

Offener Schaltkreis. An Interactive Sound Installation

Christoph HAAG
Martin RUMORI
Franziska WINDISCH
Ludwig ZELLER

Klanglabor, Academy of Media Arts Cologne (KHM)
Peter-Welter-Platz 2
50676 Cologne,
Germany,
osk@khm-lists.rumori.de

Abstract

Offener Schaltkreis (Open Circuit) [1] is an interactive sound installation developed by students at the Academy of Media Arts, Cologne. It mainly focuses on openness, which applies to all facets such as optical appearance, the interface given to the user, the technical tools being used and the collaborative style in which the installation has been developed. In this paper, we will discuss the aesthetical and technical issues of our sound installation *Offener Schaltkreis*.

Keywords

sound installation, interaction, interface design, tangible, *pd*



Figure 1: user interacting with *Offener Schaltkreis*

1 Introduction

“At the Academy of Media Arts, art, technology, and science work together for mutual enhancement. Different ways of thinking meet: theory encounters practical design, technological programmes and artistic imagination combine.”¹

The interactive sound installation *Offener Schaltkreis* is actually a result of such a meeting of two different programmes within the KHM: *Hybrid Space* and *OSFA*.

¹from the information flyer KHM 2006/2007

The *Hybrid Space* was founded by Prof. Frans Vogelaar within the media design department. “A new interdisciplinary field of design, researching the transformations of architectural, urban/regional space of the emerging ‘information age’, explores the dynamic interaction of architecture/urbanism and the space of mass media and communication networks. It develops scenarios for the interplay of public urban and public media space.” [2]

The *OSFA* series of workshops introduced by Martin Rumori is connected to Klanglabor within the department of arts and media studies. *OSFA* translates to “open source for arts” and emphasizes on all aspects for using open source technology for artistic purposes.

Offener Schaltkreis is experienced by putting freely placeable speaker-cylinders on a labyrinth created out of open copper tracks. Since these tracks carry electrical audio signals, corresponding sound layers become audible. This simple principle of operation is derived from another project, created at about the same time at KHM: *Talking Cities Radio* [3]. While *Talking Cities Radio* is an interface for the audible content of an exhibition, *Offener Schaltkreis* aims at being a sound installation whose aesthetical criteria were entirely developed collaboratively from scratch.

2 Aesthetical Approach

2.1 Model of a city

According to Foucault [4], the city is considered as a heterotopia: an agglomeration of diverse spaces, not least on an aural level. The acoustic impressions differ from place to place, just like inhabitants and surroundings are different. Every neighbourhood has its characteristics and on the way through a city, not only the visual, but also the acoustic environment is

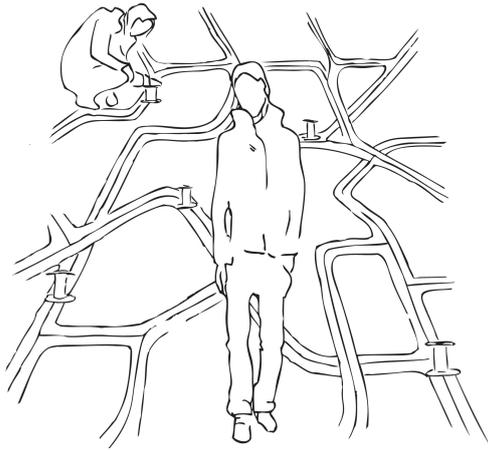


Figure 2: design sketch for *Offener Schaltkreis*

constantly changing. The experience of moving through an urban environment gets downscaled and transferred into a room. Through putting the speaker-cylinder on the tracks a concrete place of sound is created, which uses the copper as a source for its emission and therefore for its sensual manifestation. But this concrete place of sensual manifestation is not connected to a special place on the map. It is not static but in a permanent shift, just like its audio source. Free positioning of the speaker-cylinder allows the visitor to create her own soundscapes. Soundscapes, which open themselves only through time and movement in space.

2.2 Transporting audio

The copper tracks on the ground resemble a map, recalling the transportation networks of a city. This fact made it evident from the beginning, to work with sounds and noises of a city, including their transformations and synthetic imitations. For every copper track an individual piece of sound has been created from collected sound material.

