Digital Synesthesia

Preface

The three-year arts-based, trans- and interdisciplinary, research project DIGITAL SYNESTHESIA (2013–2016) aimed at the exploration of the synesthetic capabilities of digital artworks. In the center of the research process stood an inter- and transdisciplinary workflow which provided an extraordinary possibility to explore the exciting phenomenon of synesthesia (Ancient Greek *syn* "together" and *aisthēsis* "sensation, perception") from the perspective of the aesthetics of digital art.

The project has focused on the technological, media, and aesthetic conditions of digital artworks to provoke translational and cross-modal sensory processes and thus provide synesthetic experiences for non-synesthetes. As a result, 14 digital artworks, which 17 internationally renowned artists have produced in cooperation with a team of scholars and scientists, are presented in this exhibition.

Visitors are invited to explore the interactive installations, responsive environments, dynamic projections, performances and their representations, live sonifications and immersive installations with all their senses and thus find out about the fascinating multimodal quality of their perception.

Projects

1.
At Play – build your own worlds!

At Play is a responsive audio-visual environment that invites visitors to create their own sculptural combinations with plastic storage bins to build the architectural landscape of the installation.

Miniature versions of containers that carry goods to world markets, these everyday plastic bins are there to be playfully moved around by visitors to the exhibition, like pieces of a puzzle.

The boxes are integrated into a pattern recognition system that matches each sculptural composition with a particular visual and sonic atmosphere. Both image and sound undergo a series of transformations in real time that imbues the grey boxes with a mysterious expressive power that has political undertones.

The "construction blocks" of At Play are symbolic objects of both childhood and the adult world, in a globalized world waiting to be reinvented. The boxes ultimately become information units, the visitors potential catalysts of change and the installation a transformation platform.

Martin Kusch / Marie-Claude Poulin

Photo: Bruno Colpron, © kondition pluriel, 2015. "Enjeux" Performance at Theatre La Chapelle, Montreal

**kondition pluriel
(Martin Kusch /
Marie-Claude Poulin)**

Artistic media
Responsive audio-visual installation
with computer-tracking system
Primary sensory modalities
Kinesthetics, Touch, Vision, Audio
2016

2.

Bestiary for the Minds of the 21st Century:
Genomic Opera

A data-mining, synesthetic, 3D-printed genetic opera

The aim of the art project is to create 3D-printed objects based on various mixed genomes, as well as to explore the possibilities of 3D-printing errors (glitches). Fragments of the genetic information of different types (mammals, insects, fungi, bacteria, etc.) are randomly mixed, and by means of algorithms transformed into audio files which then are converted into 3D-printed objects. These environment-friendly 3D-printing filaments, combined with glitches and incomplete 3D-printed remains, make up the core of the musical notations.

I researched the available genome databases like Ensambl, Genome, Wormbase, Flybase, etc. to mix and cut eukaryotic and prokaryotic genomes in random combinations. The nitrogenous bases (as the letters A, T, G, C) are read by a software that transforms text into audio files. These are transformed into 3D objects, which are again printed in plastic with a 3D printer and pasted onto paper as music notations. The generation of AUDIO and VIDEO through TACTILE actions involves audience participation: The audience interacts by rubbing the 3D-printed objects with a piezoelectric microphone connected to a transductor to visualize new sounds. In parallel, each page of the opera is photographed and scanned with sonogram software in order to be converted into sound archives.

Thus, the final performance of the opera is a combination of:
- 3D-plastic-printed genome-data-mining-instruments, performed live by a musician rubbing the 3D printed objects with piezoelectric microphones,
- Recorded mixed genome fragments,
- Sonogram audio files, and
- The score that instructs the performers during the entire duration of the piece throughout the four acts.

