

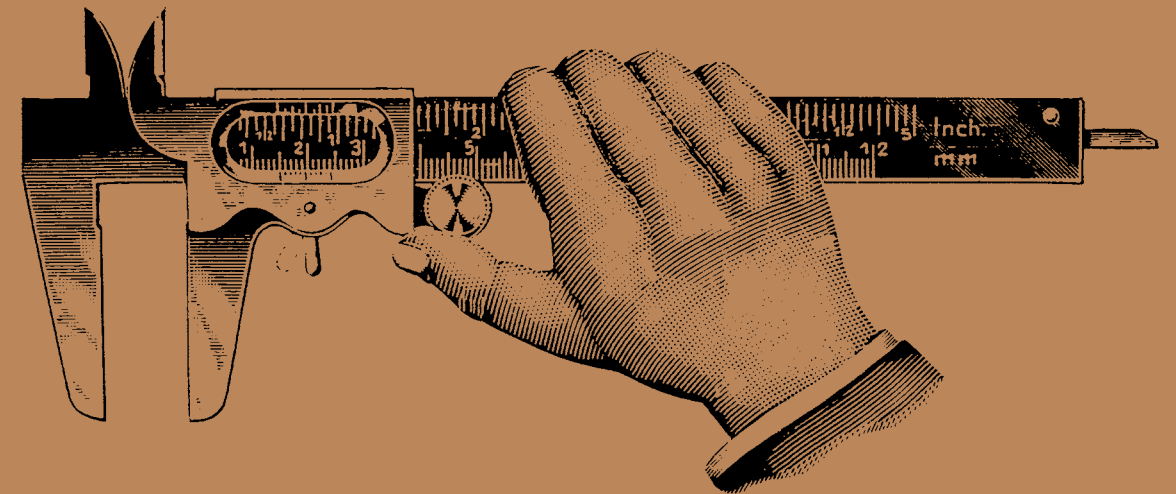


The focus on artistic research and development is the key aim of the Bergen Academy of Art and Design. Through a series of internationally peer reviewed publications KHIB contributes to the debate and development related to contemporary visual art and arts education.

Ellen Røed's project *Processing Change* was carried out at the Department of Fine Art within the Norwegian Artistic Research Fellowship Programme. It was supervised by Trond Lossius and Joost Rekveld. The final artistic results were 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 results. Together, the artistic work and the critical reflection constitute the formal results of Ellen Røed's fellowship project. They were assessed by a peer based committee consisting of Inger Lise Hansen, Ann Helen Mydland and Kjetil Berge.

Ellen Røed

SKYVELÆRE



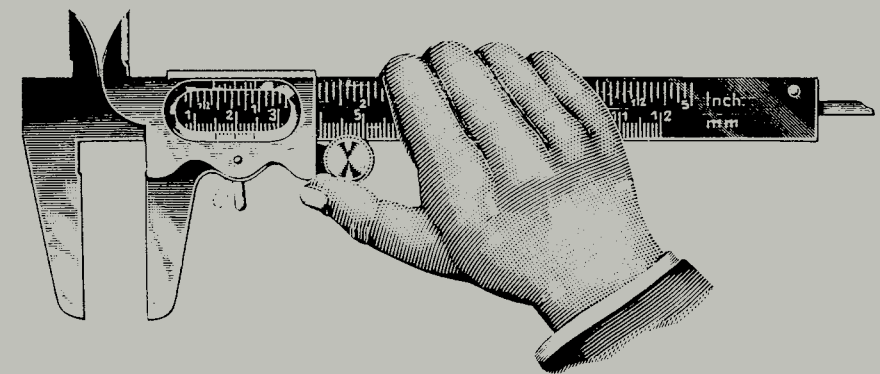


Figure 1.
A Vernier Calliper or Skyvelære. The gap between the
set and the variable edge constitutes a significant
relationship where information is produced.

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INTRODUCTION

From the end of the 1960s, the specific materialities of video offered artists a set of critical tools that enabled inquiries into more overarching cultural conditions. Video became a mode of developing insight and of producing and sharing knowledge. Today, when artists are renegotiating their understanding of the environment, video appears to be a both apt and relevant mode of inquiry. Devices such as cameras allow their user to engage with the world in a particular way through providing reference on one hand and performativity on the other.

From 2009 to 2013, I carried out a fellowship in artistic research at the Department of Fine Art at Bergen Academy of Art and Design, in which I applied video art as a means of exploring specific environments. I reflected upon on how video enable active and significant relationships between sites, devices and their users. In this text I will present my fellowship project through a discussion of the resulting solo exhibition *Skyvelære* (Røed 2013) at 3,14 gallery of contemporary art in Bergen.

The exhibition was opened by Dr Werner Schmutz, Director at the *Physikalisch-Meteorologisches Observatorium Davos* in Switzerland. His presence reflects how I have turned to the natural sciences for reference and perspectives on questions concerning the production of knowledge in relation to the natural environment. 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 emerge from a desire to understand and engage with the world.

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. When devices such as cameras or microphones are employed in the process of shaping or developing a form or representation, they enable a particular kind of understanding based on information (reference) and performativity. Operating cameras and other recording devices involve certain acts, such as focusing or adjusting position, that are an essential part of producing an image. By providing structure, such acts, or gestures, modulate the relationship between the person who gestures, and the world in which she does so. They involve a form of tuning between the observer and the observed, between the gaze and the world, between the image and the device.

Dr Werner Schmutz hosted the *XIth International Pyrheliometer Comparison Event* in Davos in 2010, where I was present to observe and document the daily adjusting of instruments performed by 85 meteorologists and metrologists representing 45 countries. This event consists of a procedure for the calibration of instruments for measuring solar irradiance. It is a preparation carried out to ensure that all the instruments for measuring solar irradiance will perform well within the larger context of knowledge production. As I filmed the activities of setting up, aligning and operating the instruments – I developed new understanding of the making of video art; I realised that the activities performed in the interaction with the technical devices had much in common with my own activities when operating a camera.

Calibration consists of tuning instruments according to a given point of reference. It is a procedure that is performed manually, in a form of fieldwork, and it involves a repetition of tiny adjustments of knobs, wheels, sliders or other controls. While adjusting the knobs or sliders back and forth with their fingers, the metrologists in Davos observe the effect of these tiny movements and readjust accordingly. During these activities, the multitude of movements that they constitute are brought into phase; they become synchronised, and they form a set of rhythms that connect the environment with the body of the observer.

I soon realised that my own gestures also appeared to be activities of tuning. Adjusting my camera enabled

me to observe and reflect in a way that I would not otherwise have done. I observed the resulting changes in the image, compared them to what I was looking at and readjusted accordingly. This is an experience that takes account of and reflects back on itself.

Another aspect of calibration is the development, throughout the scientific community, of a shared set of skills and experiences, a shared way of perceiving and acting. Like music, measuring solar irradiance is a practice that requires not only tuning, but also a set of skills acquired through instruction, community building and extensive practice. It is a collective strategy for being in tune across a multitude of processes. In Davos, my movements when operating the camera, the movements of the metrologists, and the movements of the sun and the clouds unfolding in the sky above Davos, were responding to one another in counterpoint. The gradually changing position of the sun was reflected in the position of the instruments in a way that emphasised the strictly orchestrated rhythm of measuring, the rhythm of the many gesturing hands, the rhythm of concentrated small talk in 45 different languages, and it even revealed the slow rhythm of the revolving Earth. The world and the representation of the world ceased to be separate, they were interwoven through activities and rhythm.

The Norwegian title of both the exhibition and this text, *Skyvelære*, is difficult to translate into English, but it provides several clues to my thinking; Composed of the words for *slide* and *learn*, from the German *lehre*, the term *Skyve – lære* denominates a vernier calliper, a device that, 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.

Reference points reveal the difference between one position and another. They mark out points that the community can tune in to, like an orchestra that tunes in to a given pitch, or like the scientists in Davos who tune in to the given standard. In use, devices such as cameras or pyrhelimeters provide structure in the sense of layers of temporary references that can be used to fine tune one’s perception. From this perspective, to develop a form is not about making a stable representation in the sense of a fixed object, but more about enabling an open network of relationships. During the process of making some of the works presented as *Skyvelære*, the world and the representation of the world were interwoven in a rhythm that connected the environment with the body of the artist-observer. In the gallery, the results of these activities are represented as time-based images, or as visual surfaces, but they may also continue to form new relationships through the perception and interpretations of the viewers who visit the exhibition.

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)

THE EXHIBITION

The exhibition *Skyvelære* consisted of an installation where video projections, sound, the gallery space itself and the various sculptural and visual elements interacted and offered alternating experiences of time as the viewer moves around. Sound was distributed in the exhibition space in such a way that it constituted an ambient auditory landscape that would sound different depending on the position of the viewer. I wanted it to operate as a system of associations where the meaning of one part could change in light of another. While each part represented the results of my artistic research seen from different perspectives, I invested both specificity and ambiguity in the various elements to keep them open to experience as well as interpretation.

The various parts of the exhibition were not intended to be experienced as separate and individual works, and hence I did not give them individual titles. In this text, they will be discussed sequentially, one work in each chapter that will be titled accordingly, e.g. *Skyvelære* #1. Numbered according to the spatial layout of the exhibition, they provide different angles and frames of reference for critical reflection. Each chapter will start with a description of the work in question, followed by contextualisation and a discussion of relevant topics. An earlier piece that was also an artistic outcome of my fellowship project, *On Balancing* (Røed & Blom, 2012), will also be presented and discussed in Chapter #2.

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 the empire style in 1845, and it is protected as cultural heritage. It is an almost symmetrical space with twelve semi-arched windows on the walls constituting the facade (Figure 2). The entrance is centred on the back wall and, upon entry, it gives an almost complete overview of the room. It is slightly winged, with an old lift and a former bank vault located in 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.

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 summer, the ambient light in the gallery had been toned down. The windows were covered with a film filtering out 95% of the light, thereby darkening the space while maintaining a transparent view to the outside, including the evening sunset. The exhibited screens were positioned off-axis, thus encouraging the viewer to venture into the room in order to see the projected images.



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

At the opposite side of the room, a tall, narrow wooden tower, with a small platform on top, is slightly angled in relation to the window. It holds a projector encased by wooden planks. A black power cord runs down from the projector and is plugged into the wall.

From the top of the tower, an image is projected onto an angled wall. It is supported on the reverse side 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 pass by (Chapter #1).

A framed photographic print, reproduced from an Ektachrome slide found in the archives of CERN, shows a man standing in front of a machine, in profile (Chapter #2).

On the left side of the room, a projected film is framed by a broad panel standing on the floor. It shows a group of men and women from many different countries who are concentrating on adjusting their instruments (Chapter #3).

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 that swept through the room like a small breeze (Chapter #4).

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

In the old lift, an LCD screen displays another time-lapse movie showing the inside of gallery 3,14 (Chapter #5).

It is dark inside the vault apart from a horizontal screen about 35 centimetres above the floor. It shows a video that explores old photographs found in the archives of CERN by panning around them using a microfilm viewer. It has real-time sound, recorded at the same time as the video (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 on the notion of an international standard, such as the Kilo, from different perspectives (Chapter #3).

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

A kinetic sculpture is hanging from the ceiling to the right of the entrance. It has four loudspeakers situated at opposite ends of two aluminium rods that rotate at 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 (Chapter #7).

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











SKYVELÆRE #1

Figure 20.
Tower seen from the entrance. Wall with projection.



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, in the same way as a similar tower would have done on the outside for a hunter or scientist engaging with the natural environment. The tower is shaped in a way that imitates the towers bird-watchers or hunters build as observation 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 might build to place various instruments on for measuring the wind, temperature or the magnetic field of the Earth.

Rather than supporting telescopes, thermometers or other observational probes, the tower supports a video projector projecting a moving image of a landscape onto an angled wall, seven metres from the tower. The wall is 5.40 metres wide and 3.38 metres high (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 to be a free-standing image. It also functions as scenography, constituting a temporary fond wall, leaving open space in front of it.

The supportive function of the structures on the reverse side includes sand-bags that underline the temporariness of the structure. Thin vertical slits repeated in the surface of the wall reveal the material from which the wall is constructed, five tall boards of medium-density fibreboard (MDF). 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 made of fibreboard. This approach, revealing the materiality of the various constructions and technologies involved, is used consistently throughout the exhibition.

The projected image is a sequence of photographs taken in June 2012, as part of fieldwork 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. The camera appears to have remained fixed in 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 emitting 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 the day and night. It was an *Eppley ST-1*, a model of equatorial solar trackers designed and constructed in the 1960s at the Eppley Laboratory.

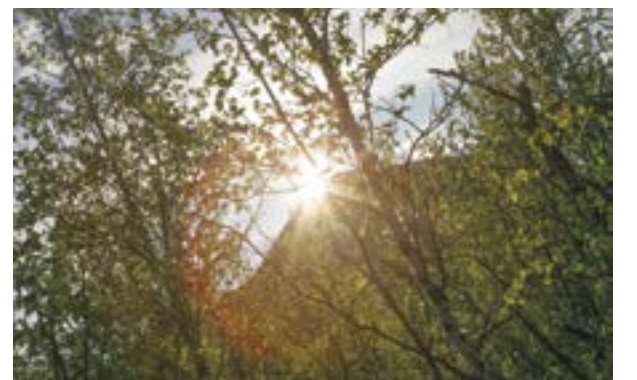
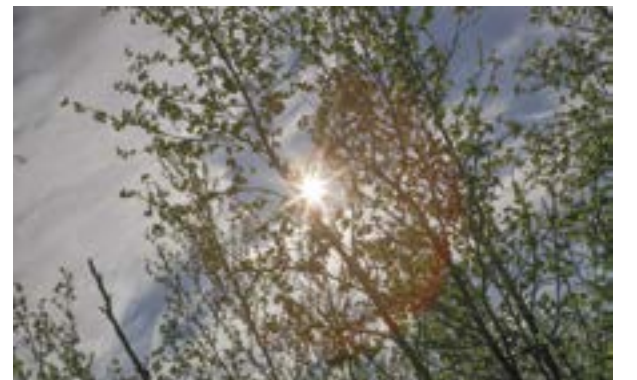




Figure 23.
Still images from the time-lapse.



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



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

I took a photo every ten seconds for several days. Seventy-two 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 lasting 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 in the sky the sun is. The movement stutters slightly and there is some flickering due to various small changes between the images. The sun is mostly located in the centre of the image (Figure 23).

Calibration

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

The photos were taken during such a navigating and aligning procedure (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.

Because of the geographical position and time of the year, there were rapid changes in the inclination of the sun, causing calibration difficulties that are reflected in the corresponding images. The position was verified and adjusted every hour. 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 made it necessary to adjust the camera every twenty to thirty minutes, and less frequently during the day depending on cloud formations.

Initially, the images taken between 3 a.m. and 5 a.m. 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 in my tent, ignoring the need to adjust the camera as the amount of light increased. I would wake up around 5 a.m. to a completely white image. Lacking sleep, it was difficult to resist giving in to the sudden comfort of heat after a long and cold night. This happened three days in a row. While the acts or 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, consists of a sequence of photos taken at a certain interval, in this case 10 seconds, and presented at a reduced interval, 1/25 seconds. Since the time span between each photo is reduced, the procedure can capture processes that evolve so slowly that they are hardly perceptible, and represent them as a 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 has to be performed manually. There nevertheless seems to be a close relationship between the two. Calibration is a measure that ensures compatibility, so that sequences of captured data, such as photographs, can be compared. Calibration involves defining a reference, an ideal. Between this ideal and the realities of practice, a form of tuning goes 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, which could capture and project moving images. However, cinema was not a single invention that can be traced through a 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 in 1874, Janssen captured a sequence of photographs. Projected sequentially, as a time-lapse, these pictures rendered the slow movement of Venus as it punctured the edge of the solar disc (Janssen, 1874). Janssen's method was improved by Eadweard Muybridge, who at first photographed sequences of animals in motion in order to do the opposite, i.e. to 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



Figure 26.
In 1838–39, a temporary research station was built in Bossekop in order to study Aurora Borealis and earth magnetism. This is the weather hut.



Figure 27.
Observation tower for hunting.

Institute, founded in 1968, still specialises in time-lapse and slow-motion systems, and it 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 for a number of expeditions collecting scientific evidence through photography. These transits offered a new possibility to calculate the solar parallax and thereby determine the scale of the universe. The parallax had been calculated on a number of expeditions during the previous transit, in 1769, for example by the astronomer Maximilian Hell in Vardø, but there were many controversies concerning the results, all of which were slightly different.¹ Photography seemed to offer the level of precision and comparability of data that were necessary 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), soon after the first transit the astronomers acknowledged that the resulting pictures were so different from each other that they were incomparable. This was partly attributed to the fact that most observers had used different devices, many of them self-invented, that imprinted themselves accordingly on the captured data (the photographs).

Differences between sets of data, one of the biggest challenges in scientific measuring, were not unusual

¹ Much later, the observations and calculations of Maximilian Hell were proved to be almost exactly correct.

in themselves. Astronomers making simultaneous observations of planetary transits from the same place would systematically record slightly different values. Such differences were attributed to a number of factors, ranging from personal aspects of the observation, such as lack of sleep on the observer's part, to more technical circumstances, such as the apparatus or the inclination of the object observed, which would in turn influence the body of the observer and even his psychic state (Sanford, 1889). The astronomy community was hoping that photography might provide a solution to the problem, since it had the potential to move the source of the evidential astronomical material from the astronomer to the sun itself. This could solve the problem of standardisation and enable the collected evidence, or data, to be 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 photos from each observer/photographer were anything but uniform, and photography revealed itself to be 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 worthless. In 1881, a conference held in preparation for 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 recognised that, when 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 used drawing as a way of collecting evidence of the subsequent 1881 transit, and, from then on, cinema and science evolved along diverging trajectories. Time-lapse photography nevertheless became an important device in science because of 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. They occur in pairs, eight years apart. While more than a century elapses from one pair to the next. In June 2004, the first transit of the pair following the one in 1881 was photographed by artist Wolfgang Tillmans 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 observed object, although I find that this is not distinguished from erotic desire in Tillmans' work (Tillmans, 2005). I do recognise the need to connect with the world through making images. Perhaps what Tillmans is doing is claiming 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 conflicts have a potential for reflection, for exploring something by following a dynamic tension, and I see no reason why this tension could not be of an erotic nature, as in Tillmans' work. Whether employing a camera or other devices, I use them to think, because 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*, alone on the sub-arctic Swedish tundra, my newly established viewpoint. I didn't repeat Tillmans' gesture, as heavy rainclouds covered the sky, but I did recognise the desire to do so.

