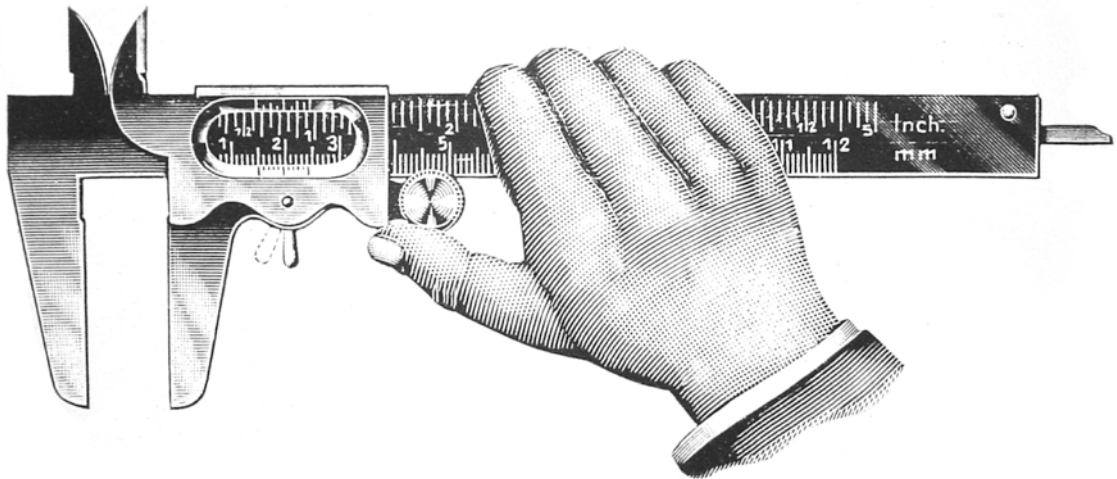


Ellen Johanne Røed

SKYVELÆRE



Critical Reflection on Artistic Results of a Fellowship Project in Artistic Research

Norwegian Artistic Research Fellowship Programme

Bergen Academy of Art and Design

2014

FOREWORD	III
ACKNOWLEDGEMENTS	IV
INTRODUCTION	1
General description of the exhibition	5
SKYVELÆRE #1	16
<i>Calibration</i>	22
<i>Capturing motion and rendering change</i>	23
<i>Problems of comparability in photography as data</i>	24
<i>Viewpoints: Geography and other representations</i>	26
<i>Clouds and other changes: The volcano</i>	27
<i>Performativities of tracking the sun</i>	30
<i>Influencing the world through performative gestures</i>	31
<i>Chasing the ideal</i>	34
<i>So I went to Tjautjas</i>	37
SKYVELÆRE #2	41
<i>Conseil Européen pour la Recherche Nucléaire</i>	42
<i>Points of reference</i>	43
<i>Resonating images as reference</i>	46
<i>Video as process</i>	47
<i>Machine vision</i>	48
<i>Video as critical tool</i>	49
<i>Digital information as real-time performance</i>	50
<i>Obtaining information through data</i>	51
<i>Data as a discrete point: Foolish Fish!</i>	52
On Balancing: An exhibition tuning itself	56
<i>Transitions</i>	57
<i>Algorithmic choreography of solar trackers</i>	58
<i>A collaborative piece</i>	62
When the material evolve	63
<i>Add a dose of generality</i>	63
<i>Process as Paradigm</i>	64
<i>From process to representation</i>	65
SKYVELÆRE #3	68
<i>The 11th International Pyrheliometer Comparison Event</i>	73
<i>Informal rhythmic patterns</i>	74
<i>The sarabande: From noise to ornamented restriction</i>	75
<i>Transfer of associations through form</i>	76
<i>Calibration - Groundwork of the natural sciences</i>	77
<i>Standards - The World Radiation Reference</i>	77
<i>Duchamp's Reference - Personal gestures</i>	78
<i>Social and scientific tuning</i>	79
<i>Shared skill and trained perception</i>	79
SKYVELÆRE #4	81
<i>From ornamented restriction to noise</i>	82
<i>Dance as a way of dissolving linear time</i>	82

<i>Noise versus phenomenon (form)</i>	85
<i>Movements of differentiation</i>	85
<i>Music as weather</i>	86
<i>The Angel of History: Process versus progress</i>	87
SKYVELÆRE #5	89
<i>Autonomic (make me magnificent)</i>	94
<i>Affordance: An invitation to act</i>	95
<i>Semiconductor: The sun as an object of observation</i>	97
<i>Terrence Malick: Nature as protagonist</i>	97
<i>Mary Lucier: The burning sun</i>	98
<i>The sun as agent in Skyvelære</i>	99
SKYVELÆRE #6	101
<i>Searching for something that we do not know</i>	102
<i>Romantic and traumatic time</i>	104
<i>Unstable significance: Site</i>	105
<i>Non - linear reading</i>	105
<i>Images as site</i>	107
<i>Desire to form a relevant connection with the natural environment</i>	108
<i>Fishing</i>	110
<i>Capturing media - producing the world</i>	110
<i>Imagination</i>	113
<i>The Hole Truth</i>	115
SKYVELÆRE #7	119
<i>In a vault: International standards of reference</i>	119
SKYVELÆRE #8	122
<i>Head, Shoulder, Toe</i>	126
<i>Activation of perceptual apparatus and place</i>	126
<i>The Utopian Mobile</i>	127
<i>Conversations as knowledge</i>	128
<i>Displacing the field</i>	129
CONCLUSION	132
<i>Performative as data</i>	132
<i>Fields and discourses</i>	134
EPILOGUE	136
BIBLIOGRAPHY	137
IMAGE CREDITS	143

FOREWORD

The project *Processing Change* (In Norwegian: *Former for forandring*) was carried out at the Department of Fine Art at Bergen Academy of Art and Design. It was supervised by Trond Lossius and Joost Rekveld. The artistic outcome was presented in the solo exhibition *Skyvelære* at the gallery 3,14 in Bergen from June to August 2013. This critical reflection contextualizes and articulates the outcome. Together the artistic work and the critical reflection constitute the formal results of my fellowship project within the Norwegian Artistic Research Fellowship Programme.

ACKNOWLEDGEMENTS

My fellowship project has taken me around and connected me with a network of people who have contributed to the work in ways that can only partly be articulated. I am grateful to everyone of them. I am particularly grateful to my supervisors Trond Lossius and Joost Rekveld, who stood by me with their clear minds, offering invaluable insight and shaping my ideas with commitment and generosity. For Joost Rekveld this has also involved a considerable amount of travelling. Trond Lossius has seen my work through the conclusive phase with boundless enthusiasm and inspiration. Anke Bangma, Susan Trangmar, and Esther Shalev-Gertz have also contributed to shaping my ideas through supervision along the way.

Bergen Academy of Art and Design has been my professional home, and my work has in particular been supported by Paula Crabtree, Nina Malterud, Jeremy Welsh, Cecilia Gelin, Kristian Skjold, Eamon O'Kane, Gerd Tinglum, Michelle Teran, Søren Kiørup, Amber Frid Jimenez, Frans Jakobi, the Re:place team, Johan Mathias Arvastson, Bjarte Bjørkum, Trond Søbstad, Sara Henriksen, Sol Sneltvedt, and Mari Aarre, together with my other colleagues at the Academy and the engaged and curious students. The Fellowship Programme for Artistic Research facilitated the fellowship and provided context and colleagues, in particular Andreas Bunte, Ane Hjort Guttu and Siri Hermansen.

Malin Barth curated the final exhibition, *Skyvelære*, with trust and engagement. Dr. Werner Schmutz and his wife Christine travelled all the way from Davos to do me the honour of holding the opening speech. Gerd Tinglum introduced him and was present on behalf of the Academy. Piya Wanthiang from BEK was my indispensable production assistant and she constructed the tower together with Jacob Alrø, who joined the production team with Nina Skarsbø and Johnny Herbert for the mounting period. This team produced miracles and even cooked a wonderful meal for the vernissage. Signe Lidén provided support and input, especially by composing sound for the four channel kinetic sculpture. She has made herself available to provide support and discuss my work as it developed, spent an entire night helping me re-solder all the cables and even took it upon herself to learn the Baroque dance *sarabande*. Monique Mossefinn, KnudsenBergHindenenes (Petter Knudsen, Anders Berg and Steinar Hindenes), Kristian Skiold, Jørgen Larsson, Roar Sletteland and Emil Skoussen have also contributed in crucial ways. BEK, with Lars Ove Toft at the steering wheel, provided project space, video editing facilities, equipment, and support. Bergen Kommune gave me extra financial support.

The artistic research project *Re:place* provided a rich frame of shared interests towards the end of the project period. I was invited to go to CERN to do research there. Research in CERN, resulting in a body of collaborative art works, was conducted in collaboration with Signe Lidén. Two of the works of *Skyvelære* were presented in the concluding exhibition *This must be the place: Pick me up and turn me round (part I)* at KINOKINO Centre for Contemporary Art and Moving Image in Sandnes, as part of a collaborative installation I made with Lidén for the exhibition (Røed & Lidén, *Les Conseilles*, 2013).

Christian Blom collaborated in developing the exhibition *On Balancing* for Borealis 2012, curated by Alwynne Pritchards. Not only was he an inspirational and inventive partner, he also constructed the most beautiful solar trackers one could possibly imagine.

At the *Physikalisch-Meteorologisches Observatorium Davos*, Dr. Werner Schmutz, Wolfgang Finsterle, Sonia Degli Eposti, and all the participants of the IPC-XI have been indispensable for the present project, in particular Wim Zaaïman, Tom Stoffel, Ibrahim Reda, Yaseen Odan, Peter Sira, Fred Denn, Andre Fehlman, Jean-Philippe Morel, Ezequiel Villegas Paredes, Mohamed Badrane, Meena Lysko, Ihab Abboud, David Riveros Rosas, Xin Ye, Artur Maria Mandlate, Rungrat Wattan and Michael Milner. Eppley Laboratories, in particular Tom Kirk, continued to provide their support in the aftermath.

At the University of Bergen, Svein Østerhus patiently shared his time, knowledge and stories. Jan Asle Olseth lent me instruments and supported me with great interest, as did Ralph Jewell who regularly invited me for tea and patiently discussed my attempts to navigate the many concepts of the philosophies of the natural sciences. He generously shared his unique understanding of representations of dynamic processes and inspiring research on Vilhelm Bjerknes. Roger Strand, Kjell Aarsnes, Ole Jacob Madsen, Thomas Gjesteland, Kjartan Olafsson and Halvor Hobak also contributed. Arvid Erdal spent a considerable amount of time introducing me to the Van der Graaf generator and its operation.

In CERN, Jens Vigen and Heidi Sandaker opened the doors for us and provided all the help and support we needed. Sandrine Reyes patiently found everything we asked for from the archives. Åse Johnson generously offered hospitality, and Doris Chromek-Burckhart lent us her antique slide projector. In Sweden, Christer Juren, Kiruna Kommun, Lennart Lanto, Birger Baal and LKAB supported me. At IRF, Urban Brändström has much influenced and contributed to my work, especially by lending me his ALIS micro-stations.

Victoria Johnson commissioned several new works that we exhibited and performed in Bergen, Padova and Oslo. Anne Marte Dyvi has enthusiastically curated my work on several occasions.

Hans Knut Sveen performed the *sarabande* on cembalo with his usual elegance and enthusiasm. *Spunk* invited me to make a new work for their concert at NUmusic (2012), and NUmusic invited me to be *artist-in-residence* in Stavanger. Lemur provided an opportunity to produce work at Bomuldsfabrikken Kunsthall as a tribute to John Cage on his birthday. Givan Bela invited me to *okno's Connected Open Greens* and *Pad.ma* worklabs organized by Anne Mie Maes, and she generously let me stay at her home in Brussel. Erich Berger and *Finish Bio Art Society* invited me to Kilpisjärvi to their worklab *field_notes*. Here, the participants' various approaches to the environment had significant influence on my thoughts. Erich Berger, Andrew Patterson, Julie Freeman, Dave Lawrence, Rozeanne Klaveren, Paz Tornero, and Beatrice de Costa particularly contributed to my work, especially to the capturing of the sounds of the Aurora Borealis.

Espen Sommer Eide, Matthew Luck Galpin, Bjørnar Habbestad, Theo Barth, HC Gilje, Amanda Steggel and Magnus Bærtås have repeatedly discussed my work as it developed, and have offered significant input to my thoughts. Beathe C Rønning, Charlotte Blanche Myrvold, Hito Steyerl, Gediminas and Noemada Urbonas, Suzanne Jaschko, Thomas Jansson, Isabelle Jenniches, Ida Tenevik Bringedal, Dušan Barok, Kristin Bergaust and Lindsay Sears have provided engaged discussions and clear insight. My parents have always supported my projects and my father has even volunteered to proofread with his usual and embracing enthusiasm. Patrik Entian is my most important collaborator in both life, art and artistic research, and a constant source of inspiration and support, and I thank him, Ole and Linus for their love and joyous attitude to life.

INTRODUCTION

Upon entering a programme that has an articulated aim to produce new insight, a number of problems concerning the complex nature of knowledge in relation to art emerge. As a newly appointed research fellow, I considered my practice from new points of view, scouting for ways of articulating the visual and aesthetic understanding inherent in my practice as a video artist. I turned to the natural sciences for reference and perspectives on questions that were beginning to form.

While contemplating similarities and differences between video art and the natural sciences, my attention kept gravitating towards Mexico City where a group of researchers have as their job to continually observe the volcano *Popocatepetl*. Situated 70 kilometres from Mexico City, *Popocatepetl* is one of the world's most active volcanoes and of a highly explosive nature. A volcano is a real world manifestation of a dynamic system, with a strong metaphorical potential. For an earlier video I used web camera pictures of *Popocatepetl* from *Centro Nacional de Prevención de Desastres* as source material, and I had imagined these scientists who were there, monitoring and analysing the small changes in anticipation of more dramatic change. Science has a magnificent tradition for producing knowledge, and provides them with relevant tools, methods and procedures for observation. Nevertheless, there are performative and metaphorical aspects of both of their practice and of the volcano that constitute an understanding that is not formalized in contemporary science. It was such aspects that kept my imagination preoccupied.

At the time I was working at a studio overlooking the fjord, and I found myself spending a considerable amount of time paying attention to small changes that were occurring outside my windows while I was thinking about the scientists in Mexico City. While observing how clouds gathered over the city of Bergen, or how the waves moved in response to changes in the strength and direction of the wind, I imagined how they would sit, leaning slightly backwards on their chairs while paying careful attention to the streams of data ticking in from the various instruments. The glasses might fall down on one scientist's nose as he falls asleep in front of the magnetogram. The gestures he would make when he suddenly woke, his brain unconsciously paying attention to something being different, a small but significant change. He might rise from his chair, his back stiffened, and move over to the window, contemplating the thin veil of smoke from the crater while considering if it might be time to head home for dinner.

I would carefully study the reflections of the sun moving along the mountain on the opposite side of the fjord. A small fluctuation, a tiny difference would occasionally set out from the background and develop into something that I would notice. Every now and then I would pull out my camera and attempt to add form and structure to the experience.

Form

The practice of both science and art involves transforming processes, ideas or material into some kind of distinguishable form, something that stands out, that we can relate to and share. Gregory Bateson, who from 1940 pioneered a form of ecologic or cybernetic epistemology, pointed out that it is difficult for people to talk about change, as (our) language is based on words such as '*it*'. *It* cannot describe process (Bateson, 1991). If we consider form, or representation, as an '*it*', its role can be to offer a distinct and specific point of view.

Most artists and scientists know that processes of forming any kind of material into some kind of '*it*' can involve painstaking and elaborate processes characterized by contradictions and negotiations. When creating a form or a representation; whether pictorial or conceptual, the material employed may sometimes act as if it has its own free will. Seemingly distracting events, errors and accidents might eventually lead to the most interesting results. When devices such as cameras or microphones are employed in the process of shaping or developing the form or representation, they also serve as tools of exploring and creating meaning.

In my fellowship project, I have considered some of the practical and performative elements involved in constructing and mediating specific representations and forms. I have explored relationships that occur during the production of such distinguishable objects, or '*its*'. Rather than focusing on whatever such objects are, I have considered the dynamics occurring between the elements involved. Far from being empty gaps, this is, from my perspective, where interesting processes evolve as the relationships are formed by activities such as reflection and tuning.

I have explored forms as resulting from and enabling situations that involve multiple agencies that are connected in active relationships. While there is not always a position or point of view that can assert authority on its own term, I have identified calibration as a way of modulating experience and tuning such agencies towards a shared language where they can play against each other.

My project has itself required tuning along the way. At times intuition runs ahead of critical understanding and I have occasionally been out of sync with my own intentions and with surrounding structures, as if stepping outside the map. This has triggered some anecdotes, for example when my nocturnal solar tracking in the academy's project space was reported to the administration by a misunderstanding security officer. It seems to me that stepping outside the map is part of the process of developing new understanding. In order to do that, you must trust not knowing where you are at all times.

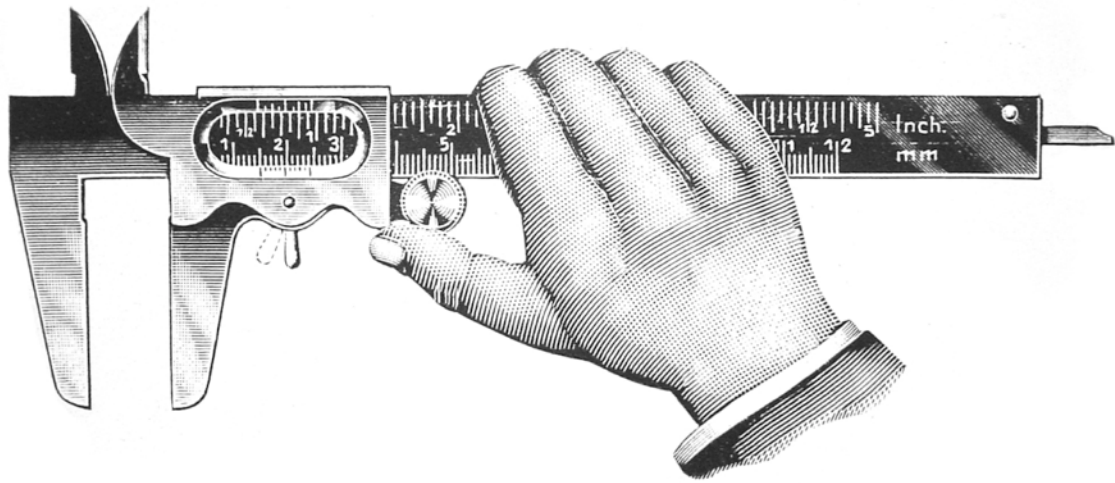


Figure 1, A Calliper or *Skyvelære*. The gap between the set and the variable edge constitutes a significant relationship where information is produced.

The Norwegian title of the exhibition *Skyvelære* is difficult to translate into English, but it provides several clues to my considerations; Composed of the words for *slide* and *learn*, from German *lehre*, the term *Skyve - lære* denominates a calliper, a device which by means of a set edge and a variable sliding edge operated by the thumb, can measure distance and depth in great detail. Moving the thumb back and forth and positioning the variable edge in relation to the fixed edge, produces a measurement, a piece of information based on the difference between the two.

I have considered how narratives operate on many levels within artistic and scientific practice. As a layer of arbitrary significance that clings to data and embeds them with certain meaning, storytelling is an important agent even in the most empirical modes of knowledge production. The narratives that I will develop throughout this text will connect events in a different logic than the narratives that have informed my visual and performative practice. This means that new plots will appear while others will disappear. I am comfortable with this as several other perspectives have been presented along the way through artworks as well as in various seminars. This text will nevertheless reveal some of the stories that have kept me preoccupied, and should be seen as a supplement to the artworks presented in the main result of my project, the solo exhibition *Skyvelære* at gallery 3,14.

The various parts of the exhibition were not intended to be experienced as separate and individual works, and hence they were not provided with individual titles. In this text they will be discussed sequentially, one work in each chapter that will be named accordingly, e.g., *Skyvelære* #1. Numbered according to the spatial layout in the exhibition, they provide different angles and frames of reference for critical reflection. Each chapter will open with a description of the work in question, followed by contextualisation and discussion of relevant topics. An earlier piece that

also constituted an artistic outcome within my fellowship project, *On Balancing* (Røed & Blom, 2012), will also be presented and discussed, in chapter #2.

Skyvelære was opened by Dr. Werner Schmutz, Director at the *Physikalisch-Meteorologisches Observatorium Davos* in Switzerland. Dr. Schmutz hosted the *XIth International Pyrheliometer Comparison Event* in Davos in October 2010, and generously accepted my request to participate as an observer. As I observed and filmed the daily and meticulous setting up, adjusting, aligning and repositioning of instruments for measuring solar irradiance, performed by 85 meteorologists representing 45 countries, my artistic research took on new directions. I realized that the activities of *tuning* and *negotiating* required in the interaction with the technical devices had much in common with my own activities. For an artist operating a camera, certain acts, such as focusing and adjusting aperture or shutter speed, or adjusting horizontal and vertical positioning — in other words various kinds of tuning — are a significant part of the construction of representation. While artists often look at something without knowing exactly what it is or what they are looking for, what happened during the IPC XI was that the gestures of tuning as a way of looking became significant in my research through the way it constitutes a reflexive experience, one that takes account of and reflects back on itself.

As an astrophysicist, the work of Dr. Schmutz is part of the natural sciences. I have turned to the natural sciences for inspiration, material and theory. Specific practices and stories of science have influenced my reflection and practice. In the context of art they resonate with on-going discourses as art and the natural sciences are disciplines that have much in common. Above all they are modes of inquiry and they produce representations that we use to understand and navigate. The resulting works operate on an aesthetic and discursive level, but like in the natural sciences, they emerge from a desire to understand and engage with the world.

Lying on our backs we look up at the night sky. This is where stories began, under the aegis of that multitude of stars which at night filch certitudes and sometimes return them as faith. Those who first invented and named the constellations were storytellers. Tracing an imaginary line between a cluster of stars gave them an image and an identity. The stars threaded on that line were like events threaded on a narrative. Imagining the constellations did not of course change the stars, nor did it change the black emptiness that surrounds them. What it changed was the way people read the night sky.

(Berger, 1984, p. 9)

General description of the exhibition

Skyvelære was devised as a set of artworks forming contextual relationships. I wanted it to operate as a system of associations where the meaning of one work could change in the light of another. The poetic and aesthetic qualities of the exhibition were crucial. While each part represented and concluded my artistic research as seen from different perspectives, I invested both specificity and ambiguity in the various elements to keep them open for experience as well as interpretation.

3,14 is a gallery for contemporary art located in the former Bank of Norway, situated in the centre of Bergen with a view overlooking the famous fish-market, the harbour and the fjord. The building was built in empire style in 1845, and is protected as cultural heritage. It is an almost symmetrical space with twelve semi-arched windows distributed on the walls constituting the facade (figure 2). The entrance is centred on the back wall, and offers upon entry an almost complete overview of the room. It is slightly winged, with an old elevator and a former bank vault located at the left wing. The vault is a cave made of impenetrable concrete walls, and the deep door frame is flanked by a massive steel door (figure 7).

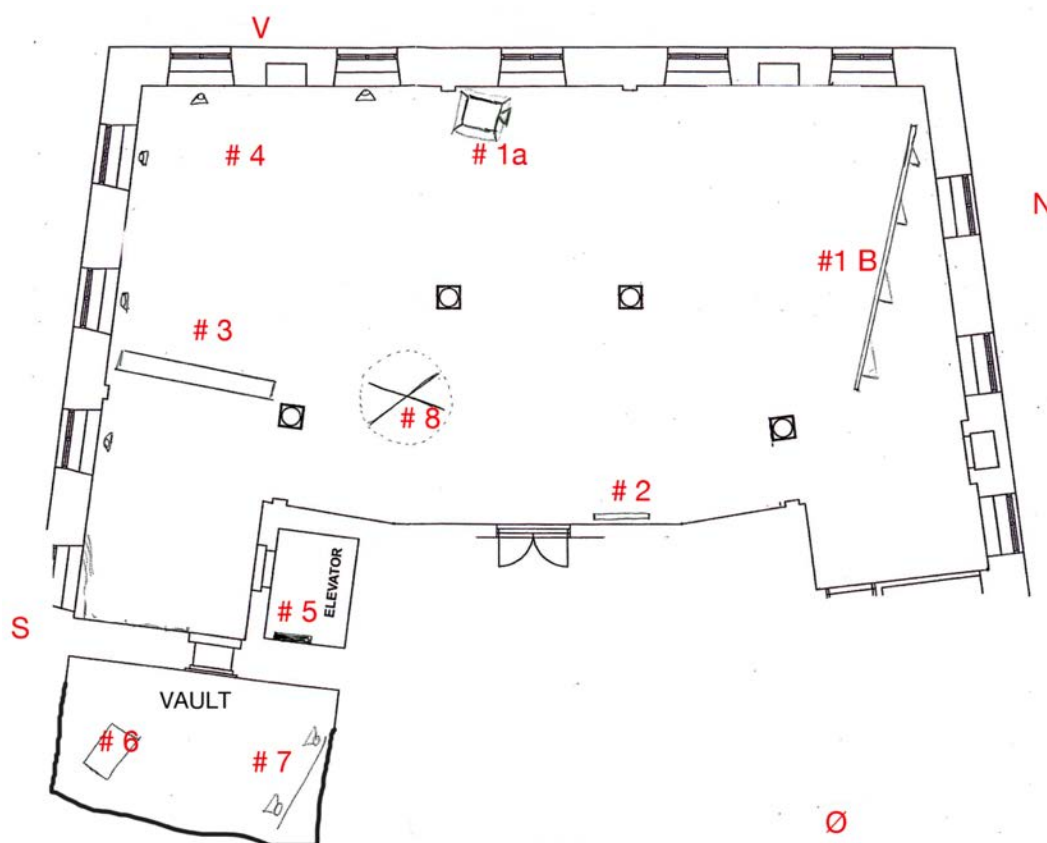


Figure 2, Floor plan of gallery 3,14 with distribution of works (#1 - #8) and cardinal directions N, S, Ø, V.

The gallery's architecture emphasizes the linear perspective and favours an ideal place from which to survey the room, at the entrance. In the making of the exhibition I sought to break from this central and symmetric perspective and highlight the architecture while undermining its inherent authority. The viewer was invited to move around in the room in order to experience the art from various positions.

In order to enable the use of large video projections in the middle of the summer, the ambient light in the gallery had to be kept down. The windows were covered with a film filtering 95% of the light, darkening the space while maintaining a transparent view to the outside, including the evening sunset. The exhibited screens were positioned of-axis, thus encouraging the viewer to venture into the room in order to see the projected images (figure 8).



Figure 3, work discussed as Skyvelære #1.

A tall, narrow wooden tower, with a small platform on the top, is slightly angled in relation to the window. It holds a projector, encased by wooden planks. A black power cord comes down from its top and is plugged into the wall (figure 3 and 4; discussed in chapter #1).

From the top of the tower an image is projected onto an angled wall. It is supported on the backside by a wooden structure and sandbags. The projection consists of a time-lapse movie depicting a landscape with the sun in the centre of the image while birch trees, mountains, and clouds pan by.



Figure 4, work discussed as Skyvelære #1.

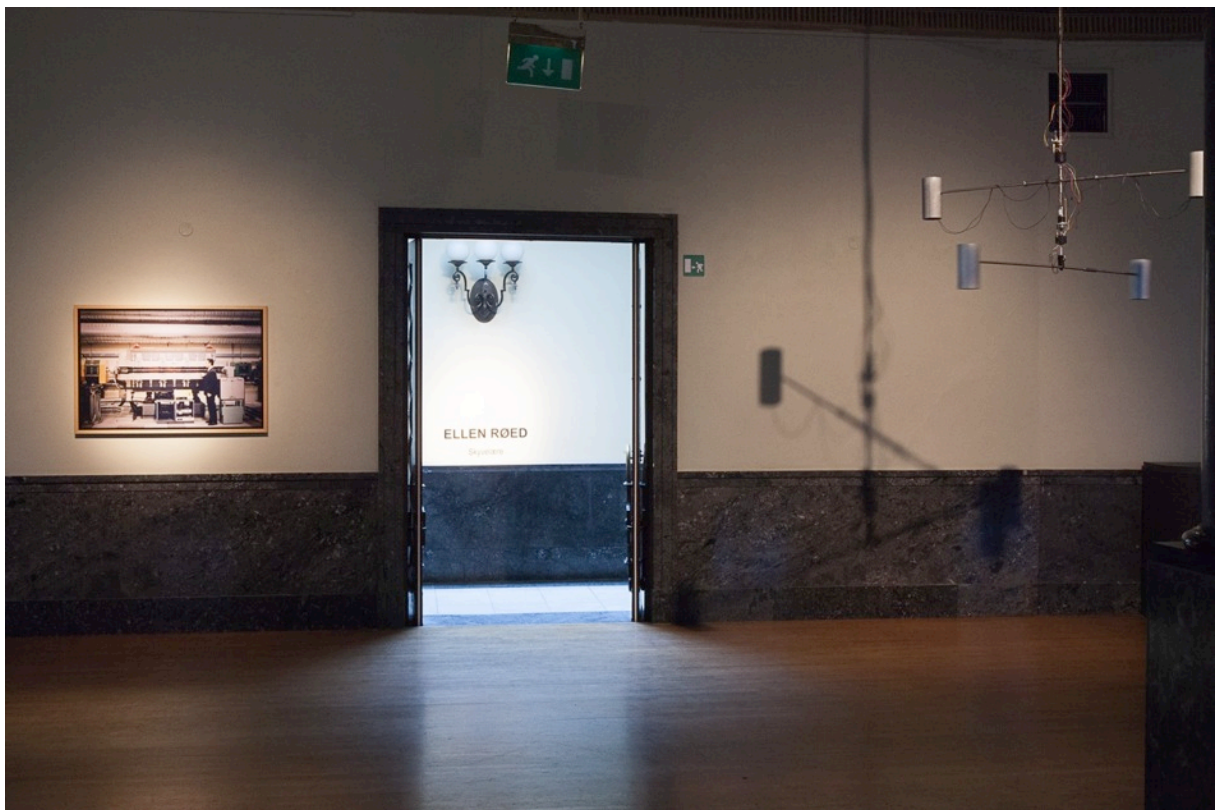


Figure 5, Entrance with work discussed as Skyvelære #2 on left side and work discussed as Skyvelære #8 on right side.



Figure 6, The photograph discussed in Skyvelære #2.



Figure 7, Work discussed as Skyvelære #3, door of vault in the background.

A framed photographic print, reproduced from an echtachrome found in the archives of CERN, shows a man standing in front of a machine, his profile towards the camera (figure 5 and 6; discussed in chapter #2).

On the left side of the room a projected film is framed by a broad panel of MDF. It shows an international group of men and women who concentrate on adjusting their instruments (figure 7; discussed in chapter #3).



Figure 8, Exhibition view with south-west corner in the centre.

In the south-west corner of the room, custom made loudspeakers were placed under the windows in the spaces formerly used for heaters. They produced a non-distinct sound sweeping through the room like a small breeze (figure 8; discussed in chapter #4).

Outside the vault, thin, black cables are flowing down from the ceiling and run across the floor towards a platform, 10 centimetres high, that carry technical equipment such as projector, amplifiers, microcontrollers, sound cards, etc. The cables seemed to flow around this arrangement in an organized form of chaos.



Figure 9, View of the work discussed as Skyvelære #5.



Figure 10, View of the work discussed as Skyvelære #7.

In the old elevator an lcd screen displays another time-lapse that shows the inside of the gallery 3,14 (figure 9; discussed in chapter #5).

Inside the vault it is dark apart from a horizontal screen about 35 centimetres above the floor, showing a video that explores old photographs found in the archives of CERN by panning around in them using a microfilm viewer. It has real-time sound, recorded with the video (figure 10; discussed in chapter #6).

Every fourteen minutes, a sound piece is played at the opposite end of the vault, from loudspeakers positioned in the dark. It is an edited sequence where five distinct voices comment upon the notion of an international standard, such as the Kilo, from different perspectives (discussed in chapter #3).

When leaving the vault, the other side of the dual projection screen (figure 11) is facing the viewer. The movement of the shadow seen in this picture echoes that of the kinetic sculpture (figure 12; discussed in chapter #8).



Figure 11, View of the work discussed as Skyvelære #3 seen from the vault.



Figure 12, View of the works discussed as Skyvelære #3 and Skyvelære #8.

A kinetic sculpture is hanging from the ceiling to the right of the entrance. It has four loudspeakers situated at the opposite ends of two aluminium rods rotating in variable speed in opposite directions from a central axis. When a viewer stands under one of the speakers, it pans slowly above his or her head displacing the sound accordingly (figure 12).

The exhibition is conceived as an installation where video projections, sound, the space of the gallery itself and the various sculptural and visual elements interact and offer alternating experiences of time as the viewer moves around. Sound is distributed in the space of the exhibition in such a way that it constitutes an ambient auditory landscape that will appear differently according to the position of the viewer.

A written interview with the artist is printed as a leaflet and is available in Norwegian and English at the information counter. It provides some additional information concerning the artistic research project, its aims and methods.

The following figures show the exhibition from various perspectives and situations, in preparation for the discussions in the following chapters.



Figure 13.



Figure 14.



Figure 15.

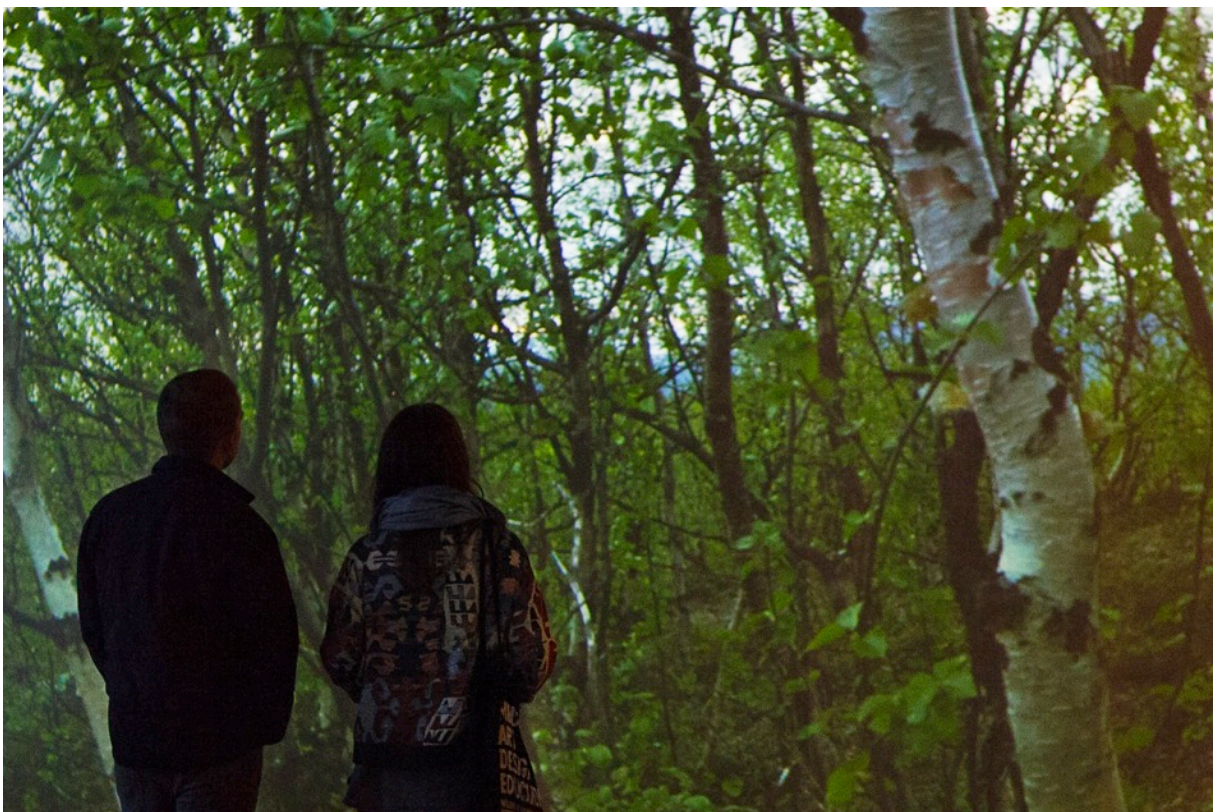


Figure 16.



Figure 17.



Figure 18.

SKYVELÆRE #1

Upon entering the exhibition, slightly off the dominating central axis, a wooden tower is seen at the opposite side of the room (figure 20). It functions both as a sculptural element and as a projector stand, a device or tool within the exhibition as it would have been on the outside for the hunter or scientist engaging with the natural environment. The tower is shaped in a way that imitates the towers bird-watchers or hunters create as observational posts in the landscape. It is constructed from found material with a small hut-like platform on top. It is also reminiscent of a weather-hut that scientists would build to place various instruments for measuring wind, temperature or the magnetic field of the earth.



