A symphony of Horror

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9th March 2012

Abstract

Reflecting on Michel Chion's definition of audio-vision and on the sense of space that cinematic experience engenders, we experiment on a live composition for light-bots and ambisonic microphone, creating a post industrial noise soundtrack to accompain a fragment of Murnau's Nosferatu. Possibilities for future usage of the microphone are outlined in the conclusions.

Cinema and spatial sound

Nosferatu: a Symphony of Horror is a classic German Expressionist film directed by F. W. Murnau, shot in 1921 and released in 1922. The film, representing the first ever realised and unauthorised adaptation of Bram Stoker's Dracula, was produced by Albin Grau, founder of Prana Films, and featured a screenplay by Henrick Galeen and an original score composed by Hans Erdmann to be performed by an orchestra during the projection. When Bram Stoker's widow sued Prana Film for copyright infringement and won, the court ordered all existing prints of Nosferatu burned, but one copy of the film had already been distributed around the world. The movie became a cult and originated the Vampire film genre but its original score has been lost. Since then many composers and musicians have written or improvised their interpretation of the soundtrack to accompany the film [Ashbury (2001)].

The experimental music composer Michel Chion, in his book named *Audio-vision*, proposes the audio-visual as a contemporary linguistic form that possesses peculiar rules and whose special syntax and grammar propose an original plane of signification that cannot be reduced to the sum of its components, because it structures a different functioning [Chion (1995)]. In this brilliant study the author suggests a number of exercises and experiments to understand and perceive the special texture and rhythm that the audiovisual form implies. One of these exercises proposes a number of subsequent observations: a fragment of audiovisual text is viewed in its original form; successively, the video track is played without any sound; finally, the sound is played without video; the last two possibilities are the conjunction of the original video with a different soundtrack, and vice-versa. This simple exercise shows that human perception

is synaesthetic, and that the signification of an audiovisual text is affected by a composition of elements deforming each other in the process of individuation.

Alan Dower Blumlein, one of the most significant British electronic engineers of his time, invented in the early 1930s a system that he called binaural (now called stereophonic or stereo), inspired by the possibility to make the sound follow the actors across the screen, so to preserve the cinematic illusion. History narrates about a proximity of intents between spacial sound and cinema, because the birth of the audiovisual language generated the invention of technological apparatuses to record and reproduce sound simulating the effects that a pressure wave engenders in space. The stereo recording technique was named Blumlein Pair, and by the mid 30s in a few short test films (most notably, "The Walking & Talking Film") Blumlein's original intent was realised [Burns (2000)].

Ambisonic recording is a series of techniques that extend the original stereo system developed by Blumlein, where a stereo signal was represented by an omnidirectional signal and a figure-of-eight microphone pointing left. With Ambisonics a sound field is decomposed into spherical harmonic components, termed W, X, Y and Z. These are collectively called B-Format. Channel W corresponds to the signal generated by an omnidirectional microphone, picking up sound equally from all directions. The other three channels hold spatial information in the form of sum-and-difference signals; channel X holds information similar to a figure-of-eight microphone facing the front (front minus back), Channel Y faces the left (left minus right) and channel Z faces up (up minus down). The signal hierarchy in an Ambisonic system goes from A-format, that may be described as the outputs of four hypercardioid microphones, each having nulls 120^{o} off-axis, pointing to the four corner direction, to B-format. Hardware or software can be used to make this conversion. The basics of the conversion from A-format to B-format is to perform a proper matrixing of the signals coming from the capsules. The SoundField microphone itself contains four capsules, mounted in a tetrahedral array (tetrahedral describes an equilateral triangle). The main difference between a SoundFiled microphone and traditional stereo or multi-mic set-ups is that all other methods capture audio from different points in space, whereas the SoundFiled presents a single point source. Two additional formats were developed for each of the decoding systems initially available (CD-4, UD-4, RM and the BBC Matrix-H), although the commercial production of these never proved viable. C-format, which stands for coded format, was readily associated with the consumer. C-format became better known latterly as UHJ. In its full form, UHJ included four channels and carried the same amount of localisation information as four-channel B-format i.e. full with-height surround. Discarding the fourth channel removed the height information, resulting in a high-resolution planar (horizontal) surround signal. Depending on the number of channels available, the system can carry more or less information, but at all times UHJ is fully stereo and mono compatible. Transversely, D-format (decoded format), was used for the decoding of signals suitable to the driving of an unspecified number of loudspeakers, therefore it cannot be precisely standardised, since it depends on the number and layout of the listeners' loudspeakers.