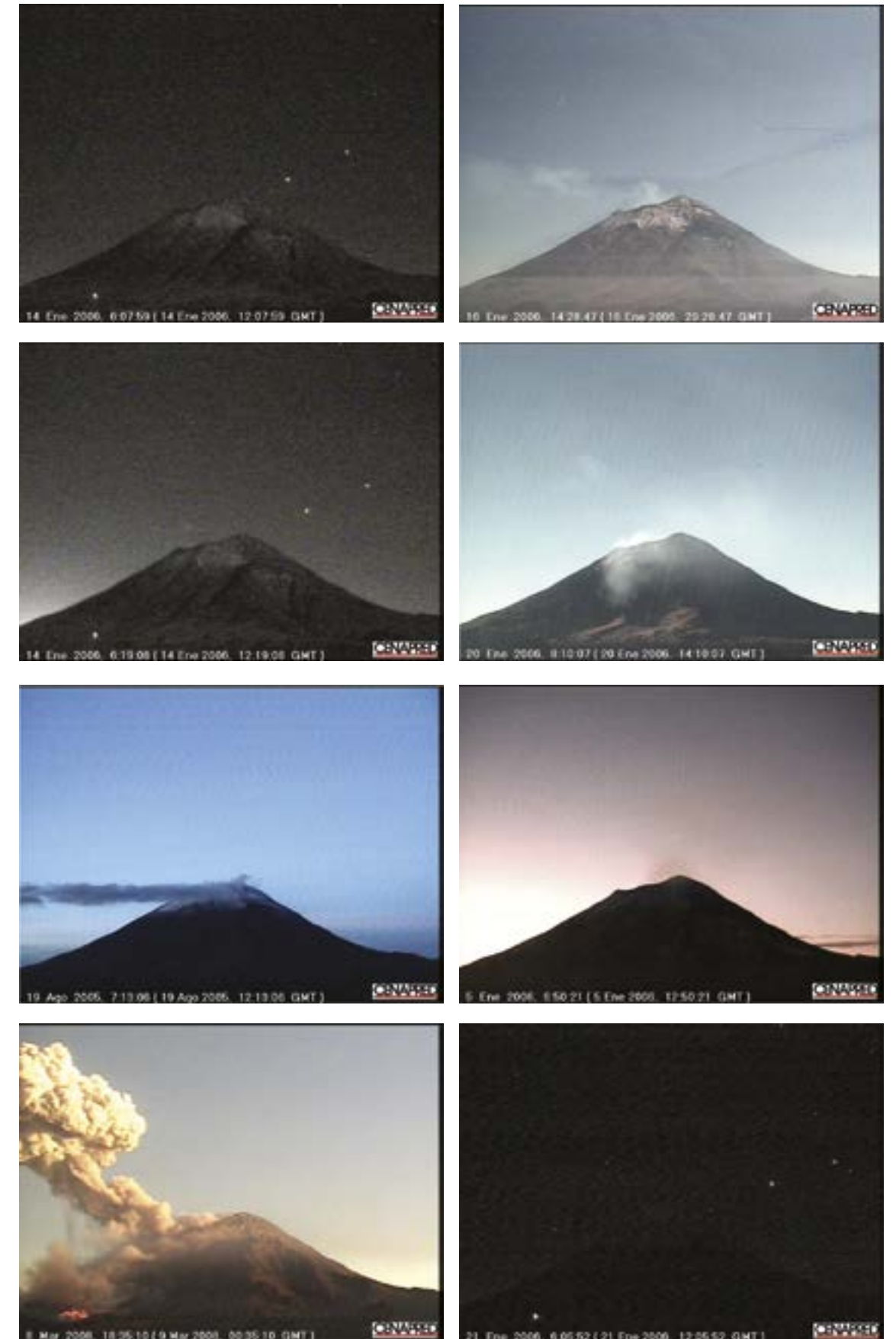
Viewpoints: Geography and other representations

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 particular form of 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 to create 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 (Figure 26), for example, would register the temperature of the air as a discrete number, data.



Figure 28.
Popocatepetl in stills
from Elektra.



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° 51' 6.7 N, 19° 0' 12.4 E, 495 masl, which is 65 kilometres from Kiruna, in the north of Sweden. This particular site was established by the Swedish scientist Urban Brändström, who is in charge of the ALIS observatories 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 northern Sweden. The design, operation and potential scientific results of the system 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 determining 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, the sequences of photographs, are often impossible to compare 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 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). What they cannot solve, however, is the problem of cloud formations that vary between different points in the landscape, which, even today, cause problems of comparability.

Clouds and other changes: The volcano

In 2005, in connection with 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 explosive nature. A week's 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 spewing ash. These processes, as well as cloud formation processes, seem chaotic, while the changes in light and seasons are cyclical. The motif 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).

I wanted to combine the images in a way that would reveal, through the combination itself, the constant tension between stability and change, linearity and cycles, so I used a careful editing procedure where the images were combined in cyclical patterns. It was a work that got me interested for the first time in working with video as a pre-edited composition, as opposed to treating video as *process*, based on its property 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 categorised the webcam images of *Popocatepetl* based on visual criteria rather than temporal ones, a procedure facilitated by the computer's need to organise 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 was 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 order 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 finalised 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 dialectical 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 with the magnificent behaviour of *Popocatepetl* itself. While Patrik Entian continued to explore such pictures from web cameras in his artistic research project on the 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 realises that, unlike the moving objects, these are not stars, but 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 carried out several projects in Bergen where I had explored the procedure of tracking the sun with the ST-1. When I participated 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 for how to operate this instrument by watching Hickey attending to the various ST-1s used 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 motorised 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, motorised camera movements that allow the world to be seen 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 that solar tracking time-lapses had any significant potential in the context of my project, being a genre I had mostly encountered in nature documentaries. Rather, I was interested in the procedure of solar tracking and the ST-1 as a device.

In a series of studies made with the ST-1, 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 in reality would exclude the sun without eliminating

2 <http://www.cenapred.unam.mx/es/>



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



Figure 30.
ST-1 in ROM8.

it as a potential. Turning ordinary places into observation sites, 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 (Figures 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 in 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, a way of considering things according to how they are done.

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 about gender (Butler, 1995), as well as in 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).

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 of performative in 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 to certain activities, as well as to 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 Austin's theories; 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 person 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 analysed by Flusser correspond to media and some create a broad historical shift in social consciousness. The gesture of writing, for example, involves the invention of linear time and, in 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).



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

Figure 33.
People watching the tracker in action
in the gallery ROM8 in March 2012.



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



Figure 34.
Video still captured at 9.30 a.m. in December.

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



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

One of the spaces in which I used the tracker was Rom8, Bergen Academy of Art and Design’s gallery for artistic research, which has windows facing south-west (Figure 32). This space allowed me to explore relationships between the sun, the site and less stable realities, such as weather conditions and my own gestures.

Eventually, I made three time-lapse films in which 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.

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

As ROM8 has large windows and an entrance that faces onto 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 on a long and dark December night (Figure 34). There is a short spectacular moment (Figures 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.

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

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



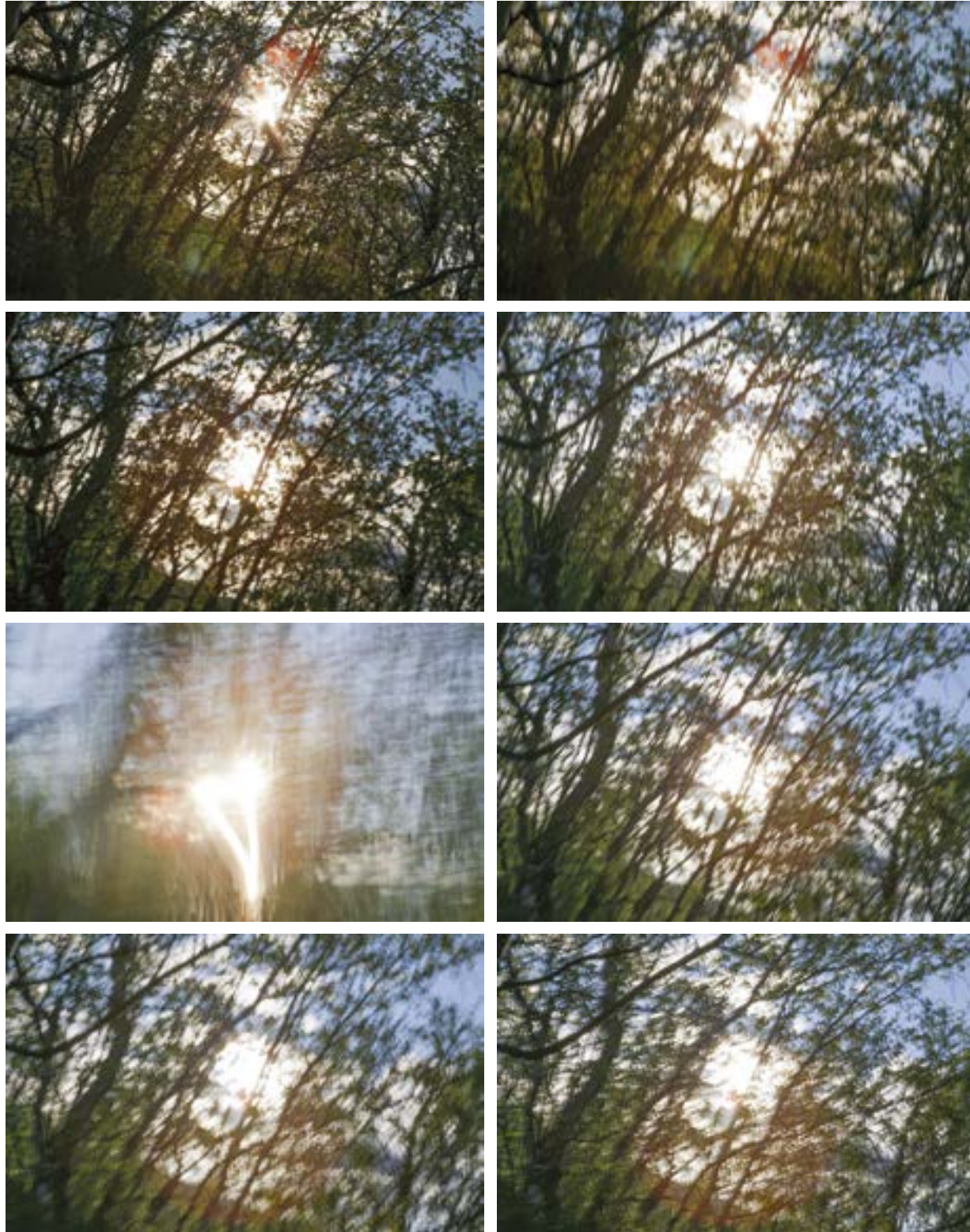
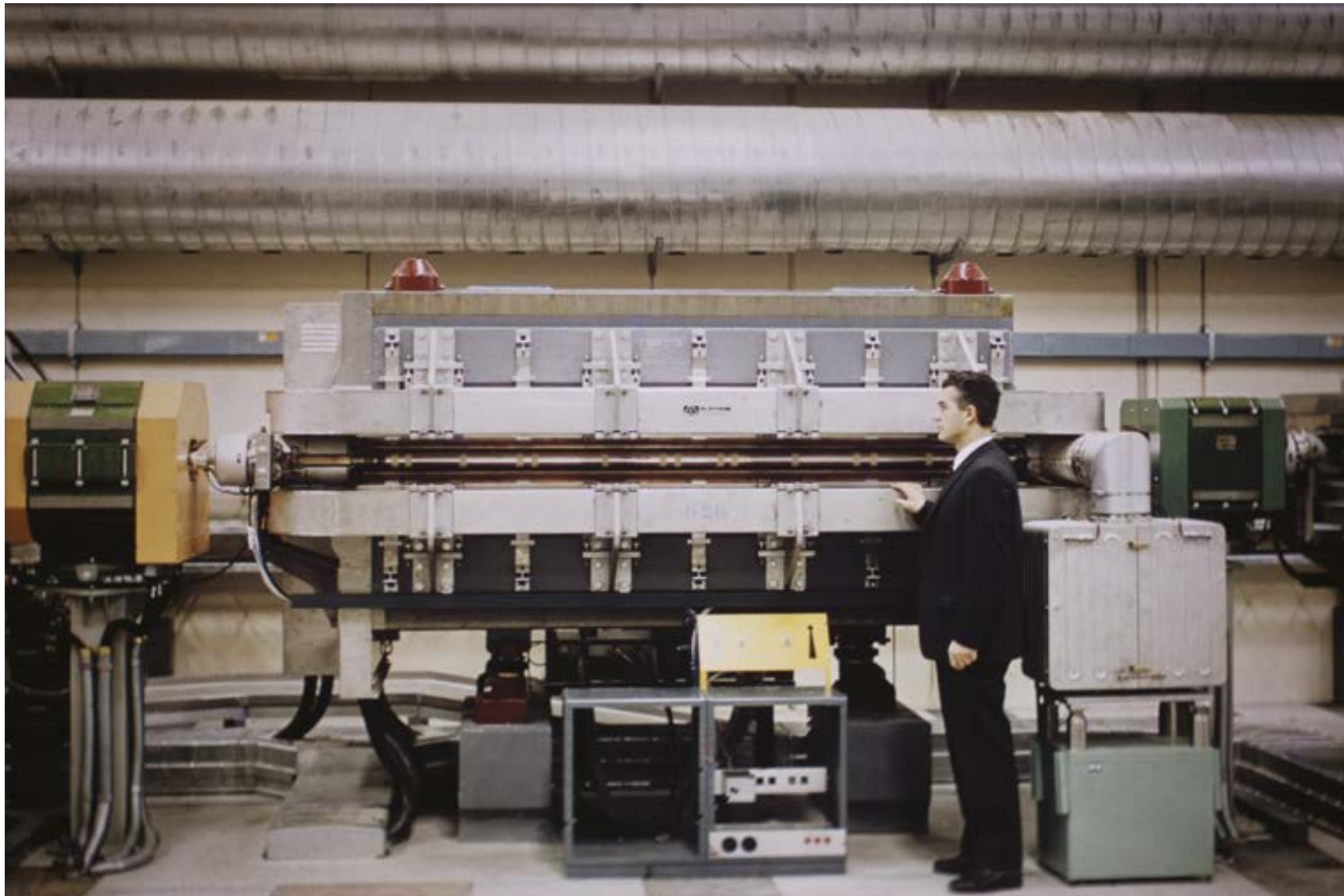


Figure 39.
Sequence of images captured during adjustment of the camera position.

From two of Brändström's sites, in Nikkaloukta and Tjautjas (figure 37), the cyclical changes of light and vertical position of the sun demanded recurring adjustments of the devices, which created interruptions and jolts in the otherwise mechanical stream of images (Figures 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 is an important part of the work that involves repetitive measuring, aligning and capturing of a sequence of data in the form of images. The presence of this layer of information, which may at first appear to be produced by mistake, reveals my main intention with the piece. It represents 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 takes place between the observer, the observed and the resulting representation.

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 destabilises the experience of the viewer, who needs to reorient his or her gaze, thus destabilising the experience of the film as well.

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



SKYVELÆRE #2

A spotlight accentuates a framed photograph, an Ektachrome, to the left 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 in which 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 comprehend the size of the machine. By doing this, he establishes a significant relationship 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-materialised by projecting it using a slide projector, re-photographing and printing it as an Ultrachrome print on photo paper.

The photograph invokes a layer of history that differs from the style of the gallery's historical architecture, which points back to Florentine palaces. In the history represented by the photograph, the quest to understand 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 in the natural sciences have resulted in many spectacular appearances, not least the particle accelerators at CERN, the most ambitious set of devices European science has 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 CERN's practice 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 in three of the works in *Skyvelære*.



Figure 41.
CERN.

In an undertaking as big as CERN, the individual researcher is of little importance and it is a challenge to find a way of approaching it, especially when the focus is on embodied practice. Most operations involve hundreds of people sitting in front of computer screens observing incoming data and looking for a small but perhaps significant difference (Figure 41). Others feed the data into models for further processing. Kjell Johnson's slide collection served as a point of entry to CERN, providing tangible material that we could work with. The photos offered insight into the cautious political optimism and sense of innovation that prevailed in the post-war period. Sixty years later, this would result in the observation of the Higgs Boson. A variety of interesting agendas emerged 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. Using 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 to orientation by establishing a relationship between two elements, 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 vernier caliper, *et 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 differ from each other.



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



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

Points of reference

Reproducing and using 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 the sciences means in practice (Figures 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 research method. In our conversations about Østerhus's fieldwork, 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.

Based on his practice of measuring, Østerhus has a unique understanding of a specific process that unfolds in the ocean streams below the Antarctic ice shelf. During field trips where he spends months on the Antarctic ice shelf, based in a tent, he uses his partly self-invented devices in an elaborate procedure of making a hole through a thousand metres 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 produces *super-cooled* water. Through his work, observations of this specific process are quantified. The super-cooled water flows out from that particular site under the ice shelf and forms a cold stabilising bottom layer, like a keel, in the large oceans. It is a central part of the

world's core ecosystems, as it balances the movement of the ocean streams. The water produced by the 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 the 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 in the global climate system. Østerhus's measurements of temperature form a reference, a measured and abstracted number. This point is a device, verifiable and comparable, a cornerstone of scientific knowledge. It serves as a point of reference in the same way that Johnson does in the photo, or that the fixed edge does, on the calliper, *Skyvelære*.

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 is going to be moved over the next twenty years, as a consequence of the iron-ore situated under the town. Continuous 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 cracks and sinks into the cavities created by the mining in several places around the town, the mining company has installed 337 concrete plinths reaching five metres into the ground (Figure 45). By mounting GPS trackers on the plinths, the mining company can compare how the position of the plinths changes over time by comparing their current locations to their previous locations. They thereby 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 being dealt with, as the entire city is gradually 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. Since 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, because artworks usually aim at being experienced and interpreted. Since many works of contemporary art employ references from specific spheres, some of the discursive elements of the work may not be recognised by all viewers. Nevertheless, such specific references are present as a *potential* that the viewers can activate. To perceive them is not a prerequisite for experiencing the artwork. Most often they have an ambiguous presence and will, if recognised, 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’s work. Both these approaches to drilling into the depth of the earth expose and represent processes hidden beneath 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 in 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 relationships 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 between images, in the splice. For the Russian filmmaker Sergei Eisenstein, who was 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 on 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 occurs 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 used 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, on the other hand, consisted of linear sequences of discrete images, captured at 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 device. 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 recording situation, the images can 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 computers than with film. This also means that video constitutes a distinct medium in terms of producing knowledge. Historically, cinematography, experimental film and video developed as distinct cultures embracing and exploring their social, political and material properties in different ways.¹

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 mounted on motorised tripods 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. They were sometimes also motorised. When several of them were combined as an ensemble, the cameras could also observe each other. The viewpoints and camera movements within the piece have been shifted from that of the human eye to the perspective of the devices, and de-stabilised. Steina Vasulka calls *Machine Vision* an *Electro/Opto/Mechanical Environment* (Vasulka, S & W).

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... ... 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 a 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

¹ Today, art historians such as Yvonne Spielman and Ina Blom argue that the media-specific properties of analog versus digital video are equally distinct, but in the present project these differences are not significant.