Figure 20, Tower seen from the entrance.

Rather than supporting telescopes, thermometers or other observational probes, the tower is supporting a video projector rendering a moving image of a landscape onto an angled wall, seven meters opposite the tower (figure 21). The wall is 5,40 meters wide and 3,38 meters tall (16:10 format) and stands on the floor. The spectator needs to enter the room properly in order to see the image. The wall is entirely covered by the projection in a way that makes it appear as a freestanding image. It also functions as scenography, as it constitutes a temporary fond wall leaving open space in front of it.



Figure 21, Tower and projection on wall (south west corner).



Figure 22, Wall with projection.

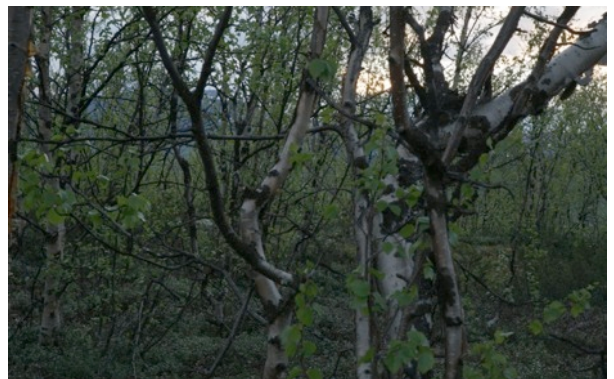
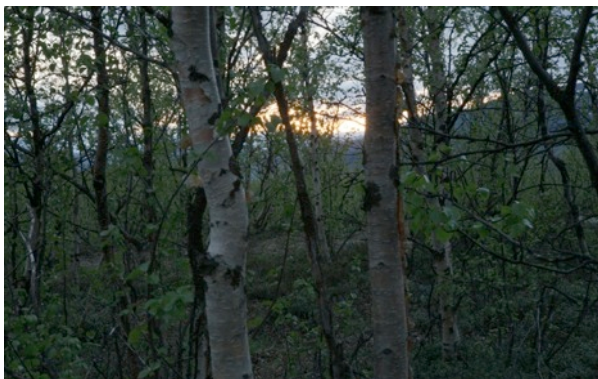
I made the material constructions as transparent as possible. The supportive function of the structures on the rear side includes sandbags that underline the construction as temporary. Thin vertical slits repeated in the surface of the wall reveal the material from which the wall is constructed, five tall boards in medium-density fibreboard (MDF) (figure 22). The brown texture enhances the images' saturation and contrasts, and resonates with the colours of the room. At the same time it reveals its nature as a construction of fibreboard. This attitude, to reveal the materiality of the various constructions and technologies involved is consistent throughout the exhibition.

The projected image is a sequence of photographs produced in June 2012, as part of field work on the Swedish subarctic tundra. Throughout the projected sequence, the sun remains in the centre of the image, while birch trees, mountains and clouds pan by. It appears that the camera has remained fixed at a specific point in the landscape, while the Earth rotated around the sun in three continuous cycles. There is no sound connected to this installation, but the ambient sounds emerging from the kinetic sculpture are vaguely present.

The sequence was made using a solar tracker that compensates for the rotation of the Earth and remains pointed towards the sun as its position changes through day and night. It was an *Eppley ST-1*, a model of equatorial solar trackers designed and constructed in the 1960's at The Eppley Laboratory.

A photo was taken every ten seconds for several days. 72 hours are represented in the projected sequence, repeating the same path in the landscape three times over in continuously shifting weather conditions. The photos are played back chronologically at 25 images per second as a time-lapse film of about 20 minutes, repeated in a loop.

This far north, the sun does not set in June. It is the period of the midnight sun, and the sun is visible 24 hours a day, unless it is hidden behind clouds, mountains or trees. This is reflected in the sequence. The sun glows and flickers, becomes paler as clouds fill the sky, and disappears and re-appears from behind leaves, mountains, or clouds that pass by. The camera never points below the horizon but the landscape tilts up and down according to how high or low on the sky the sun is. The movement stutters slightly and some flickering is occurring due to various small changes between the images. The sun is mostly located in the centre of the image (figure 23).



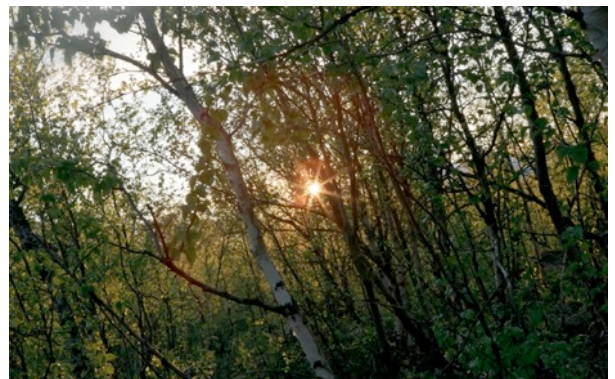
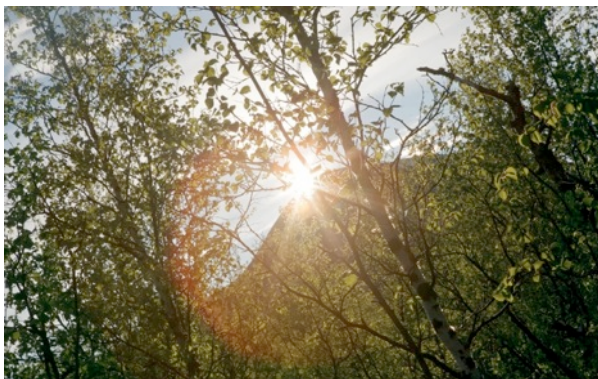




Figure 23, Still images from the time-lapse.



Figure 24, The ST-1, here during an experiment with two cameras mounted on it.

Calibration

The ST-1 (figure 24) requires manual calibration, which involves a repeated repositioning according to the actual position of the sun (cardinal directions, vertical angle), its own position (longitude, latitude, cardinal directions), and true solar time, which must be calculated according to a formula.

The photos were taken during such a procedure of navigating and aligning (figure 25). In the sequence the sun occasionally drifts off from its ideal position, in this case in the centre of the image, revealing that further calibration is necessary. It is soon pulled back to its ideal position.

The geographical position and time of the year entailed rapid changes in the inclination of the sun causing difficulties in calibration reflected in the corresponding images. Every hour the position was verified and adjusted. Also, while the shutter speed was mostly kept at six to eight seconds, other parameters of the digital camera were manually tweaked on an ongoing basis in response to fluctuations in the amount of light. A cloud passing in front of the sun required the shutter speed and ISO to be changed, and this produced deviating images that interrupted the impression of continuity in the sequence. During the evening, night, and morning the changes in light

required the camera to be adjusted every twenty to thirty minutes, during the day less frequently depending on cloud formations.



Figure 25, Ellen Røed practicing alignment of the ST-1 in Bergen.

Initially, the images taken between 3 am and 5 am were completely burnt out. This happened because it was cold and the heat of the sun warming the tent around 2.30 in the morning made me fall asleep, ignoring the need for adjusting the camera as the amount of light increased. I would wake up around 5 am to a completely white image. Lacking sleep it was difficult to resist giving in to sudden comfort of heat after a long and cold night. This repeated itself three days in a row. While the gestures of calibration produced informative errors, these mistakes destroyed the significance of the sequence, depending on continuity, so I excluded that material from this piece.

Capturing motion and rendering change

The technique applied here, time-lapse, is a sequence of photos taken with a certain interval, in this case 10 seconds, and presented with a reduced interval, 1/25 seconds. As the time-span that occur between each photo is reduced, the procedure can capture processes that evolve so slowly that they are hardly perceptible, and represent them as continual movement, thus revealing slow change. Time-lapse photography often involves an automated procedure while calibration is one of the procedures of the natural sciences that still need to be performed manually. Nevertheless there seems to be a tight relationship between the two. Calibration is a measure that ensures

compatibility, so that sequences of captured data, such as photographs, can be compared. Calibration implies defining a reference, an ideal. Between this ideal and the realities of practice, a form of tuning is going on that activates the relationship between the ideal and practice and makes it reflexive.

The ultimate Scientific film

Time-lapse photography evolved in the second half of the 19th century, a period marked by a rich and complex web of developments in science and technology, through advances in photographic techniques that could capture and render motion in a sequence of images. In 1895 the Lumière brothers patented their cinematographic camera that could capture and project moving images. Cinema was however not a single invention that can be traced through linear history. Twenty years earlier a device for sequential photography was invented by an astronomer, Jules Janssen in order to photograph Venus passing in front of the sun. During the transit of Venus of 1874, Janssen captured a sequence of photographs. Projected sequentially, as a time-lapse, these pictures rendered the slow movement of Venus puncturing the edge of the solar disc (Janssen, 1874). Janssen's method was improved by Eadweard Muybridge who at first captured sequences of animals in motion in order to do the opposite, capture movement and study it as sequential steps (Muybridge, 1877). Time-lapse films based on microscopic images of microbes and other organisms invisible to the human eye were first produced in 1909 by Jean Comandon at the Pasteur Institute in collaboration with the Pathé brothers, who had acquired the Lumière brothers' patents (Comandon, 1909). The Oxford Scientific Film Institute, founded in 1968, still specializes in time-lapse and slow-motion systems, and has developed camera systems that can enter and move through impossibly small places (Williams, 2011).

Problems of comparability in photography as data

Two passages of Venus in front of the sun, first in December 1874 and again in December 1882, made the sun the target motif of a number of expeditions collecting scientific evidence through photography. These transits offered a renewed possibility to calculate the solar parallax and in consequence determine the scale of the universe. The parallax had been calculated in a number of expeditions during the previous transit, in 1769, amongst other by the astronomer Maximilian Hell, in Vardø, but there were many controversies around the results, all slightly different.¹ Photography seemed to offer the level of precision and comparability of data that was needed to produce a uniform representation of the movement of Venus in front of the sun, so astronomers devised new instruments and techniques of solar photography in preparation for the first transit. However, as Canales describes in *A Tenth of a Second* (Canales, 2009), the astronomers soon after

¹ The observations and calculations of Maximilian Hell were much later proved almost exactly correct.

the first transit acknowledged that the resulting pictures were so different from each other that they became incomparable. This was partly attributed to how most observers had used differing devices, many of them self-invented, that imprinted themselves accordingly in the captured data (the photographs).

Differences between sets of data, one of the biggest challenges in scientific measuring, was in itself not unusual. Astronomers making simultaneous observations of planetary transits from the same place, would, in a systematic way, record slightly different values. Such differences were attributed to a number of factors ranging from personal aspects of the observation, like the observer's lack of sleep, to more technical circumstances such as the apparatus or the inclination of the object observed, which would again influence the body of the observer and even his psychic state (Sanford, 1889). The astronomic community was hoping that photography might provide a solution to the problem, as it carried a potential for moving the source of the evidential astronomical material from the astronomer to the sun itself. This could solve the problems of standardization and allow the collected evidence, or data, to become comparable. They also invented *the personal equation*, mathematical equations applied to the observational data of each astronomer/device, as a way of counteracting some of the individual differences between astronomers' data.

In the end it turned out that the resulting photos from each observer/photographer were everything but uniform, and photography revealed itself as an imprecise and unreliable method for gathering scientific evidence. Astronomically, and for the task at hand, the data Janssen had captured with his photo-revolver were considered useless. In 1881, a conference held in preparation of the second transit concluded, on the basis of the experience from 1874, that direct observations were better than photographic ones (Canales, 2009). By 1882 almost every astronomer recognized that in planning the 1874 transit expeditions they should have '*agreed on the type of instruments and adopted everywhere the same dimensions in order to render observations more comparable*'. (Conference Internationale du Passage de Venus, 1881, cited by Canales). Following these events astronomers applied drawing as a way of collecting evidence of the subsequent 1881 transit, and from there on cinema and science evolved along diverging trajectories. Time-lapse photography nevertheless became an important device in science through its ability to reveal change occurring in slow processes.

Transits of Venus, when the planet Venus appears as a small, dark disk moving across the surface of the sun, are among the rarest of predictable celestial phenomena. It occurs in pairs, separated by eight years, which are themselves separated by more than a century. In June 2004, the first transit of a pair following the one in 1881 was photographed by artist Wolfgang Tillmanns from the attic of his studio. The photos are considered to be among his best, and have clearly

influenced his practice. In *Truth Study Centre*, a printed collection of photographs published the following year; observation is treated as desire, a desire to engage with the world and to connect with the object of observation, although in Tillmans' work I find that this is not distinguished from erotic desire (Tillmans, 2005). I recognize the need to connect with the world through making images and perhaps what Tillmans is doing is to claim erotic desire as a form of knowledge in itself. In my work, I tend to plunge into unknown territory, looking for a potential conflict or tension. Such potential conflicts offer a potential for reflection, for exploring something by following a dynamic tension. Whether employing a camera or other devices, I use them for thinking, as they form reflexive relations through inherent contradictions embedded in the tension.

The second of the pair of transits photographed by Tillmans occurred in June 2012, while I was in the process of making *Skyvelære #1* on the sub-arctic Swedish tundra, my newly established viewpoint. I didn't repeat the gesture of Tillmans, as it was raining, but I did recognize the desire to do so.



Figure 26, (Left) In 1838–39 a temporary research station was erected in Bossekop in order to study Aurora Borealis and earth magnetism. This is the weather hut. Figure 27, (Right) Observational tower for hunting.

Viewpoints: Geography and other representations

In the *Skyvelære* exhibition the tower marks a viewpoint. It indicates how a place or position can be chosen and marked as a specific point. As such it introduces a form of particular geography, where this point is somehow fixed and different from the rest of the world, which might be in movement and flux.

While art produces representations that aim at creating transitions and transformations, scientific measurements produce quantified representations of the world, extracting bits of information from its never-ending flow. A thermometer in a weather hut would for example register the temperature of the air as a discrete number, data (figure 26). A point can also be such a piece of quantified representation, something defined and discrete representing a snapshot of the continuous.

The photos used for the *Skyvelære #1* time-lapse were captured from a specific point in the landscape: $67^{\circ} 51' 6.7 N$, $19^{\circ} 0' 12.4 E$, $495 masl$, which is 65 kilometres from Kiruna, in the north of Sweden. This particular site was established as such by the Swedish scientist Urban Brändström, who is in charge of the observatorial practice at *The Swedish Institute of Space Physics*. As part of his PhD project, *The Auroral Large Imaging System (ALIS)* (Brändström, 2003), he constructed a ground-based network of automated *auroral imaging* stations in a grid in the northern part of Sweden. The design, operation and potential scientific results constitute the topics of his thesis. The aim of the system is to simultaneously photograph the Aurora Borealis from different points in the landscape. This is a method that provides him with sequences of data in the form of pictures capturing the same phenomenon at the same time, but from different viewpoints. The main scientific objective of this more complex form of stereographic imaging was to obtain information about the altitude of the observed phenomena in the field of auroral physics by comparing the images from the different viewpoints and determine the 3D spatial structures.

It soon became clear that *ALIS* had more success in other fields, for example studies of Polar Stratospheric Clouds (Brändström, 2003). The main reason for this appears to be that the resulting data, sequences of photographs, are often incomparable, in spite of Brändström having done everything in his power to follow the advice from the *Conference Internationale du Passage de Venus* in 1881. He has consequently used the same dimensions and types of instruments in order to render observations more comparable. He and his colleagues have also found a solution to the problem of calibrating the image sensors (CCDs) of the cameras (Wang, 2011), but what they cannot solve is the problem of cloud formations that vary across the different points in the landscape, even today causing problems of comparability.

Clouds and other changes: The volcano

In 2005, for a project in collaboration with artist Patrik Entian, we set up a computer to automatically download images from a web camera installed by scientists at *Centro Nacional de Prevencion de Desastres*, as part of their surveillance of the volcano *Popocatepetl*.² This is one of the most active volcanoes in the world, situated 70 kilometres from Mexico City, and of a highly

² <http://www.cenapred.unam.mx/es/>

explosive nature. A week-full of pictures were downloaded by the computer every now and then for a couple of years. The web camera is mounted on a fixed point in the landscape and maintains a static view on the volcano. As a result, the volcano manifests itself as a stable structure with unstable qualities, fuming, glowing and sometimes bursting with ash. These processes, as well as those of cloud formation, seem chaotic, while the changes in light and seasons are cyclical. The motive resonates with traditional Japanese depictions of the volcano Mount Fuji, especially 36 *Views of Mount Fuji*, a series of large, colour wood-block prints by the Japanese artist Katsushika Hokusai (1826 - 1833).





Figure 28, Popocatepetl in stills from Elektra.

Wanting to combine the images in a way that would reveal, through the combination itself, the constant tension between stability and change, linearity and cycles, I applied a careful editing procedure where the images were combined in cyclical patterns. It was a work that got me, for the first time, interested in working with video as a pre-edited composition, as opposed to treating video as *process*, based on its capacities as a signal. The result was a time-lapse movie, but one that broke with the convention of linearity in favour of repetition and cyclical processes. Having sorted and categorized the webcam images of *Popocatepetl* according to visual criteria rather than temporal ones, a procedure facilitated by the computer's need to organize data in databases, I structured them in a cyclical pattern that created accelerating structures. The static volcano, occupying more than half of the image, was present in every single image, while everything else in the picture were subject to change, in repetitive cycles (figure 28). By using small loops, and adjusting the in-points and out-points I introduced new images in each repetitive cycle of the loop, a strategy inspired by the work of minimalist composer Steve Reich (Reich 1982). While a time-lapse movie normally represents a passage of time simply by being a linear sequence of images that follow each other in the same succession as they were shot, the loop offers a way of constructing time in a cycle that returns to the same disasters again and again. Through incremental tweaking and working with stillness versus acceleration, repetition versus

change, signal versus noise, the volcano material was transformed into a visual site of passion and rage.

The video was finalized for a commission where it accompanied the musical composition *Elektra* for electronic violin and live processing by the composer Knut Vaage, performed by Victoria Johnson. It has been shown as a projection in various contexts, sometimes alone and sometimes with a musician performing in a dialectic relationship with the video. Whenever I experience it in a new context it comes across as slightly different. Sometimes the volcano seems to be the protagonist, at other times the cloud formations take centre stage, and at yet other times the web-camera itself becomes the protagonist. In addition to its image sensor (CCD), and lens, the camera has certain procedures embedded in its technology; it takes black and white pictures during the night and colour pictures during the day. It takes one picture every ten minutes, and uploads it to a specific URL where it replaces the previous picture. It does all of these operations continually, but not without making mistakes and producing noise. These performative aspects of the camera, including the failures, had a prominent position in the edited piece, along the magnificent behaviour of Popocatepetl itself. While Patrik Entian continued to explore such pictures from web cameras in his artistic research project regarding materialities of images (Entian, 2012), I became more interested in what happens between the images - the performative manifestation of change.

The composition constituted a sequence of comparable data revealing changes that would otherwise have remained hidden. For example it was interesting to notice that during the darker parts of the piece, when the night-sky over the volcano is clear, star-trails appear as arrows shooting through the sky as the earth rotates in relation to the stars. In the same images there are many stars that do not seem to move, but instead remain fixed in the same location. As we are used to seeing stars as fixed points of light, it takes some time before one realizes that unlike the moving objects, these are not stars, they are broken pixels in the camera, revealed as such through the differences occurring in the collapsed duration that is created by the animation.

Performativities of tracking the sun

Prior to going to Sweden in June 2012, I had done several projects in Bergen where I had explored the procedure of tracking the sun with the ST-1. When I was participating in *The XIth International Pyrheliometer Comparison Event* in Davos, I worked alongside John Hickey, the engineering physicist from EPLAB who designed the ST-1. I learned the procedures of how to operate this instrument by watching Hickey caring for the various ST-1s employed by most of the countries represented there. Later on I borrowed one from the Geophysical Institute at the University of Bergen in order to experiment with it. Having observed with great interest the details of the human-device interactions and how the device continuously pointed towards the

sun in Davos, I intended to use it as a motorized camera tripod. I much admired the work of video and film artists Michael Snow and Tony Hill, who have invented ingenious devices for creating extraordinary, motorized camera movements that allow seeing the world from unfamiliar viewpoints. In spite of this, or perhaps because of it, I was not particularly interested in exploring automated camera movements per se. Nor was I convinced of any significant potential of solar tracking time-lapses, a genre I had mostly encountered in documentaries of nature. Rather, I was interested in the procedure of solar tracking and the ST-1 as a device.



Figure 29, ST-1 with Camera mounted in ROM8 in November 2011.

I treated the sun as an ideal and utopian condition. Utopia, according to Vilém Flusser, means groundlessness, 'the absence of a point of reference' (Flusser, 2011, p. 3). Not only does it rain approximately 300 days a year in Bergen, a fact that makes tracking the sun an unfeasible project, but I selected places and perspectives that would in reality exclude the sun without eliminating it as a potential. Turning ordinary places into sites of observation, I experimented with treating the sun as an ideal, a mere but distant possibility. Thus, I was exploring but not fulfilling the potential of the ST-1, to track the sun (figure 29 and 30).

Influencing the world through performative gestures

My interest in solar tracking developed from trying to understand more about the relationship between unfolding processes, such as the continuously occurring changes of natural and artificial light inside a room, on the one hand, and representations of processes on the other. From my

perspective, this relationship is performative in the sense that unfolding processes are given a certain form. I understand performative as an action that does something, that shapes reality. It is also a perspective, in terms of considering things according to how they are done.

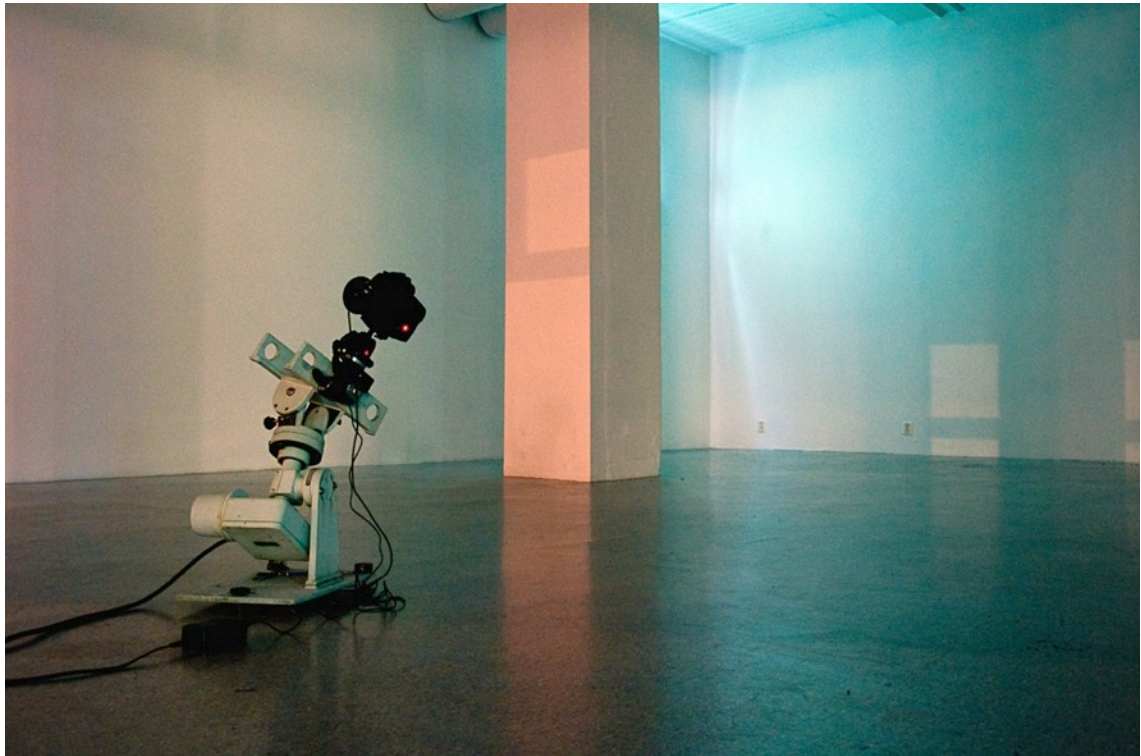


Figure 30, ST-1 in ROM8.

According to Austin a performative utterance is one that changes reality, whereas a descriptive utterance merely describes reality (Austin, 1975). However, describing an object, a person or a phenomenon in a certain way forms it as an object (or subject), thus shaping reality. Performativity is also a central notion in most discourses concerning gender (Butler, 1995), as well as in the studies of *science, technology and society* (Pickering, 1995), and in *actor-network theory* (Law, 2007). From Butler's perspective, performativity is the way gender/identity is *acted out* as a constructed set of already existing cultural values. Actor-network theory offers tools for considering '*everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations*' (Law, 2007, p. 2). Instead of asking why things happen, actor-network theory asks '*how they occur. How they arrange themselves. How the materials of the world (social, technical, documentary, natural, human, animal) get themselves done (...) And how they go on shifting and relating themselves in the processes that enact realities, knowledges and all the rest.*' (Law, 2008, p. 10).



Figure 31, Ellen Røed tracking the sun with two cameras on the ST-1, November 2011.

From this angle, performativity appears as a perspective, a way of considering things from the viewpoint of how they are acted out. This is in accordance with how I understand the notion performative within this text, an action that does something, or a perspective concerned with the doing of things. Through similar sensibilities I have applied a performative perspective on certain activities as well as on the effects of how they are done through devices and images.

Throughout, the notion of gesture has emerged as central, both in the sense of an activity carried out by the hands, but also in terms of an activity that has a performative effect, like an utterance in the theories of Austin; an action that is an intervention in the world, that does something. This is an understanding of gesture I have adopted from Vilém Flusser who is concerned with gestures in relation to their effects, for example the gesture of writing. Explicitly, Flusser sees gesture as a movement of the body, or of a tool connected to the body, for which there is no satisfactory causal explanation. A gesture is the expression of a particular form of consciousness, a particular relationship between the world and the one who gestures. For example, the gesture of photographing involves a photographer moving around his subject, changing the distance, changing the angle, finding what he may not have quite known he was seeking. Many of the gestures analyzed by Flusser correspond to media and some creates a broad historical shift in social consciousness. For example, the gesture of writing involves the invention of linear time and by consequence of history.

Chasing the ideal

In order to explore the performative aspects of the construction of representations, such as gestures, it seemed more interesting to work with the absence of the sun and concentrate on the practice and experience involved in producing data/representations while attempting to balance between ideal and reality (figure 31). One of the spaces in which I employed the tracker was ROM8, the KHIB project space and gallery, which has windows facing towards south-west (figure 32). This space allowed me to explore relations between the sun, the site, and less stable realities such as weather conditions and my own gestures.

Eventually, I made three time-lapse films where I traced the path of the sun in a careful observation of the space and of changes in light within the space, at different times of the year, from inside ROM8. Edited in a linear way, as regular time-lapses that follow the chronology of capturing the photos, they nevertheless have a circular structure inherited from the movement of the sun.

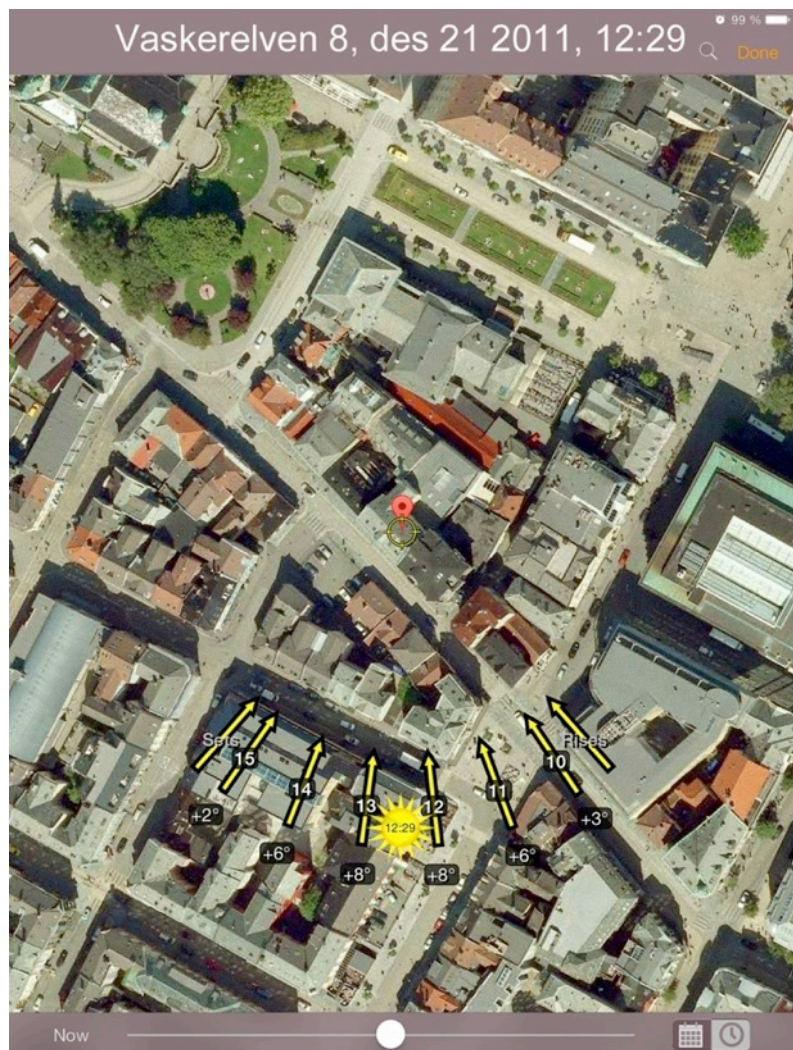


Figure 32, A representation from *Sun Seeker* of the position and presence of the sun in relation to ROM8 on the 21st of December.

Two of these films were included in another outcome of my fellowship project; the exhibition *On Balancing*, showed in ROM8 in March 2012, that will be discussed in chapter #2.



Figure 33, Spectators of tracking in gallery ROM8 in March 2012.

As ROM8 has large windows and an entrance that faces a popular street, this added another performative and more social/relational layer. As a performer, I was observed from the outside by the public passing in the street (figure 33). The door was open, and quite a few people stepped in and engaged with the project from within their frames of reference. As most people in Bergen have strong feelings about the absence of sun, there was a high degree of understanding and an interesting layer of storytelling developed through an exchange of anecdotes. These conversations became a motivating factor and important aspect of the work.

In the most interesting of the resulting films, the image slowly renders the path of the sun across a grey floor in a long and dark December night (figure 34). There is a short spectacular moment (figure 35 and 36) when the camera, having left the floor and crawled up the wall in the morning light, briefly meets the sun at solar noon, the sun appearing in a short glimpse before the sharp light, in spite of my frantic adjustments of the aperture, shutter speed, ISO setting and ND-filter of the camera, burns out the image. The sun soon descends behind the nearby buildings, while the camera continues its long journey and pans across the floor in the shadow of the earth, meticulously revealing the changes in the ambient light.



Figure 34, Videostill captured at 9.30 AM in December.



Figure 35, From the inside of the art gallery ROM8, on the 16th of December 2011, at solar noon, the camera and the sun were aligned for a short, spectacular moment.



Figure 36, From the inside of the art gallery ROM8, on the 16th of December 2011, at solar noon, the camera and the sun were aligned for a short, spectacular moment.

In all of these experiments, the elaborate calibration of the tracker and subsequent capturing of at least 24 hours of material involved several days and nights without sleep. As a result, my poor decisions and clumsy movements resulted in errors that would disrupt the impression of continuity in the sequence. In the resulting material, these errors appear as the most interesting, as they reveal the relationships at play. Between the position of the sun, the site, the apparatus and myself, there is a dynamic pulling in different directions as if we all want different things. As the ordeal was repeated at several sites and times, it became clear that in order to reveal this essential inter-connectedness, the ideal, in this case the sun, had to be visible in the film as an active agent and as a part of the recurrent negotiations. In the natural sciences the International Standards of Reference provide ideals that form reflexive relationship between the devices, and their operators in a similar way.

So I went to Tjautjas

In the North of Sweden, the midnight sun offered such a continual presence where the ideal representation could be chased while I explored the various agencies involved in making it. By bringing the tracker to Brändström's sites in the North of Sweden and applying the procedure there, I also expected to gain further insights as I examined his sites and viewpoints by trying them out for myself.



Figure 37, The ALIS station in Tjautjas. The glass dome in the ceiling, holding a camera, is dismantled during summer season as there is too much light for the Aurora Borealis.

From two of Brändström's sites, in Nikkaloukta and Tjautjas (figure 37), the cyclical changes of light and vertical position resulted in recurring adjustments of the devices that created interruptions and jolts in the otherwise mechanical stream of images (figure 38 and 39). These distortions, occurring at irregular intervals, disrupt the impression of continuity and disorient the eye. They may seem to be errors, but at the same time they indicate the presence of a person, working in the background to capture the discrete data representing the continuous process of the revolving sun. The layer of hands-on adjustment carried out by someone in the semi-automatic procedure involving repetitive measuring, aligning and capturing a sequence of data in the form of images are an important part of the work. The presence of this layer of information, that may appear at first to be produced by mistakes, reveals my main intention with the piece. It represent the difference between a mode of observation that involves looking *at* something, which treats the motif as an object and where the observation itself can be transparent and automated, and a mode of observation that involves looking *for* something, which is a more reflexive process that happens between the observer, the observed and the resulting representation.

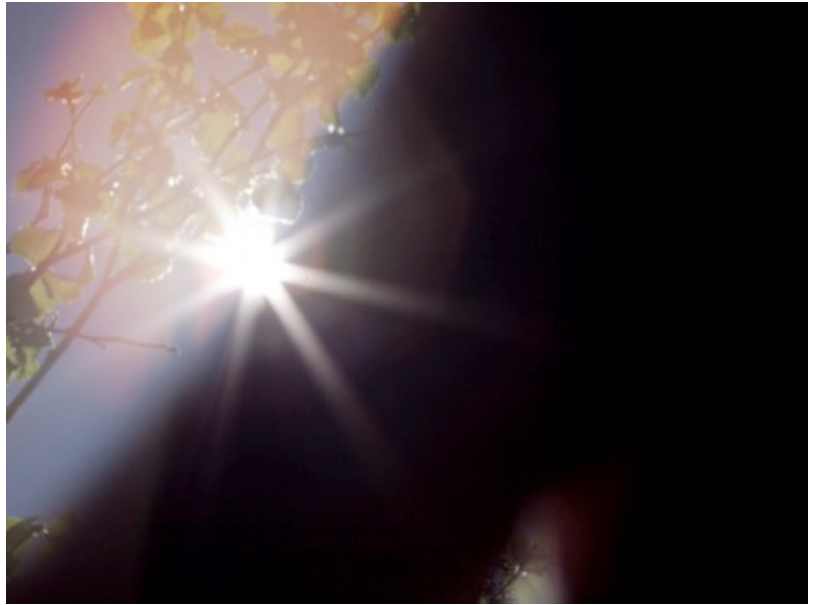


Figure 38, Video still. My hand adjusting the camera is caught in the image.

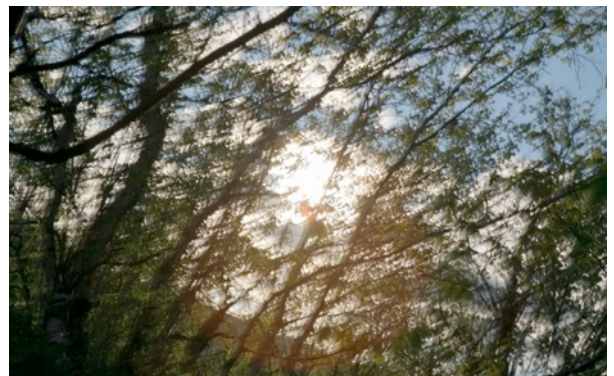
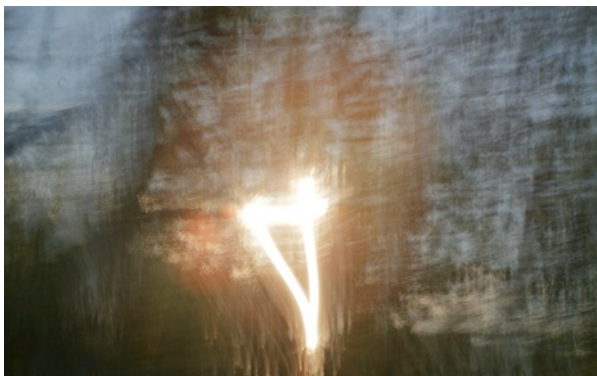
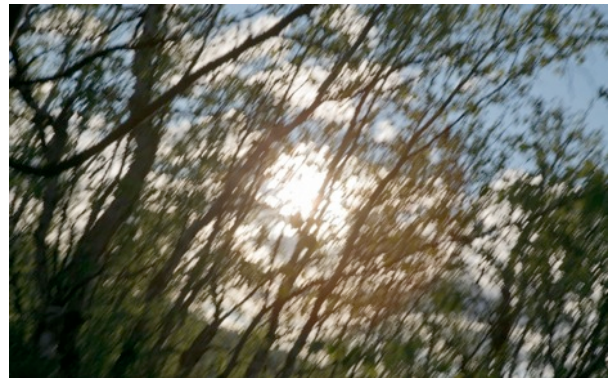




Figure 39, Sequence of images captured during adjustment of camera position.

