Conversations with Spaces

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INTRO

Conversations with Spaces

In my research project I have been investigating the relation between time, space and motion by developing and implementing a set of audiovisual tools to transform, expand, amplify, connect, compose and capture spaces.

My aim has been to create works that relate more to the mind-body than to the intellect, works through which I can give my audience an awareness of presence of the kind that has been described by the German-American theorist Hans Ulrich Gumbrecht as "the state of being lost in focused intensity" (Gumbrecht:104). My approach has been to move back and forth between experiments with audiovisual media and digital control systems in a controlled lab environment, and interventions in public space.

I have taken the role of the artist engineer: Only by having a fundamental knowledge of the technology am I able to use it as an artistic tool. It is the trial and error process that creates the most interesting results. A lab situation enables me to work in a physical space to develop ideas, tools (software and hardware) and methods that heighten my sensitivity and give me the competence to improvise with/in other spaces.

I have been interested in a process of moving from the general to the specific, and to see how the general concepts of time, space, motion and memory develop into specific works of art through a multiple-angle bombardment in the lab environment. I have roughly divided my research into four areas, which more or less overlap in the single projects:

> The focus on space using image, light and sound, experimenting with masked video projection, light points, concrete sound sources and directional soundbeams.
>
> The distribution of points in space, the connections between these points and the choreography/structuring/sequencing of the movement between/of the points: A digital control system for multichannel sequencing and distribution in a network.
>
> The implementation of digital networks in the physical world using micro controllers, electronics and mechanical movement.
>
> Breaking up time and space into fragments and building up new time-spaces by stretching or compressing time, dissolving spaces into textures through magnification and animation, reshuffling timeframes, freezing layers of time into a space.

This multi-perspective approach has produced a whole body of works presented or performed during the research period, including *mikro* performances (animation of microscope textures), *nodio* (series of multichannel audiovisual installations), *soundpockets* (sound installations), *wind-up birds* (network of mechanical woodpeckers), *shift* (mapping of video projection onto wooden boxes) and finally the two installations presented at Hordaland Kunstsenter (HKS) under the name of *blink:*

Two empty spaces transformed using light and sound, but expressed in very different ways.

This text gives a glimpse into my working process, by making two trajectories through the three years, and by presenting some ideas which have interested me during this process.

The two trajectories share the same departure point: the *nodio* project, which I started to work on in 2005, but which I continued to develop during my research fellowship. One trajectory covers the work with mapping video projection onto objects and surfaces and the development of the Video Projection Tool (VPT) software. The other trajectory covers projects related to physical computing, sound and public interventions. Of course the two trajectories are not isolated from each other, and some projects didn´t fit in either category and will be mentioned briefly. To simplify I could say that the two installations presented as *blink* at HKS in october 2009 represent the two trajectories.

A critical reflection can take many forms. For me it has been important to include different types of text material from work diaries, blog posts and catalogue texts. However, the main body of the text was written during the last months of the research fellowship. I have also decided to include extensive visual material, not only as illustrations to the text, but more as a complement to the written material.

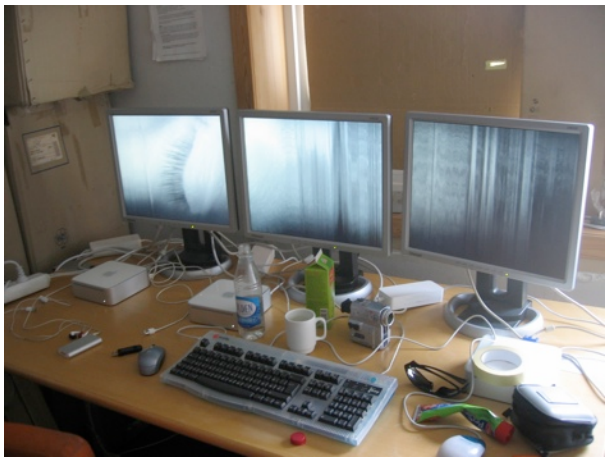
PRELUDE

A short history of nodio

Nodio is a a system I have developed for composing real-time multichannel audiovisual installations. It has evolved over several years and has been the foundation for much of the work done during the research fellowship period.

The departure point for *nodio* was the work with *Krets*, a Kreutzerkompani[1] performance from 2005, where I wanted to work with patterns of light and sound. The sound and light sources were all part of the set design: half-transparent domes with light inside, and black domes with speakers inside, placed on a circular astroturf. I was interested in a combination of physical presence of both speakers and lights in the space, to avoid moving sounds in a virtual sound space and using "invisible" light sources.

In spring 2005 I was invited to present a work at the one-night exhibition Prøverommet BETA at Teatergarasjen in Bergen. I had the opportunity to work at BEK for a week, preparing for the exhibition.



The initial setup was 3 mac minis and 3 monitors with built-in speakers. The mac minis were connected in a wireless network together with my laptop. The monitors were placed next to each other, forming a horizontal line.

I had several ambitions with the project, but mainly to explore the possibilities of a multichannel audiovisual system, finding multichannel setups often being very little adventurous. The main force of the system is that it is real-time based, which means all the processing is done in real-time, ultimately becoming a instrument or composing tool for multichannel image and sound.

[1] A collaboration between choreographer Eva Cecilie Richardsen and myself, producing a number of performances in the period 1998-2006

I wanted to explore the movement of image and sound, mainly movement between sources, or the relation between movements on the different sources.

For this I wanted a tight link between image and sound. When there was a change in image, there would be a change in sound. I created a simple analysis of the video, which generated a sound based on that analysis. For illustration purposes: Different patterns of white would produce a sound, a black image would be silent. So if there was a short loop of a video played on source 1 containing bright/white material, and the other two sources were black, there would only be sound from source 1, and if the loop was moved to source 2 and then source 3 (while the other sources were black) the sound would appear to travel with the image, from left to right across the three monitors.

I also wanted to explore the different ways of creating image spaces with the three screens. They could either function as one wide image, being split over the three screens, as three different images, or maybe more interesting, the screens would be treated as a frame or canvas of movement, only revealing parts of the experienced space. For instance, if an image travelled from left to right, would it stop at the right screen and go back right to left, or continue off-screen and appear again on the first screen on the left? By creating different patterns of movements I could expand the visible space.

A third aspect would be the relations between the sources, if playing the same clip, would they play in sync and just loop a few frames, or play from different points with different frame rates, behaving independent of each other?

This was a lot of material to dive into, and I only managed to get a few of the ideas implemented for the exhibition, and all the changes needed to be done manually from my laptop.

The wireless network made if possible for the three nodes to share information with the other nodes, as well as my laptop which was the control center. I created a rough version of a sequencer, which gave the first hints at the possibilities inherent in the *nodio* system.

I continued development at a residency at Tesla in Berlin in the fall of 2005, but due to technical problems I didn´t achieve so many new results, except for a simple standalone sequencer.

Drifter at Trøndelag senter for samtidskunst, 2006

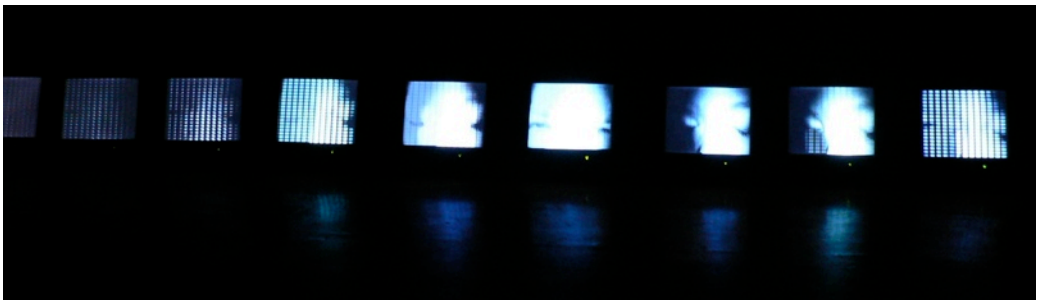
In 2006 I created two versions of the installation *Drifter*, based on the *nodio* system: 12 nodes placed in a circle, where images travelled clockwise in the circle, leaving traces which travelled in the opposite direction. The nodes created sound from the image, and they were tuned to four different frequencies, so the final sound output would be chords.

The second generation of *nodio*, in the fall of 2006, focused on the compositional and sequencing aspects of *nodio*: How to create a multichannel audiovisual composition, how to create interesting chords of image and sound, and how to move from one chord to the next, and how to determine the duration of each chord in relation to the others, and to create a sequence with an interesting dynamic.

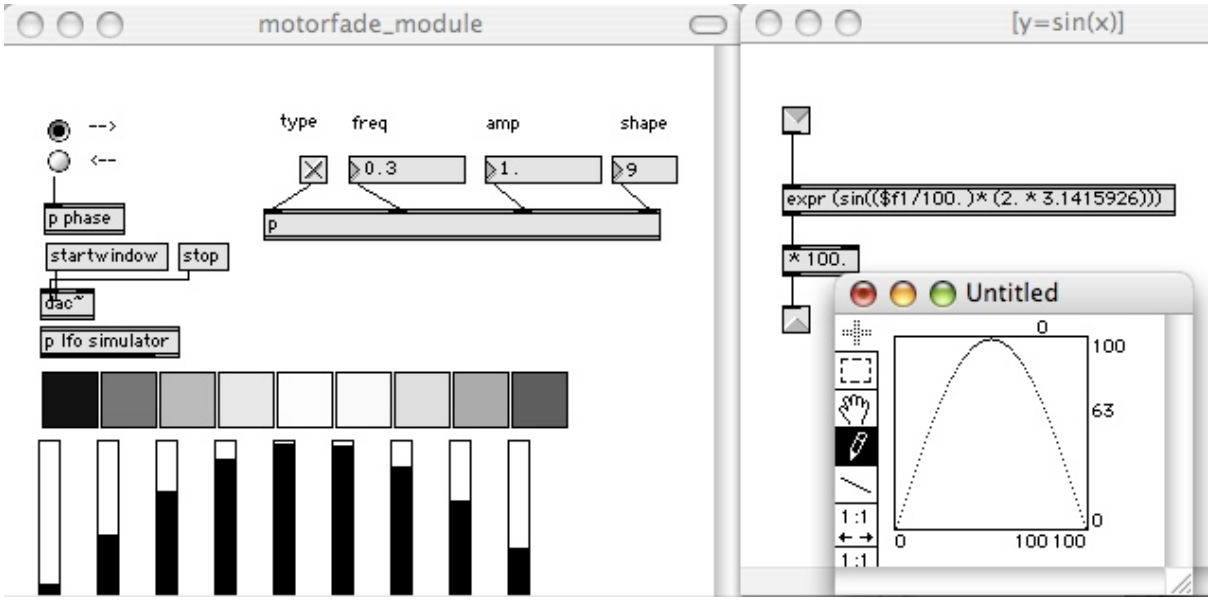
This being a real-time system, I had the privilege to work by trial and error, but I needed a way of grabbing the current state of the system, where I happened upon something I liked, and to combine the grabbed states (or presets) into a time-based sequence. Unexpected things would often happen in the transition from one preset to the other because of the way the system interpolated the data.

This was the first time I had a solid-working sequencer, which ran for a month at an exhibition at Akershus Kunstsenter, and later at Lydgalleriet. I made the system very flexible to be used in various settings: I divided the functionality into different modules: The client modules, which would be the same on each node, the motor module which tell the clients what to do and coordinates them, the composer module which was the interface for the motor, and a simulator.

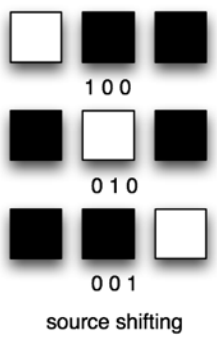
In a performing/composing situation, the composer module would be on a separate computer, optionally together with the motor module. In a installation setting the composer module wouldn´t be needed, and the motor would be on one of the nodes. Finally, for sketching it would be possible to have the composer, motor and simulator on one computer for testing out ideas without using the actual nodes.



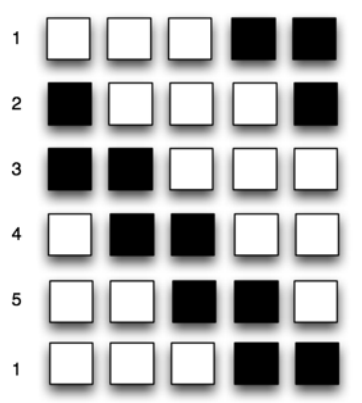
The third generation was developed at the lab in 2007, where I worked with nine nodes placed in a horizontal row. For this generation, (except for the work involved in making a composer setup for nine nodes, I made a system which is much more flexible in terms of the number of nodes involved) I wanted to move a bit away from the model of the second generation, of saving states and combining them in a sequence. I wanted more to explore the movements between the screens, through LFO (Low-frequency Oscillation)-based fade patterns, source-shifting and groupings.



A sine wave is used as a way of controlling the levels of a fader on each node, by letting each node be at different phases in the sine wave. Without being too technical, this means that fade patterns didn´t need to be produced centrally, but on each node, and was an efficient way of synching the nodes.



By source shifting I mean being able to use binary sequences as simple ways of moving sources within the system.An example with 3 nodes: If I use a binary sequence of 1 0 0, and for each step the sequence moves to the right and wraps around to the left, I would get a series 1 0 0, 0 1 0, 0 0 1, 1 0 0, etc. 0 would be black, 1 could be a color or a video loop. To make it more complex each node could have different active (not black) sources. So node 1 is set to 2, node 2 to 5, node 3 to 8, giving us a list of 2 5 8. Using the same binary list as before, 1 0 0, we would get the following output by multiplying the lists: 2 0 0, 0 5 0, 0 0 8.



Group of 3 rotating through a list of 5 items

Grouping is an expansion of the source-shifting. By for instance turning on three images next to each other and then shift and rotate as above, you could get something like this with a list of 5: 1 1 1 0 0, 0 1 1 1 0, 0 0 1 1 1, 1 0 0 1 1, 1 1 0 0 1, 1 1 1 0 0, and you get the illusion of the 1´s moving together.

The fourth generation of *nodio* is more a way of integrating the *nodio* system into the Video Projection Tool, where each video plane corresponds to a node of video and sound. Instead of eight nodes being on eight different computers connected in a network the nodes would now be on eight different video planes, contained within one computer, but still behaving as eight different nodes. This is obviously a much more computing-intensive job, as one computer has to do the same work as eight, and also demands a sound card with the same number of outputs as there are nodes.

I developed this during my work at Teatergarasjen, and this was also the basis for *shift* 2 which I showed in Roskilde.

The fifth generation of *nodio* could be thought of as the integration of physical computing into the audiovisual network.

nodio five-aside at USF, Bergen april 2008

TRAJECTORY 1

Painting with light

Video projection is basically an advanced light source: In combination with a computer you can combine an infinite variety of masks with millions of colors to give you a tool for painting with light.

I realized quite early in my work the potential of using video projections as light sources. In 1999-2000 I developed the project VideoNervous where I wanted to explore the combination of computer controlled digital video with video projectors, and this resulted in my first experiments in projecting video into three dimensional spaces and onto physical bodies. [2]

Just by thinking of video projection as light detaches it from the usual format of projection of content onto a screen, and opens up to projecting on bodies, objects, surfaces, walls, floors, ceiling, buildings etc.

Different lighting completely changes the way we perceive the world, take for instance how a city changes over the course of a day.

The interplay of light and darkness forms the world (as we experience it), and by being able to control both the placement, intensity, color, and shape of the lights as well as being able to control these parameters over time gives me the possibility to transform spaces using light.

One of the interesting differences between film and video projection is the depth of field. While film projection has a very narrow depth of field, video projection has an almost endless depth of field, so both foreground and background can be sharp at the same time. This makes it possible to project on objects/forms at various depths using the same video projector.

There are many commercial solutions available to project one image over several projectors, basically a video-wall concept but instead of splitting the image over monitors you can split them over projectors, making it possible to achieve huge projections.

I have had a different approach: how I can use one projector to project on several surfaces simultaneously, by dividing, in software, the projected image into several smaller images. This technique has allowed me for instance to project on three sides of a cube using one projector, with the illusion of it coming from three different sources.

When projections match the objects/surfaces they project upon, the physical forms appear to get a second “skin”, either of solid color, image or video. The objects get a projected texture.

There seem to be two main approaches to achieve this[3], which can loosely be defined as mapping and masking.

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[2] For instance *Joystick* from 1999 by DemoDans (later Kreuzterkompani) and *Tigerhagen* by Hollow Creature from 2000-01.

[3] a third might be said to use a camera

Mapping is based on creating a virtual 3-D model of the objects/forms you want to project onto.

The idea is then to match exactly the position of the projector with that of the virtual camera in the 3-D model, so that the virtual model maps exactly onto the physical form. This is extremely meticulous work which needs exact measurements and endless calibrations, but can produce some stunning results. Since the content is produced using 3-D geometry, the textures projected reflect the limits of these environments, so very often what is projected is a combination of solid lines and solid color.

The most interesting thing with mapping from my point of view is the possibility to make virtual shadows. Again, since this is made in a 3-D environment, you can add virtual lights to the model, which can cast shadows using the right renderer. By animating the positions of the lights, the shadows move.

Masking is based on masking out shapes, basically the same function as a gobo[4] has for light.

Instead of working with a virtual 3-D model, you work with multiple flat layers which mask individual surfaces of a form, but which are positioned, scaled and rotated in a 3d space.

In some ways masking might seem an inferior method to mapping, but in most cases an audience wouldn´t notice the difference, and it has many benefits when it comes to the actual process of making it, and the access to individual surfaces makes it possible to make interesting video textures.

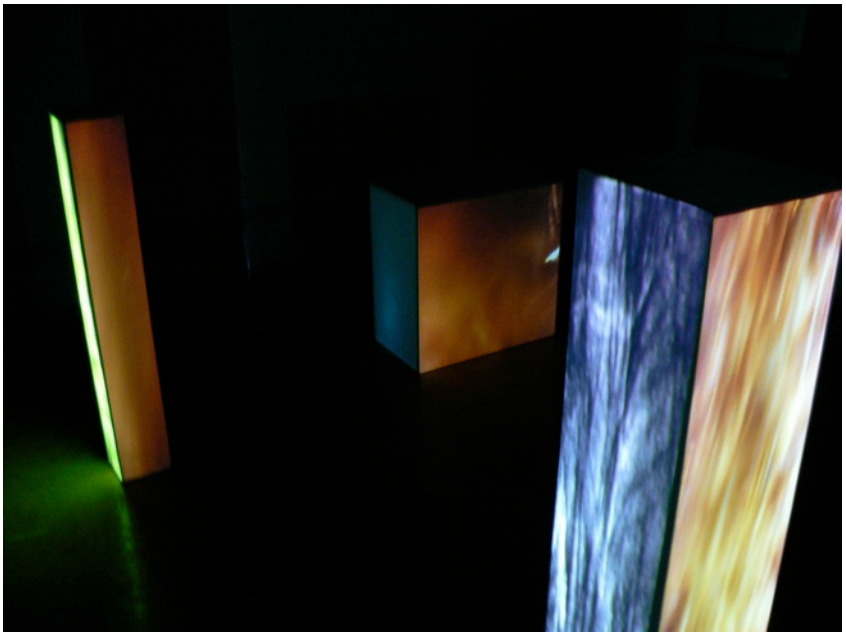
The main benefit is that you don´t need to measure or calibrate anything. You place the projector and work with matching each layer to a different surface.

When I started working with this around 2000, it was a cumbersome process, because there were no available tools for doing this in real-time, so it often meant a very long process of trial and error, creating a mask in one program, projecting it using another, and then going back and forth.

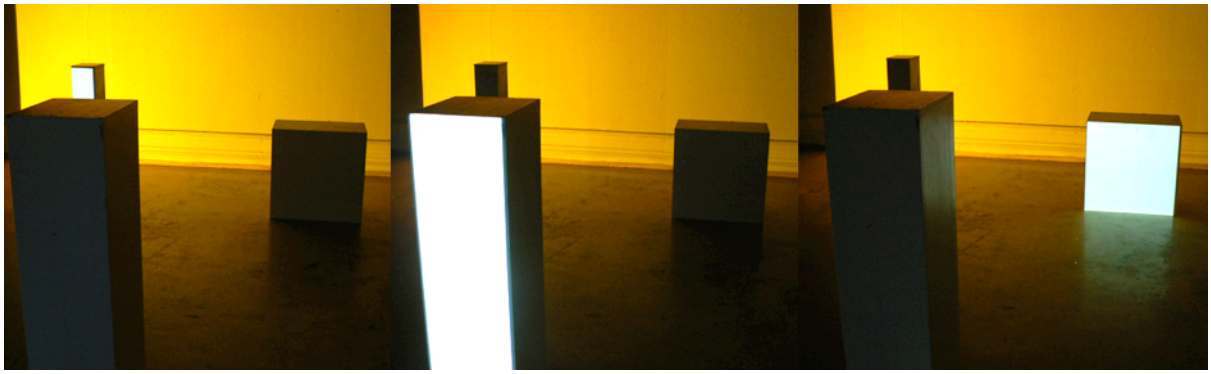
One of the goals for my research fellowship has been to make it possible to improvise to some extent with spaces, to make fast intuitive tools similar to the real-time instruments I have developed for live improvisation, but for projection into spaces/onto objects.

[4] a partial screen/mask used in front of a spotlight to project a shape

First projection lab: tegnesalen January 2007



My first intensive work period in the research fellowship was a two week lab session where I mainly worked on developing the nodio system (more on that elsewhere), but also had a short week to test out some initial ideas related to projection. I was able to produces a number of sketches which has been the foundation for a lot of the masking/ mapping/relief projection work I have done since then.

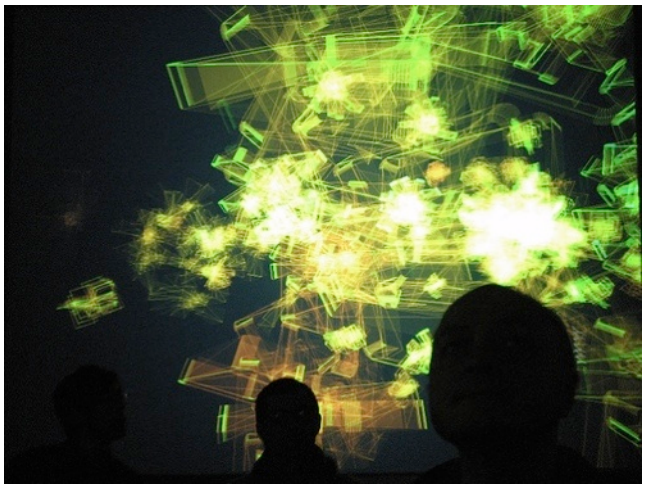


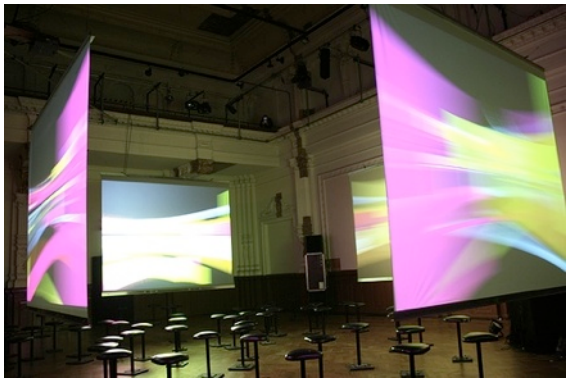
They were intended as proof of concept, as the programming and accuracy was rudimentary:

Use one projector to cover two sides of a cube
Use two projectors to cover four sides
Use one projector to cover one side of three different cubes
Move image from cube to cube (a continuation of nodio)
The illusion of movement by switching nodes in a series on/off

I also tested working with a second projector filling in the background wall so I could experiment with relations between foreground and background.

Liquid space workshop



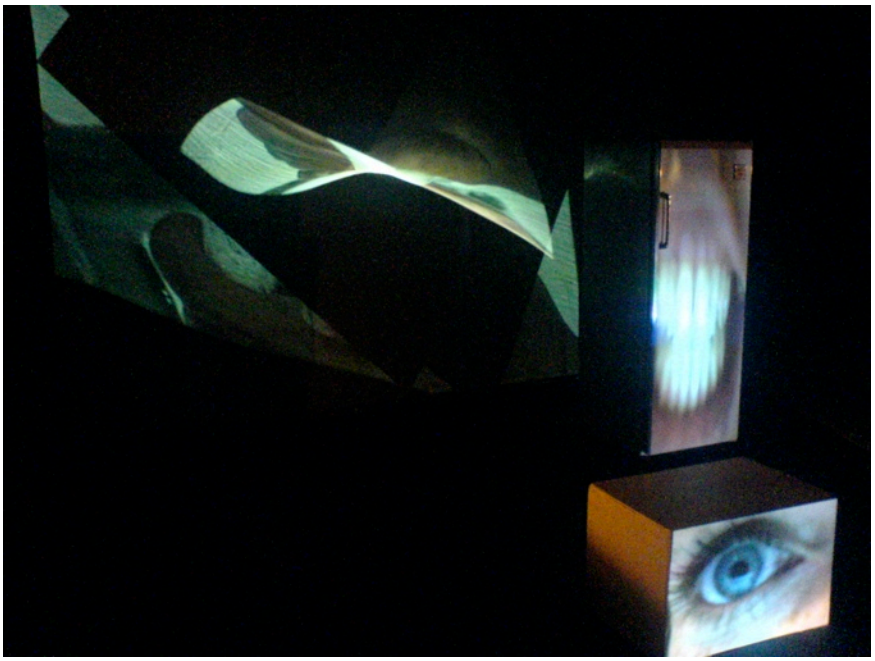


Brussel-based lab.au organized a two-week workshop as part of Club Transmediale in Berlin in january/february 2007, inviting artists and musicians with various backgrounds. They have organized similar workshops elsewhere using their custom built software, which I unfortunately found to be buggy and unintuitive, to create a immersive audiovisual environment. The main features of the environment is navigation in 3D space and spatialisation of sound, connecting sound particles to geometric objects.

The physical setup is flexible, but for this workshop it was four screens forming the walls of a room. My experience was that this type of virtual 3D is experienced as very flat, it doesn´t help being surrounded by 4 screens, it still feels very distanced from my body which is present in the space.

There were quite a few interesting projects that was produced during the workshop, but in general it pointed out a few things in relation to how I didn´t want to work with projections in space (virtual 3d on flat screens), and I found it problematic that the participants spent most of the time in front of the computer trying to figure out how to use the software instead of trying out ideas in the space.

KHIO workshop

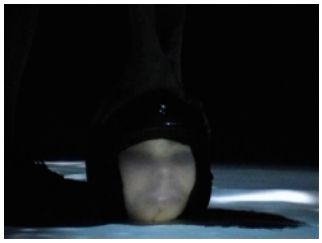


In June 2007 I was invited to KHIO (Oslo National Academy of the Arts) to give a workshop for a small group of students from the directing,choreography and scenography department, looking at how to work with video in a physical space like a stage.

I wanted to let the students start exploring the possibilities of working with video in relation to different materials, treating it as light, combining set design and narrative. However, none of the students had any particular background using computers and video, so I needed to develop some intuitive, elementary tools for the students to work with.

We needed a way to capture video, either live from a camera or from recorded material, without learning a big application like Final Cut, so I created a simple capture application with basically just a record button.

We needed to be able to project onto physical objects, so I made an application for projecting three layers of video. As well as being able to position and scale each of the layers, it was possible to store presets of a scene, and create a cuelist to move from scene to scene, thus making it possible to use the application for a simple performance setup.

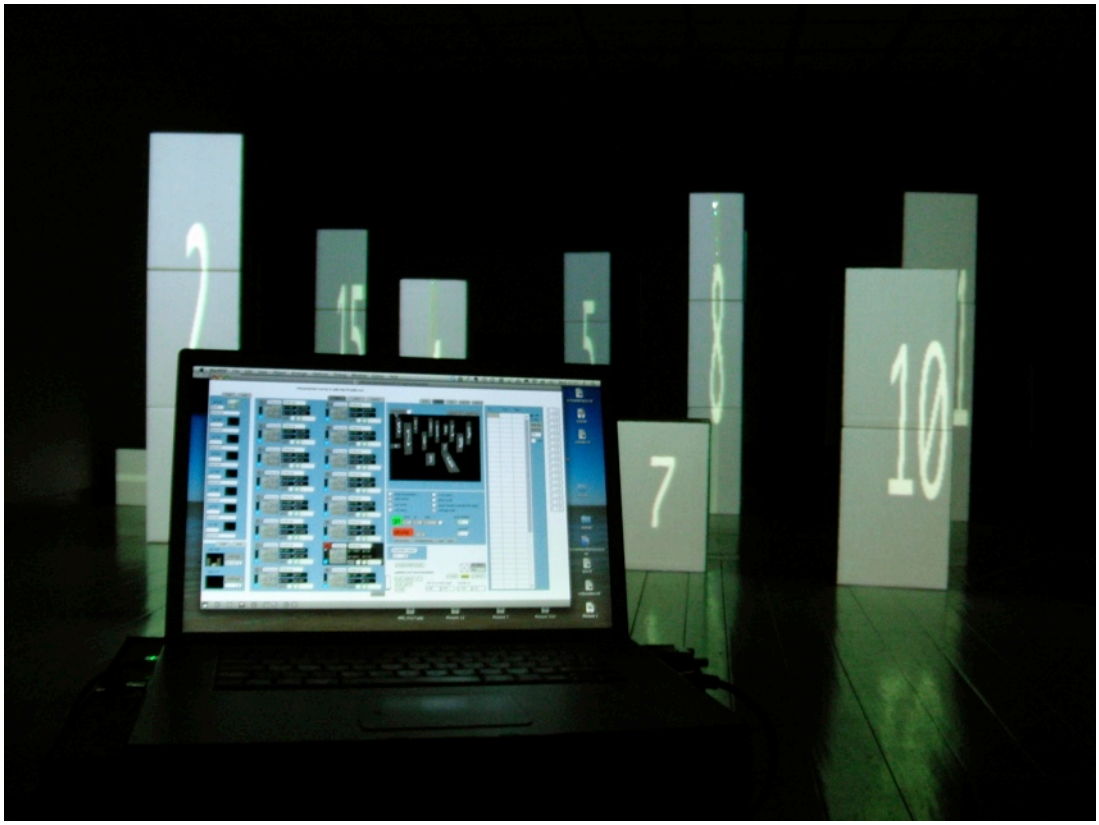


Finally, we needed to be able to make accurate masks so the projected layers would fit exactly on the objects projected upon. For this I made a simple mask tool.

The software tools were developed during the one week workshop, so I could incorporate the needs of the students and add features as needed.

