

DESIGN OF A DYNAMIC NETWORK OF SONIC INTERACTIONS

technical infrastructure (performance tech set-up)

- what are the system components?
- what connects from one system component to another (or to all others), and how?
- what is the system dynamics? How it is made to change in time?

is the result of composing the interactions

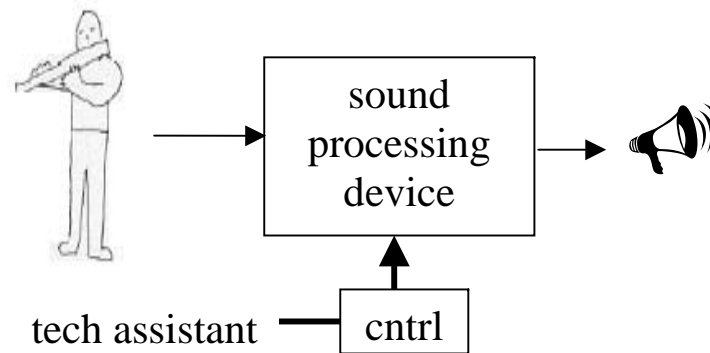
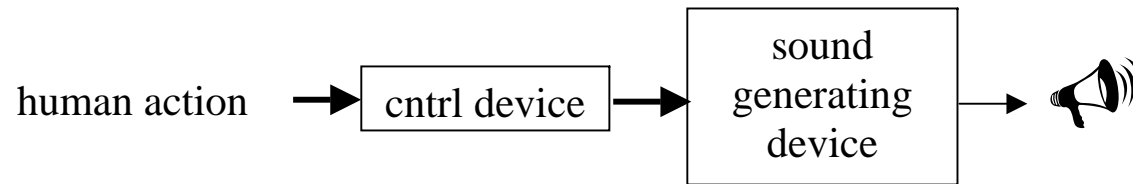
may change in time due to turbulence and perturbations (noise) in the environment, or to wanted gestures or events (instrumental, etc)

infrastructure is of compositional, creative relevance

it implements the processes by which sound and music should come about
it is the performance instrument or real-time "task environment"

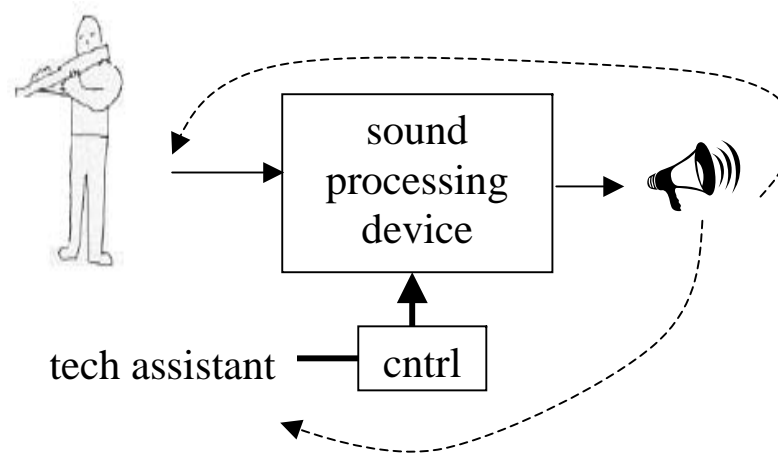
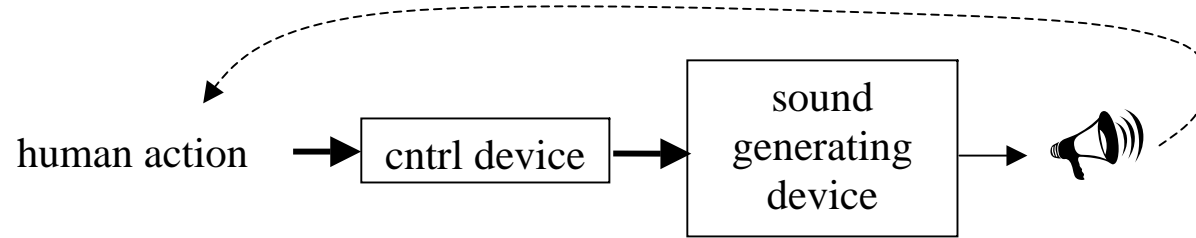
regardless of the particular composer's or sound artist's awareness, in all live-electronics praxis sound and music are bound to the technical infrastructure in place

