workshop forecast may 7-16, 2014
exhibition turbulence nov 8-29, 2014

graz, austria

introduction

This brochure chronicles a workshop and an interdisciplinary exhibit. The first was a platform to articulate two different projects into an applied outcome. In the following pages you find information on the institutions and projects involved; a documentation of the workshop in a diary format, and a documentation of the exhibition. This is not only the purpose of this documentation, but also to expand a debate of interdisciplinarity within the academic milieu, as it attempts to find languages and formats of bringing academic research and production to the public – within a dialogue between art and science.

The two different frameworks that came together are the "Forecast" workshop and its unfoldings into the exhibition "Turbulence: a climate sound portrait". One framework is the EU funded project ADRIART - Advancing Digital and Regional Interactions in Art Teaching, which offered a course entitled "Responsive Art in the Public Realm" in an international consortium among four universities. The second project "SysSon" is an Austrian FWF funded research project that aim to sonify climate data. Within these two settings, our aims was to explore ways of setting the realms of interactive art and sound in dialogue with scientific data and digital techniques, while contributing to the contemporary debate on climate change with researchers, teachers and students.

CONTENT

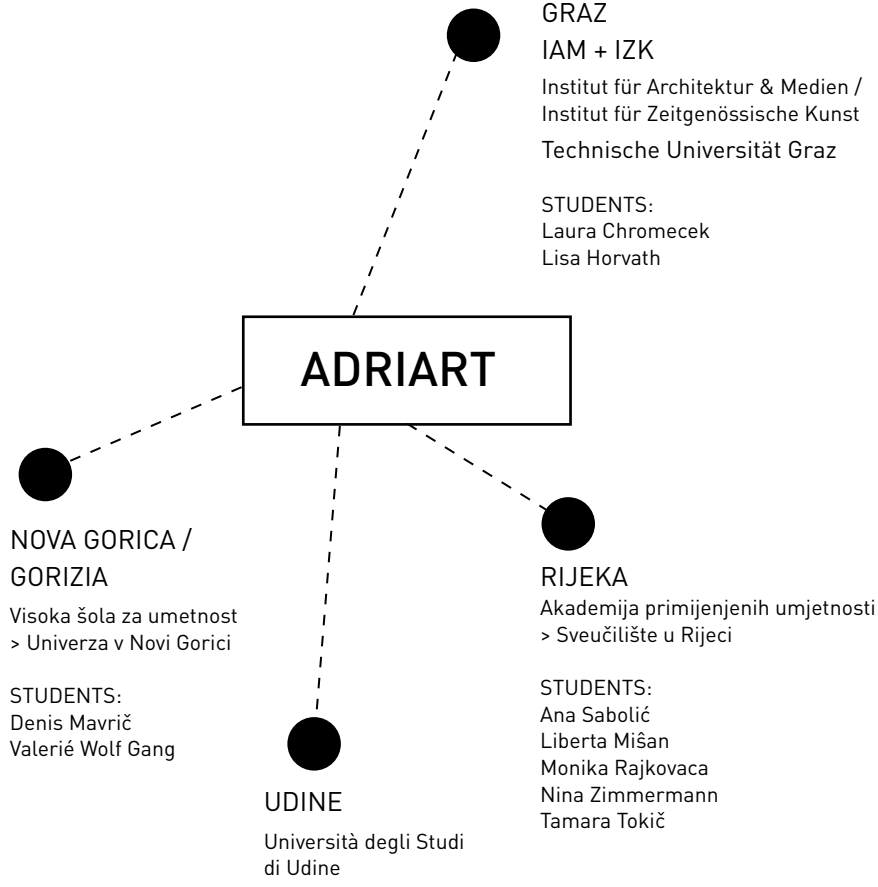
The data space observed emerges out of a net that is stretched over the globe and is monitored during a long period of time. How can that complex data space – as it is produced in climate research – be shown through sounds in a microclimatic exhibition space?

So far, researchers have focused on artificially simulating the development and creating visual representations of this data. Yet, this project wants to represent that heap of information using another dimension of our senses: hearing. The data collected is translated into sounds, this means the data becomes audible.

The task of the workshop was to create a spatial ambience and a sensorial interface to display the sounds – which resulted from the process described above – and to interact with them. The final installation is presented in an interdisciplinary exhibition in the Forum Stadtpark Graz, aiming to make this particular research tangible for a broader audience. An immersive spatial setting displays sensors that transform the impulses given by visitors into a modulation of the sound patterns.

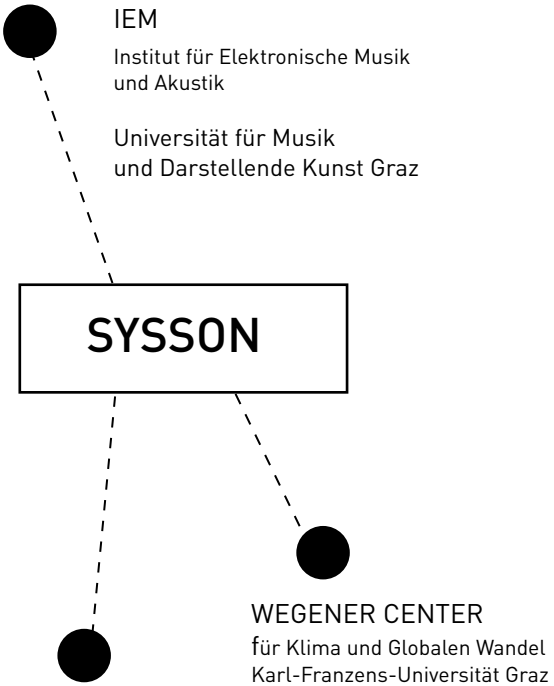
cooperation framework

FORECAST - WORKSHOP
Responsive Art in the Public Realm



EXHIBITION - TURBULENCE

FORUM STADTPARK



1. ADRIART

ADVANCING DIGITAL AND REGIONAL INTERACTIONS IN ART TEACHING

The ADRIART project developed an international master study programme in contemporary arts and applied practices named MAP - Media Arts and Practices, aiming at the areas of audio-visual arts (film, animation, photography), inter-media arts (spatial, new-media, trans-media) as well as (historical, theoretical, critical) arts discourses.

The complete two-year implementation cycle strongly focussed on short location-specific mobility runs and promoted participation of the best mentors and students from the region. Among four countries and in five languages the programme discusses site-specific (demographical, social, cultural, ecological, migratory etc.) topics in interdisciplinary ways, while stimulating multi-cultural academic exchange and graduates' development towards self-sustainability. Within this context the IAM and the IZK of the Graz University of Tecnology developed in partnership a pilot mobility that combined „discourses and techniques in practice" into a workshop called Responsive Art in the Public Realm.

Partner institutions are the University of Nova Gorica School of Arts; the Academy of Applied Arts at University of Rijeka; the Institute of Architecture and Media and the Institute of Contemporary Art at Graz University of Technology; the Department of History and Preservation of Cultural Heritage at University of Udine.

responsive art in public realm

MOBILITY COURSE FOR THE
MASTER OF ARTS AND PRACTICES

This module aims to combine abstract/theoretical criticism, technical/ technological skills, project development/ management and realization/ documentation of the work in an applied manner. Students were invited to research on creative strategies and development of intermedia artistic projects that work actively with the public realm in its broadest sense. They learned to use both analogue and digital tools that enable interactive artistic installations and/or performances fostering public participation.

It addressed a different but very specific topic and location each year. Location-based partnerships were organized in advance by the teaching/ research team, enabling a challenging and collaborative context for the work to be developed. According to the chosen partners, specific problematic and themes defined the context for students to work with. Grounded on a basic acquaintance of relevant artwork touching the selected theme plus introductions into algorithmic code on a proposed programming platform group projects, were elaborated. Outcomes were tested and exhibited in public. Finally, the reactions of the participants and the forms of interaction were critically analysed and discussed as central plot of the final assessment.