The installation is constantly playing. For every track a virtual read head loops in various speeds through a given sound piece. Every track includes four parts, which create, while playing all tracks together, changing auditory scenes.

2.3 The visitor as an author

A silent labyrinth created out of open copper trails on the floor carries the electrical signals of a multichannel sound repository. By putting freely placeable speaker-cylinders on them, the carried sound layer becomes audible. *Offener*

Schaltkreis reacts depending on the manner in which the speaker-cylinders are used: if nothing is moved, the sounds stay calm and soft, but if cylinders are repositioned, the currently played sound material is modulated by increasing speed, pitch and velocity.

If nothing happens during a few minutes, the installation starts cooling down, back to the quietest, lowest level, where it remains sleeping: just like every acoustic space sleeps while nobody is there. As soon as a single cylinder is moved during this state, the sounds of all speakers suddenly jump to a higher level of activity. Thus, they give the impression of a social structure: a sensitive, pulsating, constantly shifting body, built with sound.

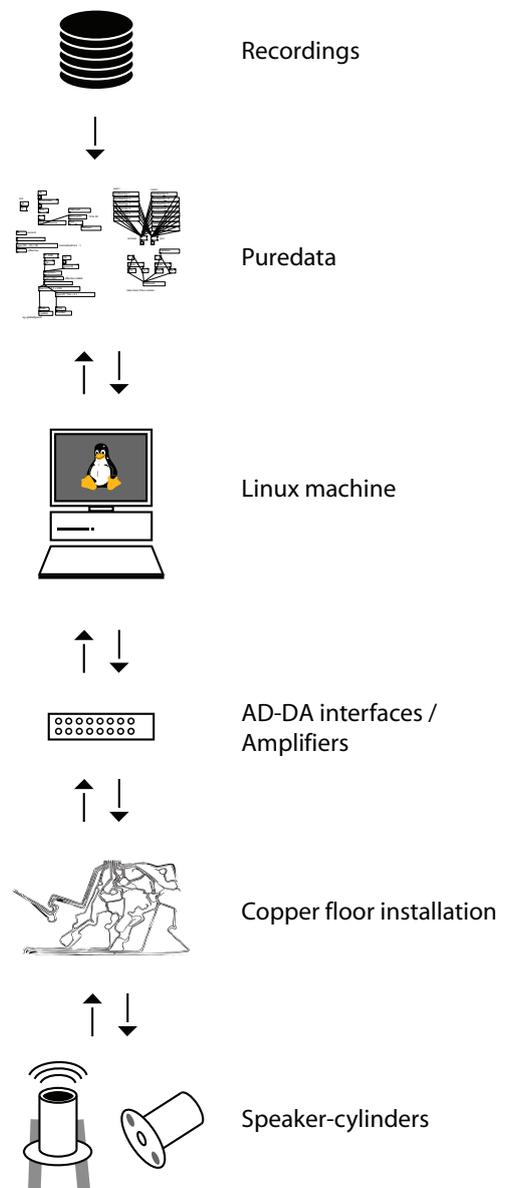


Figure 3: technical flow chart

3 Technical Description

A Linux PC with a multichannel audio interface drives the openly installed copper tracks (mass and signals). The freely movable speaker-cylinders also have open copper contacts at the bottom so that placing them on the tracks connects the amplified audio signals to the speakers.

3.1 Software

The audio recordings described in chapter 2 are played back by a *pd* patch [5]. The patch is freely available at [1]. It reads the materials in progressing loops, playing repeatedly with forward-moving loop markers. That kind of “macro-granular synthesis/sequencing” creates a diffuse sound, that morphs between different areas of the recordings, presenting ever-changing sound facets.

The interactive mapping of the visitor’s activity to sound shaping parameters like volume, “loop” length (or “macro grain length”) and thus pitch and speed is done directly in each track’s player instance.

The more the system is stimulated (up to a certain point), the less the actions of the visitors are taken into account. This kind of damping makes it hard to reach the defined maximum value, allowing for soft boundaries of the dynamic range. The lower end of the dynamic range represents the abovementioned “sleeping”. In this state, the least activity on the speaker leads to a sudden high increase.

In order to accomplish the interactive mapping, it is necessary to track the visitors’ actions. Therefore discrete “put” and “remove” events are generated based on electrical measurements on the copper tracks.