typical infrastructures



$$out = f(in, cntrl)$$

typical infrastructures (incl. implicit feedback loop)



$$\begin{aligned} out &= f(in, cntrl) \\ in &= f(out, cntrl) \end{aligned}$$

basic design of "live-electronics music"
basic design of "interactive" music

- linear design
- feedback is implicitly part of it as a matter of fact, not as required
- feedback and noise may source of problems
 - ↳ audio engineering provides solutions

space is where feedback and noise occur

↳ does *not* belong to the intended sonic message, instead *virtual space* (spatialization, "space synthesizers") may be part of the message

space : conflict of virtual and real superposing
(reality is NOT easily gotten rid of)

↓
audio engineering provides solutions?

typical infrastructures

external conditions (as audible in the room, and as shaped by the room) are represented as symbolic data = a stream of control data that a human agent modifies by operating on available devices in order to change the internal state of the computer process

typical infrastructures

the role of the *human agent* is to act as the *interface* between processing device and sound - she or he provides the parameters for the actual recursive function implemented not to move to unstable system states

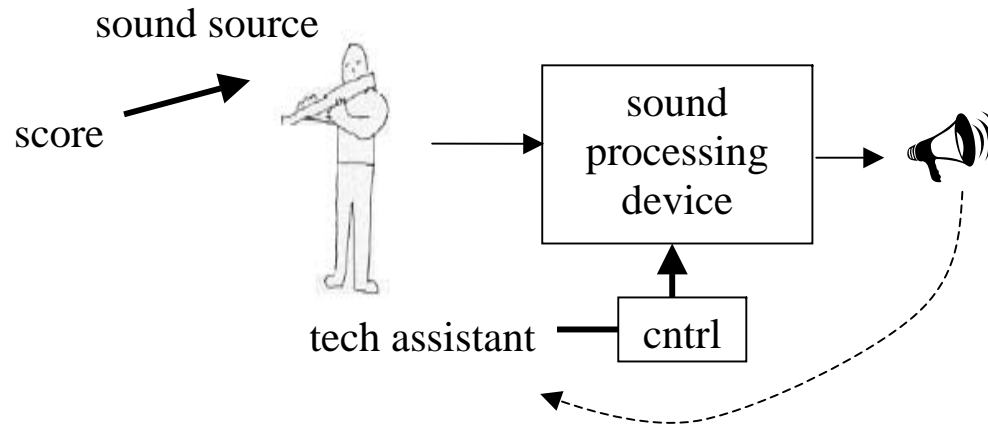
typical infrastructures

compositions based on this typical tech infrastructure

Luigi Nono's late work (e.g. *A Pierre*, *Das Atmend Klarsein*, etc)

Karl-Heinz Stockhausen's *Mikrophonie I*

John Cage's *Cartridge Music*



what role has the musical score?

- prescribes or provides sonic materials to be delivered into the system (programming of material supply)
- acts as a filter and inhibitor of materials that may cause the system to go unstable

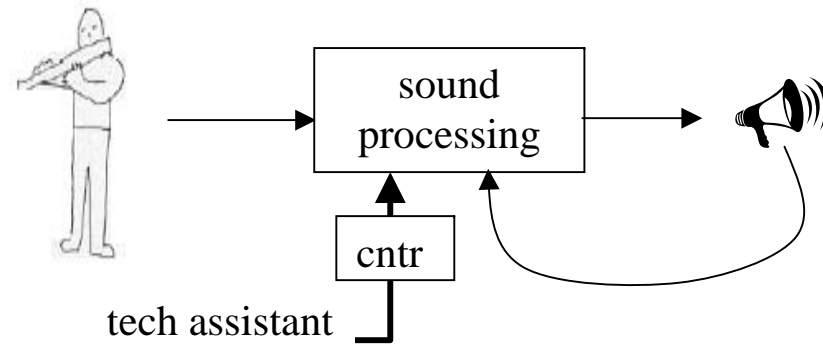
component parts – z.B. the computer, signal processors – do not know anything of what the sound input is: upon unwanted events, or

mistakes, all system adaptation is in the hands (and ears) of the tech assistant (electronic performer)

the sound processing may cause an excess of feedback gain, and saturation, it is not able to *benefit* from feedback

human agent supplies the overall system with knowledge (competent action) not implemented in the computer