Micheal Gerzon, the inventor of the Ambisonic microphone, who was also

very active in many other areas of audio and elsewhere, wrote an extensive number of articles, from deeply technical papers for scientific journals such as the *Journal of the Audio Engineering Society*, to more approachable pieces for the general public.

> *Michael realised that the one plus three channels were exactly like the definition of Einstein-Minkowski space-time, with the mono channel playing the role of time, and the other three channels the role of space. Not only could this be rotated, but one can apply the Lorentz transformations of Relativity Theory. These have the effect of drawing sounds forward or pushing them back.*
>
> Alexander (2008)

In a sense, with or without the aid of the ambisonic technics, a soundscape is always narrating a story that, through its development in time, describes a specific space. So what makes an ambisonic soundscape peculiar, in what does it differ from any other soundscape and in what is it equivalent? R. Murray Schafer, in his book *The Soundscape*, outlined a comprehensive analysis of the contemporary sonic environment [Schafer (1977)]. Distinguishing natural and industrial sounds, Murray explores human perception of the environment connecting sound to the symbolism it engenders, reaching the crucial topic of noise, or what is considered noise nowadays. Because noise is like style, it is a phenomenological element whose perception dynamically changes over time, therefore that which is perceived as noise, from both a semantic and a physical perspective, is undergoing a constant transformation. And sound design becomes the architecture, and the archeology, of the invisible, that which is perceived but not seen, while contemporary trends in education point towards an awareness of the influence of the audible landscape on the construction of the social and individual Self. The soundscape is a property of the space in relation to the individual and her or his perception, and the sound waves or pressure waves become relations between entities, objects and personae. Because a sound wave cannot be a soundscape if it is not recorded or perceived, and this perception is the effect of a body over another body...

> *When a body "encounters" another body, or an idea another idea, it happens that the two relations sometimes combine to form a more powerful whole, and sometimes one decomposes the other, destroying the cohesion of its parts.*
>
> Deleuze (1970)

If a soundscape can be defined as sound that talks about space, or as the expression or speech of space[1], an ambisonic recording appears, on the other end,

[1] Speech, like sound, tend to imply a relation. A person can speak without anyone listening, and the leaves of a tree can resonate when the wind blows even if no one is noticing it, but for communication to happen, or for a sound to become a soundscape, the presence of an observer is necessary. Heisenberg brought this relation and the function of the observer at the core of science, as he explained thoroughly in his book *Physics and Philosophy*[Heisenberg (1958)]

rather as a sound that contains space, and the fact this space maybe real or illusory, is of no importance.

Your wife has a beautiful neck

The idea of this project was to learn about ambisonics connecting its use to the origins of spatial sound, that was developed at the end of silent cinema. Nosferatu, with its peculiar history and its lost sound score, and also with its expressionist set design and the *anti-copyright* anecdote, seemed the perfect film for the experiment.

The teaching of Michel Chion on the one hand, and the professional experience as a video-editor of the author of this paper, stimulated a special capability of constructing sound tracks over video images.[2]

The initial concept, therefore, contained all the necessary characteristic to make it a challenging and enjoyable research project, and the opportunity to record professionally the sound of a number of DIY instruments that are normally played live, and whose sounds are mostly ephemeral, presented itself.