3.2 Hardware

Besides the actual audio content signals, all tracks carry an inaudible 20 kHz sine signal at constant amplitude. This is used as a reference signal for counting the amount of speakers that are placed properly on the copper tracks. The sum of the audio and the reference signals is fed back into the corresponding *adc* inputs of *pd* where the 20 kHz sine is isolated.

When no speaker is placed on a specific track, the feedback signal of that track will be at $-\infty$ *db* in amplitude, since the electrical circuit is simply not closed. In the arrangement, we avoided adjacent tracks of the same kind, thus making sure that masses and signals are always



Figure 4: signal composition

alternating. As a result, a proper speaker connection is guaranteed at any arbitrary position of the installation.

With the first speaker placed, the amplitude of the isolated feedback signal jumps to a certain value well above zero. Due to electrical laws, this level U_{sens} converges logarithmically towards the amplitude of the fed-in signal when more speakers are added to the same track, because all speakers will be situated in a parallel connection ($U_{sens} = 1 - \frac{1}{1+n}$).² This exponential graph can be transformed in order to get the discrete integer value of placed speakers.

The tracking of the visitors’ activity is accomplished by interpreting this number on a per track basis. The change of this quantity can be interpreted either as addition (“put”) or removal of speakers. As described above, this information is then used as a parameter for the sound generation within *pd*.

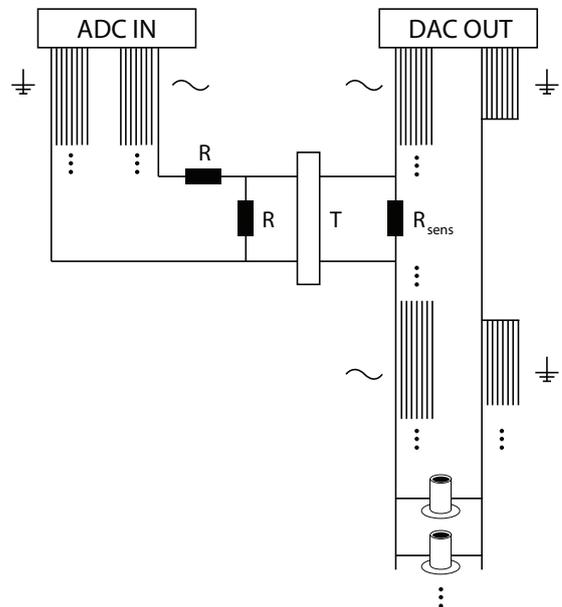


Figure 5: circuit diagram

²The more speakers are placed in that parallel connection, the more the equivalent resistance of the floor installation is decreased resulting in an increase of U_{sens} on that voltage divider.

4 Open Source and Open Circuit

Since this work originated out of the seminar series *OSFA workshop series*, the use of open sourced software was indeed one of the few fixed preconditions for developing this project.

The installation tries to empower the visitors or listeners to act on their own. We try to give them the freedom to use the installation in any way they wish. This attempt finds its counterpart in the use of free software, within the empowerment of using and modifying software in any way we choose.

Of course, also the economic aspect of using open source software is important to its use in the context of media art. Free software sometimes simply also means: “free as in beer”.

Open Source is generally available on more platforms than proprietary software, since everybody can hack a port to her favorite system, thus complying more easily to her predefined constants.

Works that are developed in an academic context, like the *Offener Schaltkreis*, are also often intended to be presented as a publication that documents more than just the result – but also the path that was taken during the design process. Obviously, presenting code as open source is an almost obligatory requirement for this way of highlighting processes besides the result itself. The open source community provides proven systems for licensing and sharing the author’s work.

5 Conclusions

Several artistic and technical aspects of the interactive sound installation *Offener Schaltkreis* have been presented. The initially mentioned openness as a main focus of *Offener Schaltkreis* had the effect of a constantly changing experience of artistic creation. While watching the visitors of the installation it turned out, that further changes to the user interface towards an even more direct feedback might be desirable.

6 Acknowledgements

Our thanks go to Martin Nawrath, technical staff of the KHM, Prof. Anthony Moore, Head of Klanglabor at KHM, Tobias Beck and Michael Thies and the entire *Talking Cities Radio* team.

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