Marcello Mercado

What happens in the monitor

1. Page

2. Sonogram software transform the image into sound

3. The generated sound is transformed into images again

4. Fragments of audio of genomes from different species are mixed with the generated sounds from images (Ex. aggagagggtttcccagg)
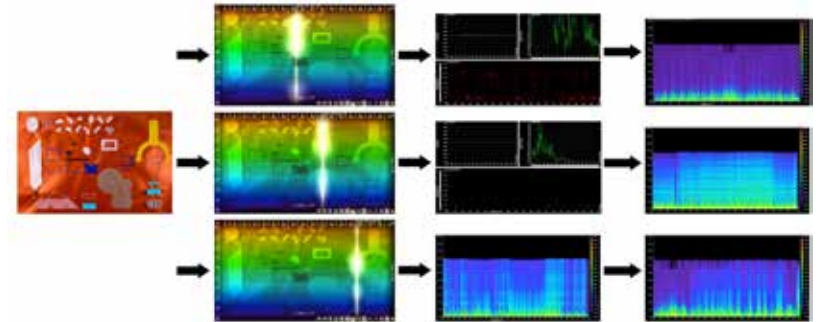
Marcello Mercado

Artistic media
2-channel video installation,
artist's book, public audio interaction
Primary sensory modalities
Touch, Vision, Audio, Kinesthetics
2015

3.

Data Music

Based on digital logic, I constructed an interactive installation. The set-up comprises a music stand shaped as an empty frame with five staves. These five staves consist of five horizontal strings building a kind of abstract geometrical guitar (in a cubist way). The strings are attached to a computer in which several musical compositions are stored, e.g. famous rock riffs. Loudspeakers are furthermore connected to the computer. This set-up enables the visitor to pull these five strings, which are the "notation" and the "instrument" at the same time, whereby she/he becomes the "composer", "interpreter", and "performer" of the music. As the music is stored physically as data in the computer, i.e. pre-programmed, we could say that the visitor performs music through an interface (music stand), which is data pro-grammed by an algorithm. In addition, the performance of the player and of the visitor respectively is recorded by a KINECT camera and projected onto a screen, or alternatively displayed by a monitor. As the images of the per-formance are purely data, the configuration of the visual data can easily be influenced by the configuration of the acoustic data. Sound and image are synchronized with each other. Thus, whenever the visitor is in front of the music stand, he sees himself projected or displayed in a normal, mirror-like way. The very moment the visitor starts performing with the music stand, his image becomes distorted and appears as a flow of visualized acoustic data.

Peter Weibel

Peter Weibel

Artistic media
Interactive audio-visual installation
Primary sensory modalities
Touch, Audio, Vision
2016
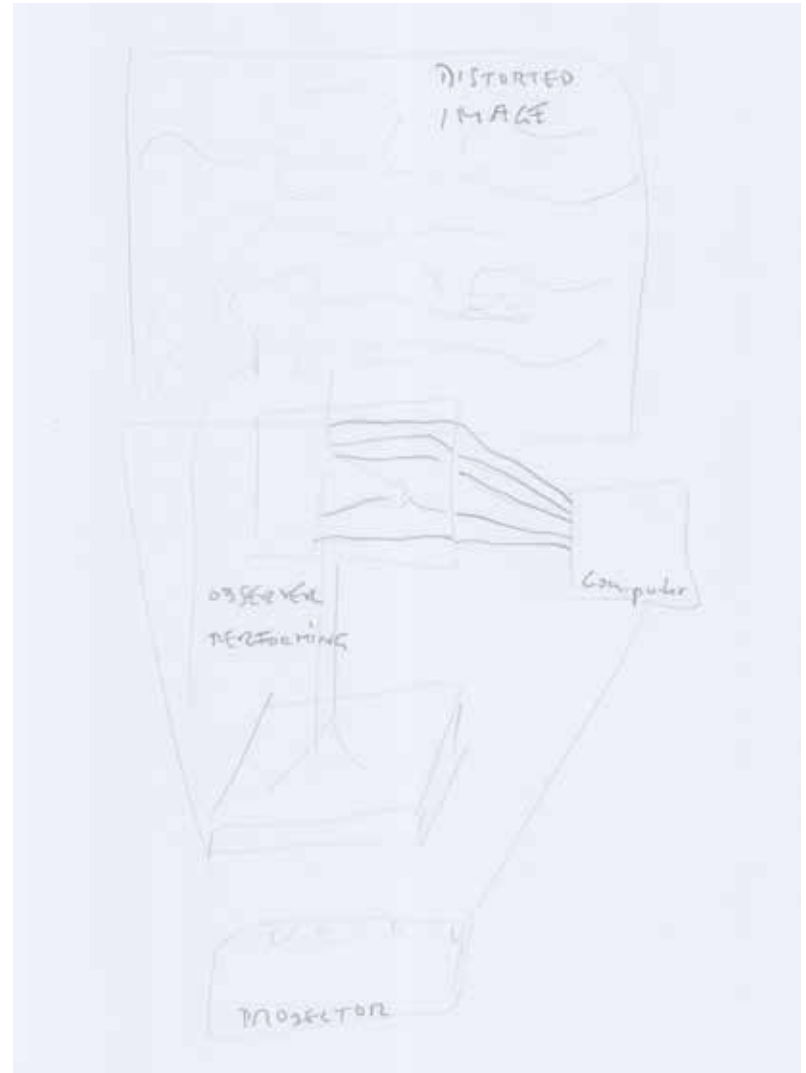
4.
E.E.G. KISS