Figure 46 (a, b, c).
Photo documentation of Machine Vision.

a mode of producing knowledge. A work like *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 dehumanised, unstable and dynamic perspectives. Not only significance, but even its own point of view are attributed to the technical apparatus itself. Today, the material conditions of video and film seem to have been levelled out since they employ more or less the same technologies. Nevertheless, their material properties carry meaning in different ways. As part of their work, certain artists therefore still work specifically with these now seemingly obsolete media, and the conditions that come with them. These approaches can be regarded as media archaeological in their methods, but they 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, although 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 digitised as a sequence of split-up data instead of a 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 that unfold 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. Unlike in the early days of Gregory Bateson, mentioned in the introduction, where cybernetic and ecological perspectives were rare, most aspects of reality today are generally acknowledged as unfolding networks and processes. In the sciences as well, 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. For many artists, it was 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 digitisable media in real time, one of the fundamental properties of the computer, was at the core of ongoing visual experiments in electronic and digital arts around the turn of the millennium. This was foregrounded by artists who were also software developers, such as Sher Doruff, Tom Demeyer, Steina Vasulka and Netochka Nezvanova, who worked at small Dutch art institutions such as *STEIM* (Studio for Electro-Instrumental Music), *Waag* (Institute for Art, Science & Technology), *V2* (Institute for the Unstable Media), *DEAF* (Dutch Electronic Art Festival)

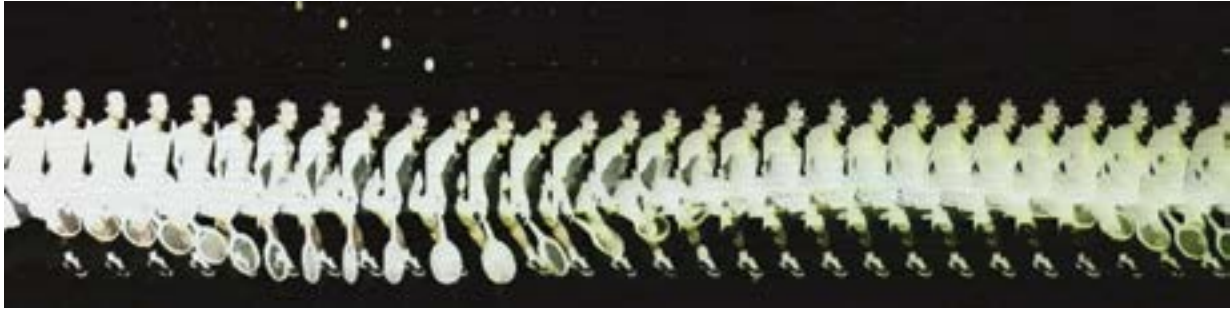


Figure 47.
Another example of memory in digital visual feedback.
(One frame from *404 not found*, tracking experiments by
Ellen Røed and Amanda Steggell, 2006)

as well as IRCAM (Institut de Recherche et Coordination Acoustique/Musique) in Paris and the non-localized *m9ndfukc*, with corresponding spread-out communities. In Norway, they 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 pioneers like Steina and Woody Vasulka. They have investigated electronic images over five decades.

As tools became more widely available for artists following the availability of laptops and corresponding software, artists like HC Gilje, Amanda Steggell, 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. In the ensuing 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 that fixes time in sequences of discrete images like a string of pearls, whereas video as real-time processes unfolds electronically or algorithmically, both within and between images that are not separated from each other (Figure 47).

Philosophically, process can be regarded as something inseparable from the general noise of the unfolding world, a non-distinct part of the ongoing of the world. People have tended to reduce such processes to forms and units and to represent them in order to make them ontologically accessible: specific, stable, and with a discrete form. One applicable strategy is to carry out measurements, 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, at the beginning of the previous century, led the Norwegian physicist Vilhelm Bjerknes to invent the methods of modern weather forecasting. During the ensuing decades, the awareness of how information and significance occur in relationships between units rather than in the units themselves spread throughout the field 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).



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

My own interest in sensing the environment developed in the context of making video accompanied by 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.

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 software for video processing called *nato 0+55*.² I had been commissioned to create 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 enabled me to use the

² *nato 0+55* was an independent addition to *Max*, the IRCAM/Opcode/Cycling'74 Max programming language, which allowed users to create programs for processing video in real-time developed by Netochka Nezvanova/*m9ndfukc* (2000). See (Bernstein) or (Mieszkowski, 2002).



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

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*³ and *BigEye*⁴ 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, i.e. it had 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 handful of push buttons that the dancers might interact with to trigger something. The potential of the sensors was to be stepped

³ *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*).

⁴ *BigEye* was one of the earliest commercially available pieces of software to perform real-time tracking of video events (STEIM, *BigEye*).



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



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

on, but there was no good reason 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 or meaning. This experience was an important eye-opener for me. After some negotiation with the choreographer, I abandoned the sensors and took 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).

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 causing 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.

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 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).

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 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.

Making the video for *Foolish Fish!* spurred a new awareness in me 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).

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 an 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 Pritchard, exhibited the piece *On Balancing* by myself and Christian Blom in the gallery ROM8. The piece was an installation that underwent continuous transitions that were inflicted on it by changes in the natural and cultural environment surrounding the gallery. Tuning, an activity that realises the relationships between object and observer, was explored in the piece from a perspective that emphasised performance and gestures of sensing the environment, in a de-humanised manner (Figure 53).

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 vice versa, as well as projections that appeared and disappeared with the ambient light. All these elements were continually transforming the appearance of the installation, which thus underwent 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 p.m., when the room was filled with natural daylight, but just before it would start to fade. In daylight, the exhibition had the appearance of 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 people. Thus, as the sun set and the daylight disappeared, the gallery turned into a performative site, an actor-less form of ambient theatre.

Ambient theatre is a term that was first used by Edgar Jager in 1995 and that Kristian Seltun (Seltun) introduced me to in 1997. Seltun recognised 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.

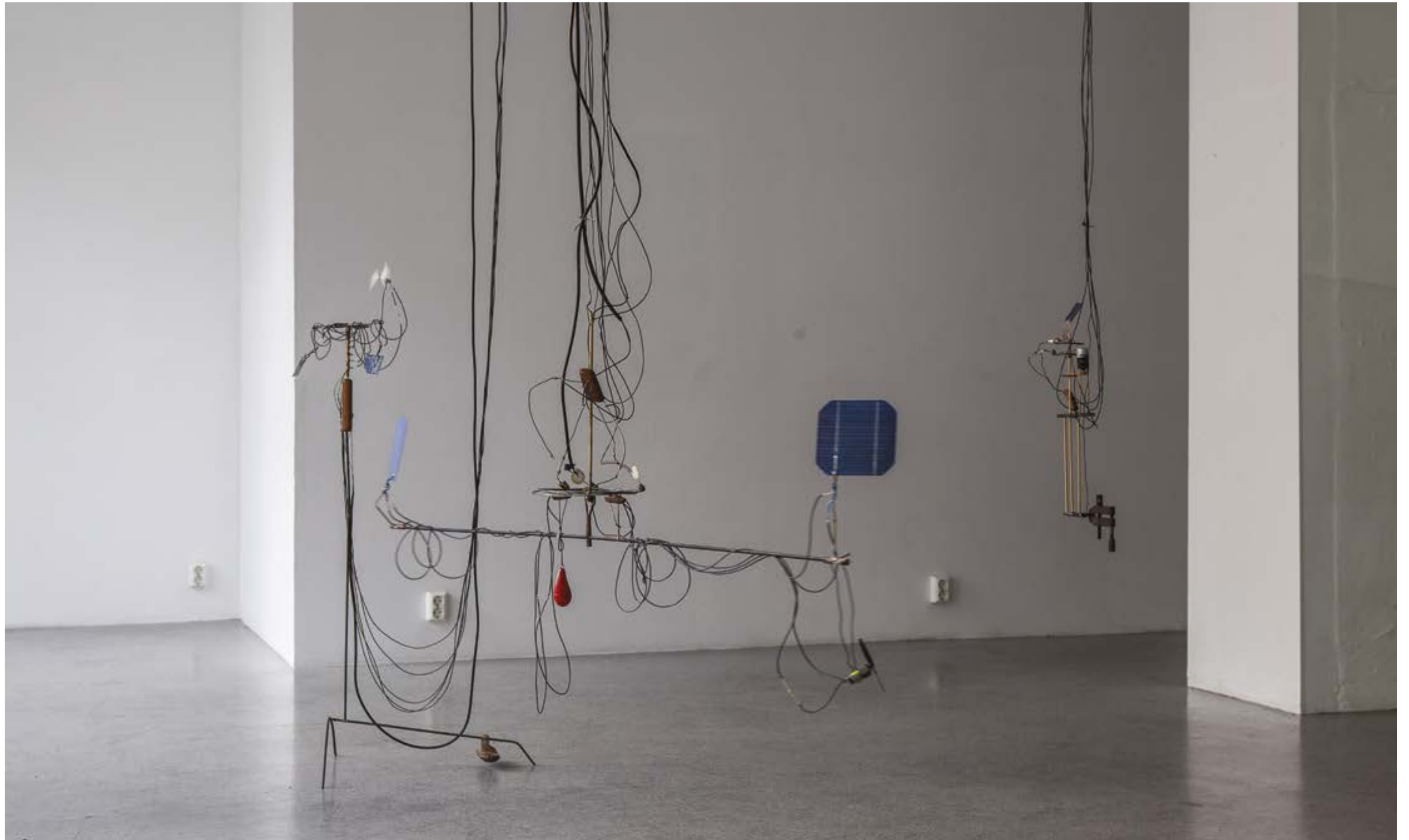
(Jager 1995, quoted by Seltun)

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

Figure 56.
On Balancing (detail).
Installation seen from the outside.

Figure 55.
On Balancing (detail).

On Balancing could be experienced until 10 p.m. inside the gallery and all night from the outside, as heard and seen through large windows. Situated at 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 that 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 windows into loudspeakers and transmitted the sound of the sculptures to the street outside.





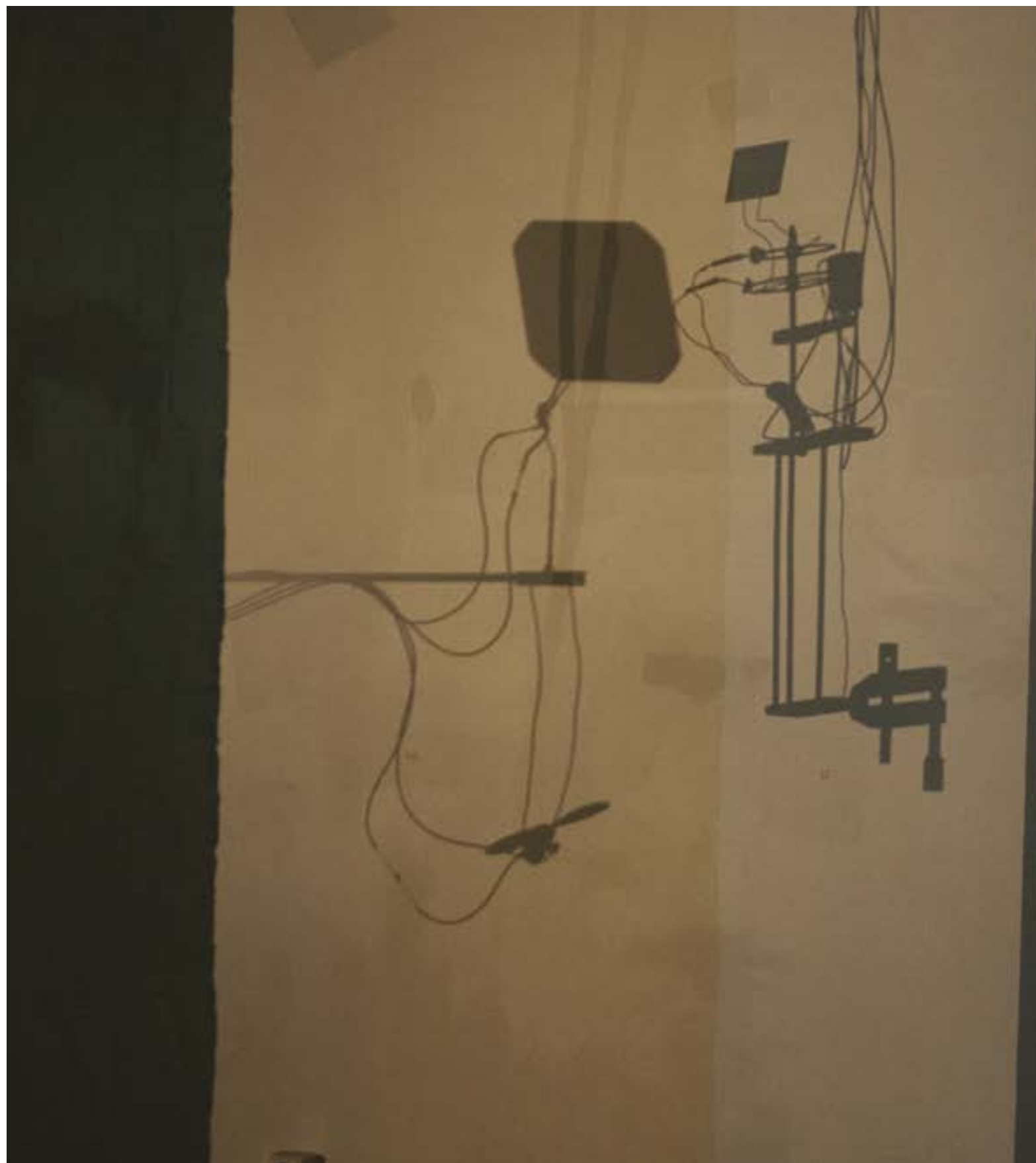




Figure 54.
On Balancing (detail).

Algorithmic choreography of solar trackers

While the exhibition was characterised 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 via 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 a message, a signal that could be interpreted as 'the sun has been found'. When they were all in the same mode, having been programmed to believe that they had 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.

A sharp circular spot of white light, not unlike a theatrical illustration of a moon (Figure 59) would light up on the back wall in celebration of the trackers having reached their ideal state. However, the trackers would soon realise that they had been misled, the spotlight being a far weaker source of energy than the real sun. This would set them off on a frustrated and aggressive spin, making noise, before they once again started

negotiating their position according to the amount of light. Eventually, based on 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 for 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, showing 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.

A collaborative piece

Previously, Christian and I had worked together on a piece of music theatre (Blom & Røed, 2008) in which 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 other's way of thinking and acting. 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 arise 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 these processes, as a negotiation between the 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 to be 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. His music was played later in the evening during the opening concert. (...) I have never quite understood the point of Luigi Nono, or, to couch it in the terminology of the work: I lack a point of reference for being able to engage with his music. (...)

The weather. In *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 is moving at a speed of 669 kilometres per hour 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 shift within the piece, creating new shadows and new points of reference that change the structure of the piece while nothing in the room has been physically moved. We see film from



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

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 March 2012, translation by Ellen Røed.

WHEN THE MATERIAL EVOLVES

As an installation, *On Balancing*, was a manifestation of a dynamic system with various ongoing processes. It continuously presented itself, realigned itself, evolved, unfolded. Such continuous happening is a quality I have appreciated and aimed for in my works, by using 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 regards 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 give it a performative potential. I find these properties interesting because they allow significance to fluctuate and respond to the specific situation of perceiving the piece.