Together, the site, the sun, the tracker, the camera and the operator form a set of relations that must be negotiated in order to construct a representation. The illusion of automatic vision and motion implicit in the time-lapse is repeatedly broken in a rhythm that interferes with and destabilizes the experience of the viewer, who needs to reorient his or her gaze, thus destabilizing the experience of the film as well.

SKYVELÆRE #2

A spotlight accentuates a framed photograph, an echtachrome, on the left side of the double door at 3,14 (figure 40). It shows what seems to be a part of a big machine, and a man, dressed in a dark suit, posing next to it, with his left side towards the camera. The composition brings to mind scientific still-life photographs where a matchbox or coin is placed next to an object in order to provide an indication of scale. That is probably exactly what the man is doing, rendering scale by inserting himself as a reference, in order to help the viewer apprehend the size of the machine. By doing this he establishes a significant relation between himself and the machine, and appends a sense of scientific formality to the picture. The man is Kjell Johnson and the slide originates from his personal collection of photographs, found in the archives at CERN in Geneva. It was appropriated and re-materialized by projecting it with a slide projector, re-photographing and printing it as an Ultrachrome print on photo paper.

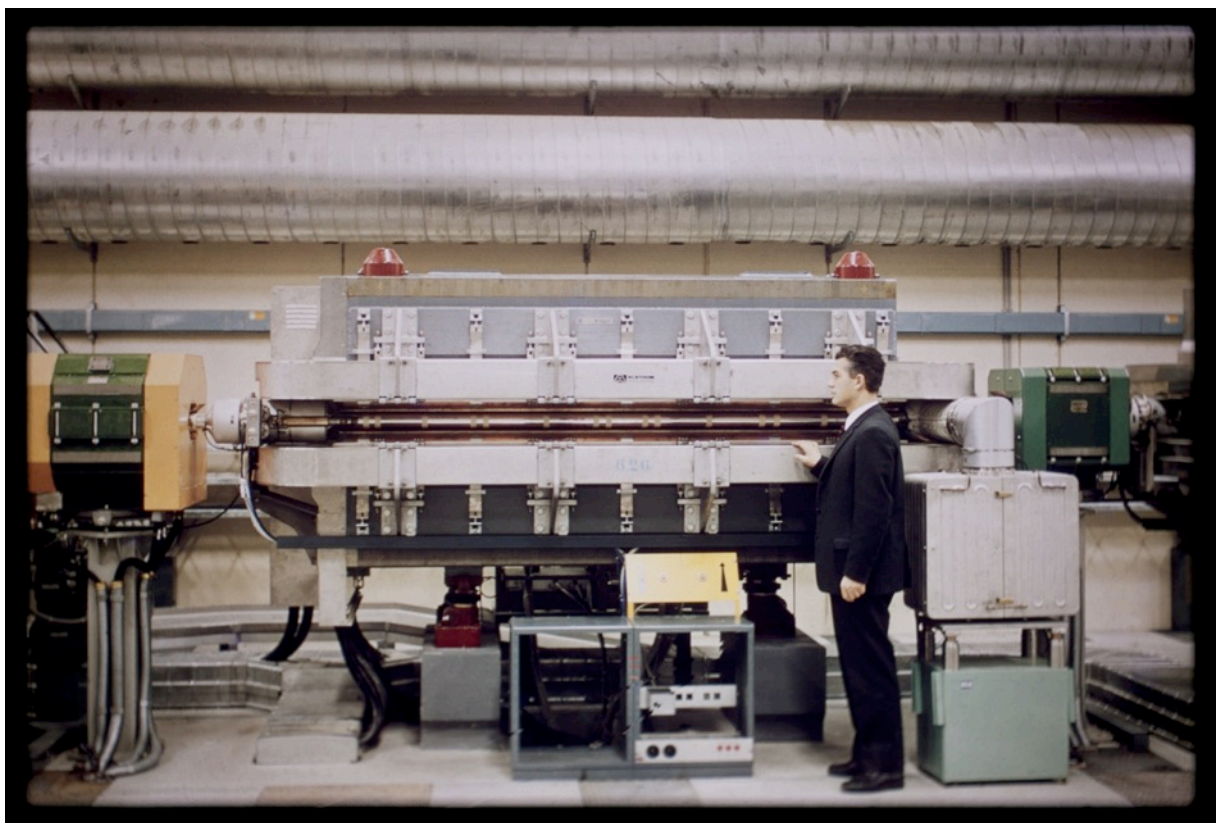


Figure 40, Kjell Johnson in front of a part of the ISR in a reproduction from a slide found in his collection.

The photograph invokes a layer of history that differs from the style of the gallery's historical architecture which points back to the Florentine palaces. In the history appearing through the photograph, the quest for understanding the universe has led to the construction of CERN, where scientists have created devices that enable them to collide particles while observing these

fundamental constituents of matter and the forces acting between them, in order to find answers about the origin of the universe.

Conseil Européen pour la Recherche Nucléaire

Research activities within the natural sciences have resulted in many spectacular appearances, not least the particle accelerators at CERN, the most ambitious set of devices European science have produced. Rather than engaging with the spectacles of science, I have been interested in the opposite; the daily, situated practices undertaken in the lower hierarchies of knowledge production. This photograph represents an aspect of both. As a found object, it offers a piece of another reality; CERN, Conseil Européen pour la Recherche Nucléaire, founded in 1952, during its first phase of innovation and construction. While it does not explain the expansion of the universe, it reveals a sense of the practice of CERN during its early days, and a sense of scientific groundwork.

Together with Signe Lidén, I visited CERN as part of *Re:place* (2013), an artistic research project at Bergen Academy of Art and Design. Our collaborative research there resulted in material used for three of the works in *Skyvelære*.

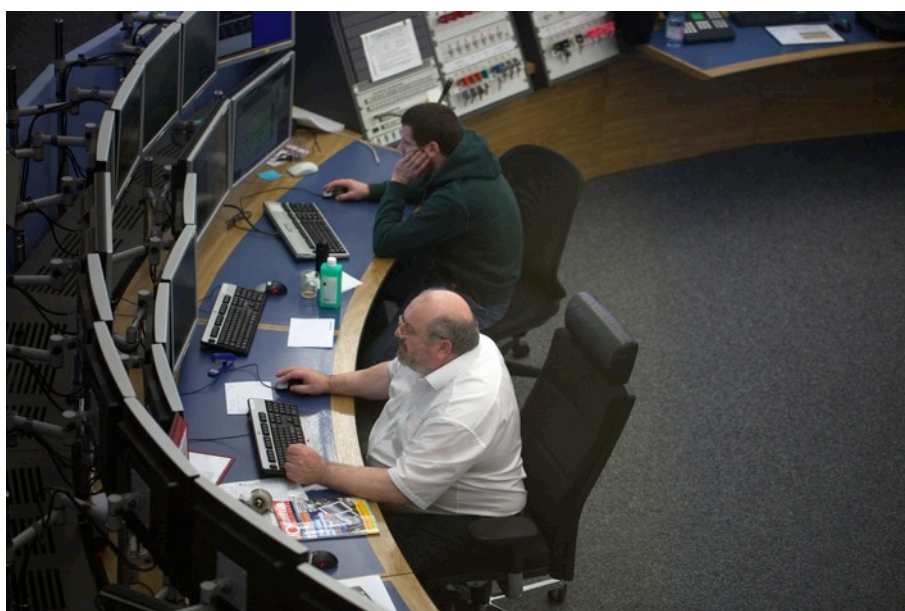


Figure 41, CERN.

In an enterprise as big as CERN, the individual researcher is of little importance and it is a challenge to find a way of approaching it, especially with focus on embodied practice. Most operations involve hundreds of people sitting in front of computer screens observing incoming data looking for a small but perhaps significant difference (figure 41). Others are feeding the data into models for further processing. The slide collection of Kjell Johnson served as a point of access

to CERN, and provided tangible material that we could work with. The photos offered insight in the cautious political optimism and sense of innovation in a post war period. 60 years later this would result in the observation of the Higgs Boson. A variety of interesting agendas appeared when studying the many sheets of dusty slides, showing the landscape, its transformation into a site, parts of huge and innovative custom made machinery, and people operating devices ranging from cranes to soldering tools. There were reproductions of complex technical drawings, snapshots from important meetings held in rooms filled with cigar smoke, and even portraits of Johnson's wife as she accompanied him around Europe to attend such meetings. From this collection of photos, Signe and I could orient ourselves in relation to CERN and its history.

Johnson's use of himself in the photograph is a significant gesture. He provides the viewer with a clue for orientation by establishing a relation between himself and the machine. In this relationship information appears according to how the two elements differ from each other.

As mentioned in the introductory chapter, a similar relationship is the fundamental principle of a Calliper, *Skyvelære*, where the difference between the set and the variable edges serves to produce information. While the thumb acts as an intermediary between two points, the information produced consists of how the positions of the two edges are being different from each other.

Points of reference

Reproducing and inserting the picture of Johnson and the machine in the exhibition is a choice that reflects my interest in the role of reference points and the relationships they form. In an early phase of this project, meetings with the oceanographer Svein Østerhus led me to investigate what maintaining standards and reference points in sciences imply in practice (figure 42, 43 and 44). Unlike the physicists at CERN, geophysicists working in the field of physical oceanography have a situated, embodied practical experience at the core of their research. Fieldwork, carried out (or performed) by people that engage with place and with instruments using their hands and bodies, is still a crucial method of research. It was in our conversations about Østerhus' fieldwork that it became clear that his work involves constructing and maintaining a referential relationship, through which a particular and radical form of change might become apparent.

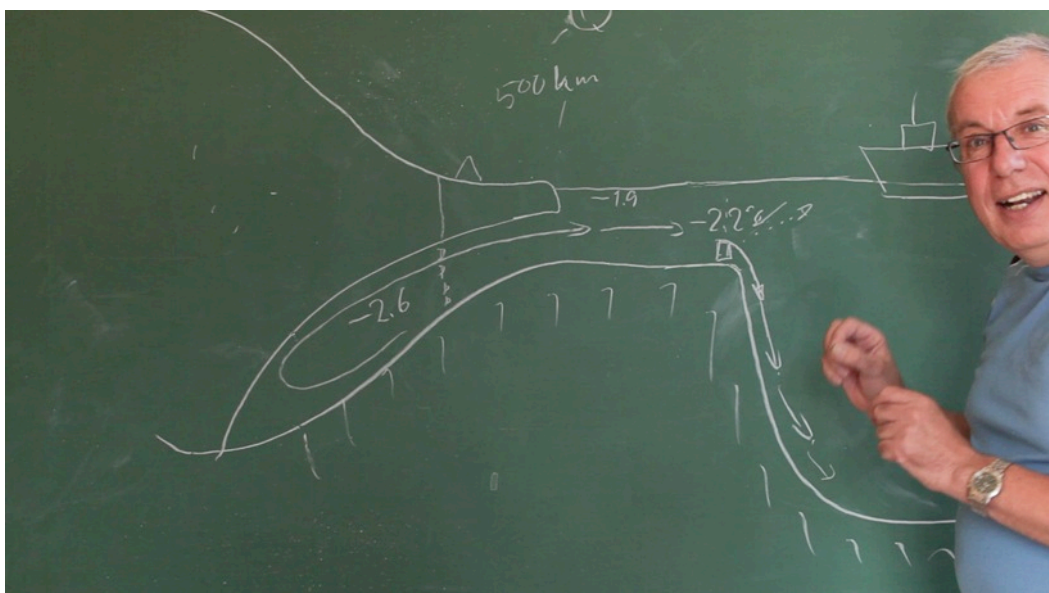
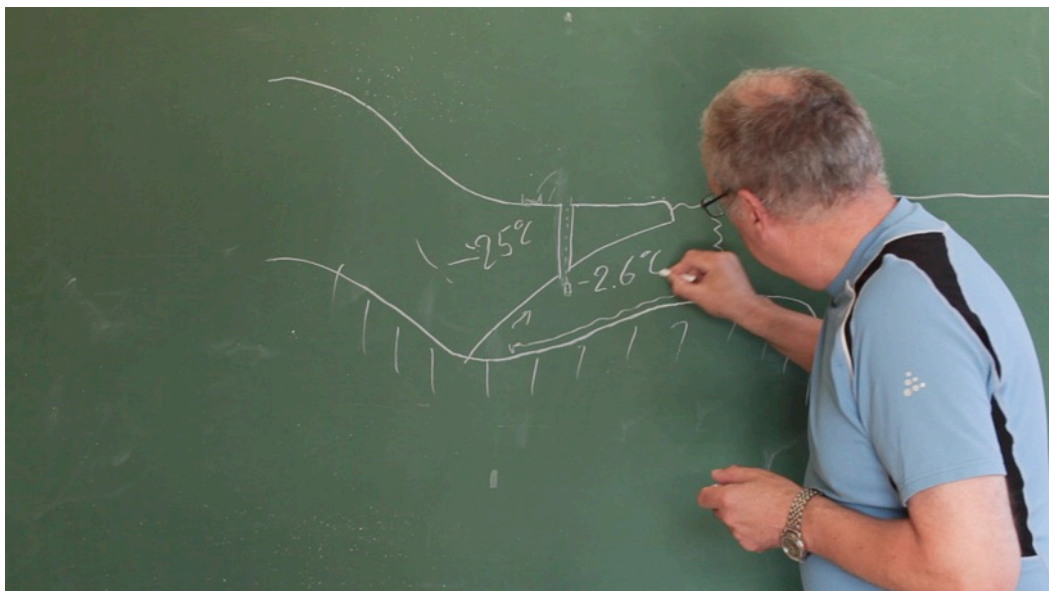
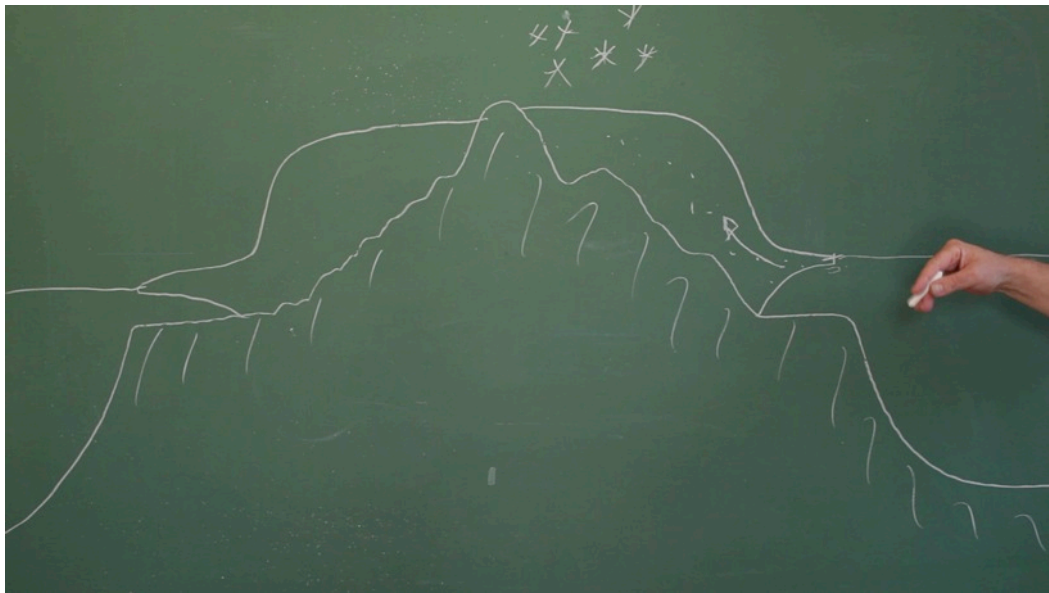


Figure 42 - 44, Svein Østerhus drawing the Ice Shelf. His tent in the centre of the drawing.

Østerhus has a unique understanding of a specific process unfolding in the ocean streams under the Antarctic ice-shelf, based on his practice of measuring. During field trips where he spends months on the Antarctic ice shelf, based in a tent, he employs his partly self-invented devices in the elaborate procedure of making a hole through a thousand meters of ice, sometimes even four times more, before he can lower his instruments into the water under the thick ice-cap of Antarctica.

There, he measures a particular process that is producing *super-cooled* water. Through his work, observations of this specific process are being quantified. The super-cooled water flows out from that particular site under the ice-shelf and forms a cold stabilizing bottom layer, like a keel, in the large oceans. It is a central part of the core ecosystems of the world, as it balances the movement of the ocean streams. The water produced by this system occurring at this site is exactly - 2.6 degrees Celsius, making it the coldest salt water on earth. Østerhus knows that it is exactly - 2.6 because he has measured it before. Every few years he, or one of his colleagues, goes back and works on the ice for some months in order to verify that this temperature is still -2.6 degrees Celsius. Any change in this value would indicate a major change in the deep-sea circulation of the Atlantic, and result in a dramatic change to the global climate system. Østerhus' measurements of temperature are devising a reference, a measured and abstracted number. This point is verifiable and comparable, a cornerstone of scientific knowledge. It serves as rendering a point of reference, the same way as Johnson does, in the photo, or as the fixed edge does, on the calliper, *Skyvelære*.



Figure 45, Decorated plinths in Kiruna. The spectacular town hall, soon to be demolished, in the left image.

I stumbled upon another application of reference points in Kiruna, where numerous plinths, disguised as public art, in reality serve to indicate movements that occur at a much faster rate. Kiruna is a mining town that will be moved during the next one to twenty years, as a consequence

of the iron-ore being situated under the town. Continued mining gradually causes the land to sink. In order to track the horizontal and vertical sliding of the land, a phenomenon that can be seen as the ground is cracking and sinking into the cavities created by the mining at several places around the town, the mining company has installed 337 concrete plinths reaching 5 meters into the ground (figure 45). Mounting GPS trackers on the plinths, the mining company compare how the position of the plinths change over time by comparing their current locations to previous locations. Thus they obtain information about the movements of the ground.

These reference points serve to mark a position in a specific place, and they also facilitate a form of memory, positioning the specific place in a specific time. The fact that they are disguised as 'public art', is a gesture of disguise by divergent rhetoric that seems to be symptomatic of the way this collective trauma is dealt with, as the entire city gradually is being demolished by the mining company, and people and services are forced to move.

Resonating images as reference

Reference is a formal necessity in the sciences, where it enables validation and comparability. In the arts, reference is mostly a discursive potential. As art exists in a multitude of discursive fields that insert and harvest meaning, artworks are often laden with references to theories and practices. However, references are rarely articulated in the exhibition context, as artworks usually aim at being experienced and interpreted. As many works of contemporary art employ references that are from within specific spheres, some of the discursive elements of the work may not be recognized by all viewers. Nevertheless, such specific references are present as a *potential* that the viewers may activate. To perceive them is not a prerequisite for experiencing the artwork. Most often they have an ambiguous presence and will, if recognized, resonate with the experience and reflections of the viewer on his or her terms.

Drill a hole about a mile into the earth and drop a microphone to within a few feet of the bottom. Mount the amplifier and speaker in a very large empty room and adjust the volume to make audible any sounds that may come from the cavity.

Bruce Nauman

This piece by Bruce Nauman entitled *Untitled 1969*, is a conceptual artwork that is brought to mind by the practice of Svein Østerhus (Nauman, 1969). It exploits the capacity of artworks to

form a resonating image in the mind of the receiver. It is interesting to note the similarities and differences between Bruce Nauman's proposal and Østerhus' work. Both these approaches of drilling into the depth of the earth expose and represent processes hidden under the crust. While Nauman's proposal is ambiguous and creates an image that may have nothing to do with reality, it nevertheless represents it in a way that resonates within the mind of the receiver. The conceptual piece, consisting merely of a written proposal, may well be considered a device in itself. It is intended to produce a particular effect, an image, in the mind of its receiver. It works on many levels because it refers to something that most people can form an idea or image of; sound coming from inside the earth.

The ability to form significant relations is an essential property of images, whether conceptual or visual. In all forms of moving images, such relationships are temporal. Meaning is created in the relationship occurring between images, in the splice. For the Russian filmmaker Sergei Eisenstein, among the first to explicitly explore and articulate this insight, the splice is not a joint but a collision, a dialectical moment of *synthesis* that produces meaning that has a bearing upon the entire film (Eisenstein, 1942). Eisenstein sees synthesis as the very essence of being, a constant evolution based on the interaction of two contradictory opposites standing in relation to one another. According to him, synthesis is embodied in conflict, the fundamental principle of every art, which in cinema is occurring in the splice when one sequence of images meets another, recorded at a different place and time. In video, this may be different. Clearly, video can be used as film, and edited in a similar manner, but it can also be applied as a reflexive medium that occurs in the present and where real-time processes can affect the very image it produces, for example by pointing the camera towards the monitor in order to produce feedback. The manner in which video forms temporal relationships, and thus creates synthesis in the Eisensteinian sense, is therefore fundamentally different from film.

Video as process

Traditionally, video consisted of a real-time, continuous electromagnetic signal. Film was on the other hand linear sequences of discrete images, captured with intervals and preserved in strips of silver nitrate film. Once developed, they could be displayed. Video does not need to be developed, it is available for the immediate playback of images. These can be recorded onto tape or a hard drive, or directly transmitted as a signal to a screen, monitor or some other devices. Video is in other words a process in itself. It can be used as a live communication tool and it is reflexive. Through these properties, video embodies synthesis in a different way than film does. In the situation of recording, the images may instantly travel back and forth between the camera and the monitor and impact on themselves as well as on the recording situation. In this sense, video has more in common with the computer than with film. This also means that video constitutes a

distinct media in terms of producing knowledge. Historically, cinematography, experimental film and video developed as distinct cultures embracing and exploring in different ways their social, political and material properties³.

Machine vision

In the works of many early video artists, the camera was explored through its prosthetic capacities as a sensory and memorial extension of the human body. Some artists, such as Woody and Steina Vasulka, treated it more as an autonomous device with its own mechanical body and unstable electronic vision. The work *Machine Vision* by Steina Vasulka (1978) consists of a series of installations where video cameras were mounted on motorized tripods and explored their surroundings in evolving movements that were rendered directly on monitors where the observations of the camera could be seen as they unfolded (figure 46). Sometimes mirrors, spheres and lenses were mounted in front of the cameras in order to alter the point of view. These were sometimes also motorized. When several of these were combined as an ensemble, the cameras could also observe each other. The viewpoints and camera movements within the piece are shifted from that of the human eye to the perspective of the devices, and de-stabilized. Steina Vasulka calls *Machine Vision* an *Electro/Opto/Mechanical Environment* (Vasulka, S & W).

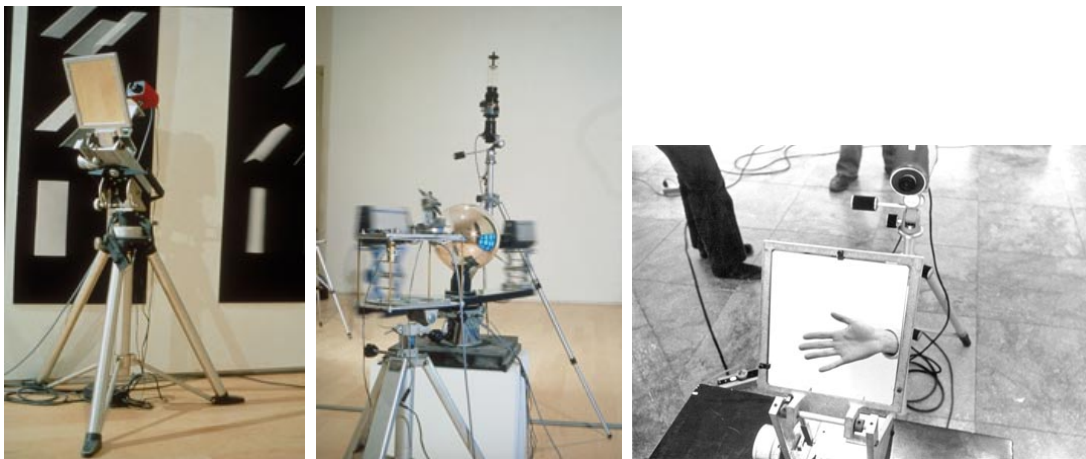


Figure 46, Photo documentation of Machine Vision.

When a human being operates the camera, the assumption is that the camera is an extension of the eye. You move the camera the way you move the head and the body. In video, unlike photography or film, the viewfinder is not necessarily an integral part of the camera apparatus. . . .

³ Today, art historians such as Yvonne Spielman and Ina Blom respectively argue that the media specific properties of analog versus digital video are equally distinct, but in the present project these differences are not significant.

In the late seventies, I began a series of environments titled Machine Vision and Allvision, with a mirrored sphere. Another variation has a motorized moving mirror in front of the camera so that depending on the horizontal or vertical positioning of the mirror, the video monitor displays a continuous pan or tilt either back/forth or up/down. A third variation is a continuous rotation through a turning prism, while still another has a zoom lens in continuing motion, in/out. These automatic motions simulate all possible camera movements freeing the human eye from being the central point of the universe.

Steina Vasulka (Machine Vision).

Video as critical tool

From the end of the 1960s, the specific materialities of video offered artists a set of critical tools that allowed inquiries into more overarching cultural conditions, and a specific epistemology evolved as video became a mode of producing knowledge. A work such as *Machine Vision* is a laboratory where some of the fundamental properties of video are explored, while at the same time offering new perspectives that reach beyond the media and discuss how we perceive the world by offering dehumanized, unstable and dynamic perspectives. To the technical apparatus itself is attributed not only significance, but even its own point of view. Today, the material conditions of video and film seem to be levelled out as they employ more or less the same technologies. Nevertheless, their material properties carry meaning in different ways. Certain artists therefore still work specifically with the now seemingly obsolete media conditions as part of their work. These approaches can be considered media archaeological in their methods, but still offer new and contemporary perspectives. The artist Rosa Barba works with 35 mm film (celluloid) and 35 mm projectors as found objects and as a specific material that in both films and sculptures reveal cultural consequences of cinema as media as well as of the end of film. In a similar albeit different manner, Norwegian artist Kjell Bjørgengen works with video as an analog electronic signal that creates images under specific conditions that reveal some of the physical as well as political conditions of images. Also, in spite of being digitized as a sequence of split-up data instead of continuous electromagnetic signal, many of the essential and seemingly material-specific properties of video, such as network, reflexivity and process are even more present in the digital. Far from making camera-recorded and edited films, a whole generation of digital artists spent the last decade creating visual processes unfolding through digital systems in real-time. Artists worked with flows of coded images performed and processed in audio-visual concerts and installations. Being based on algorithms and feedback systems, such artistic expressions are continuous with digital processes going on in most aspects of today's culture, as we are endlessly embedded in and surrounded by algorithmic feedback processes. Unlike in the early days of Gregory Bateson, mentioned in the introduction, where cybernetic and ecological perspectives

were rare, most aspects of reality are today generally acknowledged as unfolding networks and processes. In the sciences too, all the major disciplines have developed in this direction. The frameset that considers *change* as something unfolding in stages along a pre-defined path has been discarded and replaced by tools for understanding (non-linear) processes (Wimmer, 2006). While the media-specific aspect of electro-magnetic continuity disappeared in video art, the digital was not an end to experimentation with process, it was for many artists an invitation into the world of dynamic algorithmic systems and experimenting with visuality as process.

Digital information as real-time performance

As all digital information has the same format, cross-connection and mapping of any digitizable media in real-time, one of the fundamental properties of the computer, was around the turn of the millennium at the core of ongoing visual experimentations in electronic and digital arts. This was foregrounded by artists who were also software developers, like Sher Doruff, Tom Demeyer, Steina Vasulka and Netochka Nezvanova, engaged at small Dutch art institutions such as *STEIM* (Studio for Electro-Instrumental Music), *Waaag* (Institute for Art, Science & Technology), *V2* (Institute for the Unstable Media), *DEAF* (Dutch Electronic Art Festival) as well as *IRCAM* (Institut de Recherche et Coordination Acoustique/Musique) in Paris and the non-localized *m9ndfukc*, with outspread corresponding communities. In Norway these were connected to Oslo based *Notam*, *Motherboard* and *BEK* (Bergen Centre for Electronic Art). Previous to that, these possibilities of new technologies had been explored by certain pioneers such as Steina and Woody Vasulka. They have investigated electronic images through five decades.

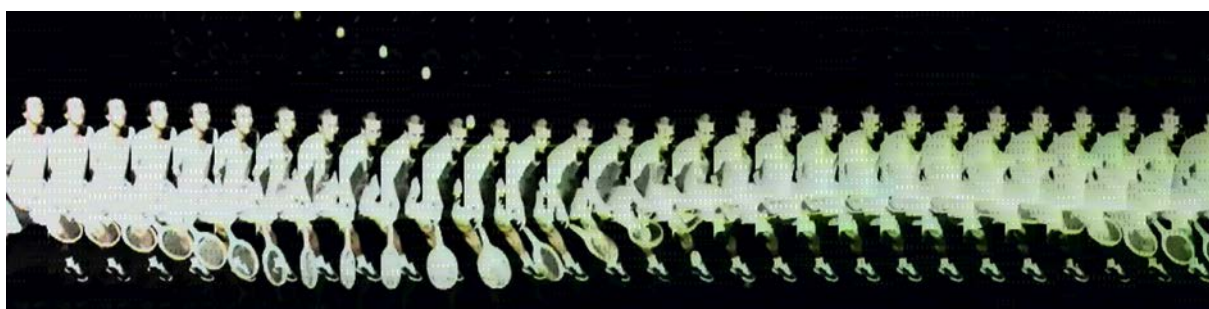


Figure 47, Another example of memory in digital visual feedback. (One frame from *404 not found*, tracking experiments by Ellen Røed and Amanda Steggel 2006)

As tools became more widely available for artists following the availability of laptops and corresponding software, artists like *HC Gilje*, *Amanda Steggel*, *Marius Watz*, *Piotr Pajchel*, *PURE/Erich Berger*, *Tina Frank*, *Kurt Ralske* and myself created code based systems for working with video as real-time digital processes. We explored system dynamics, information, visual aspects of raw data, situatedness and spatiality in works that favoured non-linearity and presence over representation and interpretation. During the following years, this form of video continued

to develop as a real-time material of reflective and self-reflective images and systems that we could use in performance.

Obtaining information through data

As regards the media-specific properties of video, time-lapse and real-time video processes are two distinct approaches. Time-lapse is based on photography which fixes time in sequences of discrete images as a string of pearls, whereas video as real-time processes unfold electronically or algorithmically both within and between images that are not separated from each other (figure 47).

Philosophically, process can be considered as something inseparable from the general noise of the unfolding world, a non-distinct part of the ongoing of the world. Humans have tended to reduce such processes into forms and units and represent them in order to make them ontologically accessible; specific, stable, and with a discrete form. One applicable strategy is to measure, thus extracting information about an ongoing process as discrete pieces of data. However, data do not provide information in themselves, they need to be activated and seen in relation to something else. This was a radical insight that in the beginning of the previous century led the Norwegian physicist Vilhelm Bjerknes to invent the methods of modern weather prediction. Throughout the following decades, the awareness of how information and significance occur in relationships *between* units rather than in the units themselves spread throughout the fields of art as well as throughout most scientific fields from system theory and anthropology to physics, psychology and philosophy. In system theory information has often been defined as difference in the relationship between something and something else. This idea is often attributed to Gregory Bateson who considered a unit of information as a '*difference that makes a difference*' (Bateson, 2000, p. 315).

My own interest in sensing the environment developed in a context of making video alongside an awareness of how information and data behave from such a perspective of information and difference (figure 48). To measure or obtain information from the environment, I have used various devices as probes; microphones, wind meters, electromagnetic radio-receivers, voltmeters, solar cells and not least video cameras. All of these produce some form of data captured from the environment through specific procedures. I have experienced that the structuring of the data, and in particular how often they are produced and sampled, are important parameters.

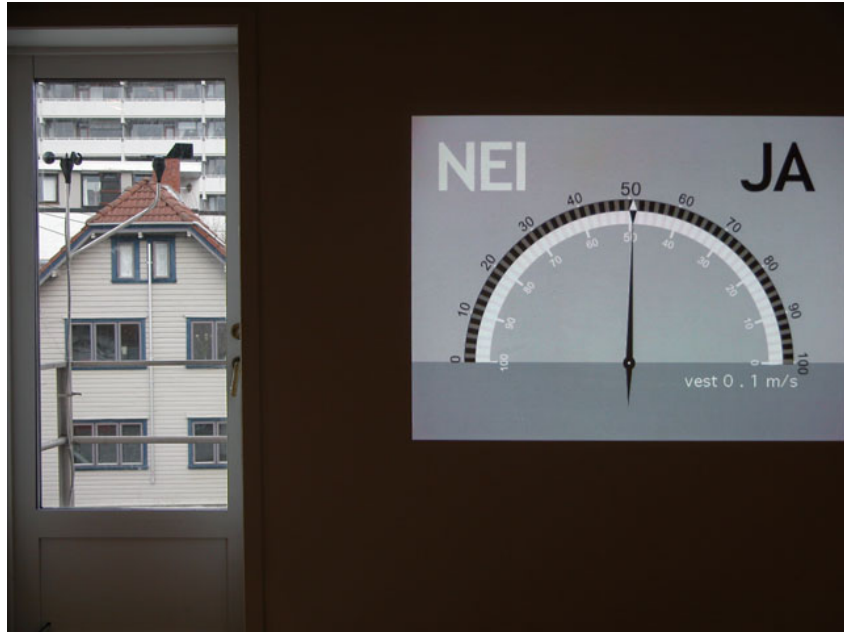


Figure 48, *JA NEI*, An opinionmeter based on the speed and direction of wind, in the exhibition *Holmgang* by Ellen Røed and Patrik Entian (Røed, 2005).

Data as a discrete point: Foolish Fish!

In the aftermath of the worklab *Hot Wired Live Art*, at Bergen Centre for Electronic Art (BEK), by artist collective *Motherboard* in January 2000, I started working with a software for video processing called *nato 0+55*.⁴ I had been commissioned to make an interactive system for a dance performance called *Foolish Fish!* (2000) where the dancers were to interact with large video projections by stepping on sensors hidden in the floor. A large grid of 32 pressure sensitive sensors, was hooked up to my computer in a way that allowed me to use the information generated as the dancers stepped on them to manipulate images and project them as interactive video. Originally made for burglar alarm systems, the sensors were intended to be positioned under a doormat, and if stepped on they would send data that could set off an alarm. Accordingly, if a dancer stepped on a sensor, a binary piece of data, 1, would reach the computer. I had previously been working with colour tracking, using the applications *Image/ine*⁵ and *BigEye*⁶ to follow the position of an object of a specific colour in a video stream. This approach had generated a sequence of information, updated approximately 15 times per second as a stream of data, numbers that would change over time, thus with dynamic properties.

When the dancers entered the stage and tried out the new system I had devised, my excitement immediately turned to frustration. Far from having dynamic properties, the sensors were like a

⁴ *nato 0+55* was an independent addition to *Max*, the IRCAM/Opcode/Cycling'74 Max programming language, that allowed users to create programs for processing video in real-time developed by Netochka Nezvanova/m9ndfukc (2000). See (Bernstein) or (Mieszkowski, 2002)

⁵ *Image/ine*, developed at STEIM from 1997 in collaboration with Steina Vasulka, was the first commercially available software that allowed users to manipulate video in real-time. (STEIM, *Image/ine*)

⁶ *BigEye* was one of the earliest commercially available pieces of software to perform real-time tracking of video events. (STEIM, *BigEye*)

handful of push buttons that the dancers might interact with to trigger something. The potential of the sensors was to be stepped on, but there was no good reasons for the dancers to do so. The choreography was not developed in a way that made the relationship between the dancers and the images reflexive, so stepping on a sensor did not reflect anything, and did not create any sense of communication nor meaning. This experience was an important eye-opener to me. After some negotiation with the choreographer, I abandoned the sensors and took on a different approach, looking for ways of more passively sensing or probing into the here and now of the performance, leaving the idea of direct and naive interactivity behind (figure 49).



Figure 49, Ellen Røed probing the sound of Aurora Borealis in Kilpisjärvi during *field_notes* (2012).

In the end, I positioned microphones around the stage. As sensitive instruments, they provided data that represented the audible environment; the music, performed live by Ståle Storløkken, and the sound of the movements of the dancers on the stage. While the sensors had sent a discrete byte every now and then if someone stepped on them, the microphones provided a much more continuous stream of data (numbers) responding to the audible events occurring during the performance. The measuring of sound resulted in a dynamic representation of what was currently happening. The information could be mapped algorithmically to various aspects of the images, in turn affecting them to be sensitive reflections of the sonic space of the performance. This articulation allowed the images to communicate independently, while still being responsive to events unfolding on the stage.



