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Between air and electricity : microphones and loudspeakers as musical instruments

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Own works

This text can be found as well on the website www.cathyvaneck.net/ownworks/.
All audio and video examples are integrated in the text on the website.

1. Actions of Memory (2003)

a performance for guitar, trombone, double bass and live electronics

Wouter Snoei: live electronics

Juan Parra Cancino: guitar

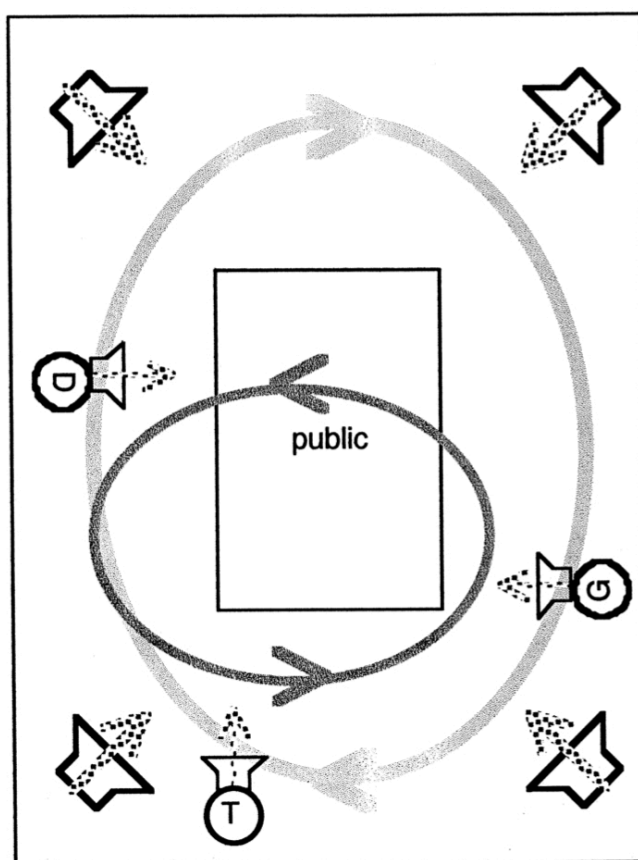
Jelte van Anandel: double bass

Joost Geever: trombone

Robert Steijn: dramaturgy

Writing my first pieces for instruments and live electronics during my composition studies in The Hague and Berlin, I was confronted with microphones, loudspeakers and musicians sharing the same stage. The use of live electronics often creates a very dynamic relationship between musician and electronic sound. In my view, the "rigid" loudspeakers were nothing more than passive reproduction devices. The contrast between what I called, at that time, "live" musicians and "dead" loudspeakers bothered me. The first project considering this matter is *Actions of Memory*. Besides four loudspeakers, each placed in a corner of the hall, three musicians wore old-fashioned living room loudspeakers on their backs and in this way were physically connected to the loudspeaker. Wherever they went in the performance space, the loudspeakers went with them. Different loudspeaker positions could be created by the musicians by taking different positions in the hall. Furthermore, there were many possibilities for communication between the musicians; for example, by emitting the sound of one player through the back-loudspeaker of another player. Evidently, during the course of this project, it turned out that identifying a musician with the sound coming out of the loudspeaker on his back was not always easy. Many of my assumptions at the start of this project were based on the idea that loudspeakers "reproduce" the sound of the musician and would, therefore, also automatically "reproduce" the musician him- or herself (see also my thoughts on reproduction in chapter 2 and 5). By reproducing the sounds, earlier produced by one musician, through the loudspeaker on the back of another musician, I assumed that they would be automatically "communicating" with each other. It turned out that these copies of the musicians did not come out through the loudspeakers. Since this was an art project that needed "a happy end" (there were public

performances planned) I focused on many other compositional aspects that were possible with this set-up and the loudspeaker question was taken to the next project.

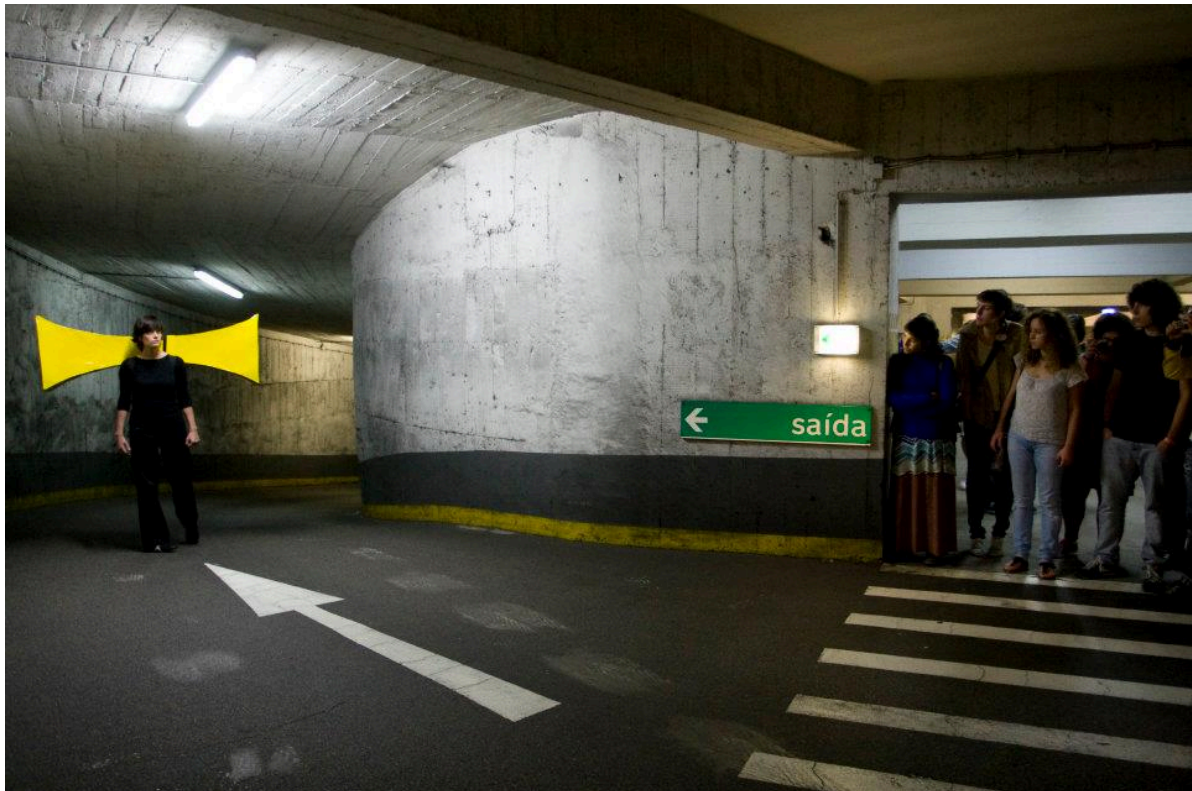


A scheme of the score of *Actions of Memory*, depicting the positions of the loudspeakers as well as the movements of the sounds.

In conclusion, I can say that the experiments I undertook in this piece raised many new questions about the possibilities of composing with microphones and loudspeakers. I decided to set-up a research project in which microphones and loudspeakers could have a "voice of their own" on stage. Besides, I was also interested in what other musicians and composers had already done in this domain. For this reason, I started the laureate-program at Orpheus in 2004 on the subject of *the active role of microphones and loudspeakers during a performance*. I continued this research from 2006 onwards as a doctoral researcher on microphones and loudspeakers as musical instruments in the docARTES program.

2. Hearing Sirens (2005–2010)

A project for MP3-players with portable loudspeaker horns.



Performance of *Hearing Sirens* in a parking garage in Porto (2011).
(picture © Silvana Torrinha)

After *Actions of Memory*, this was my second attempt to perform with loudspeakers attached to the bodies of the performers. This project has accompanied me through nearly my whole research period and I have made several pieces for these portable loudspeaker horns. The first version of *Hearing Sirens* was a piece for three dancers, called *Oefening in stilzwijgend zingen* (2005). After this initial composition, several others followed, which I discuss later in the text on *Hearing Sirens* (2007) (for one performer).

The most important insight I gained by creating *Hearing Sirens* is the correlation between the interacting parameters *movement* and *space* (see chapter 4 for an in-depth discussion of these parameters). Originally, this project was focusing on "movement of sound sources", as its most important compositional parameter considers the use of loudspeakers. This movement of the sound source is always parallel with the movements of the person wearing the loudspeaker horns and could not be achieved by the use of conventional musical instruments.

A real discovery for me was the interaction happening between sound emitted by the horns and the performance environment. As I explain in detail later, the emission of sound through the horn loudspeakers creates a spatial discovery of the performance environment, much more elaborate than the spatial interaction normally happening between instruments and environment. This was an effect I had not thought of when conceiving these loudspeakers. Contrary to what was the case when composing for the *movement* parameter, when composing for the *space* parameter the movement of sound sources is never parallel to the movements of the person wearing the loudspeaker horns. A small movement of the performer will cause a big change in how the sound waves are reflected by the environment. The position of the sound source seems not to be the loudspeakers attached to the body of the performer, but the reflections of this sound source by the environment. This effect cannot be obtained by conventional musical instruments, since they do not emit their sound with such strong directional qualities.

The interacting parameter *space* became important now as well and severely influenced how I conceptualised later compositions for this set-up (see *Hearing Sirens* (2007) for one performer). The project made me aware of the difference between *movement* and *space* as well as the potential of combining both. I started to consciously compose for these two parameters, creating specific sounds for each parameter as well as performing accordingly to make the specific interaction (*movement* or *space*) audible.

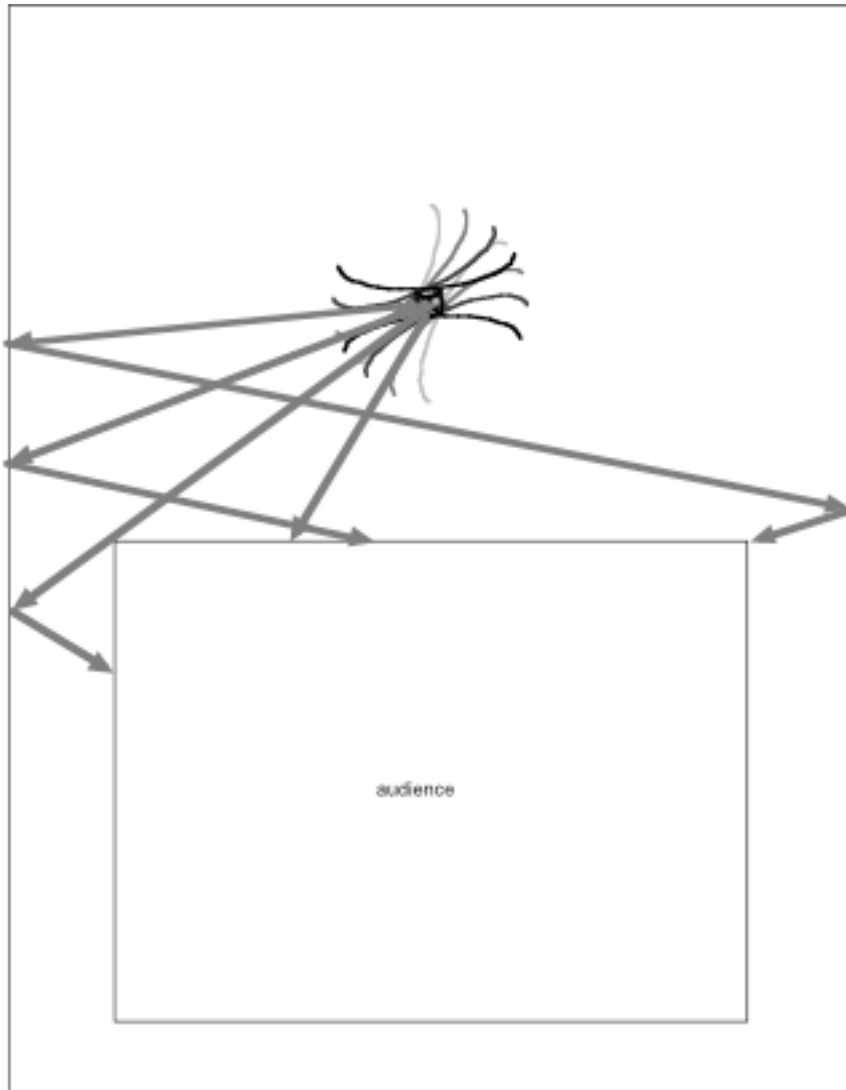
In my theory-focused work, I was confronted with similar problems. Whereas in my compositions, the differentiation between the categories are an aid to composition, by analysing pieces by other composers with the use of these parameters I was able to discover their compositional strategies. I have often been in doubt as to whether *movement* and *space* should not be one parameter, since *movement* is a change of the position in *space*. Is the audience, by throwing Anna Lockwood's *Sound Ball*, not discovering the space in a similar way as in Kirsten Reese's *Der tönende See*?² Technically speaking the same process is going on in the pieces of Reese and Lockwood. The bowls in *Der tönende See* only have to speed up and they would indeed be very similar to the *Sound Ball*. But it is exactly their slow movement that gives the observer time to hear their position in space in comparison to other sound sources, instead of focussing on how their position changes in space (which is the case for the *Sound Ball*).

² Both pieces are discussed in chapter 4.