I decided to make these tools available to the public for free, and this was the predecessor to VPT, Video Projection Tools.

VPT: video projection tools



Over the last three years I have gained knowledge on projection onto objects and surfaces, by participating in workshops, giving workshops, finding and sharing information online, producing work for exhibitions and through intensive lab sessions, and learning about other artists´ work within the field. All this experience has been put to use in the development of the Video projection tools, or VPT.

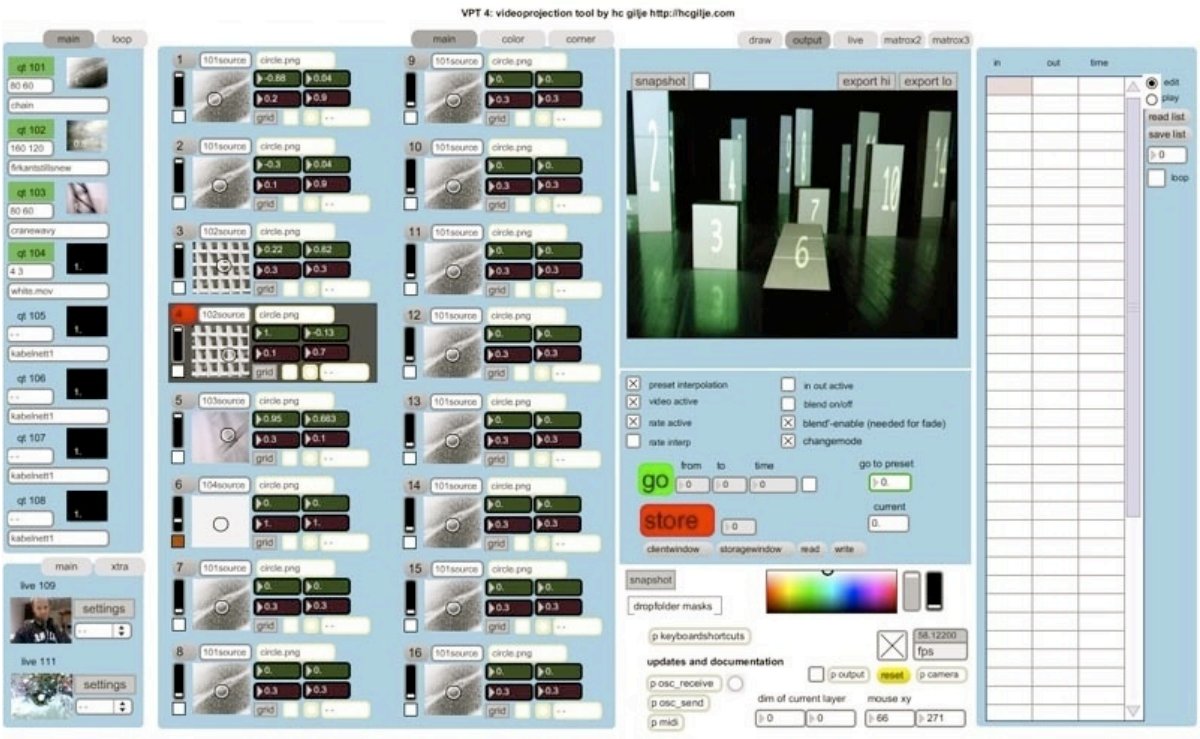
> Through my own lab sessions: Starting with my first projection lab in January 2007, the projection lab at Teatergarasjen in April 2008, shadow lab in January 2009, and snow lab in February 2009.
>
> Through my participation at the liquid space workshop at Club Transmediale in 2007, through the workshops and presentations I have given at KHIO and Medialab Prado in Madrid.
>
> Through discovering work by for instance Pablo Valbuena, AntiVJ and Michael Naimark.
>
> Through work on my specific projects like *shift* in Roskilde 2008 and *multimorf* on the Opera House roof in Oslo April 2009.

The development has been a constant series of iterations between workshop, own projects, and feedback from the web.

The documentation of how to use the software has been extremely important, to make it as detached from me as possible, software support is a big job.

During workshops I can immediately see how people expect something to work, and during practical experimentation either new uses of existing set of tools occurs or some obvious functions which are missing are discovered and eventually implemented.

The process is quite different when developing my own projects, as I know the tool intuitively, and a specific project often demands specific features or tweaks to existing features which wouldn´t make sense to put into a public release.



VPT is made available through my project blog “Conversation with spaces”. Updates, documentation and feedback from the user can be found there. Feedback from the blog are usually bug reports, questions regarding how to use it (90% of the questions are from people who haven´t bothered to read the manual or watched the tutorials), and some suggestions for new features.

As of now, this tool is the only free mapping/masking tool available for both mac and windows, and has a user base spread all over the world, ranging from art students, VJs and professional artists. It was initially intended as a tool for experimentation, but is now complex and stable enough to be used for performance and installations.

VPT is programmed in a graphical programming environment called max/msp jitter. Max/msp jitter is a program for making programs, you build your own programs in a very visual way by working with boxes representing objects with different functions. These boxes have inlets and outlets which allows them to receive and send information to and from other objects, which are connected together with patchcords, reminiscent of analogue synths.

A program made in max/msp jitter, often referred to as a patch, can be compared to building a circuit board, where you

control the flow of information using the various objects connected together, so you get a very visual representation of what the patch actually does. The program structure and the GUI (Graphical user interface) as presented to the user are identical.

Max/msp jitter was originally a visual programming language developed at IRCAM [5] in Paris, based on the midi protocol to make the computer able to talk to synthesizers and external controllers like faders,knobs and sensors. Over the years it has expanded to include both audio, video and 3D capabilities, so it is a tool that opens up for cross-media applications.

It has a dedicated user base which share their own patches (programs) and extensions, thus contributing to the further development.

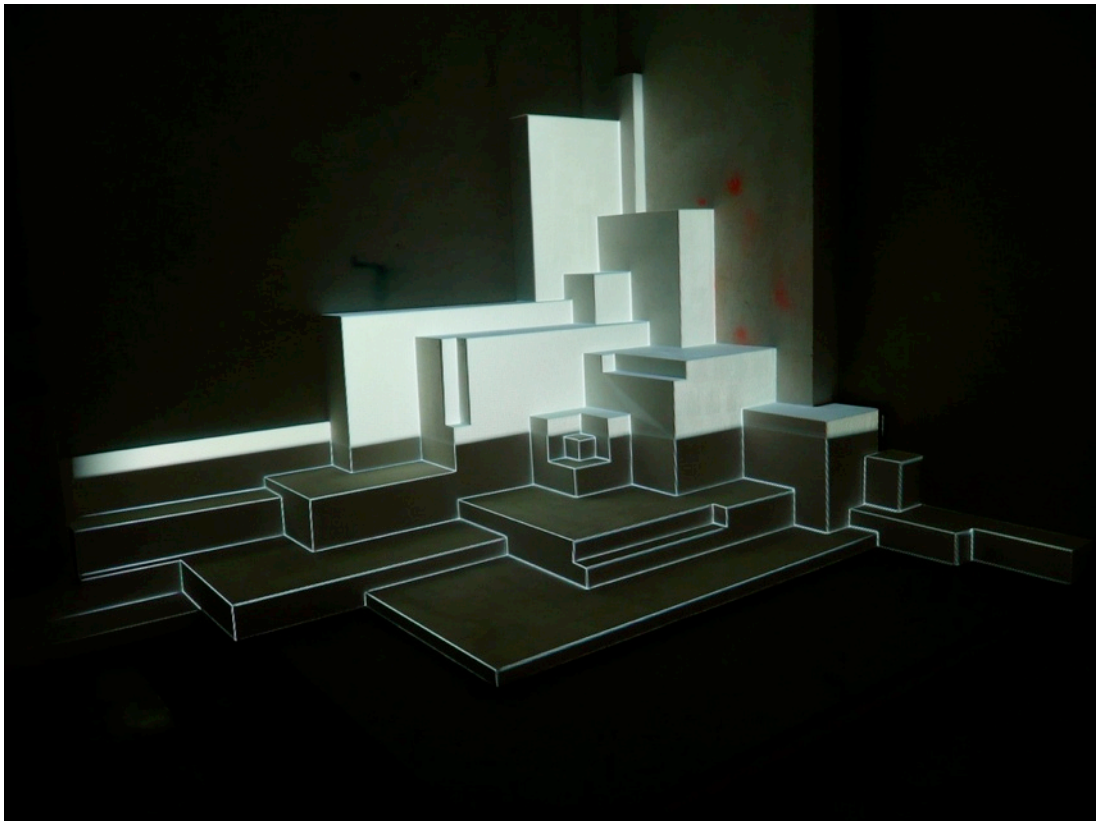
Max/msp jitter and the range of extensions available make it possible for artists to design their own programs without the knowledge of a programming language like C.

An extremely useful feature is the possibility to make so-called “standalones”: a program created using max/msp jitter but which runs without the user needing to install max/msp jitter. This makes it possible to distribute applications like VPT to people who don´t own max/msp jitter or who know nothing about the programming environment in itself.

It has been my main software platform for 10 years, and I have used it for live improvisation, real-time audiovisual installations, creating raw material for single channel videos like shiva, control of different hardware devices like light dimmers, video switchers, pan/tilt motors, and of course the whole *nodio* project has been developed using max/msp jitter.

[5] Institut de Recherche et Coordination Acoustique/Musique

Valbuena & AntiVJ



Pablo Valbuena: Augmented Sculpture
Ars Electronica 2007

In september 2007 I went to ARS Electronica in Linz, and was recommended to see Pablo Valbuena´s *Augmented Sculpture*. It consists of a physical structure in the corner of the room, with the exact same virtual shape projected onto it using one projector. By then animating the color and lighting of this virtual shape, some very interesting light/shadowplays takes place.

From Valbuena´s description of the work:

> This project is focused on the temporary quality of space, investigating space-time not only as a three dimensional environment, but as space in transformation.For this purpose two layers are produced that explore different aspects of the space-time reality.
>
> On the one hand the physical layer, which controls the real space and shapes the volumetric base that serves as support for the next level. The second level is a virtual projected layer that allows controlling the transformation and sequentiality of space-time.
>
> The blending of both levels gives the impression of physical geometry suitable of being transformed. The overlapping produces an euclidean three-dimensional space augmented by a transformable layer that I can control, resulting in the capacity through the installation of altering multiple dimensions of space-time.[6]

[6] http://www.pablovalbuena.com/

His work was developed in one of the Interactivos? sessions at the Medialab Prado in Madrid, collaborating with some game designers. They managed to make a perfect match between the virtual form and the physical form, and by placing the form in a corner of a space they avoided any issues with shadows from the projector. The modelling and animation was done in a standard 3D software and then rendered as a video to be played back and projected on to the physical form.

Some of the differences between his work and my work with the shift installations:

Playback - realtime
Mapping (3d model)- masking (working with individual surfaces)
One complex form - many simpler forms
Changes within a form - relations between forms
Ambient sound - specific sound related to the video
Playback from speakers - objects projected upon also produce the sound
Solid line,monochrome surfaces/light - combination of color,texture, video

While Valbuena has received a lot of attention for his augmented sculpture work, the projection mapping poster boys are AntiVJ:

> AntiVJ is a visual label initiated by European-based artists whose work is focused on the use of projected light and its influence on our perception.
>
> Clearly stepping away from standard setups & techniques, AntiVJ presents live performances and installations where projection on volume, visual mapping, tracking and augmented reality, stereoscopy and holographic illusion are providing to the audience a senses challenging experience. [7]

The output ranges from small-scale projection experiments on paper models to large-scale projections on buildings and even one inside the cathedral of Breda. They have become experts at animating buildings, creating spectacular perspective depth illusions, making elements of the architecture detached from their very solid fixtures.

I find the work of Valbuena and AntiVJ quite interesting, but I think it is worrying that a certain type of aesthetic has been established which is recycled with more or less success by a lot of people: animated solid lines outlining the geometric forms, which are then filled by solid white, different patterns and color, and sometimes shadows to create illusion of depth.

It has become standard decoration at big club events or technology related festivals and feels like a stagnation considering all the possibilities.

One recent eye-opener for me was actually a commercial for the footwear maker Puma, which used video mapping as a set design to instantly change from one space to another.[8]

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[7] http://www.antivj.com/

[8] http://vimeo.com/3605859
http://www.droga5.com/

Michael Naimark: Displacements [9]

A different approach to projecting onto objects and surfaces came from Michael Naimark in the early eighties. He wanted to introduce a sense of spatiality by synching projection movement with camera movement (rotation). The projected image moved around the space, while images of stationary objects stayed put on the walls of the playback space: The frame moved instead of the object. The effect was exactly equivalent to viewing a dark space with a flashlight.

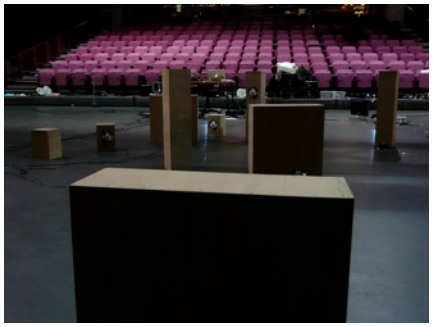
In the article "Spatial Correspondence" he describes the relation between the record space and the playback space:

> The concept of spatial correspondence was incorporated into an art piece that attempts to address the distinction between "real" and "movie" in a most direct way. It involves the creation of a living room space, complete with sofa, tables, television, wall hangings, etc. From the center of the space, a 16mm camera is panned on a one rpm turntable, shooting the space and people interacting with it. After shooting all objects in the room are secured in place.
>
> Then, the entire contents of the room are spray-painted white. Everything.
>
> The result is a moving movie projection, where everything is projected back onto itself, now white, acting as its own screen. Such projection, sometimes called "relief projection", is truly 3D. All objects appear astonishingly real. (All people appear equally unreal, as their images wrap flatly around the objects in the room.)
>
> Consider filling all surfaces of a media room with imagery. The viewer can see everything merely by eye movement: display bandwidth is high, interactivity bandwidth is zero. Now compare to a video flashlight: display bandwidth is much lower, interactivity bandwidth is non-zero. In both cases, the user decides what to see. The real-world analog is the difference between turning on an overhead light and using a flashlight. (Naimark:81)

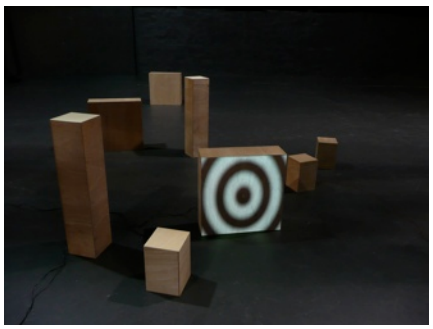
[9] *Displacements* was first made in 1980, recreated in 2005 using digital video.

Teatergarasjen: combining projections with nodio

In april 2008 I got the opportunity to borrow the large theaterspace of Teatergarasjen (a space which was demolished shortly after), a stage where I have had the chance to show several of the KreutzerKompani performances. This gave me the opportunity to extend my masking projection project, by being able to work more with depth, and to introduce sound.



Prior to working at Teatergarasjen I had constructed plywood boxes in three different sizes (60x60x20 cm, 90x20x20cm,30x20x20cm). They were untreated as I wanted to emphasize the idea of a second skin when projecting onto the boxes.



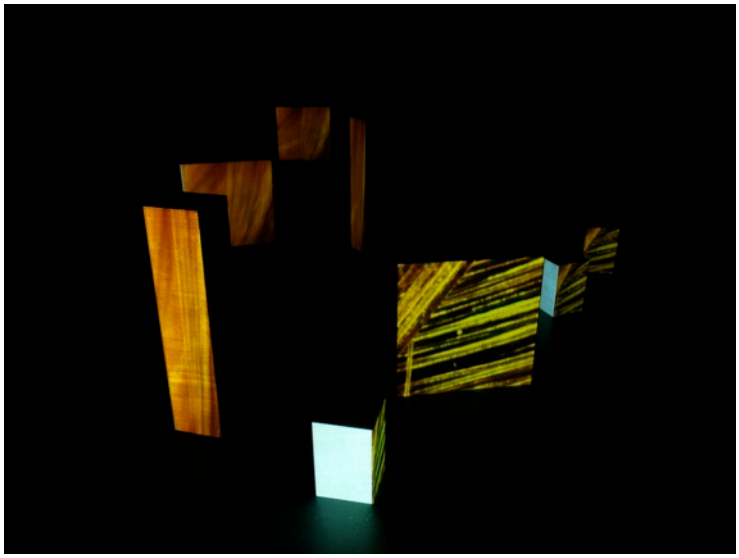
I spent quite some time on the programming side as this was the first time since the 2007 lab I got the chance to work with the masked projections. I rewrote the original VPT completely, as well as implementing the *nodio* system, so that each projected surface would be a node in the system. This meant that when something was projected on one of the faces of a box, this box would generate sound based on what was projected on that particular box.

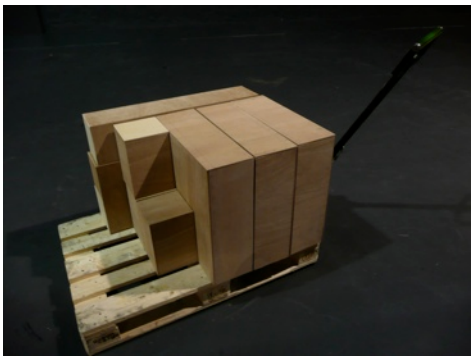
I used sound transducers placed on the inside of the boxes, making the wood of the box vibrate to produce the sound (instead of a traditional speaker that moves air). Because of the different sizes of the boxes the sound resonated quite differently, which gave the setup an additional quality.

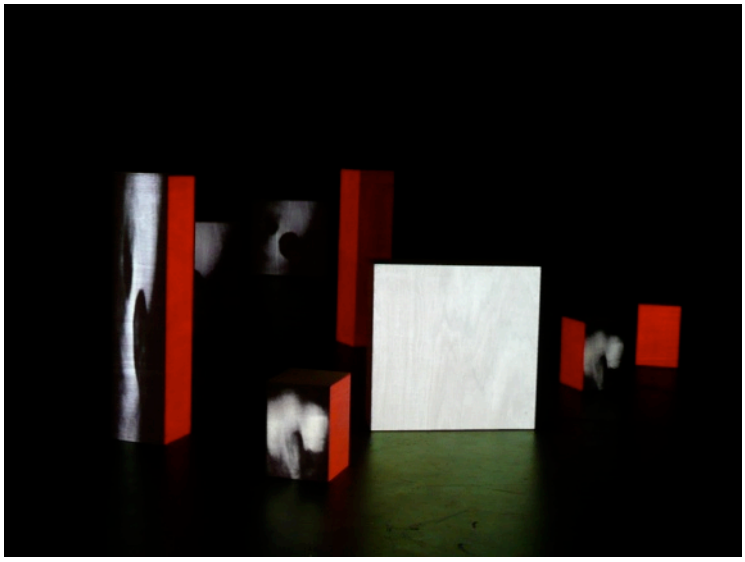
I made some further attempts at projecting 3D forms (cubes) onto the physical cubes and got half-decent results, but decided to put priority into experimenting with creating movements between the different boxes, composing with image, sound, movement and space.

I thought about combining the projection surfaces with monitors, but decided against it.

I spent most of the time working on relations between projected surface and sound produced, and worked with different ways of constructing sequences, for instance some loop being moved from box to box, one at a time, three loops moving together etc. This was partly transforming some of the results from the *nodio* lab in 2007.







Medialab Prado

In may 2008 I was invited to Medialab Prado in Madrid to contribute to a ongoing series of lectures and workshops called "light,space and perception" organized by Pablo Valbuena, Daniel Canogar and Julian Oliver. The aim of these series was

> to conduct research and experiments with the use of light, projection, and visual perception in different settings, gathering people from fields including architecture, visual arts, urbanism, stage and set design, programming, physics, optics, psychology, and the physiology of perception. [10]

It was obviously a very interesting context for my own work. My contribution to "light,space and perception" was a presentation related to dynamic spaces and my own work, as well as an intensive video projection workshop. The contrast from the workshop at KHIO the previous year was massive: At KHIO there were 9 students working at 3 work stations for a week. In Madrid it was 50-60 people on 3 stations for a couple of hours.

It went surprisingly well, and pushed the development of the software further, especially on the documentation side, to make it possible for the most enthusiastic people to continue working with it (One guy had driven all the way from Bilbao for my presentation). I was really amazed by the energy and enthusiasm displayed by a very diverse group of people, in terms of age (oldest was around 75), gender and background.

It seems like Medialab Prado has found a good model for a medialab, with a heterogeneous user group, a high level of activity with many projects going in parallell. Their focus is on production and collaboration through workshops like Interactivos? and the exchange and discussion of ideas through weekly meetings like openlab. The Medialab has avoided the festival/exhibition approach which in my view makes similar institutions less attractive as their resources are bound up on large scale once-a-year projects (maybe just lasting a few days) instead of having a steady level of activity spread out over many projects and throughout the year.

Medialab prado tries to develop knowledge within the user base. For instance, if they organize a workshop on physical computing, the participants´ newly gained knowledge is used in later workshops, so that they maybe don´t need to get an external workshop leader, at least not for the basics. In Norway it seems to be a tendency to always look for the big names when organizing workshops, so if you want to have an introduction workshop on the Arduino microcontroller you would try to invite one of the people who created Arduino, instead of using local knowledge. This also results in that every workshop becomes a beginners workshop, and what´s the use of inviting an expert on electronics to learn people how to solder or make a LED blink?

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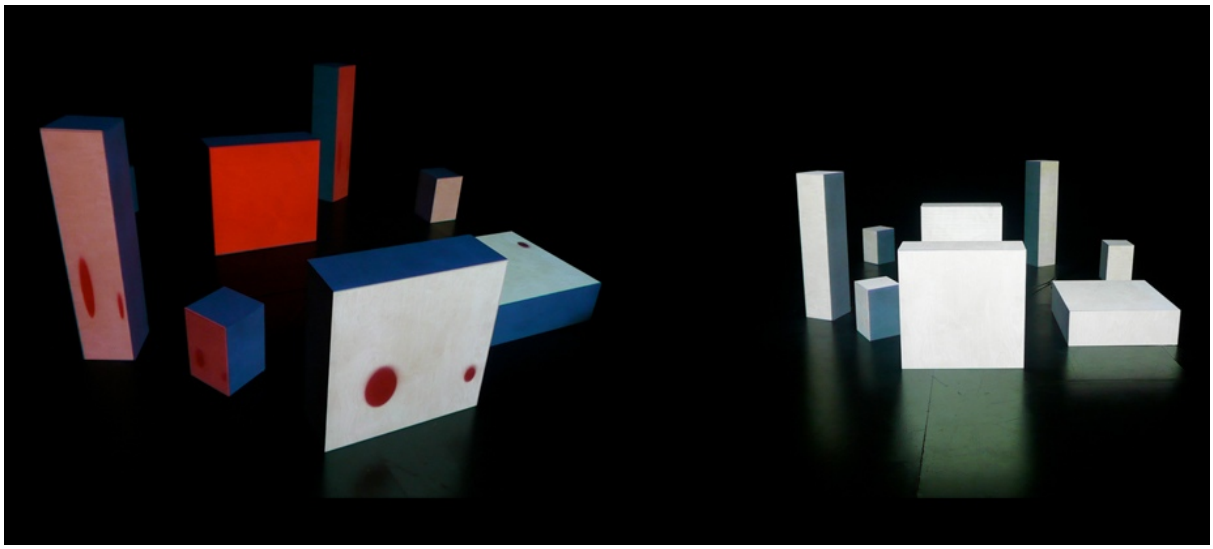
[10] http://medialab-prado.es/article/luz_espacio_y_percepcion_

Shift



Light snaps, precise and sharp, shutter sound, revealing these hidden geometries, a movement from surface to surface as sudden as the click of your right hand, rhythmic light jumps, discontinuous.

Now think on a larger scale: the same occurring on skyscrapers across a cityscape, an urban environment unfolding and explored, a story of a city told through bars of light dancing across its surface, its harbour, its derelict abandoned ex-industrial areas and gentrified alike, a geography of light.

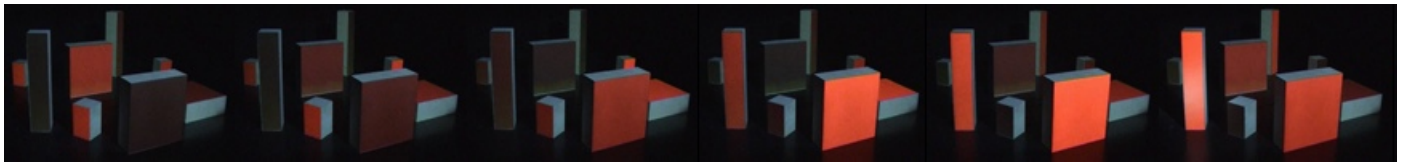
Robert Wilson:

Without light there is no space.

…——

Now this would put Hong Kong's 8pm so-called Symphony of Lights to shame. [11]

In october 2008 I was invited to participate in an exhibition at Museet for Samtidskunst in Roskilde. This was finally an opportunity to show a projection mapping piece to the public.



[11] The blog *obstruction theory*: http://obstructiontheory.com/2008/11/24/as-a-light-dances-across-the-city/

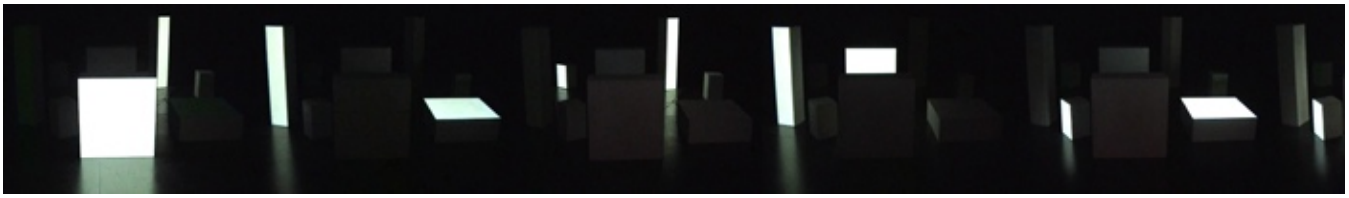
> You enter a darkened space with several small screens of different sizes placed at different depths and angles in the room. If you look closer you will notice that the screens are actually surfaces on plywood-boxes. The image and sound seem to travel together through the space, moving between the boxes, creating rhythms of light and sound in the space.
>
> Shift is an installation where I explore the idea of focusing a space through image, light and sound. I try to create dynamic spaces by projecting and placing video and sound into a three-dimensional physical space, and to create movement by moving image and sound from object to object in the space.[12]
>
> I decided to give my current series of projection works a name, shift: moving from one place to another, changing the emphasis, direction or focus of something.
>
> It also has a loose relation to the idea of shapeshifting.
>
> As mentioned in my previous posts about my relief projection projects, shift combines multichannel sequencing, audio generated from video, with masking/mapping a projection to fit physical objects. This creates a dynamic audiovisual landscape, a spatial light painting.[13]

I wanted to make a structure that combined long drone sequences and rapid sharp sections, contracting and expanding the space in different ways. The structure should work independent of when people enter the space, so no particular beginning and end.

The visual material was very sober, mainly monochrome colors and some dot patterns. The dot patterns produced sounds in a similar way that the pins of a music box do. As in the work from Teatergarasjen, the sound was produced by the boxes, and generated based on an analysis of the visual material projected onto each box.

After the physical setup and masking of the boxes was finished, which took a few days, I had almost a week to create a composition using this setup. I started by building up individual scenes (or sections) and then creating an overall structure for the scenes. This process involved a lot of waiting, observation, feeling, small adjustments, and more waiting, until I was happy both with the internal dynamic within a particular scene, the transitions between the scenes and the general rhythm and energy of the work.

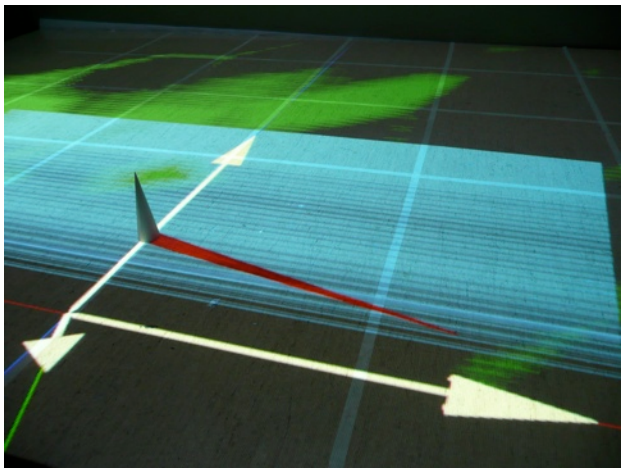
Being able to compose in real-time in the space of the installation allows me to work in a much more intuitive way than having to prepare material in advance and then try it out later in the space.



[12] From work description, in the book based on the exhibition

[13] From conversations with spaces blogpost about shift

Shadowlab 2009



In january 2009 I had another projection lab, where the main focus was to create fake shadows for physical objects. I had spent a lot of research on how to create shadows in OpenGL using max/msp jitter but without satisfactory results.

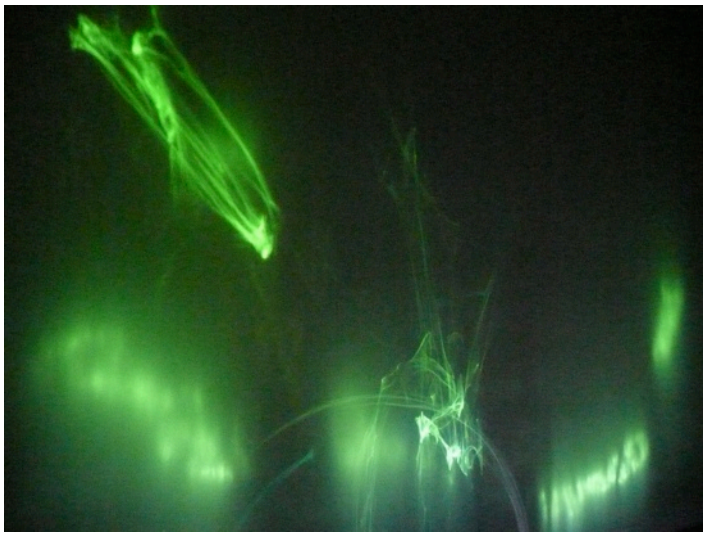
One of the aims was to create a sundial (for rainy days).