For the first piloting year, 2013, this workshop was developed in partnership with the Kunsthaus Graz. The students were invited to develop an interactive installation for the Kunsthaus BIX façade. The works were physical devices placed in the surrounding public space. When activated by the public, the devices sent signals to the façade. For the second piloting year, 2014, this workshop was developed in cooperation with the SysSon project, aiming at a public interactive exhibition in the Forum Stadtpark Graz, which became also part of the MAP IN MOTION multilocal and multitemporal event series with editions in Rijeka, Ljubljana, Zagreb and Nova Gorica.

iam

INSTITUTE OF ARCHITECTURE AND MEDIA
GRAZ UNIVERSITY OF TECHNOLOGY
RICHARD DANK
http://iam.tugraz.at/

The TU Graz Institute of Architecture and Media is dedicated to exploring and expanding the potentials of digital tools and methods in architecture. Founded in 2004, the institute is active in research and teaching in four main areas: computers as tools (applying and developing new software to support architectural design), computers as media (using networks for creative collaboration), computers as part of the construction process (digital fabrication, mass customization) and computers as part of our built environment (ubiquitous computing, hybrid environments). The guiding principle is that information technology leads to an „Augmented Architecture“: new media aren't just commodities, they expand architecture as a discipline. They challenge architects to redefine the way they design, opening up new forms of making and creative exploration.

The institute is equipped with a digital workshop and an Augmented Architecture Laboratory. It teaches students of architecture both at Bachelor and Master levels. Classes and skills taught range from fundamentals of architectural representation to advanced digital techniques such as complex 3D modeling, visualization, simulation, animation, rapid prototyping and generative methods. Studios offered at Master level take on research-oriented topics, often involving parametric design, scripting and digital fabrication.
Current research projects with external funding are in the area of architectural geometry, parametric design and resource efficiency. Members of the institute regularly present their work at conferences and publish it in books and journals, recently guest editing the Graz Architecture Magazine GAM.10 on „Intuition & the Machine“.

izk

INSTITUTE FOR CONTEMPORARY ART
GRAZ UNIVERSITY OF TECHNOLOGY
DANIELA BRASIL / NAYARÍ CASTILLO
http://izk.tugraz.at/

The TU Graz Institute for Contemporary Art (in German Institute für Zeitgenössische Kunst - IZK) was founded in 2003 and is dedicated to artistic research and contemporary artistic production. The teaching practice mixes theory and research in an applied manner, where students have to realize artistic pieces to be displayed in group exhibitions or in public space. These are often in collaboration with external partners, in concrete spaces of the city of Graz and beyond. The participation in real contests is also a recurrent feature, where students' works have the chance to be realized in a professional setting.

The IZK open workshop offers a large space and different equipment to support the realization of the projects. It is equipped with various machinery - such as wood and metal tools, industrial sewing machine, silkscreen and book binding facilities as well as high frequency welding machine and air compressor for constructing pneumatic structures. Classes and Master Studios are mainly focusing the development of individual or collaborative site-specific works, mainly connected with thematic research on chosen issues connected to the social, environmental or political issues of the city of Graz and beyond.

2. SYSSON

SYSTEMATIC SONIFICATION

The research project SysSon - A systematic approach to develop sonifications (2012-2015, funded by FWF) explores the sonification of climate data in cooperation with the Wegener Center for Climate and Global Change and the Centre for Systematic Musicology, both part of the University of Graz. Sonification requires multidisciplinary knowledge of domain scientists (in SysSon these are the climate scientists), sound designers, programmers, and HCI experts. Within the project, collaborative design strategies were applied to the auditory field in order to develop a more systematic approach to develop sonifications (http://sysson.kug.ac.at/). The developed framework was the starting point for the installation presented within this brochure.

Sonification is the use of non-speech audio to convey information or perceptualize data. Sounds are synthesized or manipulated such that changes in, for example, their location, timbre, pitch, or loudness reflect changes in the data. Auditory perception has advantages in temporal/ frequency and spatial resolution as compared to sight. This opens possibilities as an alternative or complement to visualization techniques. Sonification is especially suited to the preliminary exploration of complex, dynamic, and multidimensional data sets. Furthermore, sonification provides a new means to communicate scientific results and inform a wider audience.

A central outcome of the research project is a user centered auditory platform for climate scientists to analyze data. A current version of this tool has been used for the installation. The SysSon platform gives scientists auditory insights that may enable them to extract previously hidden patterns from data. A variety of sonification models to choose from helps to optimize the auditory display of a data set.

SysSon is an iterative project following a systematic research approach developed with an interdisciplinary team of sound experts and climate scientists. In several user studies and workshops, the climate scientists and audio experts were asked to work together to create and improve features of the SysSon platform. Initial needs assessments and user tests made the work procedures and the terminology of climate scientists clear and informed the architecture of the system. Climate scientists were asked to pair sound stimuli with climate terms and evaluate the sonic features of the tool aesthetically. Correlations between climate terminology and sound stimuli for the sonification tool were assessed to improve the sound design. Intuitiveness, learnability, memorability, and aesthetic preference of the sounds have been the main concerns in this research approach. The sonification tool has also been tested and evolved throughout the "Climate by Ear" workshop where sonification experts and climate scientists worked together.

CLIMATE CHANGE 2014 IPCC

Fifth Assessment Synthesis Report Intergovernmental Panel on Climate Change Adopted - 1 November 2014

Climate in a narrow sense is usually defined as the 'average weather', or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. The classical period of time is 30 years, as defined by the World Meteorological Organization (WMO).

Climate models reproduce observed temperature patterns and trends. Human influence on the climate system is clear. This is evident from increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and a better understanding of the climate system. The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions. The ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification.

Many adaptation and mitigation options can help address climate change, but no single option is sufficient by itself. Effective implementation depends on policies and cooperation at all scales, and can be enhanced through integrated responses that link adaptation and mitigation with other societal objectives. Adaptation and mitigation responses are underpinned by common enabling factors. These include effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods, and behavioral and lifestyle choices.

iem

INSTITUTE OF ELECTRONIC MUSIC AND ACOUSTICS
UNIVERSITY OF MUSIC AND PERFORMING ARTS GRAZ
HANNS HOLGER RUTZ / KATHARINA VOGT/ VISDA GOUDARZI
http://iem.kug.ac.at

The Institute of Electronic Music and Acoustics, IEM, is Austria's leading institute in the field of audio engineering and computer music. As part of the University of Music and Performing Arts Graz, IEM is a multidisciplinary institution whose general mission is to bridge the gap between science and the arts. IEM pursues research and artistic creativity in computer music, sound design, 3d audio, psycho-acoustics, real-time software, and software-based simulation techniques. Since 2013, the IEM hosts the Sonic Interaction Design (SID) lab, where interactive sound systems can be evaluated. Furthermore, it has established a new research focus since 2005 on sonification by initiating and hosting several research projects, workshops, and courses. Domains that have been sonified at IEM range from computational physics, neurology, physiotherapy over climate science to juggling and dance.

As unique characteristic, the IEM regards sonification as part of its research focus in computer music and media arts. The development of the computer into a meta medium in the last decades led to fundamental transformations in the composition, representation, production, interpretation, performance, distribution, imagination and experience of music. Computer music research deals with questions addressing these transformations, aiming at a better understanding of the latter, in order to be able to actively shape and assume them. Scientific research as well as artistic research and practice cross-pollinate each other in this inquiry. The research results are documented in texts, sound works, software and models.

pedagogical approach

As shown in the diagram the workshop is divided into four segments. The following pages highlight the conceptual, technical and subjective challenges that these phases presented to the entire team. The starting point was the notion that, in order to work with art and science a combination of expertise and skills to find appropriate and sensitive ways on how to feel and interpret weather phenomena is required.

To support this, the online and the face-to-face segments of the workshop were especially designed as a gradual immersion into the thematic and into different techniques. Our pedagogical approach consisted of different activities:
1) Upon arrival in Graz, students and teachers visited the facilities of the three institutes (art, media and music) involved in the cooperation; 2) They participated in field excursions to weather stations, conducted by experts from the Wegener Center; 3) Subsequently the first brain storming day took place in-situ at the location of the outcome exhibition (Forum Stadtpark); 4) A "retreat weekend", where invited artists conducted an "unlearning experience", investigating forms of „how to feel"weather. 5) Different prototypes were conceived, tested out and built, leading to a rich discussion in forms of installation and interactive art.

Such a pedagogical approach, offering different layers and modes of encounter, is still not very common in academic practice. Nevertheless, these interdisciplinary and intense modules are becoming an important issue within the discussion of contemporary art and in the general field of education. The propagation of more experiential and experimental learning processes simultaneously contests the traditional vertical and rational modes of knowledge transmission.