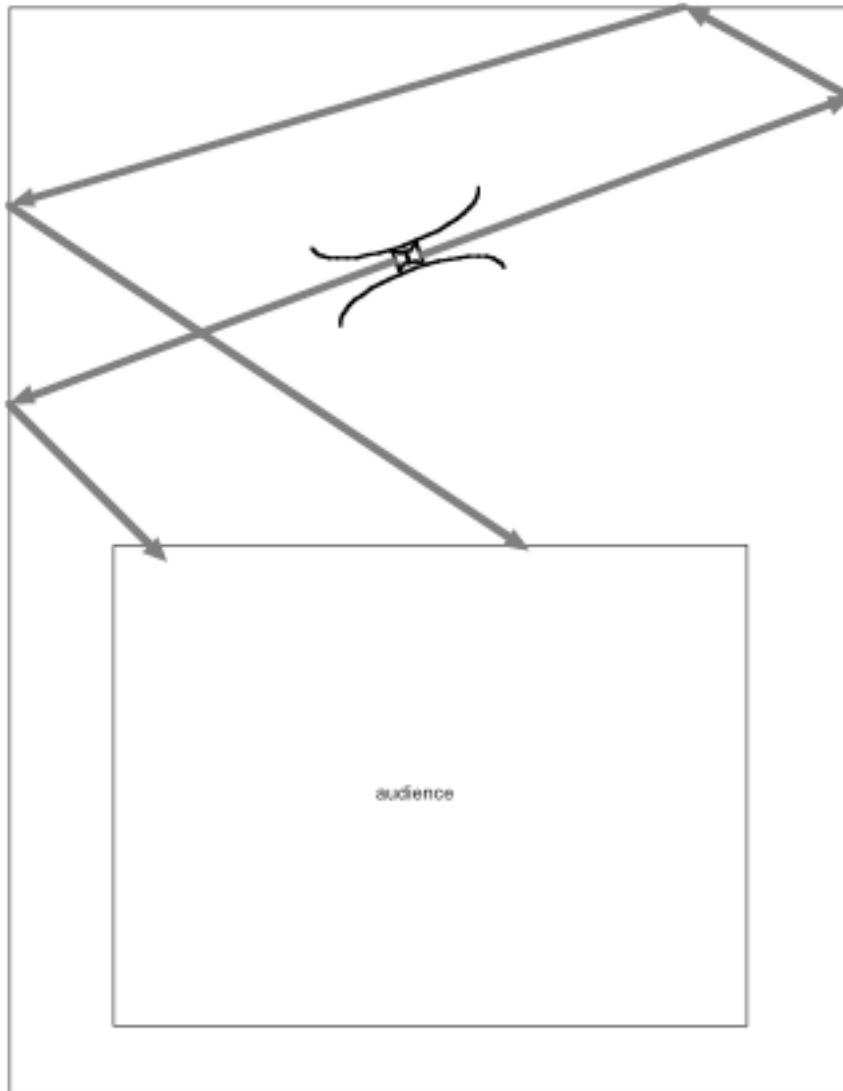
Construction and acoustical effect of the loudspeaker horns.

I built so-called portable loudspeaker horns, consisting of a small MP3-player, a box with an amplifier and battery, and two loudspeakers in two big, yellow horns. The construction is made to be worn on the back of a dancer or performer. During the performance, an MP3-file with a composition of mine is played. The pieces are performed by the performer(s) walking, dancing or moving in different ways.

Horns were used for optimising the transmission of sound waves from membrane to air before electricity made amplification of air pressure waves possible. As soon as electric amplification became available, horns were replaced by loudspeakers. In this project, I use what are normally regarded to be "disadvantages" of horns, such as colouring the sound and emitting sound in just one direction. Due to their specific form, the horn-loudspeakers guide the sound waves strongly in a bundle instead of a broader radiation pattern. The sound is diffused to the right and to the left, contrary to what is the case in a stereophonic loudspeaker system in the living room, which projects phantom images of the sound. By using these horns, often the first reflections are heard by the audience instead of the direct sound, as the scheme depicts. Depending on its form and material, each environment will reflect the sound in its own characteristic manner. Over the years, many performances were carried out in different environments, such as hills, woods, snow landscapes, city centres, a covered bridge, a conventional concert hall and a parking garage. The pieces *Klangverordnung* and *Extended Ears* are continuations of *Hearing Sirens* by elaborating upon some of the ideas in this project.



A small movement by the performer changes the position of the reflection, and the indirect sound source (perceived as the actual sound source by the audience) makes a big movement (again a simplified presentation).



The sound waves (this reproduction of the acoustical signals is, of course, very simplified compared to what happens in reality).

The form and colour of the horns are based on two of the applications of a "siren". The siren is both a mythological woman, having the body of a bird and the head of a woman, and a noise-maker, used to warn in emergency cases. The sirens as bird-women were known in Antiquity for their beautiful singing. Men were unable to resist them and most of the men who heard them did not survive. The siren as a noisemaker is used to warn people that there is an emergency happening, and can therefore be seen as a survival tool. Sirens use a rotating disk with holes to create its characteristic sound. I used both of these concepts as an acoustic, visual, and conceptual starting point for this project.



Attic red figure vase, depicting sirens
(450 BC, the scenery is from *The Odyssey*).



A siren as an outdoor warning noise maker.

3. Oefening in stilzwijgend zingen (2005)

for three dancers. portable loudspeaker horns and electronics
commissioned by the Festival Rümelingen

Jessica Billeter, Helena Zwiauer and Samuel Meystre: dancers
Teresa Rotemberg: choreography



A rehearsal of *Oefening in stilzwijgend zingen*: the three dancers are wearing the portable loudspeaker horns.

This was the first *Hearing Sirens* piece I created. Similar to the idea in *Actions of Memory*, I wanted to attach the sound source to the body of the performer. This time, not to create a more dynamic relationship between musician and loudspeaker, but to experiment with sound sources that move along with the performer. To give the loudspeakers more directional quality, I attached a big cardboard horn to them. Together with Teresa Rotemberg, an experienced choreographer, I

developed the choreography for this piece. The performance took place outside, in the hills in Switzerland. For the festival, a village of shipping containers was built, and each artist presented his or her work in such a shipping container. During the performance, my dancers moved from the hilly landscape towards the shipping containers, ending their performance on top of these.



The performance started in the hilly landscape...



...and ended on top of the shipping containers.

The sound emitted by the loudspeakers has been synthesised with the use of pulses and filters, using the software MaxMSP. The aim was to create a sound that resembled emergency sirens, but could in a flexible way be changed to other sounds, such as clicks and noises, that are less related to a typical siren sound. I designed most of the sounds whilst listening to them through monitor loudspeakers in the studio, since the horns were not yet finished. In later pieces for the loudspeaker horns I always listened to the loudspeaker through the horns for designing my sounds, so that I could know how they would influence the sound result. The piece is originally for six channels, since it has been composed for three dancers, each with two loudspeaker horns. This is a short fragment of the piece, before it is diffused through a cardboard horn, and thus contains only sounds as generated by the computer software. To obtain the effect of the performance, one should attach horns to ones loudspeakers at home, but a small impression can already be obtained by turning both loudspeakers in different directions:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/02OefeningFrag.mp3

As can be seen in the short video below, the choreography is focusing on the *movement* parameter as mentioned in relation to *Hearing Sirens*. When the dancers "fall", their loudspeaker horns are turned towards the audience. This becomes even clearer with the turns at the end of the movie: the sound source moves at the same speed as the dancers:

www.youtube.com/watch?v=0iTcsF-i5bA

In the open air, there are nearly no reflections of the sound waves, since there is nothing that can reflect them. As soon as the dancers enter the shipping container village though, the metal walls of the shipping container reflect the sound and I discovered that these horns may cause spatial effects (see *Hearing Sirens*). I experimented with the horns by rehearsing and performing the same piece in a conventional concert hall. This performance led to the conclusion that indeed a different spatialisation is obtained as soon as the first reflections of the sound are heard instead of the direct sound waves, as emitted by the horns. What kinds of changes this caused in the performance can be read at *Hearing Sirens* (2007) (for one performer).



The shipping container village reflected the sounds emitted by the loudspeaker horns, contrary to the hilly landscape.

4. Medea werden (2006)

for mezzo-soprano, three actresses and loudspeakers

Uta Buchheister: mezzo-soprano

Franziska Dieterich/Bärbel Schwarz/Mariel Jana Supka: actresses

Cathy van Eck/Daniel Plewe: sound, video

Sabine Hilscher: set and costume design

Henning Fülle: dramaturgy

Matthias Rebstock: concept, stage direction



Contact microphones on the actresses' shoes triggered sound files through loudspeakers that were placed all over the floor.

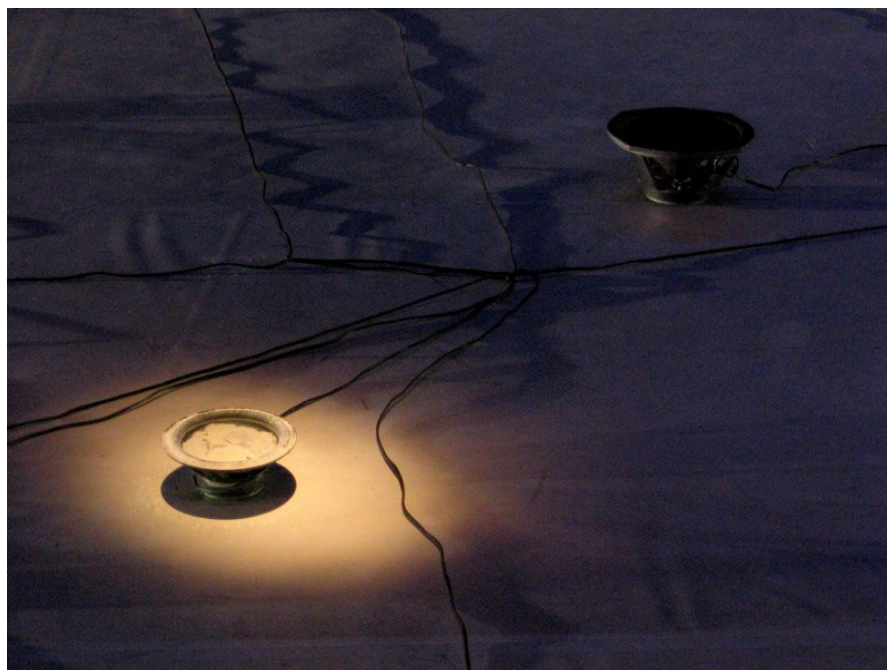
In this theatre piece, microphones and loudspeakers are a central element. We did many experiments with microphones and loudspeakers during the rehearsals, such as putting sand or water in loudspeakers and cutting their membranes. During the piece, all kinds of interventions with microphones and loudspeakers were happening: contact microphones on the actresses' shoes triggered sound files through loudspeakers that were placed all over the floor; a loudspeaker was placed on various parts of the body of one of the actresses to "hear" her thoughts; and a set-up very similar to Steve Reich's *Pendulum Music* was used. We experimented also with very low frequency oscillators, for example, sine waves between one and five hertz. When receiving a three hertz signal, loudspeakers will of course move their membrane at a speed of three cycles. This phenomenon played a role in all pieces categorised as visible vibrations.



An actress is triggering sounds with the help of a small microphone. She walks on the loudspeakers.



A loudspeaker was placed on various parts of the body of one of the actresses to "hear" her thoughts; and a set-up very similar to Steve Reich's *Pendulum Music* was used (see the pending microphone).



A loudspeaker filled with sand.

5. *Blik na blik* (2006)

for a small guitar, live electronics and tin cans
written for Daniel Göritz
commissioned by the Festival Klangwerkstatt



By putting the loudspeakers in a line next to the performer, they are both at the same perspective on stage.

This piece is the first in a series of experiments with tin cans and loudspeakers or tactile transducers. One of the aims of *Blik na blik* was to create a set-up, in which a musical instrument (in this case a small plucked string instrument, which I call a tin can guitar) would be *supported* by loudspeakers that were built by the same material as the instrument, in this case, tin cans. The resonating qualities of the instrument relate directly to the resonating qualities of the

loudspeaker, a similar approach to the one used by Alvin Lucier in *Music for piano with amplified sonorous vessels*. The small tin can guitar is confronted with virtual guitars, *generated* by a computer (more information on the supporting and generating approach can be found in chapter 2).

For *Blik na blik* I built a small instrument from a tin can, quite similar to a small guitar, and picked up its vibrations with the help of a contact microphone (AKG C411). Seven loudspeakers in a row are used for the sound diffusion, as can be seen on the picture. All of these loudspeakers were prepared with different amounts of tin cans, causing them to resonate the sound emitted by these loudspeakers, each in a different way. By putting the loudspeakers in a line next to the performer, they are all at the same perspective on stage. The guitarist could be seen and heard in the same row as the tin can towers. Besides the sound of the amplified guitar, I used synthesised guitar sounds, mainly developed live with the "mandolin~" object of the PeRColate library for MaxMSP software by Dan Trueman and R. Luke DuBois (see www.music.columbia.edu/PeRColate/). With the help of this so-called physical model of a mandolin I could create many different sounds similar to the ones made by plucked string instruments. These sounds were often triggered by the guitar but also played independently by the live electronics performer (me, in this case).

The relationship between the small tin can guitar player and the sound emitted through the tin cans was an important compositional element. At the beginning, the guitar plays just one tone, and triggers a sound made by the physical model of a mandolin. The single "ploing" goes from one loudspeaker to another:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/BlikOnepitch.mp3

The musician plays the tin can guitar through the loudspeakers and, as can be heard in the following fragment, a movement from one loudspeaker to another is automatically not only a change in position in space but also in sound colour:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/BlikJustAmplified.mp3

The tin can loudspeakers seem to "store" the sound of the guitar in their cans, with the help of electronic processing (I use a very long reverb on the guitar sound):

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/BlikReverb.mp3

During the piece, the tin can loudspeakers become more and more autonomous, resulting in a solo by them (played by the live electronics performer) without any triggering by the tin can

guitar. Although this could have been done with a fixed sound file as well, I preferred to perform this, since it was easier to adapt my performance to the resonances of the tin can towers in this way:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/BlikZelfstandig01.mp3

This solo of the tin can loudspeakers ends in all of them playing in a very "virtuoso" manner:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/BlikZelfstandig02.mp3

The piece ends with the tin can guitar triggering generated sounds by the computer that slowly move from one tin can loudspeaker to the other. The tin cans interact with the sound diffused by the loudspeakers. After the guitar is plucked, the only parameter that changes is through which tin can loudspeaker the sound is played:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/BlikLongResonance.mp3

When I developed this piece, I was merely interested in confronting several forms of plucked string sounds with one another. When reflecting on this piece in a later stage of my research, I realised that the *supporting* (amplification of the guitar), *generating* (synthesised guitar-like sounds) and *interacting* (the tin cans alter the sounds emitted by the loudspeaker) approach are, in fact, all present here.

6. Büchsen für Pandora – Musik aus der Dose (2006)

for loudspeakers, tin cans and live electronics



Four loudspeakers of which three have a fixed tin can tower placed upon them. The fourth loudspeaker is "played" by placing different tin can towers on the loudspeaker. A light sensor is used to trigger changes in the computer software used for this piece.