Figure 50, Traces of dancers movements in projection in Foolish Fish, Trondheim 2000.

I experimented with the sample intervals between incoming data. Increasing the duration of the interval created a more interesting dynamic as distinct events could be perceived (figure 50).



Figure 51, Gaps of information creates memories as traces of Jens Nilsson's movements in iVisit (Nilsson and Røed, 1999).

By taking advantage of the change occurring between each such distinct sound-event, I let images of what happened at each such moment become visual events in the projection. Each image provided a form of reference for the next. This quality could now be exploited as a strategy for working with traces, letting remnants of visual events stick in the projection like geographical memories, revealing what had happened in the space between one moment and the next (figure 51).

I made sure that between one image-event and the next, something had been sufficiently changed to be perceived as different by drastically lowering the resolution enough to break the appearance of continuity. This created visual information, contrast and a texture in which change became apparent, as each event became a reference for the next. The images thus became a visual map of occurred events, each different from the last. The choreography could be perceived in relation to images of a movement that had previously happened.

This making of the video for *Foolish Fish!* spurred a new awareness of how the intervals *between* representations generate meaning/information and can be manipulated to render transitions and transformations, especially when combined with visual feedback, combining the output of the camera with the input (figure 52).



Figure 52, Spectator interacting with visual feedback and sound tracking. In such images several layers of time accumulate in a single image that thus embodies its own memory (Ellen Røed Feedback, 2000 and 2001).

I continued to explore the strategy of using microphones to measure the audible activity in the performance/exhibition space I worked in, generating data that reflected their environment while treating video as an unfolding process. This method engaged place, time, activity and sound directly in images. It was a direct and intuitive way of exploring the context, by transmitting energy from the surroundings into the work, be it audio-visual performance or installation. The information from the microphones and other probes could be connected to different visual parameters in various systems. Through simple buffering and feedback procedures the systems had a complex memory. By alternating between high and low resolution in the flow, or using various forms of delays I could adjust the responsiveness of the systems, turning them into devices for tuning into the situation. The probe had also become an instrument.

On Balancing: An exhibition tuning itself

In March 2012, the Borealis festival for Contemporary music in Bergen, curated by Alwynne Pritchards, exhibited the piece *On Balancing/Om å balansere* by me and Christian Blom in the project space *ROM8*. The piece was an installation that underwent continuous transitions inflicted upon it by changes in the natural and cultural environment surrounding the gallery. Tuning, an activity that realizes the relationships between object and observer, was explored in the piece from a perspective that emphasized performance and gestures of sensing the environment, in a de-humanized manner (figure 53).



Figure 53, *On Balancing*, an installation of performative, optical solar trackers looking for the Sun, made by Ellen Røed and Christian for the Borealis festival in Bergen 2012 (Røed & Blom 2012).

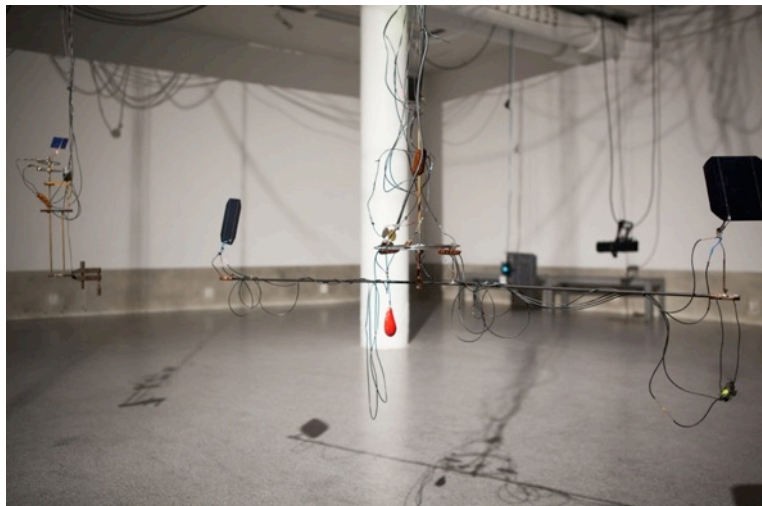


Figure 54, *On balancing* (detail).

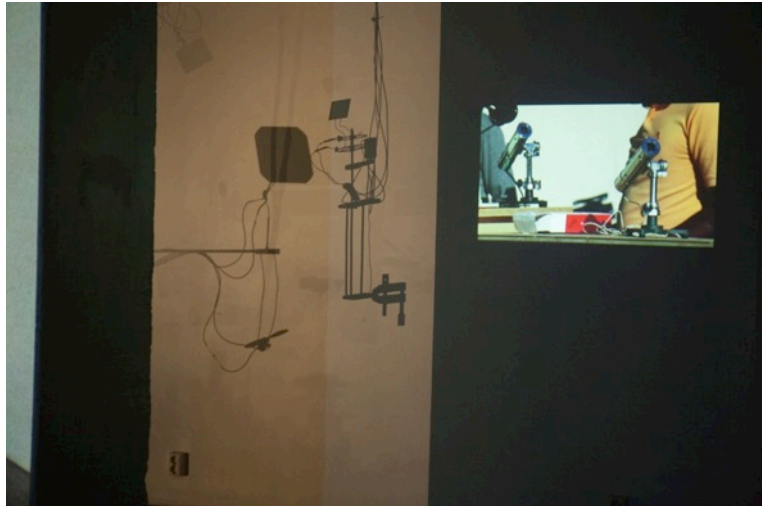


Figure 55, *On balancing* (detail).



Figure 56, *On balancing* (detail). Installation seen from the outside.

Transitions

The installation contained moving elements in dynamic relationships. At the core was a series of ambient transitions going on inside and outside the space: changes of light, the rhythms of passing cars, their headlights creating moving elements of light within the space, sound moving from inside to outside and vica versa, as well as projections that appeared and disappeared with the ambient light. All these elements were continually transforming the appearance, and the installation thus went through changes without anything being intentionally changed *by* someone.

At the centre, a group of kinetic sculptures were trying to tune themselves according to a fixed point of reference that was actually not there; the sun. The exhibition opened at 4 pm, when the room was filled with natural daylight but just before it would start fading. In daylight, the appearance of the exhibition was in accordance with an exhibition displaying a handful of kinetic sculptures as contemporary art.

As daylight faded video projections and light elements would gradually appear and transform the exhibition into a carefully lit, staged and choreographed automated performance, that would not involve any persons. Thus, as the sun set and the daylight disappeared, the gallery turned into a performative site, an actorless form of ambient theatre.

Ambient theatre is a term that was first used by Edgar Jager in 1995 and that I was introduced to by Kristian Seltun in 1997 (Seltun). Seltun recognized this quality in my collaborative work with Tore H. Bøe and invited us to create performances for Avantgarden Teater in Trondheim. We made *Klubb Kanin*, a series of club like events (1998 - 2002), *Papercuts* (2001) and *Paperworks* (2002).

Ambient theatre creates an independent place, a theatrical space to show things. [...] The outer form and the inner consequences are intertwined. The acting is not important but the environment in which the maker is functioning socially. It does not show a central perspective of our universe. Moral questions, psychological answers do not have any roles in this world of sketches. [...] It is ambient, it is space filling time, a vision of possible worlds.

(Jager 1995, quoted by Seltun)

On Balancing could be experienced until 10 pm inside the gallery and all night from the outside, heard and seen through large windows. Situated on street level the gallery had large windows facing the street. These windows were activated as a porous membrane between the interior and the exterior. The light of cars passing in both directions would be reflected on the walls as moving elements of lights which had a vivid impact on the appearance of the room as a continually shifting environment. The mechanical sounds of the sculptures were transported to the large windows where transducers (figure 57) transformed the large windows into loudspeakers and transmitted the sound of the sculptures to the street outside.

Algorithmic choreography of solar trackers

While the exhibition was characterized by several transitions going on inside and outside the space, the behaviour of the kinetic sculptures sensing and interacting with their environment remained the centre of attention. They were the performers, turning around while measuring the level of light reaching their solar cells. They functioned as optical solar trackers, and used solar cells as sensors to measure the amount of light and navigate accordingly.

The trackers oriented themselves towards bright light through a pair of solar cells (figure 58). The level of energy in the two cells was compared, using the first as a reference for the second. The difference between the two was indicative of the direction of the light and the motors were directed accordingly. If the light was equally strong on both sides, the tracker would slow down

while evaluating whether this source of light might in fact be the sun and concentrate on the light, tuning in on it. The other trackers received notice; a signal which could be interpreted as ‘the sun has been found’. When they were all in the same mode, all presuming to have reached the ideal, they would stop, to collect energy, in a theatrical pose, while the spotlight would cast a strong and sharp light on them that again created shadows on the wall, rendering them again as art objects or perhaps as puppets in a piece of shadow theatre.



Figure 57, Detail: Transducer turning the window into a loudspeaker, seen from the inside.

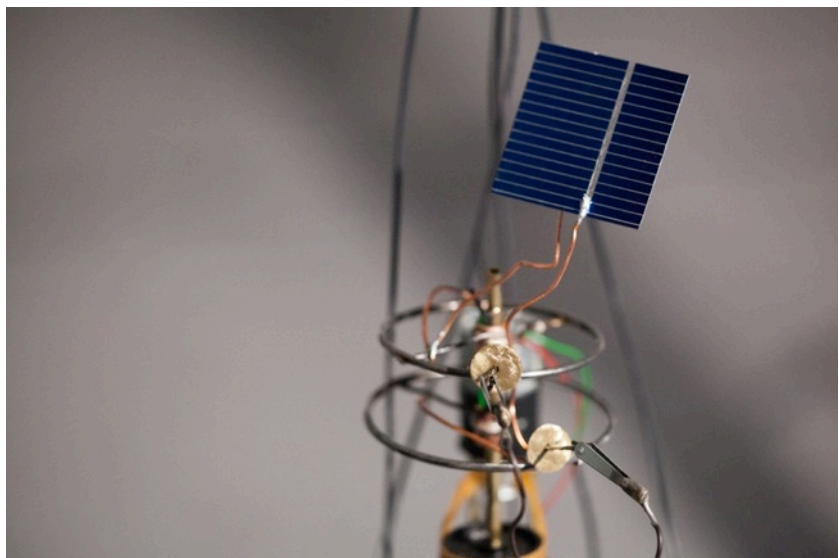


Figure 58, Detail: solar cell rotating on slip-ring.

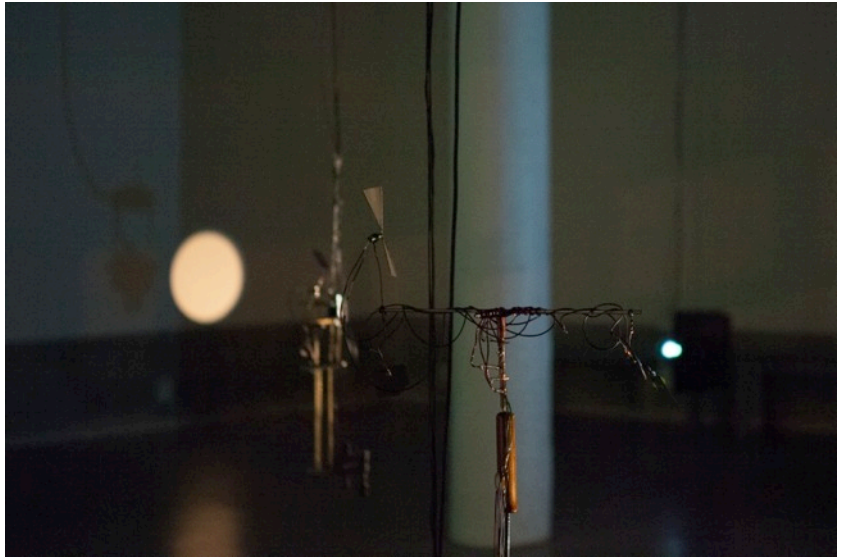


Figure 59, The light spot on the back wall indicates that the trackers have, apparently, reached their aim.

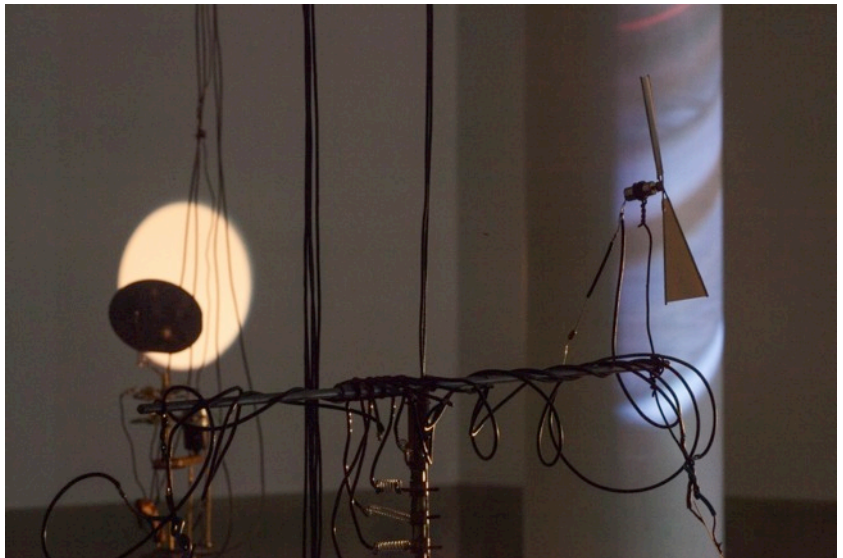


Figure 60, Detail.

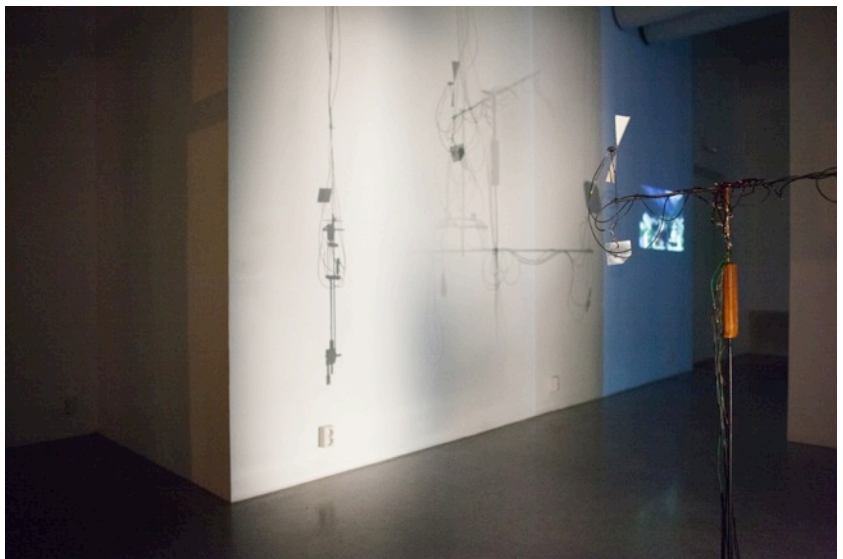


Figure 61, Shadows cast on the wall as the trackers stop and pose.

A sharp circular spot of white light, not unlike a theatrical illustration of a moon (figure 59) would light up on the back wall as a celebration that the trackers had reached their ideal state. However, the trackers would soon realize that they had been misled, the spotlight being a far weaker source of energy than the real sun. This would set them off in a frustrated and aggressive spinning around, making noise, before they once again started negotiating their position according to the amount of light. Eventually, according to a random parameter, a spotlight would come back on and the procedure would repeat itself in more or less the same pattern. This choreography was more consistent after sunset than when the exhibition opened.

In the exhibition there were also three projections. In two photographic studies projected on the pillars of the room, a camera follows the path of the sun during 24 hours, seen from inside the gallery space, as described in the previous chapter. A small projection in the back corner of the room displayed images recorded at *The 11th International Pyrheliometer Comparison Event* (IPC-XI) that took place in Davos, Switzerland in 2010, revealing meteorologists and metrologists (scientific measurers) in the process of calibrating their instruments by measuring the energy of the sun. In this way, the sound elements, light installations and several video projections worked together with the trackers as one transformative installation embedded with certain references, and clues.



Figure 63, Sketch for installation with performative solar trackers for Borealis 2012.

A collaborative piece

Previously Christian and I had worked together on making a piece of music theatre (Blom & Røed, 2008) where we staged the various elements of a piece of Baroque music by Couperin. I had appreciated our joint process of negotiating both the content and the form of a piece through experiments and observation where we slowly tuned in to each others way of thinking and doing. Now the whole concept of tuning, both to each other and to the environment, and thereby negotiating a set of ideas as well as a space, became the core of our working process. During several laboratory sessions we experimented and developed different prototypes and ideas (figure 63). We were inspired by the elaborate choreography that can occur during the production of (popular) scientific devices, but we also took a step away from such ideas in order to make an artwork that could generate meaning in its own right. We spent time looking into the online culture of DIY videos on solar trackers, as well as on other devices for observing the world.

The installation echoed an interest in what happens between the environment as a set of ongoing processes and activities of trying to capture, represent and understand them, as a negotiation between environment, devices and reference points. Through the staged choreographies, we treated reference points as something evasive that would slip away.

A crucial aspect of the exhibition was how its form was transitional and unstable. It was intended as a reflection on how form is of a temporary, constructed and negotiable nature.

The exhibition *On Balancing*, a mixed-media work of art by Ellen Røed and Christian Blom, opened two hours before the general opening of the Borealis festival. (...) In *On Balancing* the artists play with the role of points of reference in understanding generally, and in scientific approaches specifically.

All too often we decry contemporary art. We have learnt to accept statements in the name of art that would not otherwise have been acceptable in civil society. Ordinary points of reference have no validity in art. Take Luigi Nono as an example, who was played later in the evening during the opening concert. (...) I have never quite understood the point of Luigi Nono, or, if I am to say it with the words of this article: I lack a point of reference for being able to engage with his music. (...)

The weather. Through *On Balancing*, Røed and Blom claim that it is not only because of the gravitational forces, but because we lack reference points that we do not sense that Bergen moves at a speed of 669 kilometres per hours due to the rotation of the earth. (...)

On Balancing focuses on how even the knowledge we claim to be most objective, is nevertheless constructed. Calibration creates a language for talking about huge distances through shared norms. Further on, the settings of lights are shifting within the piece, creating new shadows and new points of reference that changes the structure of the piece while nothing in the room has been physically moved. We see film from the outside on the inside, and even the inside is filmed and projected somewhere else on the inside. As a viewer I start looking for where I am, and as I move around the space, I am even more disoriented. No point has absolute authority.'

Magnus Andersson in *Morgenbladet* 15.th of March 2012, translation by Ellen Røed.

When the material evolve

As an installation, *On balancing/Om å balansere*, was a manifestation of a dynamic system with various ongoing processes. It was continuously presenting itself, realigning itself, evolving, unfolding. Such continuous happening is a quality I have appreciated and aimed for in my works, by means of expressions that rely less on representation and more on unfolding processes. This is an approach that has developed through working with video from the media-specific perspective discussed earlier, and that considers video as a particular form of image-culture derived from the technical and cultural features of the electronic image. Video, when considered from this perspective, is fundamentally a process, with properties formed by the electronic signal as a continuous flow. It is transformative, real-time and reflexive, features that provide it with a performative potential. I find these properties interesting as they allow significance to fluctuate and respond to the specific situation of perceiving the piece.

Add a dose of generality

Departing from my concern with unfolding processes and expressions that favoured presence over representation in a number of my previous works such as *Feedback* (2000), *Sement* (2000), *Papercuts* (2001), *Paperworks* (2002), *Virtual Garden* (2003), *Tower with Cage* (2005), *Etterklang* (2005) and *Utopian Mobile* (2009), I initially defined *process* as a key topic for the artistic research fellowship project. I considered process suitable as an overarching theme and narrowed it down to the still rather general phrase; '*how process become manifest as form*'. Within such a framework, the actual work I produced would add more specific meaning to the general theme.

For me this was a way of overcoming the resistance I experienced in defining, or confining, my by nature non-linear and open-ended artistic practices within a predefined project.⁷

Soon after my entry into the programme, in the exhibition *Process as Paradigm* (2010) at *LABoral Centro de Arte y Creación Industrial* in Gijón, Spain, curators Susanne Jaschko and Lucas Evers took a somewhat different approach to *process* as they celebrated artistic expressions involving evolving systems. Their approach links back to the 60s and 70s where certain artists, such as Hans Haacke, were concerned with dynamic behaviour within systems, as well as to *System Esthetics*, a theoretical framework that favoured processes and dynamic environments over the unique art object (Burnham, 1968). The earlier works of Hans Haacke with systems and

⁷ Ane Hjort Guttu discusses in *Billedkunst* how such a strategy of making the scope as wide and general as possible was also applied by most of our colleagues within the Norwegian Artistic Research Fellowship Programme (Guttu, 2013).

processes often involved an evolving organic system, such as the piece *Condensation Cube* (1963–65) that embodied a real-time condensation cycle where water vaporised and became water again, within a sealed cube of transparent acrylic glass, a closed but dynamic feedback system (Grasskamp, 2004). This is an approach to process that is different from that of for example Arte Povera or minimalist sculpture from the late 1960s that explored the artistic process in relation to the energy and transformative potential of materials. Richard Serra, Mario Mertz and Gilberto Zorio all favoured process as the energy created by the transformative potential of the meeting between artist and material and viewer and artwork. Many artists during in this period, following the ideas of iconic artists like Marcel Duchamp, John Cage and Merce Cunningham were interested in systematic inquiries and procedures, and several combined these with ecological and cybernetic thinking inherited from among others Gregory Bateson. Hans Haacke was a friend of writer Jack Burnham, and his work with evolving systems and particular methods and approaches were feeding directly into Burnham's ideas that opposed the unique and static art object. Jack Burnham was in favour of art that could unfold, and he theoretically explored several of Haacke's works when he formulated his once radical art theories as a critique of modern sculpture and in favour of an art that was dynamic and system based. His theories have recently been revitalized by contemporary discussions in the field of electronic art (Shanken, 2009).

Process as Paradigm

By displaying artworks that are developing, that are growing, that are decaying or in other ways are changing according to some kind of system, the exhibition *Process as Paradigm* aimed at exploring the field between '*predictability and uncertainty, the instability and relative balance of systems and the processes which unfold in them*' (Jaschko & Evers 2010, p. 22). The curators stated that

At present, we, the globalised society, are challenged by a series of processes that seemingly got out of our control. On-going conflicts in various parts of the world, the sudden melt-down of world economy and the threat of climate change, only to name the big headlines, are valid proofs that we are deeply involved in social, ecologic and economic processes which are of such complexity that we have become aware of our limitations to master them -- (...) In the light of this, it is understandable that innovative contemporary art does no longer hold on to the safe properties of the final object, the ultimate manifestation of a creative process, but moves to the uncertain territory of unpredictability and successive live generation of form.

(Jaschko, 2010b)

While the claim of paradigm may be disputable, this is a curatorial approach that echoes concerns that artists are challenged by at this moment. We perceive ourselves as potential contributors in

an urgent inquiry of relationships between the world and our understanding of it, however difficult it seems to find a relevant way of engaging in such inquiries and even to engage such issues through art.

From process to representation

The instability and fluctuating energy of processes has always interested me as material for making art, especially for exploring sound and image relationships. Such an approach has allowed me to experiment with dynamic behaviour in systems that are unstable and where the significance of images fluctuates according to the relationships they are part of. As I intended in the present project to explore the relationship between form and process, I had even argued for the relevance of such a focus using arguments not very different from those articulated by Jaschko and Evers in their curatorial statement.

Upon investigating more closely the relationship between information, presence and representation in art as well as in the sciences, my research kept gravitating towards something slightly different, something that I kept on looking for when confronted with the curatorial statements of Evers and Jaschko. In their statements, I missed a discussion of how change is made apparent, how it becomes manifest, or evident, in terms of representation and perception. Such questions have more to do with how understanding of change is continuously negotiated through formal and informal structures, where humans, devices and environment influence each other. While these issues seem to be articulated in relation to the exhibition *Process as Paradigm* through notions of performativity, change and flux; systems and the way they work 'untouched by the artist and in a more or less unpredictable way' that 'involves slow and persistent emergence in real-time' are defined by the curators as more important (Jaschko, 2010a). Process is opposed to fixed form and all the works in the exhibition are, as stated, ongoing processes of change evolving throughout the duration of the exhibition.⁸

When I considered the exhibition *Process of Paradigm* with respect to the concerns of my research, it appeared that *Process as Paradigm* aims at exploring live processes *per se*, in an exhibition or museum context, while I was more interested in how process becomes evident and is articulated as knowledge, in other words the making manifest of processes. This became even clearer after the seminar *Right about Now* (March 2011) where I invited Jaschko to discuss notions of data collecting and time versus processes. *Making manifest* implies that process or change is made apparent through some form of representation or quantification, such as the series of measurement Østerhus repeatedly carries out in the Antarctic.

⁸ I have not seen the exhibition and base my reflection on information from the catalogue and on Suzannes presentation in the symposium *Right about Now* that I arranged at KHIB in 2011.



Figure 64, A Pyrheliometer is an instrument that reveals the difference between the energy level in a tube like cavity when the sun shines directly into it and when it is closed.

From such a perspective, it appeared necessary to further consider the issues of perception, representation and information in relation to performance. For example, some of the processes on display in *Process as Paradigm* evolved gradually throughout the duration of the show, spanning four months from April to August. How would the audience perceive the undergoing change?

'the works,' write Jaschko and Evers, *'demand for persistent, durative and repeated observation'*.

(Jaschko & Evers, p. 24)

In many cases of slow processes, the human senses will not perceive the small changes occurring during such persistent and durative observation, or it may be impractical for other reasons to do so. The dynamics of such changes may be so slow that they are ignored. They evade our memory because they take place at such a slow rate that our short-term memory will not notice them, and so gradually that they continuously rewrite our memory of how they were before. We need some form of reference in order to compare the present state with a previous state and become aware of and perceive the difference.

This is exactly the kind of demands that caused scientists to apply time-lapse photography. Time-lapse allowed change occurring in processes too slow or too fast for human senses to perceive to appear, to become manifest, through this specific form of representation. This is not unlike what the mining company does with the plinths in Kiruna or what I did with the low resolution sampling of sound in the dance performance *Foolish Fish!* Each image is a reference for the next and the sequence of images represents change. What might otherwise appear as static is revealed as dynamic. This is not unlike how Johnson is in relation to the machine in photograph.

The length of time elapsed between each image is an important parameter that will determine how differences reveal themselves as each previous image becomes a reference for the next. The temporal significance of a time-lapse appears in the relationship between one image and the next. These intervals can be considered transitional, like events in a narrative plot or splices in cinema.

When developing my project proposal, I had not envisioned a framed photograph in the final exhibition, but rather a system allowing processes to unfold. Towards the end of my fellowship, I decided to let *Skyvelære* not contain live signals or unfolding processes, not in the sense I had previously intended, nor in the sense advocated by Jaschko and Lucas. The works in *Skyvelære* are devised as forms that are stable in the sense that they are pre-recorded and pre-edited and maintain their form throughout the duration of the exhibition. Nevertheless, they form an aesthetic system, not in the sense of Burnham's theories, but in the sense of a construction of a network of references and relationships where significance is processed and transformed through the ambiguous system devised by the exhibition. At the same time the materiality of the individual works emphasize their nature as temporary constructions. They offer possible view points rather than demanding the position of stable art objects. Rather than being fixed statements they are more akin to anecdotes; they attempt to engage in a conversation.

SKYVELÆRE #3

The twelve semi-arched windows set a rhythm in the space of Gallery 3,14 that is accentuated by the four black marble pillars and the complex golden stucco ornamenting the room. In the left side of the room, a heavy frame constructed from MDF stands directly on the floor without any support. It is positioned in such a way that only a panel is visible from the door (figure 65). 3,30 meters broad x 1,86 meters high, the screen is a dual projection screen, allowing the image to be seen from opposite viewpoints (figure 66, 67 and 68).



Figure 65, The frame seen from the door.

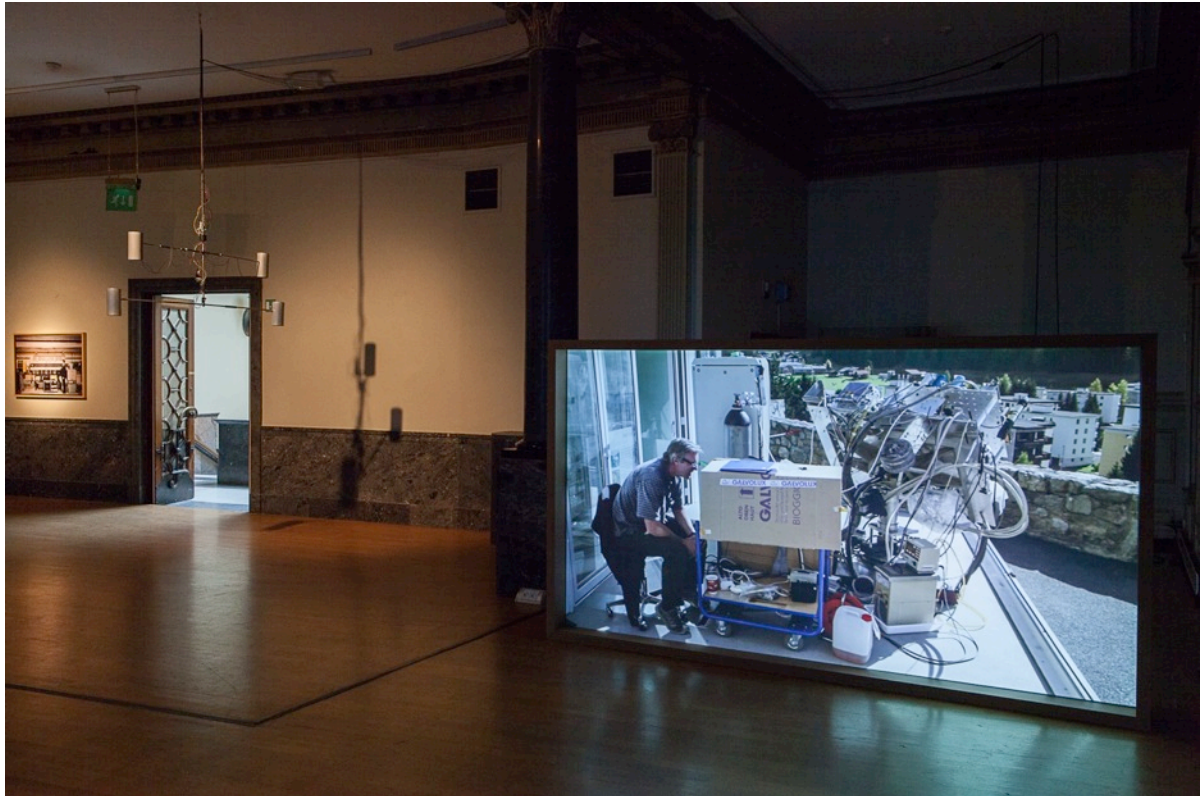


Figure 66, projection seen from south west corner towards entrance.



Figure 67, projection seen from south west corner towards vault.

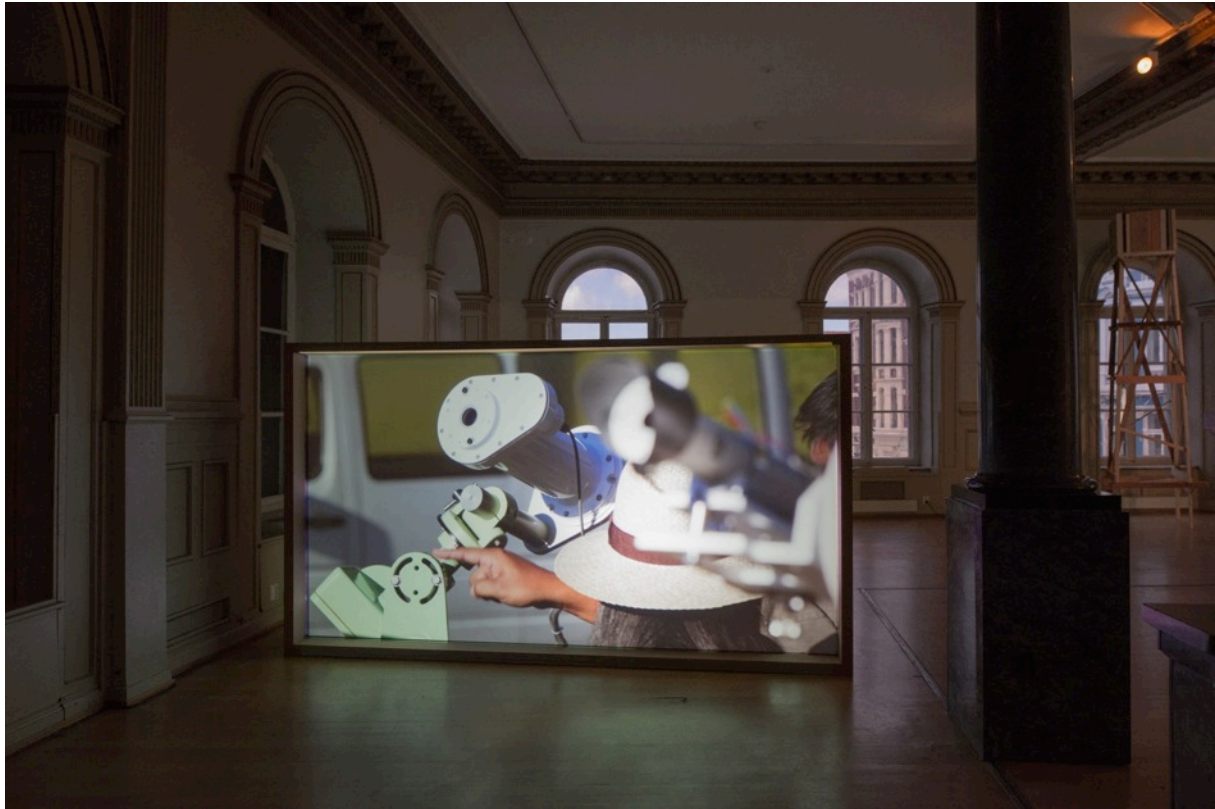


Figure 68, The projection, here showing an ST-1 at work in Davos seen from the opposite side, outside the entrance of the vault .

A group of men and women from around the world concentrate on adjusting their instruments and taking measures while gazing toward the sun. An elderly man with a hat close and put away his cardboard suitcase. In the background several other men, slightly out of focus, are wearing identical hats. A man grabs a pale, green instrument with both hands and turns it towards the east. He verifies the position of the device by leaning gently forward and inspecting it carefully. A woman carefully adjusts a silver knob on a white tube, her hands shaking slightly while strands of her red hair stand up in the wind. Yet another man turns toward the sky with a scrutinizing gaze before continuing to fiddle with his cables.

Edited into a tight compositional pattern, the images show sequences of similar activities and gestures repeated by a range of people working on a range of instruments. Mounted on solar trackers that continually point towards the sun, the instruments are *pyrheliometers*, a cavity-based device for measuring solar irradiation. The activities of tuning the instruments, verifying their position, counting, reading their data and in other ways observing carefully while adjusting them, are carried out in a concentrated and dedicated manner in rhythmic patterns that are emphasized through the compositional editing of the video.

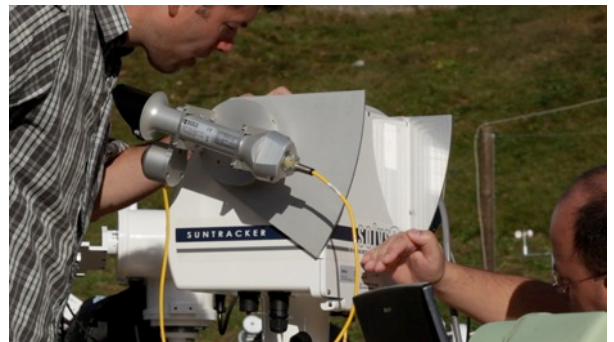
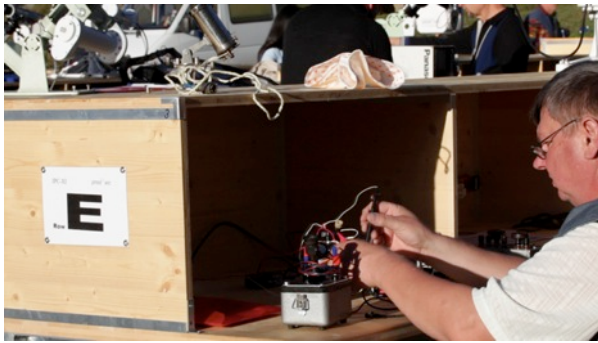
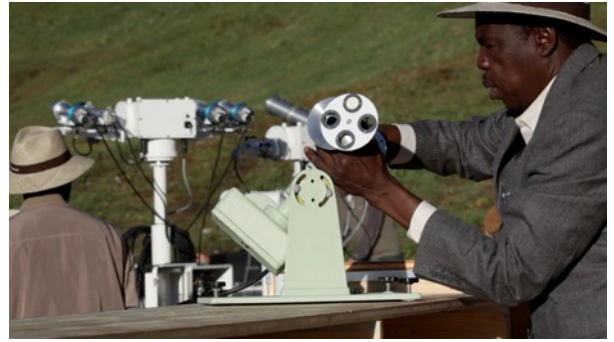






Figure 69. Stills from the video.

