The Miracles of Feedback

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Abstract

This paper deals with my fascination for acoustic feedback. Although it goes beyond the theme of the gizmo, I think it links very well. From an artistic point of view, I will describe several types of feedback, and give descriptions, drawings and images of works we made based upon these different types. Besides that, I want to express my doubts, theories, and questions, as well as our motives and enthusiasm for using this medium.

An introduction and three anecdotes:

First let me introduce myself: Mario van Horrik from the Netherlands. Together with my wife, Petra Dubach, I work with the media movement and sound, mostly. Through the years, we have presented sound/movement installations, performances and concerts in museums, galleries, factory halls, mine buildings, open air, concert halls, an abandoned synagogue, and other odd places around the world. Petra comes from a dance background, I from the music. We are both in our early fifties and we feel we've come a long way to where we are now. To be honest, we are not sure where exactly this is and our work doesn't fit the usual artistic disciplines or predicates any more. That happens to people who get involved with feedback, as you will find out.

1.
For me, everything started when I was a little boy, from a traditional family in the southern part of the Netherlands. I was the youngest of 11 children, and my 5 brothers and I slept in the attic of the house.

Since I was the youngest, I had to go to bed first, and I always tried to stay awake until my older brothers would come to bed. In so trying, I used to open the small attic window, which I could reach from the end of the bed. If I stretched myself a bit, I could just look outside, with the cold iron of the window frame against my cheek. About a mile away from our house was the railroad track, and the big mystery for me was that I sometimes could hear a train, but couldn't see it; and sometimes I could see the train, but not hear it.

2.
When I was a bit older, I watched one of my brothers, a carpenter, saw a piece of wood.
I asked him if I could help, so he let me saw a piece of wood. After a few minutes, I was exhausted, and complained about it, when my brother told me: "You have to let the saw do the work."

3.
In the late 70's, when I was (still) a good looking, young guitar player, who had given up the dream that some day I would be as famous and as great a genius as Jimi Hendrix, I saw in a British magazine a picture of the British composer and musician Steve Beresford. In his hand, he held a guitar with clothespins clipped on the strings. I was intrigued, and tried the pins on my guitar. It sounded shitty, but soon I found myself playing on 3-stringed guitars, prepared with sticks, beads, etc. Years later I met Steve, and told him about the picture, and how it had inspired me. He laughed and told me that the pins had been put on the strings to make the picture look more interesting.

Types of feedback.

People may use feedback occasionally, as a small part in a bigger whole, like guitar feedback in pop music. That's not what this is about. We are using feedback as a conceptual basis for our work. We are searching for the 'bone' of sound. We are not scientists, so our characterization of types of feedback maybe not be accurate or complete; however it is based on our practical experience. The types of feedback that I am acquainted with are:

- Direct acoustic feedback: direct contact between speaker and sound source (for instance when you place your electric guitar against the speaker box).
- Indirect acoustic feedback: the process that takes place through the air (microphone in front of speaker)
- Industrial feedback: the system of measuring and controlling, mostly performed by sensors, and electric circuits.
- Improvisation: play acting (controlling) and reacting (measuring) between 2 or more people simultaneously.
- Combinations of the above.

Techniques.

The simplest technique for creating acoustic feedback is to put a mike in front of a speaker, and turn up the volume of the amp to the point that the feedback will build itself up. If you leave it like this, eventually your ears and gear will be ruined. The frequency 'picked' by the equipment is determined by the quality and acoustic properties of the amp, speaker, microphone, and the space. I don't know if a formula exists that will make it possible to make calculations, but to me it seems to be impossible. Anyhow, the first conceptual acoustic feedback-piece I know of is Pendulum Music (1968) by Steve Reich, who used 3 microphones/amp/speaker-sets. The mikes hung from the ceiling on different lengths of cable, and were swung. The tempo varied because of the differences in cable-length, and passing the speaker, a short feedback sound came from the speaker. The piece ended when the sound was continuous, because the swinging had died out.