2014

APRIL

* research on interactive artistic installations
* exercises in Arduino and Processing

ONLINE

MAY

* welcome, introduction, presentations
* visit and brainstorming at the venue
* visit to the weather stations
* unlearning retreat
* final concept presentation
* building the prototypes
* final presentation for external guests / critique

WORKSHOP FORECAST

FACE TO FACE

JUNE

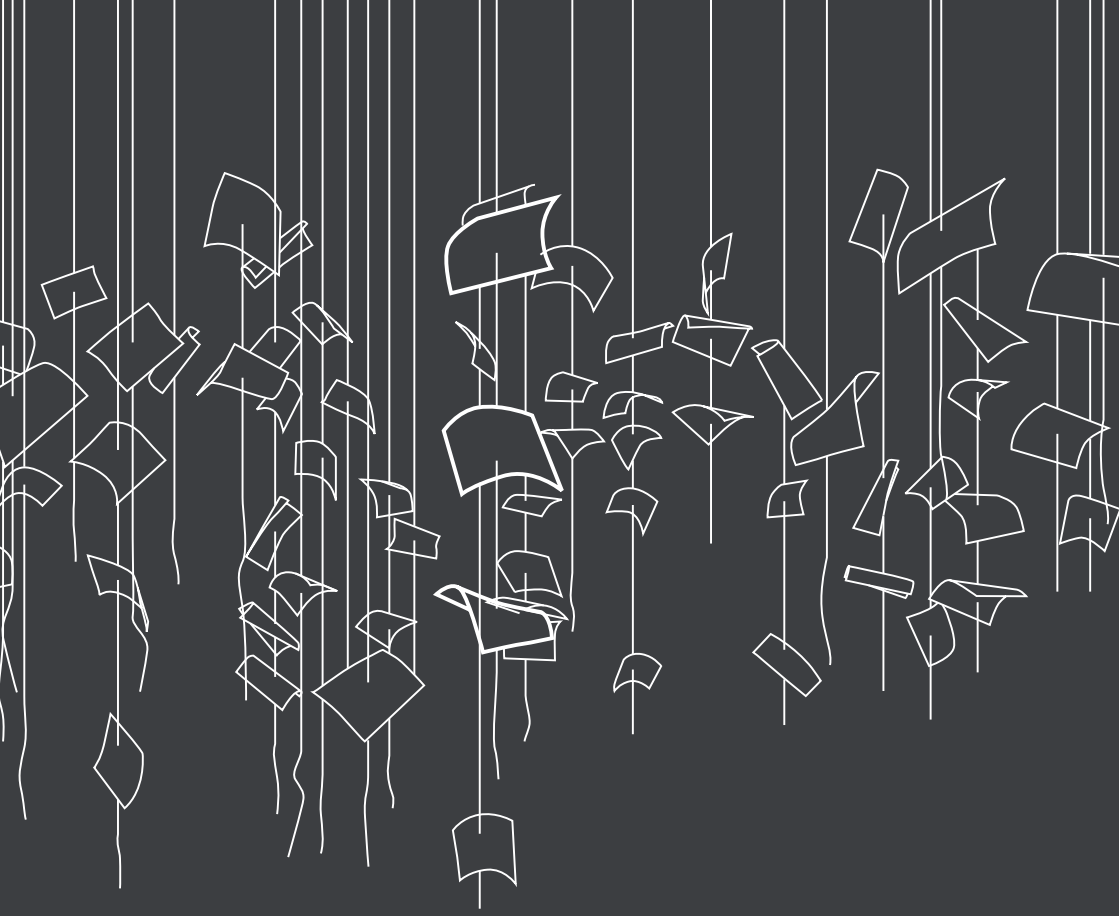
* documentation/ evaluation
* peer-to-peer feedback

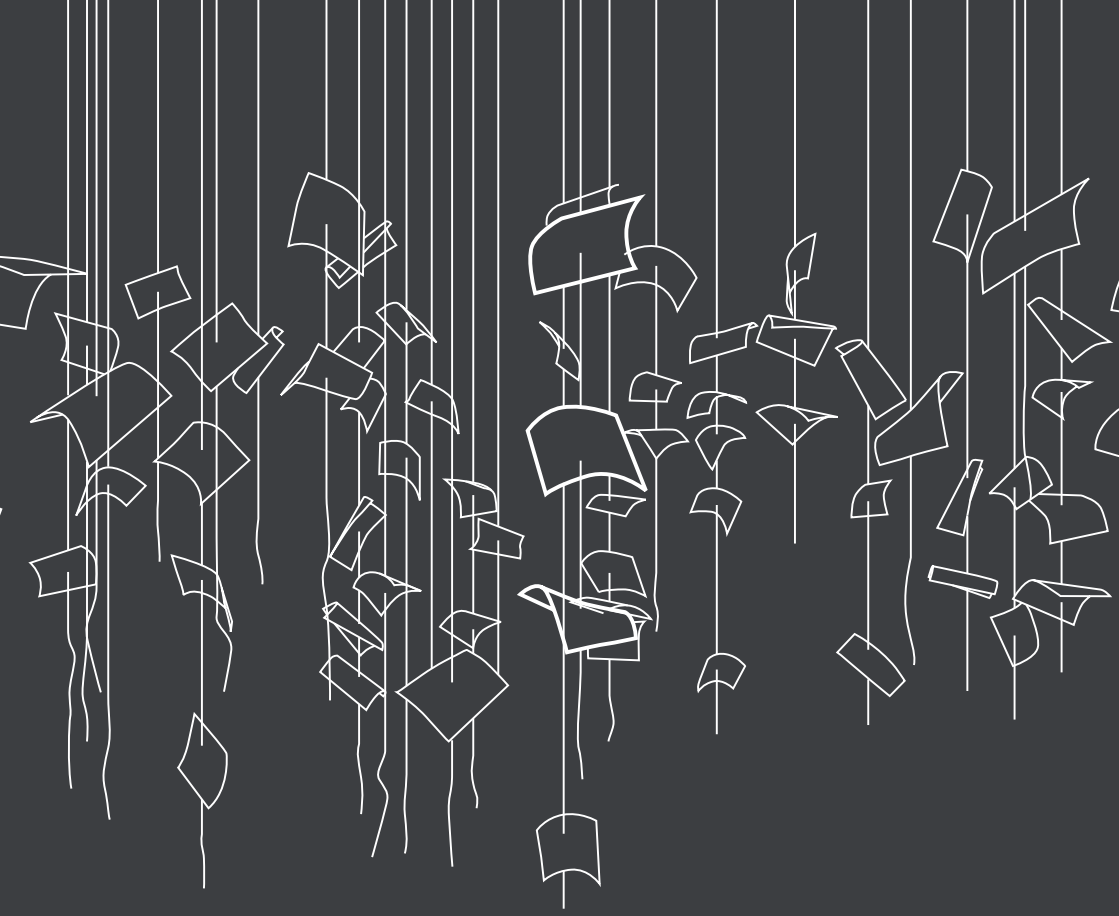
ONLINE

NOVEMBER

* students, teachers and technical assistants work collaboratively to set up the show

EXHIBITION





FORECAST: responsive art in the public realm

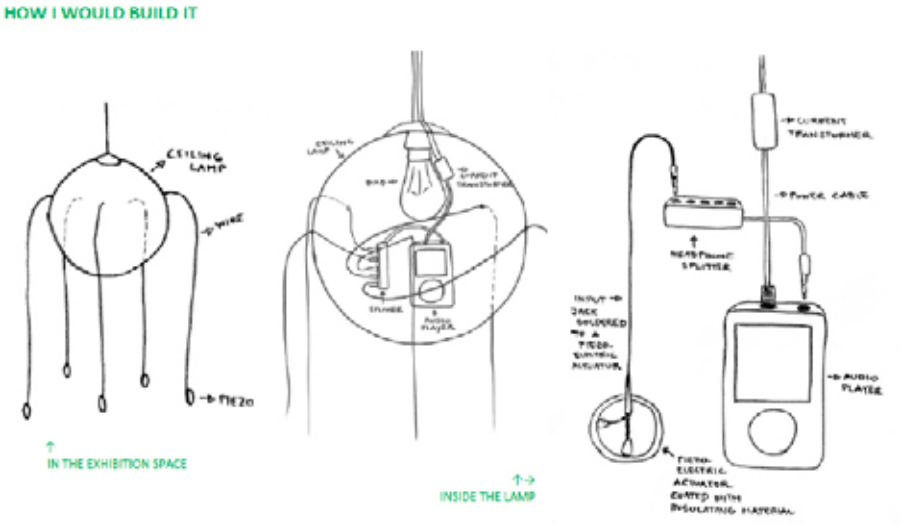
WORKSHOP
7-16 may 2014

Within an intense format that mixed field research, corporeal and sensorial experiences of climate phenomena with a technical introduction to programming, processing and sonification, students developed collaborative artistic proposals for the Turbulence Exhibition in the format of three working prototypes. One was chosen for the show.

on line preparation: artistic research

We divided the research in different tasks where students got exposed to different artists and their methodologies. The first task invited students to research on interactive art works that stimulate the interaction with the public through the usage of technological devices; the second task on the other hand, explored art pieces dealing with climate change and weather phenomena. In both cases, the exercise consisted of trying to uncover hidden techniques that made the chosen works responsive.