Waiting for the Vampire

Although the result is a rather modest piece of work, the production process behind this soundscape was complex and required extensive research and an interesting learning curve. First of all, a fragment of the film was identified and selected for the soundscape, and the narrative illustrated by the images was translated into text (see appendix_1)

The function of the analysis of the visual narrative was the perception of the rhythm of the selected film fragment, trying to understand, step by step, its meaning and how the content was visually communicated. Once the video was cut, the experimentation with the ambisonic microphone Soundfield SPS422 began. The system consists of two parts that are used together, a SoundField microphone and an AC powered 1U SoundField Processor. The SoundField microphone contains four capsules, mounted in a tetrahedral array. The soundfield processor was connected to a Traveler MOTU Firewire audio interface that requires a plugin to be recognised by Logic. The first tests were recorded on Sunday March 8th at Regents Studios in Hackney; sound generated by light bots as well as the environmental soundscape were the object of the tests. Most of the material used in the sound scape composed along with this paper was recorded during the full moon night between Monday February 6th and Tuesday February 7th. The recordings were made in the performance space at EECS, Queen Mary, University of London. A table for light and bots was set-up in the

[2]Video-editors can be divided in two categories in relation to sound: some select an audio track and construct the visual rhythm over the sound. Others compose the visual elements trying to develop an inner structure, adding sound much later in the editing process; this way the sound is arranged to enhance the visual structure, rather than the opposite. The author of this paper belongs to the second type of video-editors.

room. A mixer Allen & Heat Zed 12FX was connected to two speakers (Mackie SRM450) and a subwoofer (Meyer Sound USW-1P). A projector model Hitachi CP-A100 was looping the video fragment of the film. The plan was to improvise over the looping video images all night long. During the afternoon, preparing the solo performance, a new light bot recalling the teeth of the vampire was soldered for the occasion. The question, aimed at creating a tension in the room, was the following: will the vampire like the music that is being offered to him? And, if he likes it, will he come to listen? The intention was to play music with a subtle sense of fear and expectation. Two people arrived in the course of the night, one was Julie, she was looking for someone and entered the room very silently trying not to disturb my experiment; that was terrifying, but unfortunately the real scream produced was never recorded. The second one was a security guard who came at six in the morning to check where was the sound coming from, and what was happening. This second visit was not scary.

At the back of the performer the recording equipment was set on a table (see diagram in Appendix_2 and pictures). The microphone was placed at the centre of the room and the tracks WXYZ were recorded in Logic with their specific name, so to be able to distinguish them afterwards. The three speakers were placed in different positions in order to experiment with a variety of spatialisation effects. In most cases the two Mackie were at the right and left of the bot's table, pointing towards the projection, while the sub was pointing towards the table diagonally. The sub at some point was positioned towards the wall at the right of the table, but no aesthetically significant sound effect emerged. The microphone was placed at the centre of the room and the correctness of its position in relation to right and left was tested at the beginning of the recording session.

The recording session was not completely satisfactory as the room had lots of vibrations, in particular the noise of the emergency exit was disturbing the play and the system did not offer the sound dynamics performed in other cases, probably because the new bot was eventually saturating the mixed due to a loose wire connection. A video-camera was filming the video projected in the dark room, and the lights generating the sound were creating beautiful reflections over the video. Unfortunately, the sound in the camera was not recorded due to a misfortune. The original plan was to match the best sequence recorded by the camera with a recording from the ambisonic microphone as a unique track. This way the post-production would have involved only the decoding from B-format to binaural and the mastering in Logic. The transcoding process was more complex than expected. After a research on current technology and the evaluation of different software solutions available for different platforms, a Max object to transform B-Format to UHJ was used to transcode the selected tracks. The material was then edited in Logic and bunched to Final Cut, where it was re-edited over the video. The final track was then re-imported in Logic for Mastering. The mastering process was kept very minimal with the intent not to betray the purity of the electronically generated sound with excessive digital post-production. A small reverb, a limiter, a multiband dynamics and a subtle equalisation were applied to the track, that was finally reimported in

Final Cut and exported as a video. The art of mastering would require more time and experience to give better results.