Other artists use feedback as a trigger: they have a microphone or instrument making feedback, and load the sound into an electric circuit, that itself may also be a feedback system. They use filters and effects to shape the feedback sound into material they can use further with computers, samplers, etc. They are what I call the 'in-betweens'; the method allows them to keep control, and express their sonic ideas in structures under their supervision; whereas Reich's concept is radical: the saw does the work, so to speak.

Description of some pieces, according to types of feedback:

Het Vogelbekkenstuk. (Direct feedback). Concert piece.

In 1988, we conceived the piece *Het Vogelbekkenstuk*. The piece is a statement about movement and sound.

There are 2 identical instruments; each consisting of 2 hinged wooden beams, with a string and spring stretched between the 2 ends of the beams, (Figure 1, below). The strings have a piezo-pick-up, and the amp/speaker stands on the lying beam. With the volume turned up loud enough, the system will produce direct acoustic feedback (the acoustic feedback takes place because there is a direct contact between the instrument and the amp/speaker).

Figure 1.
Het Vogelbekkenstuk, photo by Wim Janssen.
Performed at Stedelijk Museum, Amsterdam.

Each player holds one instrument, and tries to stand as still as possible. We didn't succeed in remaining still, but this is something that can't be seen, it is only heard. We look static, but whale-like, gliding sounds come from the instruments.

Sometimes, for a short while the sounds are stable and fixed, but then something changes again, interferes, etc.

Originally, I made the instruments so that the strings would be plucked, but during the sound check of a concert, on a hollow stage, the instruments started to give us feedback. It took quite some time to get rid of it.....So you see, strange coincidences can happen, and in this case (as is in most) my brother was right: we did let the saw do the work.

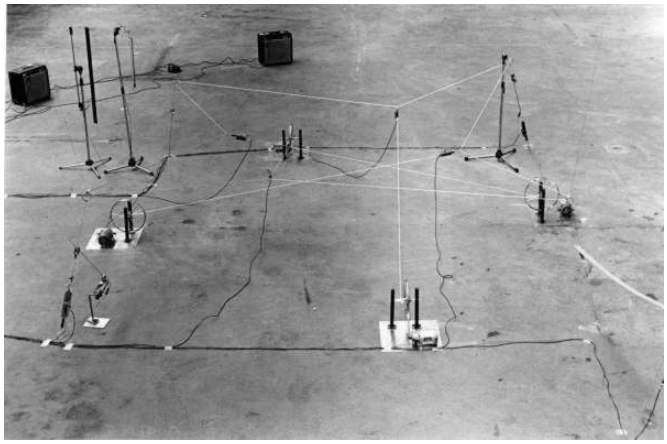
DioN.Y.sus' Scales. (Industrial feedback).Installation.

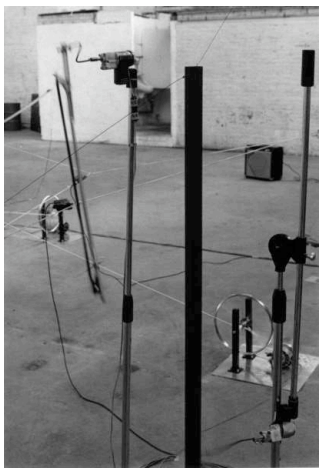
A completely different type of feedback, maybe unfamiliar to most artists, (although it is a part of everyday life) is industrial feedback. I was first told about it in 1991by professor Zweitse Houkes from the Technical University of Enschede in the Netherlands. He explained to me that industrial feedback is a system of measuring and steering (or controlling) to create certain results. For instance your central heating system: if you want your living room to be 20 degrees Celsius (68F), you set your control to 20C. If it is colder, the heater will start heating until it is 21C (69.8F). Then it stops, and starts again when it is 18C (64.4F). Temperature is measured, heater switched on or off: simple.

In industry, feedback is used to have very precise control over processes: to have pieces of wood sawn in the exact format and shape needed; to have parts of trains interlock precisely, and to produce as many clothespins a day as possible. So, I wondered if I could make a feedback system that would be useless (art), and especially unpredictable in what it produced and when. I didn't want it to be precise and exact, but to find the widest limits possible.