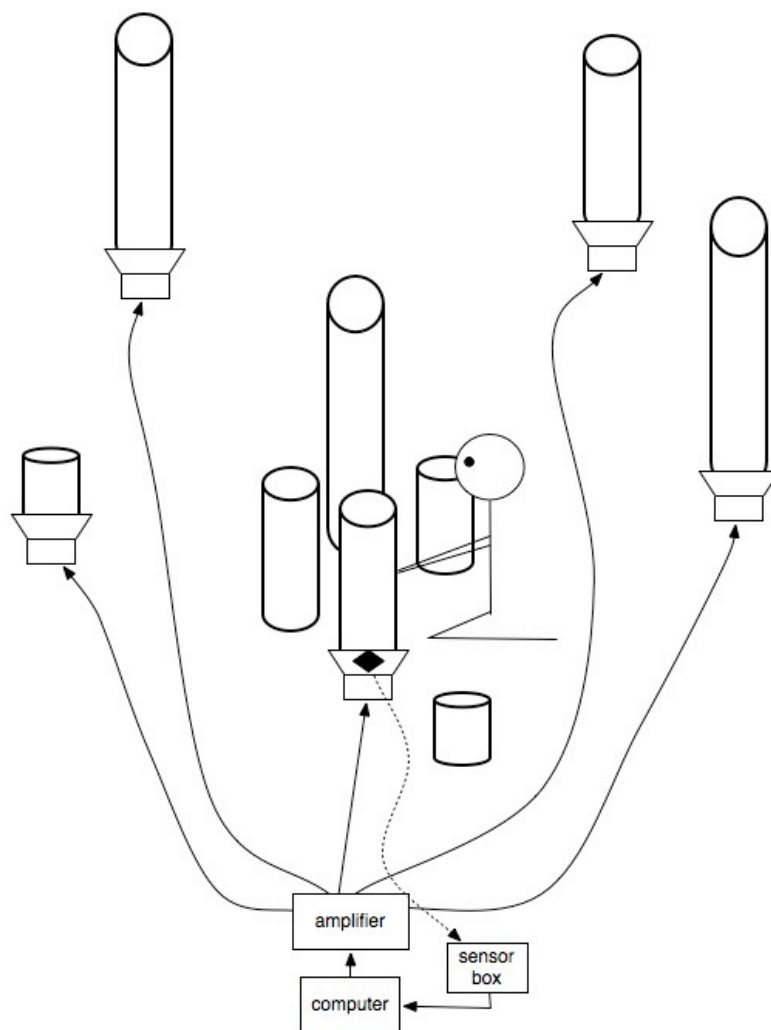
This is the second piece using tin cans. This was a short study, using the same set-up as in *Blik na blik*, but this time using tin can sounds. I wished to investigate how differently the tin cans would react when used as resonators for their own sound. I am performing by changing the amount of tin cans on one of the loudspeakers (see the scheme and picture). A light sensor (photo cell) is placed on the loudspeaker. According to how many tin cans are placed on the loudspeaker, the sensor will pick up more or less light. The output of the sensor is used for controlling a MaxMSP patch, which shapes the sound of the performance. The sounds are recorded tin can sounds, modified live by using several sampling techniques, transposition and reverb. The sound is diffused through four different loudspeakers placed on the floor, all equipped with a tower of tin cans on top of them. The difference in resonance of each tin can tower was audible as long as one was close to the tin cans, but was more difficult to distinguish in a bigger space, especially if the space added some reverb. For this reason, I decided in *In blik*—the next piece for tin cans—to use a set-up, in which the audience can walk around the tin can loudspeakers.

Unfortunately, only a bad recording exists of this piece, which was performed only once. In the first part of the piece the tin can sound moves from one loudspeaker to the other. This movement is controlled by the light sensor output:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/pandora1.mp3

Later on, the light sensor is controlling several forms of sound processing, such as adding reverb:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/pandora2.mp3



Set-up scheme for the performance *Büchsen für Pandora*

7. Hearing Sirens (2007) (for one performer)

for portable loudspeaker horns and electronics
written for the Mobile Music Workshop



Performance of Hearing Sirens in Amsterdam (2007).

After my experiences with loudspeaker horns in *Oefening in stilzwijgend zingen*, I decided to develop a new composition with the horns for only one performer and one pair of loudspeaker horns, so the interaction with the performance environment would be clearer. This composition was mainly composed whilst listening through the loudspeaker horns, resulting in sounds that are much rougher and harsher than in *Oefening in stilzwijgend zingen*, which was composed with the use of monitor loudspeakers. Directional characteristics of sound waves can be easily identified by human beings, especially short, high (especially around 3000 hertz), and noisy sounds. In the second composition for *Hearing Sirens* I added more energy to the upper partials

of the sound spectrum (which is what causes the sound to be "rougher and harsher") and worked with much shorter sounds. The composition uses, for example, high and noisy sounds (this sound file sounds differently, when diffused through the loudspeaker horns):

www.cathyvaneck.net/ownworks/wp-content/uploads/2007/05/hoogradio.mp3

I also used isolated clicks. Due to their shortness, their reflections can be well heard. The horns also colour them strongly:

www.cathyvaneck.net/ownworks/wp-content/uploads/2007/05/ticks.mp3

This gives an impression of how they sound during a performance:

www.vimeo.com/66799938

During the second part of this movie, another compositional technique for discovering space is used. Since both loudspeaker horns emit their sounds in opposite directions, many possibilities for spatial interaction are created. An example is to rapidly alternate a sound between the loudspeakers, which both send their sound to a different part of the environment and therefore different spatial qualities will be heard:

www.cathyvaneck.net/ownworks/wp-content/uploads/2007/05/extremepanning.mp3

As can be seen in the movie as well, the performers' movements are totally different from those of the dancers in *Oefening in stilzwijgend zingen*. The movements of the dancers evoke associations, resulting in a story that is told. In *Hearing Sirens* (for one performer), the focus is not on the movement by the performer, but on the interaction between sounds emitted by the loudspeaker horns and the environment. For this reason, my movements are in a slow and "discovering" manner. I search for interaction between the sound emitted by the loudspeaker and the environment, and as soon as I find a movement or a spot that I consider sonically interesting, I repeat the movement or stay at that spot. My way of performing this piece could be compared with Alvin Lucier's *Bird and Person Dyning*. I prepare these performances by visiting the place and testing out the acoustical characteristics by hand clapping. I discover the spatial response of the environment and decide which sound will be played at which position as well as what kinds of movements would probably be suitable. Evidently, since this performance usually happens in public space, I cannot test the sound through the loudspeaker horns, since that would already be the performance itself.



Performance of *Hearing Sirens* in the snow.

8. groene ruis (2007)

for a small box tree, hair dryer and live electronics
written for the Gaudeamus Music Week



A choreography of hand and arm movements controls the sounds.

In *groene ruis* I use sounds of a small tree and a hair dryer not only as direct musical material but also for triggering sound files and synthesised sounds, programmed in Max-MSP. The piece is a combination of directly amplified sounds (tree and hair dryer), pre-recorded sound files, and live-processed electronic sounds, all triggered by the performer. A choreography of hand and arm movements controls the sounds.

I play the tree with movements, similar to movements used for playing a traditional musical instrument: I pluck its branches as if they were harp-strings. Every pluck on the tree causes an electronic "ploing" sound (in fact, an enveloped sine wave) and for this reason, the movements of the performer seem to have transformed the tree into a musical instrument. After a while, though, the "ploings" break away, and the amplified sound of the tree itself becomes audible. The illusion of the tree being a musical instrument collapses. Now, the tree sounds like what it looks like. Whilst in the beginning, my movements of playing an instrument seemed to cause the sound, now the materiality of the tree itself seems to be sounding.

In this piece, the perspective on musical performance changes: the first part concentrates on the activity of performing movements; the second part on the object which receives these movements. This change of perspective would not make any difference in the case of non-

electroacoustic music, since their relationships would have been compulsory. As for this example, plucking a tree in a certain manner without electronics involved would have had only one possible sonic result. Due to the use of electroacoustic and electronic aids, though, the sounding result is no longer dependent on either the movements of the performer or the material itself and for this reason, plucking the tree in a certain manner can produce myriad sonic results.

Both the electronic "ploings" and the amplified sound of the tree are caused by two contact microphones, attached to the small tree. The tree functions as the membrane for these contact microphones and my movements cause the tree to vibrate, barely audible, but clearly perceptible for the contact microphones. The microphones transduce the vibrations into electricity, and from that moment onwards, the relationship between the movements of the performer and the sound can be composed. During the first part, the vibrations of the tree picked up by the contact microphones are used by the computer to trigger the "ploing" sounds. During the second part, these vibrations are sent directly through the loudspeakers and therefore the amplified vibrations of the tree are heard.

Later in the performance, the hair dryer is added and its sound is processed and starts to take on a sonic identity which no longer reminds us of the everyday object. The hair dryer is moved in different ways: sometimes in a realistic way, as if drying hairs, but in a highly stylised and abstract way during other parts of the performance, as if a musical instrument is being played:

www.youtube.com/watch?v=d0G7Deg2neM

The performance switches between actions that are perceived to be musical actions and actions that are more closely related to everyday life. This piece adds more possibilities to the gestural identity shifts I describe in chapter 5, whilst analysing *Windy Gong* by Ute Wassermann and the snare drum pieces by Wolfgang Heiniger. This time, the *supporting* approach (the amplified tree) is confronted with the *generating* approach (the "ploings").

groene ruis [Dutch for "green noise"] is supposedly the background noise of the world. Green noise is also used to describe the overwhelming amounts of information about how to be "green" or more environmentally friendly.

9. *dazwischen* (2007)

for three loudspeakers, three performers with contact microphones and live electronics
written for the music theatre Wanderland
commissioned by the Festival Klangwerkstatt

Susanne Kabalan, Andre Bayer, Cathy van Eck: performers



The performers were standing on a stairway in the theatre.

dazwischen is a part of the music theatre piece *Wanderland*, which theme is "transition". The performers are standing on a stairway and they play a specific choreography of hand movements on the balustrades, merely based on "waiting" positions: a stairway as a place of transition. All performers wore gloves with a contact microphone which picks up vibrations as soon as the performers move their hands on a surface. The signal of the contact microphones is used to trigger all kinds of electronic sounds (*generating* approach), emitted through small loudspeakers in boxes, hanging at different spots in the performance space. Three times in the piece the succession of hand movements triggering sounds is interrupted by inserting sound files of a talking and laughing crowd in a café. On the ground floor of the stairway there was a café, and

with the use of these sounds, I wanted to integrate the everyday life of the place into the performance:

www.cathyvaneck.net/videos/dazwischen01.mp4



The movements of the choreography were merely based on "waiting" positions.



All performers wore gloves with a contact microphone and the sounds were emitted through small loudspeakers in boxes.



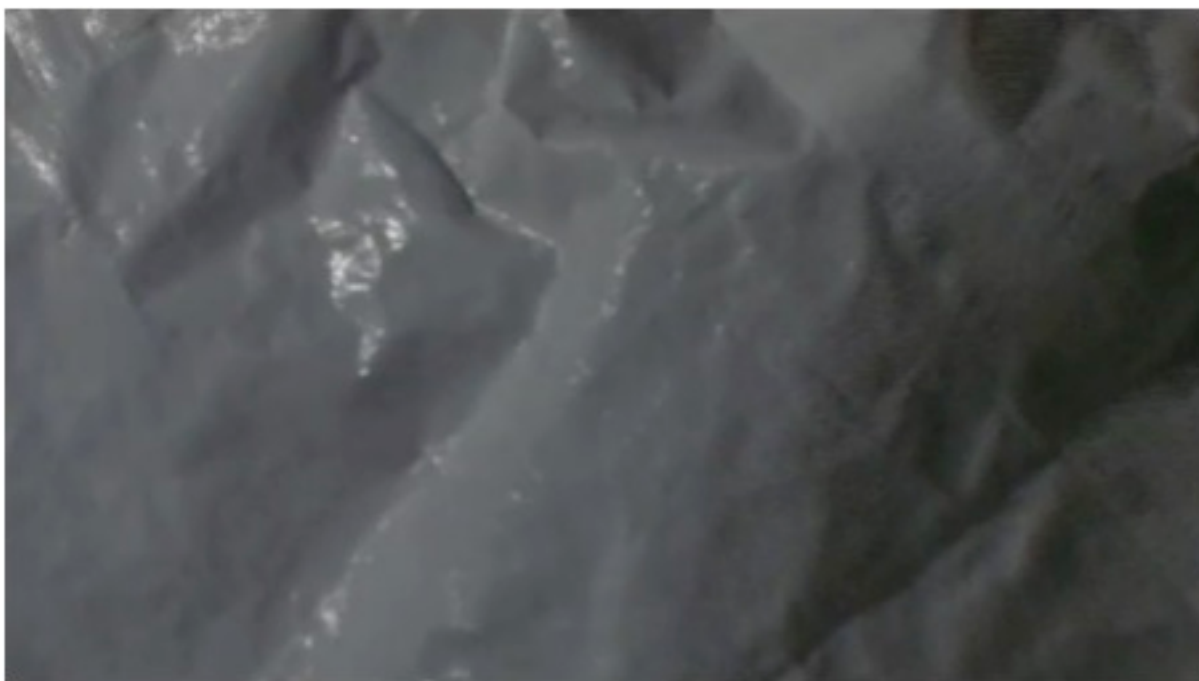
The audience climbed the stairs during the performance.

10. Luftschlösser im Bau (2007)

for 10 musicians, 7 castles in the air structures and electronics

written for the music theatre *Wanderland*

commissioned by the Festival Klangwerkstatt



White plastic tarpaulin is placed on top of subwoofer loudspeakers.

Luftschlösser im Bau is written for soprano, baritone, three clarinets, two trumpets, a trombone, two accordions and seven loudspeaker objects. In this description I focus on the loudspeaker use and not on the parts played by the conventional musical instruments. The loudspeaker objects are used in this musical theatre piece as references to unfinished castles in the air. They are white, fluffy, unformed objects, hanging from the balconies of the theatre, not resembling castles at all. During the performance, these objects start to sound and vibrate.

I used loudspeakers—so-called "subwoofers"—that are constructed especially for the production of low frequencies. By sending sine tones between 3 and 16 hertz through the loudspeakers, their membranes will vibrate at this frequency. I hung a white plastic tarpaulin on top of these loudspeakers, which can be brought into vibration by the loudspeaker membrane. Depending on the type of electronic sound, the plastic tarpaulin will make noise: low and loud frequencies are normally only perceptible as the movement of a loudspeaker membrane, but in this case, the loudspeaker membrane "plays" the tarpaulin. When higher frequencies are played

through the loudspeakers, the tarpaulin will remain silent. Similar to the set-ups used in, for example, *Rainforest* by David Tudor and *Windy Gong* by Ute Wassermann, the reaction of the material is very much dependent on the spectral characteristics of sound emitted by the loudspeaker. The material parameter, as discussed in chapter 4, is one of the main elements of the composition. Besides, the vibrations of the loudspeaker become visually perceivable as well:

www.cathyvaneck.net/videos/Luftschloss6.mp4

11. Wings (2007 - 2008)

for big white shields, three microphones, one loudspeaker and three performers

Part of three performances using feedback by *a search for renoise* (strings by Juan Sebastián Lach Lau and *tubes* by Paul Craenen)

with support from Champ d'Action and ORCiM



Three performers are manipulating the acoustic feedback with foam-board panels.