Share your private kiss

E.E.G. KISS is an installation and a digital synesthetic, communal kissing ritual. The installation of the EEG KISS Artistic Social Lab consists of a two opposite chairs, "a love seat", where kissers can take place. Wearing an E.E.G. head sensor, their brain activity during kissing is measured. Around them four screens mirror the actions of both kissers and witnesses: through real-time E.E.G. data, soundscape and a surveillance system. The question "How does your kiss feel in E.E.G. data?" invites all participants to perceive and interpret the abstract, immersive E.E.G. data-visualisation and the sound as an aesthetic experience, based on mirror neurons, and to share an intimate and intuitive co-creation of a kiss.

The E.E.G. KISS soundscape is based on the kissers' streaming E.E.G. data. The Brain Computer Interface and the neuro feedback system translate these data of "kissing brains" into a music score and an algorithm to generate an E.E.G. KISS symphony. Each E.E.G. KISS soundscape is saved in a public database on the artists' website to be downloaded and shared. The soundscape is developed with Tijs Ham at STEIM Amsterdam.

Karen Lancel / Hermen Maat

Photo: Lancel/Maat 2015. At Brakke Grond/Frascati Theatre Amsterdam (Yami-ICHI and Privacy Festival)

**Karen Lancel /
Hermen Maat**

Artistic media
Performance, installation
Primary sensory modalities
Taste, Touch, Vision, Audio
2016

5.

facades

facades is an audiovisual animation, conceived for performance in a Full-dome. Fulldomes are immersive, dome-based projection environments which allow the full and multimodal integration of the viewers in a multi-sensory, potentially interactive experiential space as an interface.

For facades Ruth Schnell has designed a dramaturgy of resolution and reconstruction. The "organic" attractive facades and streetscapes appear elastic; open spaces overlay each other, panoramas may emerge. The viewer can move virtually in a horizontal fashion or into the depth of the configuration. The individual motion of the projected content simulates both spatial dynamics as well as a first-person perspective.

The accompanying sound is based on the 1986 recording of the text "No Such Agency", published by media theorist Friedrich Kittler about the NSA. The image content is open at the top and bottom; spatial engagement occurs without "heaven" and "earth". The presented immersive experience is also an experience of instability.

The imagery of facades has its starting point – developed using a photogrammetric method – in 3D models of city buildings. Here, through several calculations and various software programs, 3D information on an object is derived from only two-dimensional images. The 3D models, generated from scatter diagrams and combined with a 3D graphics program to form streetscapes, allow changes in perspective and various simulated movements.

facades was originally developed for dome projection in Montreal's Satosphère, a Fulldome 18 meters in diameter with a 360-degree expansion of the image on the horizon and 210 degrees at the zenith. In the exhibition an Oculus Rift 2 model version is on display.

Patricia Köstring

Photo: Sebastien Roy. Performance at SAT, Montréal/Canada, 2015

Ruth Schnell

Artistic media
Audiovisual animation,
immersive Fulldome projection
Primary sensory modalities
Vision, Audio, Kinesthetics
2016

Concept and idea: Ruth Schnell
Artistic direction: Ruth Schnell
Media content and animation: Nikola Tasic
Media setup: Martin Kusch, Johannes Hucek
Sound: Alexandre St-Onge, Marie-Claude Poulin

6.

The Flying Umbrella **Project**

The performance consists of two robotic flying creatures in the form of umbrellas mating in the air. Created with customized flying machines, control algorithms, and animatronics, these umbrella robots kiss, embrace, caress, and copulate with each other in the air. At the same time, specific sound frequencies are generated digitally from these body motions and intimate contacts, allowing audiences to not only see but also hear the sensuality and lust of these artificial life organisms. The performance therefore explores the idea of robot pornography, and also investigates the use of flying robots in creating motion-sound cross-modal perceptual experiences for artistic aerial performance.