I was lucky, and got an invitation to do a show in Art in General in New York City, as well as a residency at Harvestwork's Studio Pass in 1994. Besides that, several Dutch institutions were so kind to spend a great amount of money on my new work to be shown at Art in General: DioN.Y.sus' Scales. The basis of this installation was a performance called 'the Boxing-ring' that Petra and I performed several times.

The basic construction is 4 strings tensed vertically from floor to ceiling, with piezo pick-ups mounted on the strings, and a metal ring at hip height. Ropes stretched horizontally between the rings make the instrument look like a boxing-ring. On cross-strings a steel and an aluminum stave were attached to it. I would play the instrument from the outside with sticks, a bow, my voice and an electric razor, while Petra performed inside the ring; pulling the ropes, hitting them, leaning against them, etc. and, in this way, tuning the sounds and adding sounds. So the Boxing ring was automated. Four motors, mounted on the floor, pulling and releasing ropes extended the basic form (Figures 2 and 3). We employed weighing scales (the type with a spring and hook, used to weigh sacks of potatoes) with a sliding potentiometer (like the volume controls from a mixing board) attached to it, to measure the pulling force and translate it into voltage. The piezo-pickups were used as vibration sensors as well. Henk Goossens and Erik van de Poel, two enthusiastic Electrical Engineering students of Eindhoven Technical University designed and built me the fantastic piece of equipment that allowed me to input all the pulling and vibration measurements. These were used to steer the output volumes to the 4 amp/speaker combinations. Volumes increased or decreased according to a more or less pulling force or vibration on a string, with a possibility to shut down the volume-output from 4 seconds to 4 minutes, using peak-level measurements from other sources. The piezo-pickups also delivered variable voltage for the 4 motors on the floor, with a protection that changed poles when the pulling force was reaching a limit; and to change poles as well through a peak-level measurement on one of the strings, for example. And it had the same possibilities for several smaller motors, such as a motor driven bow; a 'rattler,' a propeller, etc, to play the instrument. This electronic device gave me the opportunity to connect whatever with whatever; and the result was amazing.





Figures 2 and 3. DioN.Y.sus' Scales, photo's by Peter Cox. At 2B, Eindhoven.

There was a seemingly uncontrolled and uncontrollable moving, silent, screaming, resting, breathing, grim, grinding, growling beast; completely unpredictable, because too many things happened at once.

Most fascinating for me was the discrepancy between the electronics and the material: sometimes a string was pulled out of reach of the motor that was supposed to play it; sudden movements made metals swing out of reach of its player-motor, etc. The whole system pulled its own leg.

And so you see...hearing a train and not seeing it (or the other way around) is peanuts compared to the things you may cause yourself once you're an adult.

Flexitar. (Improvisation). Concert piece.

Another type of feedback we have come across is similar to the industrial feedback, but is performed by people. In that sense, every piece of improvisation is a performance of this type of feedback; that is, if it is performed by at least 2 persons simultaneously. The purpose is, of course, to make music together; and because you can't tell what your music partner will do, you have to be very alert. Sometimes you 'work together', and sometimes you try to get your partner to 'follow' or change what he or she is doing. So you might call it mental, aural or physical feedback. I conceived the piece Flexitar in 1988, first as a solo piece. The setup is like this:

A long string is woven through the 3 strings of a guitar and it ends in a piece of elastic cord that is attached to a fixed object, like a wall. At the point where the long string (minimum length 3 meters) is connected to the cord, a piezo pickup is clipped on the string with a clothespin (!). When playing the guitar strings, something weird happens: somehow the transversal vibrations of the guitar strings are being transformed into longitudinal vibrations in the long string. This means, that you don't need much tension on the long string to make it sound.

By using the elasticity of the cord, I have some freedom to move a little bit (maybe one meter, depending on the length of the elastic cord), and in that way I can 'tune' the long string. Sometimes, when playing one guitar string, up to five layers of sound frequencies occur from the long string, ranging from very low to very high. When 'tuning', this changes: the low frequencies have a tendency to change slowly, sometimes they disappear; sometimes they slowly glide into another higher or lower, more or less for some time 'fixed' pitch.