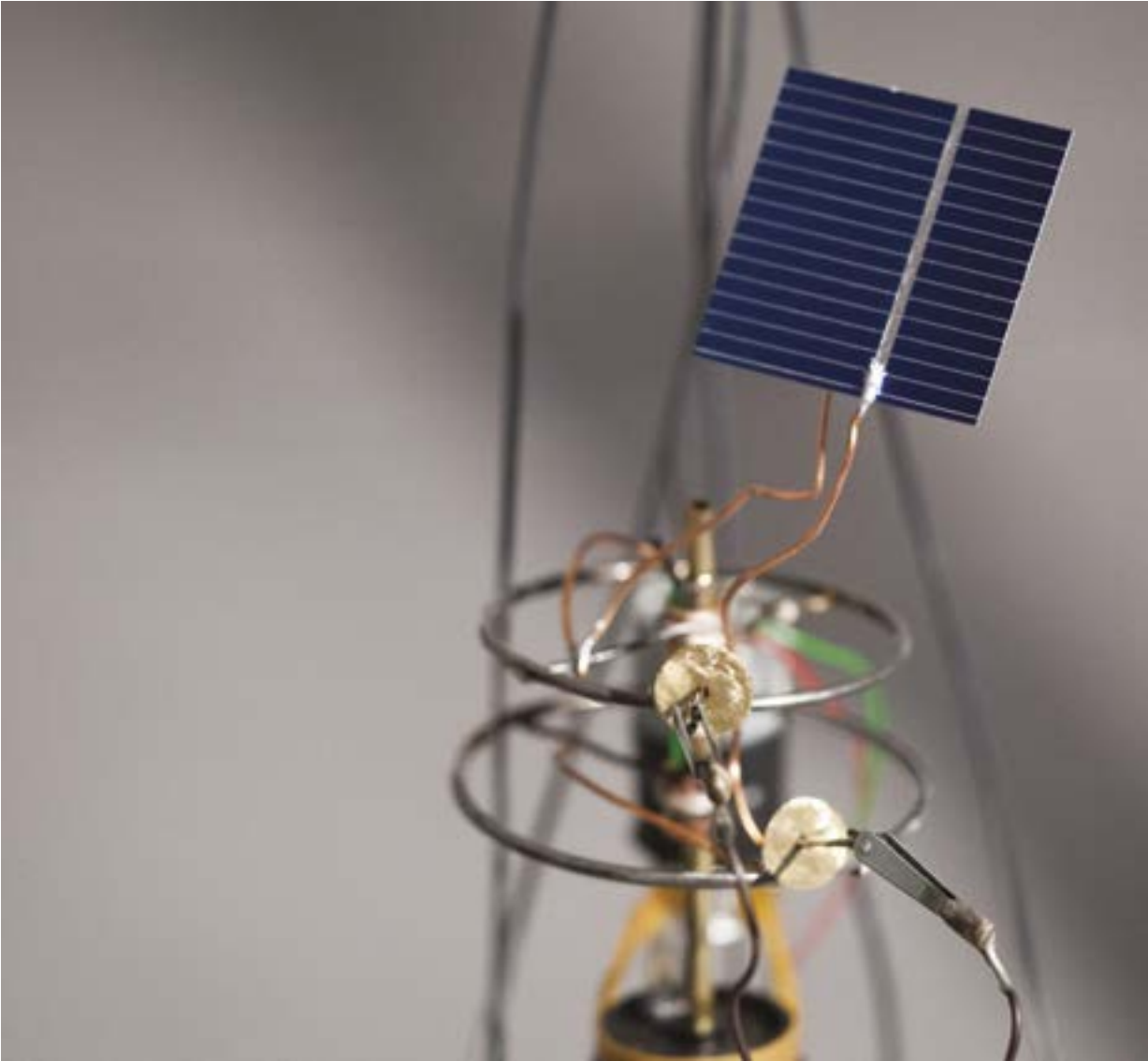


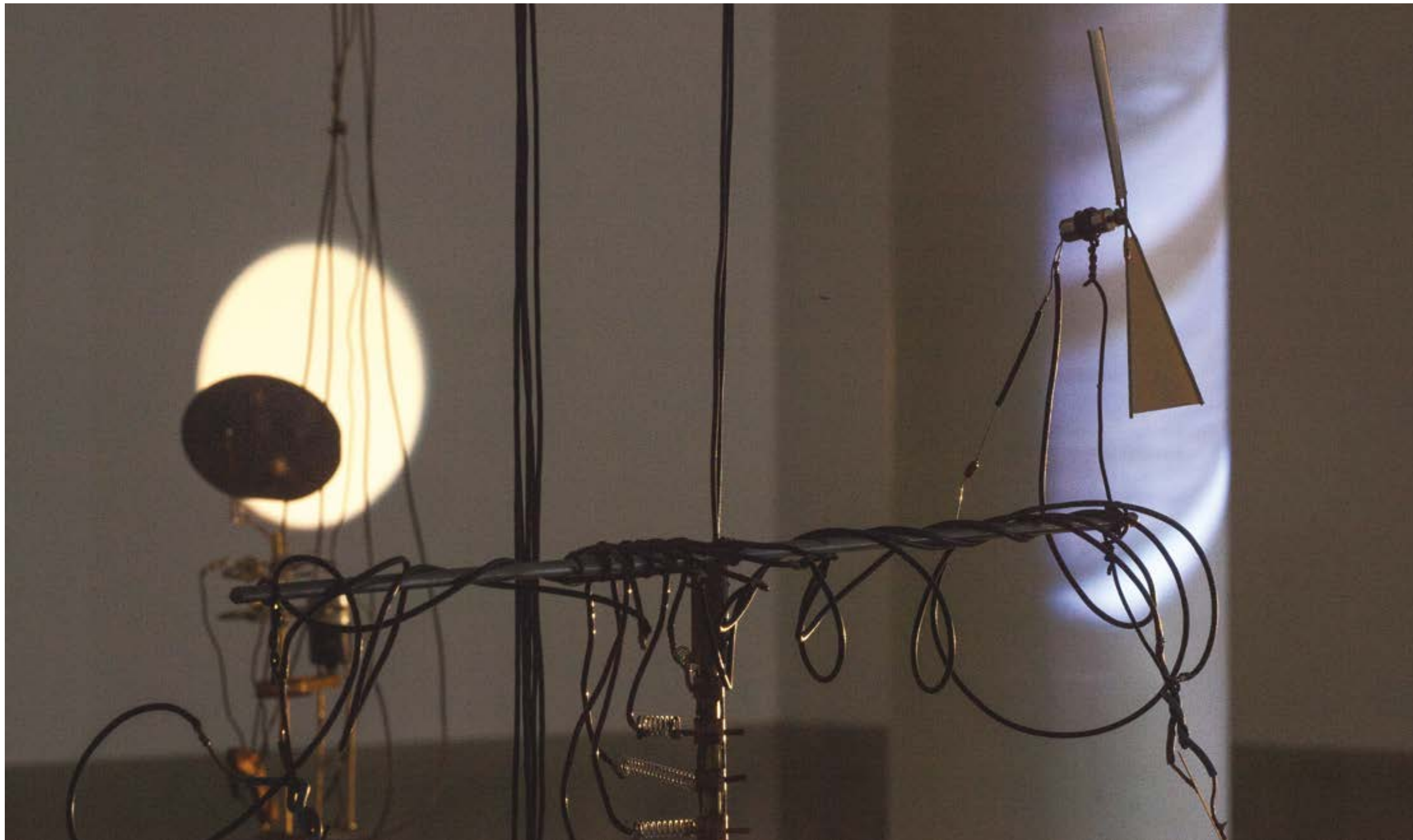
Figure 58.
Detail: solar cell rotating on slip-ring.

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 my artistic research fellowship project. I considered process suitable as an overarching theme and narrowed it down to the still rather general phrase; 'how process becomes manifest as form'. Within such a framework, the actual work I produced would add more specific meaning to the general theme.

Figure 60.
Detail.

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





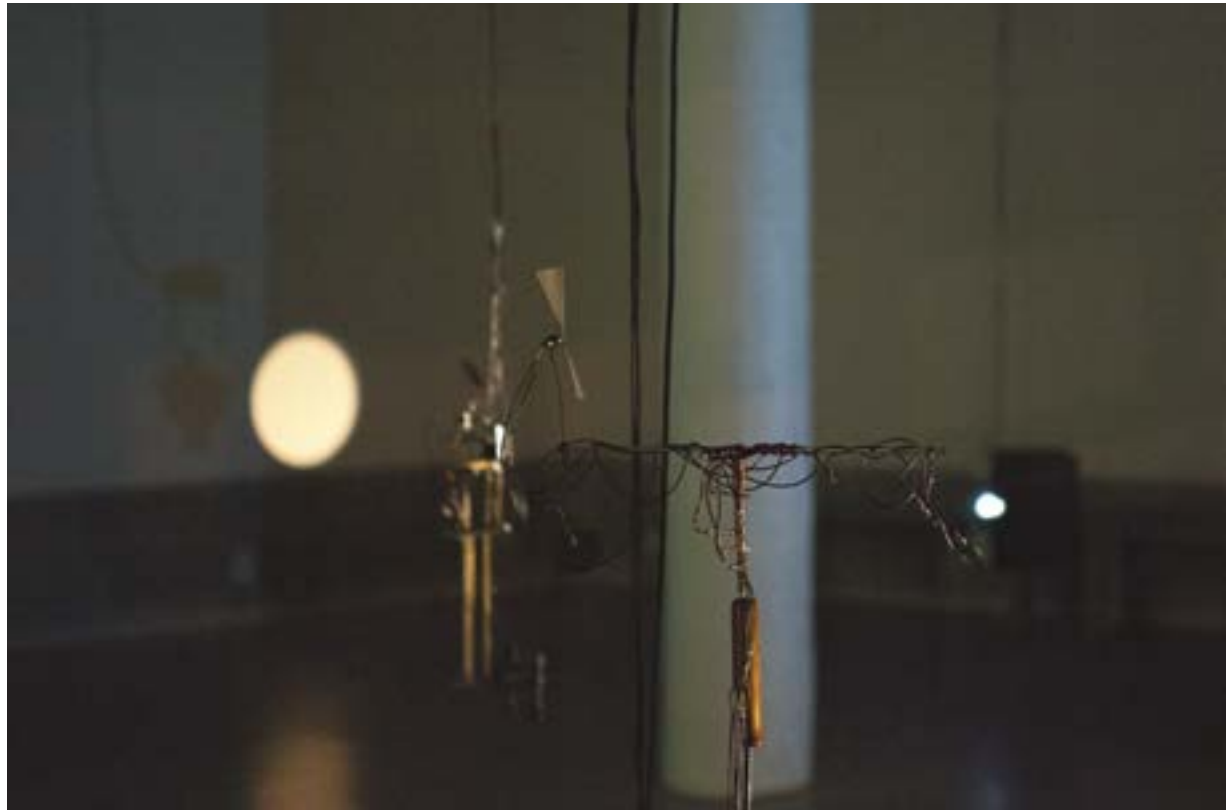


Figure 59.
The light spot on the back wall indicates that the trackers have apparently reached their aim.

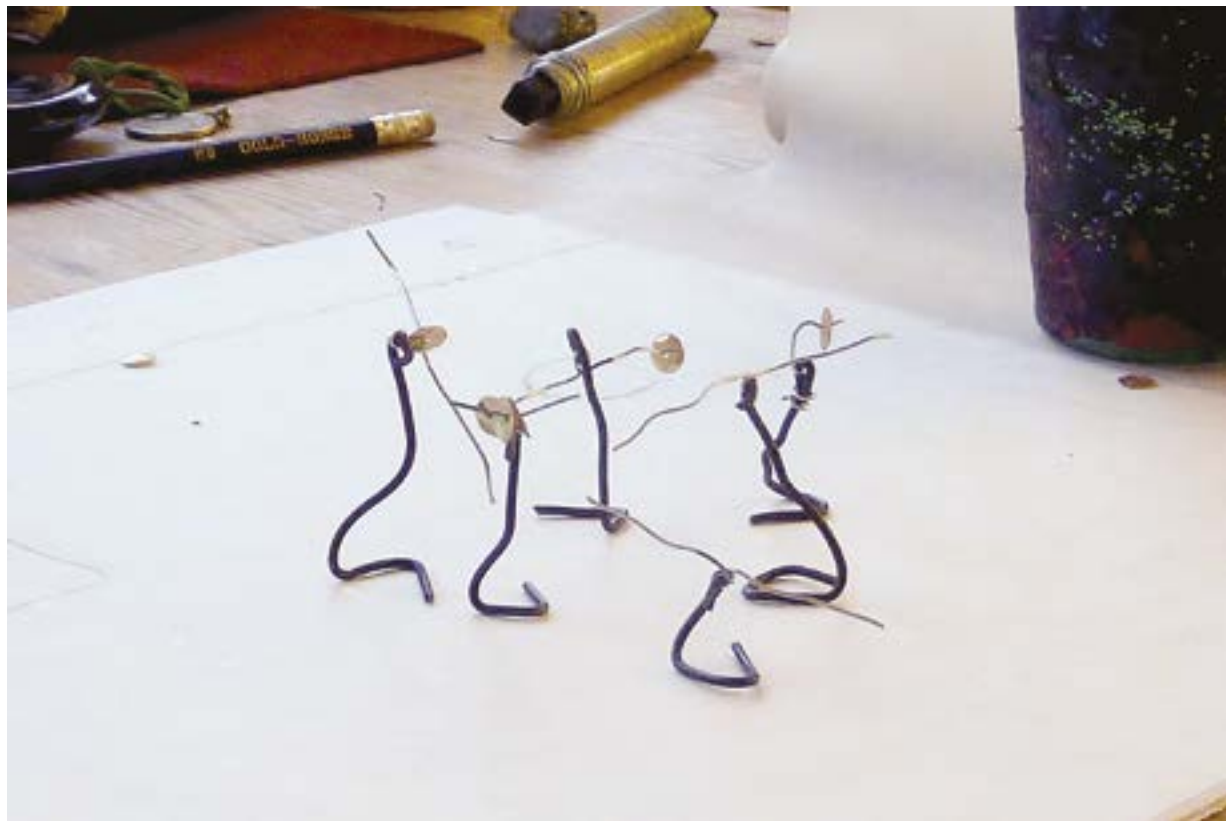


Figure 63.
Sketch for installation with performative solar trackers for Borealis 2012.

Soon after I started on 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 has links back to the 1960s and 70s, when 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 on systems and processes often involved an evolving organic system, such as the piece *Condensation Cube* (1963–65), which 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, which 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 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 of them combined these with ecological and cybernetic thinking inherited from Gregory Bateson, among others. Hans Haacke was a friend of the writer Jack Burnham, and his work on evolving systems and particular methods and approaches fed directly into Burnham's ideas, which 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 revitalised 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 are changing in other ways according to some kind of system, the exhibition *Process as Paradigm* aimed to explore 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 currently being challenged by. We perceive ourselves as potential contributors to an urgent inquiry into relationships between the world and our understanding of it, however difficult it might seem to find a relevant way of engaging in such inquiries and even to engage with such issues through art.



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 process to representation

The instability and fluctuating energy of processes has always interested me as a 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 to explore the relationship between form and process in the present project, 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 Evers and Jaschko's curatorial statements. In these 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 people, devices and the 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.⁵

When I considered the exhibition *Process of Paradigm* in the context of the concerns of my research, it appeared to be aiming to explore 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 collection 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 measurements Østerhus repeatedly carries out in the Antarctic.

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 over the duration of the show, spanning four months from April to August. How would the audience perceive the ongoing change?

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

(Jaschko & Evers, p. 24)

In many 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.

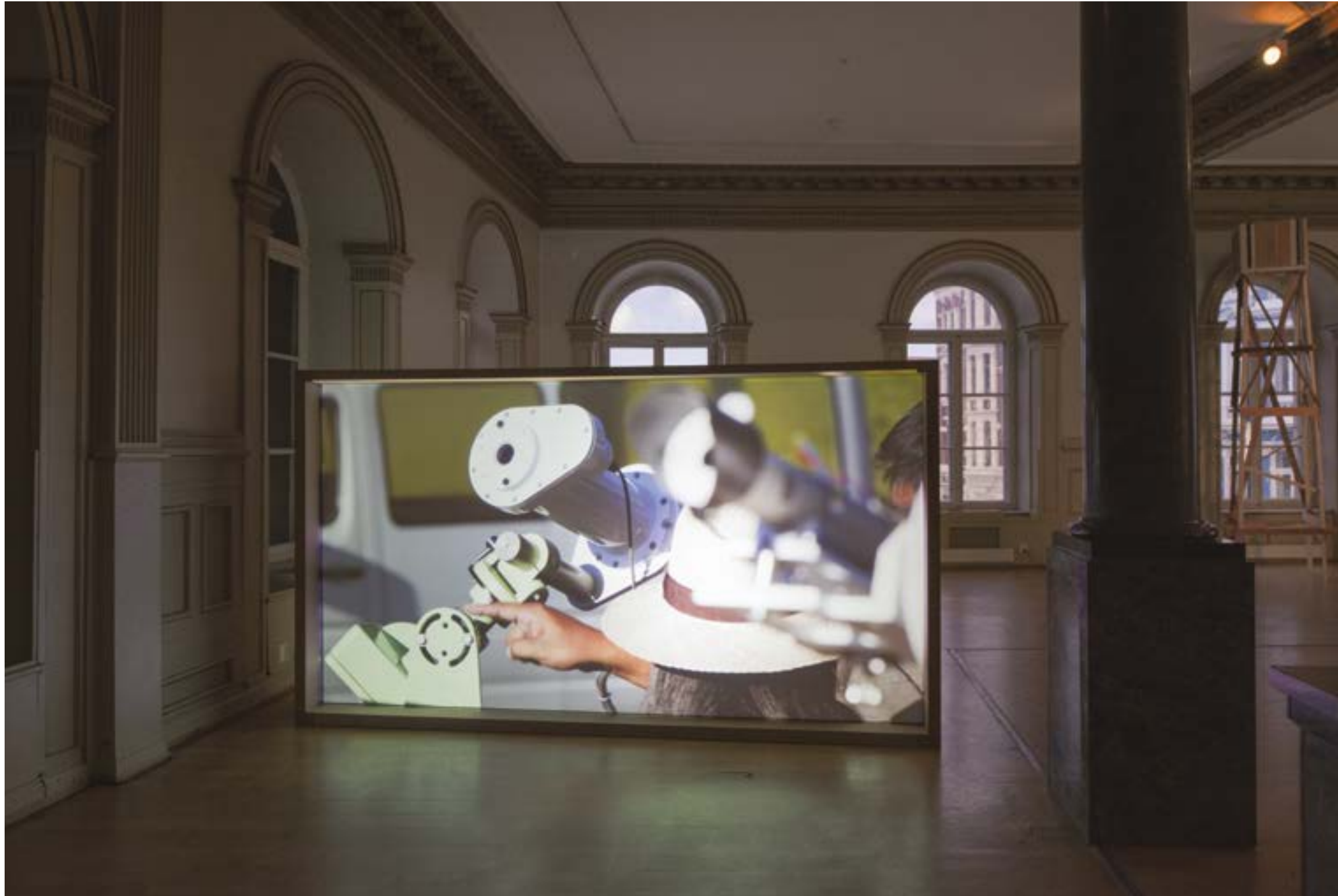
These are exactly the kind of demands that caused scientists to use time-lapse photography. Time-lapse allowed change occurring in processes that were too slow or too fast for human senses to perceive to become manifest through this specific form of representation. This is not unlike what the mining company is doing 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 appears in relation to the machine in the photograph.

The length of time that elapses 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 work such as framed photograph in the final exhibition, but rather a system allowing processes to unfold. Towards the end of my fellowship, I decided not to let *Skyvelære* contain live signals or unfolding processes, not in the sense that 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 emphasises their nature as temporary constructions. They offer possible points of view 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.

⁵ I have not seen the exhibition and base my reflection on information from the catalogue and on Suzanne's presentation at the symposium *Right about Now* that I organised at KHIB in 2011.

Figure 65.
Skyvelære #3 seen from the exit of the vault.



SKYVELÆRE #3

The twelve semi-arched windows define a rhythm in the gallery space of 3,14 that is accentuated by the four black marble pillars and the complex golden stucco ornamenting the room. On the left of the room, a heavy frame constructed from MDF stands directly on the floor without any support. 3.30 metres broad x 1.86 metres high, the screen is a dual projection screen, allowing the image to be seen from opposite viewpoints (Figures 65). A group of men and women from around the world concentrate on adjusting their instruments and taking measurements while gazing toward the sun. An elderly man with a hat closes and puts 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 forwards 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 scrutinising 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 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 observing carefully in other ways while adjusting them, are carried out in a concentrated and dedicated manner in rhythmic patterns that are emphasised in the editing of the video.

The 11th International Pyrheliometer Comparison Event

The video employs a specific viewpoint through a specific approach to 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), which took place in Davos, Switzerland in September and October 2010 (Figure 69). Eighty-five 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 countries' 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

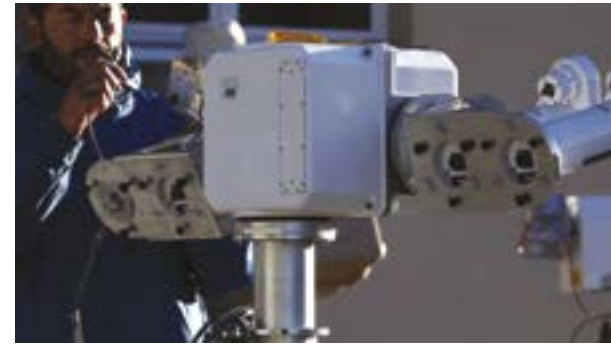
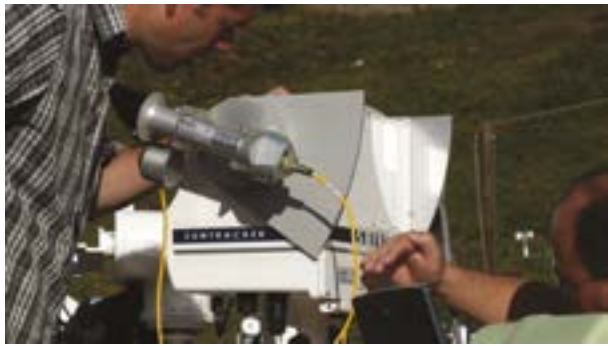




Figure 69.
Stills from the video.

structures, for example 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. 91. This developed into a consideration of the relationship between formal knowledge and personal gesture.