Alan Kwan

Alan Kwan

Artistic media
Aerial Robotic Performance
Primary sensory modalities
Kinesthetics, Touch, Audio
2016

Artist: Alan Kwan
Artistic & Engineering Advisor: Bjorn Sparrman
Engineering Advisor: Roger Wang
Sound Designer: Jose Alejandro Rivera
In co-operation with TONSPUR Kunstverein Wien (Artistic director: Georg Weckwerth) /
Q21 (at MuseumsQuartier)

7.
I am Sound

The installation is in fact a musical instrument system. Presented as a darkened room with a pool of light indicating where the visitor should stand, it is composed of three vital parts: hardware, software and the viewer. The hardware consists of a "curtain" of 12 aluminum plates which are tuned to vibrate at frequencies which produce specific tones and their harmonics. The plates function as both loudspeakers and a projection screen. A small camera and microphone captures information from the viewer; a willing participant who, facing the camera and microphone, looks forward to where their face is projected in front of them onto the plates. The visible image is how the machine interprets the visual information received: grey, pixelated, in jittery motion, fragmented and framed by green lines as the algorithms select and transform this mirror of the self into data. Converted into data, the face, captured as a low-resolution surveillance image, is digital information which vibrates, emitting unique, harmonious audio created specifically from the data obtained from each individual facing the camera. What is revealed, an augmented, amplified selfie portrait, becomes a personal musical "voice" of the subject with interconnected harmonic tones.

Excerpt from "On 'I am Sound'" by Kathy Rae Huffman

Photo: Thiel / Reiserer. Mixed media installation (custom metallophone, video, audio, electronics).

**Tamiko Thiel /
Christoph Reiserer**

Artistic media
Interactive installation
Primary sensory modalities
Vision, Audio, Kinesthetics
2016

8.
IN_SIDE VIEW

IN_SIDE VIEW is an installation whereby the viewer, seated in a chair, is able to explore a series of stereoscopic panoramic photos using a Samsung Gear VR HMD (head mounted display). Turning the chair rotates these panoramic scenes, which offer a conjunction of photos of Angkor Wat of foliage amalgamated with stone, and of the interior of a Sydney hardware store after it had been ravaged by fire. The viewer controls these changes of scene using a tongue operated switch that is held in the mouth, and this switch connects via Bluetooth to the HMD.

In IN_SIDE VIEW senses are senselessly conjoined, the world put back together, "an incessant shower of innumerable atoms" (ibid), seeing oneself as another, in side out, in the circle of confusion, amongst trees / stone-scaled / snake roots // eyed / tongue in cheek / switchback // past / future! / present // cable / tie // wrap / around // heady / giddy / techy / tacky / vroom // memory / aromatic / terror // ruination / fervid bedlam. The where-with-all in_side a pataphysical allegory for the multi-sensory encounter between the body and the perceptual imaginary, between nature, manufacture and ataxia.

Jeffrey Shaw / Sarah Kenderdine

**Jeffrey Shaw /
Sarah Kenderdine**

Artistic media
Immersive installation
Primary sensory modalities
Taste, Touch, Vision, Kinesthetics
2015

Panoramic photos of Angkor Wat: Jeffrey Shaw and Sarah Kenderdine
Panoramic 3D photos of a fire-damaged hardware store in Sydney:
Jeffrey Shaw and Volker Kuchelmeister
Application software: Leith Chan
Hardware: Samsung Gear VR, Conceptus tongue switch

9.
MotU #4 – #6

The work motU #4 – #6 from the series Mirrors of the Unseen challenges the supposed credibility of the visible. The habitual process of seeing is interrupted by words and icons made of light; they seem to emerge from three flickering LED beams and float hologram-like in front of the space. Nothing can get in the way of translucent (written) images. They are present, and yet at the same time do not exist: Only individual perception makes them accessible to the viewer.

The light rod installations make use of the inertia of the human eye: The photoreceptors of the retina cannot resolve separate frames at a rate of more than about 20 frames per second. This is the reason why we see film as film, why the annular motion of a flashlight in the dark appears to describe a closed circle of light. For the display on the light rods, words, icons and also schematic photographic images are broken down into points that are successively shown on the vertical columns of the rod.