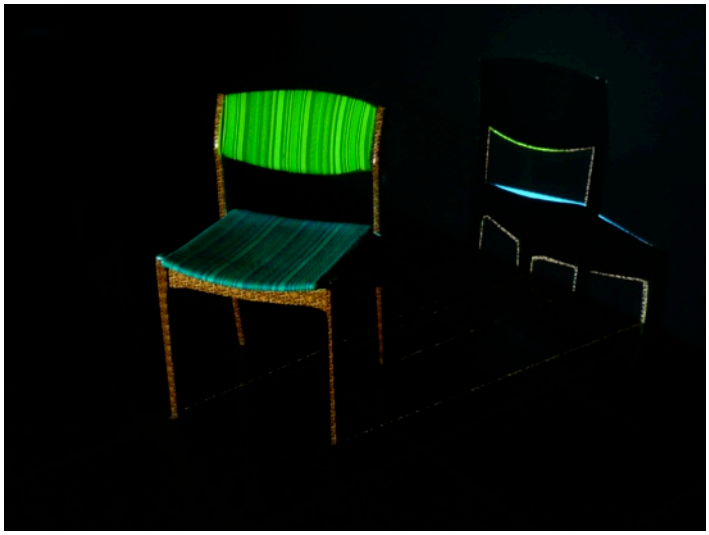
Since I was not getting anywhere with jitter, I wanted to either try to pre-render a 3D scene and play it back, or try out vvvv, a windows only application with a similar graphical programming approach as max/msp, but with a much more sophisticated grip on 3D and projection.[14]

I decided to dive into vvvv, to be able to work real-time with 3D models, light and shadows in a physical setting. This meant a lot of the time was spent on measuring, calibrating,re-measuring, tweaking over and over again. I got some quite decent results, but not quite satisfactory. It also meant learning the logic of a new software. The most frustrating was not being able to ask someone, or participate in a workshop to work hands-on solving these issues. It did however give me several useful tricks for calibration, including placing a camera by the projector, which then sees more or less the same as the projector projects.

After a lot of trial and error I was able to make a quite acceptable animated sundial shadow with a cone casting the fake shadow.

[14] "vvvv is a multipurpose toolkit focusing on real-time video synthesis, connecting physical devices, and developing interactive media applications and systems."
http://vvvv.org/tiki-index.php?page=Propaganda





More or less by accident I started working on reflections from the video projector bouncing on the linoleum floor onto the wall, creating some interesting images.

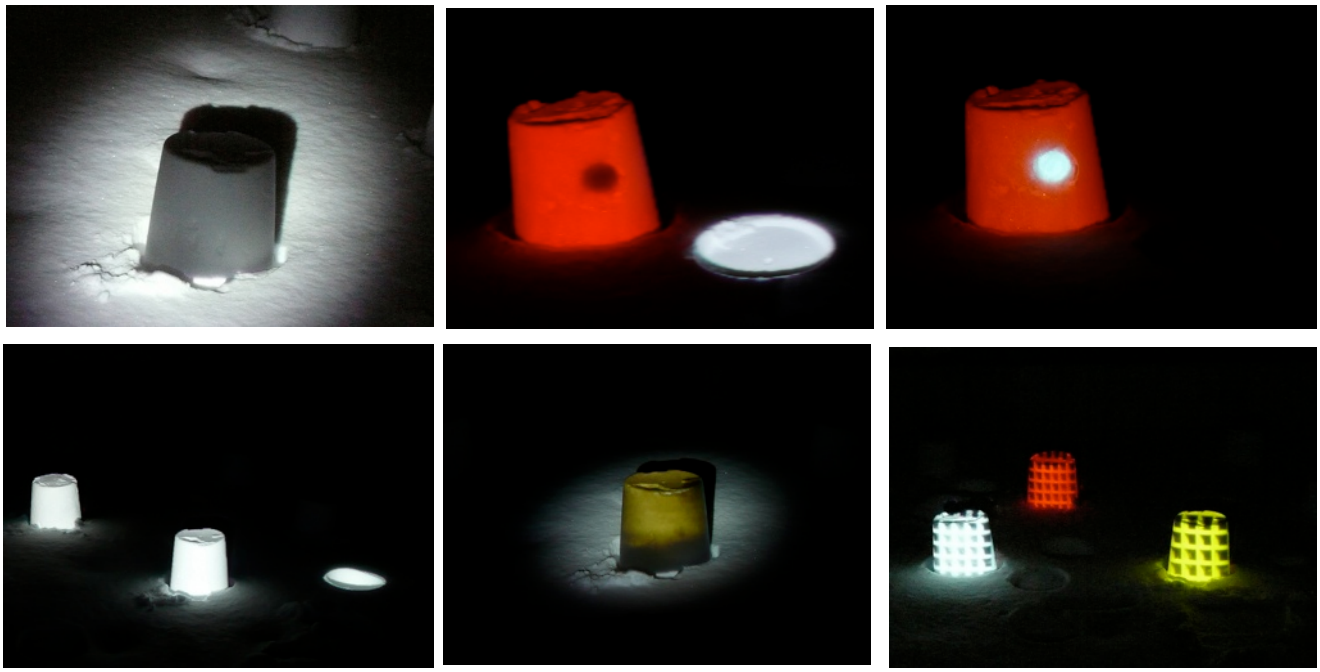
I also worked on the idea of painting with light, using the video projector to “paint” a chair.

The most concrete that came out of this lab, was that I was able to get the functionality of corner-pin distortion in max-msp jitter. Corner-pin distortion allows you to distort the perspective of an image by moving its corner points. This is very useful when working with projections in physical spaces. For instance if you want to project onto a normal rectangular screen you often get a trapezoid image if the projector isn´t positioned exactly right in relation to the screen. This is normally resolved using the keystone function on the projector. With corner-pin distortion you just map the corners of the projected image to the screen´s corners.

Corner-pin distortion is a built-in feature in vvvv, but by initiating a discussion with one of the jitter developers on the jitter online discussion forum, a way of doing this in jitter was exposed. This functionality was included in the next update to VPT, and was a major breakthrough, as it reduced the time to mask projections to surfaces and objects dramatically.

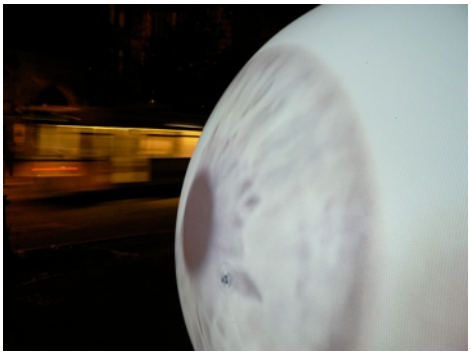
Snowlab

It doesn´t often snow in Bergen, and when it does it usually melts away almost before the snow hits the ground, but for a week in the winter of 2009 Bergen turned white and I got a chance to test out projection on snow.



I was both interested in the material quality of snow, being white and easy to form to different shapes, but also its temporal quality: eventually it melts and disappears. Two days after my projection experiments all the snow had rained away.

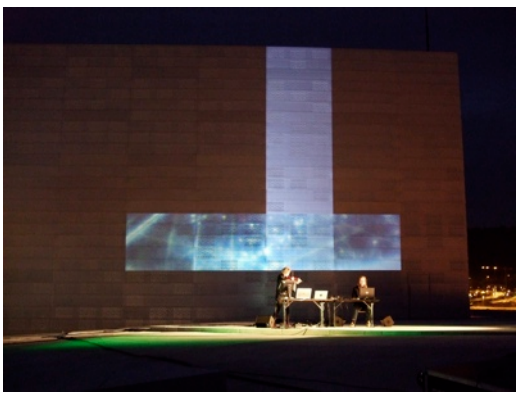
I first got interested in the temporal quality of the material used as surface when working with Iball in Berlin 2006, where I projected on an inflatable sphere.



Snowlab was a chance to test out the new mask drawing features of VPT, making it much quicker to work, so just in a few hours I was able to create some interesting sketches. I took photos of the snow forms from the position of the projector, and used that as departure point for creating the masks.

Operahouse roof

In april 2009 I was invited to be part of a concert on the roof of the new operahouse in Oslo, with an ongoing collaboration between composer Knut Vaage, violinist (and research fellow) Victoria Johnson, Thorolf Thuestad on electronics and myself on video. The operahouse is built mainly from white marble, and the roof of the house is accessible to the public, and has quickly become a popular spot to hang out (a urban iceberg/ mountain).



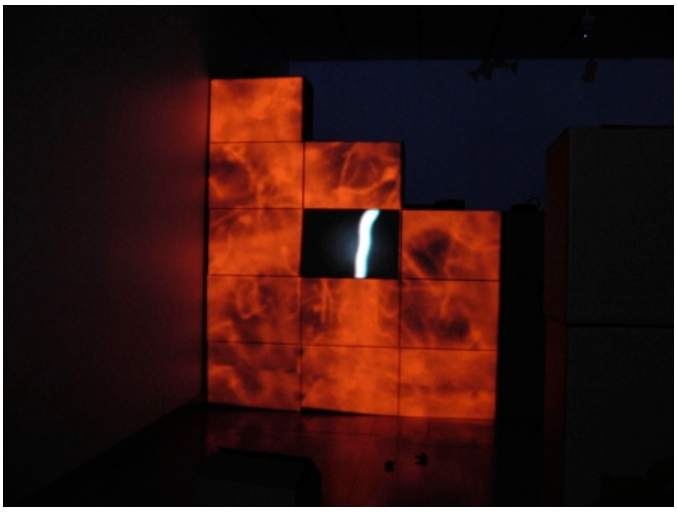
The concert was to take place in front of the stage tower, which is covered in aluminum plates with patterns of dents and bulges reminiscent of braille patterns for the blind. The plates with the dot patterns was created by artists Løwaas and Wagle as part of the commissioned artworks for the opera house.

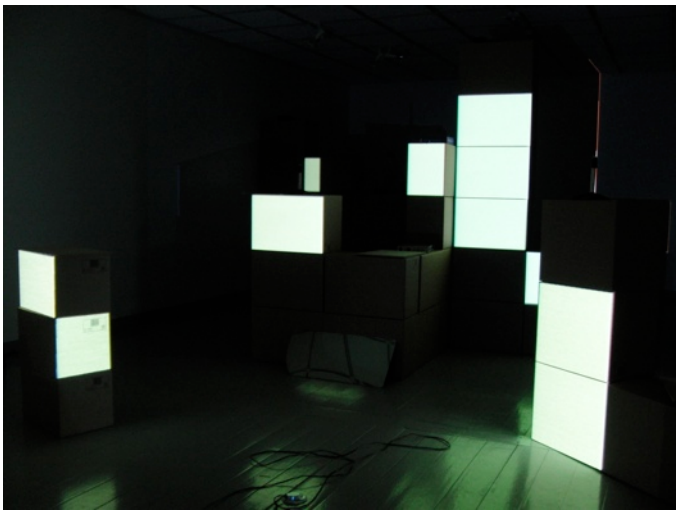
The rectangular plates are mounted in a grid on the wall, and I decided to use the structure of the wall as a way of organizing the image in the 16x12m projection, so I used VPT to mask out horizontal and vertical stripes. This was an important test on how quick it would be possible to work with the tool, as the time from it was dark enough to see the projection until the concert started was roughly an hour. It was also an opportunity to realize how cold it is to work on a laptop outdoors in Norway on a chilly spring evening (which is an interesting challenge for doing the snow projection project in January, in Tromsø in the north of Norway..).

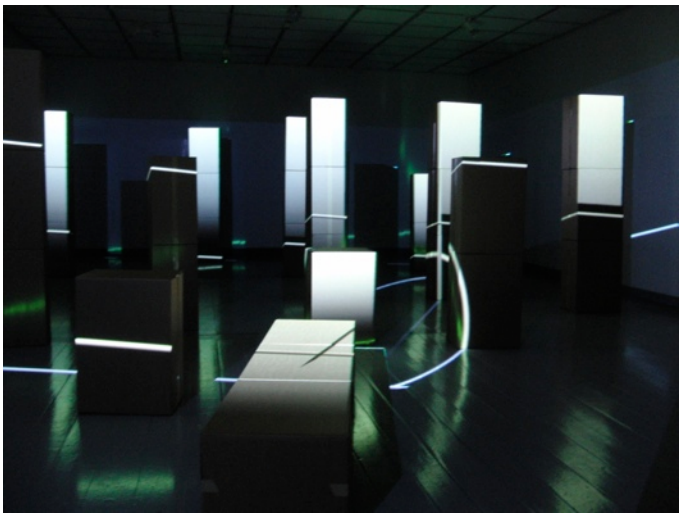
HKS summer camp

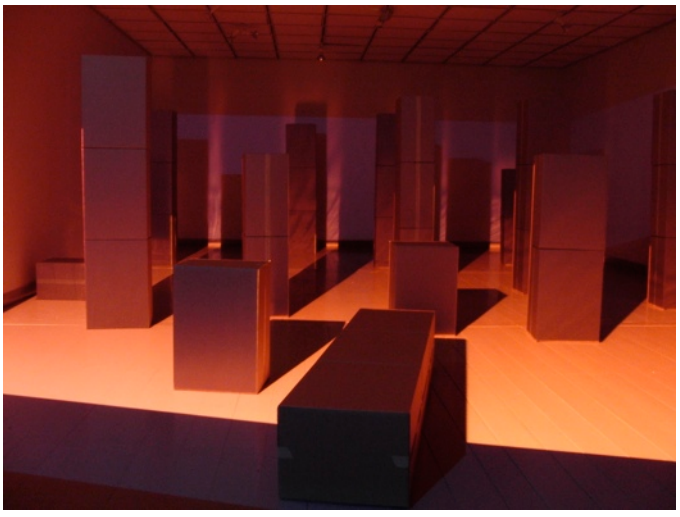
I was given the opportunity to work in the gallery space at HKS most of the summer, which gave me the possibility to try out many ideas for the upcoming exhibition. Instead of working on one idea preparing for the exhibition I decided to turn it into an extended lab session, unofficially known as HKS summer camp. The focus of the summer camp was light, shadow and projection.

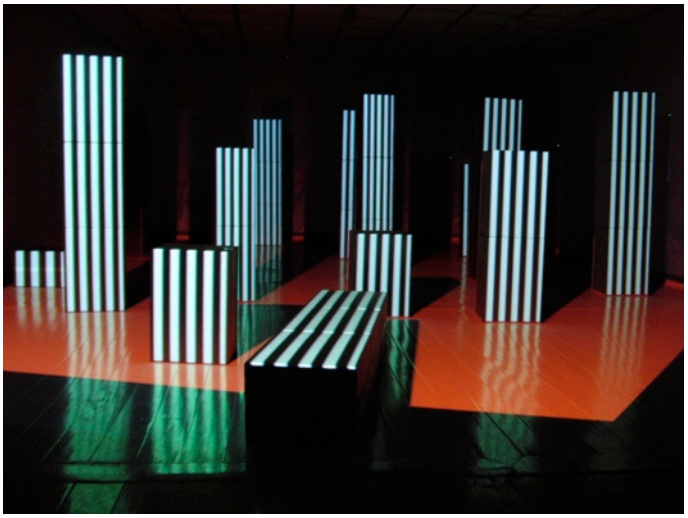
I wanted to explore many different scenarios for projection onto different structures and decided to use a type of building blocks which made it possible for me to easily build and reconfigure new spaces without great effort: Cardboard boxes. Cardboard, apart from being practical and recyclable, also has some interesting qualities as projection material. I wanted to play with the contrast between the ordinariness of cardboard boxes in normal light, in contrast to what they could be transformed into using masked projection. I got hold of over hundred boxes, and started to build corridors and walls with them. I also experimented with using the inside of the boxes, the idea being to have a projection surface on one side and long corridors lit up with light on the inside of the cardboard box structures.

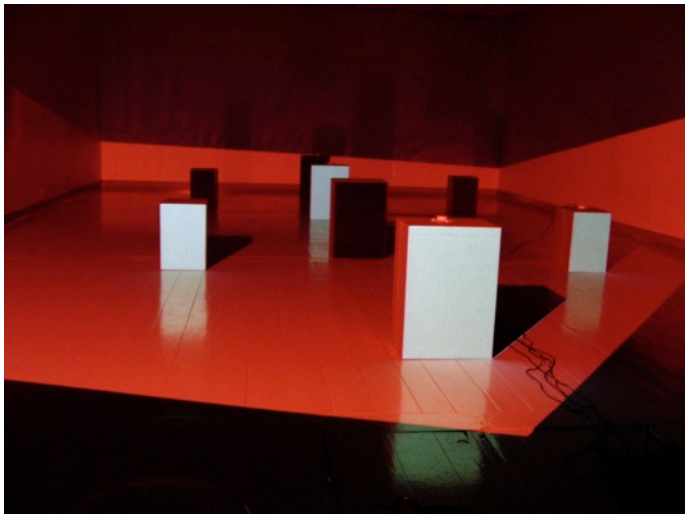








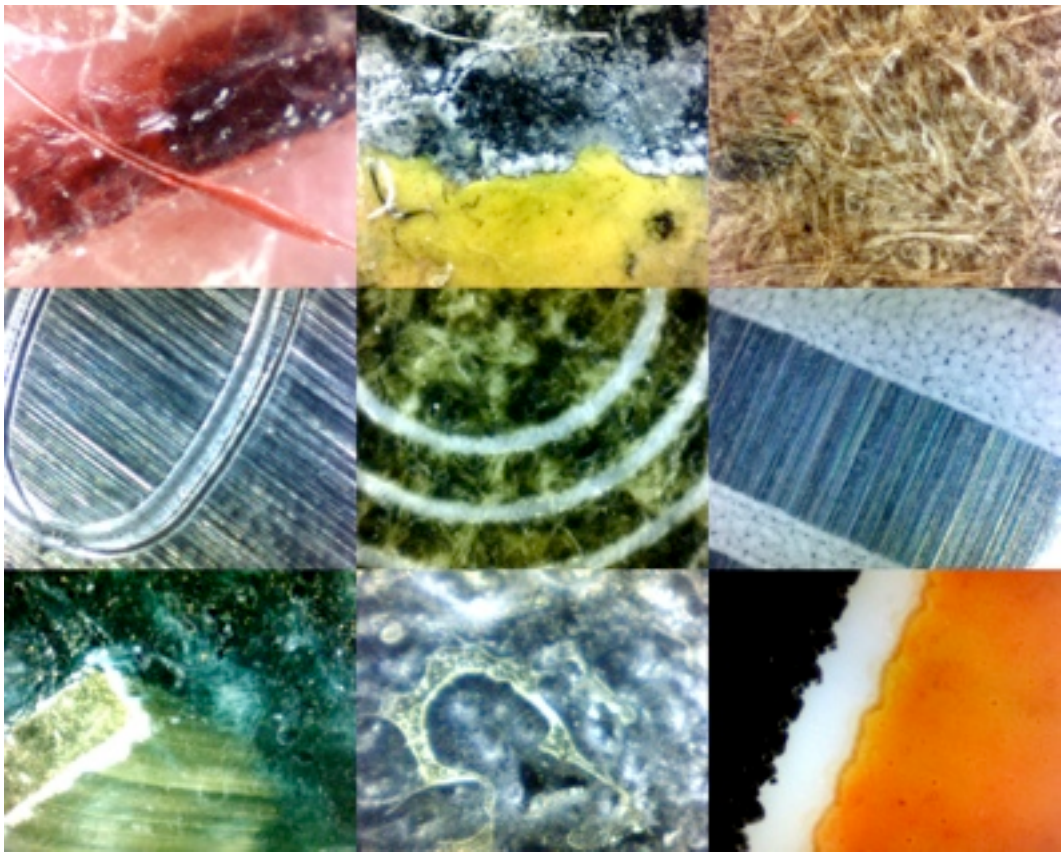




I produced some visually interesting images using lots of boxes, but gradually reduced the number of boxes. At the end of the summer I was down to eight, and created some simple sequences combining simple sine tones with movements between the boxes. I realized eventually that what was happening around the boxes might be more interesting than what was happening on them: The shadows of the boxes reflecting onto the walls, the reflection of video from the floor hitting the boxes and walls.

INTERLUDE

mikro



My initial interest with microscope images was the scale, to see something which is all around us but at a completely different scale, detaching the object from it´s more recognizable form at normal scale, and turning it into texture and color.

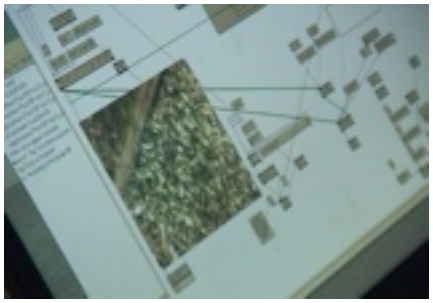
I have also found it interesting to create movement through animation, to give a time dimension to a series of stills, like I discussed in the liquid space workshop, how the rhythm and speed of the animation affects our notion of time.

The idea of animation, giving life to dead objects, runs through the whole project, animation through motion, by projecting, displacing and reassembling.

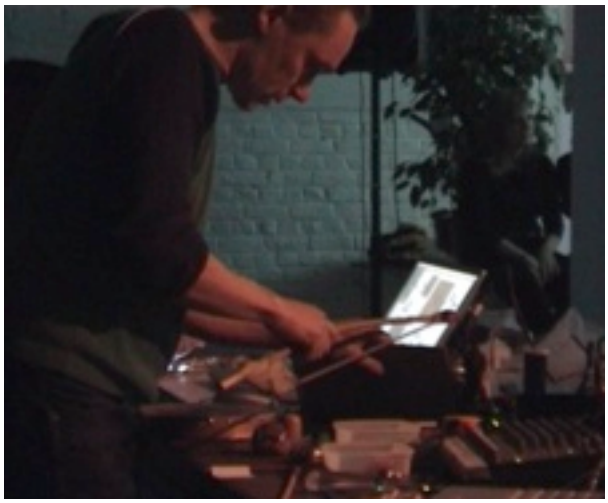
I have for many years worked with real-time buffers both for live improvisation, dance and installations. The buffer contains a series of video stills, either captured from a connected camera or sampled from an existing movie file or still image. The buffer can be accessed and played from any point and in any order, thus being able to reshuffle the frames of a video sequence, or construct a video sequence from a series of stills, which is the case in the *mikro* performances.[15]

[15] First performance was at Paradiso in Amsterdam in February 2007, then a tour followed in the fall, to various venues in Netherlands, Belgium, Poland and Norway.

For the *mikro* performances I wanted the buffer to be quite short, just 50 frames, which would be just two seconds if played back at normal speed. I made the playback and recording quite simple: recording would happen at random frames, and I can control speed and playback mode (normal loop, palindrome,random single frames, or “drunk”, where the next frame deviates within a given range from the previous frame), and blending frames.



The focus for me as a performer is on the choice of materials and the use of the microscope, using them as tools of improvisation. The result is a visual explosion of textures, which in some ways can resemble experimental films in the style of Stan Brakhage.



The performances are a collaboration between sound artist Justin Bennett and myself, and are completely improvised. My source material is always found at the locations we perform, so it is a very direct way of relating to the local environment, a site-specific project, but at the same time being so abstract it is completely cut off from it´s origin, which are very mundane objects like coins, empty beer cans, a towel, a broken saw blade, some sand, a plastic bottle, a fruit, etc. It is a way of creating a poetics of everyday, turn something unspectacular into a intense audiovisual experience.

I was invited to provide visuals for a concert with Sidsel Endresen and Punkt (Bang - Honoré-Bøe) which was a remix of a concert by BJ Nilsson and Hildur Gudnadottir. I followed the concept and sampled still images from the first concert which became the departure point for the second. A large video projection behind the musicians panned slowly . And the images became more layered during the course of the concert as new images from the ongoing concert was added to the buffer. The main difference from the *mikro* buffer was that the source was a live camera, and that new frames were inserted into one very long image file, so instead of having a series of frames, the buffer was a widescreen canvas, where new frames would partially overlap with old frames, creating a more and more dense panoramic landscape as the concert progressed.

Bennett and I did a short experiment with this type of buffer in may 2009, but it did not work so well with microscope textures somehow, which are already so dense.

I have used microscope textures as material for several projects the last few years, because it has this dynamic quality of being context specific yet abstract.

The two main projects was collaborations with two different composers, Yannis Kyriakides and Knut Vaage.

The piece *The queen is the supreme power in the realm*[16] composed by Kyriakides was a commission by Zentrum für Kunst und Medientechnologie (ZKM) and the Köln based contemporary music ensemble Musikfabrik. Kyriakides based his music on old british telegraph code books, and I used a mix of scanned pages from these books with microscope images of the letters. I animated this material in many layers. I was interested in combining the images from two overlapping projectors, so the layering both happened inside the images but also as a result of how they overlapped on the performers on stage and the screen behind them, how images from one projector filled the shadows from the other one. It was a way of using the animated layers as light.

The other project was a collaboration with Vaage for *Multimorf*, originally a piece for a electric violin, electronics and a brass band and video, later reduced to electric violin, electronics and video.[17] My source material was based on the first version with the brass band, as I used microscope textures from their instruments as material. I combined a very slow zoom into some of the textures with some rapid animations.

[16] It was first performed at ZKM and the Köln Triennale in may 2007, then at the Moers festival the year after.

[17] It was first performed at USF in Bergen in September 2007, then at the Oslo Concert Hall in September 2008, and finally on the roof of the new Opera House in Oslo in April 2009. See the Opera House roof section for more info and images.

TRAJECTORY 2

Physcomp/ubicomp

Just after starting my research fellowship in October 2006 I attended a seminar in Oslo organized by Atelier Nord called Interface and Society. The seminar featured prominent speakers like Bruce Sterling and Adam Greenfield, which both delivered interesting presentations. The buzzword of the conference was ubicomp, or ubiquitous computing, a term coined by Marc Weiser:

> Ubiquitous computing names the third wave in computing, just now beginning. First were mainframes, each shared by lots of people. Now we are in the personal computing era, person and machine staring uneasily at each other across the desktop. Next comes ubiquitous computing, or the age of calm technology, when technology recedes into the background of our lives.[18]

> Ubiquitous computing (ubicomp) is a post-desktop model of human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities.
>
> At their core, all models of ubiquitous computing share a vision of small, inexpensive, robust networked processing devices, distributed at all scales throughout everyday life and generally turned to distinctly common-place ends.[19]

Sterling focused on different scenarios involving relations between physical objects and digital networks, including rapid prototyping, RFID tracking, searchable databases, recycling of physical objects using ebay etc.

Greenfield expanded on his book *Everyware*, which looks at already existing examples of ubiquitous computing, and possible future scenarios.

I have read *Everyware* and I have been intrigued by the idea of distributed computing, more or less invisible in our environment. I later found it as a more elegant way of describing one of the research areas in my fellowship, related to mobile devices, physical computing and wireless networks.

My interest in physical computing, or bringing the inside of a computer outside or vice versa, goes all the way back to my time at the Academy in Trondheim, where I invested a lot of time and money on different sensor/control platforms, including Icube, ADB I/O, the Handyboard (think C based, used a lot in lego robot building) and the basic stamp. I realized a few projects while I was at the academy, but I found it hard to develop this further, mainly because there was no education or resources available locally, and there was a limited selection of resources online.

In the end, I put this on the shelf in 1999.

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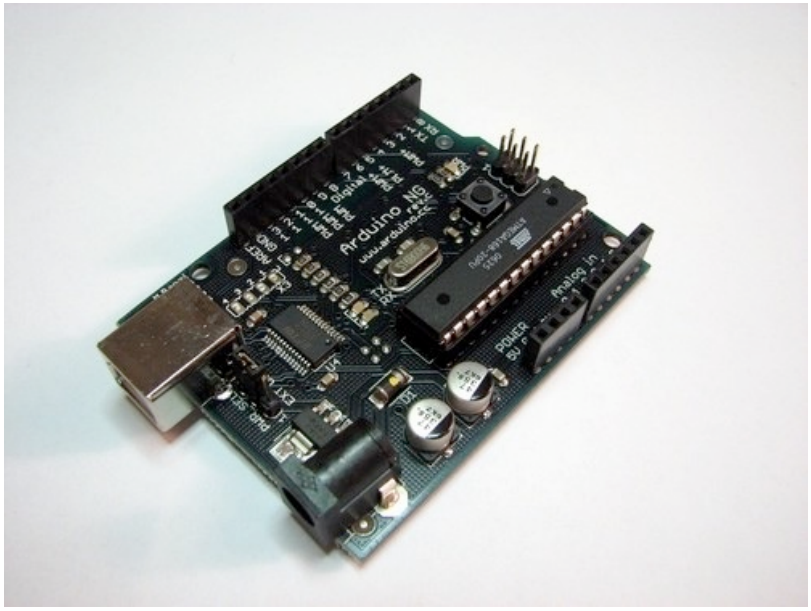
[18] http://en.wikipedia.org/wiki/Mark_Weiser

[19] http://en.wikipedia.org/wiki/Ubicomp



Almost ten years later, the situation is completely different. There are plenty of courses and classes for learning physical computing, there are many books available, and a massive amount of information on the internet through wiki´s and discussion forums. The technology has become much more accessible and affordable. The Arduino platform, which has played an important role for the widespread use of microcontrollers among artists, designers and students, costs only 25 euro.

> Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.
>
> Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP). [20]

Quite early in my project, where I have tried to establish different types of relations to spaces, it became evident that a lot of opportunities lied in giving electronics and microcontrollers another go.

One of my first investments was a microcontroller and the book *Physical Computing* by Igoe and Sullivan, which covered the basic physical computing topics: Connecting and interpreting data from sensors (digital and analog input) and controlling external devices like motors and lights (digital and analog output). This was a frustrating period, because there are so many sources of error if something doesn´t work as expected: you could have made a programming error, connected the electronic components to the wrong ports on the microcontroller, there could be a bad connection, a component used the wrong way etc. So without someone looking you over the shoulder now and

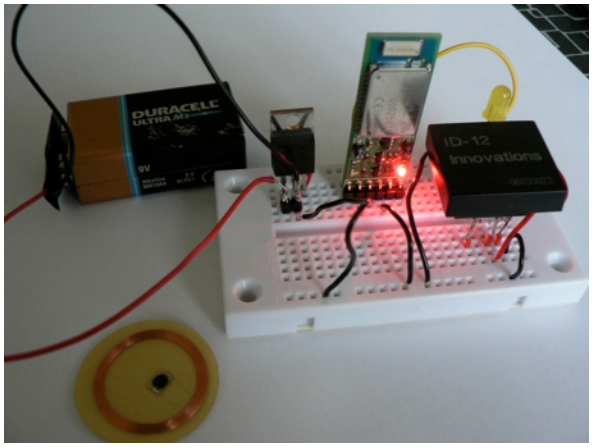
[20] http://arduino.cc

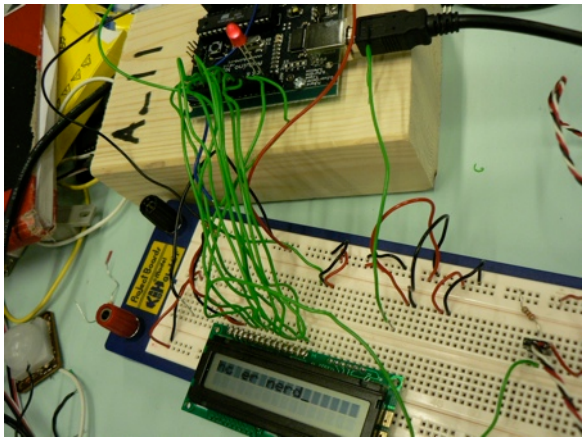
then, things move forward slowly. For some types of questions you could always ask on a forum, and then maybe get a reply immediately, or a day/week later.