The 11th International Pyrheliometer Comparison Event

The video portrays a specific viewpoint through a specific approach for observing the world; the scientific procedure of calibration of instruments to the international standard for measuring solar irradiation during *The 11th International Pyrheliometer Comparison Event* (IPC-XI) that took place in Davos, Switzerland in September and October 2010 (figure 69). 85 meteorologists and metrologists (scientific measurers) from 45 different countries came together for three weeks at the *Physikalisch-Meteorologisches Observatorium Davos/World Radiation Center* to calibrate their own nations' pyrheliometers in accordance with this standard.

The video portrays and reflects on the informal aspects of producing knowledge, such as gestures and performance, as seen in relation to formal structures, such as rhythms and reference points. While making the work I was concerned with contrasting non-determined processes, which I considered as *noise*, and form. I will discuss this further on p. 86. This interest developed into a consideration of the relationship between formal knowledge and personal gesture.



Figure 70, video still.

Informal rhythmic patterns

While performing a ritual, the meteorologists and metrologists are tuning in to the world and each other, positioning themselves in relationship to the sun, to their devices, and to their community. The informal gestures perceived in the video also carry a layer of significance with respect to how they organize into rhythmic structures. The gesture performed by a Peruvian meteorologist as he holds his thumb up toward the sky to see whether it can cover the sun or not, becomes even more significant as another meteorologist, wearing an identical hat, repeats the movement in almost exactly the same way (figure 70). By studying how the sunlight falls around his thumb he interprets the amount of particles, or pollutants in the atmosphere. A halo forming around his thumb indicates a concentration of particles that will interfere with his measurements and influence his data.

During the 21 day long event, the (sunny) days were divided into intervals of 90 minutes occurring repeatedly with six-minute breaks between them. These intervals were broken down into a series of 90-second segments, during which measurements were taken at 30-second intervals. When 85 people thus engage their bodies, especially their hands and eyes, in synchronized activities involving a variety of forms of the same type of instrument, complex rhythmic patterns emerge. The various mechanical beats of the instruments seemed to regulate the movement of the activities, while the slow steady pace of the earth's orbit around the sun was continually defining direction, as the pyrheliometers were following and always pointing toward the sun, from dusk to dawn. The scientists embodied all of the different temporalities with an elegance that seemed to be inherited from the devices, and enforced by their Panama hats. A subtle noise consisting of scattered small talk in many languages, accompanied by the ticking, buzzing and penduling produced by some of the instruments was interwoven by penetrating sound signals that marked the beginning of the different temporal cycles.



Figure 71, Elizabeth Svarstad Lauritsen performing sarabande in a historical outfit.

The sarabande: From noise to ornamented restriction

During the editing and post-production of the video I developed strategies for organizing the material in time in a way that could reflect the aesthetic aspects of the relationship between the formal and the informal. Along with a play of arbitrary associations, I decided to incorporate a strict musical form to organize the informal movements of the meterologists and metrologists into a structure with a distinct form; a Baroque dance music in triple meter, the *sarabande*. The compositional structure of the *Sarabande* of *Le Cinquième Suite* by Charles Dieupart (1667 – 1740), was used as principle for the editing of the video. I analysed and interpreted the sarabande as a musical movement that balances definition in the chord progressions, short phrases with clear conclusions, and ornaments that seem to be circular and return to the same position they started from. In my analysis of the corresponding choreography, I considered how the dancer moves with defined movements, such as small jumps, dragging toes that seem to be drawing a pattern on the floor, as well as carefully articulated hand movements in complex patterns in the air (figure 71). At certain moments the dancer is standing still, so as to define a point, while her fingers or toes are drawing ellipses or points⁹. Having identified such variables, I applied them as principle for the organisation of my visual material.

⁹ A performance of Sarabande can be seen here: <https://www.youtube.com/watch?v=FBzihgRIJhk>

Transfer of associations through form

The rhythm of the musical piece aligned with how I perceived the organization of activities in the IPC-XI; a formal pattern that coordinated the meteorologists' and metrologists' movements in a time based composition structured around a division of three. It was however a play of associations far more speculative that directed me towards this particular dance. It started with an association of how the ellipse, discovered as an orbital path by Kepler in 1609, was drawn by the ornamented gestures of hand and foot in the performance of a sarabande (figure 71).

Continuing these associations, I saw in the sarabande a tension between formality and a form of noise. Originating in Guatemala and Mexico, the sarabande was at first a erotic dance. The actual use of the word '*sarabande*' may, apparently, be traced via Spain, back to the Moors, and is said to have meant 'noise' in the Moorish language. Orchestrated according to a strict choreography, the dance sarabande became popular at the French court at more or less the same time that modern scientific methods developed. The sarabande was the favourite dance of Louis XIV, and gradually evolved to become very slow and restrained, expressing desire through restrained but exquisite precision performed in an exaggerated manner. While the German music theorist, Johann Mattheson complained that it 'expressed no passion other than ambition', the sarabande is generally considered to be characterized by restrained desire (Mattheson, 1739).

While there is no real connection between Louis XIV, one of his favourite dances and eightyfive meteorologists and metrologists meeting in the Alps to measure the irradiance emitted by the sun, I nonetheless pitted these elements against each other, while reflecting on the potential meaning created by such a juxtaposition through rhythm, form and symbolic associations. I later detached these reflections from the piece, leaving them to exist as a hidden layer of meaning that has been turned in to an aesthetic form. That the gestures performed in the video are structured according to the compositional pattern and choreography of the sarabande is not visible.



Figure 72, video still.

Calibration - Groundwork of the natural sciences

Scientific measuring involves complex procedures for making data universally compatible, and calibration has to be performed according to set standards. By referring to standards, data are comparable, verifiable and subsequently agreed upon. The use of *International Standards of Reference*, e.g., the kilogram, the meter and Volt, is a cornerstone of knowledge production in the natural sciences.

The international prototype meter and the international prototype kilogram, the international standards of length and mass, were accepted in 1889 and placed in respective vaults in a castle outside Paris where the International Bureau of Weights and Measures resides. The meter was soon replaced by an equation based on the speed of light in vacuum, but the prototype kilogram is still the same artefact, carefully preserved in the vault at Le Pavillon de Breteuil, originally constructed for the brother of Louis XIV, who inaugurated it in 1672. Canales propose that the failures of photography in relation to both the first and the second transit of Venus in 1874/82, discussed in the previous chapter, played a role in the development of international standards of measurements (Canales, 2009). The importance of defining and implementing international standards for ensuring compatibilities of data obtained by measurement became even more evident and urgent after these transits.

Standards - The World Radiation Reference

The Standard for measuring solar irradiance is a *convention-based standard*, known as the *World Radiation Reference*, WRR (PMOD 2014). It is re-negotiated in Davos every five years, according to the results of the International Pyrhelimeter Comparison Event, as a reference value based on the average measurement of 15 instruments. Each device that participated in IPC is equipped with its own 'personal equation' that the meteorologists and metrologists will apply to their data when processing them. They will bring their calibrated instrument back to their country and proceed to calibrate all the national Pyrhelimeters. The reference is thus distributed throughout the entire international community.

In scientific terms, applying calibration procedures is merely maintenance. In itself it does not produce any new knowledge. It ensures the premises for scientific knowledge production. Calibration can be seen as a kind of tuning, a preparation of an instrument which ensures that it will perform well within a larger context. As a means of ensuring that all of the gathered data are comparable within the practices of scientific and commercial measurements, calibration means tuning the instruments according to this shared point of reference.

Duchamp's Reference - Personal gestures

In his work, *3 Stoppages Etalon (3 Standard Stoppages)* (1913-16), Marcel Duchamp paved the way for an art that transcends subjective self-expression in favour of systematic consequent inquiries supported by procedures (figure 73).



Figure 73, 3 Stoppages Étalon, Paris 1913-14.

In Duchamp's work, that mainly consists of a wooden box containing a set of 'rulers', the artist created his own standard references of a meter. Using gesture, he produced a measure that served as a formal reference in spite of being subjective, random and experiential. It was created by dropping a thread onto a canvas three times. He stretched out his hands, one meter apart, and dropped the thread from a height of one meter. The thread was fixed as it fell. Using this method, he produced a formal measure that he later reproduced in wood as a set of rulers and applied as a basic geometric unit of a meter. Repeating the procedure three times produced three standard meters, all different and all equally valid. These were his *Standard Meter(s)*, or *étalons* as the standard meter is called in French, and he used them as geometrical units when constructing a number of artworks, including the seminal work *La Mariée Mise à Nu par ses Célibataires, Même* (1915 - 1923) also known as *The Large Glass*. *3 Stoppages Étalon* is the first artwork to explicitly employ random as a strategy, and in itself an iconic reference in the field of art. It is a demonstration that in the arts standards can be experimental and random.

Duchamp's standard was not merely random, it was also personal, and a direct result of the movement of his hands. When he used it as a formal reference, a geometric unit, he demonstrated that, in terms of procedure, his gesture was as good as any other measure. Then he dropped another thread – and yet another. In the end, Duchamp had the results of three gestures, three experiments; for him they were all equally valid as a reference and as a measure. The work is

remarkably precise and compact in its critique of science. It is both in favour of and a critique of scientific methods. Critical of the emphasis on visual appearance and artistic self-expression in the arts, Duchamp was clearly disappointed with the determinism that frequently defines art as a creative medium. He was in an early phase of developing an aesthetic that moved towards ideas of systems, parameters, logic and mechanisms of transformation. It is interesting to note the way he, in spite of favouring systems, procedure and the mechanical in art, celebrates the personal movement of the hand, the gesture, as being significant. Duchamp was attracted to machines. They have no taste and no feelings. He liked their anonymity, which suppressed the question of the author. Machines are procedural, carrying out something rather than accumulating it. Nevertheless, this homage to gesture complemented the machines with the personal and with experience.

By applying arbitrary gestures in a systematic fashion, he renders them as a procedure, which transcends the random and offers a new map and structure, later employed as a grammar for knowing where to position things in relation to each other. He produces a form of geometry and geography that is personal. Applying it provides indication of position.

Today remote sensing has taken over much of the data-gathering practices, such as in the ALIS system of Urban of Brändström, but calibration of devices remains a practical task that has to be performed manually to ensure that the data collected by the instruments are compatible. As such, it still offers the scientist a direct experience of reality. The activities of tuning and aligning can be seen as a way of navigating and positioning oneself in relation to the world through the devices.

Social and scientific tuning

As depicted in the video, calibration involves tiny incremental adjustments of knobs, wheels, sliders and other controllers. While adjusting the controller slightly back and forth with their fingers, the meteorologists and metrologists observe the effect of these tiny movements in relation to something, in most instances the position of the Sun. Such adjustments are forms of *tuning*. Tuning thus involves a process of producing very small differences. It is not a question of polarity, of either this or that, but of a differentiating process that will eventually lead to a definable and isolable term, or a scientific point. This will serve as reference, a position, or a viewpoint, and form new relationships.

Shared skill and trained perception

Another aspect of tuning that takes place during calibration, is the development, throughout the scientific community, of a shared set of skills and references, a shared way of perceiving and acting within the community. Measuring solar irradiance is, just like music, a practice that

requires not only tuning according to a certain pitch, but also a set of skills acquired through instruction, community building and extensive practice.

In the video, the form of the sarabande merely serves to accentuate the formality of the procedure depicted, while giving emphasis to the informal gestures performed and rendering them as a form of multifaceted social ritual, containing a multitude of rhythms that serve to create presence. As such, the event is an opportunity for the participants to connect with each other and with the world, in a shared time and space and through coordinated sensory activities. It appears as a collective strategy for being in the world and in the moment. From this perspective, the formal scientific procedure is a device, not for verifying data, but for maintaining a community through a common experience.

SKYVELÆRE #4

In the south west corner, in the open area where one might prefer to watch the scientists portrayed in the projection of *Skyvelære #3*, a non-distinct, continuous sound, noise-like as ocean waves hitting the shore, passes through the room in continuous and repetitive movements (*figure 74*). Soft and abstract the sound seems to move from in front of the viewer, where the image is, towards the tower by the windows behind the viewer, and back, sweeping through the room like a small, audible breeze. The sound is spatially distributed in a specific pattern throughout the large south-west corner. It is played back from five handmade, white, cardboard speakers located inside the panels below the five window frames, barely visible behind the grill in the panels. Every six minutes, a soft female voice counts: 'en - to - tre ' (one - two - three), setting a rhythm that corresponds to the edits in the video of meteorologists described in *Skyvelære #3*.



Figure 74, In the south-east corner of the room, loudspeakers were placed under the windows in the spaces formerly used for heaters.

The sound is an abstract whispering that evades indexical categories. Reproduced using multichannel sound spatialisation, it moves through the room like an evasive ghost. The sound and the video described in *Skyvelære #3* co-exist, but they are not synchronized or dependent on each other. The handmade and discreet appearance of the speakers underline the ephemeral character of the sound, thus avoiding the heavy presence of technical machinery often experienced in surround sound installations.

From ornamented restriction to noise

The sound source is a recording of the dynamic friction of the silk skirts of a dancer, dressed according to French fashion in the 17th century, performing a Baroque dance in triple meter, the sarabande. The spatial distribution of the choreography of a sarabande has served as a pattern for the spatialisation of the sound (figure 75). Information about the source and procedure for making this part of the exhibition is not immediately accessible to the viewer. It is a non-distinct soundscape independent of its origin. The presence of the sound has a phenomenological effect, as it addresses the sensuous and embodied experience available through the ears; an appreciation of sound, space and time. The sarabande is thus brought back to its Moorish meaning; a form of noise.

As a layer of abstract noise, the work constitutes a contrasting element to the video that portrays activities associated with measurements, quantifying the unfolding reality into measured points, thereby giving them definition. The presence of the sound also introduces another effect of time and space within this part of the room. As the sound-source moves from speaker to speaker it constitutes a presence that moves about, offering an experience, subtle and discrete, but present as something that unfolds in time.

The sound consists of pre-recorded material, played back in a loop, but nevertheless, it is a non-discrete, undefined or unidentifiable temporal unfolding, resisting definition. As a work, it is not experienced to have a distinct beginning or end, and can only be perceived as a form of continuous flow. It represents what I have several times called process, in spite of being generated through a stylized and cultural form. Within the exhibition, this work suggests the environment, the landscape, or nature.

Dance as a way of dissolving linear time

The rhythmic and musical structure of the sarabande has been abstracted into a soundscape not unlike the ocean, aiming at dissolving the imposing linear structure of time and space imposed by the architecture of the room. While its subtle and almost imperceptible presence could never achieve such an effect, the sound is nevertheless the testimony of a gesture allowing someone to escape linear time, even if only for a fleeting moment.

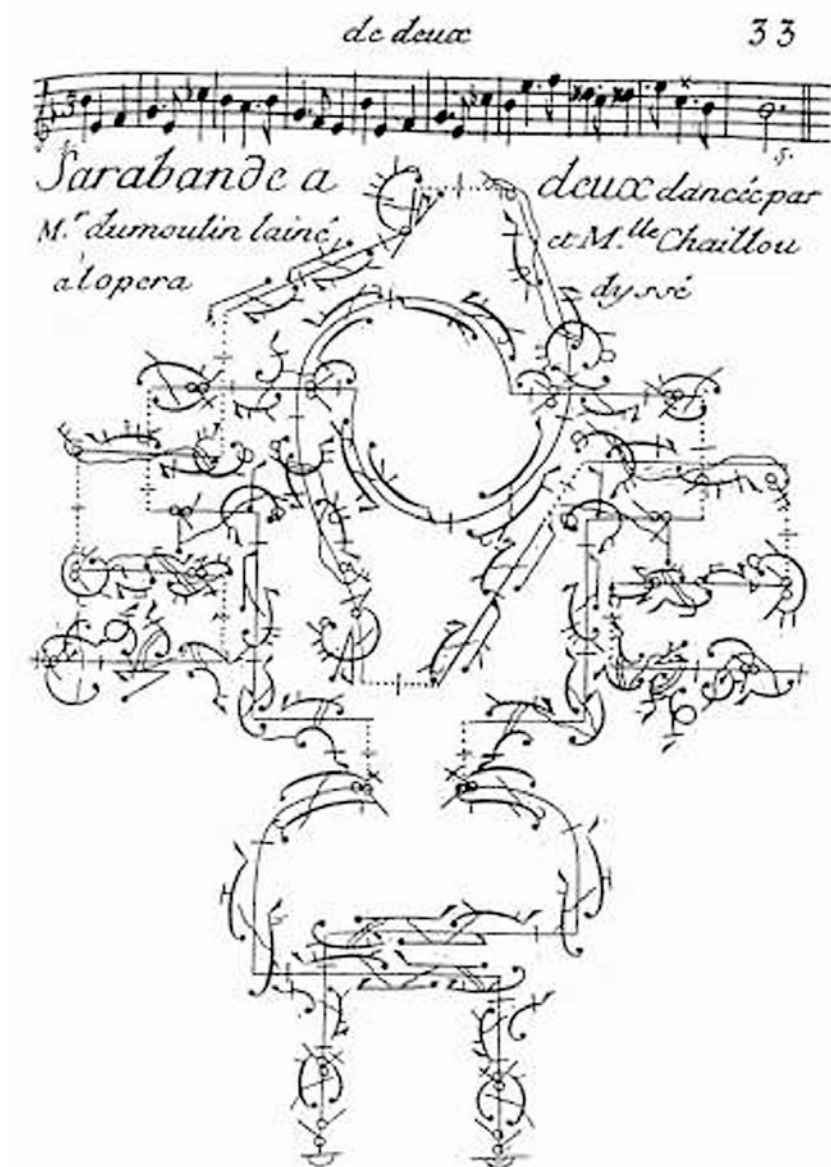


Figure 75, Spatial layout of a choreography for a sarabande for two dancers.

As proposed by Yi Fu Tuan (Tuan 2001) the experience of space and time is biologically largely subconscious and linked to our bodies through recurrent phases of tension and ease. They are easily confused in the sense that we often use time units to describe space, and spatial notions, like *length*, to describe passage of time. Through the construction of perspectival landscape, 'organizing the simultaneity of space into a happening in time' the image of time as an arrow has, since the Renaissance, taken precedence over the idea of time as a circular orbit or swinging pendulum. Landscape pictures, Tuan claims, have taught us to organize visual elements into a *dramatic* space - time structure, that he exemplifies with the road, disappearing into the distant horizon, its surrounding space shaped like a cone, opening up from the point where one stands, to the broad horizon separating earth from sky; the future. From this point, we can only move in one direction, forward, towards our destiny (figure 76).



Figure 76, Two performers dancing towards the Future.

Music, according to Tuan, has the capability of undoing this influence of landscape. It can, through the effect of rhythm, 'insert' us in an experience of time where we can suddenly move in all directions with equal ease, movements which would otherwise cause great stress. Under the influence of rhythm we can step backwards or sideways as well as forwards, thus forgetting, if only for a moment, our goal-directed life. Through rhythm, we exist in 'presentic' unoriented place, using a term from Erwin Straus, a time-space structure that escapes linearity.

While dancing around the room thus 'inserted' in rhythm, the dancer, represented here by the frictionous sound of her swirling silk skirts distributed in the room in circular movements, can be considered to have existed in such a 'presentic' place.

The soundscape provides three qualities, a lush and quiet sonic texture of mostly high-frequency noise reminiscent of distant waves or a cascading waterfall; an impression of movement in space, and a non-linear and irregular coming and going, a form of appearance and disappearance in a vague sensation of waves perpetually rolling against the shore. The rhythm of these comings and

goings are more irregular than the waves, but they are not unpredictable, as the ornamented choreography of a dance in triple meter has provided the structure of the source.

Noise versus phenomenon (form)

Michel Serres links the sound of the ocean to the beginning of the world, as this sound appears before being defined and articulated into the world of phenomena. For Serres, noise is the opposite of form.

Noise cannot be a phenomenon; every phenomenon is separated from it, a silhouette on a backdrop, like a beacon against the fog, as every message, every cry, every call, every signal must be separated from the hubbub that occupies silence, in order to be, to be perceived, to be known, to be exchanged. As soon as a phenomenon appears, it leaves the noise; as soon as a form looms up or pokes through, it reveals itself by veiling noise. So noise is not a matter of phenomenology, so it is a matter of being itself.

(Michel Serres, 1997, p. 13)

Historically, the thoughts of the Pre-Socratic philosophers Heraclitus and Parmenides represent two different modes of understanding reality. According to Heraclitus, everything is in flux, 'everything flows'. All that exists and the universe are in a continuous, ceaseless movement of transformation, nothing exists as a static entity and only change is real. It is therefore impossible to step into the same river twice. Parmenides objects to this view from an ontological perspective, considering change as an appearance that is not ontologically accessible. We cannot know the world unless we first look beyond the mere appearances, and consider its essence. We need the static form, 'river' to be able to relate to it and know something about the river. This view is often expressed as 'everything rests' (Sotemann, 2013). Parmenides' view guided the beginning of Western science, first in its discovery of logic and geometry, then in the application of those mathematical truths to the description of mechanical motion. The mechanistic paradigm dominated science for centuries. It considered *change* as something unfolding in stages along a pre-defined path towards a known end. This view is the basis for what we tend to call development (Wimmer, 2006).

Movements of differentiation

The scientific approach to producing knowledge that developed within western science consists of reducing flows and processes to discrete points through measurements. This approach was criticised by the French philosopher Henri Bergson who insisted on an understanding of life as a

contingent process of growth and change, and of time as a force (*élan vital*) that pushes life along. In 1907 Bergson argued that when we measure change we map it onto space, thereby stopping the movement of time, turning it into space (Bergson, 1998). Bergson recognizes that clock-time, produced by reducing the flows of reality to points (instants) of identical time lengths (minutes, days etc.) has many practical advantages, but that we must not confuse clock time with time itself, which endures. Clock-time considers movement by measuring the change, and thereby stopping it.

In order to be fully able to understand the world, our logic ought to be extended and adapted to the dynamics of duration, actual time and the force of life. Bergson sees this force of life as a movement of differentiation, as everything in life is in continual transformation where it becomes different from what it was before, an idea that has been further explored in contemporary philosophy in the work of Gilles Deleuze.

At about the same time, in the beginning of the 20th century, the break-through of quantum physics triggered a radical change in human understanding. Quantum physics described the nature of matter in terms of a duality of wave versus particle. Particles are separate and identifiable entities that have localized (particle) properties, situated next to each other; while waves have distributed wave properties within a field of energy. The revolutionary idea that quantum physics express is that all beings, at the subatomic level, can be described equally well as particles or as waves. In other words, it is not a question of either - or, but a question of perspective. About one hundred years after this shift in human understanding of matter, all the major disciplines of science have developed towards seeing change as evolving processes (Wimmer, 2006).

Music as weather

In the 1960s, as art and music were developing a new awareness of process, John Cage began to think about music as weather. Wanting music to be indeterminated; he also developed a notion of process, music that was in continuous change, shifting, omnidirectional and unpredictable; like the weather.

Just as my notion of rhythmic structure followed Schoenberg's structural harmony, and my silent piece followed Robert Rauschenberg's white paintings, so my Music of Changes, composed by means of I Ching chance operations, followed Morton Feldman's graph music, music written with numbers for any pitches, the pitches notated only as high, middle, or low. Not immediately, but a few years later, I was to move from structure to process, from music as an object having parts, to music without beginning, middle, or end, music as weather.

John Cage (2014)

Cage's way of contrasting structure from process is useful as it offers a parallel perspective to that of Michel Serres. From the perspective of *music as weather*, a constructed form can also be indeterminate, open and without beginning, middle or end. Process is considered to be a form, only a more open and durative form than in conventional music.

Cage was experimenting with removing or changing conventional parts of music, such as melody, pitch, rhythm and other forms of structure, or with generating them through chance operations. He would for example use *I Ching*, or throw out stones on the notation paper and draw their shape, as strategies for making music. Unlike his *music as weather*, which he considered indetermined, the form in these compositions were determined through various gestures where chance was involved. The chance operations provided musical structure, and he sometimes refers to them as objects. The object was for Cage something given, something providing a defined or fixed structure in the composition, even if this was created by chance. This idea of an object providing structure is not completely different from how the Kilogram, kept in a vault in Paris, is providing reference as an international standard of mass, or how Duchamp's *étalon*, produced by the stretching out his hands and dropping the thread onto a canvas where it is later fixed, serves as a given structure in his visual compositions (Judowitz, 1998).

The Angel of History: Process versus progress

A more recent piece that overturns these concepts is the work *I Need Some Meaning I Can Memorize [The Invisible Pull]* by Ryan Gander (2012), installed in the main hall of Fredericianum in the exhibition dOCUMENTA (13). It is a work that has some thing in common with the way I treat sound in the work we have discussed here, as it also exists as an impression of movement in space. In Gandner's piece there are no apparent structures at all, except those offered by the exhibition space, the context and the experience of the viewer. Upon entry, the vast museum space of the ground floor of Fredericianum is completely empty, but after a while one notices that the room is filled with air, moving air, a light wind that is flowing through the space, caressing the skin and hair of the viewers, playing light-heartedly with their clothes and offering relief from the stuffiness of spending a summer day in a massive exhibition together with thousands of spectators gathering from around the world. Thus offering a sensuous and refreshing experience of art, Gander has constructed a non-determined form and made a piece that above all presents itself to the viewer as a strong sensory experience that evades any notion of structure and that silences discourse in favour of phenomenological experience through sensuousness and embodiment.

Nevertheless, there are several references existing informally as potentials of significance within the work; First of all, notions of crisis, destruction and history are resonating throughout the

entire exhibition. Several works render an image of Kassel and its Fredericianum as sites of destruction of the war, as part of a history to which the existence of dOCUMENTA is strongly connected. Thereby, one can easily imagine how, in a moment of war, battle has broken all the windows of the perhaps evacuated building, perhaps leaving the huge empty room for the wind to play with. In addition, as I was observing the other viewers immersed in the experience of the light breeze, the piece reminded me of the previous Documenta, the 12th edition (2007), in which the motive of *History as an Angel* appeared as an almost secret leitmotif in several of the exhibition venues. While in my mind that concept resonates strongest with a song by Laurie Anderson, that she has borrowed it from Walter Benjamin who speaks of the 'Angel of History' - an angel whose gaze is fixed on the past and who is caught in a storm blowing from Paradise towards the future, to which his back is turned. Benjamin himself develops the image from a drawing by Paul Klee, *Angelus Novus* (1920), which he apparently owned. The drawing, itself carefully inserted into DOCUMENTA 12 in a staircase, is iconic for readers of Benjamin.

A Klee drawing named 'Angelus Novus' shows an angel looking as though he is about to move away from something he is fixedly contemplating. His eyes are staring, his mouth is open, his wings are spread. This is how one pictures the angel of history. His face is turned toward the past. Where we perceive a chain of events, he sees one single catastrophe that keeps piling ruin upon ruin and hurls it in front of his feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. The storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress.

Walter Benjamin, (1968, pp. 257-8)

SKYVELÆRE #5

The interior of the gallery 3,14 is studied and revealed in a time-lapse video that is on display inside the small, antique elevator of 3,14 (figure 78). Resonating with its materiality, the 27 inch LCD screen in 16:10 format has been stripped of its plastic casing. A naked screen with a narrow steel frame displays the gallery room in a slow movement that pans on both the vertical and horizontal axis during shifting conditions of light in a circular loop. The automated camera movements echoes the time-lapse described in chapter #1, where the camera is mounted on a solar tracker and thus following the rotation of the sun. The same procedure is repeated here, inside the gallery. However, the flow of images is smoother as all changes in light and inclination progress evenly without any disruptions breaking the appearance of continuity.



Figure 78, inside the elevator .

The film traces the path of the sun during 24 hours reduced to 3:38 minutes. An observant viewer will recognize the pattern of speed and movement from Skyvelære#1 and realize that the procedure has been repeated inside the gallery (figure 79). As in the time-lapse films from ROM8, discussed in chapter #1, the sequence consists of photographs taken while tracking the sun from a viewpoint where the sun is invisible, inside the gallery (figure 80). The sun is never directly visible in the sequence, only indirectly through the occurring changes in the natural light, but these are corrupted by the changes in the artificial lights of the city, entering through the many windows. The angles of the camera pans are less radical than in Skyvelære#1, as the time-lapse was produced on the 26th of March, a few days after the first day of spring, the *vernal equinox*.



Figure 79, The screen in the elevator displaying a moment when sunlight almost hits the lens of the camera.



Figure 80, In the video, the sun is decending.

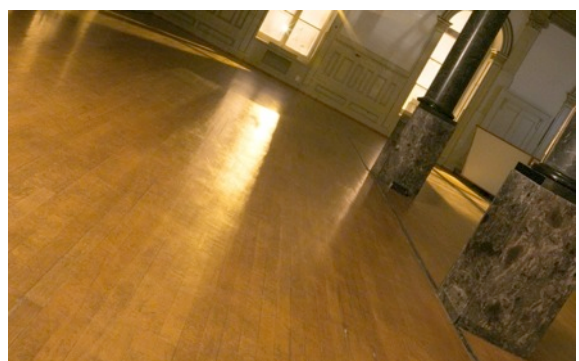
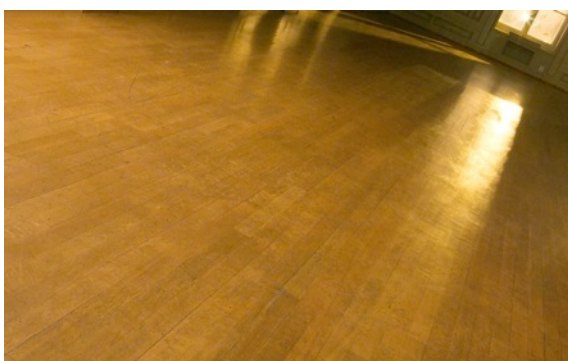
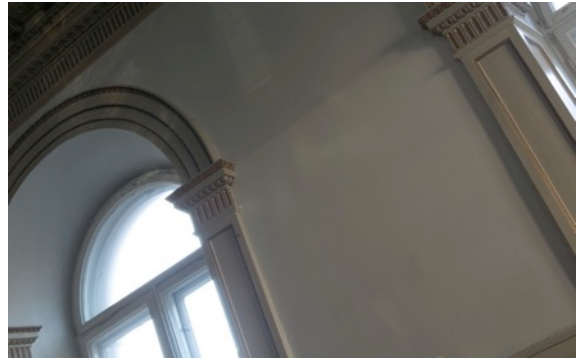




Figure 81, Stills from the time-lapse.

Because the angle of the earth's inclination toward the sun changes throughout the year, lengthening or shortening the duration of the day depending on season and latitude, day and night are of equal length twice a year. These are the spring and autumnal *equinoxes*. Equinox means *equal night*. As the sun's equidistant position between the poles of the earth at the time of the equinox can be considered as a planetary balancing act, the spring and autumnal equinoxes are considered celestial tipping points. They have been observed for thousands of years giving rise to seasonal folklore. Believing that special gravitational forces apply, many claim to be able to balance eggs and brooms on their pointy end on the days of the semi-annual equinoxes, and a Google Image Search of *broom* and *equinox* will reveal a multitude of brooms standing straight up, on their soft end (figure 82).

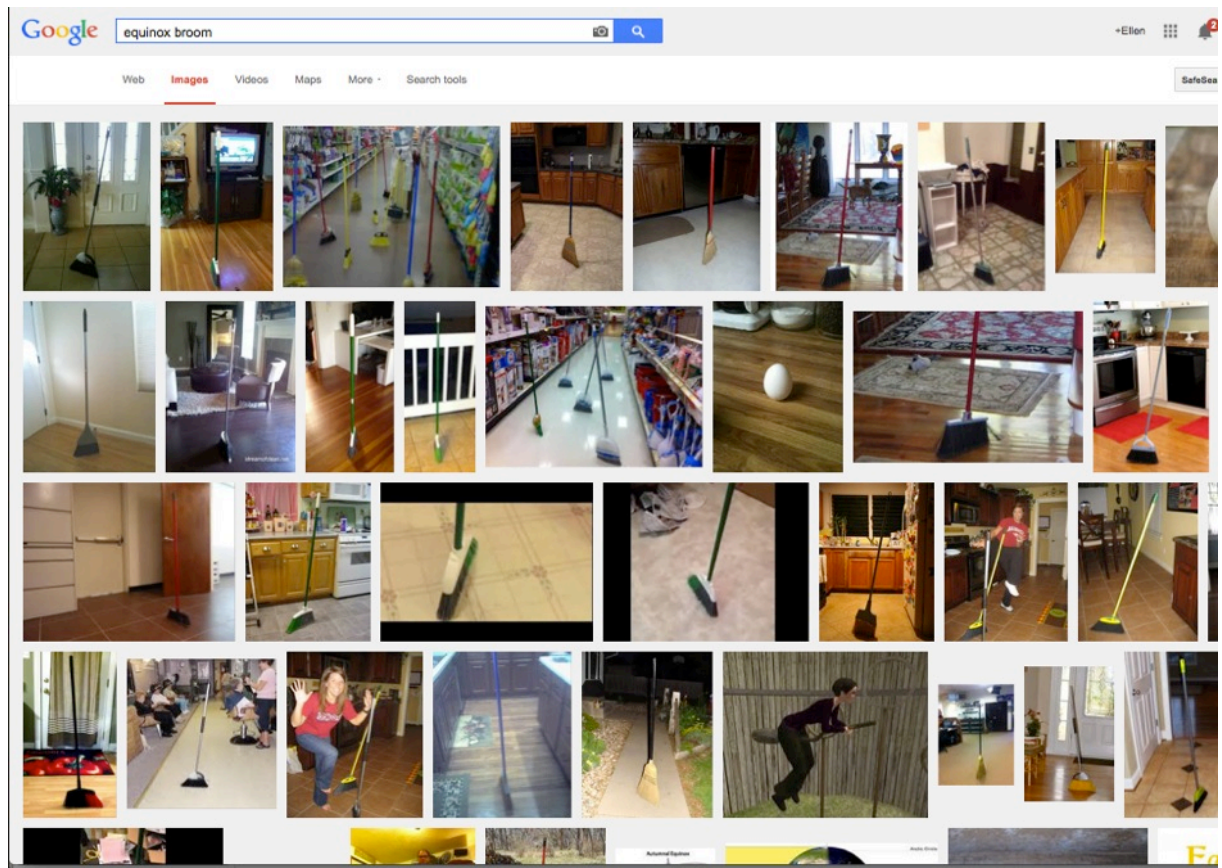


Figure 82, Detail from Google Image Search on equinox and broom.



Figure 83, Screen-dump from *Sun Seeker*. Near to Equinox in March.
Gallery 3,14 in the centre of the image.

In the time-lapse, day and night are of approximately equal length (figure 83). The camera therefore pans across ceiling, floor, west and east walls in equal amounts of time. This results in a balanced distribution of time and space that is quite different from the panning movement of the video described in *Skyvelære#1*, where the sun never sets, and the camera accordingly never points lower than the horizon (figure 84). While the video of *Skyvelære#1* represents a form of extraordinariness, in terms of solar tracking, this video represents a more ordinary situation.

Autonomic (make me magnificent)

The timelapse from within the gallery never displays the sun, and there are few negotiations revealed by the smooth and automated movement. The panning, on both axes, is consistent and systematic, mechanical and untroubled. It is a sequence of images that observes and documents the space and the changes occurring in it according to a specific procedure, and treats the gallery as an object of observation.