Reflections

Using an ambisonic microphone is more complicated and effective than expected. Whereas the effects were audible in the case of environmental recordings, the tracks reproducing the light-bots instruments didn't give satisfactory results, at least in the spaces that were used for this experiment. Initially, the idea of this project was connected to a special squared sound venue that used to create a very interesting dynamic when the light-bots were played on a quadriphonic PA. Unfortunately, the space that had generated the entire concept was not available anymore at the time of the realisation of the piece, and this affected the results. If recording the sound of a complex space seemed to give interesting results, the use of the ambisonic microphone for electronically generated sounds needs further investigation.

Conclusions

The ambisonic microphone is an extremely fascinating instrument whose artistic potential is still to be explored, probably due to the technical difficulties that the device initially presents, and the costs of a good hardware solution. Currently, we propose two main direction of usage: on the one hand, the ambisonic technique allows a more advanced and precise reproduction of reality, that is of interest of musicians and film directors. This usage supports narrative and figurative art, but can also be implemented for documenting live performances, where the spectator's presence contributes to the creation of spatial effects and may produce realistic recordings that preserve the liveness and performative dimension of the event. On the other hand, another possibility unfolds: can an ambisonic microphone be used to generate, throughout its mathematical and physical model, the creation of the sound of non existing and surreal soundscapes? How far can the physics and mathematics of sound be used to push the boundaries of illusion and human perception? Surpassing virtual and three dimensional worlds, can analogue ambisonic recordings be used to construct an abstract expressionism of sound?

References

Michel Chion. Audio-vision. Sound on screen. Columbia University Press, 1995.

Russel Burns. The life and times of A D Blumlein. London, UK: IEE, 2000.

Robert Charles Alexander. Michael Gerzon. Beyond Psychoacustics. Lincolnshire, UK: Dora Media Productions, 2008.

Roy Ashbury. Nosferatu : director, Friedrich Wilhelm Murnau. London, UK: York Press, 2001.

Gilles Deleuze. Spinoza. Practical philosophy. Presses Universitaires de France, 1970. City Light Books, 1988.

Werner Heisenberg. Physics and Philosophy. The revolution in modern science. New York, USA: Harper & Row, 1962.

R. Murray Schafer. The soundscape. Rochester, USA: Destiny Books, 1977.

Appendix

1 Fragments of narrative

The dummy, a man running, men running in the field, men attack the dummy, dissolve in black, the sea and the moon, waves and bubbles, the vampire at the window, the woman sleeping, she makes a deep breath, suddenly she wakes up, she looks scared, the vampire at the window, she touches her own heart, she bows, the man on the armchair, she gets out of bed, she walks like a somnambulist (sleepwalker), she reaches the window, she opens the window, the vampire at the window, the vampire moves his hands, she moves her hands, she sighs, she looks possessed, the man snoring on the chair, she looks at the man: she seems on the rink of madness, the vampire at the window, the vampire moves his hands like a puppeter, she retracts scared, the she obeys and opens the window, the vampire moves like an Egyptian, she holds herself to the wall, the man is sleeping ignoring everything, the house door with the shadows suddenly opens, the vampire is at the door, she sees him and jumps, she cover her own face with her hands, she sits on the chair, the vampire at the door sets out like walking like an Egyptian, she wakes the man up, and faints, he drags her on the bed, she hugs him, and ask him to call the doctor, he leave the house running out of the front door, she gets up, she was not sleeping, she goes back to the window, she looks for the vampire, the vampire shadows on the staircase, she hears a noise, she suddenly turns around, the vampire is no the landong, extending his fingers, she pulls back with fear and deference, she put her hands on her own heart again, she draws back, she is scared, the window the bed, she falls on the bed, the shadow of the hand of the vampire on her breast, with his clutches - he grabs - her soul, he clenches her soul, and rips it out off her heart, she draws her head back, and exhales a breath.