What I needed was a workshop.

I was fortunate to be able to participate in a workshop at The Architecture School in Oslo (AHO), with Tom Igoe, one of the authors of *Physical Computing*. This workshop changed in many ways the focus of my project, as I realized all the possibilities at hand. It was an intense introduction to Arduino and Processing, covering basic input and output, serial communication, RFID, bluetooth and Xbee radio modems.

The essence was the easy way of communicating between computer and microcontroller, microcontroller to microcontroller, a network of physcomp devices, in many ways the core of ubiquitous computing.





At the time, Igoe was writing on the book *Making Things Talk*, which became an essential book in my work with developing *the wind-up birds*.

Soundpockets

Hauntings? Dimension Doors? Time tunnels?
A boy heard what appeared to be the sound of a sheep coming from the wall of Strykejernet Art School.
A bartender at Blå was concerned when he heard running water like that from a leaking water pipe. The sound disappeared before he was able to locate it.
A seagull can be heard, but is nowhere to be seen.
Soundpocket artist HC Gilje is causing slight disturbances in the urban interfaces.[21]

In the spring of 2007 I applied to participate in a project called Urban Interface, organized by Atelier Nord and curated by Susanne Jaschko. The exhibition, which was a follow-up to a similar project in Berlin, would feature art projects in public space in a few selected areas of Oslo.

I applied with a series of projects I called *Soundpockets*, where I wanted to create local, intimate sound zones, a way of linking points of sound together and to integrate these soundpockets into an already existing soundscape:

Soundpockets is a series of projects of intimate sound interventions in public spaces. By using fm radio waves, sound beams and miniature speakers to create local pockets of sound, the different projects have different scope and focus: creating private listening rooms, changing soundtracks of a location, displacement of time/or space and a bit of general disruption of everyday life.[22]

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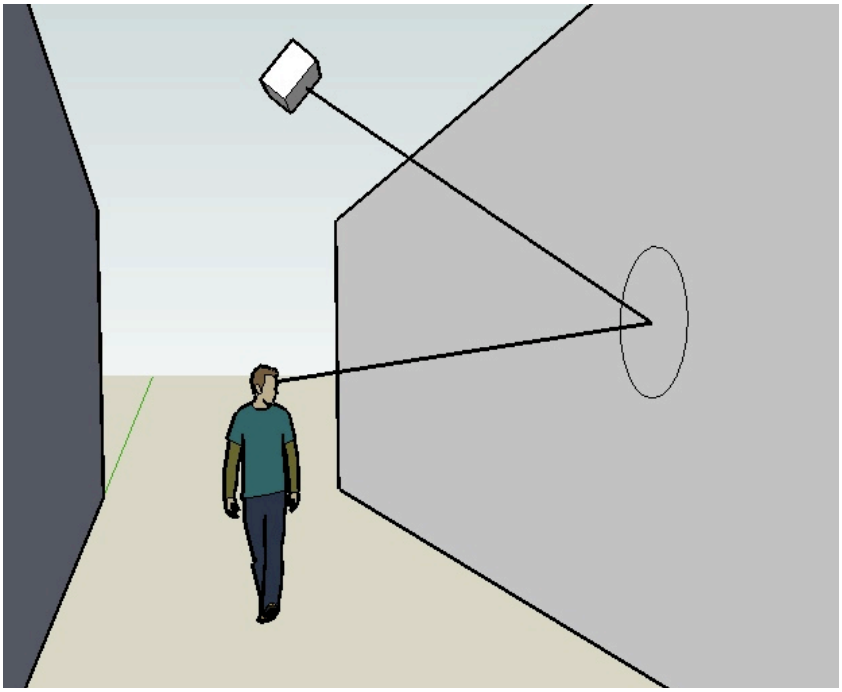
[21] http://oslo.urban-interface.net/articles/2007/09/12/hauntings-dimension-doors-time-tunnels/

[22] From the project proposal for *Soundpockets*

Due to economic and practical reasons I concentrated on two of the five suggested projects: Very local radio stations and sound beam.

Soundpockets 1: Directional soundbeam



Using a directional sound beam to project a localized sound into a public space: This sound can only be heard by people positioned within the radius of the sound beam, which can be as narrow as 50 cm in diameter. It is similar to a beam of light, only being sound instead. When it hits a surface it is reflected.

Soundpocket 1 was installed in a narrow passageway in Oslo, connecting two parts of the city. The sound beam was mounted on a pan/tilt head, making it possible to place the sounds very precisely in the passageway.

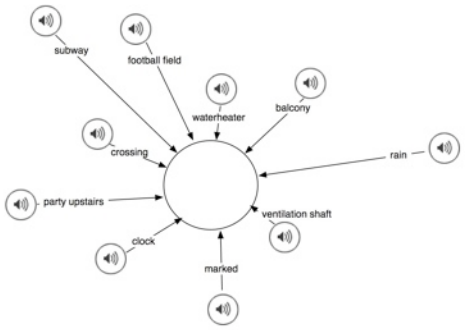
By bouncing the sound off surfaces, it seemed as if the sound is coming from a window, door, elevator, a poster on the wall, etc.. This made the piece into something which added another layer of sound to the existing soundscape, blending (sometimes disappearing) into the location.
Most of the sounds would appear to belong to the site, although dislocated (like the sound of the chandelier in the wind), the sounds of birds, telephones, babies crying, dogs barking, water running etc.

It was interesting to see how the piece was received. It was obvious for me that it wouldn´t work very well as a typical art piece, it had a much more interventionist quality. I wanted it to be slight distortions to the regular soundscape of the passageway, and was pleased to see that the people who used this passageway regularly were noticing these disturbances. This could be described using the first of Barthes´ three listening modes: hearing involves "evaluation of the spatio-temporal situation" and thus, it is linked to a "notion of territory". It places the listener on alert when new sounds which don´t "fit in" are heard.
By adding an extra layer of sound it also made people focus on the sounds which were already there.

The inspiration for this project comes from when I studied in Trondheim in the nineties, when I heard some stories about how a directional speaker had been used to cause a certain distress on a bridge over the local river: A person walking alone across the bridge suddenly heard whispering voices. An out of tune clarinet was projected into a marching band playing on the 17th of may (Norway´s national holiday).
If these stories are true or not, doesn´t really matter, it is the idea of having a private experience in a public space which intrigued me.[23]

[23] http://hcgilje.wordpress.com/2008/03/06/soundpocket-1/

Soundpockets 2: Very local radio station



I collected a library of field recordings I have made over the years. I set up an internet radio station for the project (using Nicecast), and played with different configurations mixing music and the field recordings, but ended up just using my own recordings.
I thought it could be interesting to stream internet radio, a global media, to very specific local areas. I found three locations in Oslo which would serve as the local radio stations. They were somehow connected to a clear visible cue in that location: A huge oak tree, a small sculpture, and a small pond in the roundabout. The range of the local stations would more or less correspond to these visual cues: If you saw them you would be able to pick up the signal from the radio stations. In numbers this would mean a range of 30-100 meters.
My original plan was to use the fm-senders for mp3 players which are mostly meant to be used to listen to the mp3 player through the car radio. The range and quality of the signal wasn´t good enough though, so I ended up getting the more powerful Aareff FM transmitters.
The senders were placed with friendly hosts, letting me use their internet connection to pick up the internet radio stream.

The result was three very local radio stations sending out a continuous soundtrack from other locations, so somehow these recorded locations came in dialogue with the physical locations of the radio stations. The listening involved active participation from the public as you would need to tune in on your own radio to pick up the broadcast.[24]

[24] http://hcgilje.wordpress.com/2008/03/08/soundpocket-2-extremely-local-radio-stations/

One of my challenges has been to find a setup with a short-range fm sender, a mp3 player and a solar cell/battery solution that would make it possible to place this unit anywhere and leave it running. This has proven a lot harder than I would have imagined.

First, there are now so many fm senders available, and it is really hard to distinguish good from bad (90 % bad), and the reviews out there are not trustworthy. There also seems to be so many factors affecting signal strength so the same sender might appear to have a strong signal one day and a really weak one the next day. Frustrating and time consuming, and I am still checking out different modules.

I guess I should ask Raghav Mahato in India, who claims to have built a radio sender for just over $1.[25]

I knew very little about solar power solutions before this summer, and the options range from build it yourself solutions to “how to survive after a nuclear attack” systems. I looked first at relatively new products advertised as solar chargers for mobile devices like ipods, cellphones and PDAs.

Most of these mobile solar chargers combines small solar panels with an internal rechargable battery with different types of breakout plugs.

Not all of them are able to provide power while charging, which was necessary for my setup. I gave the Freeloader a try as it sounded like the perfect companion for a fm sender and mp3 player: it has a 2100 mAh battery, but the results were very disappointing. I guess the current from the solar panels is just too weak to provide enough power to keep the battery charged while in use.

There are not so many other ready-made solutions, either they have a smaller capacity than the Freeloader or they are just chargers (so the batteries can´t be used while they are being charged).

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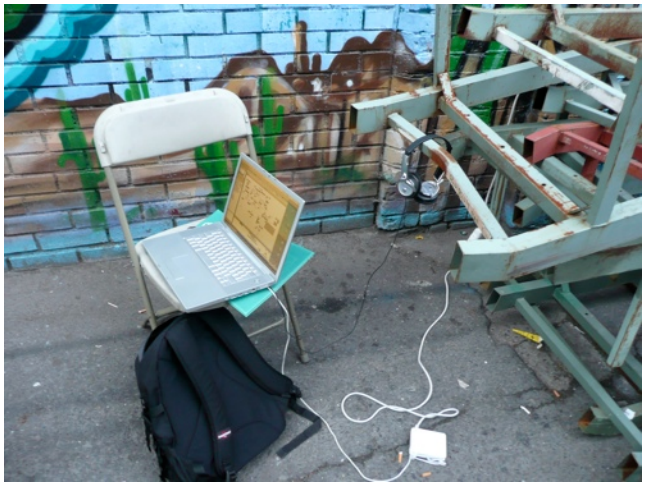
[25] http://news.bbc.co.uk/2/hi/south_asia/4735642.stm

I am now looking at more heavy-duty solutions, 6-15W solar panels in combination with a charge controller and a lead battery, but this becomes quite expensive and heavy. And all I need is about 100-150mAh. I am still hoping for the perfect solution to pop up.[26]



Excerpts from work diary during the making of *soundpockets:*

06.08.07
am I creating a soundtrack for specific locations, transmitting sounds from other places into other spaces, or a fictive soundtrack which people can listen to?

I need to clarify this.

It seems one direction I am thinking in now is to make a audio parallel to my stream of consciousness video installations.

also, should I mix sounds from specific locations with “spatial sounds” like splet or nnc?

I like the idea of tuning in and out of different spaces, you are at the beach, you are in the city, you are in the apartment, it is raining,etc.

Do I ruin this idea by mixing in spatial tracks?

and, is it important that this is streamed, why cant it just be a local mp3 solution?

if it is important, it should be because the different locations should have the same soundtrack, that it is possible to live mix, and the idea that the sound is streamed over internet into these small spaces.

and, space, place, location, are there any good definitions to distinguish them from each other?

[26] http://hcgilje.wordpress.com/2007/07/24/solar-energy-fm-sender-mp3/

09.08.07

DIP SWITCH (S2-SW1 and S1-SW2)

MHz	1	2	3	4	5	6	1	2	3	4	5	6
87.5	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	ON
87.6	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	OFF
87.7	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	ON
87.8	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	OFF
87.9	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	ON
88.0	ON	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
88.1	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	ON	ON
88.2	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	ON	OFF
88.3	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	ON
88.4	ON	ON	OFF	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	OFF

It was interestingly clunky to configure the fm sender, one thing is the 12 dip switches to set the frequency according to a lookup table, another thing was the capacitor tuning to lock the frequency, and then do something with the fm modulation which I didnt quite understand. Anyway, I got it working, the range is great, but there is some sort of grounding problem which at the moment makes it useless. Hopefully I will get more time to look into it tonight, as I might consider ordering one or two of its little brothers, 50mw senders.

14.08.07
I tested out some different types of sound, and was a bit surprised that pure noise produced the most local sound, and a pure sine tone was really hard to define the position of. I ended up playing with some of the maxwell city material. I still have this idea of the whirlwind in the back of my head.

…

A interesting and quite nice thing I discovered today was that I could capture the sound in the palm of my hand. This might be hard to do when there is no visible cue (I used the laser today), and it would probably work great on a soft ground with most of the sound being absorbed. This could be a nice project to do later?

15.08.07
I did more testing, first in the studio. I made it easy to change between groove, sfplay,noise and live source which passes through a biquad. This made it easy to try out new sounds. I also tried different variations, with sound only when the d47 is moving, only when it is pausing, different sound when it moves and when it doesnt etc. This is very approximate though, I need to figure out if it is easy to calculate when the unit is in position.

I had a quite nice sound by accident from a speeded version of a keychain.

…

try to calculate the math for making the d47 arrive at the same time on both axis to a new position?

figure out how to know when a position has been reached, ideally there should be some feedback system from the unit itself, but I believe it isnt.

If I know the speed, and the number of steps it will move I should be able to get a fairly accurate estimation, but hard to take into account acceleration.

30.08.07
Just an hour before I left Oslo I got the new fm transmitters.

They were in the tradition of unnecessarily complicated interface, having to remove 6 screws to tune it, and getting no visual feedback on which frequency you are on: you first need to find a frequency on the radio, then turn the capacitor until you receive a clear signal. I struggled a lot with this and ended up with calling the company, and the problem was that I used a screwdriver to adjust the capacitor screw, but it acts as an antennae so you actually pick up a lot of ground noise and other channels. By using a piece of thin hard plastic it worked quite ok, but it would be an idea to put this in the manual? Also, just to know that you pass through the whole frequency range in one turn (the screw turns endlessly) is useful information.

I did a search on the radio in three locations, and ended up with 94.8. Hopefully this is a good frequency in two weeks as well!

…

Another problem is that it is very noisy there in daytime due to the metal workshop, making it very hard to test properly, and since the ladder was borrowed from them it meant I had to stop when they stopped..

The positive thing I found out is that it does seem like it will work with this speaker, it works quite well with certain sounds like the keys and glass sounds, but apart from that I didnt find out much, I am really a bit stuck with this. I dont want it to be just a banal "sound shower".

…

yesterday I found the remaining macminis (at some point in beginning of October I think 10 of them will be in action!), and I will configure them for itunes radio listening but also fill it with the sounds in case radio streaming fails.

I found a nice script last night which constantly checks if the connection is still running, if not it tries to reconnect. This might be very useful. Ideally I should be able to remote control the macminis (at least the ones for the radios) from the internet, but I guess if the internet fails that wouldn´t be of much use.

I should try to figure out how I could make the radio-stream script launch at startup, start the stream and keep checking, so a simple restart would immediately launch itunes, connect to radio stream, and keep it connected.

I am considering if I should try to program it to behave differently at different times of the day, but maybe I am just overcomplicating things.

…

I need to force myself into thinking of how I want to use the pan-tilt, is it a space-probe, or is it playing back sounds related to the specific location? What can I prepare sound-wise before I am on location again?

6.11.07
Summing up the *soundpockets* project.

The radio piece worked quite stable, I liked the idea of linking a visual cue to the listening range of each station.

The DogA location worked fine, I used the more powerful sender there as it should cover a larger area. For some reason the internet connection dropped out, so it ran locally the last week. When I was installing it there was a launching of a new Renault car, with live link between 17 different countries, so there was a big satellite dish car outside, quite a nice illustration on connecting spaces and the difference in resources between arts and biz.

In general I guess it became a big secret, as few people use radios, so it was a lot of work for very few listeners, all the time I spent on collecting sounds, editing them, trying them out in different combinations seem a bit like a waste of time, but I was quite happy with the result, a continuous stream of locations. Would it have been better to have presented it in a different way?

And if I actually could have hooked into the light poles (for electricity), I could have had more stations, but then played back locally.

I quite like the concept of using a general access media as internet radio to broadcast to local physical locations, and also the nature of radio is to cover as big an area as possible, instead I chose to use it for creating very local radio stations.

The directional sound beam in combination with the pan/tilt unit in the Blå passageway also turned out to be a bit of a secret, but in a nicer, subtler way I think.

The hardest part was to make some sort of composition out of the sounds connected to the specific positions, since only one sound could be played at a time, pointed in a specific direction for a certain duration. I really wanted to avoid a spectacle/circus showing off the tricks somehow, and I didn´t want it to be sounds all the time, but at the same time if nothing happens for too long people would think it didn´t work (which I know some people thought). So, after figuring out which sounds worked at which locations I tried out different ways of sequencing it, something which I probably should have had another day for. Some sounds played for 3-4 minutes, some only for 5-10 seconds.

An interesting issue appeared on the evening of the opening. We had decided to do a tour of the projects after a welcome drink. I realized that was the worst way to experience this piece, standing there waiting for a sound, tell people that NOW you will hear water running over THERE, etc. In general the idea of people coming there to experience an art piece was a bit awkward. On the other hand it worked really well with people who used the passageway on a daily basis, who would notice small things being different.

I thought it worked quite well as an intervention, a disturbance, but less as a classical art piece, which means I was actually very happy with the result!

Wind-up birds - the beginning

Introducing a new species, the wind-up birds.
The wind-up birds are a flock of mechanical woodpeckers, having found their first home in a forest in Lillehammer, Norway as part of the UT-21 project.

How will nature treat them, with hostility or acceptance? How will the wind-up birds adapt to heat/cold wet/dry conditions? Will small insects creep inside the circuitry creating possible short circuits, beetles eat the wood, squirrels use the wood slit as nut storage (or the roof as a slide?), birds use it as a shelter, etc.? Will they be treated as foreign objects or accepted into the local eco-system?
How do real woodpeckers react? Are they threatened, attracted, or not bothered? Will they use the roof as a pecking drum?
Initial tests indicate an attraction: it took 15 minutes for a real woodpecker to join a wind-up bird on the same tree.[27]

During a group session at one of the biannual research fellow gatherings at Voksenåsen, I was talking about the *soundpockets* project. On my group was the curator Per Bjarne Boym, who after learning about the *soundpockets* project invited me to participate in a Polish-Norwegian art project to take place in the city and surroundings of Lillehammer the next summer. For some reason I almost immediately knew what I wanted to do: I wanted to make sound travel through the forest, connecting a series of sound points together to be able to create patterns of movement with sound. I also wanted these sound sources to be acoustic, mechanically produced.

[27] http://hcgilje.wordpress.com/2008/09/04/wind-up-birds/

There was a lot of technical challenges to the project. It was supposed to run for a month, so I needed something stable and solid, and of course a way of supplying electricity. Initially my plan was to place the modules along a lit path through the forest (for skiing in the forest in the evenings). However, since this was before the skiing season, the power was off, and in the end I had to go for a self-contained mobile power solution. One option was to use solar cells, but I was not able to get much further than my failed experiments from *soundpockets* the summer before, and relying on solar power in September in a forest in Norway is not a good idea.

I did some research on fuel cells, making energy from Hydrogen, using ethanol or water as fuel. There is a lot of research to make fuel cells small enough to power mobile phones, but no solution anywhere near market release at that time. The closest I got was a model car which could run on water, sold as an educational kit on alternative energy.

Finally I thought of different contraptions for mechanically producing energy, like dynamos, wind-up mechanisms, or the pull-wire mechanism used to start boat- or lawnmower motors. This would mean the audience would actively participate in bringing the piece to life, but this would turn the project into something completely different. I was more interested in a self-contained system, that needed to be discovered by the public.

Several people suggested that the sound should be triggered by a sensor, but the idea of this type of reactive relation between public and work doesn´t appeal to me, as it moves the focus of the audience onto their own action. As soon as people discover that they can trigger something, they want to repeat the action to confirm it, and you get a particular type of audience behavior.

In the end, the only practical solution for supplying electricity was batteries.

The worst case scenario was to have a large car-battery for each module (leaking lead into the forest). A lot of physcomp projects are made as prototypes for one or two day presentations or else they run off the grid, so until recently there hasn´t been much focus on making energy efficient constructions.

A lot of the wearable computing projects are misleading, because they “forget” to mention the power consumption, which would often mean you would need to carry around heavy batteries or being close to a power outlet.

Another issue with physcomp projects often being temporary is that they are not built to last, so this was another challenge for me, making both a hardware and software setup that would work outdoors for a month.

I am not quite sure when the idea of the sound device being a mechanical woodpecker came up, but partly from growing up in a forest with lots of woodpeckers, but also from recent years at Helgøya [28] where I have listened to woodpeckers drumming in the spring: Hearing the sound, trying to see them. It is fascinating how these small creatures are able to produce such a rapid, loud sequence of sounds, it puts my search for energy efficient solutions in perspective (When I was a kid I had a book called "Nature thought of it first", where humans have tried to replicate behavior from nature).

In the house on Helgøya there is a door knocker made as a woodpecker: When you pull the string, the woodpecker pecks on the door.

There were three main hardware design challenges: The mechanical device that would produce the sound, a type of resonance box to amplify the sound, and an electronic circuit to control the mechanical device and also to communicate with the other modules in the network.

I was relatively blank on all three, but with the controller I at least knew where to start looking.

For the mechanical device I needed something which was able to trigger fast enough and at the same time be loud enough.

One of the projects I looked at was Liveform:Telekinetics by Jeff Mann and Michelle Teran. LFTK was a picnic experience taking place in two different places, connected over the internet. Different kitchen utensils were modified so they could be controlled by the other picnic party, thus a sort of communication through the objects occurred.

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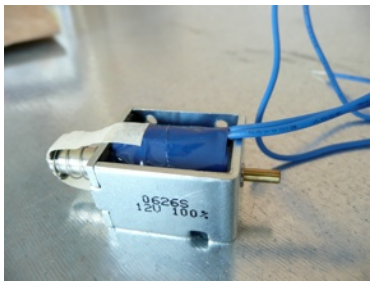
[28] an island on Norway´s biggest lake Mjøsa

One of the objects was a wine glass clinker. They generously provided recipes on how to produce them. Other solutions I looked at was Maywa-Denki´s knockers and an installation by Untitled Soundobjects.



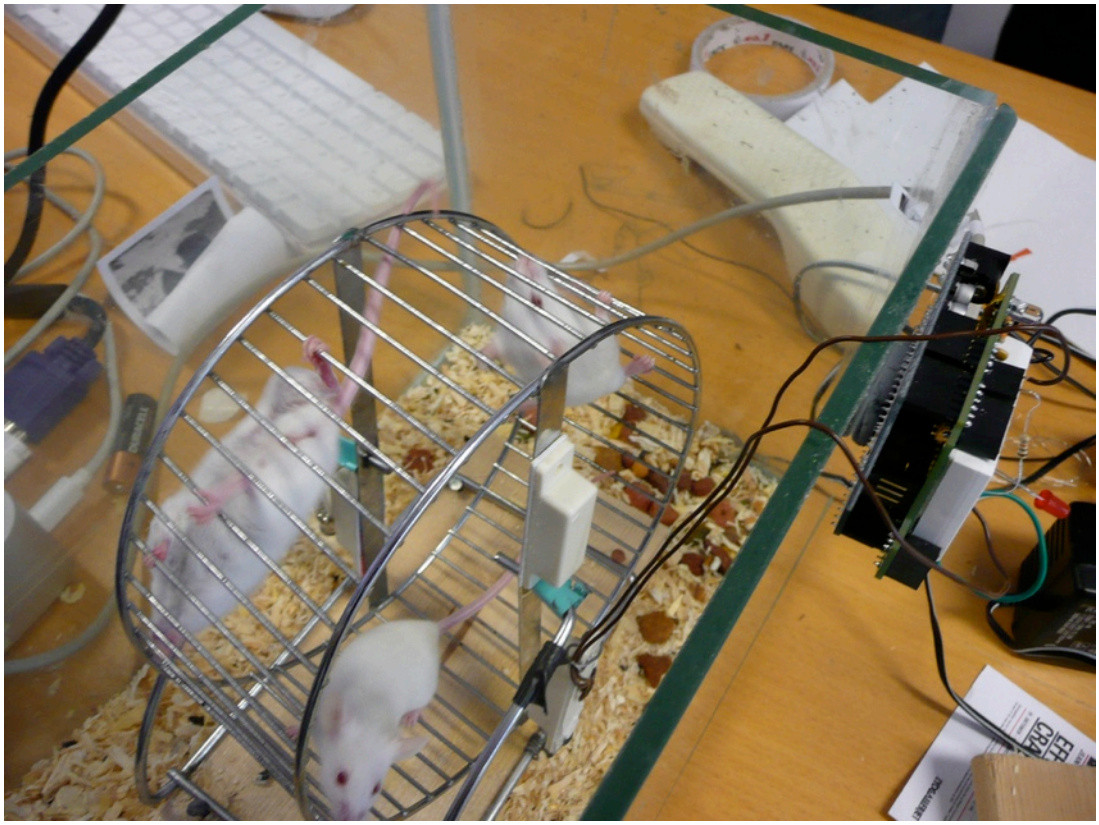
I ended up using simple push-magnets, solenoids which push a rod about a centimeter when electricity is applied, and a spring makes sure the rod goes back to its initial position when no electricity is applied. This can easily be controlled using an Arduino microcontroller.

As resonance box I browsed through some instrument building books, but found it to be too complicated, and instead decided to go for a wood block (slit drum), a simple percussion instrument made from a piece of wood with a slit in it (another childhood flashback?).

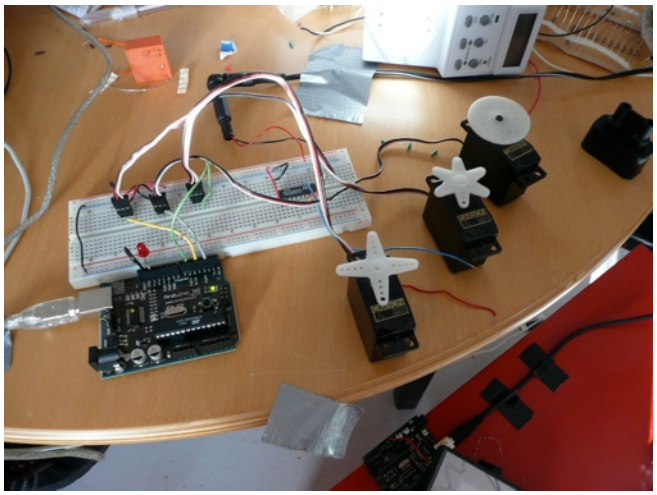
After spying at the local drum shop I bought some hardwood and together with Kristian Skjold, the woodshop technician at KHIB, I made some simple, but beautiful wood blocks from steamwood ash, and a simple construction to connect the solenoid and controller to it.

All the woodpeckers sounded slightly different.

Connect the dots



As part of the obligatory teaching of the research fellowship program, I organized a two-week workshop, together with Amanda Steggell, in the interdisciplinary weeks, which is a period when students from any department can sign up for a course they find interesting.

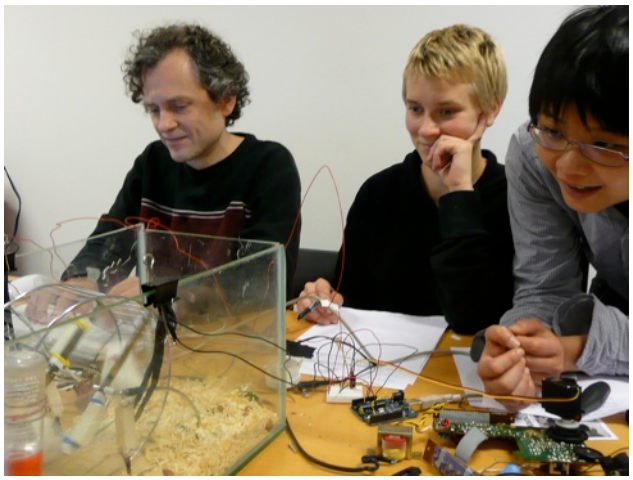


I called the workshop “Connect the dots”, and the intention of the workshop was to focus on relations between objects, relations between spaces, and different ways of connecting them using simple software and hardware modules. I had in mind the workshop I did at KHIO with video projections, where we focused on what the tools could do and experimented with that, and not on how to make the tools or how they worked. It turned out that the students at “Connect the dots” wanted a more basic understanding of physical computing and electronics, so the workshop became an introduction to the Arduino microcontroller and physical computing.

Working with microcontrollers involves (at least) some knowledge about programming and electronics. Programming is something which is possible to learn by looking at

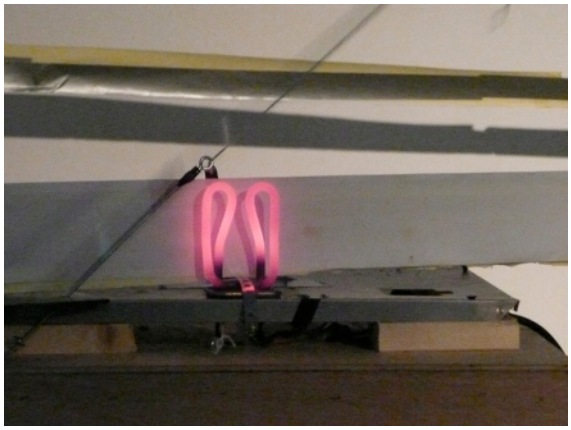
examples, copy parts of other peoples code etc. Since electronics involves working with connecting physical components and electricity it is so many more practical problems to run into, which makes a workshop the best way to get started.

This was a challenge to me, because my electronics knowledge was fairly superficial, especially if we ran into problems. I spent almost a month preparing the workshop by learning as much as possible, and in the actual workshop I did short introductions/ demonstrations to a new topic (turning something on, getting information from a light sensor, etc) every day, and then spent the evenings preparing for the next topic, trying to be one day ahead of the students, which worked fine for the first introduction week.