Informal rhythmic patterns

While performing a ritual, the meteorologists and metrologists tune in to the world and each other, positioning themselves in relationship to the sun, to their devices and to their community. The informal gestures seen in the video also carry a layer of significance with respect to how they organise 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 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. Complex rhythmic patterns emerge when 85 people thus engage their bodies, especially their hands and eyes, in synchronised activities involving a variety of forms of the same type of instrument. 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 continually defined direction, as the pyr heliometers followed the sun, always pointing towards it, from dawn to dusk. The scientists embodied all of the different temporalities with an elegance that seemed to be inherited from the devices, which was reinforced by their Panama hats. A subtle noise consisting of scattered small talk in



Figure 70.
If one can cover the sun with the thumb,
the atmosphere is clear and measurements will be good.

many languages, accompanied by the ticking, buzzing and pendulous movements produced by some of the instruments, was interwoven with penetrating sound signals that marked the beginning of the different temporal cycles.

The sarabande: From noise to ornamented restriction

During the editing and post-production of the video, I developed strategies for organising the material in time in a way that would reflect the aesthetic aspects of the relationship between the formal and the informal. Playing with arbitrary associations, I decided to incorporate a strict musical form to organise the informal movements of the meteorologists and metrologists into a structure with a distinct form: a piece of 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 the 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, returning 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 her toes that seem to draw 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 draw ellipses or points.¹ Having identified such variables, I applied them as a principle for the organisation of my visual material.

¹ A performance of the 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 organisation of activities at the IPC-XI, a formal pattern that coordinated the meteorologists’ and metrologists’ movements in a time-based composition structured in triple time. It was, however, a far more speculative play of associations that directed me towards this particular dance. It started with an association with 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 an erotic dance. The actual use of the word ‘*sarabande*’ can apparently be traced via Spain back to the Moors, and it is said to have meant ‘noise’ in the Moorish language. Orchestrated according to a strict choreography, the sarabande became a popular dance 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 it 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 characterised by restrained desire (Mattheson, 1739).

While there is no real connection between Louis XIV, one of his favourite dances and 85 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 into an aesthetic form. That the gestures performed in the video are structured according to the compositional pattern and choreography of the sarabande is not apparent.

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 metre and Volt, is a cornerstone of knowledge production in the natural sciences.

The international prototype metre 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 metre was soon replaced by an equation based on the speed of light in a vacuum, but the prototype kilogram is still the same artefact, carefully preserved in the vault at Le Pavillon de Breteuil, originally built for the brother of Louis XIV, who inaugurated it in 1672. Canales proposes 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 measurement (Canales, 2009). The importance of defining and implementing international standards to ensure the compatibility 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 Pyrheliometer Comparison Event, as a reference value based on the average measurement of 15 instruments. Each device that participates in IPC is equipped with its own ‘personal equation’ that the



Figure 71.
Elizabeth Svarstad Lauritsen performing the sarabande.

meteorologists and metrologists will apply to their data when processing them. They take their calibrated instrument back to their respective countries and proceed to calibrate all the national pyrheliometers. The reference is thus distributed throughout the entire international community.

In scientific terms, applying calibration procedures is merely maintenance. It does not produce any new knowledge in itself. It verifies the premises for scientific knowledge production. Calibration can be seen as a kind of tuning, a preparation of an instrument that 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, consistent inquiries supported by procedures.

In Duchamp’s work, which mainly consists of a wooden box containing a set of ‘rulers’, the artist created his own standard references for a metre. 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 metre apart, and dropped the thread from a height of one metre. 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 metre. Repeating the procedure three times



Figure 72.
Video still.

produced three standard metres, all different and all equally valid. These were his *Standard Metre(s)*, or *étalons* as the standard metre 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 randomness as a strategy, and it is 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 how, in spite of favouring systems, procedure and the mechanical in art, he 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, which he 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 gives an indication of position.

Today, remote sensing has taken over many data-gathering practices, such as in Urban Brändström's ALIS system, but the 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. Just like music, measuring solar irradiance is a practice that not only requires 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 emphasising the informal gestures performed and portraying 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 to be 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 common experience.

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



SKYVELÆRE #4

In the south-west corner, in the open area where one can watch the scientists portrayed in the projection of *Skyvelære #3*, an indistinct, continuous sound, a noise like ocean waves breaking against the shore, passes through the room in a continuous and repetitive rhythm (*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 again, 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), laying down a rhythm that corresponds to the edits in the video of the meteorologists described in *Skyvelære #3*.

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 synchronised or dependent on each other. The handmade and discreet appearance of the speakers underlines 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 time, the sarabande. The spatial distribution of the choreography of a sarabande serves 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 returned to its Moorish meaning: a form of noise.

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

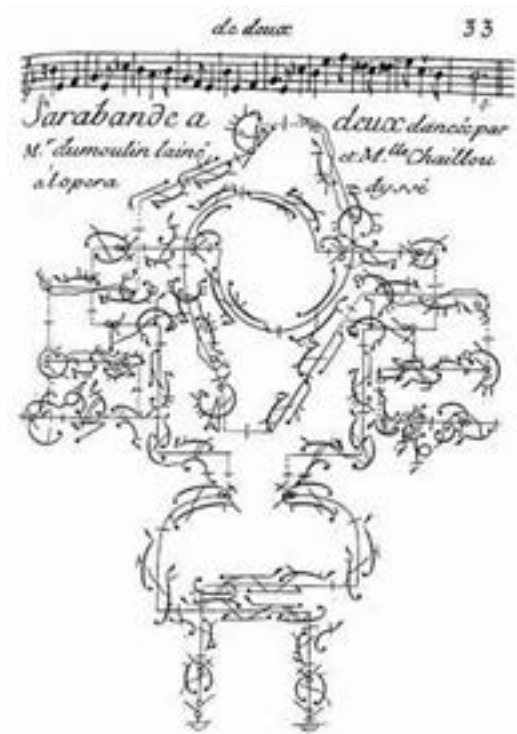


Figure 75. Spatial layout of a choreography for a sarabande for two dancers.

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. It is not experienced as having a distinct beginning or end, and it can only be perceived as a form of continuous flow. It represents what I have several times called process, despite being generated through a stylised and cultural form. In the context of 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, with the aim of 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 evidence of a gesture allowing someone to escape linear time, even if only for a fleeting moment.

As proposed by Yi Fu Tuan (Tuan 2001), the experience of space and time is largely biologically subconscious and linked to our bodies through recurrent phases of tension and relaxation. They are easily confused in the sense that we often use time units to describe space, and spatial notions, like *length*, to describe the 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, ever 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 organise visual elements into a *dramatic* space-time structure, which he exemplifies with a road disappearing towards the distant horizon, its surrounding space shaped like a cone, opening up from the point where



Figure 76. Two performers dancing towards the Future.

one stands to the broad horizon separating earth from sky, the future. From this point, we can only move in one direction, forwards, towards our destiny (Figure 76).

Music, according to Tuan, is capable of undoing this influence of landscape. Through the effect of rhythm, it can ‘insert’ us into an experience of time where we can suddenly move in all directions with equal ease, movements that 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 a ‘presentic’ unoriented place, to use a term from Erwin Straus, a time-space structure that escapes linearity.

While dancing around the room thus ‘inserted’ into rhythm, the dancer, represented here by the 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 has three qualities, a lush and quiet sonic texture of mostly high-frequency noise that is 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 breaking against the shore. The rhythm of these comings and goings is more irregular than the waves, but they are not unpredictable, as the ornamented choreography of a dance in triple time has provided a structure for the source.

Noise versus phenomenon (form)

Michel Serres links the sound of the ocean to the beginning of the world, because 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 ideas 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 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’s 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 measurement. This approach was criticised by the French

philosopher Henri Bergson, who insisted on understanding life as a contingent process of growth and change, and 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 recognises that clock time, produced by reducing the flows of reality to points (instants) of identical lengths of time (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, since 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, at the beginning of the 20th century, the breakthrough 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 localised (particle) properties, situated next to each other, while waves have distributed wave properties within a field of energy. The revolutionary idea that quantum physics expresses 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 a hundred years after this shift in human understanding of matter, all the major disciplines of science have moved 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 ‘indetermined’, 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 with process is useful because 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 experimented 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. For example, he would use *I Ching*, or throw stones onto 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 was determined through various gestures where chance was involved. The chance operations provided musical structure, and he sometimes refers to them as objects. For Cage, the object was something given, something providing a defined or fixed structure for the composition, even if it 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, provides a reference as an international standard of mass, or how Duchamp’s *élan*, produced by stretching out his hands

and dropping a 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 something 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 Gander’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 entering, the vast museum space of the ground floor of Fredericianum is completely empty, but after a while you notice 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 viewers from around the world. Thus, by 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 that exist informally as potentials of significance within the work. First of all, notions of crisis, destruction and history resonate throughout the entire exhibition. Several works portray an image of Kassel and its Fredericianum as sites of the destruction of war, as part of a history to which the existence of Documenta is strongly connected. It is thereby easy to imagine how, in a moment of war, all the windows of the perhaps evacuated building have been broken, leaving the huge empty room for the wind to play with. In addition, as I observed 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 theme of *History as an Angel* appeared as an almost secret leitmotif in several of the exhibition venues. In my mind, that concept resonates most strongly with a song by Laurie Anderson, which she has borrowed 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 developed the image from a drawing by Paul Klee, *Angelus Novus* (1920), which he apparently owned. The drawing, which was 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)

Figure 78.
Inside the lift.



SKYVELÆRE # 5

The interior of the gallery 3,14 is studied and revealed in a time-lapse video that is on display inside 3,14's small, antique lift (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 shows the gallery room in a slow movement that pans on both the vertical and horizontal axis under shifting light conditions in a circular loop. The automated camera movements echo the time-lapse described in Chapter #1, where the camera is mounted on a solar tracker and thus follows the rotation of the sun. The same procedure is repeated here, inside the gallery. However, the flow of images is smoother since all changes in light and inclination progress evenly without any disruptions to break the appearance of continuity.

The film traces the path of the sun over a period of 24 hours reduced to 3:38 minutes. An observant viewer will recognise the pattern of speed and movement from *Skyvelære#1* and realise 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 changes occurring in the natural light, but these are corrupted by the changes in the artificial light 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 26 March, a few days after the first day of spring, the *vernal equinox*.

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 regarded 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 people 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 pointed end (Figure 82).

In the time-lapse, day and night are of approximately equal length (Figure 83). The camera therefore pans across the ceiling, floor, and the west and east walls for 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



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

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



Figure 81. (a)
Stills from the time-lapse.

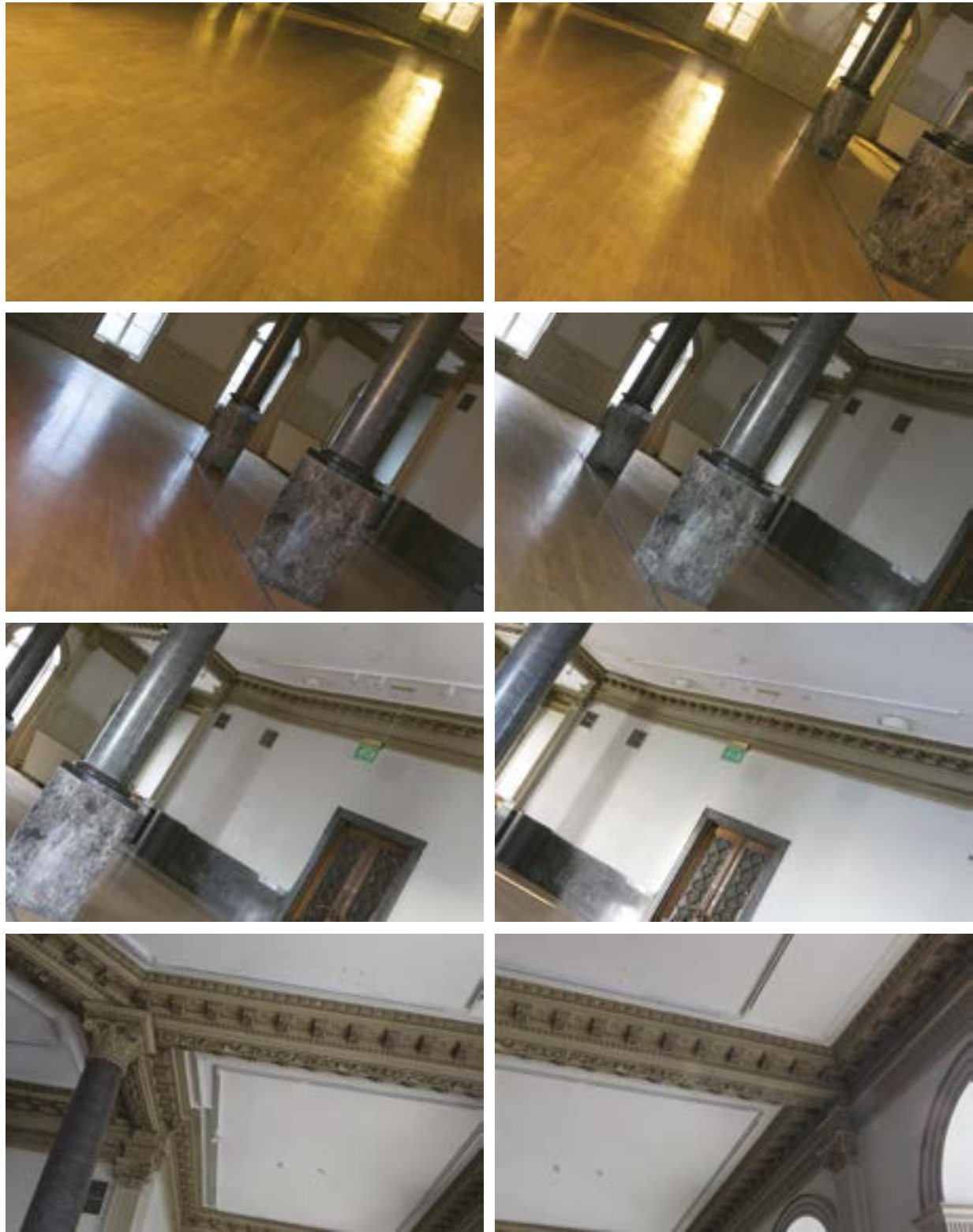


Figure 81. (b)

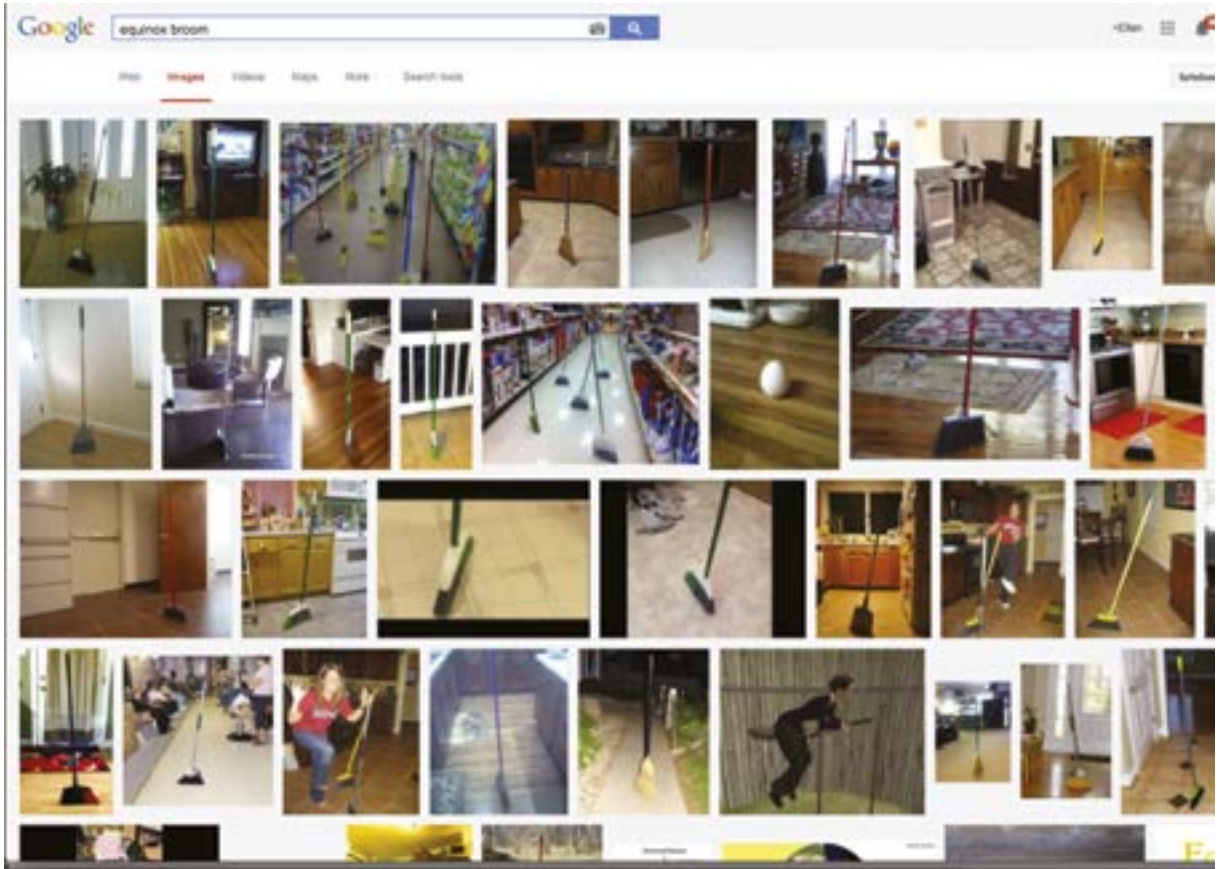


Figure 82.
Detail from Google Image Search on equinox and broom.

described in *Skyvelære#1*, where the sun never sets, and the camera therefore 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 time-lapse from within the gallery never displays the sun, and few negotiations are revealed by the smooth and automated movement. On both axes, the panning, 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, treating the gallery as an object of observation.

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 without interruption. Having already completed the calibration, positioning, alignment and adjustment of settings on the 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 take 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.