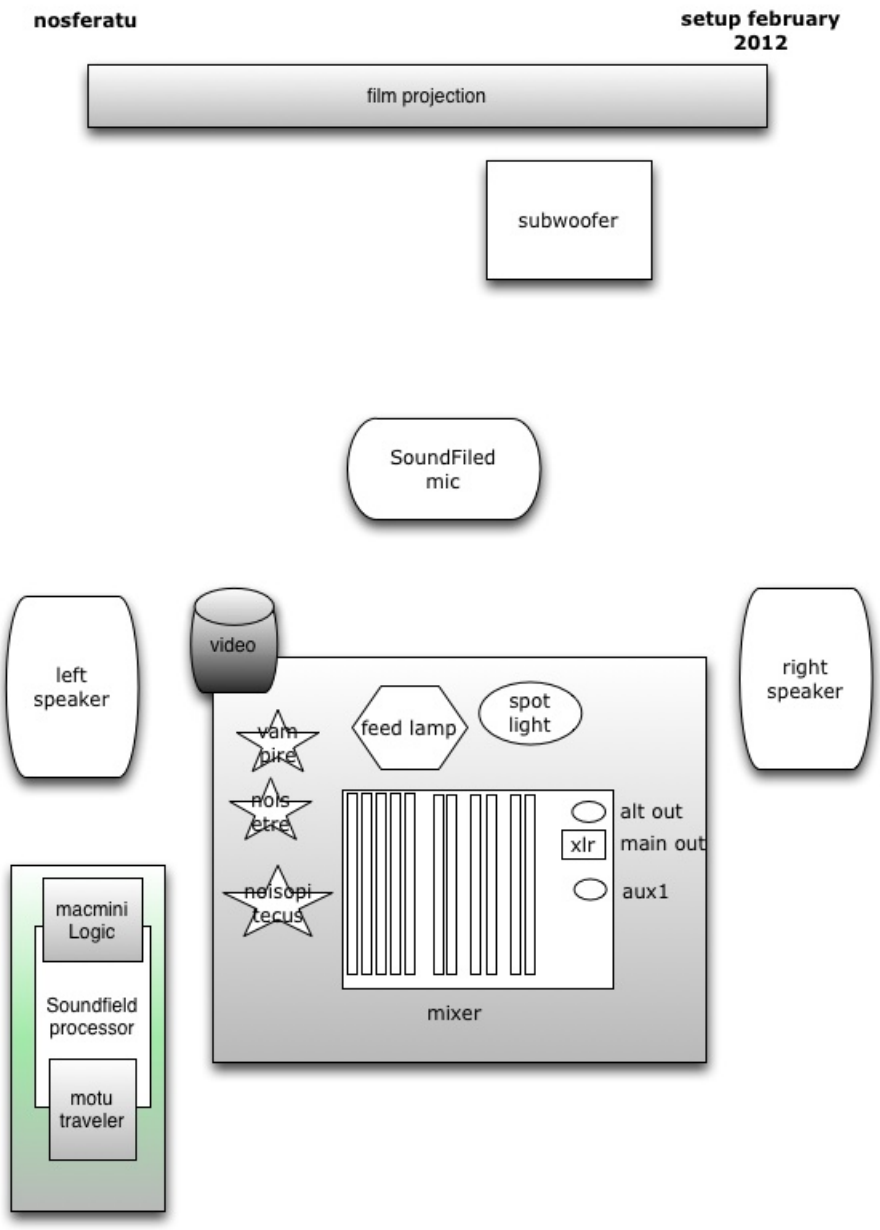

Figure 1: Performance setup.