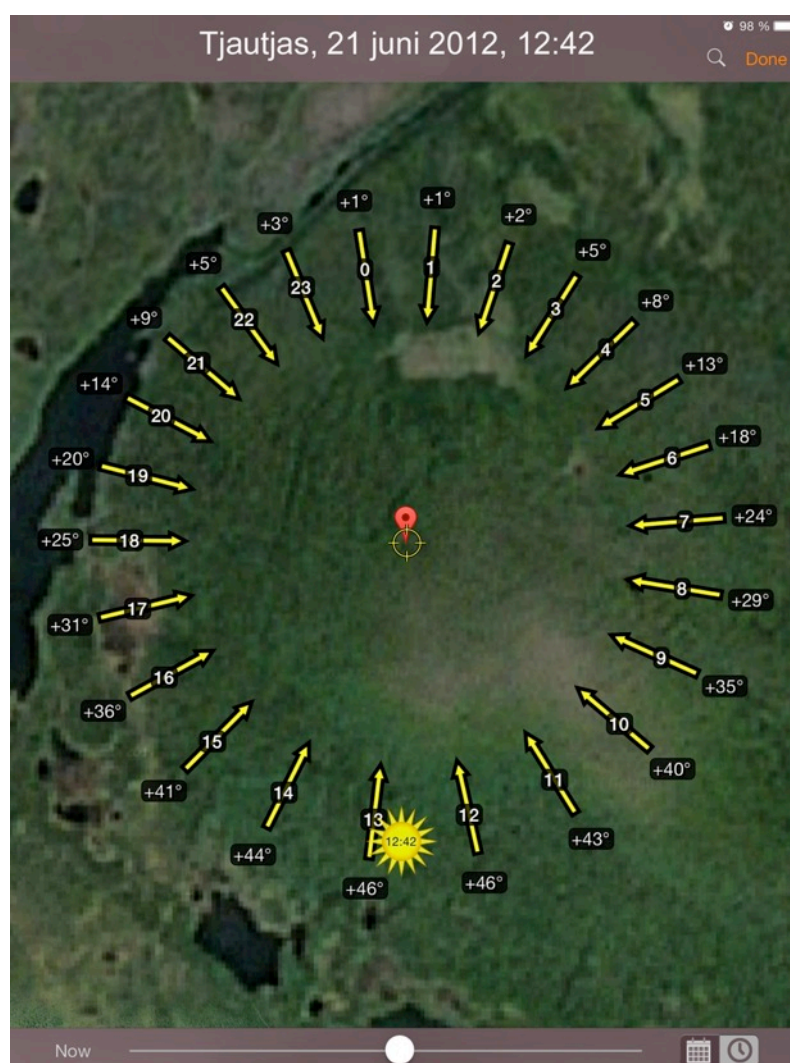


Figure 84, Screen- dump from *Sun Seeker*; 21.st of June in Nikkaloukta is an extraordinary situation in terms of inclination.

Photos represent the presence and the choices of someone who has decided to capture them. In this time-lapse, the artist is less present in the images than in the time-lapse of the sun, as the devices capturing the photos operate automatically and uninterrupted. Having already completed calibration, positioning, alignment and adjustment of settings on camera, tracker and timer I handed over all further adjustments to the machines. The site had relatively controlled and stable light conditions, which made it possible to leave further adjustments to the apparatus of the camera. As a result, the only adjustments occurring during the making of the film, is taking place inside the camera. While it is not operating as a truly autonomous device with a free will, certain decisions are left to be made by it.

Since the sun does not play a part in any visible negotiations, it is neither present in the making of this work as an ideal to be strived for, nor as an agent with its own power of effectuation. Its path is merely traced as a template for the movement of the camera, through the procedure embedded in the tracker. In the absence of both the sun, a stubborn ideal protagonist that is hard to negotiate with, and myself, who unlike the machine may commit irrational decisions at any moment, the devices and the site will be seen to have reached a peaceful agreement.

There is also a dialectic relation between the two time-lapse videos. The first, dominating the exhibition upon entry, provides a reading key for the latter, hidden away in the elevator to be discovered later on. The viewer needs to recognize the gesture of solar tracking from the first film in order to understand that they are watching the path of the sun in the second. Reciprocally this offers new perspective on the first through the way it is balanced and ordinary (vernal equinox and geographical position), and especially in terms of how it treats its object as an impassive *object of observation*, rather than as an agent that *does* something in the construction of the representation. When comparing the two films, these aspects of both films might appear as something that is different and significant.

Affordance: An invitation to act

For an artist who is interested in both images and scientific devices applied in relation to the environment, I do not consider making a time-lapse while tracking the sun as a radical gesture. This is an activity afforded by the solar tracker, so I am merely realizing its potential. From such a perspective, devices are objects that have a sense of *intent* embedded in them, a property which allows an individual to *do something* with them, e.g., a knife or a book. The knife *affords* cutting with it, the book *affords* reading. In a similar manner, the solar tracker *affords* tracking the sun. Affordance, in other words, is a *potential* embedded in the relation between the thing and an individual that might act with it in a certain way. Psychologist James J. Gibson coined affordance in 'The Ecological Approach to Visual perception' (1979). It is currently considered to describe a

relation between animals and features of situations (Chemero, 2003). The affordance of the ST-1 is that it will point toward the sun irrespective of where it is. In the production of the time-lapses in *Skyvelære* the mechanical bodies and electronic vision of the devices were operated according to their respective affordances.

Solar trackers used to be exclusively available to astronomical and meteorological research communities where their affordance was realized by mounting complex instruments of precision on them in order to perform observations and measurements of the sun and other celestial phenomena. Recent developments in photovoltaic (solar) energy production as well as in popular astronomical culture (in particular space photography), have made them much more accessible. As a result, time-lapse movies that use solar tracking are quite frequently seen on YouTube, especially in (amateur) documentaries portraying nature.

Occasionally, and increasingly more often, solar tracking time-lapses also appear in cinema, e.g., the film *Tree of Life* (2011) by Terrence Malick, and in art, e.g., the video *Heliocentric* (2010) by artist duo *semiconductor*, consisting of Ruth Jarman and Joe Gerhardt. The images obtained by tracking the sun while capturing a time-lapse are attractive as they offer a vision that is not otherwise possible through human sensory experience. They may be considered to reveal a 'true' perspective because we all 'know' as an objective fact that the Earth rotates around the sun.

*It is usually all but impossible to visualize how the earth moves around the sun,
even though we know it to be true.*

(Semiconductor, 2010)

Due to its affordance, you will probably want to use it to track the sun once you get access to a solar tracker. In addition, the tracker carries a second affordance, a potential of mechanical movement that triggers another impulse; the creation of *time-lapse*. Time-lapse films, in particular within the genres of scientific film and documentaries portraying nature, but also in art-films like those of the Norwegian artist Inger Lise Hansen, often involve repositioning the camera in incremental steps between each photo. As this repositioning is carried out between each captured image, the gesture is not visible in the resulting motion that appears through the sequence of images. It is possible to move the camera manually, but applying a motorized and automatic device for repositioning it makes the procedure more transparent as the motion appears to be smoother and continuous. A motorized solar tracker, such as the ST-1, has a potential of being used as such an automatic device that will reposition the camera, for instance in the production of time-lapse movies. Thus, the ST-1 affords two activities; to track the sun and to

automatically reposition a camera. The gesture of creating time-lapse movies where the camera smoothly follows the movement of the sun can therefore be considered a common response to the invitations inherent in the solar tracker.

Semiconductor: The sun as an object of observation

In England, artist duo *semiconductor* explores ways of perceiving the world in the natural sciences and often proposes alternative ones. They work with a combination of recorded footage, often shot by scientists, and digital video processing. Several of their works have layers of both abstract data processing and visualisation and sonification based on sampled data that represents something else. Their time-lapse film *Heliocentric*, premiered at the International Film Festival in Rotterdam in 2010, was made using a solar tracker, operated according to the inherent affordance of a solar tracker. Their time-lapse, like mine, tracks the sun while following its trajectory through a sequence of captured images. Unlike mine, it portrays the sun as a stable *object* fixed in the centre of the image as the frame smoothly pans the sky from sunrise to sunset.

In the first part of *Heliocentric* we see the sun in a sky heavily textured by aeroplane contrails, while for the second part the procedure is repeated inside a Victorian green house. The glass building, filled with large palms, provides a stronger sense of place and scale without losing contact with the motif outside the building. The soundtrack reveals that they have also applied audio tracking to the visual material and remapped certain parameters. I would assume that information concerning the number of bright pixels in the central area of the image, is mapped to select parameters of the soundtrack, such as pitch and amplitude. This creates a beautiful multi-sensory work where the intensity of the sun influences the sound and where the perspective of the solar tracker is made essential. The work renders an automated vision, representing the point of view of science, observing the sun through and from automated devices and procedures.

Terrence Malick: Nature as protagonist

A very different approach to the sun is taken by filmmaker Terrence Malick in his latest film *Tree of Life* (2011). Malick is an experimental filmmaker who operates within the feature film industry in Hollywood. One of the particularities that characterize his films, is the way he treats nature, or landscape, as such a prominent backdrop for his plots that it permeates the sceneries of the films as an active *agent* with its own power of effectuation, and almost becomes one of the protagonists. This active use of landscape was perhaps most prominent in the epic war drama *Thin Red Line* (1998), and in the story of Pocahontas in *The New World* (2005), but in *Badlands* (1973), an experimental *Bonny and Clyde*-like road movie, the landscape also played an affective and active part. In *Badlands*, the main protagonists *Holly* (Sissy Spacek) and *Kit* (Martin Sheen),

have set off a spiral of violence that escalate rapidly. They nevertheless appear disconnected and impassive in relation to the plot they are themselves creating, as if they lack the appropriate tools for relating to their own reality. This peculiar attitude towards their own destiny and evolving story is reflected by their surroundings, such as a bird or deer that observe them from within the forest. The forest also protects by shielding them in its density and revealing their enemies one by one, to be defeated as they approach. In an opposite manner, the desert betrays them so that they are eventually captured. Nature thus seems to be an active *agent*. Far from being objectified, as in *semiconductor's* Heliocentric, nature appears in *Badlands* as another kind of process, one evolving in a much slower speed than the one Kit and Holly has gotten themselves into. This approach to nature is even stronger in Malick's latest film, *Tree of Life*. In this strange epic, interwoven with abstract parts that depict *Genesis*, the sun appears to be a protagonist that gives life, but it is also able to *burn*. In the works of Malick, a layer of agency is in this way embedded in the presentations of nature.

In the social sciences, the term *agency* usually refers to the capacity of individuals to act independently and to make their own free choices. This common view which narrows agency to something individuals have, has been challenged by less anthropocentric approaches by post-human social scientists such as Bruno Latour and Donna Haraway, who explore symbiotic relationships between human beings and material entities, and discuss *non-human* and *material* agency. They claim that material entities also engage with one another in a way that *does* something, such as, to use an example from the social sciences, a speed bump that raises a car that passes over it (Knappett & Malafouris, 2010).

From this perspective, objects that are part of the world, such as instruments, planets, clouds, fishing rods, or pictures, can be considered as having their own potential, existing in the relationships they are part of. Nevertheless, they can have an unintentional effect. At the same time, most objects can be manipulated, overturned, ignored, pushed, torn apart or cut up. In addition all kinds of errors, occurring during such activities, may be embraced like any other chance event.

Mary Lucier: The burning sun

In 1975, Mary Lucier produced a multi-channel video work installed on seven horizontally aligned video monitors (Lucier, 1975). Each monitor successively displays a thirty minutes long recording of the sun rising over the East River in New York City, from each of the seven mornings of recording. As a video artist, at this point Lucier had a strong interest in landscape as well as in using video as a tool of tracing or mapping space (Barlow, 2000). As she directed her video camera towards the sun for half an hour, the strong light and accumulating heat burned a scar in

the picture tube of the camera that would leave a fierce mark on all images, thereby destroying its potential for recording 'unmarked' images. But Lucier embraced this effect and persisted. She let the sun carve, as with a chisel, into the picture tube during the 30 minutes of the recording session, thus inscribing its path into the images. As she repeated the procedure six times, new scars, each according to the path of the sun on the different mornings, were carved into the sensor. As the earth slowly rotates around the sun, the path was slightly different each day, and these scars, rendering a white, burned out line on the screen, accumulated. That way, on the seventh tube of the installation, the image is marked by seven different traces of the sun's trajectory through the burning force of its luminosity. Far from realizing inherent affordances, Lucier celebrated and took advantage of what was at first a disaster, a direct destruction of her equipment by what should have been her object of observation, thus revealing its power as subject. Applying the destructive impact as a creative device, she continues to structure the effect of its force. In a much stronger sense than in the work of Malick, she renders the sun not only as a protagonist, but as a powerful agent, a writer, and a destructive as well as creative maker of maps, as the inscriptions reveal a certain geography.

Andrew Pickering combines ideas from the post-humanist trend in science and technology studies, advocated by Latour and Haraway, with an interest in *temporal emergence* (becoming) in his development of a performative conception of scientific practice. From this perspective he analyses a range of scientific practices while claiming that we need to think of these as open-ended, *reciprocally structured interplays* of human and non-human agency. Scientific practice, he claims, involves a *dance of agency*, revealed when approached from such a performative perspective (Pickering, 1995). The closure of a scientific inquiry is often shaped by a 'mangle' of resistance and accommodation. Rather than producing unitary and objective outcomes, this process results in multiplicity as well as interference, difference, and interaction (Pickering 1995). In this respect, scientific processes are similar to those of artistic practice.

The sun as agent in Skyvelære

Through the presence of acts of negotiation and tuning in the large projection described in *Skyvelære#1*, the time-lapse projected from the tower, the sun is treated as a subject. Rather than being an impassive object, the sun can be considered as a dynamic process having a specific agency. The position of the sun appears as an ideal to be strived for, and also as a consequence of the repeated alignment of the devices. This approach has some elements in common with Terrence Malick's treatment of landscape, and is slightly different from the gesture of *semiconductor's Heliocentric* where the images represent the sun as a stable object, with a fixed, non-negotiable position. In my film, the sun is more active, clearly not as in Lucier's piece, but it

has a kind of velocity as it plays a role in the negotiations occurring in and between the images, the *dance of agencies* carried out in the practice of constructing the film.

In the time-lapse in the elevator, on the other hand, the object of observation, the interior space of 3,14 is treated merely as an object. It is observed through an automated and autonomous vision. Having orchestrated the procedure in great detail through day and night, I remained a spectator, observing the process with great attention. Now, the construction of the images would not involve any apparent conflicts and the gallery room passively surrendered to the gaze and agenda of the camera leaving only the changes of light to be negotiated within it. I could rest on the floor, benefitting from how the inclination of the sun would direct the camera towards the ceiling when it approached the southern corner of the gallery space. From the inside of my comforting sleeping bag I watched the camera/tracker operate and I saw and heard the processes evolving in the room throughout the night and following day as for the first time, as if directed by the devices.

Through my approaches of making solar tracking time-lapses, representations are explored as evolving constructions that involve multiple agencies that are continuously engaged in negotiations. While there is no position or point of view that can assert authority on its own term, calibration towards a given reference has appeared is a way of tuning such agencies towards a shared language where they can play against each other, just like in a dance. By including the performative and situated processes of producing and experiencing a representation, it appears as something different than a fixed form, but rather as a dynamic field evolving and allowing new order to unfold in resonance with the experience and imagination of the receiver. From such a perspective, representations are more than stable, mediated constructions, they are processes, or part of processes.

In the sciences, quantum physics offer a double perspective in which the vision of particles, separate entities that are connected to others only externally, is complemented by a perception of a wave-like field of interaction and negotiation – waves merging, weaving into one another, evolving together and allowing new order to unfold. It seems necessary to consider form the same way; it can be considered as both point and waves. From such a perspective, the process-ness of video that I discussed in chapter #2 is less unique than I once thought. So is the process-ness of living, evolving forms as exhibited by Jaschko and Evers in *Process as Paradigm*.

SKYVELÆRE #6

At the back of the left wing of the gallery, the vault, a relic from the time the building hosted the National Bank of Norway, is a dark cave made of impenetrable concrete walls. At knee height, a horizontal LCD screen, slightly angled, provides spatial information and light that help orient the viewer in the darkness (figure 86). The screen displays a sequence of video clips showing old photographic slides seen through a microfilm projector, of which we see the screen. A panning movement, achieved by adjusting the framing and position of the slides, transports the gaze around on the surface of the image. It is a slow and hesitant motion through an unknown territory. Someone is exploring the image, focusing and attempting to navigate in it, without knowing exactly what they are looking at or what to look for. The microfilm projector is recognizable through a thin black line, almost like a slit in the image, that crosses it horizontally, providing a clue for orientation. The video sequence lasts for 32 minutes, and repeats the procedure of navigating in the image on a collection of similar slides (figure 87). The low sound that emerges from a loudspeaker inside the box has been recorded simultaneously with the video. It adds the ambience of the recording situation, and the sound of the microfilm viewer being used, to the visual experience. Occasionally a low whispering can be heard, as two people discuss what they see. The viewer may feel that he or she is looking over their shoulder while they are exploring these visual landscapes. The positioning of the screen and framing of the image add to that impression.

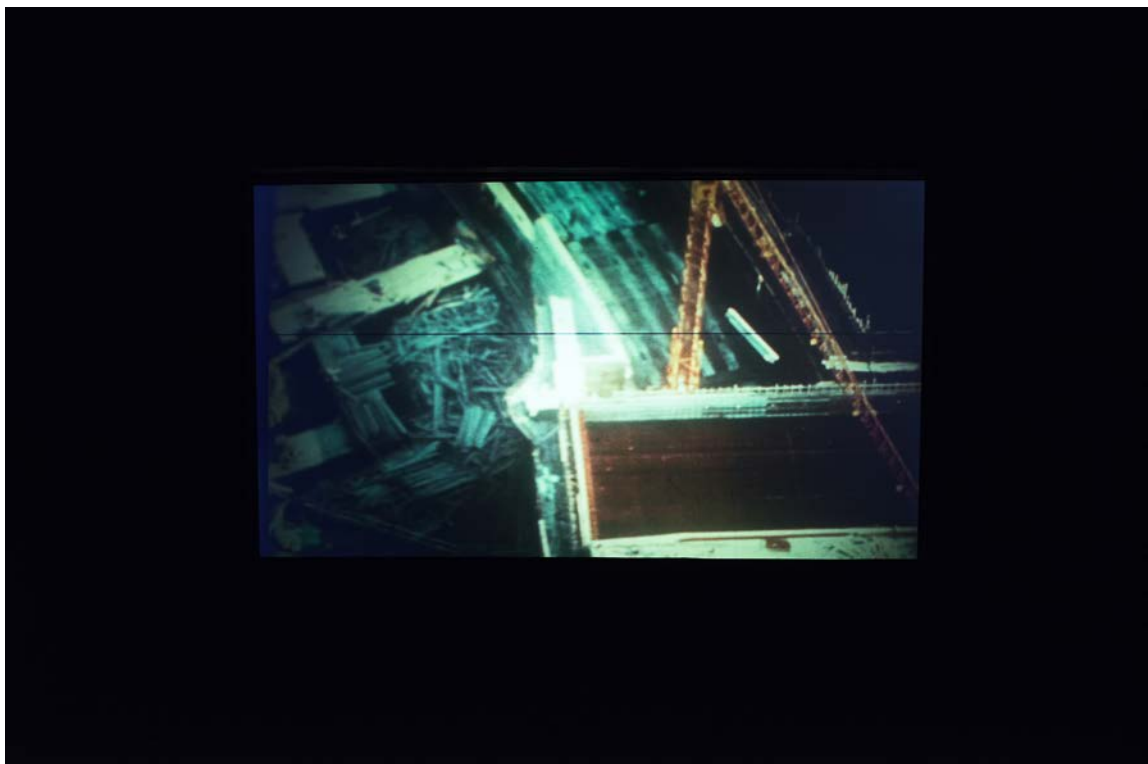


Figure 86, An almost horizontal video screen is installed at knee height as a light-object in the dark space. Here it is seen from above as it would be by a spectator.

The slides are from the collection of Kjell Johnson, archived at CERN, in the same way as the photo in Skyvelære #2. Most of them are aerial photos of the building site of CERN during the initial phase of construction in the 1960s. They show the site of construction with cavities, materials, structures and various constructional devices as well as parts of the surrounding landscape.

The video was made in collaboration with Signe Lidén, at CERN in Geneva in March 2013, during our joint research visit there. The video images have a remarkable aesthetic enhanced by how the old slides are seen on an lcd screen and through a more or less antique micro-film projector. In a similar manner the materiality of the site depicted, its geography and scale are confusing. The slides are aerial photos; some from straight above while others appear slightly angled, shots from the top of a crane. What might be huge, torn down buildings or structures under construction appear like piles of shredded paper. Certain recognisable objects such as a truck, a crane or a small farmhouse in a field provide a fleeting sense of orientation. The slides document the transformation of a site and in the video they also have a particular appearance of being in transformation that is created by our gaze and corresponding movements of panning.

Searching for something that we do not know

Without really knowing what we are looking for and only gradually understanding what we are looking at, we scanned each image, bit by bit, in an errant and non-linear manner, slowly exploring its content, its appearance, its potential, through the adjustable frame and focus of the microfilm projector. A video camera, framed so as to capture the screen of the projector, documented the process.

The slow process of manually scanning across each of the slides, the fixed frame revealing a part of the picture little by little as a new, moving image, constituted an open-ended dialogue with the original material. We did not yet know what these explorations, or experiments, would become. We did not yet know which of the slides or which of the movements that would reveal themselves as particularly interesting. But we were both starting to realize something, recognizing a form of *synthesis*, to use Eisenstein's term (see chapter #2), while we were paying careful attention to what was appearing. By means of the knobs on both sides of the microfilm projector we tuned our perception of the images as well as our imagination, resonating with the experience of employing the apparatus as an extension of our senses.

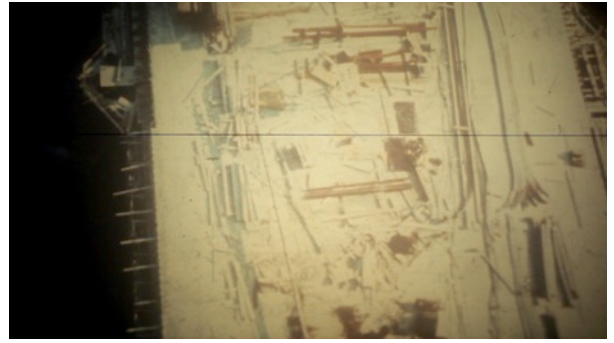
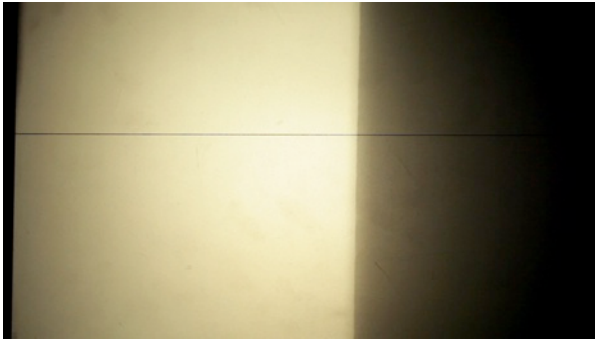




Figure 87, Video stills.

Romantic and traumatic time

The obsolete technologies of the slides and microfilm projector and the slow and vaguely articulated movements around the surface of the images combine with a somewhat tender vulnerability in the images. This creates a nostalgic character that is amplified by how the images offer a dive into a historic time of 50 years ago, when CERN was in its first phase of innovation and construction.

There is a contrast between the authority imbued by CERN as the largest institution in Europe for research in physics, itself the most absolute of the sciences, and the appearance of the site as a transitive wound, that due to the perspective appears as something intimate. As mentioned in chapter #2, the collection of slides also provided an access point to CERN and its history, and allowed us to navigate within the labyrinth it constitutes. The slides reflected a once politically careful optimism and sense of innovation that appeared through the sheets of dusty images of landscape, people and machinery. Nevertheless, the images also revealed a form of loss, a post-war loss of innocence, and the loss of individual significance within scientific practice, of a time when informal knowledge, thoughts, practice and innovative skills of more or less ingenious individuals still had an impact on knowledge production, even in a collective effort as big as this.

Such an image of the scientist as a talented practitioner has resonated throughout the working process of *Skyvelære*, as I have been tracing stories and collecting anecdotes regarding a number of scientists, including Odd Dahl; an inventor and instrument-maker based in Bergen. Dahl was profoundly involved in the construction of CERN and in charge of designing the first big

accelerator, the *Proton Synchrotron*. A true inventor of instruments, Dahl was formally trained as a pilot, but he was awarded honorary doctorates at several universities for his contribution to nuclear physics. One of his particular skills, according to his former colleague Arvid Erdal (personal communication), was his ability to think through drawing. Today, it seems that many of such tacit and personal aspects of scientific work that are not accumulated by scientific formalities have in some respects been lost (Polanyi, 2000; Dahl, 1955; Dahl & Landro, 1981).

In the particular slides used in this work, there is a sense of loss of innocence in the landscape, caused by the ambitions of modernity. However, the site does not in any way appear to be victimized. In a sense the traces of excavation are reminiscent of the scars of burning in Lucier's Dawn Burn (Lucier 1975). The abrasions in the landscape are constructive and creative, traces of a process that is evolving rather than of something painful or destructive.

Unstable significance: Site

While the elements such as the truck, the crane and the barn are recognizable to the viewer and provide reference and sense of scale in the perception of the images, they fail to provide stable information about the significance of the images, as the movement of searching through the landscape continues as if something else is at stake. The gestures of searching and panning destabilizes the significance of the images and leaves them negotiated but still open-ended. These performative gestures produce questions rather than answers, in terms of what we might be looking at. The pictures of the site that is about to become CERN, a large area of Meyrin outside Geneva, become themselves a *site* through this performative action.

Within the arts, notions of site and site-specificity have often referred to how the significance of certain works of art were tied to a fixed geographical location, or at least a specific environment from which the art work cannot be separated. This notion has been challenged by contemporary discourses (Kwon 2004, Kaye 2000) and site is now considered to be as much a process or concept activated by performative practice. This is coherent with my understanding of how performative actions contribute to a shaping of reality, they *do* (something).

Non - linear reading

In his discussion of a performance by *Forced Entertainment* that consisted of a coach tour of various locations in Sheffield, UK, entitled *Nights in this City* (1995), Nick Kaye argues that the work 'emphasises the constructed nature of role, identity and place, performing a 'writing over of the city' (Kaye 2000, p 8). This perspective is interesting as it underlines the performative aspect of these constructions. It is also worth noting that Kaye does this by paying attention to the gesture of *writing*. I consider that the corresponding gesture of *reading* can produce a similar

effect that may be shared with the viewer. Our work is a *reading* of images. The movements are non-linear, as the reading of an image will always be, thus creating stories in a way that shape time by curved associations and imaginations rather than by drawing a line of past - future (history) the way the reading of a text would do.

Another approach to reading landscape can be found in the *California Trilogy* of James Benning (1999 - 2001), in which the minimalist filmmaker observes and explores the landscapes of three sites in California, The Central Valley, Los Angeles and Death Valley, through a systematically produced structure of static camera shots. The shots render selected parts of the landscapes as scenes. The framing invites the viewer to explore each shot as a scene, or image, often without providing any clues to what Benning has found interesting in them. The landscapes depicted are a mix of nature, rural and urban scenes. Several of them are in a process of transformation, for example engulfed in a forest fire or opened up by an excavator. Each film consists of 35 shots, each shot lasting for 150 seconds. This form directs attention to what is happening in each shot through a remarkable insistence on the presentness of each part of the landscape, but without providing reference or clues that could point towards a specific significance. The landscapes appear as unfolding processes through Benning's careful reading of them, and there is no apparent logic that reveal why he has chosen one particular motive and framing in preference of what must have been endless possibilities, or why he has chosen to present them in this particular order. Far from constructing a narrative, the trilogy presents these landscapes as a careful audio-visual reading.

Place is not avenged by offering itself up to us for sensate inspection alone, but by shifting the ground under he or she who watches. Though the framing of these landscapes could not be more stable or more consistent, to view these films is to become a nomad, wandering through territory with only your senses and your wits about you.

(Moore, 2003, p. 35)

The soundtrack consists of ambient soundscapes, recorded simultaneously with the images, and provides no further clues as to the significance of the images.

The absence of manipulative film language, the pure it-ness of the image as it is delivered to us drives us to listen carefully to the sounds for subjective guidance. (...) they are similarly autonomous.

(Moore, p 37)

While the composition of the shots refuses to construct a plot in the traditional sense, they nevertheless inform each other, and multiple layers of time emerge through the strict composition. In narrative cinema, scenes are connected into a story through the plot while in

Benning's work time is created by a more economic structure and a lack of plot that challenges the viewer's habitual perception of time in film. This manner of structuring time is characterized by an interesting tension between linearity and non-linearity. Through the medium of film, the scenes are presented one after another. The non-linearity of the landscapes and of Benning's gaze appears as a contrast to this linearity, a contrast which is further emphasized by the rigid composition.

The work seems to resonate with Vilem Flusser's notion of time as a product of media (Flusser, 2000). According to Flusser, different media produces time in different ways and time is not a property of nature, but a property of media. While the reading of images is non-linear - the gaze can wander over the surface of the image at its own will - writing create linear time. This linearity transforms, from Flusser's perspective, scenes into processes where one thing follows after another in successive order, as in historic time. In Benning's trilogy the different layers of time resonate with each other in a way that is not usually experienced in cinema, and the work reveals how the medium of film as medium structures perception and constructs time.

Through his charting of digital media, Lev Manovich acknowledges that the visual culture emerging through the digital is cinematographic in its appearance (Manovich 2001). In accordance with the ideas of Flusser, he shows how the language of cinema and of digital media are nonetheless fundamentally different, and how the shift to computer-based media redefines the nature of static and moving images. This happens through the way information is organized and accessed in the digital. The computer stores and organizes information in databases as discrete elements which maintain their independence even when combined into larger objects. These elements can be accessed algorithmically and they appear through non-linear structures that can be instantly and dynamically manipulated and re-distributed. In cinema on the other hand, time appears through a given structure. It seems to me that Benning, far from attempting to break this form, imposes structure with such formal rigity that he frees the gaze by subverting narrative in such a way that the gaze may wander over the surface of the image and explore it.

Images as site

Nick Kaye bases his analysis of site-specificity on discussions of minimalist sculpture in the 1960s and combines these with a conceptualisation of place formulated by Michel De Certeau who considers space a *practiced place*, organized by cultural activities such as walking, listening, reading or viewing (De Certeau, 1984).

Space occurs as the effect produced by the operations that orient it, situate it, temporalize it, and make it function in a polyvalent unity of conflictual programs or contractual proximities.

(Kaye, p 117)

In the 1960s Michael Fried stated in his critique of minimalist sculpture that the transitory and ephemeral act of viewing brought minimalist sculptures into the theatrical and performative. As Nick Kaye combines these ideas with those of De Certeau, a site appears to be a place that is activated and ordered by the elements of performance; movement, body and transience.

The gestures applied by myself and Lidén to the slides from the collection of Kjell Johnson serve to activate the spatial layout of the images as a visual and historical landscape that is turned into a *site*. This happens by the non-linear movements of searching and adjusting the frame and focus, and implies that the transformation from image to site happens when the images are transformed into a process that unfolds in time. Miwon Kwon confirms the viability of this idea through her argument that the site-specific artwork '*no longer seeks to be a noun/object but a verb/process provoking the viewers' critical (not just physical) acuity regarding the ideological conditions of their viewing*'.

(Kwon, 2004, p 22)

Desire to form a relevant connection with the natural environment

Our examination of the old slides was motivated by a desire to form a connection with CERN, to find a way of relating to such a huge and intangible institution. Our strategy of applying the microfilm projector to achieve this, is in some respects similar to how some artists approach the environment with devices that provide structure to their experience. Their desire is to connect with nature in a way that transform it from being a remote idea or image, to being something tangible that they may form an active relationship with.

In the field of electronic art, inquiries concerning landscape seemed to belong in the seventies where early video artists like Nancy Holt, (e.g., *Swamp*, 1971), Mary Lucier (e.g., *Attention, Focus, and Motion*, 1975) and Steina Vasulka (e.g., *Summer Salt*, 1982) explored relationships between landscape, the camera and the recorded image. Until about a decade ago, artistic inquiries with electronic devices seemed more to be an investigation of the digital; the prosthetic aspect of the devices, the networks, the sensors, the data. Artists were exploring what these could do, how they generated meaning and of how we could use them. Today, as the environment is no longer some vast and distant resource but a source of increasingly urgent concern, the scope of artistic inquiries have changed and artists are once again exploring their natural environments and negotiating their relationship with nature. Artists in the field of electronic art are developing their inquiries through a variety of sensing devices for field recordings (e.g., Jana Winderen) and gathering of environmental data (e.g., Andrea Polli). They form communities and networks for

exchange of understanding and other forms of knowledge that complement the scientific (e.g., *OKNO, Finnish Bio Art Society*). They collect sounds and images from the environment (e.g., Julie Freeman), or measure and collect samples such as plants or animals for further analyses (e.g., Brian Degger, Anu Osva). I see such activities as a negotiation of how they may contribute to understanding and knowledge production by forming a connection, an active relationship, with the natural environment.

I find it interesting when these approaches focus on the activities of getting data from the environment rather than on processing these data, as is the case with many of the approaches that were discussed in *Field_Notes: From Landscape to Laboratory* (Beloff, Berger & Haapoja 2013). This focus implies that the acts of producing the data in the environment may in themselves be a way of developing insight and generating meaning.

A similar attitude is in some respects reflected in the term *capta*, which is proposed by some researchers (Checkland & Holwell, 1997) as a complementary term to *data*. *Capta* is data that appear in accordance with how it is produced. It is data which have been selected and transformed into information as they are given meaning and context by their interpreters. Once data are captured as part of an information system, a conversation or any kind of interaction they become *capta*, in contrast to other forms of data.

I have considered and discarded the term *capta*. While the term *capta* might have been stretched to include information concerning the performative aspects of the situated and embodied gesture of capturing, creating such a distinction also means reserving the term *data* to a more objective view of the world. This involves implying that other forms of data are independent of the personal knowledge of the individuals who captured and selected and who received them. It also indicates that data, in other forms are not produced, but gathered and that they need no interpretation. I have been interested in activities and agencies involved when applying observational devices and probes, such as a camera, radio receivers and microphones, to engage with the environment and construct representations from it. From the perspective of my fellowship project, such strategies create reflexive relationships that generate and carry meaning that cling to the data as a sticky layer and cannot be separated from them.

There is an interesting tension between different modes of approaching the environment with devices such as the ones that I have taken an interest in. They are tools for observation, for measuring, and for capturing data. At the same time, they are instruments of navigation and perception, for applying ones senses and body in a more performative sense. They allow the user to be present in an experience mediated and structured by the device. The microfilm projector had this effect of allowing Lidén and myself to be present in a visual and historical exploration of

CERN. In spite of being produced through many layers of technology, these images appear in the exhibition as a landscape that is activated by a reflexive relationship through a navigational device, the microfilm projector. A longing to form a connection with CERN is expressed through the exploration of the old slides. This echoes the inherent desire in some of the practices I have considered, a desire to connect with nature.

Fishing

For five decades, Steina Vasulka has persistently reinvented the camera eye through explorations of landscape as media. While her works are complex in terms of exploring technological vision, she insists on the simplicity of her impulse:

It is a very good excuse when you go out to either take a fishing rod and go and fish or you take binoculars and you are watching birds and I take a camera and I watch nature

(Vasulka, 2001)

According to this, the device, whether camera or fishing rod, is not an 'excuse', but rather serves as a tool for engagement, an imaginative tool that offers an active and structured connection with the environment.

When recording sound out in the field, one uses devices such as a microphone and headset as a tool for listening and for capturing data in relation to an unfolding landscape of sound. The listening device is operated as a dynamic probe that can be moved around in the landscape in accordance with the sound reproduced through the headphones, resonating with the listeners' imagination and intent. Bringing such a set of devices into the forest an early spring morning can, for example, reveal sounds you would otherwise not have noticed, perhaps from birds hiding in the density of the shrub. By moving the microphone while listening carefully a whole new world might appear. When exploring this auditory landscape, you will be moving the device around, using it to navigate in the experience of the sound according to your own imaginative expectation and response to what you hear. The microphone is thus used as a navigational tool, searching, scanning, and responding to the smallest of changes. Between the landscape and the sensory experience, the navigation, adjustment and negotiation with devices form another process that shapes the experience.

Capturing media - producing the world

Recording devices such as microphones and video cameras produce data in the form of visual or auditory images. According to Flusser (2000) it is difficult for us to distinguish between the world itself and the images of the world produced by technical devices. Considered from the opposite

perspective, images tend to produce the world as much as they represent it, as we are no longer capable of distinguishing between the world and our own images of the world. Either way, we are confronted with a dynamic relationship between world and image. The experience of navigation and orientation described above takes on another layer as it occurs in the continually altered relationship between the world, the device, the body and the image. In the process where individuals tune in to their environment using such devices, the images produced are crucial as they provide a new layer of form and structure. They are influencing the imagination but they are also resulting from it. They can even be shared, thus involving a tuning in with each other (Coyne, 2010).

In the poster for *Skyvelære*, a man is depicted with a device, of which we see the antenna, held up towards the sky (figure 83). Dave Lawrence, the man in the picture, and I spent hours this way, sticking our devices into a night sky of Northern Lights partially hidden from our view by a thick layer of clouds, attempting to live out the dream of gaining direct access to this environmental phenomena.