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

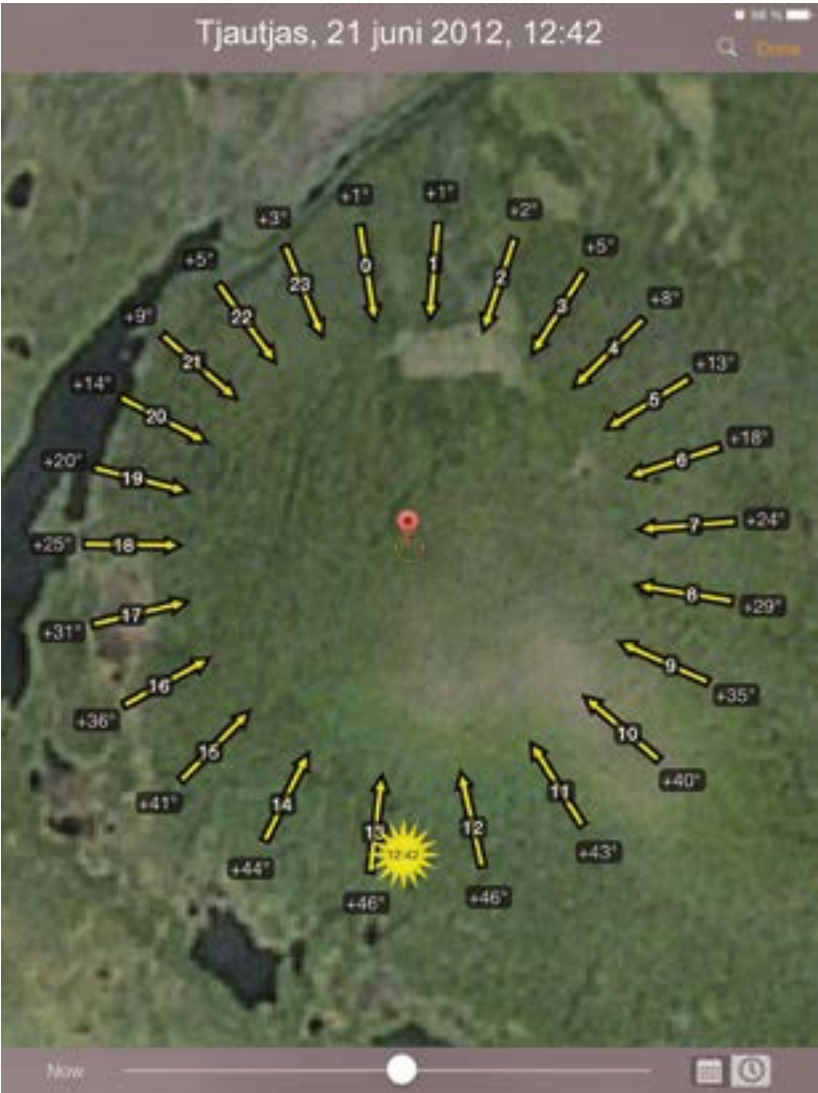


Figure 84.
The screen-dump from Sun Seeker; 21 June in Nikkaloukta is an extraordinary situation in terms of inclination.

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 striven 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 make irrational decisions at any moment, the devices and the site will be seen to have reached a peaceful agreement.

There is also a dialectical relationship between the two time-lapse videos. The first, which dominates the exhibition upon entry, provides a reading key to the latter, hidden away in the lift to be discovered later on. The viewer needs to recognise 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 a 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 to be a radical gesture. This is an activity afforded by the solar tracker, so I am merely realising its potential. From such a perspective, devices are objects that carry properties that allows or invites 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 of the sun. Affordance, in other words, is a potential embedded in the relationship between the thing and an individual who might act with it in a certain way. Psychologist James J Gibson coined the term affordance in ‘The Ecological Approach to Visual perception’ (1979). It is currently regarded as describing a relationship 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 realised by mounting complex precision instruments 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 documentaries portraying nature.

Occasionally, and increasingly often, solar tracking time-lapses also appear in the 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 because they offer a vision that is not otherwise possible to achieve through human sensory experience. They may be regarded as revealing 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 a solar tracker to track the sun once you have access to one. 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 in the sequence of images. It is possible to move the camera manually, but applying a motorised and automatic device to reposition it makes the procedure more transparent since the motion appears to be smoother and more continuous. A motorised solar tracker like the ST-1 has a potential to be 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: tracking the sun and automatically repositioning 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, the artist duo *semiconductor* explore ways of perceiving the world in the natural sciences and often propose 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*, which 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 across 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 in the second part the procedure is repeated inside a Victorian greenhouse. 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 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 Hollywood film industry. One of the particularities that characterise his films is the way he treats nature, or landscape, as such a prominent backdrop to his plots that it permeates the sceneries in 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 triggered 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 to relate 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 observes them from within the forest. The forest also protects them by shielding them in its density and revealing their enemies one by one, to be defeated as they approach. Conversely, 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 a different kind of process, one evolving at a much slower speed than the one Kit and Holly have 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 Malick's works, 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 down to something individuals have, has been challenged by less anthropocentric approaches taken 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 take 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 regarded as having their own potential, carrying meaning that occur in the relationships of which they are part. Most objects can also be manipulated, overturned, ignored, pushed, torn apart, or cut up. In addition, all kinds of errors occurring during such activities can 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-minute-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, Lucier had at this point a strong interest in landscape as well as in using video as a tool for 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 the images, thereby destroying its potential to record 'unmarked' images. But Lucier embraced this effect and persisted. She let the sun carve, like a chisel, into the picture tube during the 30 minutes of the recording session, thus inscribing its path onto the images. As she repeated the procedure six times, new scars, each reflecting the path of the sun on the different mornings, were carved onto the sensor. Since the Earth slowly rotates around the sun, the path was slightly different each day, and these scars, displayed as a white, burned-out line on the screen, accumulated. On the seventh tube of the installation, the image is therefore marked by seven different traces of the sun's trajectory through the burning force of its luminosity. Far from realising 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 Malick's work, she renders the sun not only as a protagonist, but as a powerful agent, a writer, and a destructive as well as a creative maker of maps, since 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 them as open-ended, *reciprocally structured interplays* of human and non-human agency. Scientific practice, he claims, involves a *dance of agency*, which is 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

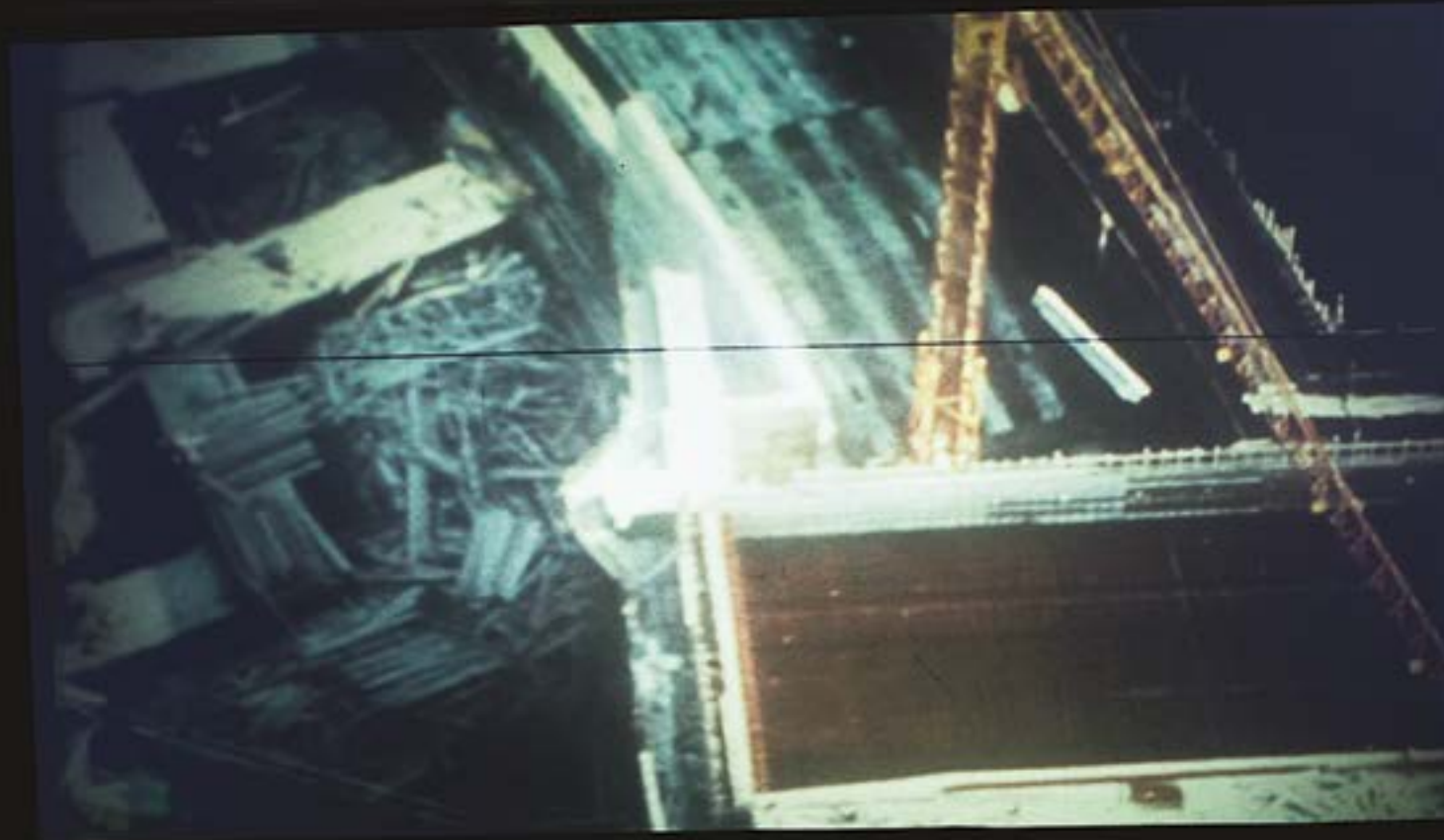
Through the presence of acts of negotiation and tuning in, the large projection described in *Skyvelære#1*, the time-lapse projected from the tower, the sun is treated as a subject. Rather than being seen as an impassive object, the sun can be considered as a dynamic process with a specific agency. The position of the sun appears as an ideal to be striven 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 it 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 lift, 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 inside 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 if for the first time, as if directed by the devices.

My approaches to making solar tracking time-lapses explore representations 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 terms, calibration to a given reference has appeared as a way of tuning such agencies to 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 the imagination of the receiver. From such a perspective, representations are more than stable, mediated constructions, they are processes, or part of processes.

As mentioned in the previous chapter, quantum physics offers in the sciences a dual perspective in which the vision of particles, separate entities that are only connected to others 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 in 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*.

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.



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 to 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 whose screen we see. A panning movement, achieved by adjusting the framing and position of the slides, transports the gaze around the surface of the image. It is a slow and hesitant motion through 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 recognisable through a thin black line, almost like a slit in the image, that crosses it horizontally, providing a clue to orientation. The video sequence lasts for 32 minutes, and repeats the procedure of navigating around the images 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.

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 at CERN during the initial phase of construction in the 1960s. They show the construction site 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 that is 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 depicted site, its geography and scale are confusing. The slides are aerial photos, some taken from directly above, while others appear slightly angled, shot 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 panning movements.

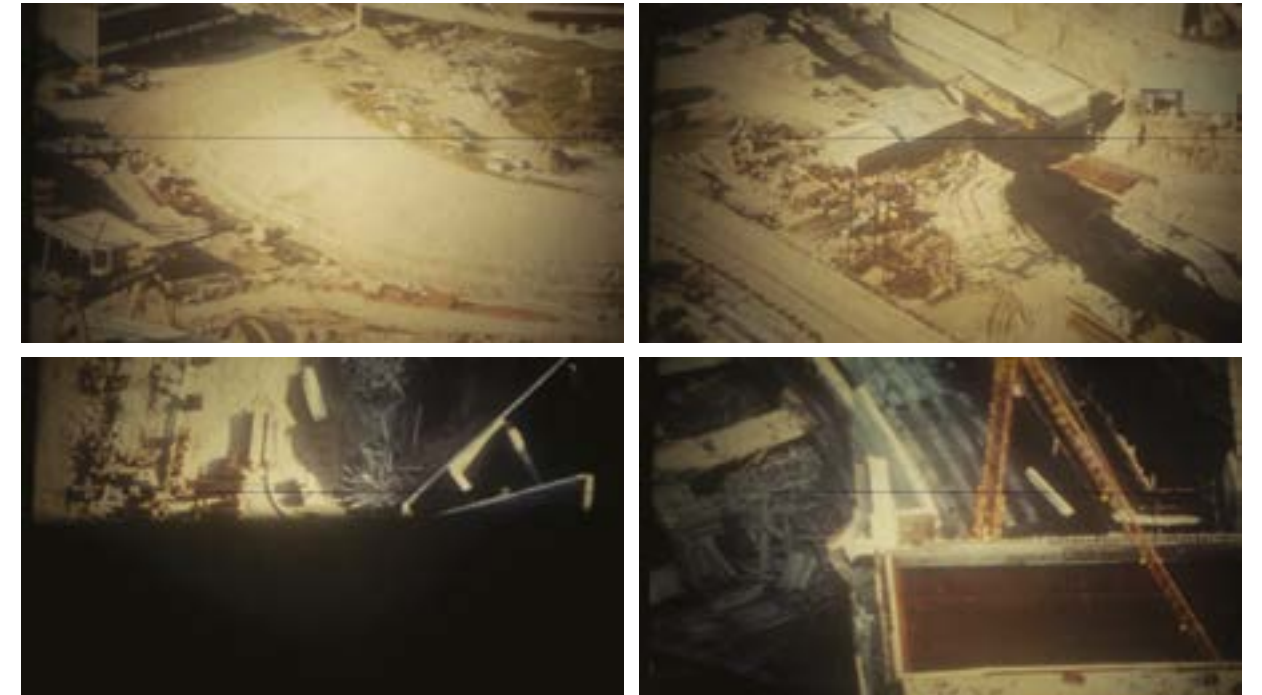
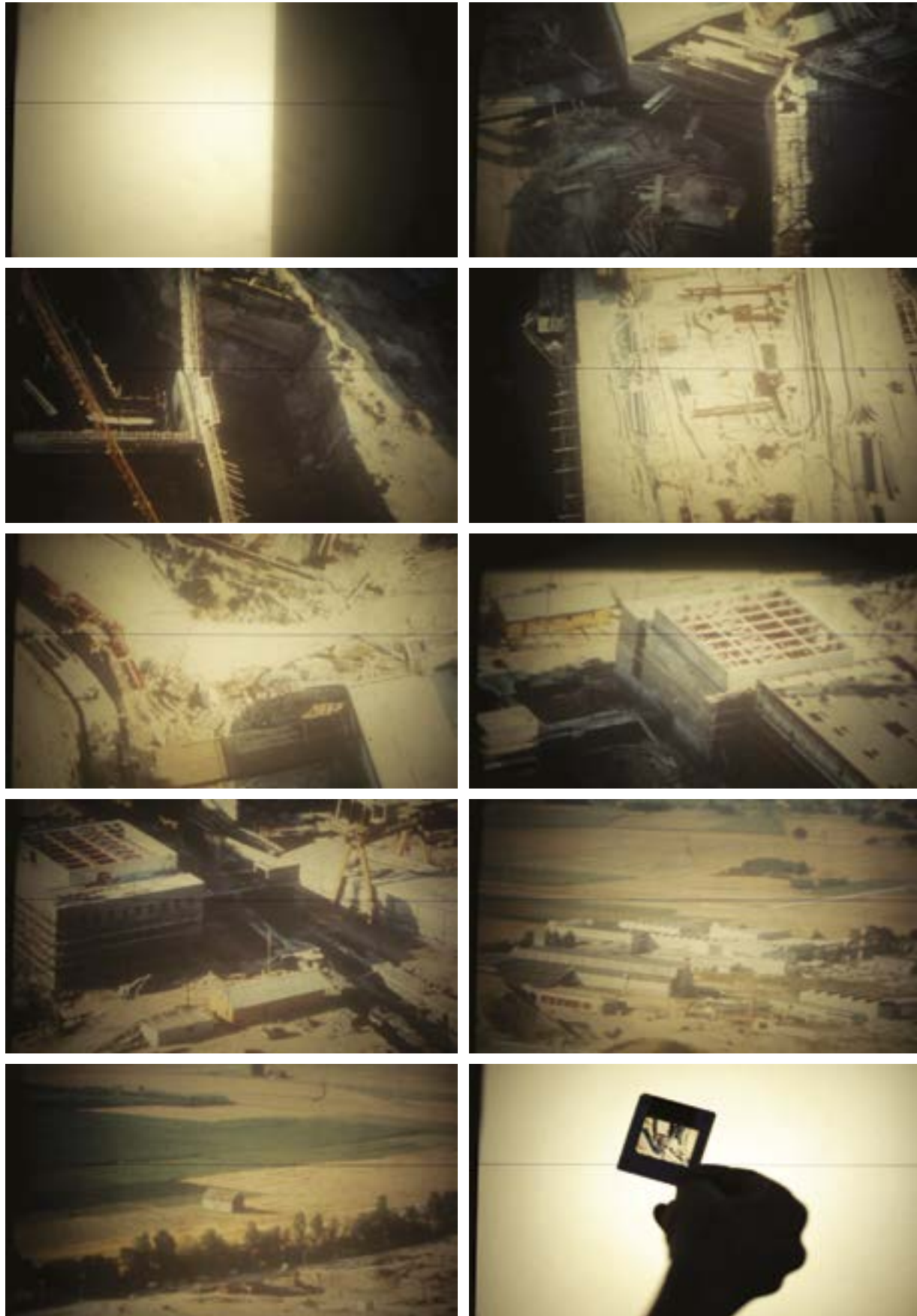


Figure 87.
Video stills.

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 would reveal themselves as particularly interesting. But we were both starting to realise something, recognising 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.

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 period 50 years ago, when CERN was in its initial phase of innovation and construction.

There is a contrast between the authority imbued in 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, which, due to the perspective, appears as something intimate. As mentioned in Chapter #2, the collection of slides also provided an entry point to CERN and its history, and allowed us to navigate within the labyrinth it constitutes. The slides expressed the prevailing cautious political optimism and sense of innovation that was also reflected in the sheets of dusty images of the 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 in 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.

This image of the scientist as a skilled practitioner has resonated throughout the process of working on *Skyvelære*, and I have traced stories and collected anecdotes about 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 was 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 by 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 by drawing. Today, many such tacit and personal aspects of scientific work that are not accumulated by scientific formalities seem in some respects to have 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 appear to be abused in any way. 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 elements such as the truck, the crane and the barn are recognisable to the viewer and provide reference and a sense of scale in the perception of the images, they fail to provide stable information about the significance of the images, since the movement of searching through the landscape continues as if something else is at stake. The gestures of searching and panning destabilise the significance of the images and leave them negotiated but still open-ended. These performative gestures produce questions rather than answers as to what we might be looking at. The pictures of the site that is about to become CERN, a large area of the village of Meyrin outside Geneva, become a *site* themselves 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 artwork 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 a concept that is activated by performative practice. This is coherent with my understanding of how performative actions contribute to shaping 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 because 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 believe that the corresponding

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

Another approach to reading landscape can be found in the *California Trilogy* by 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 portray 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 lasting for 150 seconds. This form directs our attention to what is happening in each shot through a remarkable insistence on the presentness of each part of the landscape, but without providing references or clues that could point towards a specific significance. The landscapes are seen as unfolding processes as a result of Benning's careful reading of them, and there is no apparent logic that reveals why he has chosen one particular motif and framing from 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 to make up 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 characterised 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 that is further emphasised 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 produce 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 will – writing creates 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 film as a medium structures perception and constructs time.