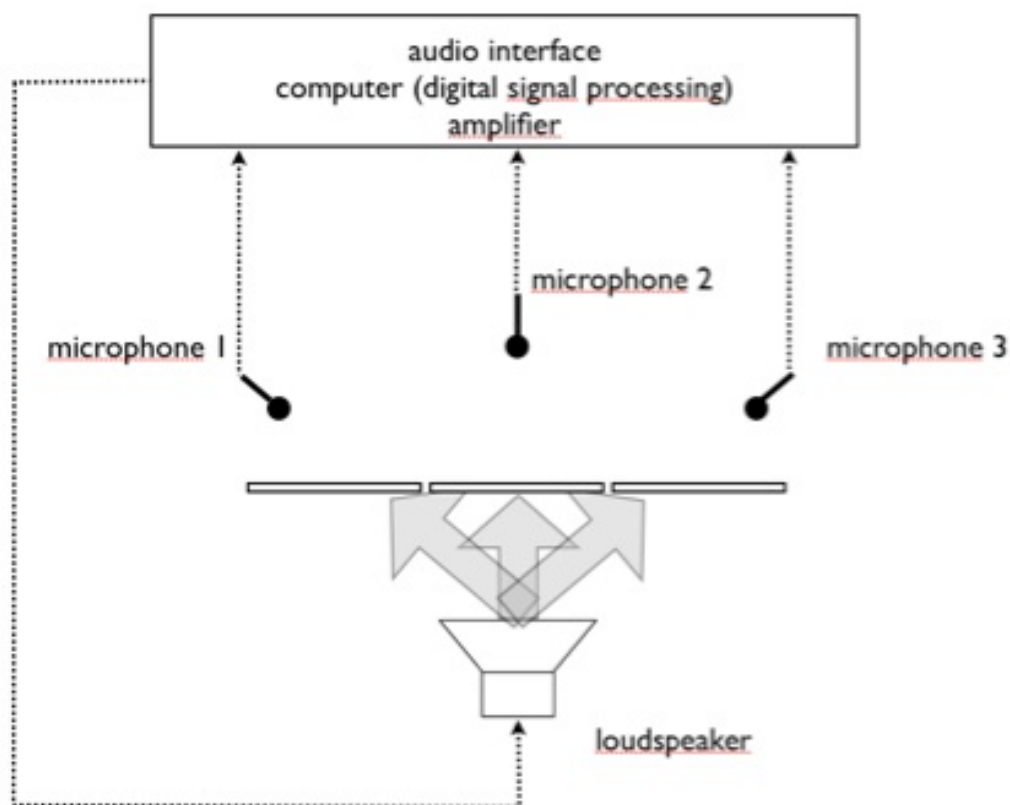
(picture ©SilvanaTorrinha)

Wings was developed during a research project together with two other DocARTES doctoral candidates, Paul Craenen and Sebastián Lach Lau. The research project focused on the possibilities of acoustic feedback combined with digital signal processing. Each performance explores a specific use of bodies, objects or instruments as sound resonators or mutes with which to manipulate the feedback-loops. A meta-musical environment comes into existence, in which sound textures, body postures, technical actions, and spatial positions interact and comment on one another. As a result, three new pieces were developed: Juan Sebastián Lach Lau uses the computer to make an environment in which, besides the feedback happening between a microphone in the guitar and the loudspeakers, there is an improvisational feedback process happening between the guitar performer and the computer responses, which guides the

development of the piece (this piece is titled *Strings*). Paul Craenen works with PVC pipes in order to build a new instrument, to trigger and manipulate feedback loops between loudspeakers and microphones, and to control the digital environment that processes the audio signals (*tubes*, see also more information in chapter 5). I manipulate the feedback by shifting foam-board panels around, creating new spaces with every movement and therefore also changing the space in which the feedback can resonate (*Wings*). The performances are not only developed by Paul, Sebastián, and Cathy; the three composers also appear on stage to execute them:

www.vimeo.com/15637848

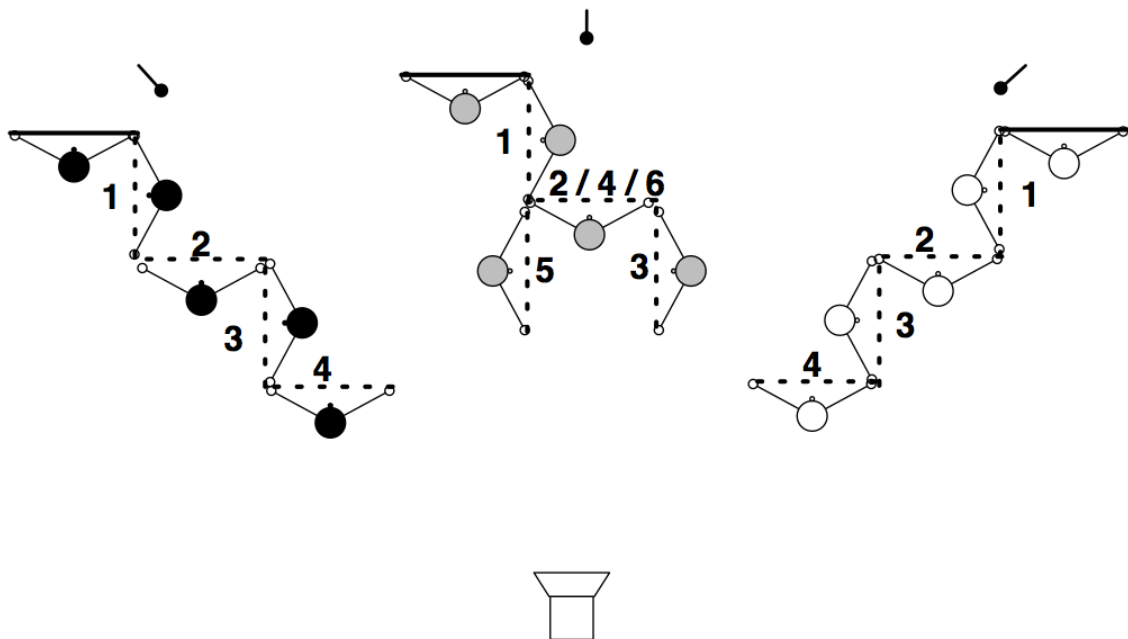
In *Wings*, three microphones stand in front of one loudspeaker. In between the loudspeaker and the microphones the three performers stand, holding big, white foam-board shields. The performance starts by turning up the volume of the loudspeaker output until feedback between the loudspeaker and the three microphones occurs. Due to the large shields, the sound waves in the air move differently than they would do without any objects blocking their way between the microphones and loudspeakers.



Set-up for *Wings*, with three microphones, a loudspeaker and foam-board panels.

The performers move the shields to different positions and manipulate the feedback with each change of the shield positions. This piece is composed by principally using the parameter *space*, as described in chapter 4, since the distance between shield and loudspeaker as well as between shield and microphones changes the pitch of the feedback. The digital signal processing by the computer reacts to these feedback pitches and processes the sound in different ways, using simple signal processing techniques such as pitch shifting and ring modulation. The result is a choreography of movements with the white shields that designs the sound as well as the structure of the composition. These movements are notated in a score:

9) make together very regular movements, turning the shields in 90 degrees (this time the notation also indicates the place to move to, so the performers are moving backwards).



A page from the score of *Wings*. The numbers indicate the order of the movements.



The performers are often hidden behind the foam-board panels in *Wings*.
(picture ©SilvanaTorrinha)

12. *in blik* (2008)

for tin can towers and electronics

written for the Lange Nacht des Musiktheaters in Berlin, Germany

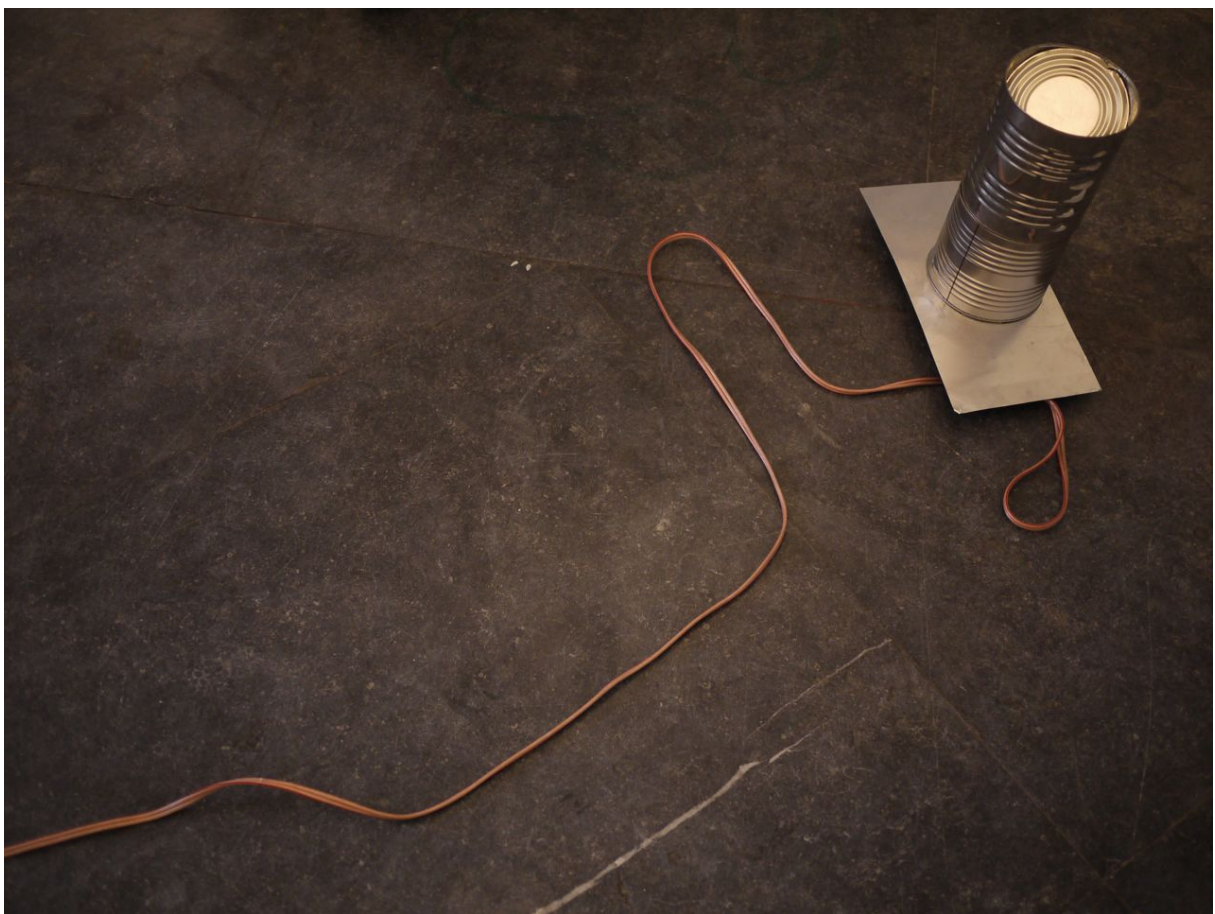


The set-up for *in blik*. Five different tin can towers, each attached to a tactile transducer.

In *in blik* there are no musicians on stage but instead five tin can towers placed on tactile transducers to produce sound. These tactile transducers (also named body shakers or simply drivers) function as loudspeakers without membranes. They vibrate depending on the electric current they receive. However, contrary to loudspeakers with membranes, they barely produce any sound but transmit their vibrations directly to the tin cans placed upon them. The tin cans transmit these vibrations to the air and make them audible. Depending on the way the tin cans are placed upon each other and the height of each tower, every tin can tower will amplify the vibrations, each one through its own characteristics. The set-up is similar to the set-up in the other tin can pieces *Blik na blik* and *Büchsen für Pandora*, but this time the loudspeakers do not interact with the tin can through the *space* parameter, but through the *material* parameter.

In this performance, the vibrations caused by the loudspeaker become visible as well. The tin can towers not only receive vibrations, which make them sound, but also produce much stronger vibrations (principally caused by low frequency oscillators), which make them move. Here, the tactile transducer is comparable to a percussionist hitting the tin cans. By these visible movements of the tin can towers, they get the characteristics typical of a performer instead of an instrument. From the moment they start to move, shake, and "walk" forward, their identity shifts towards being that of an active performer rather than a passive sounding object. They oscillate between object (the instrument played on) and subject (the musician who is playing, making movements to make sound). The border is crossed between listening to a sounding object, on one side, and the sounds made by a moving performer, on the other. The vibrations of the material change into the movements of the performer and the instrument transforms into a performer:

<https://vimeo.com/66903094>



Some of the lid of the tin cans has not been removed. The lid will produce sound as well.



The tin can towers are placed differently, according to the characteristics of the performance space.

13. Mit Luft gebaut – Musik aus der Dose (2008)

for castles in the air, tin can towers, loudspeakers and three performers; performances in a sound installation for a guitarist and two singers

Alexandros Drymonitis: guitar

Kerstin Fuchs, James Orsher: voices

Cathy van Eck: composition, objects, live electronics



Seven "castles in the air" are used in this piece.