The highest frequencies change very fast, already when I shift my weight from one leg to the other.

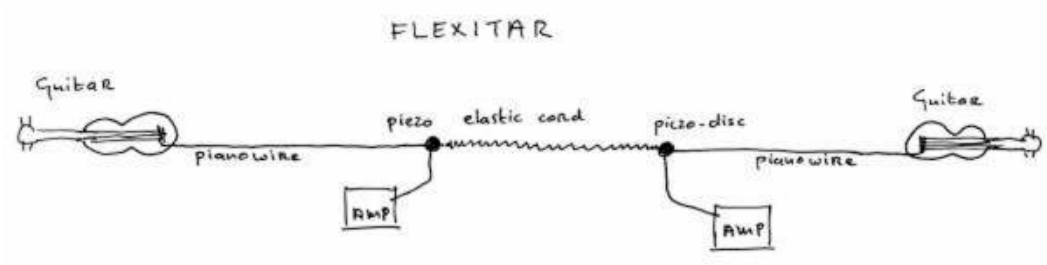


Figure 4. Flexitar. Drawing by Mario van Horrik.

When we play the piece together, the construction is like this: guitar-long string-elastic cord- long string- guitar. (Figure 4). Then, the process becomes more complex of course. Partly, in the space the sounds of the 2 long strings interfere, merge; and because neither of us can stand completely still

while playing, the sounds change all the time. The aim is to make a sound piece that is interesting in its development, with climaxes, changes, etc.

The problem is that one of us may not understand what the other's intentions are. So, when one of us likes to continue what we were doing, the other may wish to introduce some change. When this is a big change, then it's obvious, and there's not much the other one can do to prevent it. With small changes, some kind of struggle between us is often the result. In fact, we place ourselves in a difficult situation, because the sounds are not really pitched, and they also change rapidly. And if I shift my weight to my other leg, it not only changes my sounds, but also those of Petra; and she may not like that, and may try to recreate what happened before, etc.

To be quite honest, we are lucky to have such a stable relationship, because sometimes our domestic disagreements are the major subject of a performance of Flexitar. You, the listener don't have a clue, of course, and thank God.....But the thing is, that if you place yourself in an 'uncertain' circumstance, you need another way of communicating (feedback) and the more often you do this, the more sensitive you think you are for it.

But that's the nice thing about feedback, isn't it? Nothing is certain.

Interference. (Direct feedback). Installation and performance.

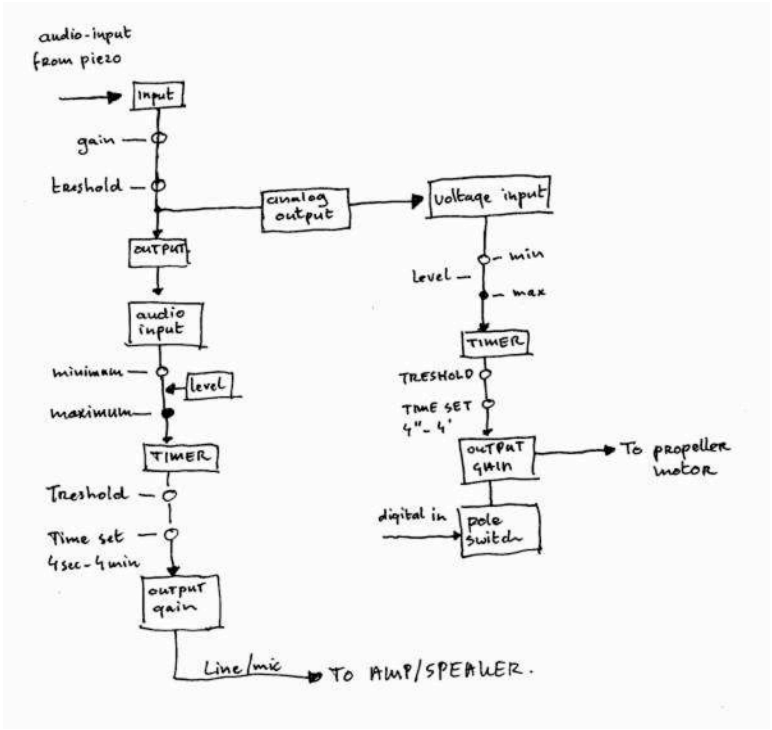
This is a sound installation conceived in 2001, using direct feedback. But the feedback is being disturbed by itself. From the ceiling 3 copperplates, dimensions 1x2 meters and 3mm thick, hang, each on two strings, one with a piezo-pickup (Figure 5). Against each plate stands a Fender Sidekick 30 speaker/amp. The volume is turned up to the point that the acoustic feedback occurs. The pickup is positioned so that a low-pitched, sonorous sound comes from the speaker. The sound builds up, until the plates start 'shaking'; causing them to move away from the speaker, fall back, etc. In this way, higher pitches are added to the drones. Elements like draft, and movements of people influence the sounds as well. Petra performed a piece several times, in which she gradually increased her tempo while walking around the plates. It ended with her sudden stop, and the plates swinging, hitting the amps, etc, until they gradually came to rest, and the feedback could build up again. In fact, it's quite paradoxical: the feedback is disturbed by movement (wind). Haven't I noticed this before sometime?