Through his charting of digital media, Lev Manovich acknowledges that the visual culture emerging through the digital media is cinematographic in its appearance (Manovich, 2001). In line 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 organised and accessed in digital media. The computer stores and organises information in databases as discrete elements that maintain their independence even when combined into larger objects. These elements can be accessed algorithmically and they manifest themselves through non-linear structures that can be instantly and dynamically manipulated and re-distributed. In cinema, on the other hand, time is manifested through a given structure. It seems to me that Benning, far from attempting to break with this form, imposes structure with such formal rigidity that he frees the gaze by subverting narrative in such a way that the gaze can 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 them with a conceptualisation of place formulated by Michel De Certeau, who considers space to be a *practiced place*, organised 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 Kjell Johnson’s collection serve to activate the spatial layout of the images as a visual and historical landscape that is turned into a *site*. This happens through the non-linear movements of searching and adjusting the frame and focus, and it implies that the transformation from image to site takes place when the images are transformed into a process that unfolds in time. Miwon Kwon confirms the viability of this idea in 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 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 give their experience structure. They want to connect with nature in a way that transforms it from being a remote idea or image into something tangible that they can form an active relationship with.

In the field of electronic art, inquiries about landscape seemed to belong in the 1970s, when 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 the relationships between landscape, the camera and the recorded image. Until about a decade ago, artistic inquiries employing electronic devices seemed to be more an

investigation of the digital: the prosthetic aspect of the devices, the networks, the sensors, the data. Artists were exploring what these devices could do, how they generated meaning and 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 has 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 recording (e.g. Jana Winderen) and gathering environmental data (e.g. Andrea Polli). They form communities and networks that share 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 analysis (e.g. Brian Degger, Anu Osva). I see such activities as a negotiation about how they can 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 activities aimed at obtaining 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 are data that contain information about how they were obtained. They are data that are 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 might have been stretched to include information about the performative aspects of the situated and embodied gesture of capturing, creating such a distinction also means reserving the term *data* for 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, selected and received them. It also indicates that data are not produced in other forms, but are gathered and that they need no interpretation. I have been interested in the activities and agencies involved when using 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 clings 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 one’s senses and body in a more performative sense. They allow the user to be present in an experience that is 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 feature 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

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

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:





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

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)

In this light, the device, whether a camera or fishing rod, is not an 'excuse', but rather something that 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, devices such as a microphone and headset are used 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 on an early spring morning can, for example, reveal sounds you would otherwise not have noticed, perhaps from birds hiding in the density of the shrubbery. 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 around 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 shifting 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 since they provide a new layer of form and structure. They influence the imagination but they also result from it. They can even be shared, thus entailing a tuning in with each other (Coyne, 2010).

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

The electro-magnetic signals of the Northern Lights, 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, yet 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. Since 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 that is different from 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*, which he developed 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 draws sound and image into a common movement through different forms of synchronisation. 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 not previously connected elements. Eisenstein's synthesis, as well as Chion's *added value*, are notions used to analyse sound-image relationships. They nevertheless appear as ideas that in similar ways analyse how the relationships between media (device), sensory experience and imagination produce 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 to 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 90.
Sonic Pavilion (Aitken, 2009).

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 that was available online.¹ As the devices transform signals into sound, actively using them has a lot in common with the approach in sound art whereby sound is recorded from the environment and used either as raw material for compositions or as it is. Such field-recording activities 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. 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 about 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 gave a performance featuring four live hydrophone inputs from Akerselva river, which runs through the centre of Oslo. Her performance revealed that the river was silent; no sounds were made by living creatures. Just before, the river had been polluted with 6,000 litres of chlorine from a source further up 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 at creating images that can 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 also an ongoing crisis in terms of imagination. As a consequence, there has been a breakdown in how both individuals and governance relate to and respond to scientific knowledge of the natural environment. 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 the narratives that characterise modernism, and scientists lack the imaginative impact and powerful tools of mediation they once had. At the same time, people want to generate their own images, stories and experiences by equipping themselves appropriately and travelling to remote places in order to gain first-hand experience and form their own connections. Recording devices, especially cameras, accompany and shape such experiences and sites, and enable their users to tune in to the natural world we inhabit, and to each other, by producing images.

Field recordings as contributions to knowledge

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

1 www.auroralchorus.com

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 of the bottom, installed 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 realised the exact proposal in Bruce Nauman’s conceptual piece discussed in Chapter #2.

Apparently, the sounds emerging from the hole are deep and resonant, and, as in the example of the Aurora Borealis, perhaps they come as much from the devices used as from the resonance of the hole itself. They would be inseparable, also from the imagination of the listener. *Sonic Pavilion* (Aitken 2009) is a constructed representation, providing a structured sensory experience that vibrates with the imaginative power of the concept originally conceived by Bruce Nauman.

Seth Kim-Cohen visited the Pavilion just before it opened and had a conversation with the artist. In a review, he accused 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)

Contrary to Kim-Cohen’s interpretation, Christoph Cox argues that Aitken’s project is a rich example of the attitude adopted by 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, through Manuel DeLanda, introduces the ideas of Henri Bergson and Gilles Deleuze, for whom nature, including people and their images, consists 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, since 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’s perspective, sound art is 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 in line with how I view the 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 and the curatorial concept of exhibiting living and unfolding processes *per se* in a museum. My interest in considering process from a performative perspective, and with the 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, is a parallel, 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 will remain an open issue, as long as knowledge is regarded as stable meaning. Kim-Cohen’s response to Christoph Cox reveals that the ancient opposition between Heraclitus’s view that everything is flux, and Parmenides’ objection that we need to stabilise the meaning of elements of the world in order to relate to them, is still pertinent.

‘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 can develop meaning that does not need to be stabilised, 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.

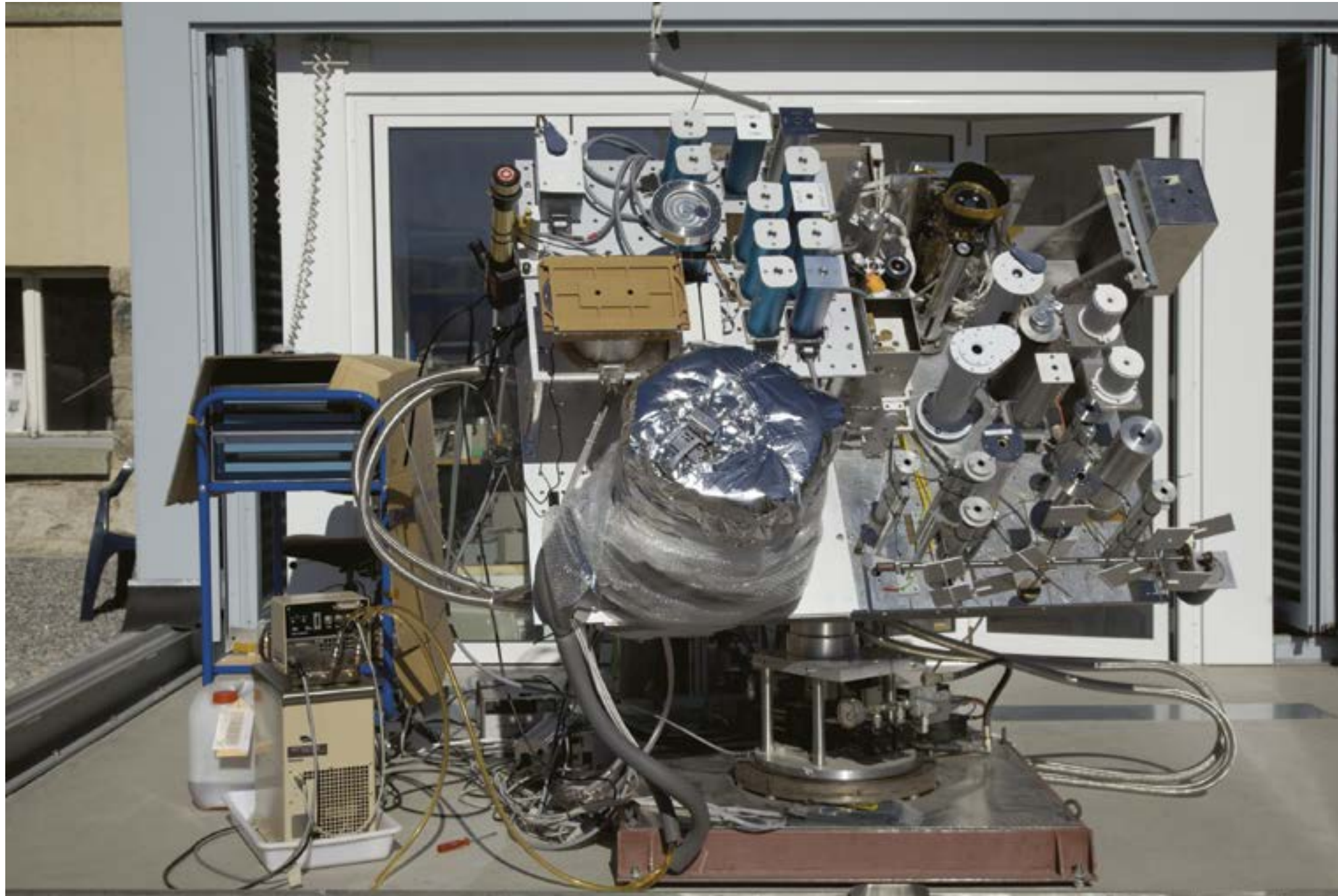
These developments are no doubt facilitated by cheaper recording technology and the connective infrastructure of the internet, but they also reveal a different attitude towards knowledge and reality, and how we inhabit the world. They mark out a post-humanist sensibility where we do not seek to own the 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 since 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 explored, and by gestures of observing, reading, and imagining.

Figure 91.
A group of instruments, including 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, especially 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.



SKYVELÆRE #7

There is also a second work installed in the darkness of the old bank vault, a six-minute-long sound collage that consists of an edited sequence of five distinct but anonymous voices commenting on the notion of an *international standard* from different perspectives.

One voice tells us that the Metre, 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 contained concrete thoughts, but removed them from their context. They seem to originate from outside an academic sphere, because the participants were all explaining to an outsider (me) what they were doing in a simplified and metaphorical manner.

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

In a vault: International standards of reference

The sound piece offers a key that could 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. The piece in itself also 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 above-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 to 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 relativise this authority, but the ideas of standards, conventions, truths and reference may resonate in the minds of the viewers.

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 may inform and renew the experience of the video as the viewer realises 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 in to a shared reference.

I found it interesting to note that, in the 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 the 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.

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

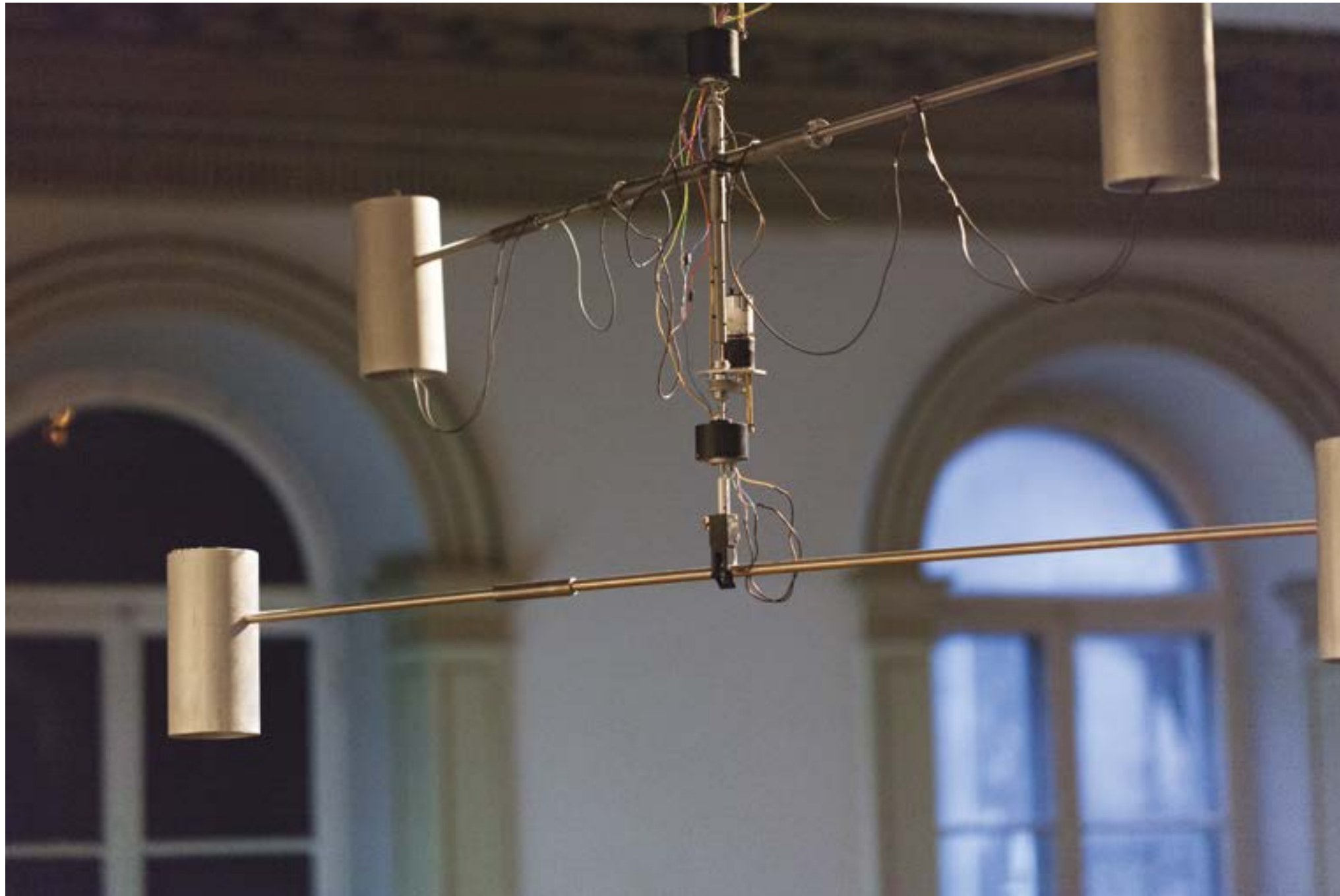
The sound collage provides a key to understanding the exhibition. It can be seen as a way of informing viewers of *Skyvelære* by distributing certain fragmented but articulated concepts, shared within the community of visitors.



Figure 91 (b).
The standard reference for salinity in sea water, in the hands of Svein Østerhus.

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

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



SKYVELÆRE #8

On the southern side of the entrance, a kinetic sculpture hangs 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. At each end of the rods, an aluminium tube hosts a small loudspeaker from which sound emerges. The speed and direction of the arms slowly changes according to a choreographed pattern that lasts for 28 minutes, the intensity alternating with the sound (Figure 94).

Depending on where the viewer is standing under the sculpture, the layers of sound will pan slowly above her head, and change as the speed and distance alter its effect. If the spectator stands just below the moving loudspeaker, the sound will appear to be approaching, passing over her head, then continuing beyond. When passing over the viewer's head, the sound is clear and distinct. Further away from the loudspeaker, the sound turns into more ambient textures that blend 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 does not have the sensation of it approaching and passing over her head.

The soundscape corresponding to the movement is composed by Signe Lidén. There are four separate sound channels, each assigned to one of the four loudspeakers. They are emitted 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 frictional 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).

A spotlight casts a shadow of the kinetic sculpture onto the wall to the right of the door, echoing its movements as a pattern of light (Figure 95). The shadow also repeats the images of shadows cast by a rotating device 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

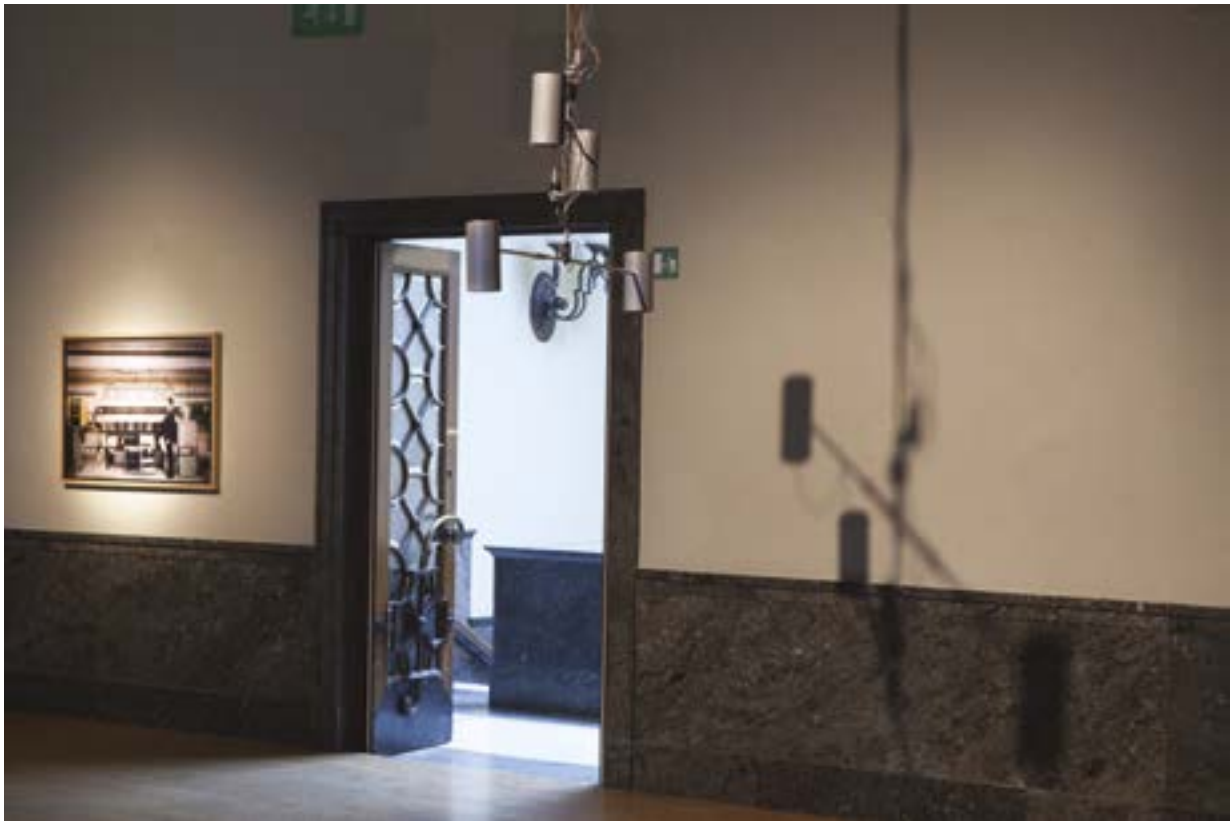


Figure 94.
The rotating arms of the kinetic sculpture accentuate and contrast the rotational panning movement of the video.