In this music theatre piece several of my pieces—*Blik na blik*, *Luftschlösser im Bau* and *in blik*—were combined into a new piece, adding some new elements for two singers. I combined the possibilities of several loudspeaker objects (using tin cans and tarpaulin) by arranging them in a big space and connecting them by composing sounds in order to investigate the different sonic characteristics of these objects. Similar principles of sound production, using both the *material* and *space* parameters, are composed into one large form out of the several small pieces from which these objects originated. I did not do many new experiments in this piece but mainly used the knowledge gained in preceding works to compose a large-scale musical theatre piece:

www.cathyvaneck.net/videos/MitLuftGebautOverview.mp4

14. Im freien (2008)

for recorder, duduk, organ pipe and electronics

written for Gerd Lünenbürger and Raphaela Danksagmüller

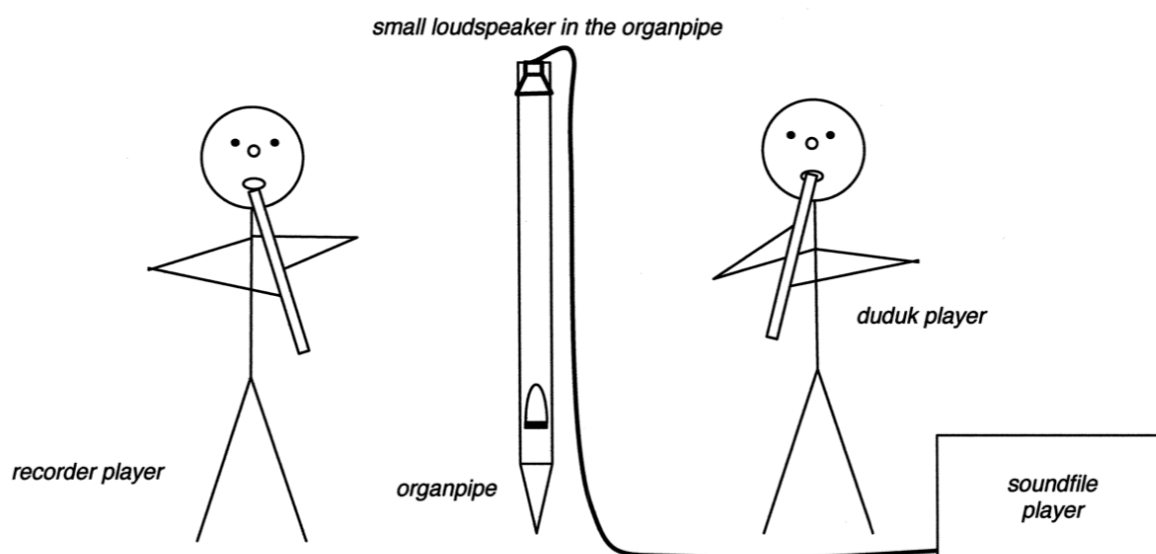


A small loudspeaker is placed in an organ pipe.

My research started as an attempt to bring microphones and loudspeakers closer to conventional musical instruments during live electronic processes, as I explained in *Actions of Memory*. One of my main aims was to convert microphones and loudspeakers into musical instruments. I call this the *interacting* approach and I describe many works using this approach in chapter 4.

During the last years I became less interested in working with conventional musical instruments, and more interested in only using microphones and loudspeakers. One of the last works composed for the combination of conventional musical instruments and loudspeakers is *Im freien*. In this piece, I tried to "dress" the electronic sound in a similar way to the two other

instruments, a recorder and a duduk. A small loudspeaker is therefore placed in an organ pipe. The pipe is a "wind" instrument, similar to the recorder and duduk.



The set-up for *Im freien*.

During the piece, fixed sound files are played through the loudspeaker, while the instruments play their parts from a score. At the beginning of the piece, the electronic part starts with one note, which is at the same pitch as the organ pipe itself. Although the sound is generated by electronic means, I want to create the illusion that the organ pipe itself is "playing" this sound. The instruments join the organ pipe in the same pitch. At the beginning of the piece, the identity of the organ pipe is therefore similar to other conventional musical instruments: they make a certain sound that is directly related to their shape. The organ pipe then starts to play more pitches, in a sound colour still similar to a conventional organ pipe sound. The identity of the organ pipe loudspeaker is enlarged. The organ pipe approximates the other instruments and starts to play similar musical material. The original identity of the organ pipe comes to an end, and shifts towards one closely related to wind instruments, such as the recorder and duduk:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/infreien01.mp3

All three instruments are played with air, and for this reason I inserted a section in which the main sound material is breath. The recorder and duduk player are breathing and breath sounds are simultaneously reproduced through the small loudspeaker:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/infreien03.mp3

Another association related to these wind instruments is brought up when the sound of birds in a forest is emitted in the middle of this piece. Birdsong is related to wind instruments in classical music: flutes are frequently used to imitate birds. The loudspeaker emits a reproduction of these birds:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/infreien02.mp3

Until I composed *Im freien*, I thought of the *interaction* approach as the ideal method to compose with microphones and loudspeakers. I analysed many pieces to discover in what ways artists interacted with microphones and loudspeakers, and developed compositions in which I searched for my own practice to achieve this. During the compositional process of *Im freien* I was not only investigating the sonic, but also the sociological context of organ pipes and wind instruments. Sounds such as birdsong and breath seemed possible associations. I realised that what could be called a genuine aspect of microphones and loudspeakers as musical instruments is not being able to create their own specific sound: their uniqueness is the ability to deal in many different manners with sound. They are able to *reproduce* other sound sources, to *support* other sound sources, to *generate* formerly unknown sound sources, and to *interact* with performers in order to create sounds of their own. The possibility of using all these different approaches as elements of a composition can be very valuable, as I prove in chapter 5. The main achievement of this piece is therefore not necessarily its artistic value, but rather the alteration of my theoretical reflection which it caused. After *Im freien* was finished, I started to look back at my own compositions and the pieces by other composers I had analysed. I realised that many—if not all—were based on a combination of approaches. The microphone and loudspeaker are not "not so good" conventional instruments, but rather, unique devices in the realm of sound producers (see chapter 5 for a more elaborate discussion of this idea).

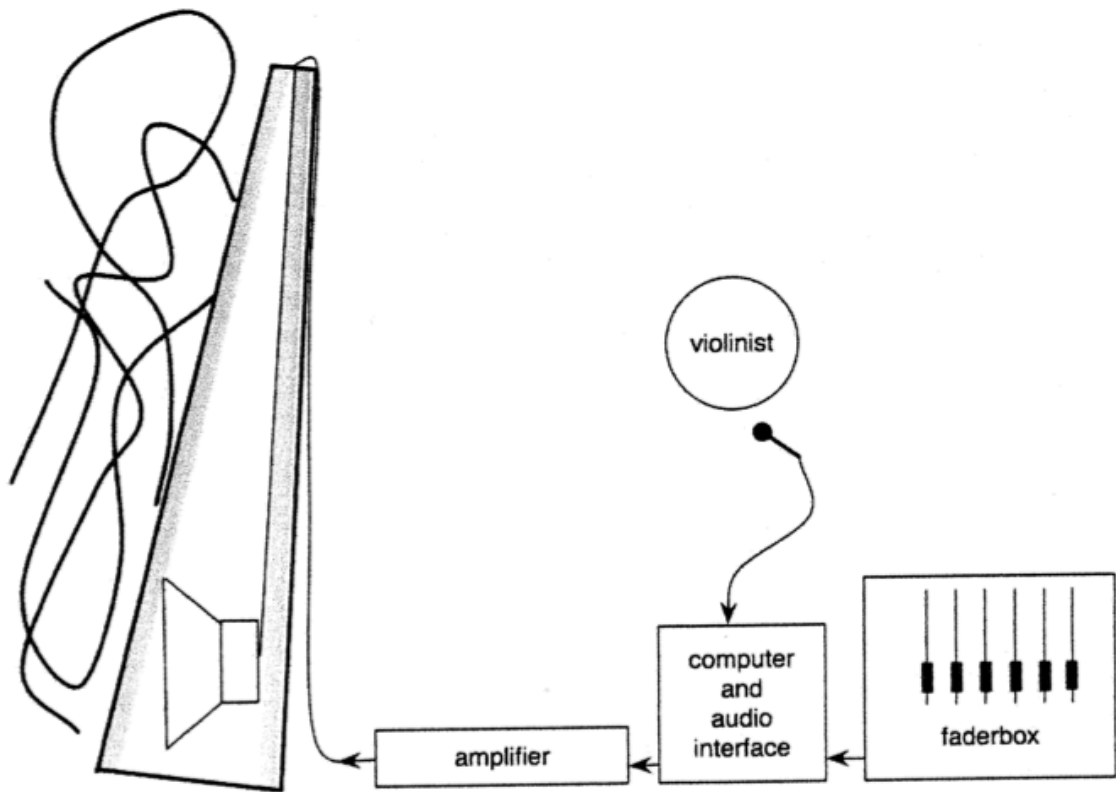
15. hout en snaren (2008)

a piece of music for violin, loudspeaker-object and live electronics
written for Susanne Zapf
commissioned by November Music



The object is made of wood and iron wire.

In *hout en snaren* the source material of the violin, wood, and strings, is the main focus ("hout en snaren" is Dutch for wood and strings). Besides the violin, also a loudspeaker object, constructed out of a tactile transducer, wood, and strings, is playing. The loudspeaker object is an archaic counterpart to the violin, and is wild and chaotic, instead of well structured. Opposite to the violin, its strings are not put up cleanly but free to vibrate with the sound.



The set-up for *hout en snaren*.

The tactile transducer sends all the sounds through the wood and strings. With the help of live electronics, the sounds of the violin are transformed and played through the loudspeaker object. The object is vibrating visibly owing to the loudspeaker, in a similar manner to such pieces as *in blik* and *Luftschlösser im Bau*. The difference, though, is that here, the loudspeaker object has a counterpart in the form of the violin, similar to the relationship between organ pipe and wind instruments in *Im freien*:

www.cathyvaneck.net/videos/HoutEnSnaren.mp4

The violin player and loudspeaker object interact in various ways during the performance. At the beginning, the violin sound is *reproduced* through the loudspeaker object:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/HoutViolinalternate.mp3

Later on, the violin player controls the loudspeaker sound with the volume of the violin sound: the louder the violin plays, the faster the loudspeaker object vibrates:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/ViolinControlsWood.mp3

At the end of the piece, the loudspeaker object is no longer directly controlled by the violin but plays its own musical material, controlled by the live electronics performer sitting in the hall:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/WoodGetsOwnVoice.mp3

16. Das Quartett oder Schumann im Netz (2009)

two interactive set-ups for the music theatre piece *Das Quartett oder Schumann im Netz - Eine Unterhaltung mit Interferenzen und Turbulenzen*

commissioned by Bühne Fasson

Mathias Wendel: voice, movement

Karin Minger: movement, dance

Curdin Janett: strings, keys

Karin Meier: voice, singing

Cathy van Eck: electronics, composition

Peter Scherz: light

Gabi Rahm: costume design

Kathrin Siegfried: dramaturgy

Nelly Bütikofer: stage direction



The performers tried to fold the music stands together, but the result was some weird metal forms.

For this theatre piece, I developed several interactive set-ups, two of which focused on microphones and loudspeakers. As in all of the theatre pieces I took part in, the use of these set-ups was developed in close collaboration with the performers, costume designer, and stage director. The interdisciplinary and collaborative character of this kind of work often gave me new ideas for my own projects, such as *Song No 3*, *Music Stands* and *Stumme Diener*.

Set-up one: for two performers, loudspeaker with paper and microphone

The singer sings a conventional song through a microphone and after some transposition, the signal is emitted through a loudspeaker, which has paper glued on its membrane. The dancer holds this loudspeaker before her mouth, and makes gestures that give the impression that she is singing. I found the idea of combining her gestures with the voice of someone else fascinating, and decided to develop an interactive performance for myself. This resulted in *Song No 3*:

www.cathyvaneck.net/videos/NotestandsQuartett02.m4v

Set-up two: for three performers, contact microphones and loudspeakers

Since the main theme of this theatre piece was music, music stands played an important role. They became a sounding object during the performance. The performers tried to fold them together, but the results were weird metal forms, vaguely resembling human forms. Contact microphones and loudspeakers were attached to the music stands and, during a short interlude, these amplified the sound of the music stands. When trying out this set-up during rehearsals, feedback would occur as soon as a contact microphone sent its signal to the loudspeaker attached to the same music stand. Since the sound of the music stand should only be amplified, I decided to amplify each of them through the loudspeaker attached to one of the other music stands. I was attracted by the possibility of generating feedback with the help of these music stands instead of through the air as I had done, for example, in *Wings*. This resulted in the pieces *Music Stands* and *Stumme Diener*:

www.cathyvaneck.net/videos/Quartett.m4v



Set-up 1: at the left the loudspeaker, which has paper glued on its membrane, left the singer.



Set-up 2. The music stands were "played" by the performers.

17. Ein Oktett für das Quartett (2009)

a piece for 8 loudspeakers and 4 performers

for the musical theatre piece *Das Quartett oder Schumann im Netz - Eine Unterhaltung mit Interferenzen und Turbulenzen*

commissioned by Bühne Fassung



The loudspeakers attached to the backs of the performers.

The music theatre piece *Das Quartett oder Schumann im Netz*, for which I made several interactive set-ups, ended with a composition of mine for eight loudspeakers. Four of these loudspeakers were attached to music stands and placed at the right side of the hall; the four others I fastened onto the backs of the four performers, at the end of the performance. They walked around with these loudspeakers, most of the time with their backs turned towards the audience. They ended standing in a row, close to the audience, as can be seen on the picture above. The sounds of this piece were principally based on recordings of the sounds produced by the performers during the theatre piece. The sounds are reproduced, not as "neutral" recordings, though, but taken out of their contexts and attached to music stands and bodies. The movements

of the performers relate to the sounds. During some parts of the composition, the performers stand still, so the sounds can be located very well. At other moments the performers move slowly and the sounds emitted by the loudspeakers are diffused in the performance space. The result is a slowly changing spatial relation between the various sound sources—the stable music stand loudspeakers and the moving performer loudspeakers:

www.cathyvaneck.net/videos/OctettQuartett03.m4v



The performers slowly walk around with these loudspeakers, most of the time with their backs turned towards the audience.

18. Song No 3 (2010)

for one performer, loudspeaker, microphone and live electronics
written for KOFOMI

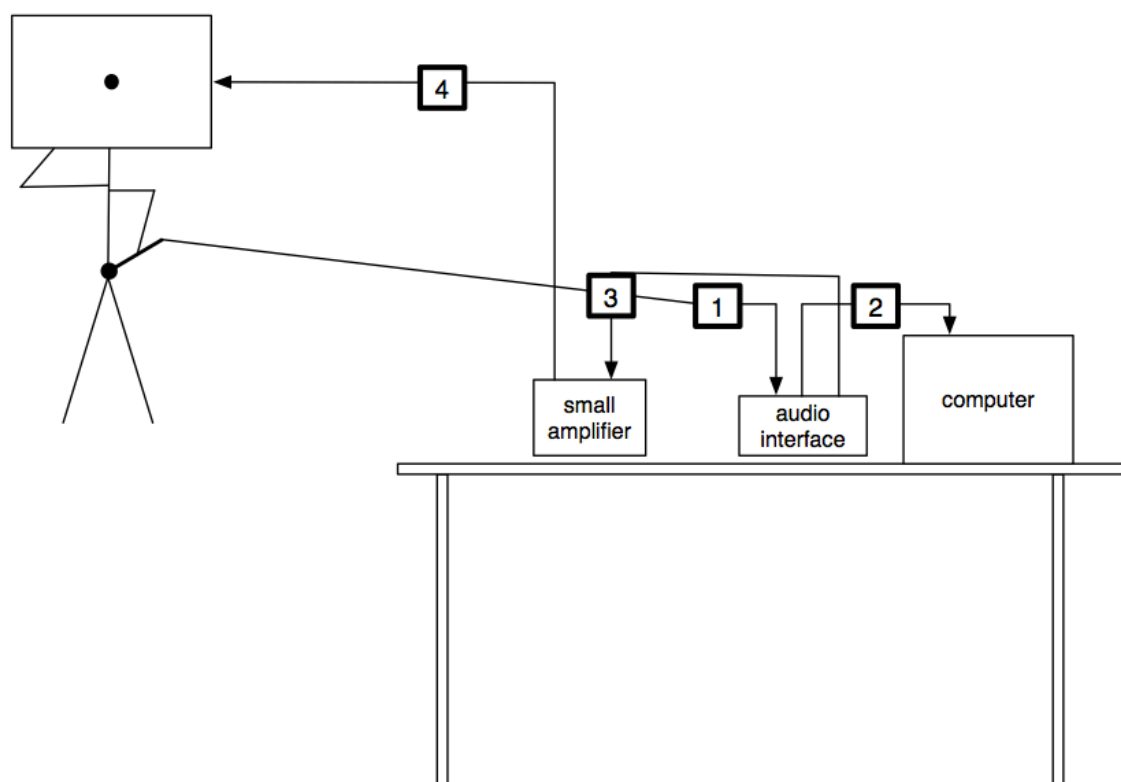


The performer holds a microphone and a large piece of white paper was glued onto the loudspeaker.