Students were asked to draw how they imagined the work was built and to draw the imagined solution of the artist. The aim of the task was to invite students, who are not familiar to build responsive artistic installations, to think about the set up and the artistic methodology employed in each artwork, thus combining the conceptual approach to the reality of the set-up and construction of a piece.



drawings from Tamara Tokić about the installation Solid Sound/Teethphones™, Tao G Vrhovac Sambolec, 2010

prototyping

Today, simple sensors are cheap and commonly available. Due to several open-source initiatives and supporting platforms, the software to develop the projects with is as easily accessible as the hardware is. But the shear number of different units and suppliers is enormous. So after miscellaneous test runs, we finally cut down the options for the students to five unique modules that seemed suitable for the task ahead.

We offered Piezo-pads quantifying pressure, environmental monitoring devices for humidity and temperature, bending sensors that change the resistance on deformation, gyroscopes returning the acceleration around three axes and light sensors measuring color and intensity. (See image: clockwise from the top left corner.)
Moreover, we provided default setups and multiple samples for each category. We gave opening introductions generally into scripting (in Processing) and more specific into utilizing the pieces (with Arduino). And thus, we tried to stimulate the slumbering creativity and the well-kept hacker in each and every one.

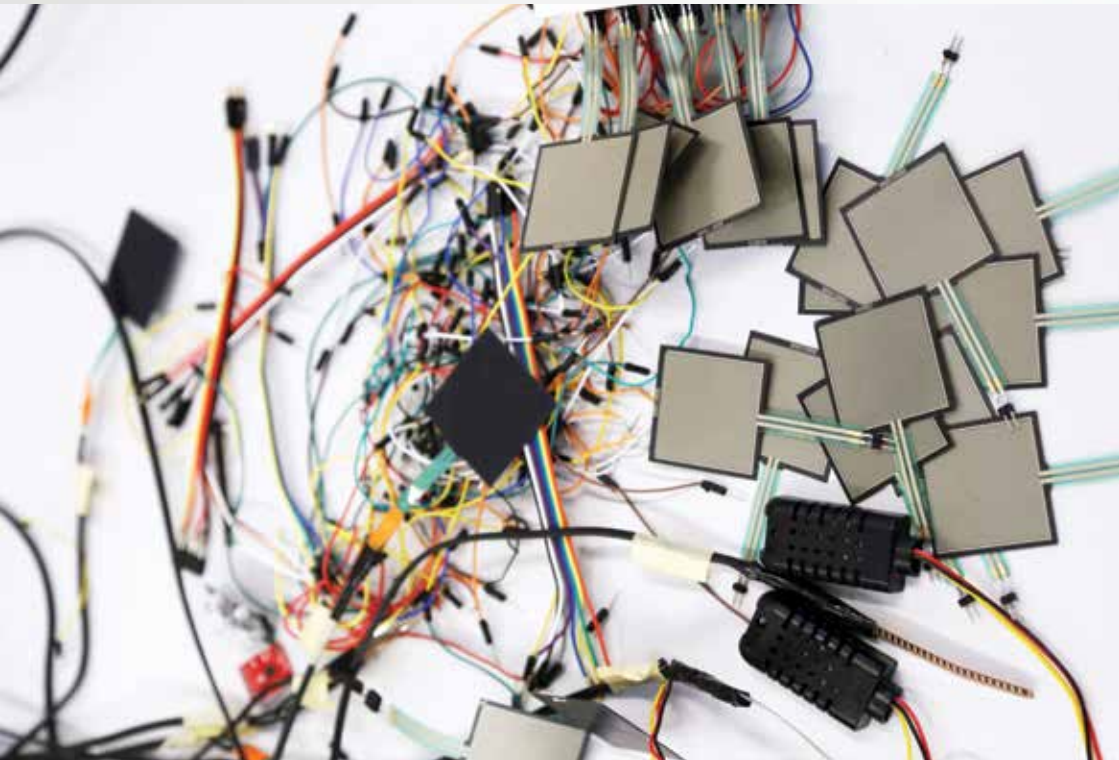
PIEZO- PADS

ENVIRONMENTAL
MONITORING DEVICES

LIGHT SENSORS

GYROSCOPES

BENDING SENSORS



brainstorming in situ

Upon arrival to the facilities, a short introduction with a welcome breakfast made students, teachers and assistants get to know each other in a personal level. After that first welcoming activity a guided tour through the different institutes: Art, Media and Electronic Music, gave physical dimension to the interdisciplinary work, evidencing also the available technical equipment. Contrary to the methodological structure of the first year and most of Adriart blended mobilities, this second Adriart workshop in Graz was designed in a way that students did not have to bring pre-conceived ideas of their projects. On the last experience in Graz, the discussion of personal projects beforehand proved to be unproductive for the discussion in-situ, specially concerning group work and dynamics.

For the teaching team it was important to stimulate above all a research atmosphere. Students were encouraged to get familiar with the fields of expertise and ideas where their project would be inserted in. An environment to get to know each other and the thematic deeply, and finally the possibility to get to know the location of the exhibition, understanding the context even before the brainstorming and developing phase took place. This allowed the workshop to become a complete experience in the conceptualization and creation of art pieces related to weather.


08/5
THU
21,4°C

weather stations

In order to understand weather phenomena and the process of collection of climate data, students and professors were exposed to different instruments in guided tours through weather stations. These visits allowed the group to get close to the scientific day-to-day job of recollection of information and to get a glance on the aesthetic of the technicality of climate research. These experiences proved to be key in the development of the prototypes for the exhibition.

The visits to the weather stations were kindly guided by Ulrich Foelsche from the Institute of Geophysics, Astrophysics, and Meteorology and Alexander Podesser from the Zentralanstalt für Meteorologie und Geodynamik).

09/5
FRI
19,4°C

retreat

With several years of experience in the field of “unlearning”, artists Catherine Grau and Zoe Kreye were invited to conduct the workshop “unlearning retreat”. Throughout their process, they have been experimenting with different forms of de-conditioning modes of thinking and patterns of behavior that are somehow defined by the homogenized educational methods of western culture and transmitted through traditional schooling. For our workshop different exercises that de- rationalize attitudes were employed, claiming the attention of our mostly neglected, but extremely sentient body.

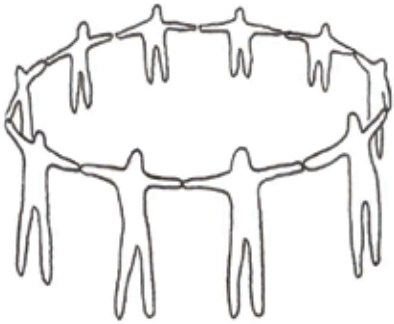
The weekend retreat was a journey to the peak of the 'Schöckel', the closest mountain to Graz and location of its main weather station. The exercises proposed by the artists-duo focused on how to activate our bodies and minds in order to feel more intensely, shifting the tendency to go beyond rationalizing perception of phenomena. As the weather strongly affects our daily moods and energies, students were invited to experience a full immersion in the landscape by exposing themselves to and observing rapid changes in the weather in-situ. They were encouraged to feel sunny, windy, foggy and rainy hours through all their senses.

unlearning exercises

0. warming up > in small groups of 3 people, each person's body is activated through touch and massage done simultaneously by the colleagues

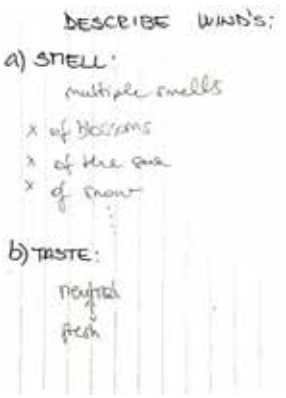
1. collective sensing body > while walking up the mountain, each person of the group selects a sense to focus on. After some time, the each person reports her findings, sharing a wider and detailed perception of space.