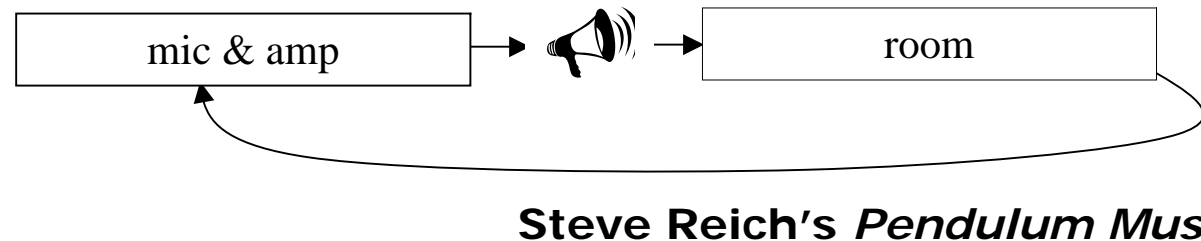
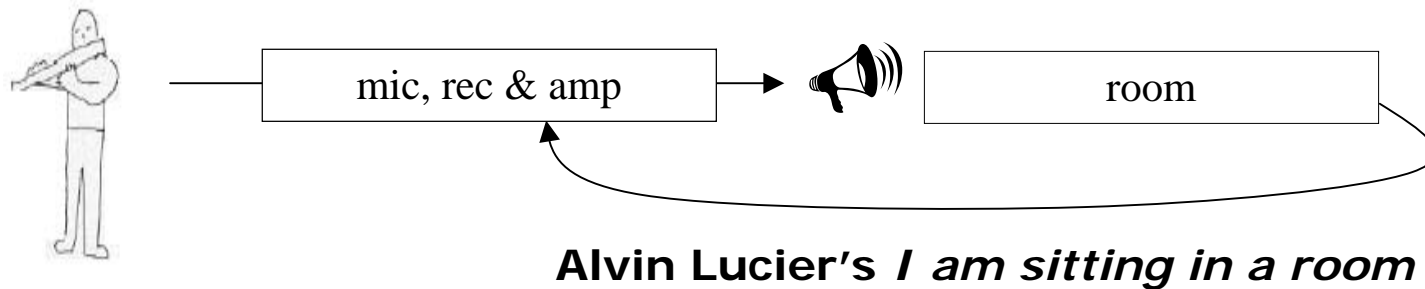
more examples



Stockhausen's *Solo*

feedback is an integral part of the design

more examples



- feedback is an integral part of the design
- space (room) is an integral part of the infrastructure, and the main source for variation and articulation of sound in time
- no human action, except (!) to set the system *initial conditions* as well as to locate and select the system external conditions (position in the room, distance between microphones and speakers, size and type of microphones and speakers, etc.)

however, in performance, no option for change:

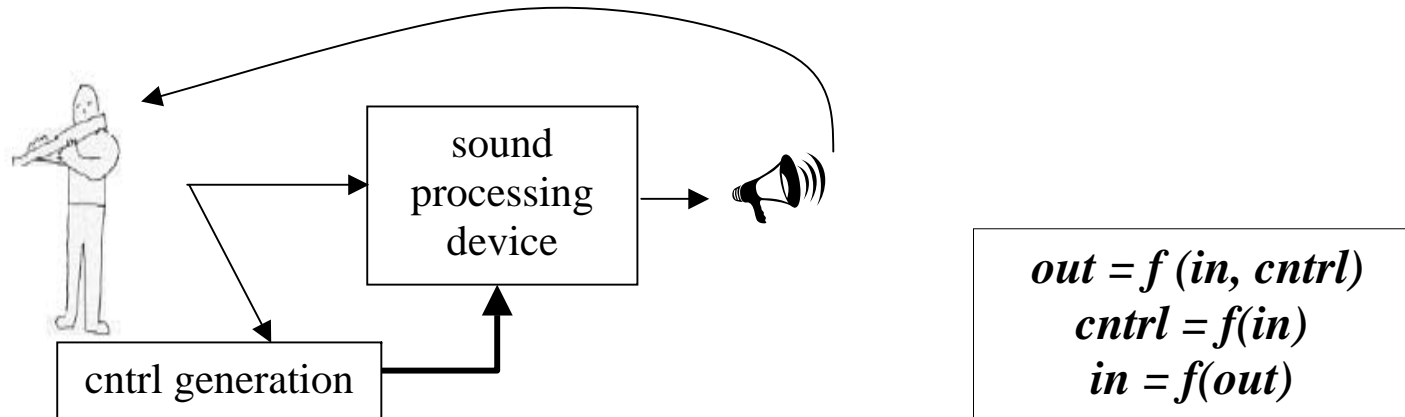
- stochastic process (!) = system dynamics bound to reach omoestasis**
- no self-organization can occur upon unexpected circumstances (z.B. too strong or too weak room resonances)**