Song No 3 is a performance during which I use arm gestures—commonly used by singers as a by-product of their performance—as a means to control electronic sound. I look for ways to use the singer's arm and head gestures as a means to produce sound. Within traditional performance practice, a singer's movements are incidental to the production of sound. These movements do not have to be unimportant though, or unrelated to the sound, unrehearsed or in any other way superfluous. I decided to use these movements for sound production in *Song No 3* because they are related to making sound but not perceived as its main cause: a singer may be able to sing without any arm movements (although it will probably sound different).

To render my arm and head movements audible, I use a loudspeaker in front of my mouth to diffuse the sound during the performance. I am not singing at all during the performance but all sounds are generated by the computer software and emitted through the loudspeaker. A large

piece of white paper was glued onto the loudspeaker to obscure my face. The audience's attention was thus diverted from the mouth, which often visually represents the voice to a focus on the gestures of the arms and head. The paper is attached directly to the loudspeaker membrane to resonate with it and gives the sound a more readily recognisable physical source. To make the sound interact with the movements of my arm, I used a microphone, exactly as singers do. The distance between the microphone and loudspeaker can be manipulated to produce different sound shaping processes. The amplitude of the microphone input signal is used by the computer to control what kind of sound processing is diffused through the loudspeaker. This control mechanism could be termed data feedback, since the sound of the loudspeaker is influencing the amplitude of the microphone signal, which is again controlling—with help of the computer software—the sound of the loudspeaker output. The same technology is used in, for example, *Open Air Bach* by Lara Stanic. Sound can therefore be controlled using the gestures that normally only accompany a singing voice.



The set-up for *Song No 3*.

These movements normally used during singing can be seen as symbolic gestures: they might have a specific meaning which points to an activity or something outside of the movements themselves. It is for this reason that I started to work with them, since they have a strong

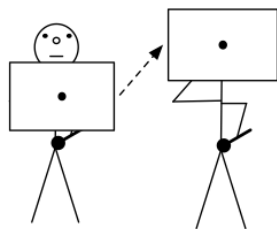
auditive connotation; we can often almost hear a singer singing when we see certain movements of a singer's arm. To use these gestures to control sound is to make an intervention in their "normal" meaning in a song by affixing to the gestures a different sound not previously associated with them. The different relationships between sound and gesture can be composed, and the relationships, which are established during the piece, can be questioned during the same performance by establishing another gesture-sound relationship. Due to these constant changes, shifting from one to another identity, a fixed personality on stage can never exist.



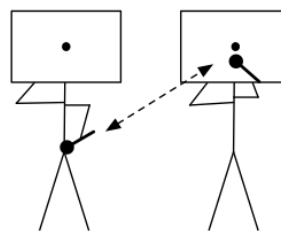
To make the sound interact with the movements of my arm, I used a microphone.

By using several kinds of gestures for controlling the sound and also some different sound processing possibilities, using the computer, the relationship between sound and gesture changes during the performance. In this way, not only the means of producing sound is different from how a traditional singer performs, so are the changes in sound normally produced by

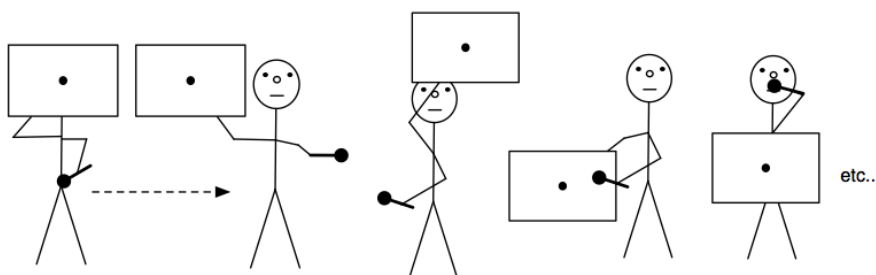
movements with a microphone. Whereas during a normal singing performance, moving the microphone closer to the mouth will amplify the sound of the voice, during *Song No 3*, moving the microphone closer towards the loudspeaker attached before the mouth can result in all kinds of audible changes. The sound itself can change in a number of ways, since it is the amplitude of the microphone signal that is mapped on to several parameter changes in the live-electronic processing. By moving the microphone, the sound may not only become louder or softer, but also faster, slower or noisier, or undergo a change in pitch. In fact, every possible sound is available, and it becomes the task of the composer to choose what kind of sound should be produced by what kind of movement. I can, therefore, decide which gesture makes what kind of sound. I am thus able to compose the relationships between performer movements and sounding results, a concept I discuss in chapter 5.



5. Singing
After having done the talking movement several times, move the loudspeaker slowly a little bit downwards. Move the loudspeaker back to the starting position till the loudspeaker is hiding your face again. Keep the microphone down during this movement.



6. Talking Movement
Repeat again several times the talking movement. At a certain moment clicks will sound. This is the moment to go on to 7.



7. Look for sounds
Start to move the loudspeaker away from the head. Also move the microphone. Look for sounds by moving them closer to each other (clicks should sound) or further away from each other (silence or a soft singing should sound). Move microphone and loudspeakers in different directions.

A page from the score of *Song No 3*. This score is for the version of *Song No 3* for Ute Wassermann, which is slightly different than the version I perform myself.

In *Song No 3*, at the beginning of the performance, every time the microphone comes closer to the mouth-loudspeaker the sound becomes much louder and more chaotic. At the end of the performance, the opposite is the case. When the microphone is held very close to the mouth-

loudspeaker, the sound becomes quite soft and tranquil. As soon as the microphone is taken away from the mouth, a loud singing voice can be heard through the loudspeaker. The consequences of certain movements change during the performance; in this case consequences we expect due to our elementary technical knowledge (a microphone close to the sound source will normally amplify this sound source) and also consequences we do not necessarily expect. This change of consequences is a dramatic line during the performance, and owing to these changes, the performer's characteristics also change. These changes happen due to playing the instrument and cause the identity of instrument and performer to shift (see more on gestural identity in chapter 5).

To compose such changing consequences between movements and sound, electricity is not only needed, but can be the means of producing such shifts in identity as described above. Since we do not connect a specific sound to them, as would be the case with, for example, a violin, microphones and loudspeakers act like chameleons, which change their identity depending on the context. By using microphones and loudspeakers as musical instruments other aspects of composition can come into focus that differ from composing for acoustic instruments: a composition can focus on identity shifts of the instrument itself, since this instrument does not have an identity as clear as the piano or violin. The microphone-loudspeaker instrument is flexible in sound as well as in playing method:

www.vimeo.com/66897933

19. When the sound of your voice slips through my fingers (2010)

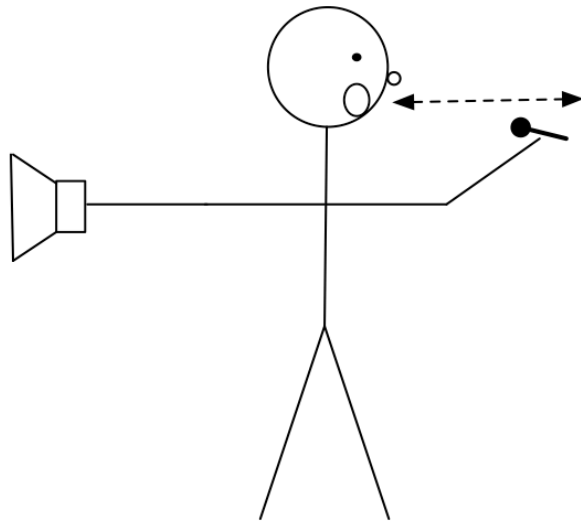
for five singers, small microphones and loudspeakers, and live electronics
written for the Neue Vocalsolisten Stuttgart
commissioned by Musik der Jahrhunderte



In When the sound of your voice slips through my fingers,
I connect the gestures of the hands to the voice, and make the gestures audible.

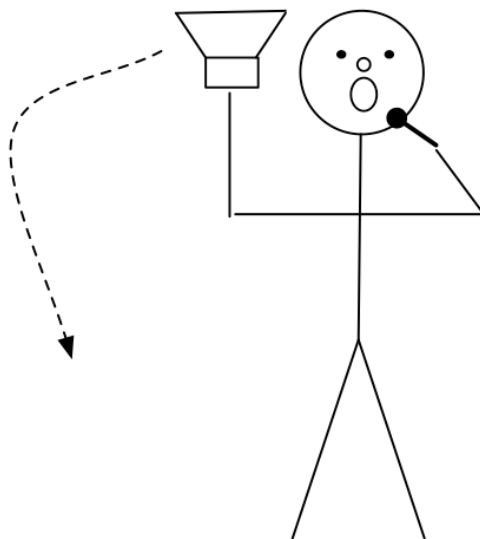
Speech is not only executed through voice, but also with the body. We make gestures to express our emotions and to underline our thoughts. There are many codified languages of gestures, often developed during centuries and handed down, most of the time unconsciously, from one generation to the other. Although these gestures may often accompany the singing or speaking voice, the gestures themselves remain silent.

In my composition *When the sound of your voice slips through my fingers*, I connect the gestures of the hands to the voice, and make the gestures audible. A small loudspeaker is attached to the left hand of the singer and a small microphone is attached to the other. By making gestures with their hands and arms, the performers influence the sound of the live electronics.



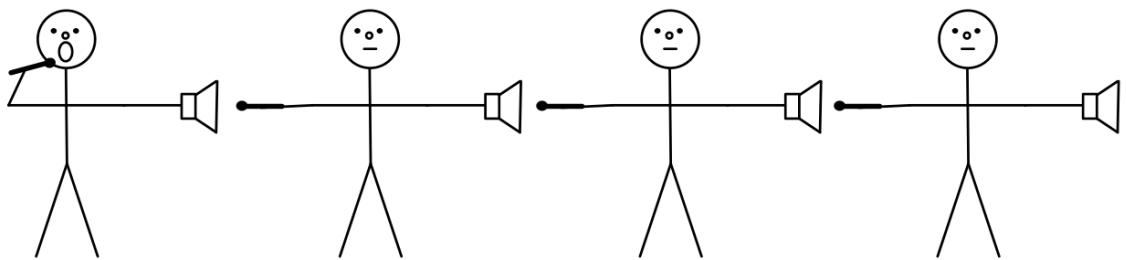
Moving the microphone changes the amplitude of the input signal.

The voice of the singer, picked up by the microphone on the right hand, is processed by the computer and then sent back to the loudspeaker on the singer's left hand. Therefore, the movements of the singer's right hand controls what sounds go into the microphone. The left hand can control the direction of the diffusion of the sound coming out of the loudspeaker.



Moving the loudspeaker changes the direction of the output signal.

With this set-up, many combinations are possible: the sound of one of the singers can be sent to the loudspeaker on the hand of another singer, the volume of the voice of one of the singers can influence the amount of modulation, done by the computer, in the voice of another singer, and using several loudspeakers and microphones in a chain creates a network of live-electronic processes.



Picking up each-others loudspeaker signal creates a network of live-electronic processing.

4-16

A page of the score of *When the sound of your voice slips through my fingers*.

The gestures for the singers are all notated.

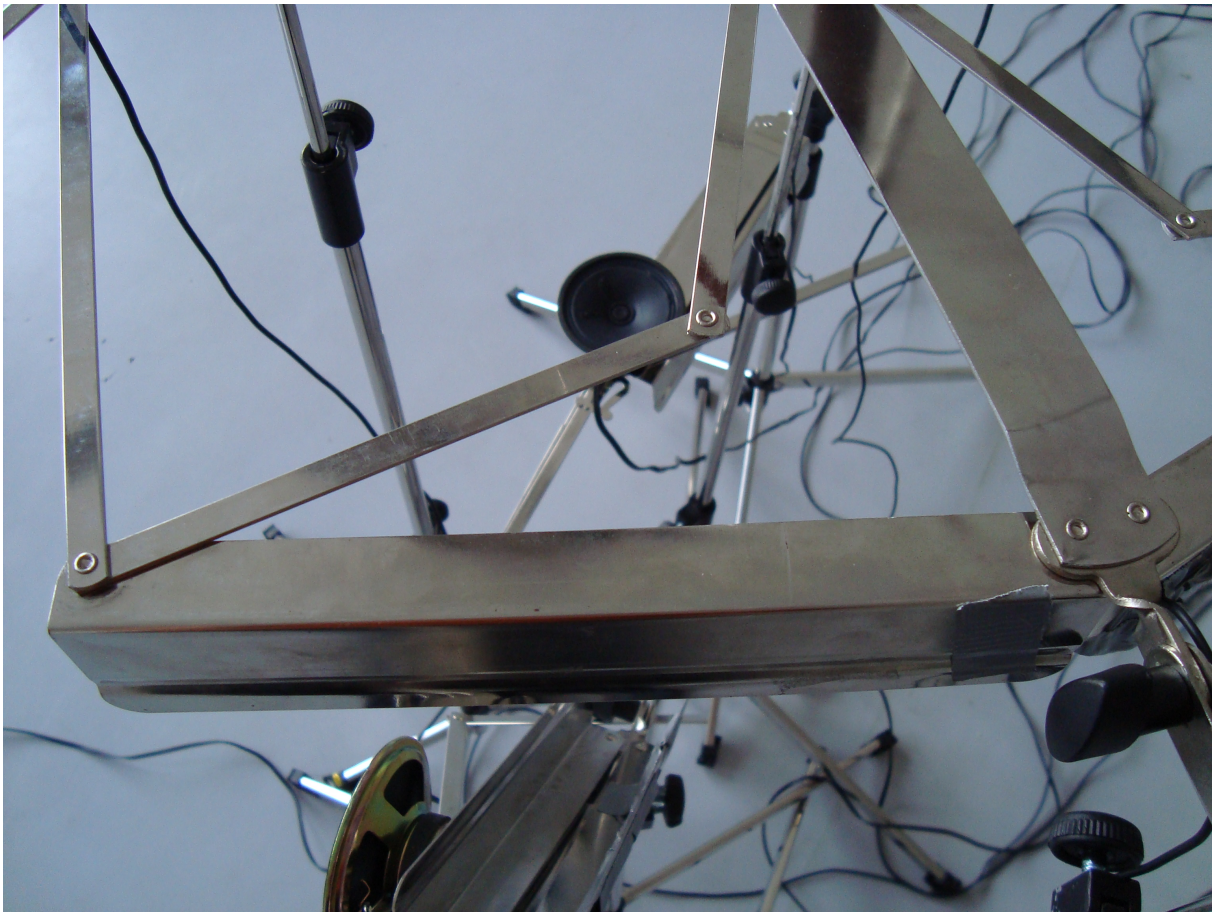
From the time of the ancient Greek theatre until the beginning of the twentieth century, actors and singers used systems of codified gestures. All emotions were expressed using a vocabulary of exhaustively prescribed and highly stylised movements and gestures, each with its own meaning and significance:

www.cathyvaneck.net/videos/WhenTheSound3.mp4

It is this ancient language of gestures which I took as a starting point for this piece. I made a choreographic score, using these ancient gestures as an initial inspiration, and translated them into my own personal version, and into a more abstract language of movements. Similar technology and gestures are used in *Ways and Means*.