In MotU, the viewer is particularly involved in the creation of the work. The icons and images on the rods alternate at a certain frequency. The afterimage is distorted in direct relation to the individual's perspective into the room. There is no collective viewing of the work; what is seen is an individual experience rather than something tangible or verifiable.

Accordingly, the works tie the fabric of the thematic representation together. The words and icons projected onto the rods for MotU #4 – #6 include concepts from the field of synesthesia which are associatively condensed through sequencing and rhythmization.

Patricia Köstring / Ruth Schnell

Photo: Alexander Pausch, © Ruth Schnell. Floating Signs, light rod installation (permanent), Bregenz/Austria, 2011

Ruth Schnell

Artistic media
Light objects
Primary sensory modalities
Vision, Kinesthetics
2011 / 2016

Concept and idea: Ruth Schnell
Artistic direction: Ruth Schnell
Media content: Ruth Schnell, Lea Schnell, Patricia Köstring
Programming and media setup: studio stefanist
**Electronics and hardware design:** Alexander Pausch

10.
Sound Calligraphy

The project consists of calligraphic handwriting containing the spectral sound information of spoken words, which can be made audible by techniques of sonification. During a live performance, I draw calligraphic handwriting which is transformed into sound by means of a special scanner (camera and computer-software). These calligraphies and a video about their genesis are displayed in the exhibition.

My interest lies in the fact that the combination of manual drawing and digital technology is able to create an artificial voice and the perception of speech. Apart from the poetic performative aspect of drawing voices, human speech and its perception are part of the focus of my interest. My drawings are in fact only layers of frequencies that imitate a human voice. It is not much more than noise and a cluster of sine waves, and it is artificial. But at a certain point in time, we can start to recognize words, maybe a sentence; we start to hear human speech. Due to the constructive behavior of the brain, we search for meaningful messages within the noise that we hear.

Ulla Rauter
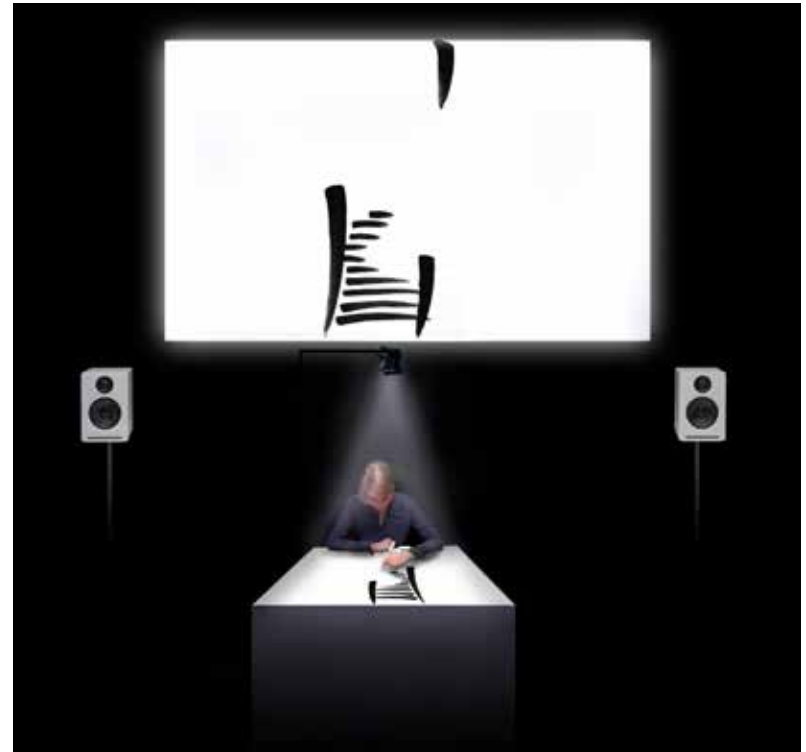
Ulla Rauter

Artistic media
Performance, drawing, live-sonification
Primary sensory modalities
Vision, Audio, Kinesthetics
2015–2016

11.
Space Time

Everyday clocks such as wristwatches have finite precision. Eventually they require correction to remain accurate. The rate of drift depends on the clock's quality, sometimes the stability of the power source, the ambient temperature, and other subtle environmental variables. Thus the same clock can have different drift rates at different occasions.