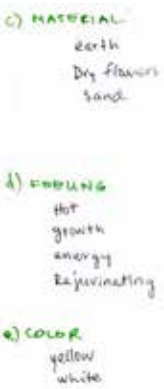
2. becoming landscape > in pairs, each person selects an element of the landscape (a tree, a mountain, a cloud)... and starts a dialogue where they try to verbalize the conditions and sensations of being that element.



3. becoming another being > alone, each participants drifts on the mountain until he/she finds a being that she/he wants to become. In a silent and meditative exercise the participants projects their consciousness to see, smell, feel as that being.
4.feeling the weather > after nightfall and after the storm, participants were invited to step out into the light rain, walk around to find a private spot, take their clothes off and feel the weather with their whole body. The temperature was around 8-10°C.
5. making a collective sound > aaaooooooihhhhhhh_iiiieeeehhh_ hummmmmmoooommm...

field notes

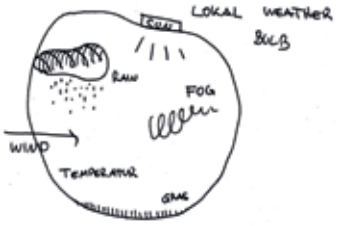




research tables for the „homesphere“ project

WOHER WISSEN DIE BESUCHER WAS ZU TUN IST!?
(ich glaube es muss intuitiv funktionieren)

WIESO PUSTET MAN PUSTEBLUMEN?



CONNECT THE LOKAL WEATHER WITH THE GLOBAL DATA

↕

OR: CONNECT THE GLOBAL WEATHER TO THE LOKAL DATA

observations from Helene Thümmel

making of

13/5
TUE
11,2°C

14/5
WED
14,7°C

presentation of the prototypes

15/5
THU
11,2°C
forecast:
cloudy
<3KM/H NNW
hier
könnte
ihre
werbun
stehen

cloud

lisa horvath I monika rajkovača I valerié wolf gang

It all started with a childhood dream. Watching clouds and wishing to play with them as you blow them around the sky. Their playful textures and shapes, till now, invite us to look at the sky and imagine different stories.

This installation merges these childhood dreams with different technologies: sound, data and interactive sensors.
A huge cloud of crumbled paper seems to be floating in space, secretly suspended from the ceiling. It glows from the inside, revealing different structures and textures of the mashed paper. With a closer look, small numbers printed on the paper are in fact the climate data used to generate the sound. On some places inside the cloud, sensors that measure temperature and humidity are mounted. When people blow there, it changes the direction and the speed of the sound moving in space. As the sound travels through the gallery you feel the cloud being blown away, represented by the soundscape surrounding you. The places where the sensors are hidden inside the cloud are indicated, by small “cloud tornadoes”. Searching and finding them creates a playful mood, discovering the cloud‘s sensitive points.

homesphere

denis mavrić I nina zimmermann I tamara tokić

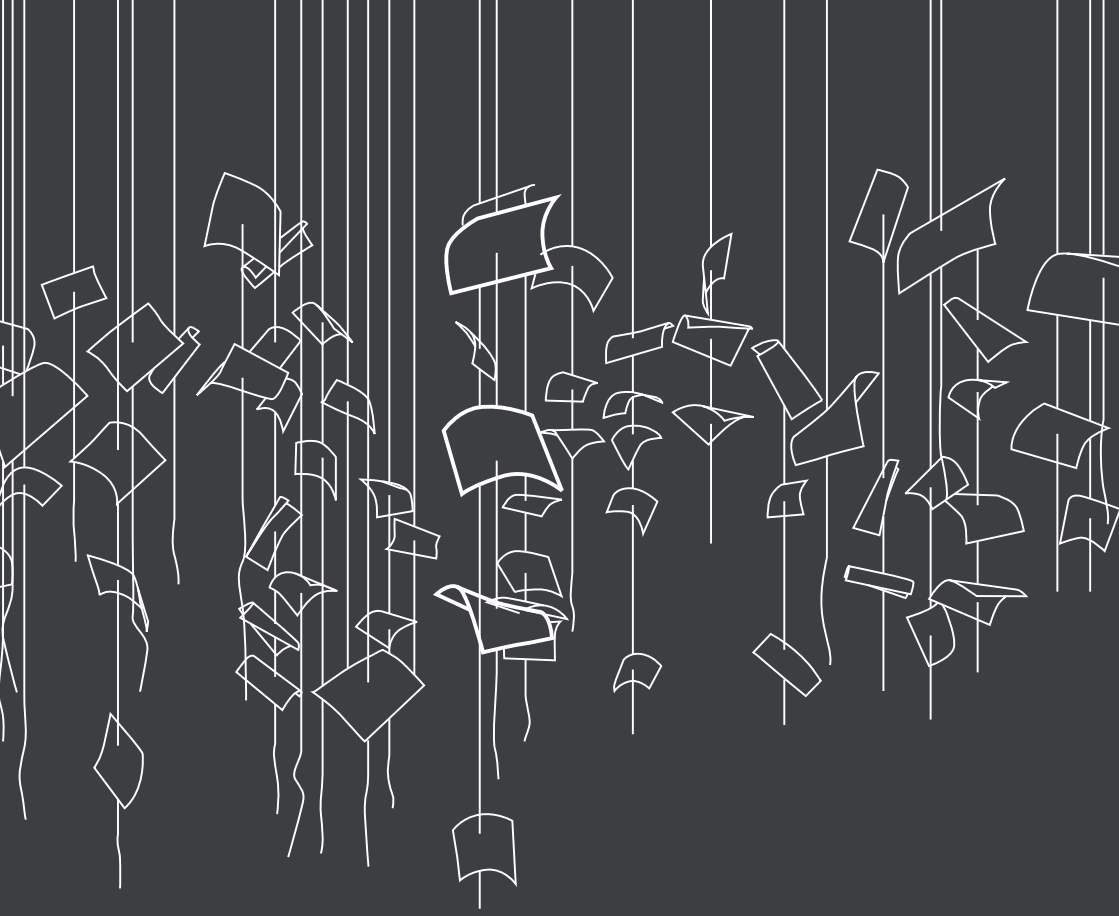
Rather than perceiving climate through sight, this work tries to approach it through senses such as smell, taste, material, feeling, and color. After conducting a small survey, links between certain smells, materials and everyday objects were defined. Therefore, the interactive sound installation is divided into three parts - living room, kitchen and bathroom - or metaphorical rooms representing a phenomenon and consisting of household objects that are typical for that particular unit, and of piezo sensors to capture the public interaction.