there is a potential for dynamical, self-organizing behaviour, but is not implemented : human agent, as part of the whole system, acts as the component providing for system's self-organization

task : instill a chance for self-organizing dynamics in *I'm sittin in a room*

ecosystemically relevant infrastructure

***sound-specific* signal processing**

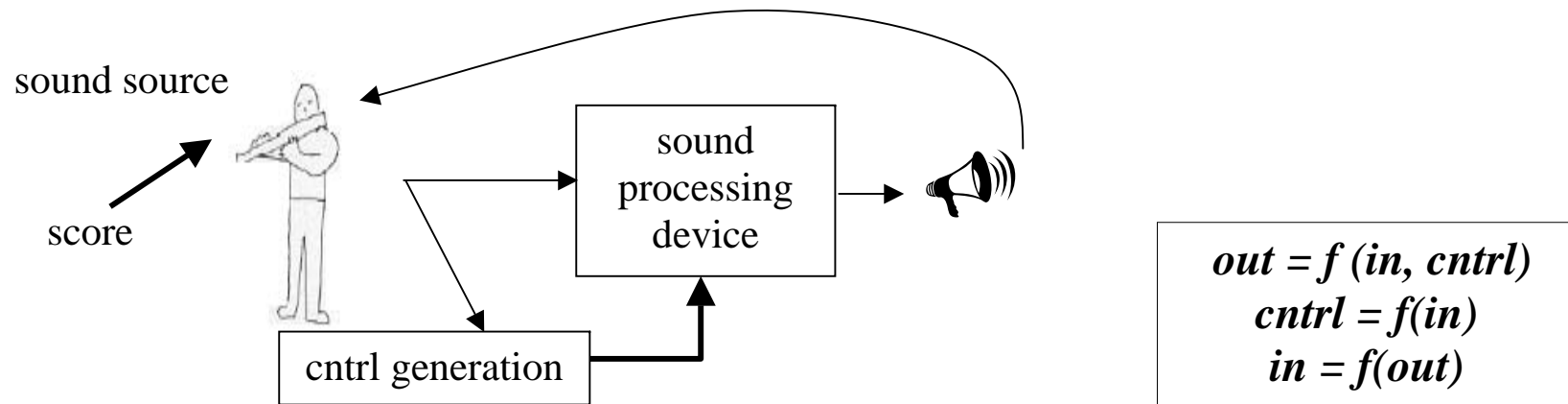


sound sets the external conditions upon which it is further generated or transformed

automated, dynamical process, specific to the particular sound

ecosystemically relevant infrastructure

sound-specific signal processing



what role may have the musical score?

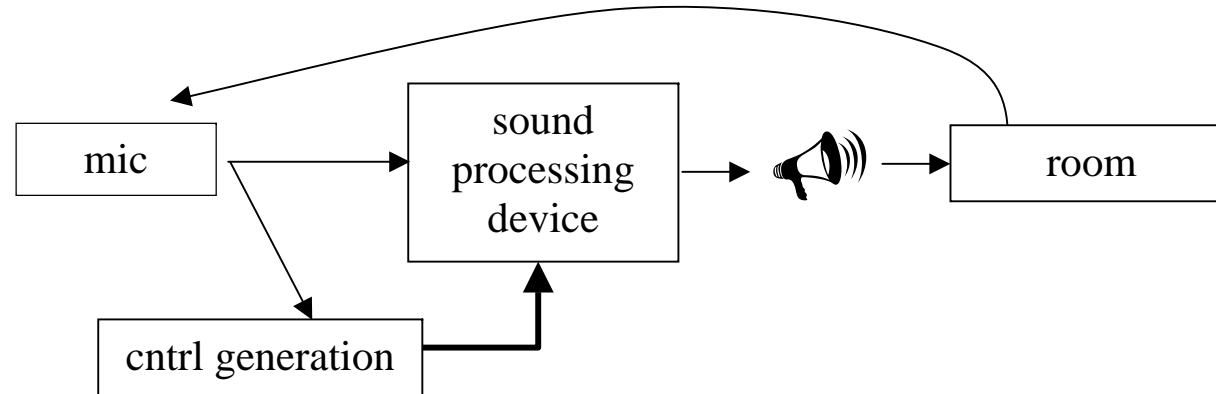
- prescribes or provides materials to be delivered, AND
- provides a source of direct (sonic) control over the processing device internal state

