

PUBLISHED IN: "IM NETZ DER SYSTEME", KUNSTFORUM
No 103, SEPT/OCT 1989, KUNSTRADIO, AUSTRIA.

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ENGLISH TRANSLATION:

(PUBLISHED IN GERMAN)

HOW TO MAKE A SELF-ORGANISING MUSICAL ORGANISM: A STUDY OF ONTOGENY AND EVOLUTION FOR THE IMAGINATION
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1. Make a toy telephone by attaching an empty soup can to each end of a long piece of string.
2. Have two people (players) stretch the string between them and listen into their soup can.
3. When one hears a sound, have him/her respond by singing a note, a word, a sound into the soup can, then listen again. The only rule is: fit the sound to what is heard. Continue to respond to some or all sounds heard. Timing determined by the rule of fit. This is the starting point of the musical organism, the zygote conceived. The string transmits the voice and modulates the sound. The receiver hears the sound which is not a voice.
4. Attach another string to the string and put a soup can on the end.
5. Have a player listen into the soup can. What is heard is not two voices communicating.
6. Have the third player respond to what is heard, listen to the surprise.
7. Attach more strings and soup cans. Bring in more players. Extend the network endlessly. The organism grows. It grows too large for unity. What is heard at one extremity is not what is heard at another. Within a limit of size, the extremities, though not the same, are complimentary through the rule of fit (short-range coherence).
8. Test for coherence, attach a second string to every soup can. Attach the other end of all these strings to a single soup can.
9. Have a player listen into the soup can. What is heard is not the extremities, but a complex. Within the limit of size, it is coherent and unitary (though not unity). Beyond that size, the complex fragments into shifting domains. This is the beginning of regional differentiation. *Observe that the complex becomes heard in the background of the individual context*
The player listening to the complex is the beginning of the nervous system. Call this player a neuron. A neuron is a cell. A cell is a coherent atomic universe, the microcosm. It is symbolic of the beginning of the singular, I, as the atom is symbolic of the beginning of the cosmos. The cosmos is symbolic of the beginning of the boundless, the macrocosm. All levels are contained within a singular uncountably infinite set, which is fractal. Thus players, being cellular universes, come within the divine order of singularity, as may a universe of players.
10. Have the neuron sing or make a sound, listen to the surprise. This is the first neural command, simplifying the complex, introducing long-range coherence.
11. Switch off the neuron quickly, too much simplification kills the organism. Command requires control. The aim is diversity within coherence. Control is by negative feedback, the extremities may limit the command by damping the command string. Have the extremities free to choose levels of damping, ie, command requires the goodwill of extremities. Command perceived as good will not be damped. Command perceived as bad may lead to the budding of independent organisms, which is good. Organisms may interact. Imagine a universe of musical organisms.
12. Have every player a neuron, connect all players to all players. Players

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damp strings according to the rule of best fit. Observe the upper limit of size when tangles appear.

13. Limit the number of connections per player, observe the expansion of the upper limit of size. Find the optimum number of connections per player for maximum size, diversity and coherence. Observe the formation of large scale domains.

This completes the embryonic development of the organism. Have some fun with the little pet. Take it out for a walk in a field or desert, or perhaps the plains of the mind as below. (Have busses ready in advance.)

Shedding the First Skin

1. Find a place where the wind blows steady. Replace the strings with taut wires attached to sturdy posts. Listen to the wires sing in the wind.

2. Replace the soup cans with metal drums (this makes the singing audible like sounding boards). Attach wind chimes, clappers, gongs, flutes, whistles, anything which tickles the fantasy. Have the players play on the wires, damp the wires, respond to the wires. Have them dance and sing, tap and bang on clappers and gongs, thump their drums, toot their flutes, blast on trumpet, you name it. Anything goes. There is only one rule: the rule of fit. The drums catch the sounds and send them along the wires. Observe the effects of changing winds, no wind.

3. Have the players wander among the drums. Observe the formation of groups, players of like affinity, travelling together. Observe the interactions of groups, the interspersion of groups, players passing from one group to another. Observe the formation and dispersion of supergroups. Observe the formation of groups beyond the skeleton of wires, local domains of specialized structure, free of aeolian control. Observe that groups may wander back into the city and ignite it with music, catching up citizens in nets of song and dance, the bait, curiosity. Observe the phenomenon of critical mass, the size of group (or supergroup) necessary for ignition.

Shedding the Second Skin

1. Give each player one single point stereo microphone, one FM receiver of N stereo channels, one $N+1$ channel (stereo) mixer, one stereo walkman recorder, and one FM stereo transmitter transmitting on one of the set x frequencies. Set range of transmitters to the order 1 to R times distance between drums.

2. In each drum place a single point stereo microphone transmitting by FM on one of the set y frequencies, range as above.