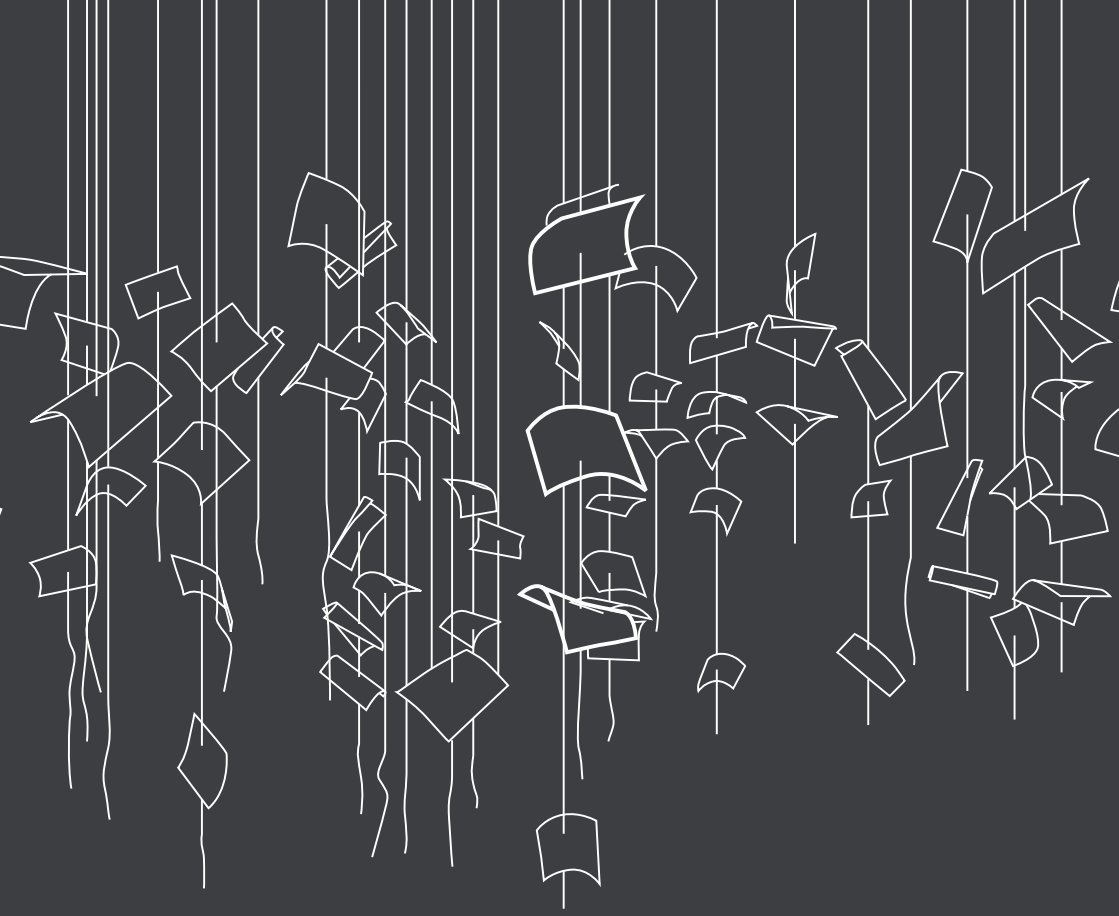
The living room consists of an armchair and a lamp with a perfume bottle in the place of a light bulb. Sensors are activated by sitting in the armchair. The perfume bottle has a tube hanging from its top, and a pump at the end of the tube that disperses sweet and fruity smell when pressed. The kitchen consists of a steel sink and a refrigerator. Inside the refrigerator there are jars filled with pickles, and other jars filled with cut grass and mud. A piezo sensor that is activated by loosening the pressure is placed on the door of the refrigerator. By opening the door the sensor is activated. The bathroom consists of a cotton shower curtain and a hairdryer. The hairdryer emanates the smell of pine trees when turned on, and piezo sensors are activated by pulling the curtain.

float

ana sabolić I laura chromecek I liberta mišan

This amorphous and abstract topography is made out of small particles, spread throughout the entire gallery space. Inspired by the external sheet of a forest, these small particles made of hanging paper creates a structure that is both massive and light, artificial and natural, object and metaphor, mathematical and poetic, shaped and ambient, all at the same time. Set as a metaphor of the surrounding environment, the topography is floating, and constantly changed by the visitors' moves. Each movement produces sound. Immersed in the feeling of under-wave structure, visitors have the chance to contribute to the shape of the topography, merely by being inside of it. Each action has consequences. Movement captured by gyro sensors triggers sounds. Movement changes the space. The installation is recreated over and over again.





TURBULENCE a climate sound portrait

EXHIBITION IN FORUM STADTPARK
8 -29 NOVEMBER 2014

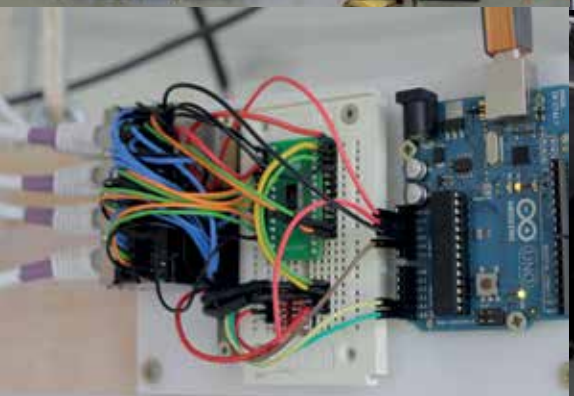
A floating topography invites the public to an immersive and interactive experience. The space is pervaded by a composition of audible climate data, where sensors generate impulses to modulate the sound, capturing physical displacements and corporeal contact.

set up

The set-up is one of the richest parts of a cooperation project, it is a period in which ideas and experiments unify in a crystallized physical form. At the beginning is a sort of complicated dynamic where the steps of an invisible consensual methodology appear. During the process, the logical steps interweave with the emotional approach to space and thoughts of the different partners involved, a time-span where the parts of the fragmentary structure of creation come together. For Turbulence -a Climate Sound Portrait- many pieces were accommodated in one and only semantics: structure, sound composition, spatialization, data translation, aesthetics and interaction.

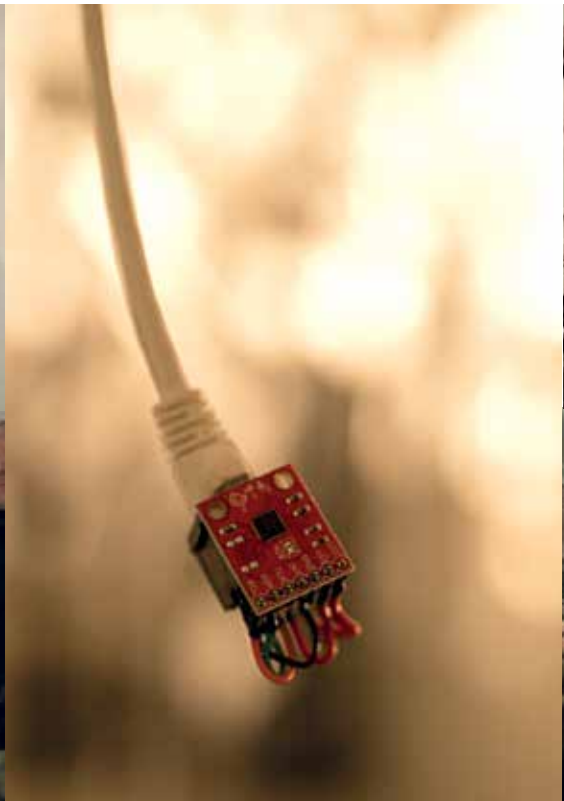
The prototype once called "float" transformed into a gigantic and intricate piece of multi-layered processes. Once the triangular frames were hanging next to the multichannel speaker system, the space started dictating the movement. The sensors allocated in the middle of each of the triangles gave the first signals for the subsequent installation of the floating body: a corporeal structure made itself of different parts. Hanging by hand each of the threads with squared papers was certainly a pleasant repetitive experience; a sort of meditation in which the team became a twining organism that knitted slowly while adapting to the changing sound environment. During uncountable hours of common work, not only the installation grew, but also an interesting conversation on aesthetics and other theoretical meanders arose. The set-up was then a surface for discussion and common decisions.

The most striking aspect of the montage dynamic in such a large co-operation system is that the personal requirements of each of the parts necessarily need to dissolve into a collaborative field. Turbulence is a paradigmatic example of this achievement, and the work stands as a witness of dialogue between institutions and projects.



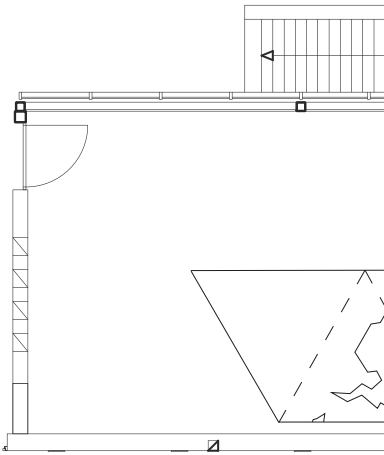
opening

„A border between paper areas and empty areas becomes visible and clear, but there is no separation in the space. The space is perceived as a unity. The former areas are no longer a spatial component. More than one person in the space at the same time means a constant change of the topography of the particles (papers). Each person passing through also shapes the space on an acoustic level, by triggering the sensors. More than one sensor is activated at the same time. The visitors also become part of the space with their shadows. Different contours appear on the wall and on the paper, according to the number and position of the people. Because of the dynamic of the shape and the lightness of paper every area seems accessible, which is why most of the visitors created their own paths rather than follow the already given ones.
The number of visitors increase the noise, abasing the sound of the installation to a secondary element.“ Laura Chromecek