20. Music Stands (2011)

for two music stands, two small loudspeakers, contact microphones and live electronics
written for the Backofen Festival



Small loudspeakers and contact microphones are attached to music stands.

Two music stands are unfolded at the start of the performance. Both are amplified using a contact microphone glued onto the stand and a small loudspeaker, placed on the floor. During the performance, the loudspeakers are placed on the stands. Through the metal of the stands the vibrations of the loudspeakers are transmitted back to the contact microphones and in this way a feedback loop occurs (similar to that in *Nodalings* by Nicolas Collins, as described in chapter 4). By changing the altitude of the stands, the distance between microphone and loudspeaker changes, and therefore, the feedback sound also changes. Unfortunately, I do not have any documentation of this piece, but the beginning of *Stumme Diener* is very similar to it.

21. Pièce d'ameublement (2011)

for grand piano, plants and live electronics.

written for Frederik Croene

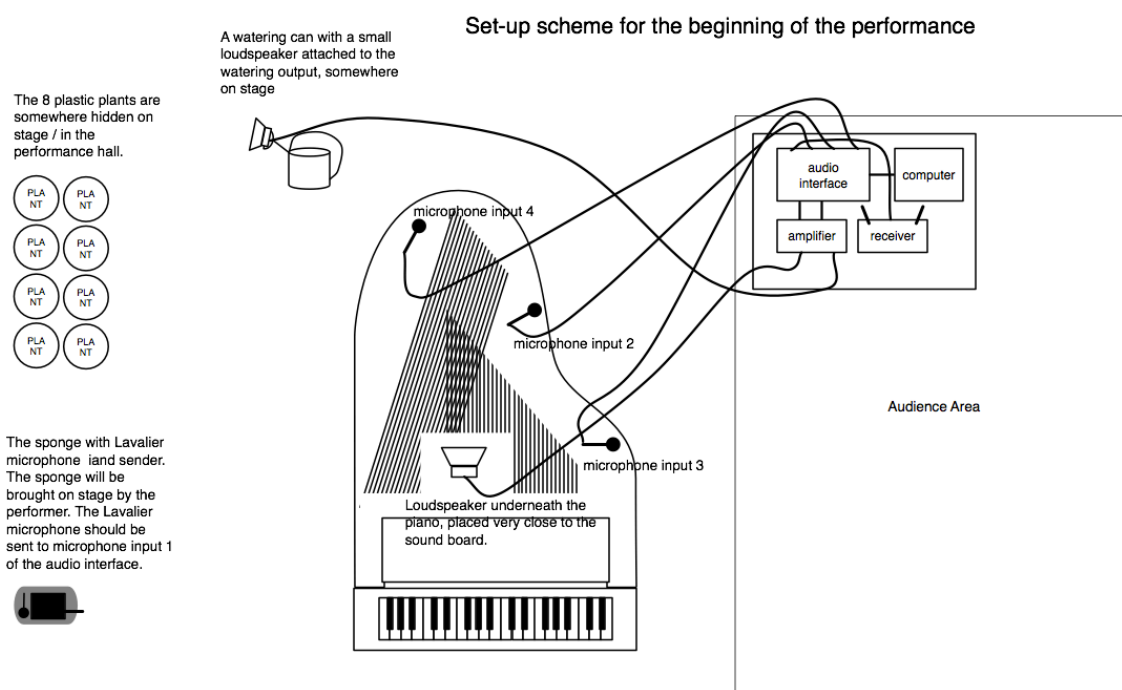
commissioned by the Fonds voor de Podiumkunsten



The plants on the piano are watered by the pianist.

Pièce d'ameublement is based on the idea of pianos functioning as furniture in many living rooms and should be performed in between the pieces of a piano recital. During the recital, the pianist sometimes places (plastic) plants on the piano. At a certain moment (preferably after a very virtuosic piece), he or she starts to clean the piano. Starting with an everyday attitude, the cleaning slowly transforms into a more stylised form of movement. The movements of the sponge become audible as well, and whilst they will sound like cleaning sounds in the beginning, pretty soon they sound more like a weird piano. A small microphone in the sponge picks up the sounds of cleaning the piano and a computer transforms this signal, emitting the result through a

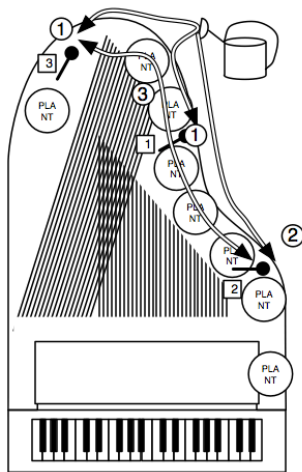
loudspeaker placed underneath the soundboard of the piano, so all sounds will be coloured by the resonance of the piano.



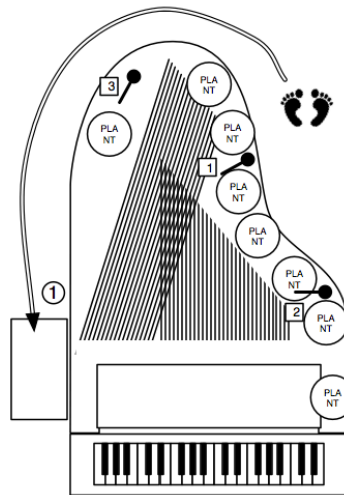
The set-up for *Pièce d'ameublement*.

The gestures of the pianist is sounding through the piano, but instead of conventional piano playing gestures, the performer is making "cleaning gestures" normally not associated with making music. By aestheticising these movements, the performer becomes a musician once again, now playing the piano with cleaning movements.

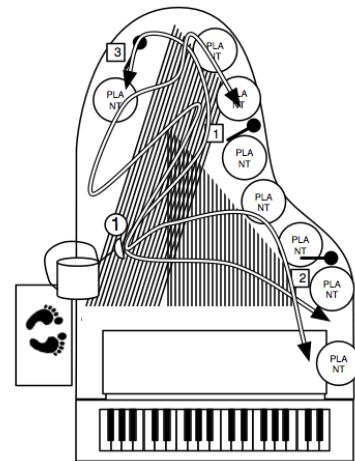
5



13
Now make more movements between microphones 3&1 and move also to microphone 2 sometimes. Make a short improvisation using all three microphones, you might speed up a bit during this improvisation.
(1) move between microphone 3&1
(2) move also sometimes to microphone 2
(3) make a short improvisation using all three microphones.



14 Patch Part 2: 7
As soon as you hear the new sounds in the electronics (more like prepared piano strings sounds) move towards the back of the piano and climb upon a stool / piano chair, holding the watering can.
(1) Walk around the piano and climb upon the chair.



15
Start to water the plants again, but with a totally different attitude: make very slow movements and big movements. Hold the watering can sometimes just close to you in your hands, to have the sound totally unchanging, than change the sound again by watering a plant.
(1) move slowly, from plant to plant, often also holding the watering can close to you.

A page from the score for *Pièce d'ameublement*.

The second part of the piece should be played in between two other pieces of the recital. The plants on the piano are watered during this piece. A loudspeaker is attached to the watering can and three microphones are placed in the grand piano. The live-electronic processing during this part is based again on data feedback: a very low noise is diffused by the watering can loudspeaker, and every time this loudspeaker approaches one of the microphones, specific sounds are triggered. During the first part, these sounds are piano notes, different for each microphone. The first microphone, at the right side in the grand piano, only triggers high notes. The microphone in the middle of the grand piano triggers notes of medium pitch. The third microphone, placed at the left side in the grand piano, plays a cloud of notes:

www.cathyvaneck.net/videos/Ameublement01.mp4

When the pianist moves to the back of the grand piano, the sounds triggered are more experimental piano sounds consisting of recordings of playing on the inside of a grand piano:

www.cathyvaneck.net/videos/Ameublement02.mp4

After watering the plants enough, the performer can now finally play Chopin by watering the plants, as can be heard in the next video fragment. His etude opus 10 No 1 is played by walking to and from the piano. When standing still, the piece is also on hold:

www.cathyvaneck.net/videos/Ameublement03.mp4

This piece actually uses microphone and loudspeaker technology mainly for triggering sounds (the watering can part) or live electronic processing (the cleaning part). Microphones and loudspeakers, besides their functions directly relating to sound, function as a kind of sensor, similar to how they are used in *tubes* by Paul Craenen and *Open Air Bach* by Lara Stanic.



The microphone in the middle of the grand piano triggers notes of medium pitch and one or two at a time.

22. Stumme Diener (2011)

performance for music stands, loudspeakers, microphones and live electronics, developed together with Susanne Zapf, also featuring pieces by Jakob Diehl and Wael Sami. commissioned by Klangwerkstatt Berlin



The set-up at the beginning of *Stumme Diener*: four folded note stands.

In *Stumme Diener*, music stands are equipped with contact microphones and small loudspeakers. The piece is a continuation of the ideas developed in *Music Stands*. Several techniques are used to "play" the music stands. The piece starts with the amplification and transposition of the sound of the music stands:

www.cathyvaneck.net/videos/StummeDiener01.m4v

By placing a loudspeaker on the music stands, feedback is created. The music stands are played by changing their height or moving some of their parts. This causes a change in the material in between microphone and loudspeaker and, therefore, also in the sound of the feedback:

www.cathyvaneck.net/videos/StummeDiener02.m4v

At the end of the piece all stands are assembled together, touching each other. The microphones and loudspeakers are now all connected to each other in a circle: the sound of the contact microphone, which is attached to music stand one, is emitted to the loudspeaker attached to music stand two; the sound of the contact microphone, attached to music stand two, is emitted to the loudspeaker attached to music stand three, and so on. The fourth music stand closes the circle, since the sound of its contact microphone is diffused to music stand one. When all four music stands are touching each other, a feedback loop through all four stands is created. This is what happens at the end of the piece, and a continuously playing sound installation is the result. The performance ends by taking down one of the loudspeakers, in this way interrupting the feedback circle:

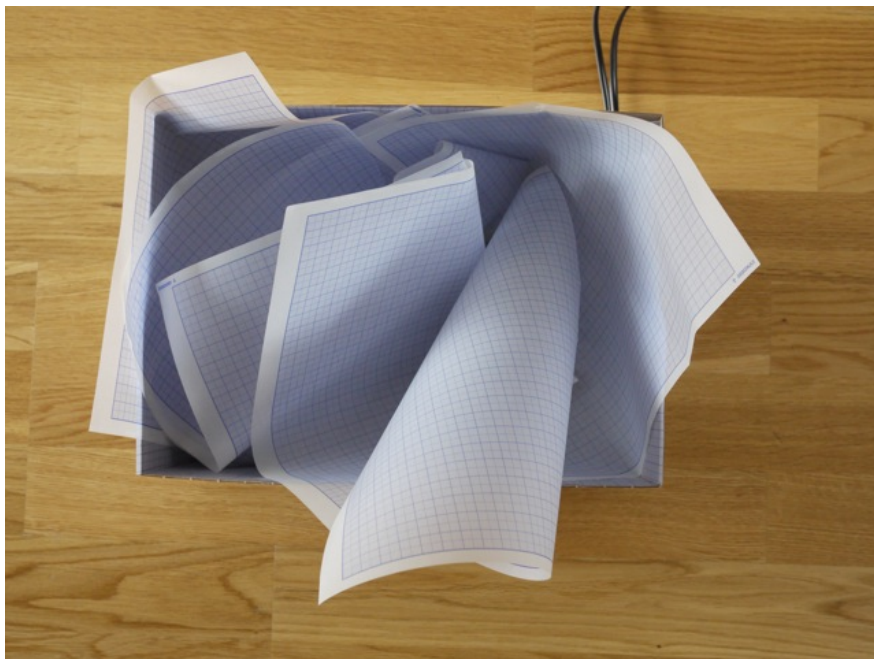
www.cathyvaneck.net/videos/StummeDiener03.m4v



Stumme Diener ends with a music stand sculpture, creating a feedback loop through all four music stands.

23. Geluid gemeten: nr. 23 & nr. 32 (2012)

sound installation for several pieces of paper, two loudspeakers, a box and electronics
written for the Kolumba museum
commissioned by the biennale cologne



All sounds are transmitted through the paper and the loudspeakers themselves are completely hidden.