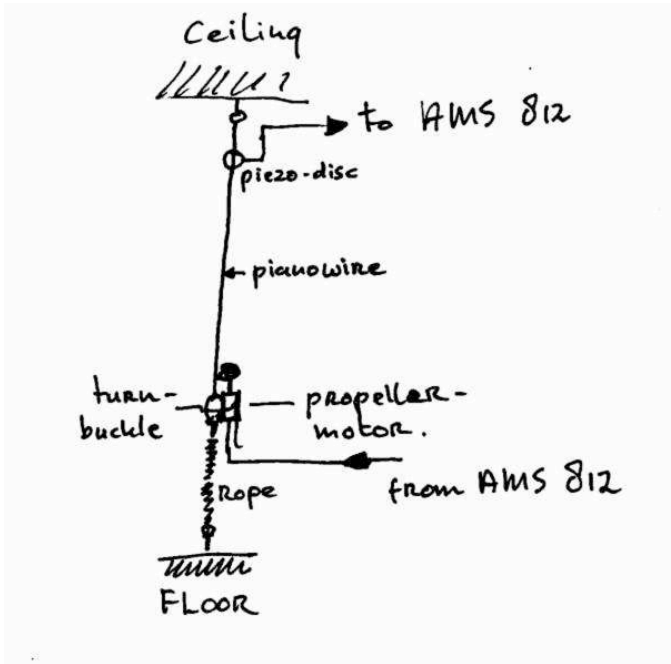
Figure 5.
Interference. Photo by Petra Dubach.
At Mine Building, Waterschei Belgium.

The Chaotic Drumming Machine. (Industrial feedback). Concert piece and installation.

Very recently, when I was working with the steering machine that was built for DioN.Y.sus' Scales, I had an amplified string played by a little motor with a rope at the axel, like a propeller. The machine

was set so that the motor got just enough voltage to make it turn. If it would hit the string, the vibrations of the string would increase the voltage fed to the motor. So, I expected the voltage to build up to the max, like in a normal feedback, and in no time the motor to be hitting the string full speed. First it did, but when I limited the maximum voltage and decreased the gain for the motor a bit, something strange happened: the motor ran at a certain speed, for some time, accelerated, slowed down, stayed stable for a short while, slowed down, etc.