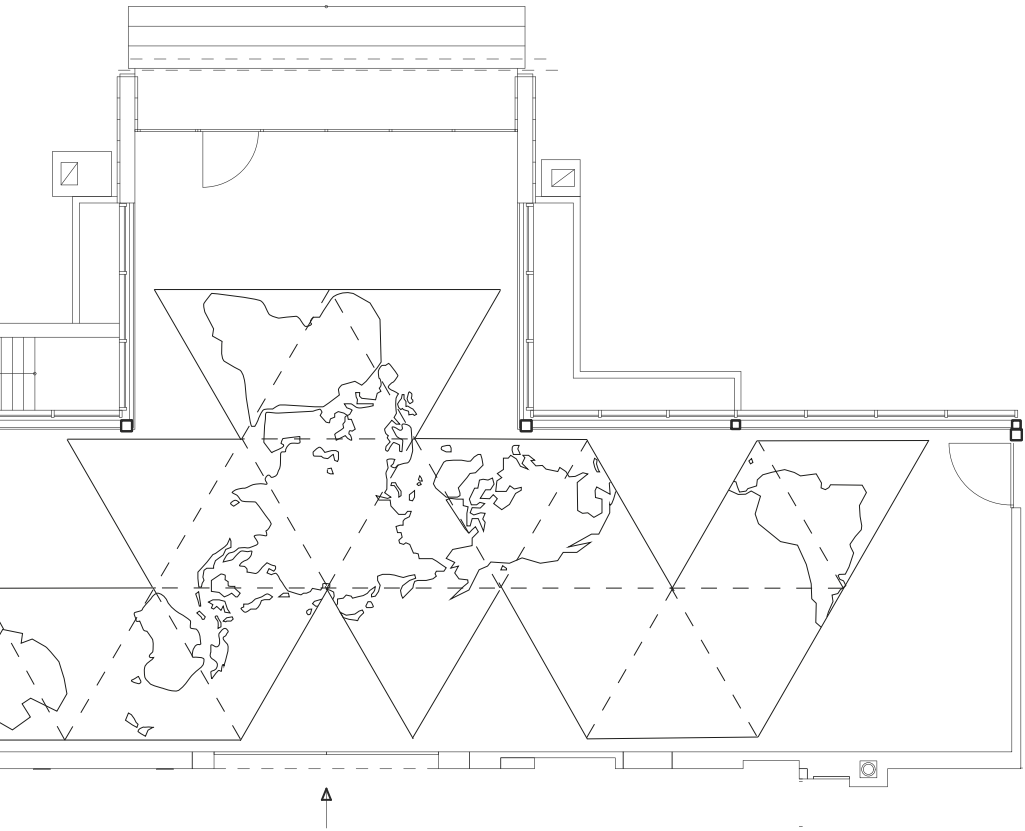
data in space

Sonification is still a young field with few scientific conventions. Various strategies for sonic translations have been implemented in the installation, based both on evaluations within the research project SysSon and on artistic decisions. The data used stems from (1) a climate model and (2) from satellite measurements:



(1) Simulations of past and future climates performed with the Earth System Model MPI-ESM-LR (Max-Planck-Institute for Meteorology Hamburg, Deutsches Klimarechenzentrum) for the recent world climate report. A historical run 1850–2005 is combined with future projections 2006–2300 for a midrange concentration pathway (RCP4.5, r1i1p1). These data were post-processed by the Wegener Center for Climate and Global Change, University of Graz. Parameters include temperature (tas), precipitation (pr), wind (eastward or ua), and radiation balance.

(2) Satellite measurements from GPS radio-occultation processed at the Wegener Center. The derived parameter is temperature anomaly (ta-anom) for the past decade 2001-2012.
The locations within the exhibition space reflect two types of translations. In most cases, data is projected through a derived version of the Dymaxion map, in other cases latitude information is combined with altitude levels of the atmosphere.



An icosahedral unfolding of the earth's spherical surface is an approach that goes back to the architect Buckminster Fuller. This “Dymaxion” projection is the only flat map of the entire surface of the earth which reveals our planet as one island in one ocean, without any visually obvious distortion of the relative sizes of the land areas. This map is utilised both in the sound layer of the system's idle state and in most sonification layers. When data sets only specify longitudinal means, higher levels of the atmosphere are paired with the given latitudes. Finally, radiation based data is given globally and distributed across all channels using a granular pattern.

sound layers

The installation is characterised by transitions and cross-modulations between a purely data-driven sonification and the appearance of sounds from field recordings. Seven sonification layers have been developed that make use of different data sets:

id 0 - soundscape:
This layer corresponds to the idle state of the system and is heard when no sensors have been moved recently. Recordings submitted to the Freesound.org platform were selected based on their geo-tag locations and their ability to coexist with the other sounds, mixing naturally occurring and culturally connoted sounds.

Sound files with the following ids were used under their respective Creative Commons licenses: 19550, 19992, 28264, 36430, 39895, 51904, 52647, 65495, 67031, 96175, 103115, 103189, 110921, 133832, 138997, 143115, 150865, 152656, 156562, 163607, 163608, 173095, 176028, 176385, 178648, 181364, 186860, 211063, 221859, 222037, 222640, 232411, 233194, 233702, 233704, 234888, 241956, 245826, 249504

id 1 - pitches:
This layer involves a typical approach to sonification—a temperature parameter is “mapped” to the resonant frequencies of sound grains. Here increasing pitch (high frequencies) denotes decreasing (low) temperature. The coldest part of the earth, the Antarctic, is easily located and perceived through a clanking timbre. Depending on the tempo at which time unfolds, one can also perceive the change in seasons and the opposition of southern and northern hemisphere.

id 2 - density:
Another standard parameter of climate data is precipitation (rain, snowfall, ...) This layer associates the amount of precipitation with the density of sonic grains.

id 3 - anomalies:
This layer uses measurement data from radiosondes. Temperature anomalies have been calculated and represent the deviation from the mean temperature for each month and location on the earth over many years. Two distinct timbres are chosen to indicate unusually cold and unusually hot months.

id 4 - intensity:
The soundscape from the idle layer has been processed to have a flat or "greyish" spectrum as well as a steady dynamic envelope. It is then subject to the modulation in intensity by a climate parameter, precipitation. A careful balance is achieved between a "neutral" matter and the possibility to still identify small gestures, such as fragments of voices, within the mass.

id 5 - blops (precipitation clusters):
More abstract methods of sonification usually involve the post-processing of the given data. Here, a method from image processing, "blob detection", was applied to generate clusters and trajectories of precipitation events that move in time and space.

id 6 - harmonic field:
The basis of all periodical changes in climate is the energy of the sun. This layer uses data of the radiation balance, the breakdown of all shares of in-going and out-going radiation to/ from the earth and levels of the atmosphere.

id 7 - wind:
Wind, as a vectorial entity, is a demanding parameter for any data "display". From the decomposed vector, we chose the east-ward component. The sounds are based on acoustic wind recordings modulated in their intensity, especially making perceivable the global west-wind zone.

An important aspect of the composition is the interplay of these individual layers. They emanate from the locations in the exhibition space where the sensors are suspended, gradually filling the space. The appearance and disappearance of the layers is a slow process for which the algorithm may choose different temporal and spectral strategies. Many of the interesting sound constellations occur during these transitions and short co-occurrences, emphasising the ephemeral and fragile nature of climate.

particularities and generalities
considerations on the sound composition

Hanns Holger Rutz

The amount of decisions to be made to arrive at a sonic rendering of climate data is enormous. Given a set of climate variables—such as temperature, precipitation or wind—how do you select and combine them, put them into relation? How do you handle their spatial and temporal dimensions that span the globe, different layers of the atmosphere and several hundreds of years? As a sound installation, how do you unfold a form within the spatial and temporal constraints of the exhibition space? What is the metaphor for the exhibition space: A laboratory? A stage? A jungle? A playground? What role is attributed to the visitors and their ability to "interact" with the work?

It is clear that any such rendering can be but a particular one, and therefore questions of validity and accountability arise. Why this decision and not another one? The crux lies in the assumption of natural forms that provide translations between particularities and generalities. We sometimes like to think that science is based on the analysis-synthesis of particularities (empirical facts) into general statements. We also like to think that art produces insubordinate particularities but secretly shares the goal: It presents idiosyncrasies, but through an act of "communication" individual experiences may be interpreted as examples of a general aesthetic discourse, and art becomes more general than any discipline on its own.