3. Have $N \ll x + y$

4. Have the players wander, among or beyond the drums, picking up sound/music complexes with microphones connected into the $N+1$ th stereo channel of the mixer; mixing mike with FM signals on 0 to N frequencies of choice according to rule of fit; singing, calling, strumming the harp, banging the drum, or whatever; recording the total synthesis from the mixer onto the walkman for further mixing in the future (NB long-period temporal oscillations: memory); and transmitting it on the personalised FM frequency. Observe the formation of structures akin to the extremities,

groups and supergroups as above. Observe a new phenomenon, the formation of hierarchical structures from the composites mixed by players, through feedback loops. Observe the spontaneous evolution of self stabilizing sound/music structures. These are the first emergent structures of the organism. Their ontogeny and behaviour can be understood by reference to the theories of Nicolis and Prigogine (1977). Observe that the exact forms of emergent structures cannot be predicted, though they fall into recognisable classes. These properties can be understood by reference to the strange attractors of chaos theory. Observe that the forms of the structures are meta-stable, buffered against changes of player responses. Observe thresholds at which collective change causes emergent structures to mutate into new meta-stable forms. These thresholds delineate the phase spaces of the organism, invariant in all organisms of the same species. These properties can be understood by reference to catastrophe theory. Observe that species evolve as defined by mutations of their phase space maps.

5. Introduce fibre optic (or direct laser) transmission for private communication between players. Provide networking facilities. Observe the formation and dissipation of transient loops within the totality of the broadcast structure. This is the beginning of maturation of the brain, the selection of the optimum connections from among all other possibilities. The developing brain maintains global coherence within the expanding system.

The organism has now matured to a point from which it becomes a living thing. Observe there is no limitation of the freedom of players, to respond or withdraw, or to swap between structures. A structure survives so long as there remains a common consent to continue by the players. Structures of interest to players (eg aesthetic) survive, others regress. Note that so long as the number of players does not fall below a minimum, players may enter and depart from the organism without affecting its global form, (though large scale immigration/emigration may induce mutations). In principle, the organism has the potential of immortality.

Shedding the Third Skin

1. Install a comparator (inverse differential amplifier) in each transmitter, using integrated circuits inaccessible to the player, to compare the output signal waveform to input signal waveforms on all channels of the FM receiver. Have the comparator measure the power of the output waveform detected in the input signals as a ratio of the summed power of the input signals.
2. Vary the range r of each transmitter in proportion to the comparator ratio. Observe that the transmitter range increases the more the output signal is mixed by other players into their own synthesised outputs. Thus structures of optimum collective approval are refined and amplified, through feedback control.
2. Install networks of repeater stations to achieve high levels of R .
3. Equip repeater stations with N_1 stereo FM input channels, N_1 computer controlled mixers each with N_1 stereo channels for operation by advanced players (selection criterion: amplification of personal transmitter range above a given threshold).
4. Interconnect mixers to permit formation of hierarchical structures internal to the repeater station through the principles of positive and

negative feedback as above. Transmit the collective synthesis on one stereo FM channel transmitting on one of the set z frequencies, range of order 1 to R_1 times the distance between repeater stations.

5. Record, on high-capacity computer memory, all mixes at all levels including transmitter output, for later mixing into the complexes (memory).
6. Have $N < N_1 < x + y + z$
7. Use principle of comparator feedback control, as above, to vary transmitter power.
8. Install private communication facilities between stations as above.
9. Install super networks of repeater stations, of regional, national, global range, frequency sets i, i_1, i_2 , etc. Principles of operation as for lower levels.
10. Install a single global transmitter ($R =$ twice galactic radius), transmitting on the hydrogen excitation frequencies.
11. Install in all receivers at all levels channels for receiving outputs from all higher levels.

The organism has now grown and matured, operating on the level of global coherence. In principle the number of players may approach 10^{10} , the projected human population of Earth by year 2020. Observe that 10^{10} is of the order of the critical mass numbers: atoms per cell, neurons per brain. In principle the organism has the potential of sentience. Observe that sentience cannot be demonstrated without communication with like organisms.

Question: Can individual players be aware of global sentience?

Shedding the Fourth Skin

1. Introduce parallel systems for networking channels independent from sound channels, ie dedicated systems for different signal origins. Each player receives, mixes, and transmits on separate channels for each modality. Multiply N by the number of modalities M , ie $N_a + N_b + N_c \dots N_m$.
2. Have players mix between modalities according to the rule of best fit. Provide further dedicated channels for each permutation of mixed modalities. Multiply N by the factorial of the number of modalities, ie $N = M!$. Allow players to transmit in any one modality of choice from the set $M!$ using the rule of best fit whilst receiving in others of choice, also by rule of best fit.
2. Experiment with different signal sources eg water waves, weather patterns. Transmute signals into video and/or sound, as below.
3. Create new dedicated systems for each valid signal source, validity determined by common consent.
4. Have the electroencephalogram (EEG) of the player a signal source. Transmute the EEG into colour video displays and sound by computer operated transposers.
5. Have the players, through meditation, generate visual and acoustic images from the mind.

6. Have the players mix their visions on the global network.

The organism now has a psyche. Observe that the psyche is a field of coherence which extends beyond the manifold of spacetime.

Shedding the Fifth Skin

1. Have the player listen.
2. Have the player respond.

The organism bursts out of the cosmos.

Question: What name shall it be given?