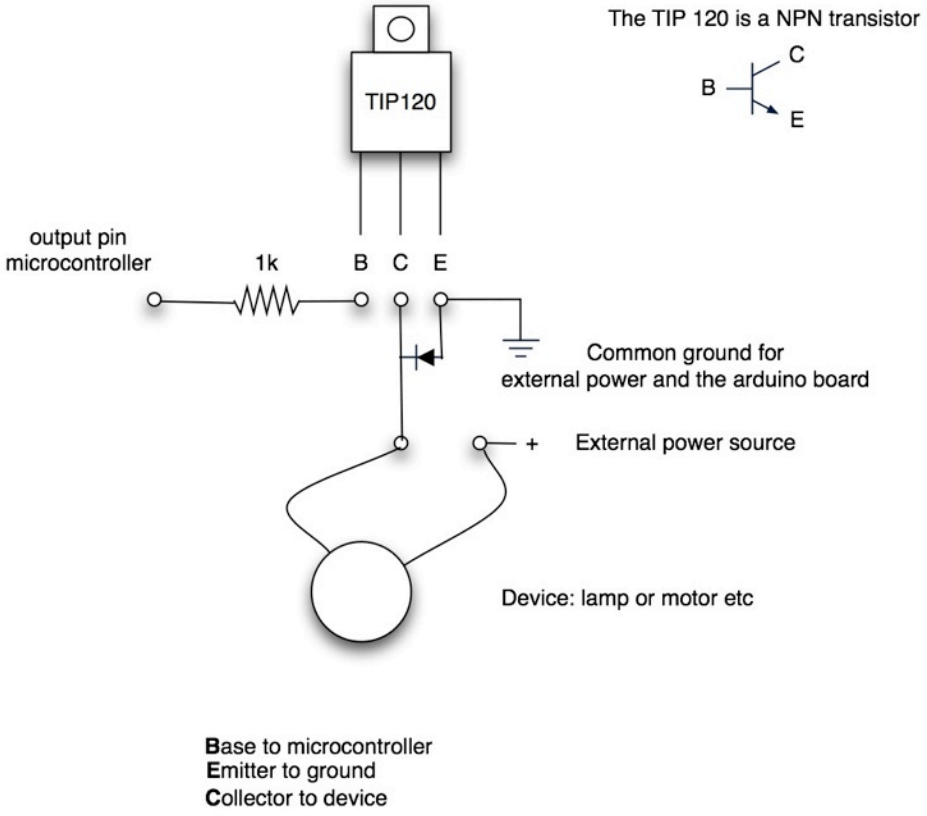


For the second week I had invited two guest teachers, Jeff Mann and Morten Kvamme, to expand on the use of the microcontrollers to turn on/off devices running on high voltage, like lamps, fans, heaters, as well as using the Arduino to create movement using different types of motors. On top of this Amanda and I presented examples from different artists.

We also produced an exhibition after the two weeks.



The most important result of the workshop was the blog[29], which was a mix of summing up the days and a reference section including circuit diagrams and program examples, and a pointer to available resources (both where to get more information but also where to buy components). It was intended as a help to self-help site, which I still use as a reference when there is something I have forgotten. This has also become a reference for a lot of users, over 20000 so far.

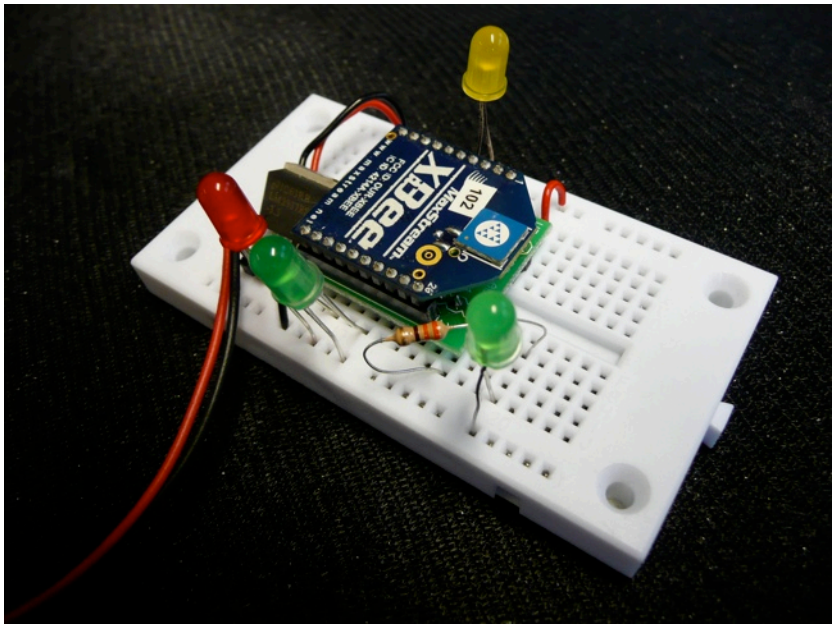


For me the lesson learned is that sharing and teaching is the best way to learn, and the combination of my superficial knowledge with more in-depth contributions from the invited guests made it an interesting workshop.

My own knowledge and experience was now at a level which made it feasible to actually realize a large scale project using microcontrollers and electronics, mainly because I knew where and how to look for solutions to problems.

[29] http://ctheds.wordpress.com

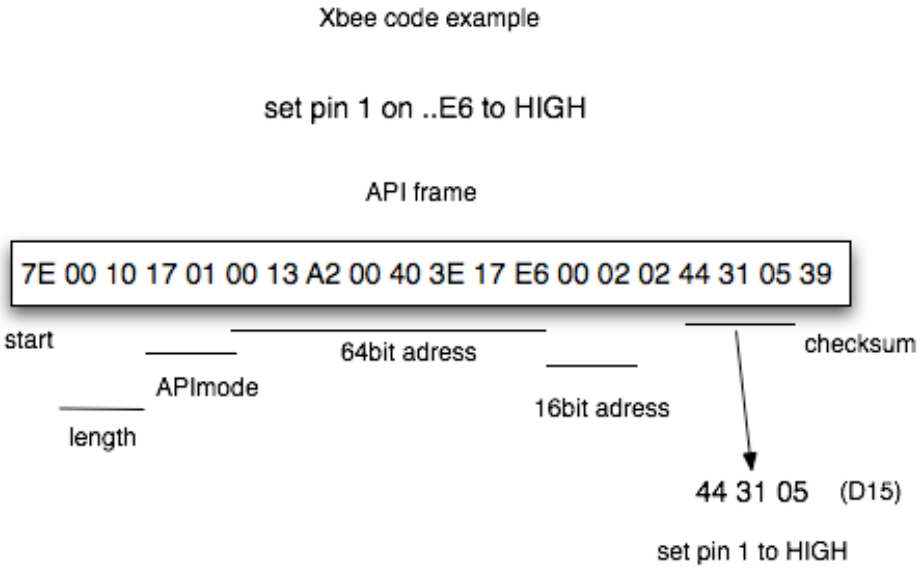
Making things talk



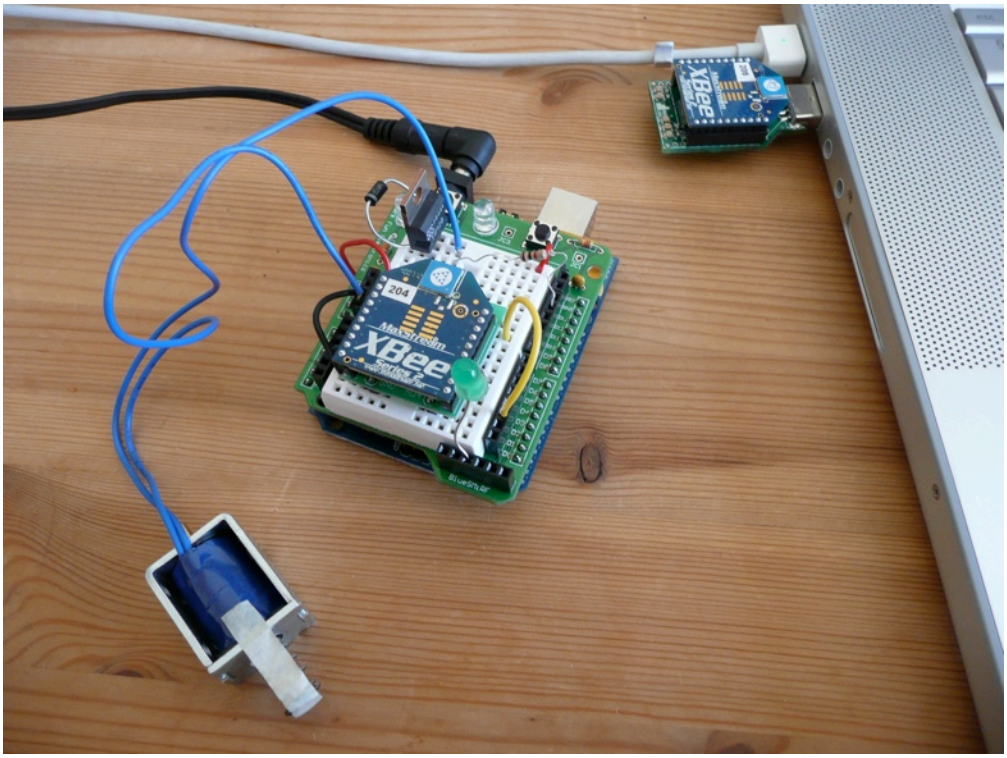
Through the research fellowship program I had the resources to invite Tom Igoe to Bergen to work with me for 4 days, which was a fantastic opportunity to get hands-on advice from an expert.

Since Igoe´s main interest has been communication between devices, which has resulted in the book *Making Things Talk*, I wanted him to help me with two projects related to connecting points in space. One of these was the wind-up birds project.

I wanted to work with small, affordable radio modems called Xbees, which have some powerful features. The second generation Xbees was just out, so there no available code for interfacing it with the Arduino microcontroller. The datasheet for the Xbee is very compact, so we spent most of the time making a parser, something that would translate codes from the Xbees into something useful for the Arduino. The goal was to have a proof of concept that I could use the Xbee modems to remotely turn on and off a led. We did this using Processing, a programming language similar to the Arduino software but which runs on a standard computer. If this worked I could easily port this to work with the mechanical woodpeckers: Remote control of the pecking.



We basically made a library of commands, which made it possible to send and receive messages through the Xbees, making a hardware device accessible for a lot of users.



I spent the next months (in between other projects) working on the Xbee code, being able to contain the code on the Arduino instead of a computer.

Energylab

Another important design issue with the woodpeckers was the energy consumption. I worked together with Jeff Mann in Berlin to figure out how to use as little energy as possible.

This involved three levels:

> Reducing the Arduino to only a chip, running at a slower frequency and lower voltage than normal.
>
> Finding energy efficient components.[30]
>
> Taking advantage of the fact that both the Arduino and Xbee can go into low-power "sleep mode" when not in use.

The sleep modes made the project realizable. The woodpeckers would peck a sequence about every five minutes for twelve hours of the day, the rest of the time they would sleep. This gave an estimated consumption of about 5Ah for a month.

Unfortunately one of the Xbees needed to stay on all the time to keep the network together. This module had a estimated consumption of 65Ah, so more than ten times that of the regular woodpeckers. This gave limits to the construction of the system, and I ended up using a central coordinator that orchestrated the other woodpeckers. For the audience though, the work was experienced as a communication between the woodpeckers.

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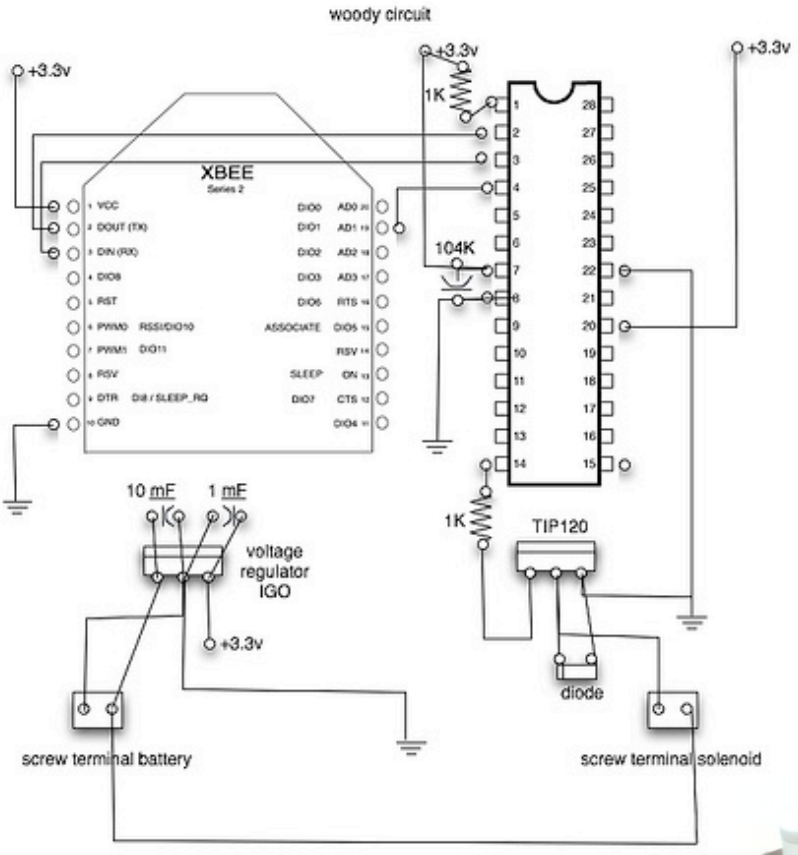
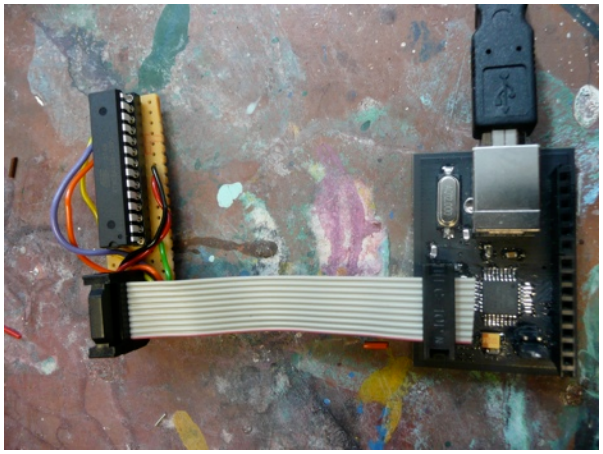
[30] To illustrate the importance of this: We looked at different voltage regulators, a component which for this project would convert 12v (coming from the battery) to 3.3v needed by the circuit. This component uses a small amount of electricity even when it is not doing anything, called the quiescent current, basically energy converted to heat. Different voltage regulators have different ratings for this, which really makes an impact over a month.

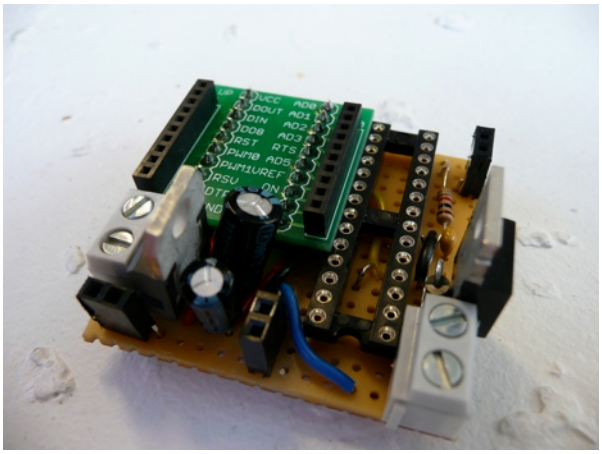
One important thing to know is that ratings and real-life performance are two different things, so it is always important to measure actual consumption instead of basing the energy consumption on a datasheet. We tested three different voltage regulators and the differences was enormous. The least efficient used 5Ah more than the most efficient, which in the end was more than the total energy consumption of the woodpecker.

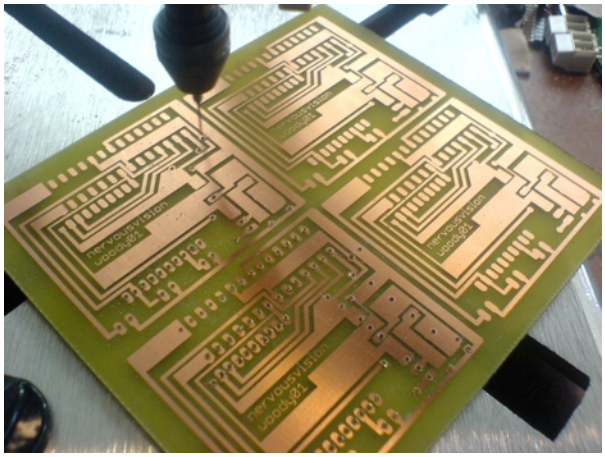
Circuit construction

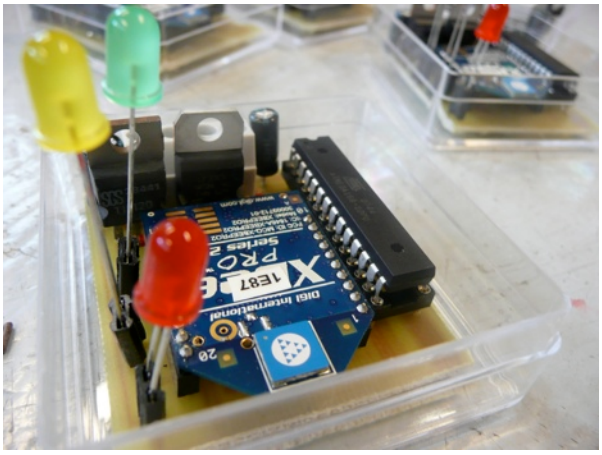


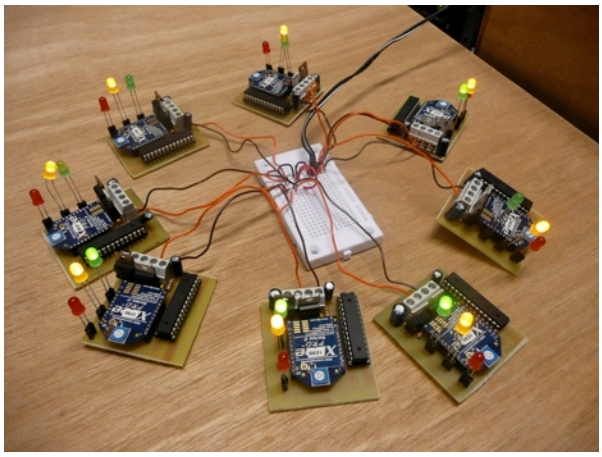
The energylab revealed that I couldn´t rely on a standard readymade solution, I needed to program the chips myself, as well as design a circuit board for the woodpecker “brain”. I designed the circuit, then Roar Sletteland created the PCB layout and etched the circuit boards.

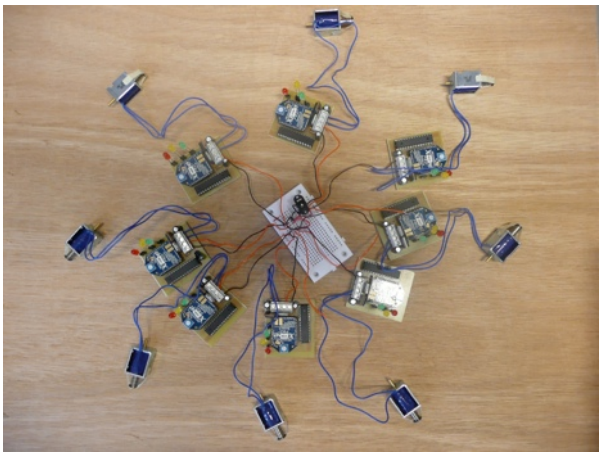












After this came endless rounds of testing the network and communication between the woodpecker modules, first in my studio, later at Helgøya.

The actual transmit range of the Xbee radios was hard to predict before being in the forest, as this depends on physical obstructions affecting the signal strength. It was also important to take the audibility into consideration. I wanted from every position of a woodpecker to be able to hear at least two others.

Setup in forest
Summing up the mounting period in the forest of Lillehammer for the UT21 exhibition.[31]

I ended up with a relatively small area closest to the waterfall, a small loop of what in winter is a ski trail.

I found a tall tree which was placed pretty much in the center of this area, and thought that would be a good place for the coordinator module.

I chose to hang one of the woodpeckers in the coordinator tree and then walk around with the coordinator module to check the network range. I had a button which triggered a pecking sequence, so that I could both hear how well the sound carried through the forest as well as test the range. This gave me a radius of about 200m around the coordinator tree, which means the signals get reduced quite a lot compared to an open landscape where they can carry up to a kilometer.

Based on the range I tried to find interesting locations for the woodpeckers, both based on what the location looked like, but also on its position in relation to the other locations.

When I was more or less happy with the locations for the different woodpeckers the quite laborious task of mounting the woodpeckers in the trees started, a lot of climbing up and down the ladder.

After this was done, the time had come to the coordinator module which I thought I would place as high as possible in the tree to improve the range.

I had hooked up my laptop directly to the serial port of the coordinator module, so that I could test the network from the ground level (using Processing). Each of the nodes (the individual woodpeckers) worked on its own, but I was not able to have them all connected to the network at the same time, which was of course essential for the system to work, so a long process of eliminating the problem started. First I tried to move some of the woodpeckers closer to the coordinator tree, but the network was still very unstable. I tried to move the coordinator module out on a branch (while I was balancing on the ladder 5m over the ground), but still no luck.

[31] translated from work diary

After a while I realized that it was the big tree the coordinator was placed in which caused the problem: I wasn´t able to place the coordinator far enough from the big trunk, which apparently absorbed too much of the signal.

So this gave me a new problem: How to get the coordinator high enough without the signal becoming too weak?

After some trial and error I ended up with a fake branch which I connected to a quite slim tree, and then the network worked perfectly!

The last part of the job was to test the Arduino code. I chose to work with a standard Arduino on the ground, connected to the serial port of the Xbee module of the coordinator module, so I didn´t need to take in and out the chip of the coordinator.

After playing around a bit I was quite happy with how the pecking sequences worked: Every time the woodpeckers woke up from sleep, a different pecking sequence would play, also with variations in the amount of pecking and the time between the pecking varied on the different woodpeckers. I chose to let them peck two series at a time, to confuse the listeners a bit in relation to how many woodpeckers were actually there, and also to increase the feeling of a communication happening between the birds.

Reactions to wind-up birds

Just a week after the opening of UT21 in Lillehammer in September 2008, I held my seminar "Conversations with spaces" at Bergen Kunsthall Landmark. I had invited Brandon Labelle, Kirsten Dehlholm, Lawrence Malstaf and Mark E. Hansen to present their take on how they relate to space in their work/writings.

I had managed to edit a documentation for wind-up birds which I presented at the seminar, which somehow appealed to a lot of people. Especially for the second day of the seminar, which was a roundtable discussion group, they were talking about it in terms of work I did before and this project, which was something else. For me it was just a natural development in my work, combining ideas from *soundpockets* with the system approach from *nodio*.

Online, a lot of blogs quickly picked up the project, most of them being related to DIY technology (robotics, wireless networks, Arduino), but also entries from sites like Birdchick.com:

An artist in Norway called HC Gilje, has a 3 year research fellowship at the National Academy of the Arts in Bergen. The big question: How can audiovisual tools be used to transform, create, expand, amplify and interpret physical spaces? Well, here's one way that the artist is trying out–using little electronic mechanisms to create woodpecker drumming sounds in the woods called "wind-up birds." This flock of mechanical woodpeckers, have been put in a forest in Lillehammer, Norway as part of the UT-21 project.

In the blog, the artist wonders, "How will nature treat them, with hostility or acceptance?" and is intrigued that the sounds fool humans. I would imagine that here in the US, they would be treated with hostility as angry birders would claim the art would drive woodpeckers out of their territories or stress them out or just plain confuse them…or be angry into thinking a flock of rare woodpeckers had moved in only to find out they were punked by an art project. Speaking of rare woodpeckers, I wonder if this project couldn't be modified to do that double knock the ivory-billed woodpecker is supposed to make? A bunch could be placed in Arkansas or Florida to try and call out the woodpecker that cannot be photographed in to the open.

Comments:

KatDoc says: September 8, 2008 at 3:08 pm

How annoying! I can't imagine it would fool a birder into thinking there were real woodpeckers, as the sounds are quite artificial sounding, at least to my ears. However, it would bug the H – E – double toothpicks out of me if I were to encounter this "art." I

go to the woods to escape sounds of mechanization, not be assaulted by it.
Put me down for one "No!" vote for Wind-up Birds.

~Kathi, in a huff

Kirk Mona says: September 8, 2008 at 6:43 pm

The demo in the studio with them all going crazy is a little annoying but the into clip of the call and response is quite interesting if not soothing. I love the sound of woodpeckers calling back and forth. I think the intersections between communication and music is fascinating and there are some cultures who's musical traditions are more closely aligned with natural sounds. Tuvan throat singers for example integrate bird songs and even the sound of babbling brooks, etc in their overtone singing which is wonderful and bizarre. I think projects that can help open our ears to the ideas of non-human conversations is a good thing. I wouldn't want it out in the wilderness per se but it would be really cool somewhere like the sculpture garden.

Avienne says: September 9, 2008 at 8:55 am

I can see the potential value in sussing out ivory bills.

Other than that, this is one of those things where my first reaction is: Ye gods, what a dumb idea. Someone actually sat around and thought of that? Someone is spending money on that? Ugh[32]

One of the interesting things about keeping a blog is to look at which sites link back to my blog. This was how I discovered an interview with Mitchell Whitelaw on Rhizome.org[33], where he used the *wind-up birds* as one of the examples for his concept of transmateriality. This opened a few conceptual doors for me, also introducing me to the writings of Gumbrecht. Whitelaw was later commissioned by HKS to write a text about my work for the *blink* exhibition.

[32] http://www.birdchick.com/wp/2008/09/is-that-a-woodpecker-or-a-wind-up-bird/

[33] http://www.rhizome.org/editorial/2071

Flying onwards

The wind-up birds didn´t settle in the forest of Lillehammer.

After a month some of them flew to the airport in Oslo, some of them to a park in Rabat, Morocco.

Two very different contexts in many ways:

Oslo Airport Gardermoen celebrated its 10 year anniversary, and I was invited as one of two projects from the UT21 exhibition to be part of this anniversary.

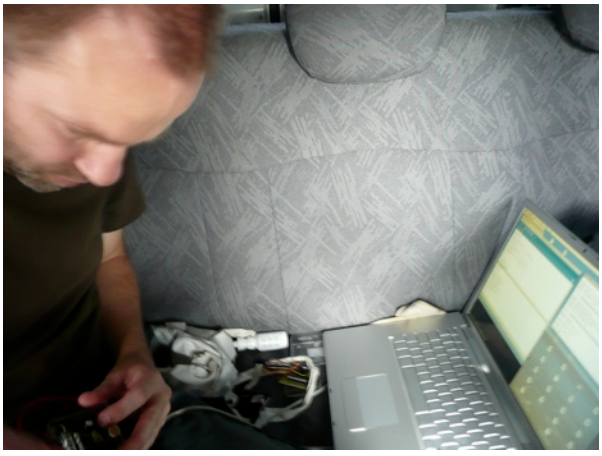
The work was placed outside in a passage between the parking area and the terminal building, a very busy pathway.

It was freezing, windy and wet the weekend it was installed. Of course everything at an airport involves heavy security, so I had a special permission card which I wore to avoid frightening passengers (bearded man climbing trees with electronics, wires and batteries). I got a lot of strange questions, people wondering what these devices were against or for, was it to chase off the woodpeckers? When I explained that they were mechanical woodpeckers I got a lot of blank stares.

A week after the airport installation I was off to Morocco: 25 degrees and sunny in Rabat, the capitol. There is a small art space there called L´Appartement 22, run by Abdellah Kharoum, which had been invited to present work at the first Brussels biennale. Kharoum initiated the project *Le mond autour de vous*[34] in collaboration with Hordaland kunstsenter and Stacion Center for Contemporay Art Prishtina. Anne Szefer Karlsen from HKS invited Pedro Gomez Enza and myself to do projects in the frame of the Brussels Biennale, but in Morocco. It gets weirder.

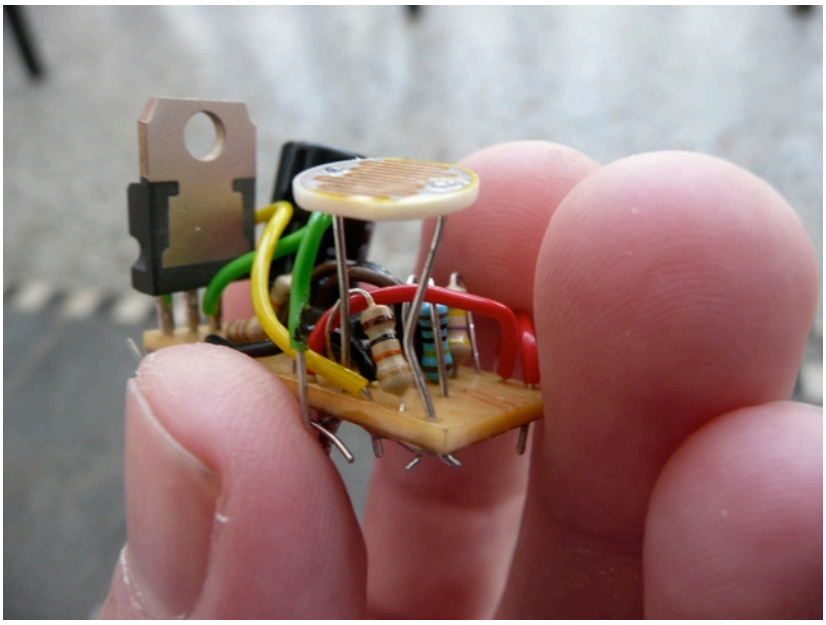
Unlike the very organized airport project, things were a bit looser here. First we needed to find a location, and after some scouting I fell in love with a beautiful and strange park, on the outskirts of the center, Le Parc Sportif, with lots of eucalyptus trees, cute fuzzy pine trees, mint tea houses and people exercising in the strangest ways.

Public art in Morocco isn't common and there had been quite a lot of discussion before my arrival as of what to do with permissions etc.



We ended up doing it without permissions, and therefore without a ladder to not draw attention on ourselves, and it turned into a strange undercover operation trying to set up the mechanical woodpeckers in trees while pretending to do other things. We even drove around in a car while I was programming in the back seat, as it would be considered suspect to sit on a bench in the park with my laptop and a microcontroller.