The dichotomy is especially interesting because sonification on the one hand can become a kind of battle ground between art and science (who is hegemon?), on the other hand it appears to be based on the

faithful processing of data, never leaving an objectified domain. At the same time, we witness a mystification of "data" where it becomes thing-like but intangible, a proper fetish. This is captured best in the noun "big data". People call themselves data scientists now. The value of information technology companies is a function of their ability to convince share holders that they have a secret sauce for analysing data. A rational replacement for religion, wonders become particularities that arise through machine learning and pattern matching applied to uniform data. Now we are engulfed in discussions about intellectual property and its strange relation to the credibility and trustworthiness of data.

For artists, data is an easy bait. With its wide availability and its uniform format, it plays nicely with other such neutralised and rasterised arrangements in media arts: The glowing pixels of projectors and screens, the neatly aligned arrays of speakers. As artists, we read the "objectivity" of data as their potential of becoming input to general transformations, as sources of connectivity. We can compose structures into which data sets can be poured, their selection and scaling may be controlled by parameters, precisely because of the reduction to uniform streams of numbers. Algorithmic composition and digital signal processing are the means by which composers conduct their "data science". Rather than interpreting this merely as an affront to accountability, the emerging wonders need not to signify a mysticism but the creative interaction between artist and machinery, thereby subjecting the production of data to scrutiny.

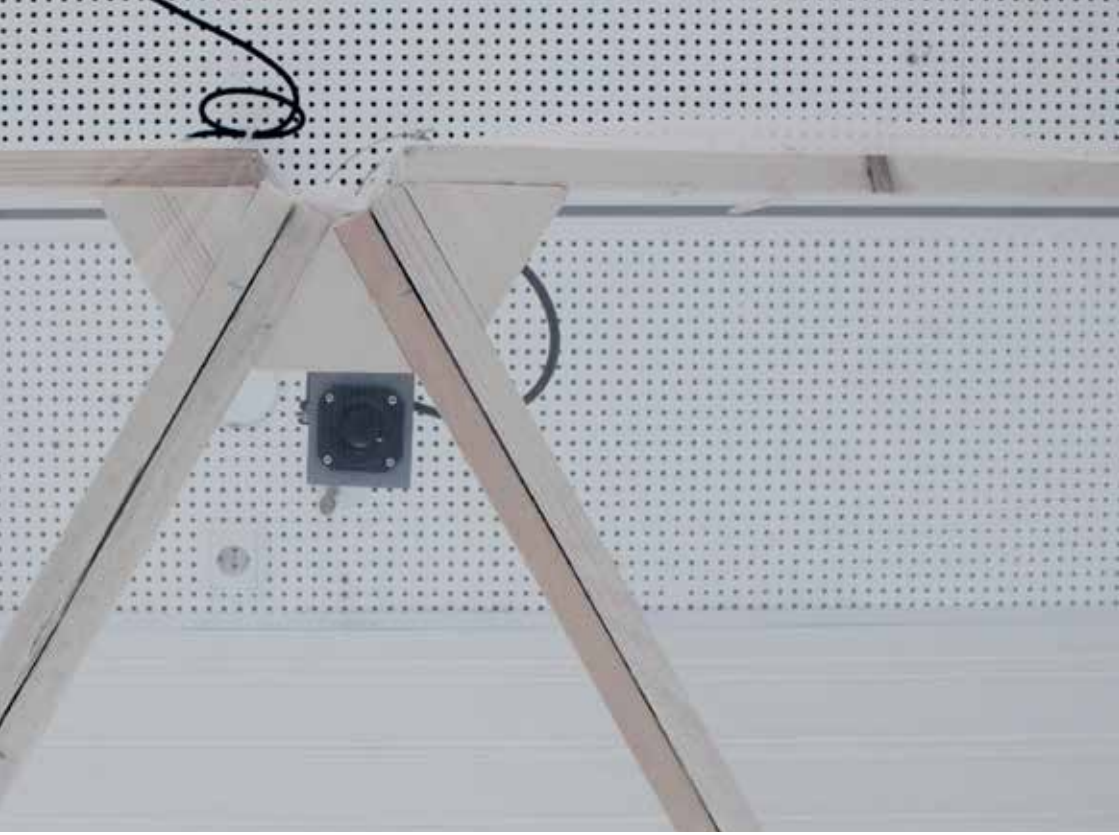
The aim would be to embrace this material play without turning it into fetishism. We must somehow justify the rules of the play, at least where we control them. I think it is useful to understand—at least tentatively—sonification as a contemporary form of musique concrète. Its analysis-synthesis is rooted in the idea that we deal with complex objects that can be decomposed. At this point it does not matter whether we take these objects as givens (data) or as something carefully fabricated (facts). Across the spectrum of operations carried out on these objects, what Schaeffer for example distinguishes as transformation, transmutation and modulation, there is still a sense of connection or non-arbitrariness between the object brought into the laboratory and the synthesised musical object.

So what are the hypothesised qualities within the climate data that may reappear in the sounding objects? As is the case with all natural phenomena, we will find two types of motions: a superimposition of quasi-periodic motions at different speeds (most obvious is the annual cycle), as well as overall tendencies and asymmetries (such as the increase in average temperature over the past hundred years and into the projected future). These motions are interesting because of their non-identical repetition, their "allures" to use another Schaefferian term. To become perceptible, they must be projected at different frequencies and different spatial locations. Irregularities can be further exposed by calculating the so-called anomalies, the deviations from the expected values at a given time and location.

The tension between the abstract global space embodied by the climate data and the singularity of the exhibition venue, its micro-

climate, is accommodated by transitions and cross-modulations between a purely data-driven sonification and the appearance of sounds gathered from a database of field recordings. Recordings that originate—if we believe the geo-tags attached by their contributors—from sites close to locations corresponding to the positions of the speakers in the installation room. A lot of geometry is involved in the composition of the sound structures, however a geometry with a twist. Using an icosahedral unfolding of the earth's spherical surface, an approach that goes back to Buckminster Fuller, we both gain a "less biased" projection of the earth's continents and reflect the T-shaped exhibition space. It further individualises the space by suggesting specific trajectories between the speakers, by introducing gradual rotations of the compass and by twin vertices that replicate specific coordinates within the room.

Finally the audience. Due to proximity to and remoteness from each loudspeaker, the visitor becomes another data scanner and singularity. Being equipped with multiple sensors, the installation retains manifest traces of these scannings in its electronic memory. Its own motion and those of the visitors form an exchange, what could be called modulations, rather than aiming for the playground scenario of a direct stimulus and response. The laboratory is defined by an inertia, a sluggishness that must not be mistaken for an obstacle but a support towards the visitor, providing just enough decoupling to lessen the expectation that explicit action is required for the machinery to work and that any action has inevitable consequences.



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TURBULENCE - EXHIBITION

SysSon – A Systematic Procedure to Develop Sonifications | sysson.kug.ac.at
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Visda Goudarzi (IEM, KUG)
CLIMATE DATA EXPERTISE
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SPACE AND INTERACTION
built installation: Float
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SPECIAL THANKS
Andi Maria Gruber, Christian Freissling, Carla Wess, Johanna Szukics, Patrick Wurzwallner, Julian Scheck, Paula Peters, Kassandra Kyriazis, Tatjana Schon, David Pirrò, Centre for Systematic Musicology, Andreas Heller, Garfield Trummer, Heidrun Primas, Roland Schwarz, and the Forum Stadtpark team.

WITH THE GENEROUS SUPPORT FROM
Forum Stadtpark
Freissling KG
Sägewerk Hansjörg Rauch
Speaker array developed by Georgios Marentakis and Sebastian Blamberger – Sonic Interaction Design Lab

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Daniela Brasil
GRAPHIC DESIGN
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COVER
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PROOFREADING
Visda Goudarzi, Nayarí Castillo
PHOTOS
all photos of this booklet were taken by the participating students, teachers and assistants, except:
Garfield Trummer, pp. 50,51, 54(right)
Jakob Isselstein, pp. 54 (left), 55 (left under)
Karoline Liedtke, pp. 55 (right), 58, 59, 69

PUBLISHED BY

Institute of Architecture and Media and
Institute of Contemporary Art -
Graz University of Technology
Institute of Electronic Music and Acoustics -
University of Music And Performing Arts Graz

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AKADEMIJA PRIMIJENJENIH UMJETNOSTI SVEUČILIŠTA
U RIJECI // UNIVERSITÀ DEGLI STUDI DI UDINE //
TECHNISCHE UNIVERSITÄT GRAZ

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SysSon

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GRAZ, AUTUMN 2014
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