Figure 88, Dave Lawrence with VLF receiver recording sounds from the Aurora Borealis outside Kilpisjärvi during *field_notes* 2012

The electro-magnetic signals of the Northern Light, transformed into sound in the form of crackling and abstract noise, appeared to come from far away. Connecting all the bits and pieces I knew about the history of understanding the Aurora Borealis, I imagined the charged particles, ions, flowing from the Sun and getting trapped by the magnetic field of the Earth. I could even

hear the collisions occurring between the ions and molecules in the atmosphere although I knew that most scientists would deny the existence of any such sound.

This experience and the representations it produces are complex. It is a sensory experience that is mediated and constructed by particular technical devices, and at the same time it is strongly influenced by imagination, intuition and references. The situation of being out on the marshes of Kilpisjärvi in the North of Finland in the middle of a September night, fiddling with cables that tended to get lost in the dark if I dropped them, further enhanced the experience. As these layers work together, I do not think that it is possible or constructive to attempt to analyse them separately. Imagination and the desire to experience and perhaps capture a particular phenomenon operate inseparably.

In his analysis of information in audio-visual media, Michel Chion introduces the term *added value* to describe how the auditive information and experience and the visual information and experience are combined to provide an added layer of meaning which is different and more than the mere sum of the auditive and the visual (Chion, 1994). Through their combination, meaning that is not present in the sound or images when experienced separately, is developed and adds to the experience in a way that cannot be attributed to any of the elements alone. This echoes Eisenstein's notion of *synthesis* that he develops from the idea that cinematic meaning is developed by synthesis generated by the coordinated juxtaposition of shots as well as audio (Eisenstein, 1942), as discussed in chapter #2.

The montage of multiple images (including perspectives from different times and places) and soundtracks draw sound and image into a common movement through different forms of synchronization. This movement is linked to the technologies of cinema as device and as media but at the same time, it is fundamentally creative because it enables synthesis.

For Eisenstein the dynamics of synthesis are dialectical, it is first and foremost a conflictual dynamic occurring in the juxtaposition of two elements that are not previously connected. Eisenstein's synthesis, as well as Chion's *added value*, are notions used to analyze sound-image relationships. They nevertheless appear as ideas that in similar ways analyze how the relationships between media (device), sensory experience and imagination are producing meaning through their inherent creative dynamic. And in this sense, there are similarities between the experience Dave and I had in the field in Kilpisjärvi and the cinematic audio-visual experience. While we do not create synthetic collisions between one image and another, we employ devices to tune in on and negotiate our sensuous and emotional experience according to the added value created by our imagination during the experience and construction of a form.



Figure 89, Julie Freeman recording sound from a river in Kilpisjärvi during field_notes 2012.

The devices we used to experience and capture the sound of the Northern Lights were receivers of low frequency electro-magnetic waves. I had borrowed one from the University of Bergen and I had assembled a second from a kit available online¹⁰. As the devices transform signals into sound, actively using them has a lot in common with the approach within sound art that consists of recording sound from the environment and using it either as raw material for compositions or as is. Such activities of field-recording involve capturing and constructing images or representations from the environment, and offering them as a sensory experience.

Imagination

The Artist Jana Winderen has developed an approach that skips the formal requirements of the natural sciences to reveal pollution in water as she couples her method of listening and capturing sound in water with tracing and mapping the condition of aquatic environments. She suggests that you can obtain information regarding the levels of pollution by listening to the sound of the insects in the water with sensitive hydrophones. She can distinguish between the sounds of different insects and generate detailed information about the health of the river in combination with a poetic sensory experience. In November 2011, she made a performance with 4 live

¹⁰ www.auroralchorus.com

hydrophone inputs from the river Akerselva that runs through the centre of Oslo. Her performance revealed that the river was silent; no sounds were made by living creatures. The river had just before been polluted with 6000 litres of chlorine from a source further up the river that had erased all life in it.

In such approaches, the desire to experience and the intent to capture something specific have a strong influence on the listening experience. At the same time, such methods are efficient in creating images that may be shared and that will resonate profoundly with imaginative understanding. The works by Winderen combine research with a subjective and metaphorical aspect that disappeared from the natural sciences during the 19th century.

There is an ongoing crisis also in terms of imagination. As a consequence the relationship between scientific knowledge of the natural environment fails in how both individuals and governance relate to and respond to such knowledge. In the 19th and early 20th century storytelling accompanied science and added a rich well of ideological imaginaries to the production of scientific knowledge. The stories of the endeavours of explorer-scientists like Roald Amundsen and Fritjof Nansen added symbolic value to their production of scientific knowledge. The symbolic value offered by ideological imaginaries contributed to the construction of ideological structures such as national identity in Norway.

Today people distrust narratives that characterize modernism, and scientists lack the imaginative impact and powerful tools of mediation they once had. Simultaneously, people want to generate their own images, stories and experiences by equipping themselves appropriately and travelling to remote places in order to have first hand experience and form their own connections. Recording devices, especially cameras, accompany and shape such experiences and sites, and allow their users to tune in on the natural world we inhabit, and to each other, by producing images.

Field recording as contributions to knowledge

Sound art is increasingly present and in focus in both the fields of art and music at the moment. Remarkably multi-faceted and interesting issues of perception and signification are brought up in the accompanying discourses. Some questions appear as more crucial to sound art as the art form produces images that are based on hearing, a sense that has mostly been ignored in the field of arts. Other questions seem to touch upon issues that more than ever deserve attention, but that have been talked through, and almost laid to rest in the more visual form of arts. Field recording is a mode that is particularly interesting as it directly involves capturing data with devices in the environment and rendering them as art works or other forms to be presented and shared.

In the first half of the 20th century, field recordists such as Ludwig Koch and Albert Brand worked as explorers and collectors – sonic butterfly catchers, capturing sound for categorisation, naming and pinning it down in collections and archives. This is an example of field recording contributing to empirical and scientific knowledge about the world (...) This field recording relies on labels and descriptions, conventions from the archive and its pedagogical objectives, to make up for whatever information is lacking from the object caught in sound. It is also entirely transparent to itself, lacking an understanding of the anthropological intrigue of the recordist rather than the recorded.

This age of innocence, now abandoned or ironised by photography, is hard to shift in the invisible realm of phonography. The difficulty partly arises from the recordists' trust in their own multisensory memory of the field. They mistake the reduced sonic data for the sensorial complexity of the contingent encounter, and forget the frame of reference left behind that needs reframing if it is to trigger anything.

(Voegelin, 2014 p. 1)

The Hole Truth

In 2009 Doug Aitken constructed a pavilion in Brazil, from the centre of which he drilled a hole about a mile into the earth. He dropped a microphone to within a few feet from the bottom, mounted an amplifier and speakers in the large room and adjusted the volume so that the sounds that came from the cavity were made audible (figure 85). In other words, Aitken realized the exact proposal inherent in Bruce Nauman's conceptual piece discussed in chapter #2.



Figure 90, Sonic Pavilion (Aitken 2009).

Apparently, the sounds emerging from the hole are deep and resonating, and perhaps, as in the example of the Aurora Borealis, coming as much from the devices applied as from resonance of the hole itself. These would be inseparable, also from the imagination of the listener. *Sonic*

Pavillion (Aitken 2009) is a constructed representation, providing a structured sensory experience that vibrates with the imaginative power of the concept, originally by Bruce Nauman.

Seth Kim-Cohen visited the Pavilion just before it's opening, and had a conversation with the artist. In a review he accuses Aitken of a form of essentialism, as the work claims to listen in on the earth and '*equates the facticity of sensory experience with truth*' (Kim-Cohen, 2009, p. 100). He states that

The situation and design of Sonic Pavilion insist that there is something sacrosanct beneath the superficial stratum we occupy. The sound emanating from the hole and amplified in the pavilion is the cipher that will unlock the coded mystery of the deep. The Rilkean implication is that a phenomenal entity, like the earth, possesses immanent, essential properties that are consistently expressed across different sensory manifestations.

(Kim-Cohen, 2009, p. 100)

Christoph Cox responded to the critique arguing that Kim-Cohen had misunderstood not only the artist's intentions, but also some of the philosophical presuppositions of the attitudes he applies to Aitken. They represent, in Cox's opinion, an unclear humanist perspective where nature is still separated from human experience.

I'm all for the critique of essentialism. Yet the version of this critique offered by Kim-Cohen is chauvinistically idealist and humanist. It draws a sharp distinction between meaning and being, world and earth, culture and nature, human and non-human, maintaining that the latter terms are, for all intents and purposes, noumenal, unavailable to knowledge and discourse, and certainly anathema to artistic practice. (At best, Kim-Cohen claims, Sonic Pavilion can only offer "the didactic monologue of a science exhibit.") It's not clear whether he believes that shifting tectonic plates make no sound, that the sound they make is unavailable to us, or that this sound is uninteresting and unaesthetic because it is nonhuman.

(Cox 2010, p. 1)

Contrary to Kim-Cohen's interpretation, Cox argues that Aitken's project is a rich example of the attitude of sound art that human beings and the processes they are part of belong to the natural world we inhabit. Cox discards Kim-Cohen's philosophical references, such as Kant, and brings in, through Manuel DeLanda, the ideas of Henri Bergson and Gilles Deleuze for whom nature, including people and their images, consist solely of differential elements in perpetual flux. In the attitude articulated by DeLanda, following Deleuze and Bergson, *difference* is not something human beings impose on an inert nature to make meaning of it. On the contrary, nature '*(ourselves, our languages, and our valuations included)* is dynamically differential through and through' and difference is the very force that pushes life along. Also, as human beings are part of the natural world we have unmediated access to the natural world.

Aitken's project splendidly resonates with the perspective offered by Manuel DeLanda's Thousand Years of Nonlinear History (Zone, 1997), which conceives of human language and discourse as one among many natural flows, the slowest and oldest of which are the geologic flows that form the rocky crust of our planet.

(Cox, 2010, p. 3)

Another interesting consequence of the attitude articulated by Cox' is how he continues to state that sound art is actually a mode that operates *across* any dialectic opposition between experience, mediation and representation.

In their basic suppositions, idealism and humanism will always misconstrue what is at issue in sound art, which short-circuits the aesthetics of representation and mediation and instead affirms an aesthetics of force, flux, and resonance.

(Cox 2010, p. 3)

From Cox' perspective, sound art appears as a form of art that does not separate environment, image, and device. It is a practice that involves tuning in on the natural environment, and process is embedded in its mode of operation. This is accordance with how I consider environment, image, and device from a perspective where they are inseparable. They work together in relationships activated by a person or persons with bodies, with a perceptive apparatus and with a performative way of being in the world that is creative and communicative, that develops form and makes images, whether the material is acoustic, tactile, or visible. This is an approach to process that is different from those discussed in chapter #2; both my own way of treating video as process as well as the curatorial concept of exhibiting living and unfolding processes *per se* in a museum. My interest in considering process from a perspective of the performative and with focus on perception, gesture and information developed as a reaction to both of these strategies. Sound art, especially acoustic ecology, field recording and similar approaches, appear in parallel as an alternative and relevant strategy that incorporates gestures of sensing, tuning and negotiating in a manner that embodies process and that makes the transitions between device, environment, perception and representation seamless.

How process becomes evident and is articulated as knowledge remains an open issue, as long as one considers knowledge as stable meaning. Kim-Cohen's response to Christoph Cox reveals that the ancient opposition between the attitude of Heraclitus that everything is flux, and Parmenides' objection that we need to stabilize the meaning of elements of the world in order to relate to them, is still vibrant.

If all is flux, how can anything be made, thought, or done?" asks Kim-Cohen. "It is impossible to understand the being or becoming of anything outside an understanding of the request of meaning.

(Kim-Cohen in Cox & Kim-Cohen, 2010, p. 4)

As Bateson pointed out, it is difficult to talk about process as long as our language is based on words such as 'it'. But there are other modes of communicating besides talking, as there are other ways of knowing besides defining. Devices that can be used to tune one's experience in relation to the environment, or any other kind of process, are tools that make it possible to understand and relate to the world through their ability to provide an active and relational form of structure. Through them and the reflexivity they offer, we may develop meaning that does not need to be stabilized, but that is based on our presence in reality.

The shift away from the transparent microphone man, towards the body inhabiting the field (...) touches on the comfort and self-assurance of the recordist in the world of the everyday, of music and of art, and how they see themselves mirrored or alienated by what we consider its actuality: musically and aesthetically as well as economically, socially and politically.

These developments are no doubt facilitated by cheaper recording technology and the connective infrastructure of the internet, but they also reveal a different attitude towards knowledge and reality, and how we inhabit the world. They mark out a post-humanist sensibility where we do not seek to own the sounds of this world, to know and to have them, but understand ourselves to be part of its soundscape, not at its centre but simultaneous with it, sounding with and through it a reality that is plural and passing.

(Voegelin, 2014 p. 1)

The images and other forms that result from working in the field with devices that produce images may continue to invite negotiated modes of navigating as they provide structure, through their form, and enable shared experiences. The video in the vault is intended to operate within such a mode by turning images into sites, to be explore, and through gestures of observing, reading, and imagining.

SKYVELÆRE #7

In the darkness of the old bank vault there is also a second work installed, a 6 minutes long sound collage that consists of an edited sequence of five distinct but anonymous voices that comment upon the notion of an *international standard*, from different perspectives.

One voice tells us that the Meter, the first international standard originating from the time of Napoleon, has been replaced by an equation based on accurate time measurements. Another voice uses the Kilogram as an example to explain the notion of comparability of measurements: '*If you buy a kilogram of sugar in Egypt, and take it home, it will still be a kilogram of sugar*'. A different voice states that the Kilogram, kept in a vault in Paris, is the last international standard to be an *artefact*, an object based standard. Yet another is concerned with the standard for solar irradiation, the *WRR*, or *World Reference*, which is described as a *conventional* reference based on an average reading of 15 instruments (figure 91). A final voice suggests that without this Reference '*there is no way of really knowing where we are*'.

The phrases are extracted from a series of conversations I had with participants at the IPC-XI; Dr. Werner Schmutz, Wolfgang Finsterle, Ibrahim Reda, Andre Fehlman, and Ihab Abboud. I selected fragments that provided concrete thoughts but removed them from their context. They appear as originating from outside an academic sphere, as the participants were all explaining to an outsider (me) what they were doing in a simplified and metaphorical manner.

For the occasion of the exhibition, the acoustic properties of the vault was improved using sound absorbing panels along walls and ceiling. As a result the reverb caused by the thick concrete walls is reduced, improving clarity and intelligibility of speech in the reproduced sound. The sound collage is played back every fourteen minutes, apparently from the hidden depths of the vault.

In a vault: International standards of reference

The sound piece offers a key that might facilitate the reading of several of the other pieces in the exhibition. It introduces an explicit relation between standards and reference points as a form of navigational tool. According to the spoken words, standards provide a relation through which things acquire a specific and verifiable shared significance. Also, the piece in itself offers a specific significance to several of the pieces in the exhibition, as well as to the room, which is indeed a vault, just like the one holding the mentioned Kilogram. These spoken words also constitute a contrast to the navigational generation of meaning in the video described in Skyvelære #6, the other piece that is present in the vault, by introducing verbal articulation in the exhibition. This is a gesture that also introduces a form of authority, as verbal articulation often imposes meaning on images. The fragmentary nature of the collage serves to weaken and relativize this authority,

but the ideas of standards, conventions, truths and reference might resonate in the minds of the viewers.



Figure 92, The video projection of Skyvelære #3 as seen upon leaving the vault.

Upon leaving the vault the viewer once again encounters Skyvelære #3, the video showing the International Pyrheliometer Comparison Event (figure 92). The information from the vault might inform and renew the experience of the video as the viewer realize that the voices originate from the same situation as in the video, and that a solar irradiation reference might be what the people portrayed in the video are working with and aiming at. They begin to see these activities of calibration in terms of tuning towards a shared reference.

I found it interesting to note that throughout a number of interviews with meteorologists and metrologists I conducted in Davos, the Kilogram, a prime example of both a reference and an artefact based reference, came up in almost every one of them, as a way of explaining to a non-skilled person the notion of a standard, of comparability and of traceability of data. One problem that was given particular attention was the instability of the Kilogram; the fact that its weight has changed during the past hundred years.

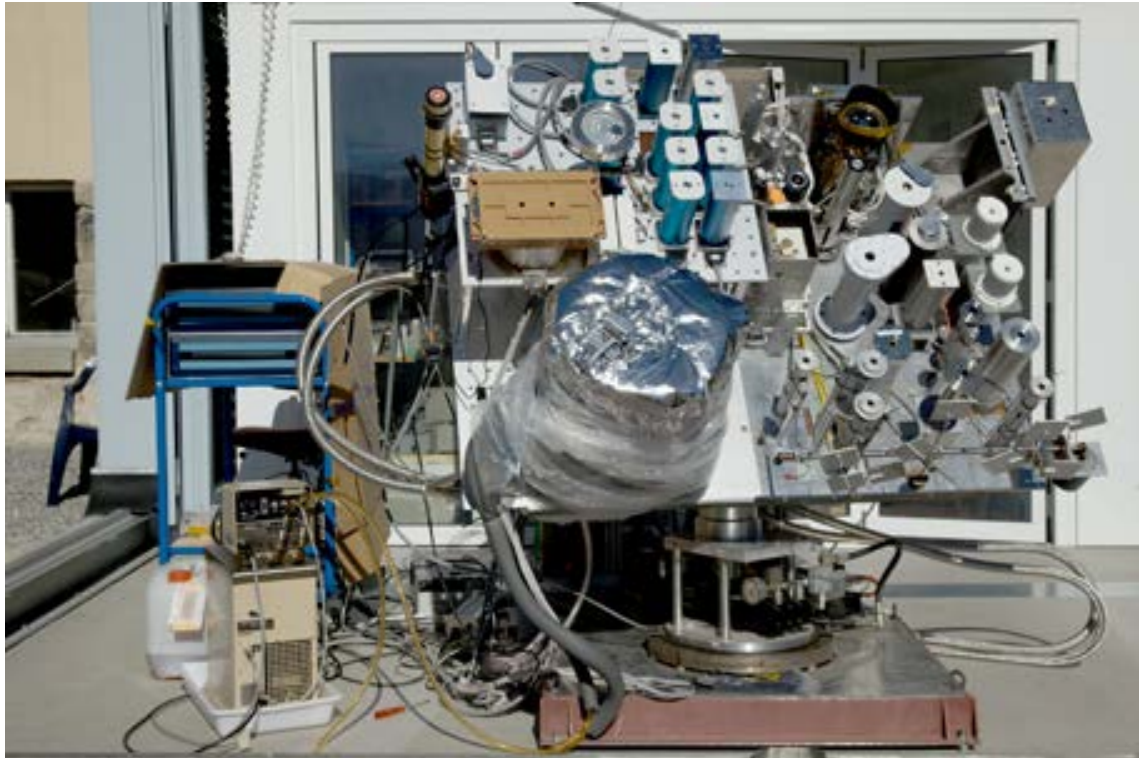


Figure 91, A group of instruments, among them those constituting the World Radiation Reference, mounted on a huge optic solar tracker outside PMOD, the Physikalisch-Meteorologisches Observatorium Davos. The tracker has a light-sensitive sensor and moves towards the brightest point of light. The resulting pattern of movement, on particular on grey days where the sun would sometimes be hidden behind clouds, was like a dance in itself. It was also a direct inspiration for the trackers in *On Balancing*, described in chapter #2.

I noticed a certain pride concerning how their own standard the World Radiation Reference, was produced through a democratic agreement, a convention, rather than being an artifact. The World Radiation Reference is produced by an average reading of a group of instruments selected from within the community (figure 91).

The sound collage provides a key to understanding the exhibition. It can be seen as a way of informing the viewers of *Skyvelære* by distributing certain fragmented but articulated concepts, shared within the community of visitors.

SKYVELÆRE #8

On the southern side of the entrance, a kinetic sculpture is hanging from the ceiling (figure 93). Two horizontal aluminium rods, each 140 centimetres wide, rotate from a central axis. The sculpture has a machine-like aesthetic with custom-made mechanical parts such as tubes, rods, joints and bearings of steel, brass and aluminium. Thin free-flowing cables connect the various parts. The arms rotate with slow, almost imperceptible changes in speed and direction. On each end of the rods, an aluminium tube hosts a small loudspeaker from which sound emerges. The speed and direction of the arms will slowly change according to a choreographed pattern that lasts for 28 minutes, the intensity alternating with the sound (figure 94).

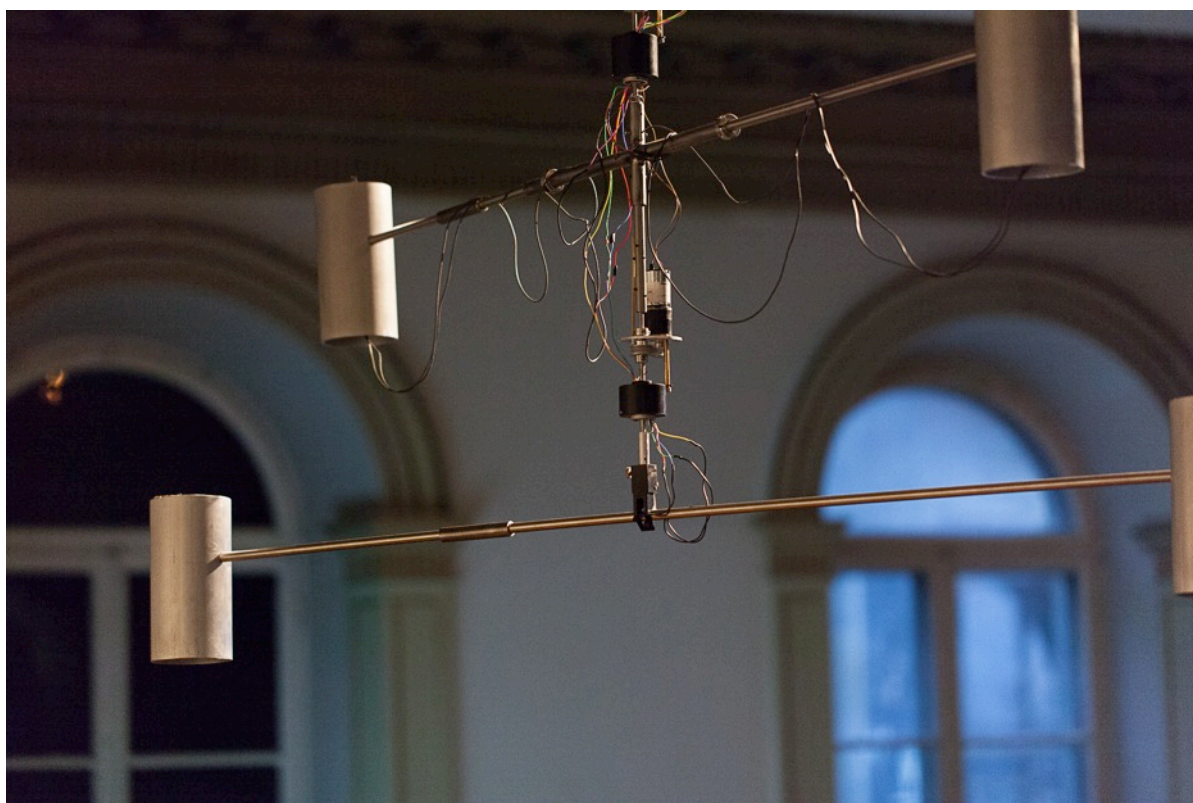


Figure 93, A rotating mechanical sculpture with sound emerging from the four vertical aluminium tubes.

Depending on how a viewer is standing under the sculpture, the layers of sound will pan slowly above her head, and change accordingly as the speed and distance alter its effect. If the spectator stands just below the moving loudspeaker, the sound will appear as approaching, passing over her head, and continuing further. When passing over one's head it is clear and distinct. Further away from the loudspeaker the sound turns into more ambient textures that blends with the other sounds present in the gallery, forming a landscape of abstract sound. Right under the central axis the textures of the sound circulate around the viewer, but she misses the sensation of it approaching and passing over her head.



Figure 94, The rotating arms of the kinetic sculpture accentuate and contrast the rotational panning movement of the video.



Figure 95, The sculpture casts a rotating shadow on the wall.

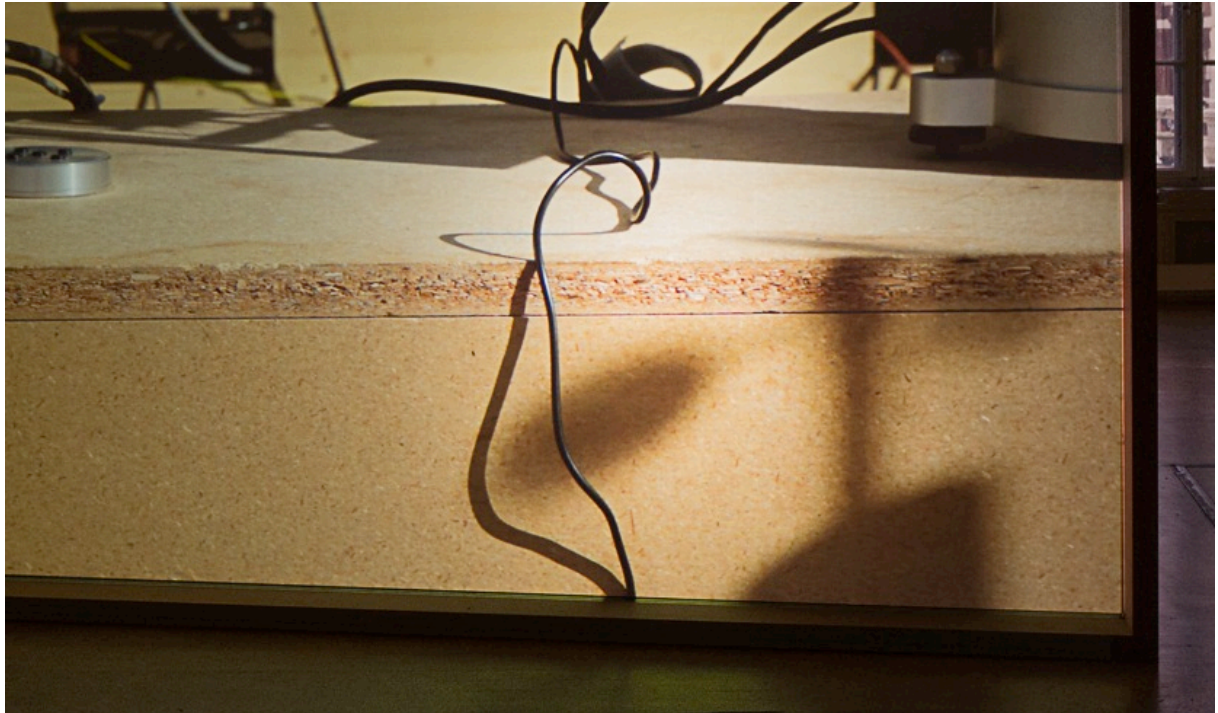


Figure 97, Detail: A shadow of a rotating anemometer in the video projection.



Figure 98, Listening to the moving sound.

The soundscape, corresponding with the movement, is composed by Signe Lidén. There are four separate sound channels, each assigned to one of the four loudspeakers, emerging as distinct layers from the aluminium tubes, or sound nodes, that shape the direction of the sound waves.

The sound is irregular yet mechanically resonating and machine-like, with frictionous layers of distinct, abstract sound that evolve with rich textures at various frequencies. The raw material used in the composition was recorded by Lidén who used contact microphones and a stethoscope to listen to and capture various parts of the machinery constituting the Proton Synchrotron at CERN (figure 96).

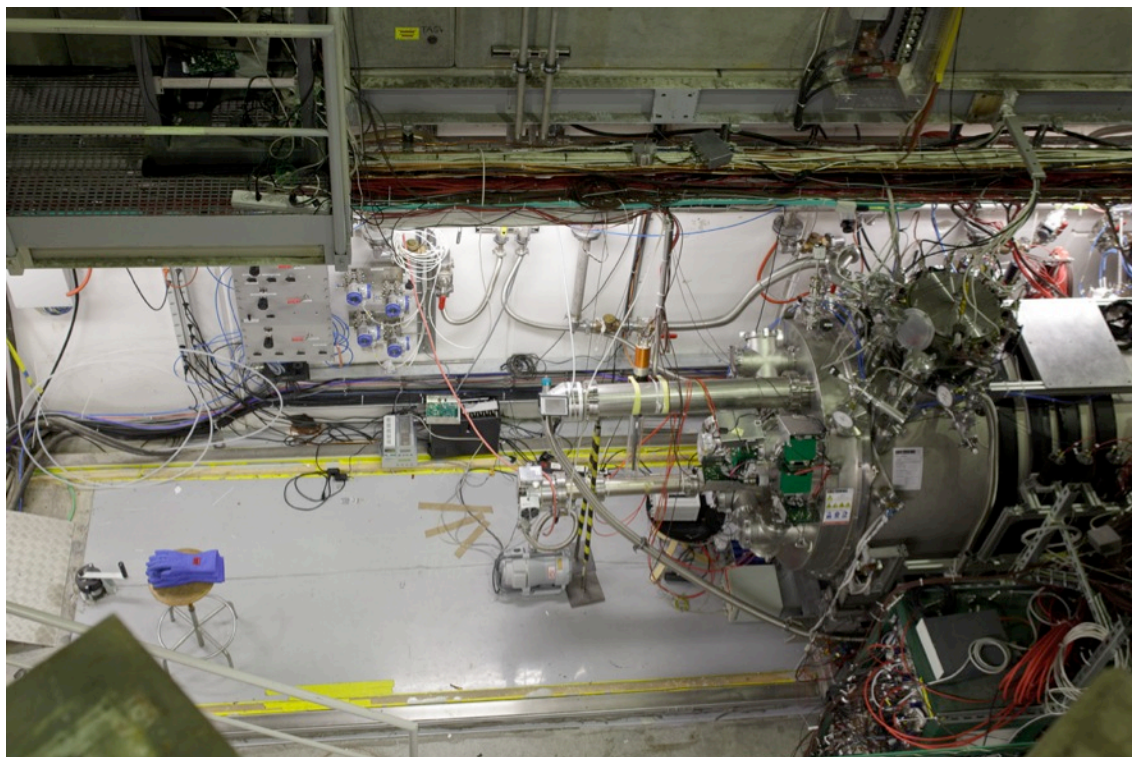


Figure 96, Small detail from a lab connected to the Proton Synchrotron at CERN.

A spotlight casts a shadow of the kinetic sculpture on the wall to the right of the door, echoing its movements as a pattern of light (figure 95). The shadow is also repeating the images of shadows cast by a rotating devices seen in the video from Davos, described in chapter #3 (figure 97).

It would be clear to a trained eye that the mechanical skills of the constructor of the machine (me) are limited, and that the various solutions for the different joints, connections, and bearings have been developed along the way, as they became necessary, and according to my specific aesthetic requirements. A few pre-made parts such as slip rings, motors and ball bearings are off-the-shelf components, while the rest have been developed through experimentation. The result is clumsy and yet somewhat elegant. The aesthetics of the sculpture is similar to a prototype that could have been made in a physics lab, where functionality is more importance than appearance. But the sculpture is an aesthetic object, and this particular appearance reminiscent of a construction from the physics lab is now more important than functionality. It is a part of the work that offers reference to the natural sciences and to their custom-made technology.

Head, Shoulder, Toe

The sculpture enables and articulates a dynamic relation between the body and the perceptual apparatus of the viewer and a flow that unfolds in time and in the horizontal and vertical axes of the exhibition space. The location of the viewer in relation to the speakers shapes the experience of the sound (figure 98). This invites the viewer to listen, either by remaining still and noticing how the soundscape changes above her head, or by moving about to navigate more actively in the continually evolving field of sound. By standing still under a speaker the viewer will hear the field of sound slowly intensifying as each sound node approaches and recedes as it moves on. If we leave aside the differences in speed and spatial distribution (circularity and verticality) and the richness of the auditive textures, the experience is not unlike hearing a train approach and disappear again.

The sculpture contributes to the ambient soundscape of the exhibition space, blending with the more horizontally distributed sound of silk skirts of Skyvelære #4. Together these sounds form a landscape of sound that will vary depending on the position or movement of the viewer and influence the experience of time in the exhibition. It was my intention to devise a way of reproducing and distributing sound in the exhibition that would be far more dynamic than a directional loudspeaker or a so-called sound beamer. A sound beam loudspeaker would use ultrasonic sound waves to project sound only at a very precise spot, and while such a point could be moved around the effect would nevertheless be perceived as a point of sound. Instead, this sculpture distributes the four channels of sound in a continuously variable field of sound waves that appears differently according to the spatial relationship between the ears of the spectator and the sound nodes, in addition to the variations in the 28 minute long composition.

The central rotational movement that Skyvelære #8 introduces in the room favours cycles over linear progression. The work also introduces the presence of a device or apparatus, a constructed mechanical and motorized *machine*, to the exhibition. The sculpture echoes, summarizes and complement elements from the rest of the exhibition while more actively engaging the body and perceptual apparatus of the viewer.

Activation of perceptual apparatus and place

The slow, rotational movement of the machine has a mechanical pace, slow and almost hesitant. It does not seem to express agency or a sense of intent, as if the machine was itself actively operating according to an assignment where it is expected to achieve a specific task. In this respect it is fundamentally different from the kinetic sculptures in the exhibition *On Balancing*, described in chapter #2, where the solar trackers are on a mission to find the sun. While those were instruments that were themselves negotiating, that had distinct moods, ambitions and

temperament, the movements and soundscapes of this kinetic sculpture are unfolding in a more indeterminate way, they are merely drifting. Tuning and navigation is handed over to the viewer who may act upon the invitation to experience and to explore the sound according to the effect of the distance between the rotating sound sources and his or her ears.

The kinetic sound sculpture inherited elements of its form from a work I made just before undertaking this fellowship project, namely another kinetic sculpture, *Utopian Mobile* (2009), that would hang from the ceiling trying to balance itself while at the same time observing and rendering images of its immediate environment.

The basic form of this work was reinvented for Skyvelære as the kinetic sound sculpture that would distribute sound through a rotational movement in two directions.

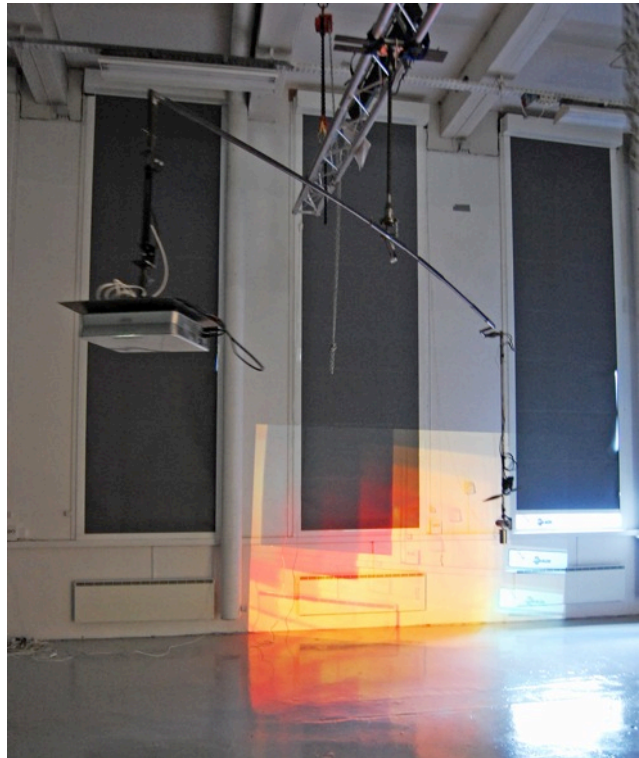


Figure 99, Prototype of the *Utopian Mobile* hanging from the stage rig of the academy's project space.

The Utopian Mobile

The *Utopian Mobile* was a mechanical mobile, where the main components of a video feedback circuit - a camera and a projector - were suspended on opposite sides of a horizontal rod. A camera mounted on a pendulum at one end captured the 'imbalance', while a projector at the opposite end rendered the captured image in the same direction. This complex system was inspired by the work of a Serbian inventor, *Veljko Milković*, who is developing a method for amplifying energy through oscillating feedback, aiming to construct a *perpetuum mobile*

(Milkovic). My idea was that if the system was to reach its ideal state, *balance*, a perfect video-feedback circuit would result as the camera would film exactly the same area as the projection. This state would be the goal of the system and attempting to get there would be its motivating force. But, through the very nature of its construction, it would also be an unreachable ideal. Due to this inherent contradiction, the attempts of obtaining balance would cause the image-circuit to be constantly tweaked, repositioned, and realigned.