[34] http://www.kunstsenter.no/en/le-monde-autour-de-vous-1st-brussels-biennial/



I built a special version of the wind-up birds for Morocco, because of the special conditions with setting up the installation. Basically I replaced the radio modems with a parasite brain (a timer and a light sensor), this made the birds more independent and maybe slightly more intelligent. The birds would then have their individual pecking cycles, and they would fall asleep when the sun went down.

This actually corresponds quite well with the natural woodpeckers, some enjoy the company of its fellow creatures, while others insist on being alone.

Sadly the wind-up birds in Morocco disappeared without a warning and has never been seen again.[35]

[35] From the catalogue of the UT21 exhibition

Piksel presentation

A few months after the Wind-up birds disappeared in Morocco, I was invited to do a presentation of them at Piksel[36], a yearly festival for open-source software and hardware that takes place in Bergen, which was an opportunity for me to give a detailed technical description of the project. In the spirit of Piksel I published on my blog a diagram and explanations on how to make a minimal Arduino, as well as code related to the Xbees.[37]

One comment I got at Piksel about the wind-up birds was that this could be something a Dutch artist would do. Indeed, I have later discovered that a Dutch artist at some point made a mechanical woodpecker, but have not been able to track down neither the artist nor the bird. Also, more recently some Dutch sound designers I met mentioned a woodpecker in a Swiss sound-walk, where the audience triggered the pecking, either by pulling a chord or triggering a sensor.

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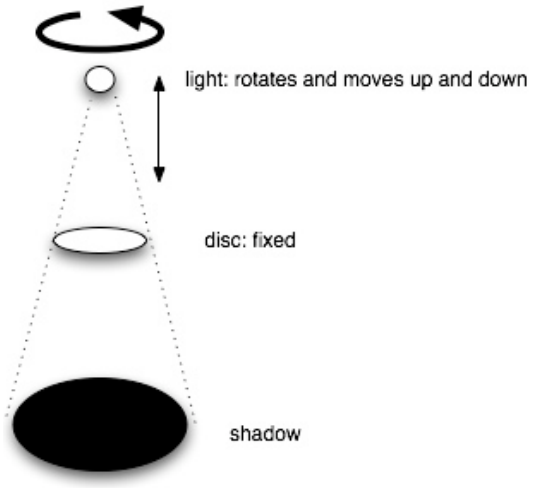
[36] http://www.piksel.no/

[37] http://hcgilje.wordpress.com/2008/12/04/in-the-spirit-of-piksel-a-minimal-arduino/

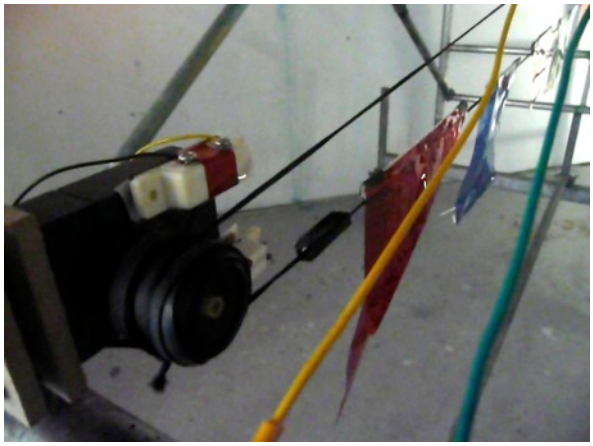
Moving shadows

I had started 2009 by working with animating virtual shadows using projection. I also had very concrete ideas for animating shadows using mechanical movement, by constructing a series of shadowmovers. Each shadowmover would consist of a disc which would cast the shadow. Above the disc there would be a rotating light, causing the shadow of the disc to move in a circle. The disc should also be able to move closer and further away from the light source, creating a growing and shrinking shadow. I wanted many of these shadowmovers in a space hanging from the ceiling, sometimes operating in sync, sometimes operating individually, and then try to create a compositional structure of these simple shadow movements.



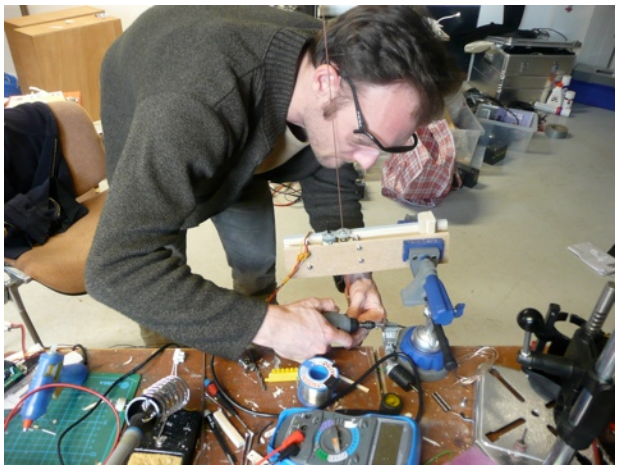
This was a quite challenging project, as I had very little practical knowledge in mechanics. I knew how to control a motor, but hardly how to convert the motion of the motor into anything useful. I had previously attempted to acquire knowledge in mechanics, but either the workshops never came beyond the point of making a motor turn, or the workshops were cancelled.

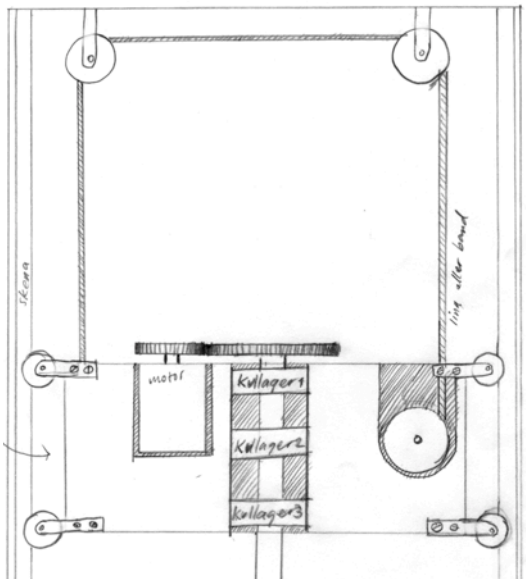
Finally in the first part of 2009 things seemed to look brighter, and I decided to give it another try. I spent weeks researching alternative slip rings (which transfers electricity to rotating parts), which would be an essential part of the shadowmover construction.



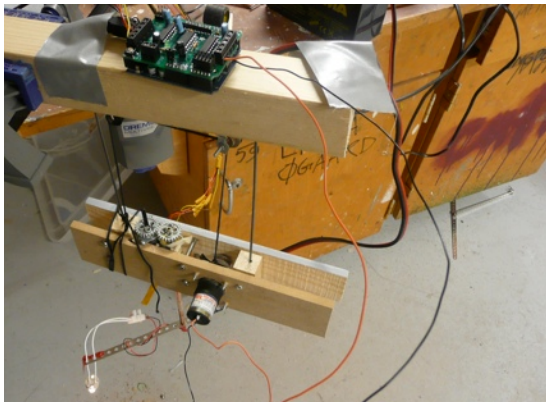
In February 2009 I attended a workshop with Lawrence Malstaf at KHIB, where I (together with Amanda Steggell) made a motorized color mixer: One horizontal clothesline pulling different color filters back and forth and one vertical dragging another set of filters up and down. These overlapped in the middle, and a light pointed at them produced changing color patterns on the wall. The visual output was quite pleasing, the mechanical construction was dodgy.

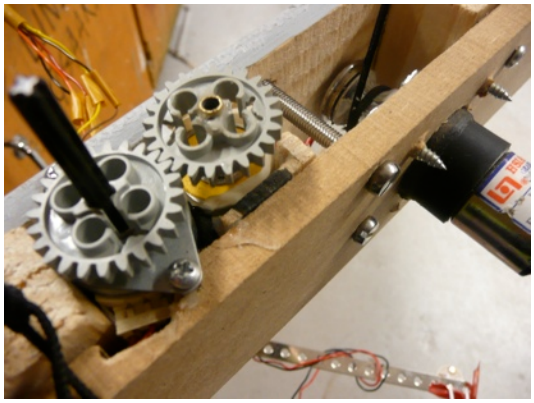
Malstaf also consulted me on my shadow moving project.





Shortly after I invited the Swedish artist Lars Brunström to help me with the developing further the shadowmover, and we managed to create a working prototype: a rotating light, and a disc being lifted and lowered, with light and motors controlled from an Arduino.





However, when Brunström left, I still felt there were too many partly unresolved mechanical issues, and without further help it seemed difficult to get beyond the noisy prototype built from lego, wood and mechano.
I did however make an attempt at another prototype using a stepper motor to be able to control the position and speed of the moving light.

All in all, the visual result wasn´t anywhere near what I was looking for, so I decided to shelf the construction (but hope to pick up the project later).

Dimsun

I did not give up on animating shadows, I just decided to take another approach, partly inspired by the LED shadow dance work of Japanese artist/technician Daito Manabe, which animates lights by having a lot of them placed in a circle and turning them on/off in sequence. Instead of mechanically moving one light source to animate a shadow I would position several lights around the object which would cast the shadow, thus creating a movement of light with a lower resolution than that of the mechanical orbiting light, but also adding many new options in terms of speed and direction, as well as the possibility of using several lamps at once.

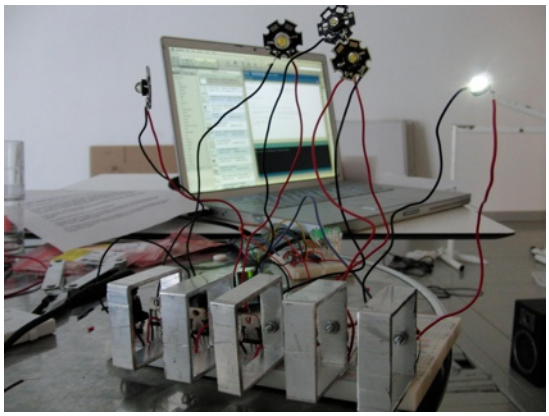
Of course the problem with having many lights and having to control them, is that standard light equipment is expensive, uses a lot of power and you need a big dimmer to control them. As always I wanted something relatively cheap and portable, and decided to look into constructing my own lighting system, which I ended up calling dimsun. This was developed during the HKS summer camp.

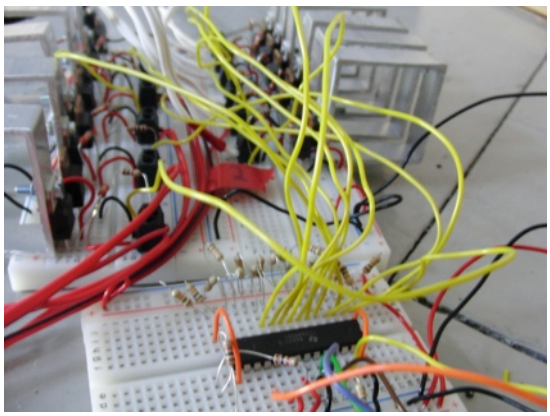
I had already done a lot of research on different light sources for the mechanical prototype, and had concluded that relative bright LEDs weren´t really bright enough, and the so called power-LEDs, which can be extremely bright, were too expensive to be a realistic alternative when I wanted a large number of lights. This was until I discovered all the nice electronics shops in China available on ebay, which sold the power-LEDs for a fraction of the price I had so far seen.

I also learned through the Arduino forums about a LED controller chip[38] that would let the Arduino control up to 96 LEDs, so I thought I had found what I needed.

Of course it turned out that the power-LEDs wasn´t as easy to use as normal LEDs, they need a very stable current or else they burn out quickly. I found, through Instructables, a regulator that was perfect for the power-LEDs. However, because of the way the LED controller chips work, I spent a long time figuring out how to combine them with the power-LEDs.

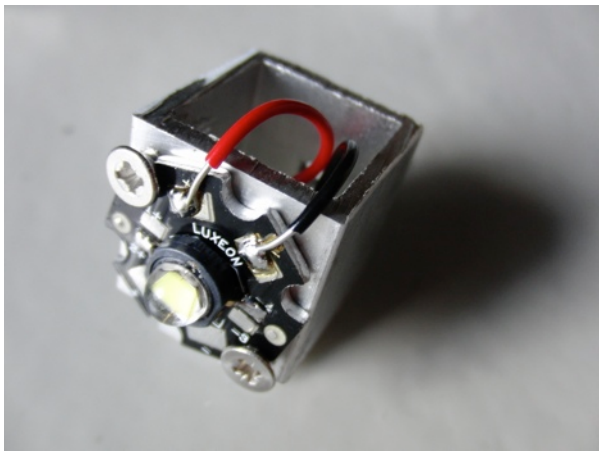
Eventually I had a working prototype for the dimmer.



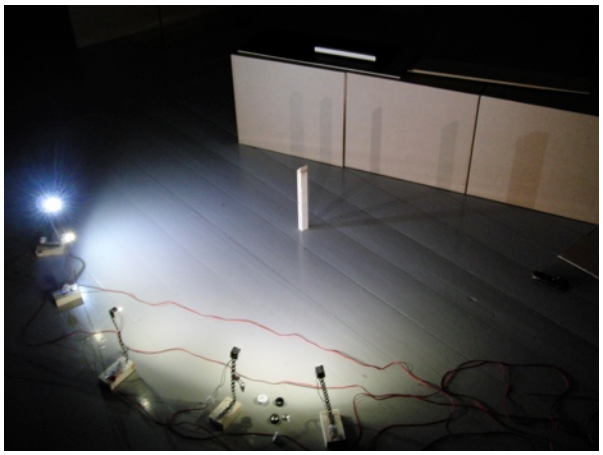


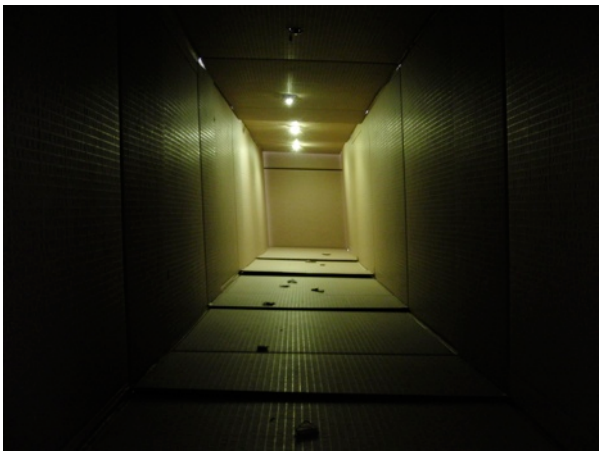
[38] TLC 5940

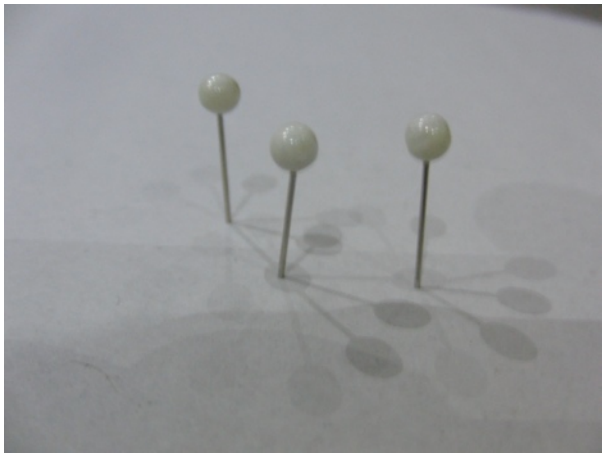
At the same time I was working on creating a lamp module for the LEDs. The LEDs get really hot, so they need a heatsink (something that dissipates heat, usually a piece of metal). I made a simple lamp using a square aluminum profile and some fixing band. I tried out a variety of lenses, also from ebay, until I found some I was quite happy with.



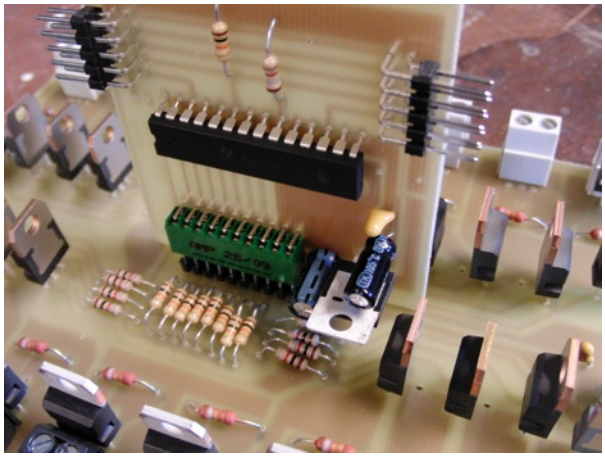
So, finally I was able to start working with the lamps and the dimmer, experimenting with a lot of different ways of positioning the lights and trying out different movement patterns.

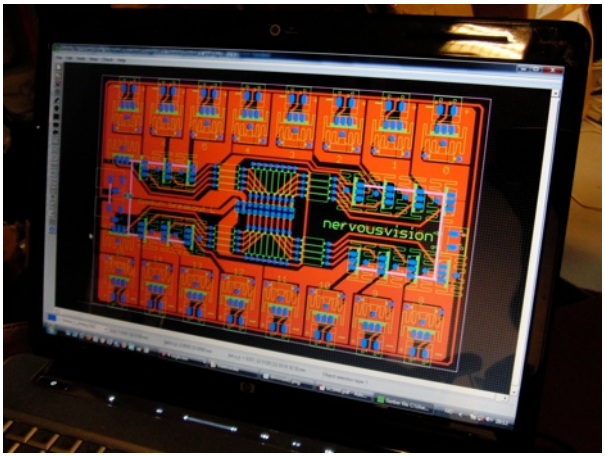




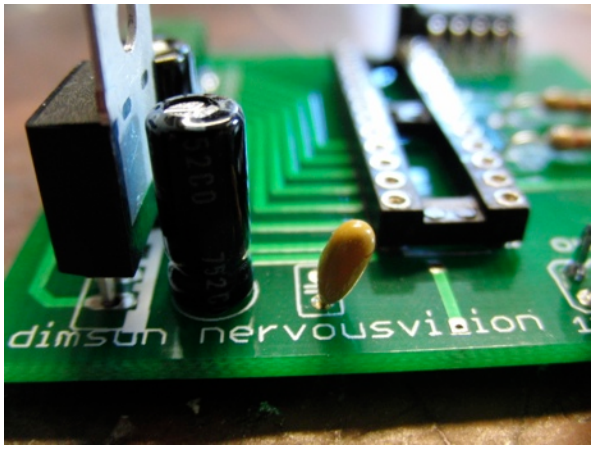


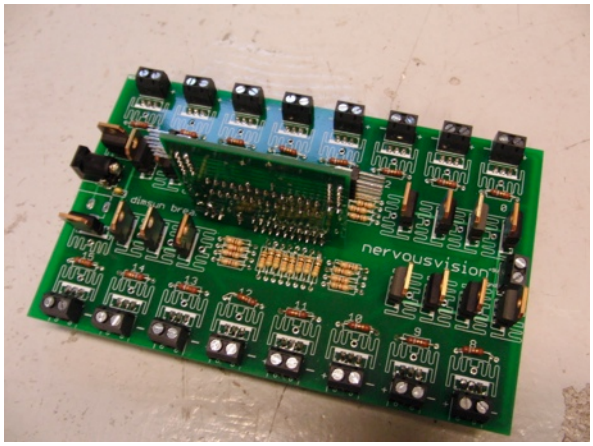
My dimmer prototype was very messy, and it would have been very risky to make more of them and hope they would work for a month. I wanted to develop this into proper Printed circuit boards (PCBs), and with the help of Roar Sletteland (who also did the PCB design for the wind-up birds) another prototype was developed based on his PCB design.





I wanted to take this one step further than with the *wind-up birds*, to get the PCBs manufactured and the holes drilled, partly to test out BatchPCB, one of the few small companies who specialize in making small orders of PCBs for a reasonable price. Normally you would need to order hundreds of PCBs at a professional factory, but BatchPCB has a different business model: You upload your design to their website and specify how many you want of each design. They combine designs from different customers onto a plate, which is then sent to China, where the plate is manufactured. The completed PCBs are then sent back to BatchPCB which sends the PCBs to the individual customers. Quite an impressive logistics system!





Unfortunately, being a bit short on time before sending the design to BatchPCB, there were still some design issues when the finished PCBs returned, which made it necessary to do some modifications to PCBs, making the whole construction process more time consuming than expected.

BLINK

The manipulation of light

> Most of the visual work of the future lies with the "light painter". He will have the scientific knowledge of the physicist and technological skill of the engineer coupled with his own imagination, creative intuition and emotional intensity. (Moholy-Nagy: 168)

The introduction of electric light opened up new possibilities for the manipulation of light. The brightness of artificial light made it possible to control the intensity and color, and in combination with lenses and gobos, also the softness and shape of the light. With brighter light sources it was easier to place light in different positions, making it possibility to sculpt with light in new ways. As important was the possibility to be able to control light over time. Finally, this was a turning point for film and slide projectors.

In *Theatre, Performance and Technology* from 2005, Christopher Baugh describes how the progress in development in light bulbs and projector technology gave rise to several new expressions within the arts. In the early twenties light became an important ingredient in the abstract, non-representational art. Light and projection played an important role in the work of many Bauhaus artists: Gropius built the Total theatre for Piscator in 1926, Schlemmer made his abstract stage performances using light as set design, and Moholy-Nagy made kinetic light modulators, photograms and films.

Alexander Scriabin wrote compositions for color, Alexander Wallace Rimington and Thomas Wilfred were pioneers with their color organs, and in the thirties color music was popular as starters for films.

Abstract films exploring light, color and movement came out of the twenties from people like Walter Ruttmann with his series of short films *Lightplay*: *Opus I* - IV (1921-1925), Viking Eggeling with *Diagonal-Symphonie (1923)* and Len Lye with his series of films from the late twenties to the late fifties.

Le Poème Electronique was made in 1958, and in the sixties there was an active scene working with combinations of film and light projections, projecting onto bodies, architecture, inflatable objects, smoke, often in combination with live music. Arthur Boyle did his light projection performances *Son et Lumière Earth, wind, fire water,* as well as live collaborations with Soft Machine and Jimi Hendrix.

The term "expanded cinema" appeared in the mid-sixties, and one of the artist associated with expanded cinema, Peter Weibel (later heavily involved in the new media art scene) tried to describe what it could mean stepping away from the cinema screen:

> Whenever the site of the film is not the screen, houses can be projected again onto houses or bodies onto bodies, the representation and the object overlap one another, the representation and the celluloid become superfluous. Technical reproducibility is replaced by immediacy, and with this the objective character of the film is transcended; state-reality is not reproduced, but rather the subject and its experience predominate. The "world" is no longer simulated; rather, the possibility of producing "world" is

demonstrated.[39]

The Czech director and set designer Josef Svoboda refined the vocabulary of light through his experiments with his Laterna Magica theatre, combining film projection, light and kinetic stage modules. He spoke of the physical experience of light: "I perceive light physically, not only visually. For me, light becomes a substance" (Baugh: 119).

The American director Robert Wilsons large-scale, but minimalistic set designs, are all based on the precise use of focused light and projection combined with a razor-sharp timing.

The last ten years has seen the introduction of advanced computer control of light, bright video projectors as well as new bright light sources, which gives the artist control down to the individual pixel. This has opened up for a new wave of projects combining the control of light, either as physical light sources or projections, with physical structures.

The city has turned into a screen for these new technologies, turning the facades of big buildings, often owned by banks and insurance companies, into spectacular LED displays. Advanced projection mapping has transformed massive buildings of stone into soft, moldable material.

Personally I prefer the less spectacular projects like Graffiti Research Lab´s *Laser Tag*[40] and *LED Throwies*[41] projects, which combine new technology with artistic interventions in interesting ways, or the visionary project waiting to be realized in Rjukan in Norway: Manipulating sunlight to get light into an otherwise dark valley using a gigantic heliostat mirror (a mirror that follows the position of the sun). [42]

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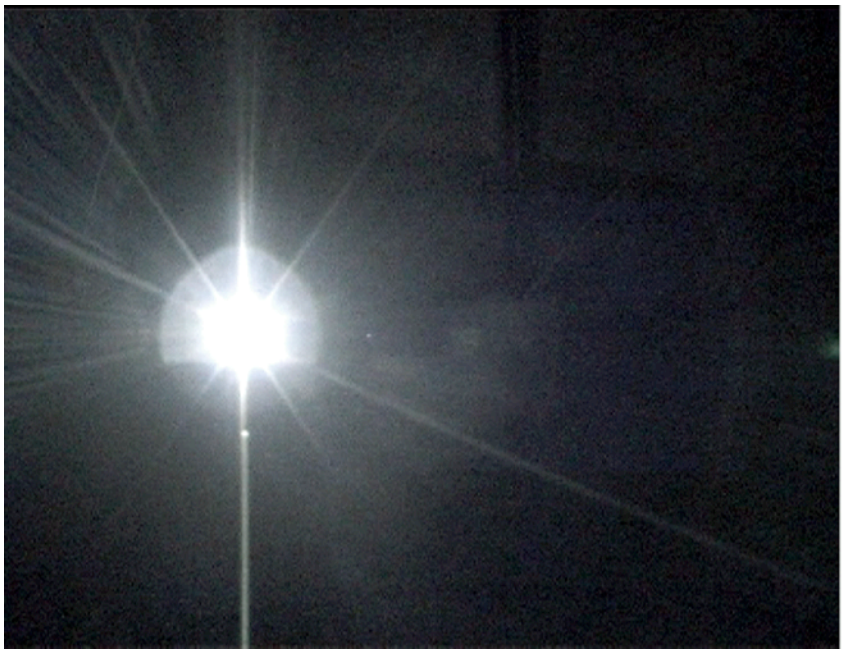
[39] This is an edited version of a lecture delivered by Valie Export at "The Essential Frame – Austrian Independent Film 1955–2003", a two-day program of screenings and talks on Austrian independent filmmaking curated by Mark Webber and held in London, May 31–June 1 2003. http://archive.sensesofcinema.com/contents/03/28/expanded_cinema.html

[40] http://graffitiresearchlab.com/?page_id=76

[41] http://graffitiresearchlab.com/?page_id=6#video

[42] Read more about the project on my blog: http://hcgilje.wordpress.com/2007/11/19/the-mirror-project/

Two empty spaces



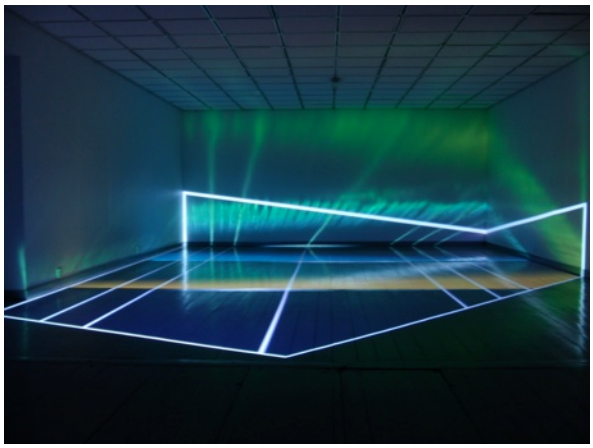
The period after the HKS summer camp was mainly spent on writing the draft for this critical reflection and resolving technical issues with the dimsun project. During the summer I had focused on working with light and shadows as well as projection on different formations of cardboard boxes.

At one point I wanted to combine the projection and LED lamps into one project, but eventually decided to make two separate projects and install the lights in the cellar, also known as krypten.

There were a few things that interested me with the light-shadow project. One part was to animate objects and people´s shadows by creating patterns of light changes, which could resemble old flip-book animations. Another element was to work with different rhythms of the movement of the light. Finally, I was quite intrigued how I was able to make a space appear to shake, or even melt, by only working with the movement of the light.

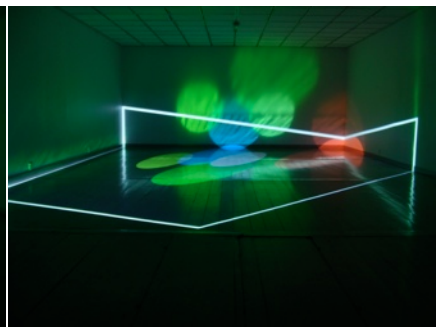
I wanted to pick up on the *nighttrain* sketch with 12 screens placed in a circle, with just a white image traveling around in the circle, which also had a sound that travelled with it (see *nodio* for a technical description of the system). I wanted to keep the tight link between light and sound in krypten, so the sound was made to follow the light, which for some has been experienced as if the lights produce a mechanical sound when they are switched on and off. The speed of the light traveling around in the circle was determined by a waveform, so it would go from quite distinctive clicks to rapid movement, and at certain points it would change direction.

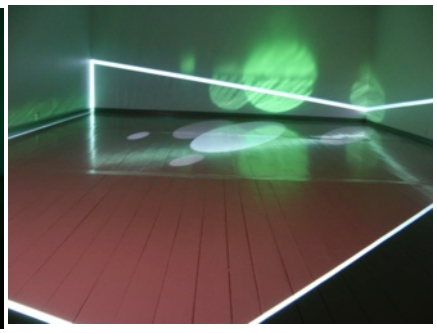
I placed 24 LEDs in a circle in the ceiling in the empty cellar space. For some people the installation was just experienced as an empty space with blinking lights. The work demands the involvement of the audience, because to experience the revolving shadow something or someone needs to cast the shadow. The work is intended as an indoor sundial, with a temporal flexibility involving compression,expansion and reversal.



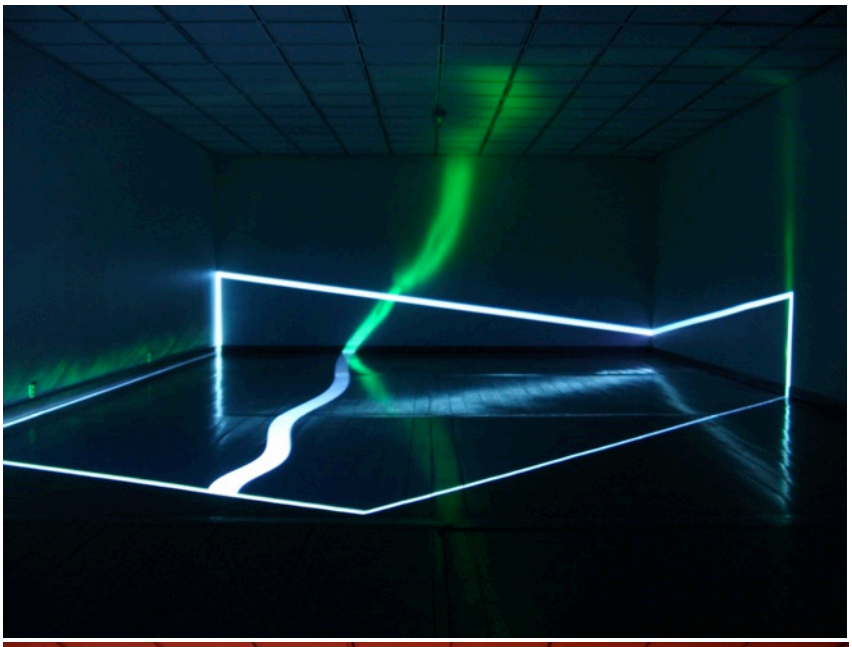
By the time I moved into HKS in the fall, I was very reluctant to fill up the space with boxes, and decided to take the consequence of my own project of improvising with spaces, and decided to work with the gallery space itself: feed image and sound into the space, and let it be transformed by the architecture and textures of the surfaces in the room. The only physical elements I added to the space was two walls with benches, to prevent light from spilling into the space. The benches invited the visitors to take the time to immerse into the work.