This is the sole installation I developed during my research project. It consists of two small loudspeakers in a small box, producing both audible vibrations as well as low frequencies, intended only to bring the paper, attached to their membranes, into movement. Thus, both the electronically generated sounds and the sounds made by the rustling of the paper are audible. All sounds are transmitted through the paper, which is glued on the loudspeaker membrane and the *interaction* is thus composed with the help of the *material* parameter. The box was part of an exhibition and concert in a museum in Cologne and should be placed in a seemingly unintentional way on a table, for example at the ticket booth. The papers also give the impression of just having been thrown into the box. The loudspeakers themselves are completely hidden:

www.cathyvaneck.net/videos/GeluidGemetenShort.mp4

24. Ways and Means (2012)

for five singers, gestures, small microphones and loudspeakers and live electronics
written for and commissioned by the Munich Biennale and the University of the Arts Berlin

Meriel Price: gestures, voice

Maren Schäfer: gestures, singing

Vera Kähler: gestures, singing

Johanna Knauth: gestures, singing

Aylin Winzenburg: gestures, singing

Annekathrin Jaco:, gestures, singing

Cathy van Eck: composition, live electronics

Enrico Stolzenburg: stage direction

Marion Hirte: dramaturgy

Kerstin Grießhaber and Carolin Schogs: stage and costume design



The distance between microphone and loudspeaker controls
what sound is played through the loudspeaker.

This piece is a part of the music theatre piece, *A Game of Fives*. Pieces by the composers Iñigo Giner Miranda, Leah Muir, Yoav Pasovsky, Abel Paúl, and myself were developed in collaboration

with stage director Enrico Stolzenburg. My contribution consisted of several interludes, taking as a theme nineteenth century texts on rhetoric and gestures. I used the same set-up as in *When the sound of your voice slips through my fingers*, but both the kinds of sounds as well as how the composition developed was done in a completely different way. I used a so-called physical model of a voice, programmed in the computer software MaxMSP. One of the advantages of physical models is that they can simulate real musical instruments—in this case, the human voice—and can transform these musical instruments into totally different sounds. The control of the signal processing was all done with data feedback. The composition was developed in close collaboration with the performers and unlike my piece for the Vocalsolisten, there was no score that I wrote, but everything was invented during the rehearsals. This resulted in using gestures and sounds that felt "natural" for the performer, instead of a predetermined choreography of gestures. The first interlude uses the combination of these sounds between voice and noise. The distance between microphone and loudspeaker controls what sound is played through the loudspeaker:

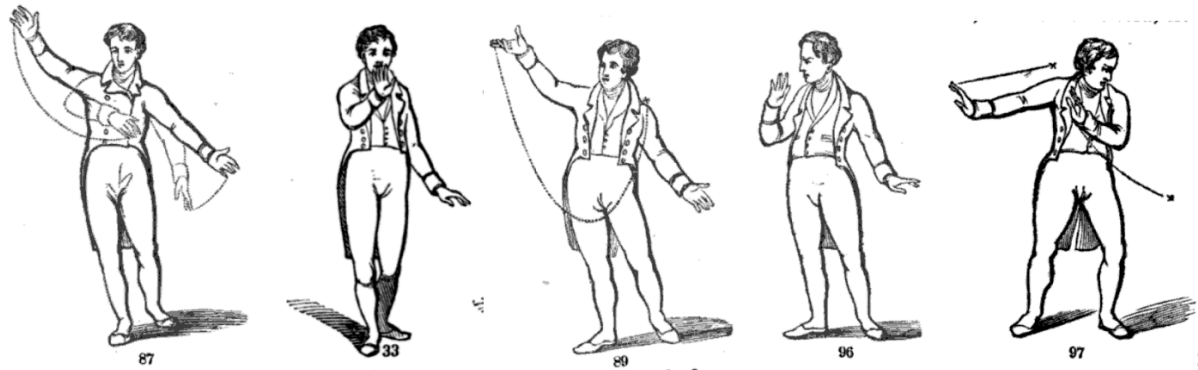
www.cathyvaneck.net/videos/PartOneWM.mp4

During the second interlude, two performers try to "sing through gestures". By making dramatic gestures, as described in nineteenth century rhetoric books, the distance between microphone and loudspeaker controls the physical model of a voice. The relationship between the performers' gestures and the resulting sound is composed, instead of being compulsory, as is the case with conventional musical instruments:

www.cathyvaneck.net/videos/PartTwoWM.mp4

In the third interlude, the singers sing for the first time. They "catch" their voice in their hands, and then continue to sing with gestures:

www.cathyvaneck.net/videos/PartFiveLonger02.mp4



Several images of gestures from the book by Andrew Comstock: *A System of Elocution, with Special Reference to Gesture, to the Treatment of Stammering, and Defective Articulation* (1843).



By making dramatic gestures, as described in nineteenth century rhetoric books, the distance between microphone and loudspeaker controls the physical model of a voice.

25. Klangverordnung – Die verbotene Klänge der Stadt Bern (2012)

performance for two big orange loudspeaker horns, the forbidden noises of the city of Bern and one performer

written for and commissioned by the Bone festival for performance art



Klangverordnung uses a set-up in which the two loudspeaker horns are moveable.

I performed the *Hearing Sirens* project at many different locations. Due to these experiences, I became interested in developing a set-up in which the two loudspeaker horns would be moveable instead of fixed on my back. In that way, there would be many more possibilities and combinations of movements and positions for the horns.

When I was asked to develop a performance for the Bone Festival in Bern, I decided to use these kinds of horns, attached to my arms. The conceptual starting point for this performance was the noise legislation laws of Bern, in practice from 1600 until today. Many "everyday" sounds were forbidden, including singing, screaming, hammering, hooping, or carpet beating. I used many of these sounds in modified forms for my composition, developed while listening to the sounds through the loudspeaker horns as well as trying out possible movements with the horns. I

learned the sounds by heart, thereby being able to execute the right movement with the right sound. Due to using two independently moving horns, I could work even more with the *space* and *movement* parameter, as I described in *Hearing Sirens (2007) (for one performer)*. This resulted in a performance in which I played back all sounds that had been silenced over the centuries in the city:

www.vimeo.com/76705797



Discovering the acoustics of the environment in Bern.

26. Double Beat (2013)

a performance for plastic bags, breath, two heart beats and live electronics
written for and commissioned by the symposium Mind the Gap



During the performance, the pregnant woman inflates plastic bags with her breath.

In *Double Beat*, the performer has to be a pregnant woman. Her heart beats as well as the heart beats of the infant are picked up each by a so-called fetal Doppler device. Although the audible result sounds as if the heart beats are just amplified, in fact, the heart's movements are detected with the help of ultrasound and this is represented in sound. The piece was performed at the MUMUTH hall in Graz, in which a system with 33 loudspeakers is situated, and the heart beats were placed at different positions of the hall. The sound fragments presented here are recorded immediately from the outputs of the computer.



The more bags that have been inflated, the longer and louder the heart beats sound.

During the performance, the woman inflates plastic bags with her breath. These sounds are picked up by a microphone. The amplitude of the microphone signal is used to control the volume of the heart beats: the more bags that have been inflated, the longer and louder the heart beats sound:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/DoubleBeat03.mp3

The two heart beats are diffused through different loudspeaker groups (not well audible on this recording). There is a low heart beat of myself, and a higher pitched heartbeat of the unborn baby:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/DoubleBeat02.mp3

At the end of the piece, the heart beats are filtered with the frequencies of the chords of the Cold Genius' solo in the "Frost Scene" of the opera *King Arthur* (1691) by Henry Purcell:

www.cathyvaneck.net/ownworks/wp-content/uploads/2013/09/DoubleBeat01.mp3

This project was part of the "Mind the Gap" symposium: "Six artists formulated a musical bagatelle, an artistic sound concept, an acoustic idea, and present their work in duplicate: both in the MUMUTH concert hall in Graz (with 33 loudspeakers) and on the Web. A major challenge was to conceive the work such that in the two very different spaces—in the black box and on the white board; with 33 loudspeakers and in stereo—it can unfold its aesthetic effect independent of the context" (see Mind the Gap: www.researchcatalogue.net/view/33841/37723/1022/567). In my online version of *Double Beat* the visitor has to "inflate" the plastic bags him- or herself (see www.researchcatalogue.net/view/41675/41676).



Searching for heartbeats at the beginning of the performance.

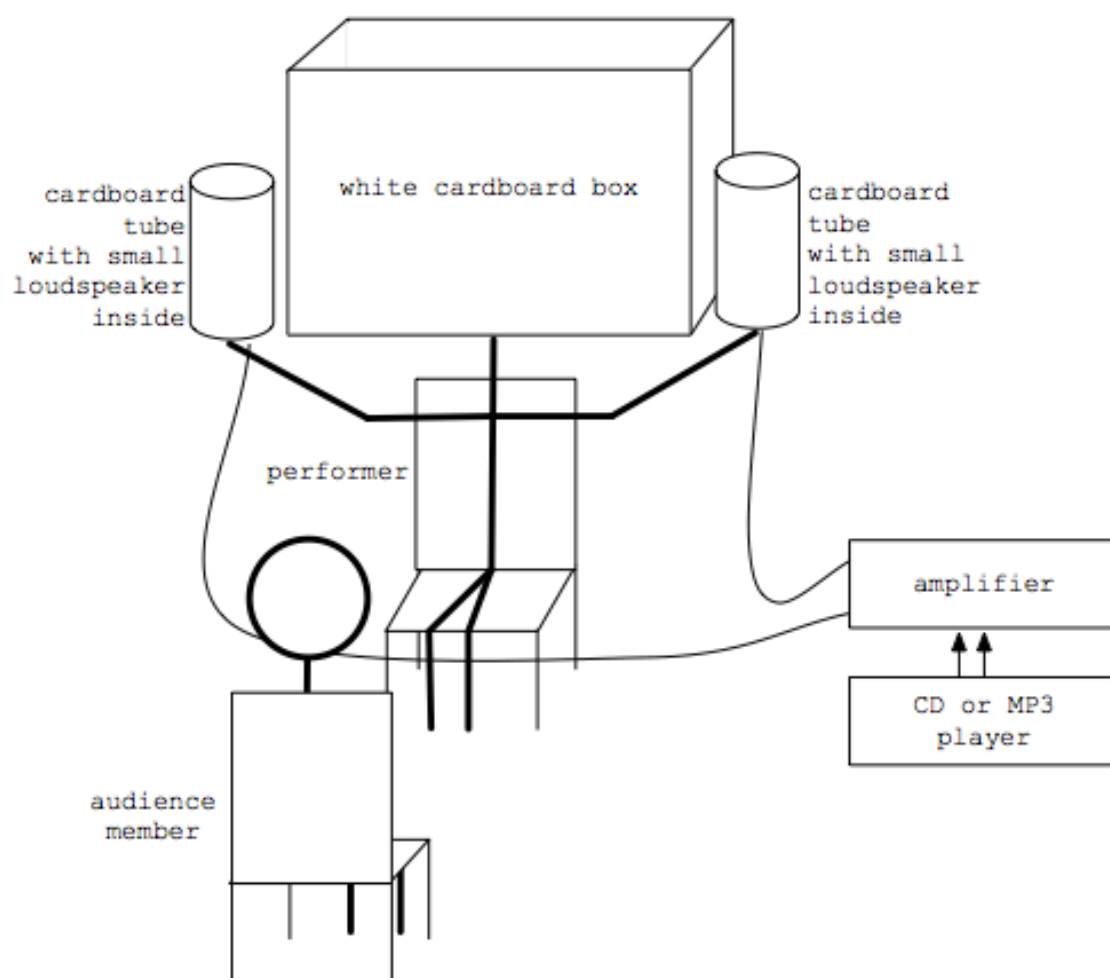
27. Square Head (2013)

a performance for one performer, a box, two small loudspeakers and one audience member
written for and commissioned by ensemble hand werk



The different positions of the loudspeakers during the performance.

Square Head makes use of what I call a "personal sound spatialisation system". Moving loudspeakers comparable to the ones in, for example, *Hearing Sirens* are used, with the difference that there is only one audience member and the loudspeakers are very small. The main parameter of interaction is therefore *movement*.



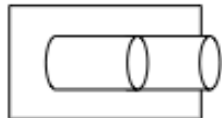
Set-up for *Square Head*.

The two small loudspeakers are put in cardboard tubes. The head of the performer is hidden in a white cardboard box, not only for visual reasons, but as well for damping the loudspeakers when placed on the box. The set-up and the different positions of the loudspeakers during the performance could be associated with elements of a face. Sometimes the loudspeakers are the ears; at other times, the eyes or the mouth.

± 1.26 - Stay in this position (tubes on closed on mask)
for several seconds.



± 1.28 - Both hands are now slowly making the opening
movement, both to the left side, at a bigger angle
than before. The tubes are closed again.



± 1.39 - Move the right tube now to the right and the left
tube to the left.



- Go on moving them till you have placed them next
to your head/mask and the loudspeakers are pointing
forwards.



- Wait in this position till the rain sounds stops.

Page of the score for *Square Head*.

The performer sits in front of the audience member and the composition is played through the small loudspeakers. The movements of the small loudspeakers are notated in a score. Most of the sounds refer to recognisable situations, such as rain, voices, photo camera clicks or singing:

www.cathyvaneck.net/videos/SquareHead2.mp4

28. Extended Ears (2013)

sound walks with listening horns and an iPhone app
developed during the research project *sonozones*, with Jan Schacher



Listening through a horn.

Extended Ears is the last piece that belongs to my research on microphones and loudspeakers as musical instruments. I was invited by Jan Schacher (also doing his PhD in the docARTES program) to take part in the research project *sonozones*, a project that focused on the sonic characteristics of the German city Mülheim an der Ruhr. I wanted to try out what kind of effect a simple transformation would have on the sounds of the city. I tried three different concepts, a "mechanical", "electric", and "virtual" transformation and walked through the city with different objects and devices to discover the changes in soundscape caused by them.

The "mechanical" transformation is done with horns made from cardboard, plastic or aluminium. This transformation does not use any microphones or loudspeakers, but the horn itself is, of course, a predecessor of these devices, as I explain in chapter 1. By listening through this horn, sounds from the direction the horn is pointed at, are more clearly audible than the

sounds coming from other directions. The principal aspect of this performance is not in how much the soundscape itself changes, but in how our listening changes as soon as we consciously listen to something. Consequently, this becomes a performance by taking the horn and walking with the horn through the city and therefore the audience member is also the performer of the piece:

<http://www.cathyvaneck.net/videos/Muelheim4.mp4>

The soundscape of the city is just slightly changed by the addition of a microphone and loudspeaker. The "electric" transformation picks up the sounds through a microphone and plays them back through headphones, while walking through the city.



Listening through microphones and headphones.

The "virtual" transformation deliberately changes the soundscape. With the use of an iPhone app that Schacher and I developed, the soundscape is picked up by the phone's microphone, transformed with the use of live-electronic processing (such as filtering and reverb), and heard through headphones.



Listening to the app *sonozones*.