLING INTERACTION MODEL**

- generative music system
  - 1*: gen. instruments
  - 2*: all available sound assets
- all interactions are perturbations
- human listener
  - 3*: interacting observer
- sonic relations: what is heard when & in what combination
- update sound database
- re-draw visual environment (“update world”)
- affective experience
- the environment is an affective whole comprised of music, image, animation, text, etc.
- sounds become music when they are part of the environment

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Third-Order (3°) Cybernetic Systems

"...the environment as we perceive it is our invention"
–Heinz von Foerster (2003b: 1)
Third-Order (3⁰) Cybernetic Systems

"The current 'state-of-the-art' is in third-order cybernetics, where the observer is part of the coevolving system. This is a more intrinsic (embodied) methodology and shows the ongoing convergence of all the various systemic disciplines, as part of the general world paradigm shift noticed recently towards more integrated approaches to science and life. In 21-st Century systematics, boundaries between systems are only partial and this implies that we must evolve with our systems and cannot remain static outsiders. Thus our mental beliefs echo our systemic behaviours, we co-create our realities and therefore internal and external realities become one."

–Chris Lucas (2001)
Third-Order (3°) Cybernetic Systems

Stafford Beer thought of cybernetics as the science of exceedingly complex systems—of systems that become unpredictably—and a science that focused, "... on adaptation, on ways of coming to terms performatively with the unknown."

—Andrew Pickering (2008: 129)
Third-Order (3⁰) Cybernetic Systems

STRUCTURAL-URAL COUPLING INTERACTION MODEL

[based on “structural coupling” by H. Maturana and F. Varela & “composition instrument” by Norbert Herber]

- the environment is an affective whole comprised of music, image, animation, text, etc.
- sounds become music when they are part of the environment

- sonic relations: what is heard when & in what combination
- update sound database
- re-draw visual environment ("update world")
- affective experience

- generative music system
  1⁰: gen. instruments
  2⁰: all available sound assets

- human listener
  3⁰: interacting observer

All interactions are perturbations

"resistance"
Third-Order (3⁰) Cybernetic Systems

"We need to have a domain which contextualises the activities of, and relations among, the participant observer ontologies of the 2⁰ domain… 3⁰ cybernetics must be a domain which allows us to come to contextualise this 'subject', with his 'ethical system' and his higher-order 'purpose.' We need to understand his phylogenesis as observer."

–Kenny & Boxer (1990)

Who is the participant observer?
Amergence and the Poiesist

Who's doing it? Who is responsible for these processes?

*user* (Norman 1989; Krug 2006)

*participant* (Cornock & Edmonds 1973; Popper 1975)

*partner* (Laurel 2001)

*vuser* (Seaman 1999)
Amergence and the Poiesist

Martin Heidegger: The Question Concerning Technology

Heidegger discusses technology's tendency towards *revealing* and *enframing*.

Enframing is "... the subjugation of the world to already given human ends..." –Andrew Pickering (2008: 131)
Amergence and the Poiesist

"So long as we represent technology as an instrument, we remain transfixed in the will to master it. We press on past the essence of technology. When, however, we ask how the instrumental unfolds essentially as a kind of causality, then we experience this essential unfolding as the destining of a revealing."

"The question concerning technology is the question concerning the constellation in which revealing and concealing, in which the essential unfolding of truth propriates."

–Martin Heidegger (1997: 337-8)

Heidegger’s revealing, "…points us to a politics of emergence…"
–Andrew Pickering (2008: 131)
Amergence and the Poiesist

Revealing and Concealing

Effect and Affect

Emergent Music?
Revealing and Concealing

Effect and Affect

Emergent Music?
Amergent Music

**Emergence** as a characterization of the action involved in reciprocal perturbation, and **Affect** as the emotional impact of this continuous exchange. Each dynamic is necessary to the processes that give rise to the musical experience.
Amergence and the Poiesist

"There was a time when it was not technology alone that bore the name technē. Once the revealing that brings forth truth into the splendor of radiant appearance was also called technē.

There was a time when the bringing-forth of the true into the beautiful was called technē. The poiēsis of fine arts was also called technē.

...What was art—perhaps only for that brief but magnificent age? Why did art bear the modest name technē? Because it was a revealing that brought forth and made present, and therefore belonged within poiēsis. It was finally that revealing which holds complete sway in all fine arts, in poetry, and in everything poetical that obtained poiēsis as its proper name."

–Martin Heidegger (1977: 339)
Amergence and the Poiesist

In works of Amergent music, the person engaged in the experience formerly known as the participant, user, player and so on is more appropriately called the poiesist.

A drawing-out or bringing-forth of narrative and adventure: Londontown

- Online virtual world
- Non-diegetic, character driven music
- Residents' social, economic, familial, and professional experiences are derived from a confluence of prior successes, failures, romances, and intrigues—all the result of their actions in the world.
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References

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