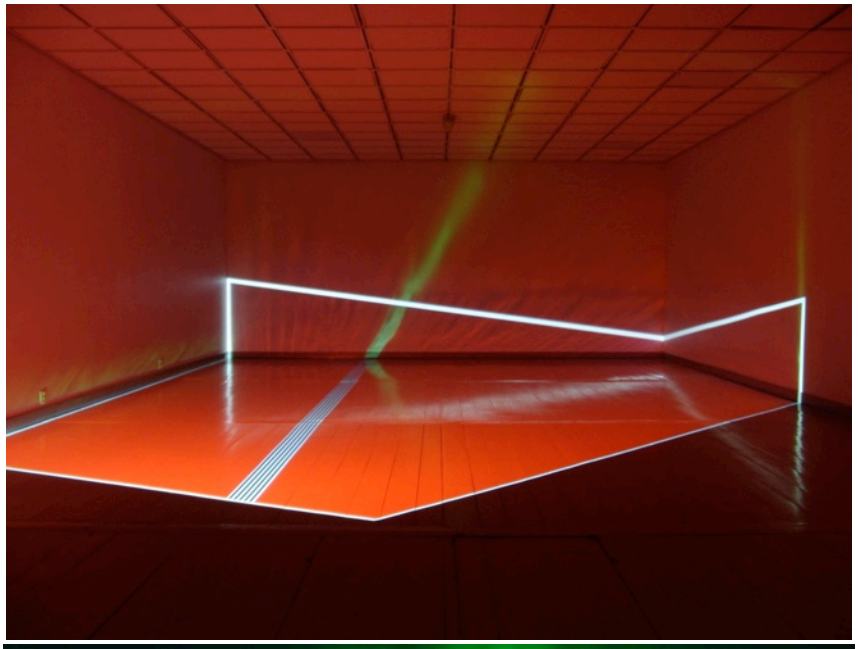
VPT was again my tool of choice, as I needed to work with precise masking of the floor, sections of the floor and even the floorboards themselves. This allowed me relatively quickly to have a setup for trying out material while being in the space. The time-consuming (and interesting) part of this project was to build up images and compose sequences.

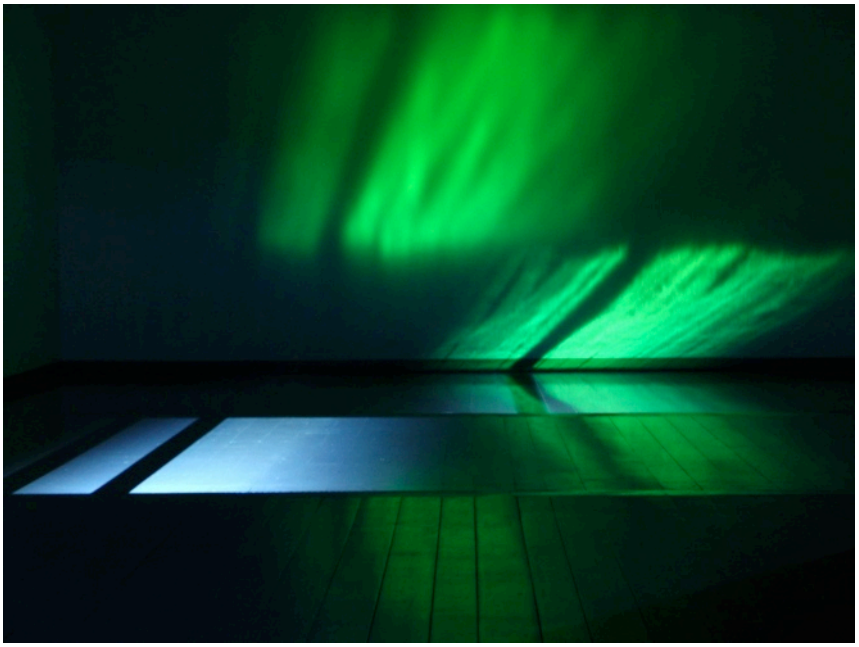




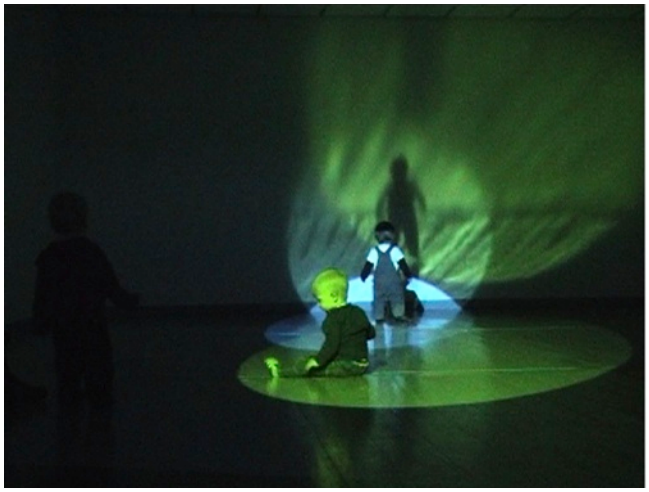
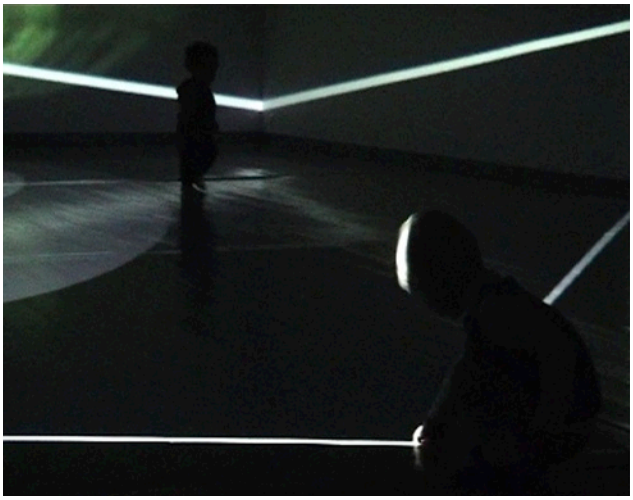
I wanted to work with sound more as a spatial aspect rather than a temporal one, and ended up with five sound exciters placed at various points in the ceiling and a subwoofer under one of the benches. The same sound was played in all the sound channels, but starting at different points, creating a slightly changing audio space.







Audience reactions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PERCEPTION

Embodiment

> The body is the place of passage of the movements received and thrown back, a hyphen, a connecting link between the things which act upon me and things upon which I act - the seat, in a word, of the sensorimotor phenomena. Henri Bergson

My interest in working with various spaces is partly based on the theories of the double embodiment, that mental space and physical space are connected through our bodies being in the world. I am interested in the potential feedback in transforming my environment, and how this transformation affects my perception of that environment which then again might produce several iterations of transformations. This is another way of describing my conversations with spaces, improvising with my extended body (through my tools) in a space, creating a dialogue between me and the physical space, or maybe just a feedback loop of me improvising with the perception of my projected mental space?

My initial fascination with psychogeography grew out out similar reasons, the study of how the geographic environment influences the emotion and behavior of the individual. I can´t say that the methods of pscyhogeography has informed my later works, although during my work with the *Cityscapes* videos the idea of the derivé definitely influenced how I perceived the city through the camera lens, letting the streets and architecture guide me instead of having a fixed plan on where to go and what to shoot.

Another aspect related to the embodied mind, is the notion that the same nerve cells that deal with motor motions are also the ones perceiving motion, thus perceiving motion somehow resonates with creating that motion: it is a operation sensed through the body, so watching or experiencing movement is reflected in the mind.

In his book *The Space Between Our Ears* from 2003 the brain researcher Michael Morgan asks if our perceptions are “informed guesses about the most likely state of the world outside? Are they, indeed 'controlled hallucinations' - controlled by the laws of probability?” (Morgan:94-95). Research seems to indicate that perception involves selecting an internally generated model and then checking it against the data from the body(Morgan:97). Similarly action also involves comparing a model with the present state of the body, thus “the distinction between the perception and action begins to fade away” (Morgan:99).

Technology and memory

Charlie Gere writes in his book *Art, time and technology* from 2006 about the french philosopher and curator Bernard Stiegler:

> Bernard Stiegler claims that it is only through technics that humanity has access to time and history. Humanity is experiencing the breaking of the time barrier, as technology has evolved faster than culture, thus bringing the whole question of the human, history and time in question.

Hominization and technicization developed in tandem, by using tools we became human (Gere:15). According to Stiegler, for the paleanthropologist Leroi-Gouthan , it is the tool that invents the human, not the human that invents the technical (Gere:19).

> Stiegler proposes that the capacity to conserve experience in a form exterior to the human body, in our technics, constitutes a third kind of memory, following that which we inherit through our genes, and which we accumulate in our lifetime: the memory of our central nervous system (Gere:20).
>
> Relative to the rhythm of technical evolution, the human had more or less stabilized biologically 20-30000 years ago. Our genetic structures seems to have been stabilized at about this moment. But technical evolution has continued and accelerated since that point (Gere:21).

Speculations on time and space

My interest is in the perception of time and space, which is not the same as the concepts of time and space described by physics:

> because we use the same word "space" to describe an aspect of our perception and world described by physics, it is easy to confuse the two. However, the space we experience through our bodies could not be more different from the silent and empty spaces between the stars.(Morgan:124)

It is tempting to follow Henri Bergson, if I understood him right, that it is not possible to measure time, there are just endless different durations. You can measure space, but not time.

Francisco Varela was trained as a biologist but spent most of his time working within the field of cognitive science. He was a proponent of the embodied philosophy and tried to combine concepts of neuroscience with phenomenology.

In an interview in the *Machine Times* catalogue for the DEAF00 exhibition in 2000 he describes time as a dynamic process: Now is a point in space that leaves a short trail which is the immediate past (retention), and like a ball moving down a slope, you can more or less get an idea of where it will continue (protention). That is, until something unexpected happens, the ball hits a stone and changes direction, and the now has to reinvent itself. Varela uses the example of walking down the street, when suddenly a car honks, and this pulls you out of your current state, the transparency of the situation is lost and a new choice needs to be made. Varela thinks that affectivity is what guides protention, so when the transparency is broken, there is a new emotional state which reinvents the now.

Following Varela, it makes sense to talk about subjective time, about fast and slow time.

The compression and expansion of time, how does this relate to memory? Obviously we remember certain moments in great detail, while other events have vanished. How is our perception of external events related to our conception of time? As long as we don´t perceive any changes, how do we perceive the passage of time? In the context of composing an installation like *shift* or *blink*, a certain rhythm creates an expectancy: moving from rapid movements to slower ones might create an unbalance, which could lead to an impatient and discontent audience, while sticking with slow movements/ rhythms creates an expectancy of little change and the body/mind accepts that.

Varela describes the now as a space inside time itself. Is this related to what I have called the crossing point between a specific time and place?

A location in time: If nothing changes, is it then the same space which time passes through, or does it appear not to change because my body is used as a measuring rod?

If I go to the same space over a few days and I notice no change, isn´t that because things have different durations? Just because I am not able to perceive any changes could just mean that I perceive at a different resolution. You can see different durations with slow motion and time-lapse for instance, which would not be visible with my own duration as a starting point.

Think of the different durations in a city, of the buildings, of the people, the shops, the green traffic light etc, old buildings like churches from the 11th century, or even mountains.

When I animate microscope stills in the *mikro* performances, I construct a movement which again implies some sort of temporal quality. Is there a threshold when consecutive images will just appear to be separate spaces/locations, and when they are experienced as a movement in/through space? Is that related to speed?

When I create light sequences to make shadows move, I create a notion of time. At what point do the individual shadow projections turn into a movement through time (and space)?

Similar questions could be asked about the *Wind-up birds*: What is the duration between peckings that either makes the woodpeckers appear to be communicating with each other, or that might imply that it is just one bird that moves from tree to tree?

How are repetitions experienced, in the context of Stiegler´s writings on recorded memory?

Mark B.Hansen writes about Stiegler´s ideas on memory and recording in his book *New Philosophy for New Media* from 2006. The third kind of memory gives you access to a recorded experience without having experienced it yourself, which marks a fundamental break in the relation between technology and time. You can perceive an exactly identical temporal object (a recorded song for instance) several times, although the perception will not be identical as it is influenced by the secondary memory of the first perception.(Hansen:256)

So every time you hear (or see) the same thing over and over again, as a loop, it gets a sort of textural drone quality. Is this related to the affective guidance of protention that Varela writes about? Gradually the repetition becomes transparent.

The anticipation of something you know will come.

The annihilation of time and space[43]

In the introduction to the *Machine Times* catalogue they write:

> "Now" lasts for approximately 0.3 seconds. This is the time it takes the various centers and sections of our brain to find a synchronous rhythm which we experience as the present. As cognitive research into the phenomenon of time progresses, it is becoming more and more obvious that time is not an objective quantity which can be measured by chronometers and divided up into seconds and everything beyond.

Paul Virilio differentiated between "extensive" and "intensive" time, extensive time is of durability and presence, similar to what was described in the previous section. Intensive time is beyond experience as it is below the the threshold of the 0.3 second now.

> It is the time which eliminates space: arrival and departure occur in the same moment in real-time and the road travelled in between is no longer relevant. Intensive time is the time that exists only in machines and between them, the context of the slow human 'now'.

I think the threshold of the now is what Stiegler is referring to when talking about breaking the time barrier:

> What would be the breaking of a time barrier if this meant going faster than time? What shock would be provoked by a device going quicker than its "own time"? Such a shock would in fact mean that speed is older than time.
>
> Therefore time and space is only thinkable in terms of speed.
>
> Speed means rate of progress or motion. In that everything, even things which are ostensibly not moving, has a rate of motion or progress, and that an object´s speed can only be perceived in relation to that of other objects, speed is pure difference. Only through the perception of different rates of movement can we apprehend time and by extension, space.
>
> By recognizing the priority of speed we can move away from time as homogeneous framework in which things happen (Gere:22).

Or to put it into the words of the dutch architect Lars Spuybroek in his lecture *Motor Geometry*: "We no longer look at objects, whether static or moving, but at movement as it passes through the object."

Andreas Huyssen suggests that one response to the ever-greater ubiquity of real-time systems is an increasing interest in memory: Speed destroys space, and it erases temporal distance. In both cases, the mechanism of physiological perception is altered. The more memory we store on data banks, the more the past is sucked into the orbit of the present, ready to be called upon the screen (Gere:5).

Why do things look more dramatic and beautiful in slow motion? When stretching a sound until it becomes a texture, is it because of the lack of perception of change that it is experienced as a texture?

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[43] a common phrase in the late nineteenth century describing the changes caused by the telephone, phonograph, photography,telegraphy and railroad. From Rebecca Solnit´s excellent book on Eadweard Muybridge, *River of shadows*

High speed contracts space, Slow speed expands it, but you can´t at the same time say something about the time?

Morgan writes that "motion is a specific sensation like color or smell, which cannot be analyzed into a series of separate, stationary sensations" (Morgan:61). Again, as with perception of space vs. physical space, we mustn´t confuse the sensation of motion with physical motion (Morgan:65).

Lost in focused intensity

I have for a long time looked for a way to talk about my work which does not involve direct interpretation. I have been envious at musicians who seldom get the question of "what does it mean?" after a concert, people are somehow satisfied with listening to a piece of music or going to a concert without attributing meaning to the experience. I have attempted to describe what I am trying to aim at in my work as similar to the energy experienced at a good rock concert, but I realize this is a very subjective experience. This was made particularly clear to me when I brought it up at my seminar "Conversations with spaces"[44] where the discussion quickly turned to preferences of music, and the whole context of being at a rock concert. The experience I was trying to describe got lost in interpretations of rock music.

I was therefore very excited when I shortly after discovered some of the ideas of the German-American philosopher Hans Ulrich Gumbrecht through Mitchell Whitelaw´s blog *The Teeming Void*. [45] What immediately caught my attention was the expression "being lost in focused intensity" which I felt summed up precisely what I was trying to describe with my experience at a good concert, or as a performer I often experience when improvising.

Gumbrecht has written a book called *The production of presence* where he tries to develop concepts that allow us to relate to the world in a way that is more complex than interpretation alone, that is more complex than only attributing meaning to the world. He shares Jean-Luc Nancy´s frustration of "so many discourses, so many texts that have no other care than to make a little more sense, to redo or to perfect delicate works of signification" (Gumbrecht:57).

He looks at aesthetice experience (or lived experience) within the framework of the humanities, and develops the mutually exclusive pair meaning culture and presence culture. Meaning culture is associated with interpretation, looking at the world from the outside, production of knowledge, mind and the temporal dimension. Presence culture is associated with the body, being part of the world, revelation of knowledge and the spatial dimension. Presence culture sets the body in the center as being part of the world as opposed to meaning culture where the mind interprets/constructs the world from a distance.

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[44] which took place at Bergen Kunsthall Landmark September 2008

[45] http://teemingvoid.blogspot.com/

In a worldview based on meaning-culture you would always want to go in depth beyond the surface, while presence is about substance and surface, a physically tangible world.

Gumbrecht describes aesthetic experience as moments of intensity, which does not contain a message, it is a difference in quantification which is experienced.

Aesthetic experience provides us with certain feelings of intensity that we cannot find in the historically and culturally specific everyday world that we inhabit. They happen within a situational framework, isolated from the everyday experience, described by Gumbrecht as structures of insularity.

There are two ways of entering structures of insularity, one sudden and one prepared. The sudden appearance of certain objects of perception diverts our attention from ongoing everyday routines and temporarily separates us. He uses the first flash of lightning in a thunderstorm as one example.

The other way is to create a situation for the audience to make them alert and open for aesthetic experience. Entering a gallery or theater could achieve this.

Objects of aesthetic experience fascinates us because they are characterized by an oscillation between meaning and presence effects. In a world saturated with meaning, we long for phenomena and impressions of presence, but in our predominantly meaning culture it is impossible to experience presence as more than presence effects. Meaning and presence always appear together, and are always in tension. We need the framework of insularity and disposition of "focused intensity" to experience the productive tension between meaning and presence, instead of bracketing the presence side.

Gumbrecht describes the specific mode of the oscillation between meaning and presence effects as epiphanies. We never know when an epiphany will happen, we don´t know the form or intensity it takes, and it undoes itself as it emerges. He doesn´t restrict this to objects of art, in fact he uses the unfolding of a beautiful play in football as an example of an epiphany.

If aesthetic experience doesn´t contain a message, what is the effect of getting lost in focused intensity? According to Gumbrecht, it helps us recuperate the spatial and bodily dimensions of our existence, or since it is only a brief moment, it prevents us from losing a feeling of the physical dimension of our lives, to catch a glimpse of "the things of the world".

The audiovisual connection

A popular concept used when talking about audiovisual works is synesthesia, which is

> a neurologically based phenomenon in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive.[46]

For example when you hear a sound you see a specific color or smell a specific scent. As Whitelaw argues in the article "Synesthesia and Cross-Modality in Contemporary

[46] http://en.wikipedia.org/wiki/Synesthesia

Audiovisuals", this analogy is limited when talking about perception of audiovisual works because they are objects of perception, not perceptions. A more useful way to describe them is using cross modal perception, the integration of different sensations (like vision and hearing) to link them to a single cause.

Whitelaw looks to research in neurobiology and psychology, using the classic example of the "hidden dalmatian" to explain the phenomenon of binding: Our perceptual system binds correlated elements into groups that often correspond to objects in our physical environment. Binding is "sticky", when you have first discovered the dalmatian, it is hard to un-see it. Another interesting feature of binding is that the act of making a binding is pleasurable in itself, the discovery of the dog "generates a pleasant ´aha´ sensation." (Whitelaw:268)

The affect attributed to the moment of binding is also true for the perceived synchronicity of light and sound: In *Mark Boyle´s Journey to the surface of the earth* J. L. Locher describes Arthur Boyle´s experiences from working with projection performances in the late sixties:

> For Boyle, the nervous energy required to link the music and the images, forcing two disparate sensory experiences to coincide, caused "excitement, satisfaction, pleasure". (Locher:78)

Gestalt groupings

The study of perception by researchers within Gestalt psychology which took place in the early 20th century, uncovered phenomena which have been "re-discovered" in more recent times. One of the founders of the Gestalt tradition, Max Wertheimer, writes in his book *Laws of Organisation in Perceptual forms* that during the cognition of sensation, phenomena are initially parsed into groups. These are the some of the groups which are most relevant in relation to my work with *nodio* and *shift*:

Proximity	Things that are located in close proximity to each other are inferred to be a group.
Good Continuation	If objects are arranged in such a way that they are collinear, or appear to continue each other, they are grouped as a whole.
Common Fate	Objects that move together are most likely connected in some way.[47]

Max Wertheimer also described Beta movement in his 1912 *Experimental Studies on the Seeing of Motion*: Beta movement is a perceptual illusion whereby two or more still images are combined by the brain into surmised motion. [48]

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[47] Taken from Andrew Lyons Time_Space_Texture

[48] http://en.wikipedia.org/wiki/Beta_movement

Cross modality in sound and vision

There have been many studies on cross-modal perception, showing the mutual influence of sound and vision. Whitelaw writes in "Synesthesia and Cross-Modality in Contemporary Audiovisuals"about:

> how vision can alter the content and spatial location of perceived sound; and how sound can alter the perceived intensity and timing of visual stimuli. We hear what we see, and see what we hear.(Whitelaw:270)

In one experiment [49]

> subjects were presented with two moving dots on intersecting paths. Two perceptual interpretations of this animation are possible: that the dots pass each other without touching, or that they collide and bounce off each other. Without sound, the former interpretation was dominant; however adding a brief sound at the crossing point biased perception strongly towards collision. (*Ibid.*)

The film-sound theorist Michel Chion writes in his book *Audiovision* that "sound is the rubber stamp that marks the image with the seal of instantaneity" (Chion:61), and uses the cinematic punch as an example: the sound is crucial to the perception of the punch. He claims that "the punch with sound effects is to audiovisual language as the chord is to music, mobilizing the vertical dimension", that strong points of synchronization like collisions, explosions, and punches allows for a temporal elasticity/flexibility, using the boxing scenes from Scorcese´s *Raging Bull* as an example.(Chion:62)

I am trying to achieve an "extended punch" in my *nodio* and *shift* installations, linking image,sound, and physical objects through motion. This is also connected to the work of New Zealand artist Len Lye, who proclaimed to be composing "figures of motion" in both his animated films and his big metal kinetic installations.

Chion coined the term Synchresis, a combination of synchronism and synthesis, in describing

> the spontaneous and irresistible weld produced between a particular auditory phenomenon and visual phenomenon when they occur at the same time. This join results independently of any rational logic. (Chion:63)

So in principle almost any visual phenomena can be hooked up to any sound effect, something which is obviously exploited in the film industry, but also in a theatre piece like Vinge and Müller´s *Vildanden* [50] where every sound you heard was dubbed live, so everything from footsteps to creaking doors, dialogue as well as violent fights were exaggerated/amplified by sound effects, which for me at least had the effect of intensifying the presence of the piece.

As Murray Schaeffer writes in *The Soundscape*, hearing is a way of touching at a distance.

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[49] Sekuler et al. (1997)

[50] Performed at Festspillene i Bergen, may 2009

The sense of hearing can´t be shut off, there are no earlids, the only protection is to filter out undesirable sound in order to concentrate on what is desirable.

A different function of sound in relation to vision is as “glue”, as a more seamless joint of two scenes which without the sound would be harder to perceive as being connected. The performance *Kamp* by dutch group Hotel Modern[51] uses sound as a way of binding the stage containing a model of the Auschwitz camp with close-up video footage from the actions occurring in the model, partly by using environmental sounds but also through the use of contact microphones on the stage floor, thus linking the two scenes which have completely different scales, like you cut between a wide-angle shot and a close-up in a film.

Color effects on the perception of time,size, weight and volume

color	Perception of time	size	weight	Volume
warm	Time is overestimated; Use warm colors for areas where time in apparent “slow motion might be more pleasurable	Things seem longer and bigger	Weights seem heavier	Decreases apparent size of rooms
cool	Time is underestimated; use cool colors for areas where routine or monotonous tasks are performed	Things seem shorter and smaller	Weights seem lighter. (Use on boxes & containers which must be carried about)	Increases apparent size of rooms

[52]

[51] http://www.hotelmodern.nl/

[52] From a lecture on color by Byron Mikellides at KHIB 2008, based on a diagram from NASA

SYSTEM - STRUCTURE - COMPOSITION

System Esthetics

In 1968 Jack Burnham wrote his famous “System Esthetics” article in *Artforum*, where he proclaimed:

> We are now in transition from an object-oriented to a systems-oriented culture. Here change emanates, not from things, but from the way things are done.

A system is a "complex of components in interaction" , allowing for a more dynamic approach:

> Where the object almost always has a fixed shape and boundaries, the consistency of a system may be altered in time and space, its behavior determined both by external conditions and its mechanisms of control.

There is a shift from end result to process, and the primary role of the artist is now the maker of esthetic decisions, according to Burnham.

Thinking of art in terms of systems makes the structure as important as the content, and it is why my working method is very much involved in the process of organizing a space, choreographing movement in a space or composing audiovisual spaces. Ways of leaving a personal stamp not only in the content but also in the structure of a work has therefore been one of my challenges in the research fellowship.

A lot of my work exists in the tension between improvisation and structure. Improvisation is always based on constraints, so I try to create a framework for events to unfold within. One example of this is the performance *Synk* (2001-2007): It involved one dancer[53], Justin Bennett on sound and myself on video.

I wrote about *Synk* in my article “Within the space of an instant” from the anthology *Get Real* in 2005:

> The idea of *Synk* was that no prerecorded video or audio would be used, only material sampled during the performance was allowed.
>
> We wanted to investigate live as raw material: to impose a structure on a live situation to allow for unpredictable results within that frame structure. My setup allowed me to sample the dancers movements and create loops which then recombined with what the dancer was doing on stage. I also used several delay buffers, feedback systems and blending a stream of consecutive images into ghostlike images. The interplay between my program, the variations of the dancer and what was picked up by the camera created a unique performance every time, mainly influenced by the shape and look of the space we performed in, everything from white gallery spaces, small black box stages and big venues.(Gilje:68-69)

In more recent work I have been interested in exploring the situational approach further, by focusing on the intersection/integration of digital systems into physical structures/environments.

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[53] The movements were developed by choregrapher Eva-Cecilie Richardsen and the two dancers Kristianne Mo and Gry Bech-Hanssen. In some performances danced by Lena Meland or Hege Holt Østbye

Transduction and Transmateriality

I discovered Mitchell Whitelaw´s writings through an interview with him in *Rhizome*, where he uses *Wind-up bird*s as an example of works "which create local,specific, and material instances of digital systems."[54] Whitelaw is an Australian artist and writer who publishes most of his writings on his blog *The Teeming Void*.

The main idea of Whitelaw is that of transmateriality, which takes as its premise Kirschenbaum´s statement that digital systems are material systems designed to support an illusion of immateriality: A file copied to two different hard drives are different due to the the material specificities of the drives, but for the computers concerned the files are identical.

Or using Kittler:

> The general digitization of channels and information erases the difference among individual media. Sound and image, voice and text are reduced to surface effects, known to consumers as interface.(Gere:4)

Another example could be the error correction system included as part of the audio cd standard: A high-quality produced disk contains 20-30 errors per second, and without this error correction system, any cd would be unlistenable. The error correction system then helps to maintain the illusion of the immaterial quality of the digital audio cd.[55]

Whitelaw writes in "Aspects of Transmateriality":

> the digital is premised on generality: the ability to transduce a pattern from one instantiation to another [such as the information stored on a cd read by the cd player], such that the pattern is effectively (but only effectively) independent of its substrate.

What interests Whitelaw is the duality of digital systems, that they operate both on the specific material level as well as on a general abstracted data level, so even though they are material systems they can be manipulated as data.

Whitelaw contrasts the general-purpose substrate of the screen with special-purpose displays, like David Rokeby´s *Cloud*, Adam Somlai-Fischer and Bengt Sjölen´s *Aleph*, Daniel Rozin´s *Wooden Mirror* etc, to show that there is a renewed interest in the local materiality of the manifestation of data instead of its abstract generality.

In his blog-post "Transduction, Transmateriality and Expanded Computing", Whitelaw elaborates on the concept of transducers. Transducers are devices that converts energy from one kind to another, for example a lightbulb converts electricity into light (and some heat).

Digital media contains many types of transducers, basically all input and output devices like keyboards, screens and printers are transducers. If we expand transduction to also include all the propagating matter and energy within a device like a computer,

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[54] http://www.rhizome.org/editorial/2071

[55] an example provided by one of the people commenting Whitelaw´s post.

and also between that device and the world, a computer can be seen as “a machine for shifting patterns through time and space.”

Current consumer computers are black box devices, they come as they are and do more or less what they were intended to do. If something breaks down you send it away to get it repaired/replaced. Parallel to this trend the “computer is undergoing a rich and productive decomposition”. Under names such as hardware hacking or physical computing, the black box has been cracked open, and the computer is exposed, extended and expanded.

A micro-controller like the Arduino offers only a set of input/output pins for us to configure and connect. It is a cluster of transducers, making connections between different devices, the computer and the environment, or relaying input from one local environment to another:

> Paradoxically the very generalities of computing-the abstractions and protocols that insulate it from local, material conditions - make it a powerful tool for transduction, that is, the propagation of specificities.

Finally, “transduction suggests a way to link practices like physical computing, fabrication, networked environments” and many more, and Whitelaw launches the term “expanded computing” as a paraphrase on expanded cinema.

Audience control

In a discussion during my “Conversations with spaces” seminar, I had an interesting exchange with Lawrence Malstaf about audience control. We both have backgrounds in both performance and installation and we were discussing how to achieve the same intensity you can get through a performance in how the audience is “guided” into the work. Malstaf suggested looking at industrial design for ways of guiding people´s focus without explicitly telling them what to do, using the example of a car: You don´t need an arrow to know what is the front of the car.