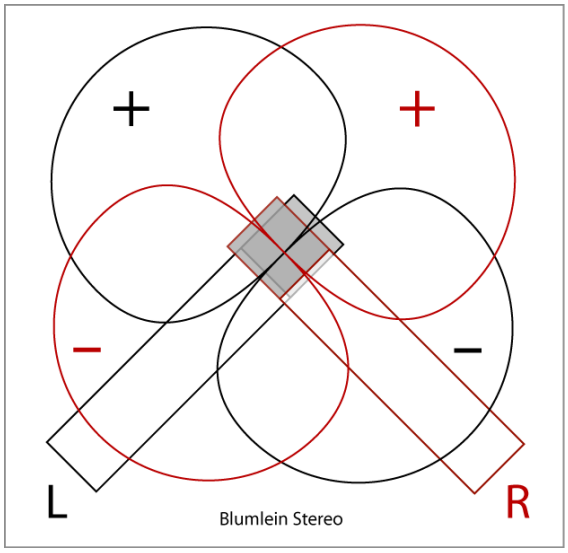

Figure 2: Blumlein Stereo

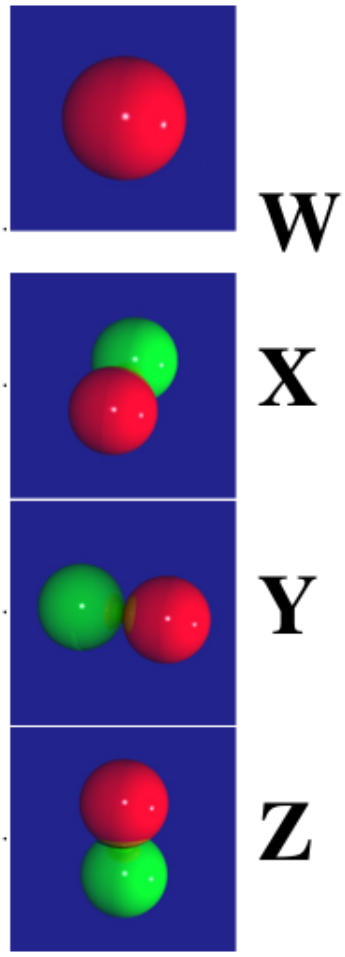

Figure 3: Ambisonic sphere

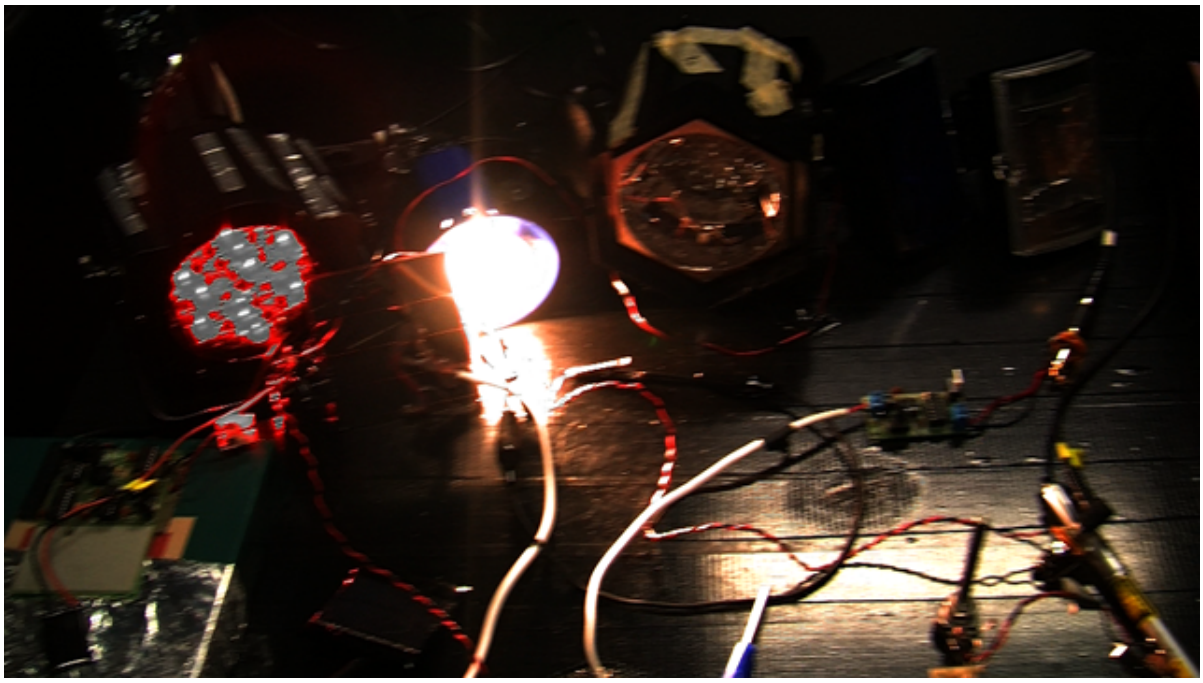

Figure 4: Bots table and lights