Figures 6 and 7.
Chaotic Drumming Machine.
Drawings by Mario van Horrik

It had become a random voltage motor (Scheme: Figures 6 and 7). I have no explanation for it; maybe

one of you scientific wizards can explain it? Anyhow, later I used this circuit like this: five strings of different length (between 15 and 25 centimeters), material (such as phosphor bronze, piano wire, copper) and thickness, are clamped in between two metal bars. The bars have one pickup. The propeller motor (this time with a double elastic cord as a propeller) hits the ends of the strings. The motor is mounted on a table microphone stand. It is an amazing drumming machine: it has some kind of chaotic basic beat that alters the tempo all the time. Besides that, the strings get hit at fast tempo, but most of the time 'dance' away from the motor's reach; plus the elastic cord makes strange, irregular movements while playing the strings. It sounds very, very irregular and virtuoso, yet with some 'steadiness' in it. I'm planning to use it as an installation, but also in concerts, changing the position of the motor. Let the (electric) saw do the work.....

Donar's Chariot (Combined direct acoustic feedback and industrial feedback). Installation.

This sound installation was conceived in 1991. In a space, 2 steel cables are horizontally stretched between 2 walls. A stripped children's carriage is resting on the steel cables. Attached to its frame is a long string, ending in a long elastic cord, that is attached to the wall. A piezo pickup is put on the long string, near the place where it meets the elastic cord. An amp/speaker combination hangs under the carriage, as a counterweight (Figure 8). The speaker voltage is fed into a voltage-amplifier that feeds a permanent magnet motor that is mounted on the carriage. The motor pulls a rope stretched between the two walls. What happens is this: the volume of the amp is set, so that the installation produces direct acoustic feedback. And because the speaker is 'fed', the motor will pull the rope, and the carriage will drive over the steel cables. Because it moves, the tension on the string/elastic cord construction changes, and the feedback sounds change pitch, so it builds up again, and so on. Sometimes the produced sound is so loud, that the system pulls itself through these 'dead points.' When the carriage reaches a point near to one of the walls, a switch changes the poles of the motor, so it will drive backwards, etc, etc.

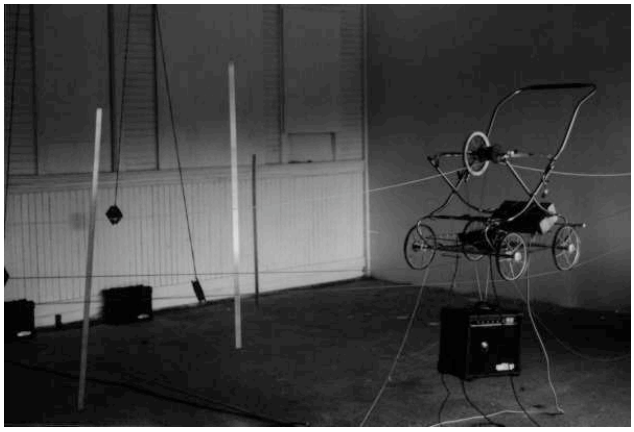


Fig.8: Donar's Chariot. Photo by Mario van Horrik. At Islip Art Museum, Islip, Long Island.

Slow Motion (Indirect feedback). Performance and installation.

Conceived in 2006. For us this is a wondrous piece, because the indirect feedback sounds and the process of controlling them are combined in the same system, in this case: instrument. The basic setup is an acoustic guitar with a guitar pickup on a stand. At some distance, an amp/speaker combination is placed on the floor. The guitar may have 3-5 strings. A stick of wood or metal is woven through the strings (Figures 9 and 10). The result is a combination of the qualities of the space, the position in the space of the guitar and the amp/speaker combination, the distance and position of amp

and guitar, the tuning of the guitar strings, and the position of the stick.

Figures 9 and 10. Slow Motion. Photo's by Mario van Horrik. At studio.