Clock drift refers to several related phenomena where a clock does not run at the exact right speed compared to another clock. That is, after some time the clock "drifts apart" or gradually desynchronizes from the other clock. Time signal stations synchronize their clocks to coordinated universal time (UTC), the international standard for timekeeping. No clock keeps coordinated universal time exactly because coordinated universal time is an average time, calculated with data collected from hundreds of atomic clocks located around the world.

In Space Time the accumulated time error of an analog radio-controlled clock is measured between synchronizations. A sensor is used that records the beat-rate of the watch's pulses. Comprising several radio-controlled clocks, the Space Time installation makes this inaccuracy audible with clocks, electronic oscillators and speakers.

Space Time uses sonification to make time tangible. Sonification is the data-dependent generation of sound, if the transformation is systematic, objective and reproducible. Then it can be used as scientific method. A distinction between data and information is irrelevant with regard to the definition: information like, for instance, a message can always be represented numerically and thus be understood as data. Sonification refers to the technique and the process; the algorithm. Sonifications of the measured sensor data may be heard as music. According to the measured time inaccuracy, the sound, the color of the sound, and the volume of the sound are varied. The time inaccuracy adds a certain chance aspect to Space Time.

Karl Heinz Jeron

Karl Heinz Jeron

Artistic media
radio controlled clocks,
custom electronics
Primary sensory modalities
Kinesthetics, Audio
2016

12.

Topography of Movement

For her dynamic image projections, Ruth Schnell works mostly with computerized projection mirrors. The image content itself is optional, and therefore projected without a background. It is repeatedly in motion: In Topography of Movement projected hands perform an activity. The sequence in turn is made dynamic, accelerated or contradicted via the movements of the projection mirror, depending on how the two movement patterns come together.

The multiple projection (a right and a left hand), the scaling of projected events, as well as the implied tilt of the camera angle from supervision in a side view override conventions of spatial order. If the left or right hand point to an absent body, a subjective viewer perspective is made impossible by the high magnification of the image content. The scaling changes the spatial reference system.

The hearing of the original sounds is simultaneous to the individual motion of the image that arose during the recording: Wiping, knocking, typing sounds. In addition, the sound contributes to the spatialization of the image content.

Patricia Köstring / Ruth Schnell

Ruth Schnell

Artistic media
Dynamic Projection
Primary sensory modalities
Vision, Audio, Kinesthetics
2016

Photo: Azalea Ortega, © Ruth Schnell. Studio test, Vienna/Austria, 2016

Concept and idea: Ruth Schnell
Assistance: Patricia Köstring
Artistic direction: Ruth Schnell
Media Content: Ruth Schnell, Patricia Köstring
Chrono-spatial composition: Ruth Schnell
Software: studio stefanist
Postproduction sound: Alexandre St-Onge
Camera: Azalea Ortega, Nikita Zhukovskiy
**Performer:** Marie-Claude Poulin, Nikita Zhukovskiy

13.

Transmission+Interference

This installation was created by David Strang and Vincent Van Uffelen and is part of their larger collaborative project Transmission+Interference. The artists explore the creative potential within light as both the creator and transmitter of sound and actively move away from creating visualizations of sound towards an audiovisual experience based on resonance and feedback loops between light, sound and object.

Transmitter > Multi-Modal Crossover > Receiver

Consisting of three parts, the interactive installation investigates the potential for using digital devices to create a synesthetic communication system. The installation draws on the different experiences of synesthetes and uses this to explore a messy and playful method of communication. Using digital protocols of ASCII, MIDI and frequency conversion, letters are encoded into a combination of a light color and a sound frequency (e.g. "A" is transmitted as yellow light and a 50 Hz sine wave) allowing a simulated synesthete to decode the text that has been transmitted through space. However, to get closer to a synesthetic communication process, the classic Transmitter –> Receiver pattern must be interrupted by a multi-modal crossover that mimics a synesthete's unique experience of light and sound. The visitor is able to adjust the multi-modal crossover to gain further understanding of a synesthete's unique experience whilst interfering with a potentially flawless communication flow.