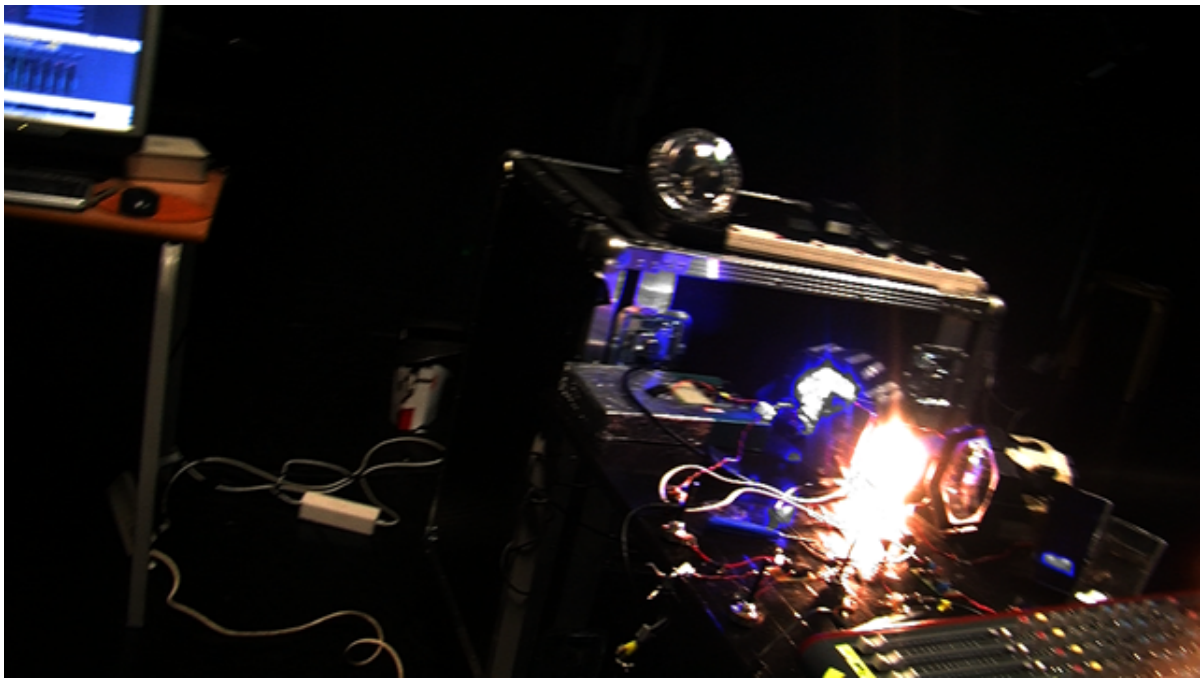

Figure 5: Bot table and lights next to the recording setup

Figure 6: Recording table

Figure 7: Nosferatu projected in the performance lab.

Figure 8: The new bot to attract Nosferatu

Figure 9: The vampire