So you can imagine that there is no such thing as an 'ideal' setup, but there will always be some kind of result, and decisions will be made, eventually..... When the volume is turned up loud enough, one of the guitar strings will start to resonate; the stick resonates with it, and will cause the other strings to vibrate as well. In the same time, this will prevent the system to run wild, because it would take too much 'energy.' This means that sometimes the system will build itself up, and die out, builds up, etc. It produces cycles that may last several seconds, and they are quite complex and unstable. Sometimes, the stick will 'walk' a bit, so the cycles become part of a longer cycle. Also, it happens that the system finds a balance, and the sound seems to be stable, and doesn't change. But then (and this happens in all circumstances), as soon as I change my physical position in the space, these sounds change as well. It may be, that one layer of the sound will be more emphasized then before; it may be that cycles become longer or shorter; it may be that the sound becomes louder or softer, or that silences during cycles become longer or shorter; it may be that unstable cycles change into stable sounds; it may be that the sound color changes. Mostly we work with a setup of 2 string instruments, each with its own amp/speaker. This complicates the result enormously, because the sounds of both systems interfere with one another, and cause even more unpredictable changes and processes. Also, in our experience, this seems to increase the influence of a person slowly moving in the space upon the resulting sound. The body in the space 'disturbs' the complex of standing waves; small movements can cause remarkable differences. In addition, we have experienced that the system needs some time to 'react' to these movements and so Petra usually moves around with very slow movements; that also explains the title of the piece.

When we present the work as an installation, the public will cause some of the changes in the sound when moving through the space.

Gesamtkunstwerk.

Many artists, who use acoustic feedback as a concept for their work, describe the influence of movement and space on its functioning. Draft, wind, doors and windows opening or closing, people passing by, the positioning of people, objects in the space, changes in their position, materials of the space and the architectural forms and dimensions of the space, the positioning of the speakers, etc,, etc. You might call these pieces "Gesamtkunstwerke." The complexity is enormous, because of all the influences mentioned above. It may sound foolish and naive, but sometimes I think that a feedback piece is the expression of theories like quantum physics, or (how appropriate) the string theory; of which I understand nothing of course, but still.....

(don't laugh; I'm only an artist who was already fooled by Steve Beresford and his clothespins). What I'm really trying to

say here, is that the phenomenon is so fascinating and complex, that the 'normal' musical 'rules', or any other rule is not applicable. The best way to deal with acoustic feedback is to expect nothing;

gradually you may become like me (or some Zen-figure) who spends more time listening to the wonders of a system that changes all by itself and all the time in a very subtle way, than may be good for him. You turn into a loner, endlessly turning his head (like a slow-motion head banger) to hear the most minimal differences.

Now you might think that us, feedbackfreaks are weirdos who hear things nobody else can hear; maybe we are weirdos, but everybody can hear the differences that occur. Maybe it needs some training and getting used to listening to it, but eventually you'll see (no:hear).

Yes, feedback is THE drug. And so, it's not only a Gesamtkunstwerk, but it also becomes a lifestyle.

Because the feedback feeds back on the way I think and act. Take for instance my attitude: a 'normal' musician or composer likes to be in control of what he or she plays or composes. I used to be like that.

But gradually it seems to become more appropriate and interesting to find out 'what the materials and systems themselves have to say.' This means that my goals have instead become questions; control has become curiosity.

To take it even a bit further: it seems like I'm no longer 'mastering' the process of experimentation; there is a feedback from the results back to me; they seem to give me new directions that I can follow up.

Final anecdote.

A few months ago, I was preparing for a performance of the Slow Motion piece. I had spent several hours in our studio working with a setup of a guitar and a laud (Portuguese lute-alike), tuning the instruments, positioning the amp/speakers, listening, walking around slowly, smoking one cigarette after another, with the instruments feedbacking all the time. Then I decided to go to the kitchen to make tea, and when I reached the door to step out of the studio, it became quiet..... I was amazed, and slowly turned around. The sound built up again.....

There are a few possible explanations for what happened. Although very, very unlikely, it could be possible that the instruments were silently laughing at me: "This old fool thinks that after 30 years he knows something!! Let's teach him a lesson." Of course, I never believed in this ridiculous theory. The following explanation of course is far more appropriate: when you work together, you also develop a relationship. The guitar and laud were of course sad that I left, and they were afraid that I would never come back. It was a misunderstanding, we talked it over, and we agreed that it would never happen again.

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Author Biography

Mario van Horrik is a sound and media artist. With his wife Petra Dubach (movement and media), he

presents installations, concerts, performances, projects and objects worldwide.

Sound Samples

Flexitar.mp3

Interference.mp3

Slow motion.mp3

Vogelbekkenstuk.mp3

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