task : write a solo instrument score meant not only to create some sounds, but to drive a digital process transforming those very same sounds in real-time

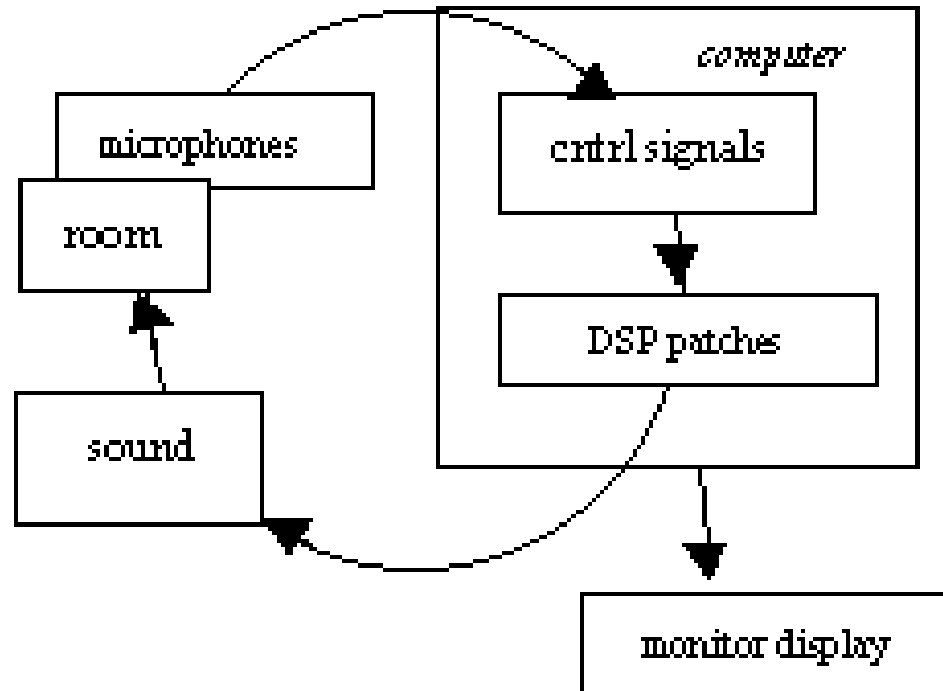
task : write a solo instrument score whose reading rules are subject to change upon the occurrence of particular sound events output heard over the speakers, as resulting from transformations of the instrumental sound itself

ecosystemically relevant infrastructure

automated *room-dependent* signal processing



...that is...



- feedback is structural (audio & subaudio)
- the sound-generating process and the space (room) are tightly coupled via microphones and speakers
- the sound-generating process adapts to the factual circumstances relative to technical infrastructure and room acoustics; space (room acoustics) heavily affects the overall system behaviour

task : design of a sound-generating infrastructure that

- elicits the room resonances**
- track down some feature in the latter and use this information to change or otherwise regulate its own behaviour**

major requirements:

some source sound (recorded or generated live, incl. high-gain audio feedback)

speakers & microphones positioned around in the room with the aim to illuminate the space resonances, and to capture sonic reflections and standing waves taking place in the room

specially designed DSP program (signal patch) implementing

- feature-extraction methods (analysis of incoming and outgoing sounds)**
- generation and processing of control signals (turning the feature-extraction data into viable dynamical controls over some audio processing transformation(s))**
- audio processing transformations driven by thus synthesized control-signals, resulting in the output sound**