David Strang / Vincent van Uffelen
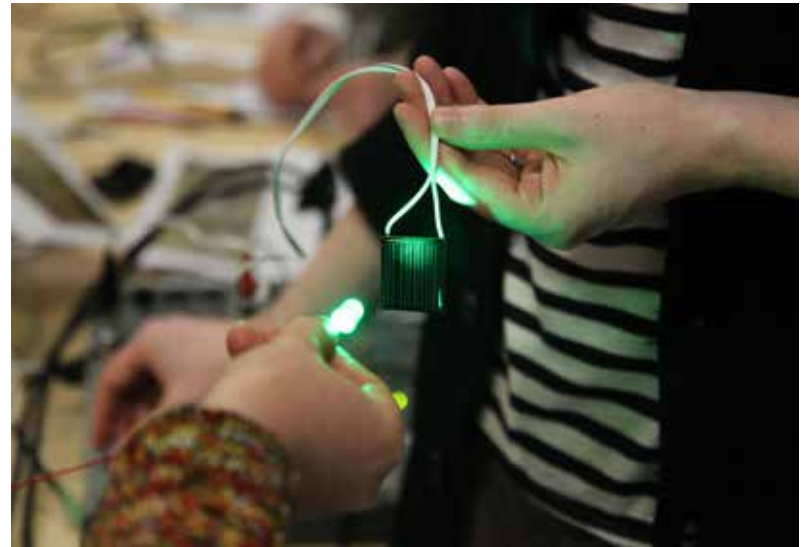
David Strang /
Vincent van Uffelen

Artistic media
Sound-light installation
Primary sensory modalities
Vision, Audio, Kinesthetics
2016

14.
VERTICAL 2

In VERTICAL 2 confusion, disinformation and communication are pro-
voked by a small white cuboid standing in a large exhibition space. It can
be entered by one person at a time. Contradictory, even paradoxical spatial
informations are produced via visual and audible stimuli. Low and small from
the outside, the space gains unexpected height and thereby largeness when
entered. The absence of consistency between the inner and outer perspec-
tive is furthermore deepened by another aspect to be experienced inside.
The cuboid not only seems to open up vertically, but also downward below
the feet.

Inside the small cuboid of VERTICAL 2, the space seems to become an
open vertical tunnel. Neuronal information about direction is given via re-
flected light, information about size via acoustic impulse responses. It might
catch the visitor's eye that the constructional elements of the cuboid are
visible from the outside in a reductionist manner. Its building style lies open;
there seem to be no secrets. The visitors are left alone with the ambivalence
of their sensation.

The realness of the outside world is considered to be independent of
human observations. In this regard VERTICAL 2 appears to be an intentional
aesthetic object that questions realness and enables visitors to synthesize
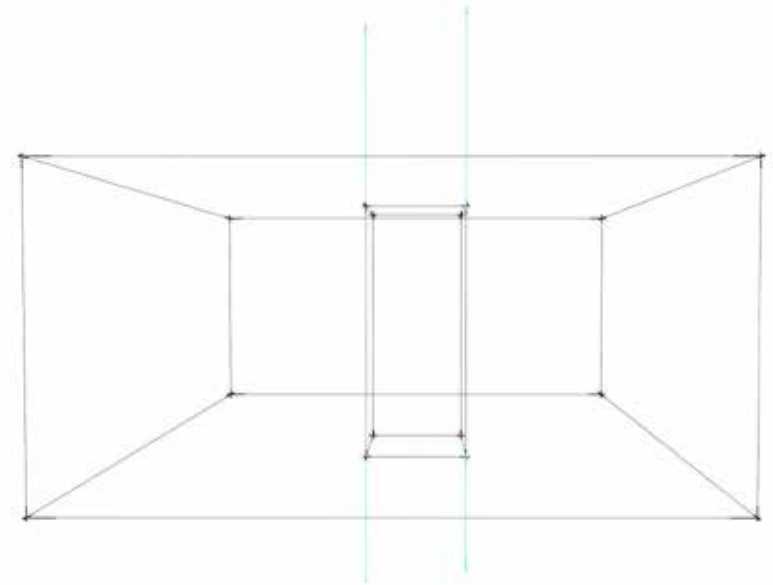virtuality.

Anke Eckardt

Anke Eckardt

Artistic media
Installation
Primary sensory modalities
Kinesthetics, Audio, Vision
2016

€ 15,–