Physical structures are one way of structuring a work, examples could be as different artists as Mike Nelson´s labyrinths (where the disorientation of the audience is a major part of the work), James Turrell´s *Mendota Stoppages* (where shutters and apertures are opened and closed and the audience moved around to experience the light from the outside coming in) or Le Corbusier/Xenakis/Varése *Le Poème Electronique* (where the audience is led through a architectural stomach).

Of course the wider context of an art work is an important structural element. I have already briefly mentioned performance vs. installation, but here is a list of some possible contexts which influence how a work is perceived:

Temporary installation vs. permanent installation

Announced vs. unannounced

Performance (beginning -> end), repetitive performance, installation

Public space vs. gallery

White cube vs. blackbox

In public space: Big event announced as art vs. stumble upon a work by chance vs. actively looking for a piece of art.

The narrative/discursive frame: what is written, how it is presented etc.

These different contexts are exemplified in the different works I have realized during the research fellowship.

The *wind-up birds* in Lillehammer and *soundpockets* in Oslo were both part of public events on the opening with a large group of people experiencing the work together. After the opening the works could be searched for using a map that came with the exhibition, or since the work was placed in the public, people could just stumble upon the work without knowing it was an art project. The context for the *wind-up birds* in Lillehammer, at Oslo airport and in Rabat also made it into very different experiences.

The compositional strategies for making work experienced in a gallery space vs. a public space, installation vs. performance has a lot to do with attention span. In a performance people expect it to have a certain duration and are somewhat more patient then when going to a gallery: Browsing from art work to art work, often a work is quickly abandoned if it doesn´t catch your attention immediately.

Tension control-unpredictability

Having worked for many years within the free-improvisation scene where it is mainly about "being there in the moment" and chasing those moments "lost in focused intensity", it has been a challenge for me try to achieve a similar experience in an installation.

The tension between improvisation and structure mentioned earlier could also be called a relation between control and chaos.

An installation can contain various levels of unpredictability, with real-time systems[56] on one end and composed playback installations on the other end.

Interactive (a word no-one wants to be associated with these days) installations are complicated as they often either produce too predictable responses to the interaction, or the system´s response is so complex that nobody realizes it is responding to anything. Another possible outcome is that the system dictates the user, that the user adapts to the system to achieve an interesting reaction. This can be exploited in a performance setting where you can get "expert users", the performers, to get the most interesting dialogue with the system.

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[56] Real-time installations generating ever changing material as it evolves, real-time systems which responds to input from the environment (input from people or detecting changes in the physical environment, for instance). This would be a classical causal circuit, a random input produces a non-random result related to the characteristics of the circuit.

Since I have had the chance to work with expert users in the dance/theatre world I have made some attempts at recreating the tension between performer and system in installations, but it is very hard to do this without the audience knowing what the system can do, or maybe even to know what I want to get out of the system. I have also produced quite a few "stream of consciousness" installations with variations of material appearing and combining in different ways. This sometimes produces interesting moments, but as I have argued elsewhere, the computer cannot make esthetic decisions, it doesn´t know when the interesting moments arrive, it doesn´t know how to hold them or to move on from them.

When the Norwegian artist Kjell Bjørgeengen spoke at a seminar about technology and art at Bergen Kunstmuseum in February 2008[57] he explained that the artistic process for him starts from the unknown. He initiates/develops certain computer algorithms that generate visual output, not knowing what the result will be. Then, seeing the result, he makes aesthetic decisions, basically selecting the material he likes, and then placing it in a fixed structure.

In "Within the space of an instant" I have described my work with software and hardware for working with video in a live context as instruments. The instruments I create determine to a large extent what the visual output will be. Bjørgeengen talked about "double subjectification", as creator of both the tool and the content.

New media devices are meant to be omnipresent and democratic, but using standardized tools like specific hardware and software makes it harder to see the artist ´s material presence, especially in new media practices: subjectivity is lost. To get around this the artist needs to use the existing tools in unexpected ways or create his own tools or modify them. This is how I understand the subjectification of the tool.

Bjørgeengen says the the subjectification of the tool opens it and gives it new possibilities, makes it do things you couldn´t have thought of in advance, thus introducing an element of surprise or risk.

Customized software and hardware generates the material that Bjørgeengen considers as raw material, not finished product. Coded procedures generate images, which are later subjected to aesthetic deliberation: For him it is essential to structure the material, described by Stian Grøgaard in the catalogue for an installation by Bjørgeengen/ Arnoud, as the "collision of a coded procedure and artistic intention [..] Bjørgeengen´s installation can appear as an attempt to make the element of surprise systematic". (Grøgaard:37)

Unlike similar generative work by other artists which continue to create variations of the material during the exhibition, Bjørgeengen is quite clear that for him the generative process stops in the studio.

My approach is slightly different, since I have often started out with some sort of concrete material, and then by applying different procedures to this material I create unexpected results, but where the artistic decisions are made at an earlier stage by creating limitations through rules, by thinking of the material as a flow which can be molded, with me as the pilot.

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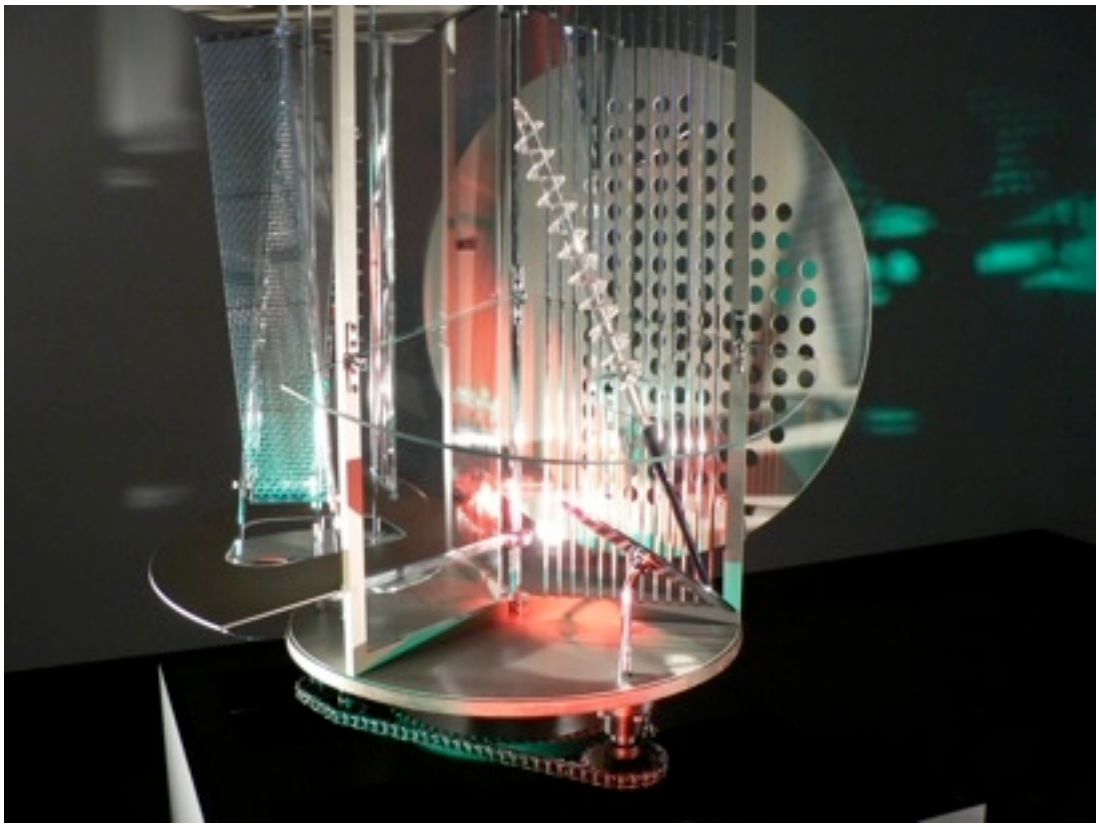
[57] The occasion being the installation by Bjørgeengen and Aernoud in Tårnsalen at Bergen Kunstmuseum

I do find that this works well in an improvisation setting, but since computers aren´t really good at making aesthetic decisions this is more problematic in an installation setting, as I am not there to guide or modify the direction that certain procedures are taking. This might result in either too many surprises or dull moments with a very open structure, or in a tighter grip on the structures of the procedures, making the result less dynamic.

This is one of the reasons I have looked into several compositional strategies, I consider Bjørgeengen´s approach as an interesting alternative (which I partly employed in shift v2 in Roskilde).

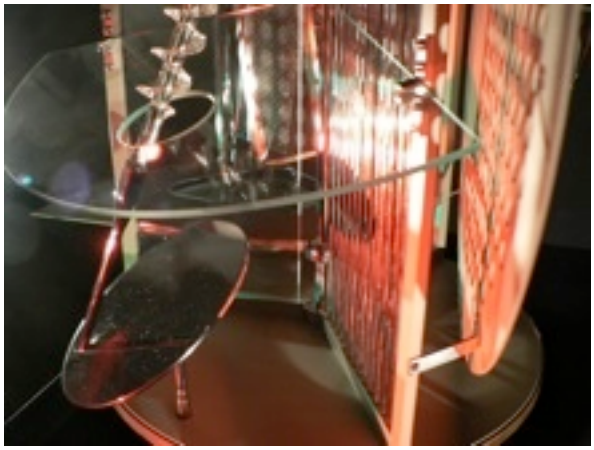
AUDIOVISUAL-SPATIAL COMPOSITIONS

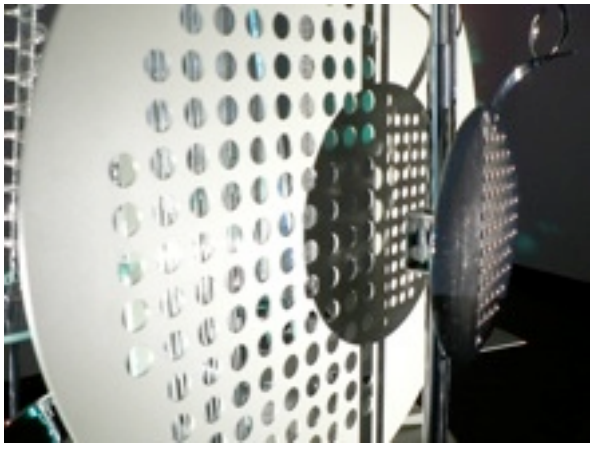
Light-space modulator



Modulation of space using light and motion.

The Hungarian artist Lazlo Moholy-Nagy has been a bit of a hero of mine, both through his own work as an artist, as Bauhaus teacher and experimenter, and his visionary writings which still hold relevance today.





One of his pivotal works is the *Light-space-modulator*, which could be described as a kinetic light-machine, which he worked on for over ten years. It consists of a rotating sculpture made of various materials: perforated metal, transparent acrylic glass, mirrors, a wooden ball, and the rotation of it creates a complex movement in itself. The work as described by Moholy-Nagy puts the focus on the interplay of the lights and the motion

of the sculpture, where the movement is cast as light and shadows on the surrounding walls.

It is slightly confusing reading about the work and then seeing it. In his book *Vision in Motion* Moholy-Nagy describes it as being inside a cube with two layers of circular openings around which up to 140 light bulbs are mounted, going on and off in a predetermined pattern, triggered by a drum contact on the rotating mechanism: “This was arranged so that within a two-minute turning period, various colored and colorless spotlights were switched on, creating a light display on the inside walls of a cube.” (Moholy-Nagy:238)

However, in the two reconstructions I have seen, one at the Van Abbe Museum in Eindhoven, and the other at the big Bauhaus exhibition at Martin Gropius Bau in Berlin the summer of 2009, both the number of lights, the colors, the dynamic quality of the lights, and the construction of the box had little to do with the original, so I have found it disappointing to see the light-space modulator in real life.

I think another reason for the reconstruction not living up to my expectations is the film *Light Display: Black-White-Grey* that Moholy-Nagy made in 1930 from the effects of the *light-space-modulator* which is really able to convey the light-shadow-movement complexity of the piece.

This film was the only realized part of a planned six part film, an abstract film about different forms of light.

Moholy-Nagy included the synopsis for the film in *Vision in Motion*, although it is unclear whether it was written before or after the shooting of the part based on the light-space-modulator, but it is interesting anyway to see a synopsis for an abstract film:

> The shadow of the rotating Light Prop
>
> The superimposition of metal details with the shadows. The shadow revolving; slowly the shadow of a ball surrounded by strong light, moving up and down over the original shadow.
>
> The lightprop turns; it is seen from above, below, frontwards, backwards; in normal, accelerated,retarded,reversed motion.
>
> close-up of details.
>
> a big black shiny ball rolls from left to right. From right to left. Over again.
>
> Positive, negative pictures, fades, prisms; dissolving.
>
> Movements, queerl shifting grills.
>
> "Drunken" screens, lattices.
>
> Views through small openings; through automatically changing diaphragms.
>
> Distortion of reflections. Pendulum.

> Blinding moving light flashes. Revolving spiral, reappearing, again and again. Rotation increases; all concrete shapes dissolve in light. (Moholy-Nagy:288)

To illustrate his ability to think ahead of his time: around the time he filmed *Light-Display* he wrote the following:

> It is indeed foreseeable that this or similar motion pictures may be transmitted by radio. In part with the support of telescopal prospects, in part as real light plays, whereby the listener owns a private lighting apparatus which can be remotely conducted from the radio station via electrically controlled color filters.[58]

He saw the potential of both streaming film wirelessly from one location to another, but also to remote-conduct an orchestra of local light-space-modulators wirelessly.

Le Poème Electronique

In one of the texts in a publication from the Bauhaus University Weimar, Acalya Kiyak sees the Philips Pavilion from 1958 as an articulation of many of Moholy Nagy´s ideas from *Vision in Motion*: plastic space, modulation of space, the use of light, separation of color from the image, using curved surfaces for projection etc.

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[58] http://www.bauhaus.de/english/bauhaus1919/kunst/kunst_modulator.htm

Poème électronique is the first, electronic-spatial environment to combine architecture, film, light and music to a total experience made to function in time and space.[59]

The Dutch electronics giant Philips wanted to use their pavilion for the Brussels World Fair in 1958 to showcase light and sound effects to illustrate Philips´s technological progress, not specific products, and they approached the French architect Le Corbusier, who was at the peak of his career at this time.

Le Corbusier didn´t want to create a façade for the Philips Pavilion, he wanted to create a electronic spectacle on the inside. He sketched the shape of the building as a stomach, with people walking through the stomach, just like a digesting system. The stomach where the eight minute spectacle took place had room for 500 people. Le Corbusier´s assistant Iannis Xenakis, later to become a very well known composer, transformed the sketches into a shell-like structure.

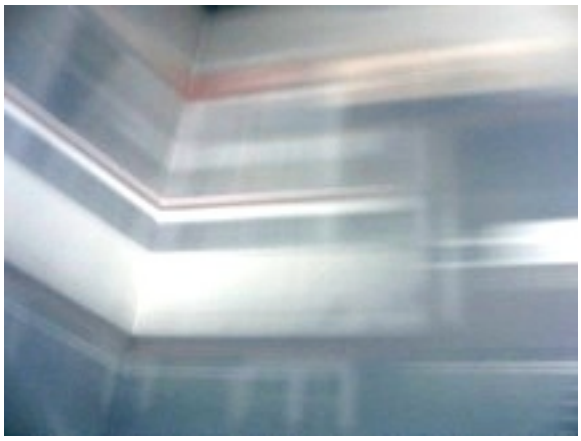
The spectacle was called *Le Poème Electronique*, combining projections of an assembly of black and white images with projections of colored two dimensional shapes, all projected on the curved walls of the interior, three dimensional objects hanging from the ceiling illuminated with ultraviolet light. The score of Edgar Varèse was played back from an array of 400 loudspeakers positioned throughout the space, so the sound could follow paths in this array. Varèse said "I heard my music literally projected into space."[60]

The result was an audiovisual spatial experience, a space being transformed into something more than what is contained within the walls of the actual building, it was the culmination of Le Corbusier´s search for "ineffable space.": "A boundless depth opened up, effaced the walls, drove away contingent presences and accomplished the miracle;" the miracle of 'ineffable space'."(Kiyak:164)

[59] http://www.medienkunstnetz.de/works/poeme-electronique/

[60] http://emfinstitute.emf.org/exhibits/varesepoeme.html

Mendota Stoppages

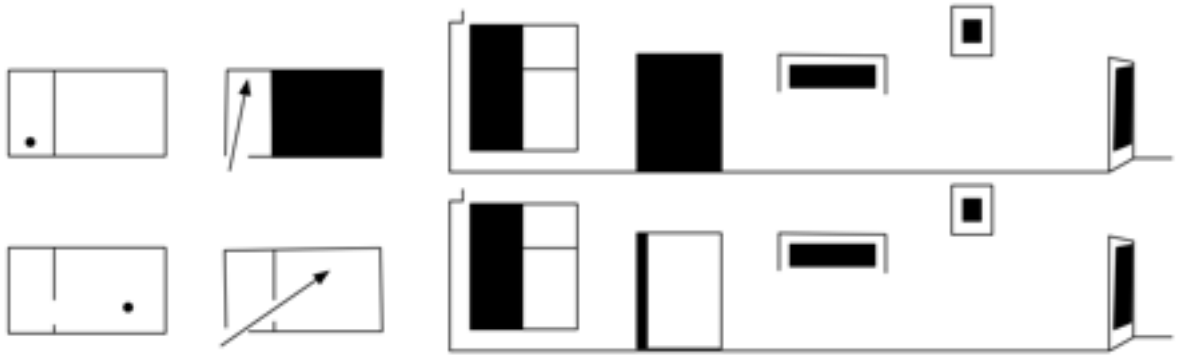


strijp stoppages by hc gije

In the late sixties/early seventies James Turrell used a former hotel as his studio and exhibition space, the Mendota Hotel. He modified the rooms, experimenting with different ways of letting light from the outside come in, through various windows and apertures, discovering different light qualities he called the *Mendota Stoppages*.

This was his first attempt at establishing a direct relationship between an inside and outside space, letting one space sense the light qualities of the other.

Eventually he put together an organized group of light images by selecting from a multitude of possibilities. He developed a night version and a day version. The night version which lasted between two and four hours, consisted of ten stages for which he made a diagram he called Music for the Mendota.



Reconstruction of two scenes from Music for the Mendota.
To the right, the rooms from above, with position of audience and entrance of light.
To the left, the various windows and apertures in different positions.

In *James Turrell: The art of light and space*, Craig Adcock gives a very detailed description of the *Mendota Stoppages*:

> Turrell and his guests went to the studio area and proceeded to view a sequence of constantly changing light events. Indeed, the nature of audience´s participation, their active engagement at basic perceptual levels, and their movement from one studio space to another gave the work a structure reminiscent of a Happening, albeit a very subdued, ethereal, and formal one.(Adcock:89)
>
> As the first stage in the sequence began, Turrell´s audience sat near the south wall of the first space. Initially, the overhead lights were on inside the space and there were no images on the walls. These began when Turrell turned off the interior lights. The shades in the south window of the space were completely opaque and set inside a recessed slot that allowed almost no light to come inside the room until Turrell opened them. As the first piece began, these shades were set to their initial open position, and when Turrell turned off the inside illumination, colored lights from the streets outside and from passing traffic began to play across the walls of the space, especially the far end wall of the room. The first piece had considerable motion associated with it, and the lights and shadows were sharp and bright enough to resemble motion pictures. Indeed, many viewers assumed that the strange images were being projected onto the walls with a motion picture projector. In fact, they came entirely from the street. When lights (say automobile headlamps or street lamps) were far away, they acted as point sources and cast shadows with crisp outlines onto the interior walls. When cars and other traffic passed close by the hotel, their lights washed over the interior and complicated both the color and the interaction of the patterns on the walls.
>
> In the second stage of the Mendota Stoppages, Turrell simply opened the right-hand shade in the south window behind his audience all the way [..] The higher position for the shade allowed light from a tall street lamp on the corner outside to illuminate the walls. The additional light tended to make the colored lights and projected shadows less sharp.(Adcock:89-91)

In later stages the audience were also moved around, and Turrell always letting in different external light sources. Gradually as more light sources were added, the light images grew more abstract and it became harder to determine which light was generating the images.

PRODUCTION

The capitalist art market

In October 2007 *Artforum* ran a series of articles focusing on art production from different angles. One article looks at professional art production companies like LA based Carlson & Co, another on Studio Eliasson. In many ways they are fascinating glimpses into a completely different world than what most artists operate within.

Professional art production companies struggle to achieve the balance between the quality of the serialized mass product and the unique art object. As Peter Carlson, the founder of Carlson & Co, says in an interview with Michelle Kuo:

> artists often want qualities that could previously only have been attained through mass production," but that "it can be extremely expensive to produce a prototype of something that is designed to be mass-produced, to attain the perfection of mass production. When it's required, we try to push the prototype as far in that direction as possible." One example of the company´s work was "developing techniques to adhere transparent acrylic polyurethane to mirror-polished stainless steel for Koons's famously perfectionist *Balloon Dog*, 1994-2000.

Some artists, instead of using external production companies, manage to build up the whole infrastructure around their own studio, turning into leader a of medium-sized corporation. Caroline Jones writes about Studio Eliasson in another of the *Artforum* articles, "The server/user mode":

> Studio Eliasson is many things. It is roughly thirty employees; it is a two-and-a-half-floor, 15,000-square-foot former train depot behind Berlin's Hamburger Bahnhof; it is a corporation, a factory, and a dynamic knowledge-production machine (as the etymology of studio still wants).
>
> Of this group [of thirty employees] (its ranks increased by temporary workers as needed), roughly a third are skilled fabricators (carpenters, welders, electricians), a third are architects and designers, and a third are discourse workers (trained art historians, an archivist, a secretary).

The art market has created an artificial supply and demand culture, resulting in absurd situations where a work made on a mass media storage like a DVD is made into something unique. Matthew Barney´s *Cremaster cycle* was made into a series of exclusive dvds, only 20 were made, selling for $100 000 each (These were later to be found on Pirate Bay).

Another illustration of the inflated art economy is the story of Damien Hirst´s pencils. *The Independent* writes:

> How much is a box of pencils worth? Fifty pence? £3.99 if the pencils have rubbers on the ends? Well, if they're part of a Damien Hirst art installation, the value is £500,000. That is what 17-year-old graffiti artist Cartrain discovered when he pilfered some pencils from Hirst's sculpture Pharmacy. And that wasn't all – he was arrested, released on bail, and is waiting to find out if he will be formally charged with causing damage to an iconic artwork worth £10m.[61]

[61] http://www.independent.co.uk/arts-entertainment/art/news/damien-hirst-in-vicious-feud-with-teenage-artist-over-a-box-of-pencils-1781463.html

There are alternatives to production model based on the traditional art economy, and I will briefly mention the DIY movement, open source software and hardware, situated hardware and digital fabrication.

DIY: sharing knowledge

There is an obvious connection between the artist engineer hands on approach and the DIY movement.

The DIY ethic (do it yourself ethic) refers to the ethic of being self-reliant by completing tasks oneself as opposed to having others who are likely more experienced complete them.

> Rather than belittling or showing disdain for knowledge or expertise, DIY champions the average individual seeking knowledge and expertise for him/herself. Instead of using the services of others who have expertise, a DIY oriented person would seek out the knowledge for him/herself.[62]
>
> DIY culture in the United States can be linked to many of the same philosophies of the Arts and Crafts movement of the 1900's, which sought to reconnect people with hands-on activities and the aesthetics associated with them - in direct opposition to the prevailing industrialization and modernization which was moving many aspects of the culture's aesthetics away from the hand-made artisan-created styles of the past and toward a mass-produced sleek modern vision of the future.[63]

It has been an essential part of my project of finding information on how to use certain components, how to make something work, using the online resources available through the DIY community of for instance Make Magazine[64] and Instructables [65], or more specific forums like the Arduino Forum. The sharing of knowledge through blogs, forums, and wikis represents another approach to art production which doesn´t involve big budgets. I have tried to share some of the knowledge produced during my three years, mainly through my blog "Conversations with spaces"[66] , which passed 100 000 visitors at the time of my exhibition *blink*.

Open hardware

Open source software and hardware shares the motivation with the DIY movement of sharing. Instead of keeping your software and hardware solutions, you make the code or schematics available, free for others to use and improve.

Wired magazine had an interesting article in their October 2008 issue, "Build it.Share it. Profit. Can Open Source Hardware Work?", about open hardware, using the Arduino platform as an example. It seems harder to accept that open hardware can be a

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[62] http://en.wikipedia.org/wiki/DIY_ethic

[63] http://en.wikipedia.org/wiki/DIY_culture

[64] http://blog.makezine.com/

[65] http://www.instructables.com/

[66] http://hcgilje.wordpress.com

business model, as it involves physical manufacturing in contrast to software. The Arduino platform is one of several success stories from small-scale businesses based on open source hardware.

Contrary to what is normal in a capitalist economy the Arduino team releases the schematics of their products, so other people can make identical copies, the only thing the team trademarked was the name Arduino. There exists dozens of micro controllers based on the Arduino, but often customized for specific tasks, and they have Arduino-inspired names like freeduino, boarduino, seeduino and roboduino to name a few.

The motivation for making Arduino open source was twofold: Not focusing on making money but on inspiring creativity, but also to benefit on the improvements coming from the user base. The team hoped that

> if Arduino were open, it would inspire more interest and more free publicity than a piece of proprietary, closed hardware. What's more, excited geeks would hack it and—like Linux fans—contact the Arduino team to offer improvements. They would capitalize on this free work, and every generation of the board would get better.

The article continues:

> There's a resurgence of DIY among geeks interested in hacking and improving hardware, fueled by ever-cheaper electronics they can buy online, build-it-yourself publications like Make magazine, and Web sites like Instructables. In recent years, hackers have been aggressively cracking consumer devices to improve them—adding battery life to iPhones, installing bigger hard drives on TiVos, and ripping apart Furby toys and reprogramming them to function as motion-sensing alarm bots. Inexpensive chip-reading tools make it possible to reverse-engineer almost anything. That's how Chinese hardware copycats rip off products so quickly.
>
> Hardware is already open. Even when inventors try to keep the guts of their gadgets secret, they can't. So why not actively open those designs and try to profit from the inevitable?

Instead of worrying about selling much hardware,

> sell your expertise as the inventor. If anyone can manufacture a device, then the most efficient manufacturer will do so at the best price. Fine, let them. It'll ensure your contraption is widely distributed. Because you're the inventor, though, the community of users will inevitably congregate around you, much as Linus Torvalds was the hub for Linux. You will always be the first to hear about cool improvements or innovative uses for your device. That knowledge becomes your most valuable asset, which you can sell to anyone.

Situated hardware

In a blog entry entitled “Idle speculation on the shan zhai and open fabrication”[67] Tom Igoe, physical computing guru and also one of the developers of Arduino, looks at open hardware from a different angle, where he finds similarities between the shan zhai manufacturers (referred to as Chinese hardware copycats in the *Wired* article) to

[67] http://www.tigoe.net/blog/category/environment/295/

small open hardware-businesses like Spark Fun, Adafruit, Evil Mad Scientist, Arduino and Seed Studio.

Maybe most interesting in this context is his description of how it is now quite feasible to develop "situated hardware" based on open hardware solutions:

> A few years ago, Clay Shirky described an approach to software development that he dubbed situated software. Watching the students at ITP, he noted how many of their ideas for software tools were developed quickly for a very specific community, and served that need well, but wouldn't scale to a larger audience. But perhaps scaling wasn't necessary, he suggested, if software tools afford a quick, improvisational approach to development, and if the result serves the immediate need. Situated software isn't enterprise software, it's localized software. Sometimes it's based on ideas from enterprise software, and sometimes it's an entirely different beast, but it's always based on the immediate needs of a local group. Situated software is often built as web mashups. What open hardware companies and the shan zhai point to is a world of situated manufacturing: hardware and consumer goods that are developed in a similar fashion to situated software. The resulting products are sometimes sloppy, sometimes unfinished, but that's okay, if they serve the immediate need. They can always be improved in the next run, which is never more than a couple thousand units away.

Digital fabrication

Digital fabrication could be the next step in the artist economy. The availability of small-scale production houses for 3d printing, milling, laser cutting, PCB manufacturing, (or digital book printing) allows the artist greater control over the means of production, and also allows for industrial quality without the need for mass production, you can produce individual instances of an object without spending a fortune. There are already websites like Ponoko, lulu, Thingiverse and BatchPCB which offers some of these services, and 3d printing and milling is soon becoming affordable enough for people to manufacture on their own desktop. In one of the *Artforum* articles on art production called "Readymade resistance", Josiah McElheny refers to a *New York Times* article, describing the imminent arrival of domestic 3d printers. You download the product and produce it at home, bringing the factory to your doorsteps.

OUTRO

The long and winding road

I would like to end with a few quotes from the media theorist Siegfried Zielinski. Zielinski, author of *Deep time of the Media* as well as host for the *Variantology* symposiums[68], has some interesting thoughts on the production of knowledge. In an interview from April 2006 with David Senior in the online magazine *Rhizome*[69], he argues that our time doesn´t necessarily embody

> the greatest possibilities of progress in the history of civilization, if one used diversity – the richness of variety in existing things, forms, techniques, arts, etc – as criteria for progress.

He also argues that new ideas are more likely to appear in the periphery rather than in the center:

> My thesis is that the new and arousing ideas come out of the provinces much more frequently than out of the centers of power, where they are worked over and freed from their resistances.

Finally, he talks about the role of the institutions of art education:

> Study at the academy should be more than ever the offer of a protected time and space where original thoughts and idea can be developed and tried out. The possibility of failure belongs to experimentation. That is nothing other than the idea of a contemporary laboratory, whose windows and doors must above all not be closed.

During the last three years I have done a lot of presentations of my work, and I have always tried to talk about the process behind a finished work, trying to see new relations between my previous work and present work, and relations to other´s work. I often present sketches and work in progress from my lab sessions to share "the long and winding road" that may or may not lead to a finished piece of work.

For me it has been important to work with sketches and prototypes without necessarily having to make it end up as a finished work. It has been three years of experimentation without needing to know too much about what I am doing and where I am going, before I start. The artistic process is not the realization of an idea, it is the starting point for developing a work. You start off with a determination of producing something out of the unknown, not knowing the end result, yet somehow knowing when you have arrived there.

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[68] The Variantology website: http://www.udk-berlin.de/sites/content/topics/research/variantology/index_eng.html

[69] http://rhizome.org/discuss/view/20967

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