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

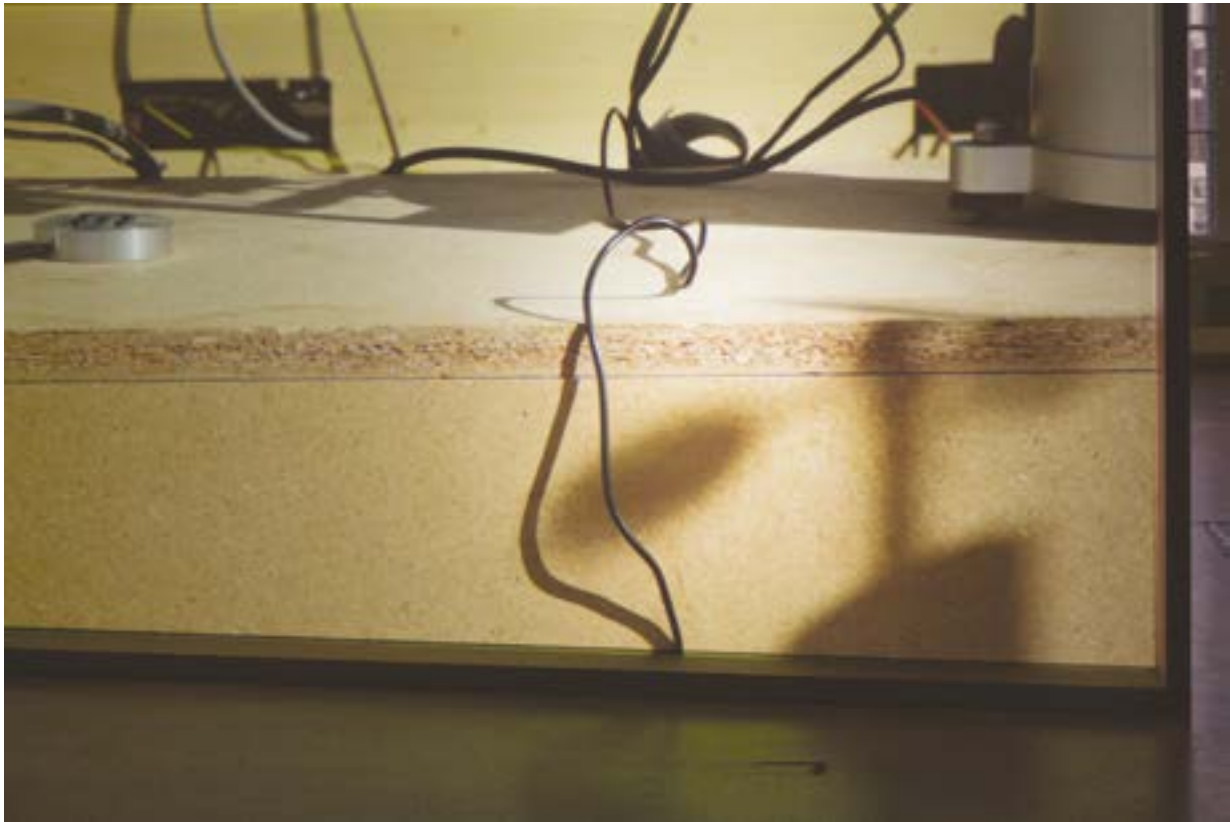


Figure 97.
Detail: A shadow of a rotating anemometer in the video projection.

Figure 98.
Listening to the moving sound.

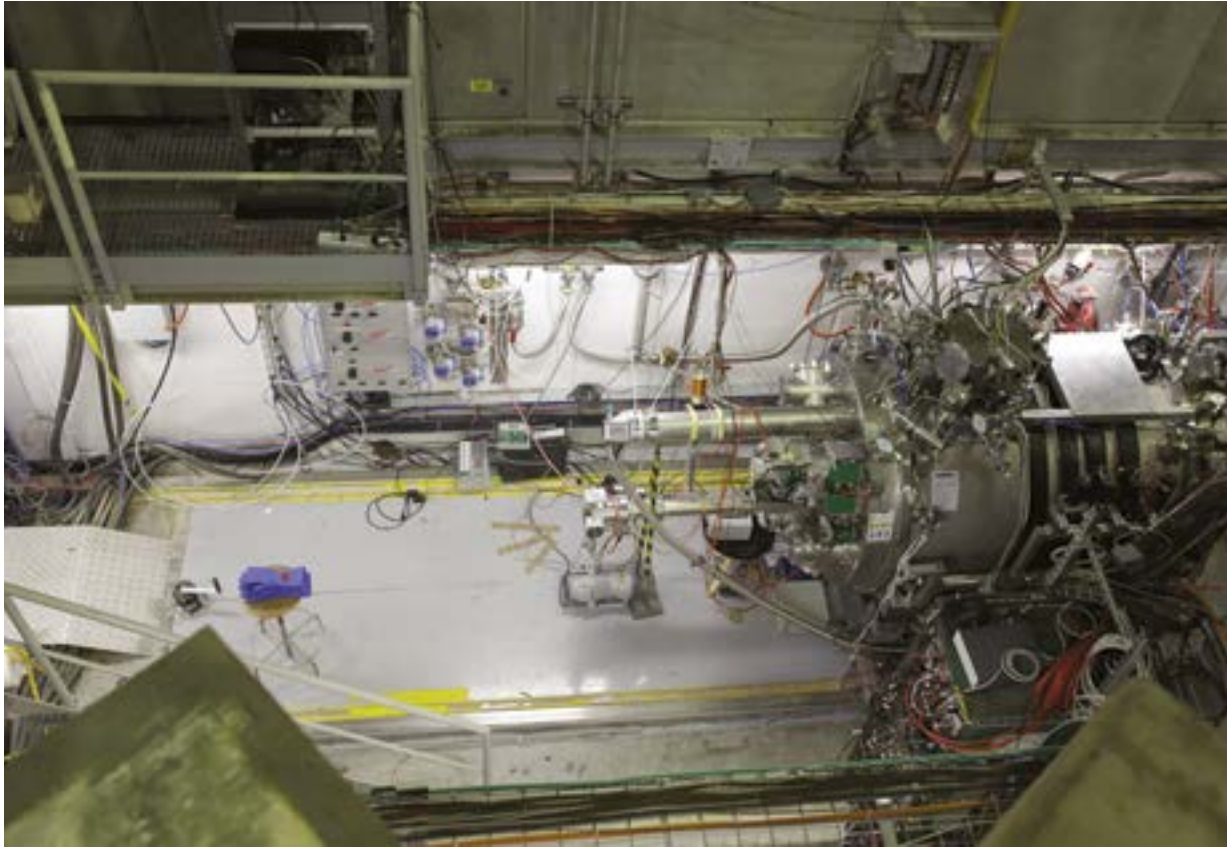


Figure 96.
Small detail from a lab connected to the Proton Synchrotron at CERN.

off-the-shelf components, while the rest have been developed through experimentation. The result is clumsy and yet elegant somehow. The aesthetics of the sculpture are 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 its functionality. It is a part of the work that makes reference to the natural sciences and to their custom-made technology.

Head, Shoulder, Knee and Toe

The sculpture enables and articulates a dynamic relationship 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 how the soundscape changes above her head, or by moving about to navigate more actively around the continually evolving field of sound. Standing still under a speaker, the viewer will hear the field of sound slowly intensifying as each sound node approaches and then 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.



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

The sculpture contributes to the ambient soundscape of the exhibition space, blending with the more horizontally distributed sound of silk skirts in *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. My intention was 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 uses 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 sound different depending on 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 a device or apparatus, a constructed mechanical and motorised *machine*, to the exhibition. The sculpture echoes, summarises and complements 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 were itself actively operating according to an assignment where it is expected to perform 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 the latter were instruments that were themselves negotiating, that had distinct moods, ambitions and temperament, the movements and soundscapes of this kinetic sculpture unfold in a more indeterminate way, they are merely drifting. The tuning and navigation is handed over to the viewer, who may act upon the invitation to experience and 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.

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 projected 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 since 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. However, through the very nature of its construction, it would also be an unreachable ideal. Due to this inherent contradiction, the attempts to achieve balance would cause the image-circuit to be constantly tweaked, repositioned and realigned.

Through *Utopian Mobile*, I was aiming to create 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 on a swing. I never managed to recreate the push mechanically. After a few minutes of operation, the different parts swinging, cranking, and moving pendulum-like, the system would quite simply calm down and settle into a position of balance. I had wanted the sculpture to be an independent system that unfolded 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 with 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 and 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 acquiring knowledge in general or in 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 in the world. Narratives about a real world must therefore contain a form of reflexivity or reciprocity, as in a conversation. By changing the mode from story-telling to conversation, nature and the world are not reduced to passive resources in 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 occurs based on the premise of equality.

Another layer of engagement, occurring in the response of 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. Since that was not in accordance with my intentions, it was left 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 that I had gathered during my fieldwork through a *machine*. However, as it developed, I realised that spoken words would have the authoritative effect I described in the previous chapter, and that, just as Haraway points out, in this context the telling of stories would have the opposite effect of 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 closer relationship between the sculpture

and my conceptual process that led me to make 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 to my extensive 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 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, although I nevertheless acknowledge how they have had a profound influence on my artistic work and understanding. It was my interest in Odd Dahl that led me to my being granted access to the archives of CERN. His presence in *Skyvelære* is not apparent, 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 based on her careful listening to the almost inaudible frictional sounds of the machinery of the Proton Synchrotron. As a field recordist, Lidén does not live up to the myth of invisible figures 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 her imagination to reflect on the encounter she is creating, and she continues to create a new reality structured in correspondence with the framework provided by the sculpture and its movements.

While creating the composition, Lidén spent time with the sculpture, tuning 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. In 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 emerges in the work, in which the machine/sculpture, its movements and the emerging sound composition have been woven together to form a whole, 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 recognises 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).

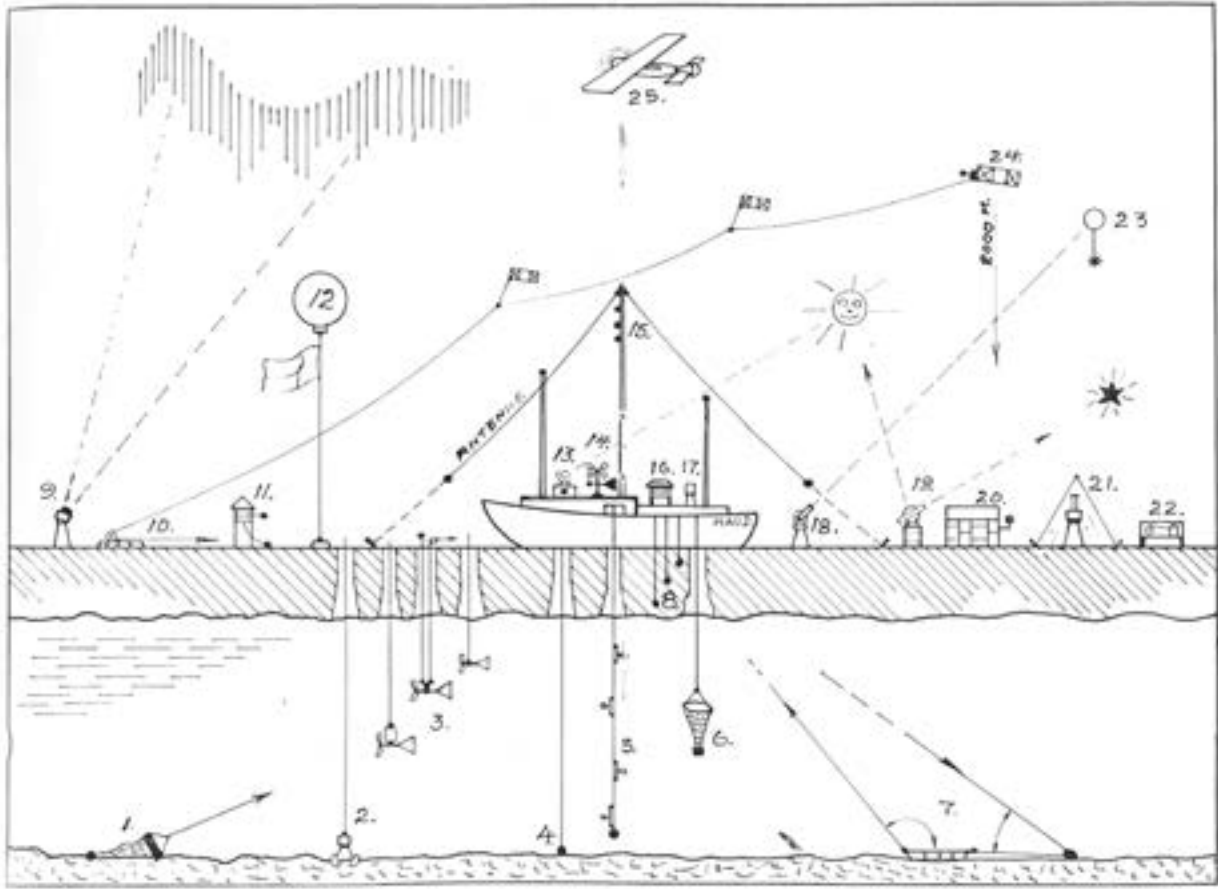


Figure 100. Drawing (48 x 33 cm) by Odd Dahl of Roald Amundsen's ship *Maud* and all the scientific instruments they had onboard during the the Northeast Passage Expedition (1918–1925).

Due to the war, *Maud* had to take the northern route to the eastern part of the Arctic Ocean through the Northeast Passage. The plan was to enter the pack ice north of the Bering Strait and drift with the ice as near to the North Pole as possible, and to carry out scientific collections and observations during the entire expedition. Odd Dahl joined the expedition as a pilot and constructed many of the instruments on board.

(Norsk Polarinstitutt)

The processes that evolved through the Utopian Mobile, my interest in the stories of Odd Dahl (Figure 100), my elaborated and experimental process of constructing a machine and the spectacularity of the Proton Synchrotron in CERN are hidden from view and inaccessible in the final piece. So is Lidén’s experience of making the recordings. Nevertheless, her presence in the recording situation adds a quality to the work that enhances the viewer’s experience of presence. 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.

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 whose 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. Since aesthetic experience is not mediated by concepts, it can silence 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 by conceptualising and reading it. Both in Gumbrecht's view 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. As I see it, 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 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 can 'oscillate between presence effects and meaning effects' (Gumbrecht, p. xv). Over the period of my fellowship project, I have realised that art can act 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.

The performative as data

At the beginning of this text, in Chapter #1, I discussed how data resulting from observation of the environment, such as sequences of photographs, often cannot be compared according to scientific requirements. *Cloud formations* are among the elements that still cause such problems of comparability. In October 2010, in Davos, an invisible stream of sand appeared to have been sucked into the atmosphere during a storm in the Sahara desert. It had entered 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, however, 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 the 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 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 by which meaning can be continuously developed and modulated through tuning processes. In these processes, the observer, the device, and what is observed appear as subjects that are actively present and involved in the production of form.

Images and other forms do not have to be regarded 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 development.

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

Through my experiments with how the performative aspects of producing a form may be present in and contribute to the experience of it, I have realised that even the stillest of images appears as something different from a fixed form. Rather, they can 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 be a field in themselves. 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 dual 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 enables significance to emerge 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 negotiate their relationship with 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. For me, it has served as a way of reflecting upon image-nature-device relationships. My attempt to contribute has uncovered 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* in the field of video art. They were developed in the 1970s, and no longer seem 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, since it is always immersive. Video and electronic art have indeed striven to become immersive, in particular during the past decade. Fortunes were spent on achieving a mere crumble of immersion in huge video installations surrounding the viewer, without any notable success.

The attraction of video in art lies in its resistance to being treated as a pure medium. Video is not an art form, nor any longer a medium even. It is a mode of inquiry that enables dialogue. This is confirmed, for example, by Gilje's work *Blink*, described earlier. Gilje's method of engaging video in conversations with spaces

shortcuts the problematic attempts to create 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 constitutes an inquiry conducted 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, with an era in which 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 properties 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 fine-tuning the instruments every twenty minutes, the camera on the ST-1 and the sun finally appear to be perfectly aligned with each other. Set up in a strictly vertical and horizontal relationship between the marsh and the sun, the camera points directly at the sun, 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 being 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 clouds gather in the sky, and, before I know it, it rains again.

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The artistic research project *Re:place* provided a rich frame of shared interests and sent me on a research trip to CERN. Research in CERN, resulting in a body of collaborative artworks, was conducted in collaboration with Signe Lidén. Two of the works in *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 created with Lidén for the exhibition (Røed & Liden, *Les Conseilles*, 2013).

Christian Blom collaborated on 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.

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Victoria Johnson commissioned several new works that we exhibited and performed in Bergen, Padua and Oslo. Anne Marthe Dyvi has enthusiastically curated my work on several occasions. Hans Knut Sveen performed the *sarabande* on the 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 and Anne Mie Maes invited me to *okno’s Connected Open Greens* and *Pad.ma* worklabs, and Anne Mie 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*, where, the participants’ various approaches to the environment had a significant influence on my thinking. Erich Berger, Andrew Patterson, Julie Freeman, Dave Lawrence, Rozeanne Klaveren, Paz Tornero, and Beatrice de Costa made a particular contribution to my work, especially to capturing the sounds of the Aurora Borealis.

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BIBLIOGRAPHY

Aitken, D. (2009) *Sonic Pavilion*. 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: Harvard 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., & Iunbeck, 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 Francais), 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 brittish 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/>.

Lyotard, 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://solarat.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, Massachusets, 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). *Heliocentric*. Retrieved 01 06, 2014 from Semiconductor: <http://semiconductorfilms.com/art/heliocentric/>

semiconductor. (2011). *Inferno Observatory*. <http://semiconductorfilms.com/art/heliocentric/> [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.

Steggell, 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.toriljohannessen.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 Kunstnersenter: <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].

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Ellen Johanne Røed, (b. 1970) is a visual artist educated at Trondheim Academy of Fine Art, NTNU (2001) and the University of Oslo (1994). As part of norwegian art collectives Verdensteatret (1995–1996) and Motherboard (1996–1998), Røed developed a devotion towards interdisciplinary forms, temporality and performativity that she continued to explore during her studies. Her practice evolved through a particular real time experimentation with moving images and their relationship to space, sound and other media. Using various electronic media she explores how video works as performative gestures.

Røed operates in cross disciplinary contexts and has collaborated extensively with artists from the field of music. She worked at Bergen Center for Electronic Art (2002–2004) and at Bergen Academy of Art and Design from 2004–2013, first as Assistant Professor and later as a Research fellow in Fine art. She recently completed the Norwegian Fellowship Programme in Artistic Research and is currently Associate professor at Oslo and Akershus University College.



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