Through *Utopian Mobile* I was aiming at making a system that could generate its own dynamics and images as a closed system. The choreography that resulted when I pulled its pendulum backwards giving it a perfectly balanced push at just the right moment, caused it to behave just like that, for a little while. To continue it needed a new push at a particular moment, not unlike a child in a swing. I never managed to recreate the push mechanically. After a few minutes of operation, the different parts swinging, cranking, and penduling, the system would quite simply calm down and settle in a position of balance. I had wanted the sculpture to be an independent system unfolding while keeping the viewer on the outside. That did not work. However, if someone engaged with it, pushed or pulled one of its arms, it would work for a while, stamping, rotating, and creating images while observing and reflecting its surroundings through an ongoing negotiation of gravity.

Conversations as knowledge

Donna Haraway and Bruno Latour focus on the role of non-human and material agency in the production of situated knowledge (Haraway, 1991; Latour 1993). From their perspective, material entities engage one another in ways that do things, have an effect, and this engagement produces a particular form of knowledge.

Situated knowledges require that the object of knowledge be pictured as an actor and agent, not a screen or a ground or a resource, never finally as slave to the master that closes off the dialectic in his unique agency and authorship of "objective" knowledge.

Haraway, 1991 p. 124.

For Haraway, objects are not simply resources for knowledge in general or for art and science in particular. They are active and co-creating rather than discovered or revealed through scientific practice. Narratives about the real world require that we converse with, and participate in a social relationship with the objects of the world. Narratives about a real world must therefore contain a form of reflexivity or reciprocity, like in a conversation. By changing the mode from story-telling to conversation, nature and the world are not reduced to passive resources for our narratives. They are included as active partners. This notion of conversation seems to resonate with and complement my ideas of tuning and negotiation. It also indicates that processes of developing

understanding ought to involve agents that are distributed horizontally and connected through a web of relationships in which communication occur through a premise of equality.

Another layer of engagement, occurring in response from a viewer, was needed for the Utopian Mobile to work. It insisted on being an artwork that invited the viewer to interact with it and engage with it physically. As that was not in accordance with my intentions, it stranded in a corner of my studio as a reminder of the dangers of not respecting how artworks tend to acquire their own logic through the process of construction.

A layer of engagement connected to the body of the spectator is also created by the kinetic sculpture in Skyvelære. My original intention was to present and distribute, in a non-hierarchical and non-linear way, elements from the interviews and sound material and I had gathered during my fieldwork through a *machine*. However, as it developed I realized that spoken words would have the authoritative effect I described in the previous chapter, and that in this context the telling of stories, just like Haraway points out, would have an opposite effect to what I wanted, which was to suggest negotiable and decentred perspectives

Displacing the field

I invited Signe Lidén to compose a sound piece in four channels for the sculpture, based on the recordings she made during our collaborative research at CERN. This would create a tighter relationship between the sculpture and my conceptual process led me to making it. It was a path that led me to the Department of Physics at the University of Bergen and its magnificent Van der Graaf generator, and further on to do considerable research on Odd Dahl, its constructor, who played a central role in the development of CERN and designed the first accelerator there, the Proton Synchrotron. While the biographies of Dahl, and several other narratives I have traced concerning individual historical scientists, have preoccupied me throughout my research, they are only indirectly represented in the final exhibition. It is not the collected anecdotes and stories in themselves that are important, but I nevertheless acknowledge how they have had profound influence on my artistic work and understanding. It was my interest in Odd Dahl that provided access to the archives of CERN. His presence in *Skyvelære* is transparent, but the kinetic sculpture and its soundscape would not have existed were it not for him.

Lidén's material is based on a form of field recording, executed in CERN according to her careful listening to the almost unhearable frictionous sounds of the machinery of the Proton Synchrotron. As a field recordist, Lidén does not represent the myth of the invisible figure with a microphone, who '*mistake the reduced sonic data for the sensorial complexity of the contingent encounter, and forget the frame of reference left behind that needs reframing if it is to trigger anything*' (Voegelin

2014). Rather, Lidén works actively with her devices and imagination to reflect on the encounter she is creating and she continues to create a new reality structured in correspondance with the framework provided by the sculpture and its movements.

While creating the composition Lidén spent time with the sculpture, tuned her sounds and their organisation to how they appeared to her through the kinetic sculpture. From this position she created a new reality that could be accessed by a spectator in the gallery and for which the machine offered a framework. Through the way it is a specific manifestation of a machine, the sculpture takes over the sound and embodies it in a way that provides it with a new specificity that becomes inseparable from the sculpture.

The work does not represent the Proton Synchrotron, CERN, Odd Dahl or a scientific machine. What appears through the work, in which the machine/sculpture, its movements and the emerging sound composition have now been weaved together so as to form one work, is a form that presents itself, as a new, specific reality rather than pointing towards another. It offers an experience that is here and now, that is embodied and imaginative. It reframes the reality of our imaginative processes of making the work in a form that invites and enables another process, through which it can resonate with the experience of the viewer, and be modulated by his or her awareness.

Simone Voegelin recognizes these qualities of Lidén's approach as a way of displacing the field rather than capturing it.

Exciting field recording does not record the field but produces a plurality of fields. It neither abandons the reality of the recorded, nor does it take it for granted, but works with it, responds to it, understands it as one imprint in the landscape made by the body of the recordist and retraced tentatively by the listener. This listener in turn generates a new imprint between the heard and the recorded, listening to the authenticity of a particular rendition rather than its source, and embracing interpretation as part of the actuality of the real. (...)

Some works (...) produce the plurality of the field that is exciting to me, and seem sensitive to the pitfalls of the humanist and Romantic endeavour of capturing nature, urban and rural. (...) the works of Cathy Lane, Signe Liden and Francisco Lopez, among others, sound the possibility of the real through interpretations of the actual, and prompt a listening to sound rather than to music and art. Lane produces a field from archive footage and life recordings digitally processed, Liden displaces the field through installation, and Lopez blindfolds the listener to achieve a different audition. They all produce sonic versions of Ana Mendieta's imprints: the moulding of one's own body into the landscape, to leave the trace of an inhabited possibility, rather than produce the reportage of an assumed actuality.

(Voegelin 2014).

The processes that evolved through the Utopian Mobile, my interest in the history of Odd Dahl, my elaborated and experimental process of constructing a machine and the spectacularity of the Proton Synchrotron in CERN are transparent and inaccessible in the final piece. So is Lidén's experience of making the recordings. She approached the Proton Synchrotron through the impressions it made on her ears and her recordings are reproduced and distributed as a new field through the machine. Her presence in the recording situation adds a quality to the work that enhances the viewer's experience of presence.

These are processes that have written themselves into the sculpture. Rather than re-presenting the processes that led to its making, the work creates a new reality that is offered as a rotating and sound-producing machine, a possibility presented to the viewer as a modulated landscape to be experienced.

CONCLUSION

The exhibition *Skyvelære* was devised as a collection where the individual parts offered an aesthetic experience resonating with each other and with their surroundings. Layers of discursive content were embedded in the colours, movements, soundscapes, forms, rhythms and images.

Experience of presence and meaning

As pointed out by Hans Ulrich Gumbrecht in *The Production of Presence* (2004), there is a tension between images and concepts as media for reflection. As aesthetic experience is not mediated by concepts, it silences discourse in favour of phenomenological experience through sensuousness, motion and embodiment. From a critical point of view, Gumbrecht traces the practice of interpretation in art as a historically rooted and established mode of perceiving art through conceptualizing it, reading the art. Both through his arguments and from the perspective of the artist, this practice is problematic. In my own work, I have often been more interested in process than in representation. I have considered that the way processes unfold as dynamic material assures their presence in the world. Rather than extracting from it, they offer an expression that favours experience. This potential aspect of art was identified and articulated by Mitchel Whitelaw in his discussion of HC Gilje's work *Blink*, at Hordaland Kunstnersenter (2009). Whitelaw describes Gilje's work, and *Blink* in particular, as a network of visual processes that through their specific manifestations primarily offer to the viewer an experience that silences discourse, and produces presence as described by Gumbrecht.

It is indeed possible to create forms that do not reduce the world to an object, but that create the possibility of a relationship with its viewer that may '*oscillate between presence effects and meaning effects*' (Gumbrecht, p. xv). Over the period of my fellowship project, I have realized that art acts as a porous membrane, in a similar way capable of doing both by inviting the viewer to take part in reflexive relationships that favours processes involving multiple agencies.

Performative as data

In the beginning of this text, in chapter #1, I discussed how data resulting from observation of the environment, like sequences of photographs, are often incomparable according to scientific requirements. *Cloud formations* are among the elements still causing such problems of comparability. In October 2010, in Davos, it appeared that an invisible stream of sand had been sucked into the atmosphere during a storm in the Sahara desert. It had gotten into the path between the sun and the 85 meteorologists and metrologists who had gathered there for three weeks to calibrate their instruments. This sand nearly destroyed their data and rendered their measurements useless. It took the scientists weeks to develop an equation that could filter out the

resulting noise and compensate the errors. Such arbitrary aspects of data capturing are usually filtered out from data sequences, as they are from time-lapse movies. Throughout my project, they have instead constituted raw material for my reflection through the production of artworks, and I have considered their potential presence in artworks from several perspectives.

It has become apparent how relationships between an observer, a device, and what is observed can be reflexive. References enable development of information and significance in the processes that occur in these relationships.

Form: a wave-like field of interaction and negotiation

Devices that can be used to tune one's experience in relation to the environment are tools that make it possible to relate to the world by means of their ability to provide an active and relational structure. They offer a method through which meaning can be continuously developed and modulated through processes of tuning. In these, the observer, the device, and what is observed appear as subjects actively present and involved in the production of form.

Images and other forms do not have to be considered as stable. They enable negotiated modes of navigating, providing structure and significance, and serve to establish shared experiences and imaginaries. In the same manner, the processes of nature that we are part of can be treated as active and co-creating rather than as resources for our knowledge.

I have exposed forms as constructed frameworks that involve multiple agencies continuously engaged in gestures of tuning. While there is no position or point of view that can assert authority on its own term, calibration has been identified as a way of tuning such agencies towards a shared language where they can play against each other, like in a dance or in a conversation.

Through my experiments with how the performative aspects of producing a form may be present in and contributing to the experience of it, I have realized that even the stillest of images appear as something different than a fixed form. Rather they may enable narrative, create a transitional field and allow new order to evolve in resonance with the experience and imagination of the receiver. From such a perspective, forms are frameworks enabling processes, and they can in themselves be a field. We have seen that even points can have this function, through the mechanisms of reference.

I have turned to the natural sciences for material and ideas. In the sciences, quantum physics offers a double perspective in which the vision of particles, separate entities that are connected to others only externally, is complemented by a perception of a wave-like field of interaction and negotiation – waves merging, weaving into one another, evolving together and allowing new

order to unfold. While a point is somehow fixed and different from the rest of the world, which is in movement and flux, devising a point enable significance to appear in the relationship between the point and something else.

Fields and discourses

The most fundamental premises and discourses of video art were formed in the 1970s. They cross-connected with other discourses and strategies, in particular art and technology and performance art, but also with land art and ecology.

Today, artists who have corresponding interests are negotiating their relation to the environment and the field between nature and art. This project has led me to conclude that the recent revival of video art and electronic art in terms of '*art as inquiry*' (Bijvoet 1997) calls for a revitalisation of corresponding discourses. It has served me as a way of reflecting upon image-nature-device relationships. My attempt to contribute has found many ideas and discourses that have added to my thinking in the fields of sociology of science and sound art. Both of these have offered refreshing ideas that are not *new* to the field of video art, but rather can be considered *old* to the field of video art. These were developed in the 1970s, and no longer appear urgent.

To borrow discourse from sound art is not satisfactory. Hearing is a very particular mode of sensing that is fundamentally different from the other senses as it is always immersive. Video and electronic art has indeed strived for becoming immersive, in particular during the past decennium. Fortunes were spent on achieving a mere crumble of immersion in huge video installations surrounding the viewer, without satisfactory success.

The attraction of video in art lies in its resistance to be treated as a pure medium. Video is not an artform and even no longer a medium. It is a mode of inquiry that enables dialogue. This is confirmed by for example Gilje's work *Blink*, described earlier. Gilje's method of engaging video in conversations with spaces shortcuts the problematic attempts of creating immersion. He treats video as dynamic light that affects the appearance of space. Rather than being imposed, first on the room and later on the viewer, Gilje's video creates a new field *between* video, the room and the viewer. His work constitute an inquiry, obtained through a wave-like field of interaction and negotiation – waves merging, weaving into one another.

'*Maybe we should stop recording altogether and simply listen*' asks Simone Voegelin. It is a relevant question. She answers it herself: '*I believe the future of field recording lies in the tension created by transforming the heard through participation, collaboration, expansion and play, through which we can try a humbler humanity of shared spaces, and renegotiate what is real.*'

In the present context, her words appear to resonate half a century back, in an era where video offered, in contrast to other art forms, the possibility of doing just that; enabling *participation, collaboration, expansion and play* through its reflexive, social, instant, performative and participatory capacities as an audio visual medium. While video in this respect has been engulfed by the digital, it still appears to be a relevant mode of inquiry, of negotiating the real. In addition, while it is not immersive and mostly has a poor spatial presence, it is nevertheless mobile and ubiquitous; found everywhere, done by everyone.

EPILOGUE

In Tjautjas, after days of intense work of fine-tuning the instruments every twenty minutes, it finally appears that the camera on the ST-1 and the sun are perfectly aligned to each other. Set up in a strictly vertical and horizontal relationship between the marsh and the sun, the camera points directly at it, and follows it up and down in the sky, around and around. I can finally capture a sequence of high quality observational data of the sun, without the sun's location in the middle of the images to be affected by the rotation of the Earth. Trees, clouds, insects and mountains can move in and out of the pictures, while the sun and I are finally ready to stare at each other without our gazes wandering off. But now the clouds gather in the sky, and before I know it rains again.

BIBLIOGRAPHY

- Aitken, D. (2009) *Sonic Pavillion*. Instituto Cultural Inhotim, Brazil. [Artwork]
- Andersson, M. (2012). *Enda mer desorientert*, Oslo: Morgenbladet March 15. 2012, p.38
- Aubin, D., Bigg, C., & Sibum, O. (Eds.). (2010). *The Heavens on Earth*. Durham; London: Duke University Press.
- Austin, J.L (1975). *How to do Things with Words*. 2nd ed. Cambridge: Harward University Press.
- Barlow, M. (Ed.). (2000). *Mary Lucier (Art + Performance)*. Baltimore: The John Hopkins University Press.
- Bateson, G. (1991). *Sacred Unity : Further Steps to an Ecology of Mind*. New York: Harper Collins Publishers.
- Bateson, G. (2000). *Steps to an Ecology of Mind*. Chicago; London: The University of Chicago Press.
- Bazin, A. (1967). *What is Cinema*. London; Los Angeles: University of California Press.
- Beloff, L., Berger, E., & Haapoja, T. (Eds.). (2013). *Field_Notes: From Landscape to Laboratory*. Helsinki: The Finnish Society of Bioart.
- Benjamin, W. (1968). *Illuminations: Essays and Reflections*. New York: Schocken Books.
- Benning, J. (Director). (1999 - 2001). *The California trilogy*. DVD: Edition Filmmuseum 78. [Motion Pictures].
- Berger, J. (1984). *And Our Faces, My Heart, Brief As Photos*. New York: Vintage International.
- Bergson, H. (1998). *Creative Evolution*. Mineola: Dover Publications.
- Bernstein, J. (2000, August 15). *A discussion of NATO.0+55+3d modular*. Retrieved 01 06, 2014 f from http://www.bootsquad.com/old_site/nato/
- Bijvoet, M. (1997). *Art as Inquiry*. New York: Peter Lang.
- Bishop, C. (2010) *Installation Art*, London: Tate.
- Bjørgengen, K. (2004). *Kjell Bjørgengen: Nye Videoarbeider*. Nasjonalmuseet.
- Blom, C., & Røed, E. (2008). *Couperins hode skulder, kne og tå*. (C. Blom, Director, H. K. Sveen, & F. Thorsen, , Performers) Borealis, Lydgalleriet, Bergen. (Performance)
- Blondie (Harry, D.) (1982). *Atomic*. From *Eat to the Beat*. (Musical Piece)
- Bourguet, M.-N., Christian, L., & Sibum, O. H. (Eds.). (2002). *Instruments, Travel and Science; Itineraries of precision from the seventeenth to the twentieth century*. London; New York: Routledge.
- Brändström, U. (2003). *The Auroral Large Imaging System - Design, Operation and Scientific Results*. Kiruna: Swedish Institute of Space Physics, IRF Scientific Report 279.
- Burgin, V. (Ed.). (1982). *Thinking Photography*. London: Macmillan Education.
- Burnham, J. (1968). *Beyond Modern Sculpture*. New York: George Braziller.
- Butler, J. (1995). Burning Acts. In A. Parker, & E. K. Sedgwick (Eds.), *Performativity and Performance* (pp. 197-227). London; New York: Routledge.
- Cabanne, P., & Jasper, J. (1987). *Dialogues with Marcel Duchamp*. (D. C. Press, Ed., & R. Padgett, Trans.) New York.
- Cage, J. (2010) *Silence*. Middletown: Wesleyan University Press.
- Cage, J. (2014). *John Cage: An Autobiographical Statement*. Retrieved 01 06, 2014 from http://johncage.org/autobiographical_statement.html
- Canales, J. (2009). *A Tenth of a Second: A history*. Chicago: The University of Chicago.

- Carlson, A. (2009). *Nature & Landscape; an Introduction to Environmental Aesthetics*. New York: Columbia University Press.
- Cayley, D. (Ed.). (2009). *Ideas on the Nature of Science*. New Brunswick: Goose Lane Editions.
- Celant, G. (1991). Gilberto Zorio. London: Hopefulmonster.
- Checkland, P. & Holwell, S. (1997) *Information, systems and information systems: making sense of the field*, Chapter 4. Hoboken: Wiley.
- Chemero, A. (2003). An Outline of a Theory of Affordances. *Ecological Psychology*, 15 (2), pp. 181-195.
- Chion. M. (1994). *Audio-Vision: Sound on Screen*, New York: Columbia University Press.
- Chippindale. C. (2000) *Capta and Data: On the True Nature of Archaeological Information*, Society for American Archaeology: American Antiquity, Vol. 65, No. 4 (Oct., 2000), pp. 605-612.
- Cohen, K. S. (2009, 11). *The Hole Thruth*. Retrieved 01 06, 2014 from http://www.kim-cohen.com/seth_texts/Kim-Cohen_Artforum_November2009.pdf
- Comandon, J. (Director). (1909). (*Agglutination de Spirochaeta gallinarum*) Paris: Gaumont-Pathé-Archives. [Motion Picture].
- Conference internationale du passage de Venus. (1881). *Deuxieme seance: Jeudi 6 octobre 1881*. Ministere de l'instruction publique.
- Cox, C, *Response to a Letter from Christoph Cox*. Artforum, January 2010. Retrieved 01 06, 2014 from The Free Library as Cox, C., & Kim-Cohen, S. *Sound arguments*: <http://www.thefreelibrary.com/Sound+arguments.-a0217772276>
- Coyne, R. (2010). *The Tuning of Place*. Cambridge: The MIT Press.
- CRISAP. (2013). *In the Field*. Retrieved 02 15, 2013 from <http://www.inthefield.org.uk/>
- Crosland, M. (1969). The Congress on Definitive Metric Standards, 1798-1799: The First International Scientific Conference? *Isis*, 60 (2), pp. 226-231.
- Dahl, O. (1955). *Organisasjonen av den moderne atomforskning og Norges stilling i denne*. Bergen: Chr. Michelsens Institutt.
- Dahl, O., & Landro, J. H. (1981). *Trollmann og rundbrenner*. Oslo: Gyldendal.
- Daston, L., & Galison, P. (2010). *Objectivity*. New York: Zone Books.
- Daston, L., & Lunbeck, E. (Eds.). (2011). *Histories of Scientific Observation*. Chicago: The University of Chicago Press.
- De Certeau, M. (1984). *The Practice of Everyday Life*. (S. Rendall, Trans.) Berkeley: University of California Press.
- DeLanda, M. (2009). *A Thousand Years of Non-linear History*. New York: Zone.
- Documenta 12*. (2007). Kassel. Curated by Roger M. Buergel (Exhibition).
- dOCUMENTA (13)*. (2012). Kassel. Curated by Carolyn Christov-Bakargiev (Exhibition).
- Duchamp, M. *3 stoppages étalon (3 Standard Stoppages)*. Paris. (1913 - 16). Collection of MOMA. (Artwork)
- Eisentein, S. (1969). *The Film Sense*. New York: Harcourt Brace & Company.
- Ekeland, I. (1988). *Mathematics and the Unexpected*. Chicago, London: The University of Chicago Press.
- Entian, P. (2011) *Looking for Painting*. Bergen: KHIB.
- Festskrift til Odd Dahl*. (1968). Bergen.
- Flusser, V. (2000). *Towards A Philosophy of Photography*. Reaktion Books.

- Flusser, V. (2002). *Writings*. Minneapolis: University of Minnesota Press.
- Flusser, V. (2011). *Into the Universe of Technical Images*. Minneapolis: University of Minnesota Press.
- Flusser, V. (2014). *Gestures*. Minneapolis: University of Minnesota Press.
- Gander, R. (2012). *I Need Some Meaning I Can Memorize [The Invisible Pull]* dOCUMENTA (13) (Artwork).
- Gibson, (1979). *The Ecological Approach to Visual Perception*. Houghton Mifflin Harcourt
- Gilje, H.C., (2009). *Blink*, Hordaland Kunstnersenter, Bergen. (Artwork).
- Google. (2014, 04 18). *Google image search on broom and equinox*. Retrieved 04 18, 2014.
- Grasskamp, W. (2004). *Hans Haacke*. London; New York : Phaidon Press.
- Guerlac, S. (2006). *Thinking in Time*. New York: Cornell University Press.
- Gumbrecht, H. U. (2004). *Production of Presence*. Chicago: Stanford University Press.
- Guttu, A. H. (2013, 6 17). Selvstendig kunstnerisk arbeid på høyt internasjonalt nivå. *Billedkunst* (4).
- Haacke, H. (1963–65) *Condensation Cube*. Hirshhorn Museum and Sculpture Garden (Artwork)
- Hankins, T. L., & Silverman, R. J. *Instruments and the Imagination*. 1999, New Jersey: Princeton University Press.
- Haraway, D. (1991) *Situated Knowledges*, The Science Question in Feminism and The Privilege of Partial Perspective*, Donna Haraway 1991. Republished 2007 in *Technoscience, The Politics of Interventions*, Oslo: Unipub.
- Hokusai, K. *36 Views of Mount Fuji*. (Artwork)
- HWLA2. (2001, August). (Curated by Michelle Teran). 'Hot Wired Live Art 2'. The Banff Centre, Banff, Canada (Artistic project).
- Iversen, G., & Jacobsen, Y. S. (Eds.). (2003). *Estetiske teknologier 1700 - 2000*. Oslo: Scandinavian Academic Press.
- Janssen, J. (1874). *1874 Pierre Jules César Janssen - Passage de Venus*. Time-lapse film. On Youtube. Retrieved 01 06, 2014 from <http://www.youtube.com/watch?v=LowU9vKZzJs>
- Jaschko, S. (2010a). empyre. *empyre@lists.cofa.unsw.edu.au*. Email to mailing list May 9. 2010 22.23: *Process as Paradigm: Concept and Context*
- Jaschko, S. (2010b). *Process as Paradigm*. Retrieved 01 06, 2014 from <http://www.sujaschko.de/en/curating/exhibitions/process.html>
- Jaschko, S., & Evers, L. (2010). *Process as Paradigm, Art in Development, Flux and Change*. (L. C. Arte, Ed.) Gijon.
- Jean Comandon (1877-1970) . (n.d.). Retrieved 01 06, 2014 from Institut Pasteur: <http://www.pasteur.fr/infosci/archives/cdj0.html>
- Johannesen, T. *Extraordinary Popular Delusions*. (2012). dOCUMENTA (13). (Artwork)
- Jonas, J. *Volcanic Saga*. (1989). Electronic Arts Intermix. (Artwork)
- Judowitz, D. (1998). *Unpacking Duchamp*. Berkeley; Los Angeles; London: University of California Press.
- Kahn, D. (2011). *Imaginary Landscapes; Kontraste Cahier No 1*. Amsterdam: Sonic Acts Press.
- Kaye, N. (2000). *Site-specific Art*. London; New York: Routledge.
- Kim-Cohen, S. (2009, November). *The Hole Truth*. Art Forum.
- Knappett, C., & Malafouris, L. (2010). *Material Agency: Towards a Non-Anthropocentric Approach*. New York: Springer.

- Kolstad, H. (2001). *Henri Bergsons filosofi*. Oslo: Humanist Forlag.
- Kwon, M. (2004). *One Place after Another*. The MIT Press.
- La Dance (L'Enseignement de la danse en lycées Français), retrieved 01 06, 2014 from <http://jiheraim-cyberland.chez-alice.fr/6-danse/pages/danspag1.htm>
- Latour, B. (1993). *We Have Never Been Modern*, Columbia: Harvard University Press
- Launay, F. (2005). Jules Janssen's revolver photographique and its british derivative, 'The Janssen Slide'. *Journal for the History of Astronomy*, 36 (122), 57-79.
- Laurie, (. A. (1989). *The Dream Before*. Album Strange Angels. (Musical Album)
- Law, J. (2007, April 25). *Actor Network Theory and Material Semiotics*. Retrieved 01 06, 2014 from <http://www.heterogeneities.net/publications/Law2007ANTandMaterialSemiotics.pdf>
- Law, J. (2008, July 15). *On Sociology and STS*. Retrieved 01 06, 2014 from <http://www.heterogeneities.net/publications/Law2008OnSociologyAndSTS.pdf>
- Lefebvre, H. (2004). *Rhythmanalysis; Space, Time and everyday Life*. London: Continuum.
- Lucier, M. (1975). *Dawn Burn*. Collection SFMOMA (Artwork)
- Lucier, M. (1975). *Attention, Focus, and Motion*. (Artwork)
- LOC (Library of Congress) (n.d.) Retrieved 01 06, 2014 from <http://www.loc.gov/>.
- Liotard, J.-F. (2010). *Les Transformateurs Duchamp*. Brussels: Leuven University Press.
- Malick, T. (Director). (1974). *Badlands*. Warner Bros. [Motion Picture].
- Malick, T. (Director). (1978). *Days of heaven*. Paramount Pictures. [Motion Picture].
- Malick, T. (Director). (1998). *The Thin Red Line*. 20th Century Fox. [Motion Picture].
- Malick, T. (Director). (2005). *The New World*. New Line. [Motion Picture].
- Malick, T. (Director). (2011). *The Tree of Life*. Fox Home Entertainment. [Motion Picture].
- Madsen, O. J.,(2010). Finanskrisen som meningskrise, i *Markedets fremtid, Kapitalismen i krise*. Oslo: Cappelen.
- Manovich, L. (2001). *The Language of New Media*. Cambridge: MIT Press
- Mattheson, J. (1739). *Der vollkommene Capellmeister*. Hamburg.
- Mieszkowski, K. (2002, March 1st). *The most feared woman on the Internet*. Retrieved 01 06, 2014 from Salon: <http://www.salon.com/technology/feature/2002/03/01/netochka/index.html>.
- Milkovic, V. (n.d.) *Two-Stage Mechanical Oscillator - A Mechanical Amplifier*. Retrieved 01 06, 2014 from <http://www.veljkomilkovic.com/OscilacijeEng.html>. (Invention).
- Moore, R. (2003). James Benning's California Trilogy: A Lesson in Natural History. *Afterall: A Journal of Art, Context, and Enquiry* (8), pp. 34-42.
- Motherboard. (1995 - 2010). *Motherboard*. Retrieved 01 06, 2014 from liveart.org
- Muybridge, E. (1877). *The Horse in Motion*. (Artwork)
- Nauman, B. *Untitled 1969*. (Artwork)
- Nauman, B. (2002). *Please Pay Attention Please: Bruce Nauman's Words*. Cambridge: The MIT Press.
- Nezvanova, N. (2002, Fall). The Internet, A Musical Instrument in Perpetual Flux. *Computer Music Journal*, 24 (3), pp. 38-41.
- Norman, D. (2013). *The Design of Everyday Things*. New York: Basic Books.

- OCA. (2013, 09 11). *OCA News*. Retrieved 01 06, 2014 from OCA: http://www.oca.no/news/7438/toril-johannessen-and-elgreen_dragset-at-the-13th-istanbul-biennial
- Oregon, U. o. (n.d.). Retrieved 01 06, 2014 from <http://solardat.uoregon.edu/EppleySolarTracker.html>
- Oxford Dictionaries*. (n.d.). Retrieved 01 06, 2014 from <http://www.oxforddictionaries.com/definition/english/device?q=device>
- Pickering, A. (2010). *The Cybernetic Brain: Sketches of Another Future*. University of Chicago Press.
- Pickering, A. (Ed.). (2008). *The Mangle in Practice: Science, Society and Becoming*. Duke University Press.
- Pickering, A. (1995). *The Mangle of Practice: Time, Agency and Science*. Chicago; London: University of Chicago Press.
- Polanyi, M. (2000). *Den tause dimensjonen (The Tacit Dimension)*. Spartacus forlag.
- PMOD (Physikalisch-Meteorologisches Observatorium Davos), (2014). *The World Radiometric Reference (WRR)*. Retrieved 01 06, 2014 from <http://www.pmodwrc.ch/pmod.php?topic=wrc>.
- Reich, S. (1982). *Vermont Counterpoint*. Boosey & Hawkes. (Musical piece)
- Røed, E. (2009). *Atlas*. Lydgalleriet, Bergen. (Artwork)
- Røed, E. (2006, 2009, 2011). *Elektra*. EKKO, Bergen Kunsthall. (Artwork)
- Røed, E. *Feedback*. (2000,2001). Trondheim Kunstmuseum. (Artwork)
- Røed, E. *JA NEI*. (2005). Rogaland senter for samtidskunst. (Artwork)
- Røed, E. (2013). *Skyvelære*. 3,14, Bergen. (Exhibition)
- Røed, E. (2012) *So I went to Tjautjas*. NUMusic, Stavanger. (Artwork)
- Røed, E., & Blom, C. (2012) *On balancing*. Bergen. Borealis, ROM8, Bergen. (Artwork)
- Røed, E., & Boe, T. H. (Directors). (2001). *Papercuts*. (E. Røed, & T. H. Boe, Performers) Avantgarden, Trondheim. (Performance)
- Røed, E., & Liden, S. (2013) *Les Conseilles*. KINOKINO Centre for contemporary art and moving image, Sandnes. (Artwork)
- Røed, E. & Nilsson, J., (1999) *Art for Pleasure and Treatment*. Trondheim, NTNU. (Artwork)
- Re:place*. (2013). Retrieved 01 06, 2014 from <http://replace-project.blogspot.no/KHIB>. (Artistic Research project)
- Robertson, R. (2011). *Eisenstein on the Audiovisual: The Montage of Music, Image and Sound in Cinema*. New York: I. B. Tauris& Co Ltd.
- Sanford, C. E. (1889). *The American Journal of Psychology*.
- Schafer, P. M. (1977). *The Tuning of the World*. New York: Albet A. Knopf.
- Schaffer, S. (1988, September 26). Astronomers Mark Time: Discipline and the Personal Equation. *Science in Context*, 2 (1), pp. 115 - 145.
- Schaffer, S. (2004). *Things That Talk*. (L. Daston, Ed.) Cambridge, Massachusetts, USA: The MIT Press.
- Seltun, K. (1997). *Fra happenings til ambient: overskridelsens umulighet*. Retrieved 01 06, 2014 from <http://www.trete.no/frahappening.html>
- semiconductor. (2007). *Magnetic Movie*. Retrieved 01 06, 2014 from <http://semiconductorfilms.com/art/heliocentric/> [Artwork].
- semiconductor. (2010). *Heliocentric*. Rotterdam Film Festival. [Artwork].

- semiconductor. (2010). *Helio-centric*. Retrieved 01 06, 2014 from Semiconductor:
<http://semiconductorfilms.com/art/helio-centric/>
- semiconductor. (2011). *Inferno Observatory*. <http://semiconductorfilms.com/art/helio-centric/> [Artwork].
- Serres, M.; Latour, B. (1990). *Conversations on Science, Culture and Time*. Michigan: University of Michigan Press.
- Serres, M. (1997). *Genesis*. Michigan: University of Michigan Press.
- Shanken, E. A. (2009). *Art and Electronic Media*. London ; New York : Phaidon Press.
- Smithson, R. (1979). *The Writings of Robert Smithson*. (N. Holt, Ed.) New York: New York University Press.
- Sotemann, C. H. (2013). Heraclitus and Parmenides - An Ontic Perspective. Munchen: GRIN Verlag oHG.
- Steggel, A. *M@ggies Love Bytes* [Performance].
- Steggell, A; Røed, E. *404 not found* [Artwork].
- STEIM. (n.d.). *BigEye*. From <http://steim.org/product/discontinued-products/>
- STEIM. (n.d.). *image/ine*. From <http://image-ine.org/index.html>
- Steina: 1970 - 2000*. (2008). Santa Fe: SITE Santa Fe.
- Steven, S. (2010). *Never Pure*. Baltimore: The John Hopkins University Press.
- Strand, R. (2002). Complexity, Ideology, and Governance. *Emergence* , 164 - 183.
- thefuturics. (n.d.). Retrieved 01 06, 2014 from Flickr:
<http://www.flickr.com/photos/thefuturistics/3981852609/sizes/o/>
- Tillmans, W. (2005). *Thruth Study Center*. Köln: Taschen
- Torill Johannesen*. (2012). Retrieved 01 07, 2014 from
http://www.toriljohannesen.no/Extraordinary_Popular_Delusions_page1.html
- Tuan, Y. (2001) *Space and Place*. Minneapolis: University of Minnesota Press.
- Vasulka, S. (1978) *Machine Vision*. [vasulka.org] [Artwork].
- Vasulka, S. (1982) *Summer Salt*. [fondation-langlois.org] [Artwork].
- Vasulka, S. (2001, Aug 7) A conversation between Steina Vasulka and Raivo Kelomees. Posted on nettime by 'Alexandru Patatics' 7 Aug 2001 14:22:59.
- Vasulka, S. (n.d.). *Machine Vision*. Retrieved 01 06, 2014 from:
http://www.vasulka.org/Steina/Steina_MachineVision/MachineVision.html
- Voegelin, S. (2014), *Collateral Damage*. In WIRE May 2014, Retrieved 01 06, 2014 from
http://www.thewire.co.uk/in-writing/collateral-damage/collateral-damage_salome-voegelin
- Wang, Z. (2011). Absolute Calibration of ALIS Cameras. *MASTER'S THESIS* .
- Whitelaw, M. (2009). *Right Here, Right Now - HC Gilje's Networks of Specificity*. (HKS) Retrieved 01 06, 2014 from Hordaland Kunstsenter: <http://www.kunstsenter.no/en/akkurat-her-akkurat-n-av-mitchell-whitelaw/>
- Wild Sky*. (2011). Ostfildern: Hatje Cantz.
- Williams, J. (2011). *Gilles Deleuze's Philosophy of Time*. Edinburgh: Edinburgh University Press.
- Wimmer, A. (2006). *Models, Methodologies and Metaphors on the Move*. In A. W. Kössler, *Understanding change*. Basingstoke: Palgrave.
- Winderen, J. (2011). *Sakte men sikkert*. Oslo Poetry Festival. (Artwork)
- Østerhus, S. (2010). (E. Røed, Interviewer) [Interview].

IMAGE CREDITS

Figure 1, Image of a Calliper from Martin Freiherr von Hagen (CC) at Flickr.

Figure 4, Photo by Bjarte Bjørkum.

Figure 17, Photo by Anne Marte Dyvi.

Figure 18, Photo by Anne Marte Dyvi.

Figure 20, Photo by Anne Marte Dyvi.

Figure 25, Photo by Patrik Entian.

Figure 26, Image of Thermometer Hut from Bossekop, by Norsk Polarhistorie.

Figure 27, Photo of observational tower for hunting by Bengt Ek.

Figure 28, Popocatepetl in stills from Elektra. Photos by CENAPRED.

Figure 33, Screenshot from *Sun Seeker*.

Figure 40, Original image from CERN, found in Kjell Johnson collection.

Figure 46, Photo made available by the Vasulkas on their website *The Vasulka Archives*.

Figure 73, *3 stoppages étalon*, Paris 1913-14. Image from MOMA.

Figure 75, Spatial layout of a choreography for a sarabande for two dancers downloaded from *La Dance*. Origin unknown.

Figure 76, Two performers dancing towards the Future downloaded from Library of Congress. Origin unknown.

Figure 82, Detail from Google Image Search on *equinox* and *broom*, performed 25 05, 2014.

Figure 83, Near to Equinox in March. Screenshot from *Sun Seeker*.

Figure 84, 21.st of June in Nikkaloukta. Screenshot from *Sun Seeker*.

Figure 90, Sonic Pavilion. Image by *Futurics* on Flickr, CC.

All other images by Ellen Røed.