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Körper

Keywords: Corporeality; Algorithmic Bodies;
Co-Presence.



We present two modules from a series of works that explore the relationship between corporeality and the algorithmic. Each module or *Körper* (body) is realised as an environmentally coupled, sensitive installation with the digitally composed modalities being primarily sound and moving image. A module is comprised of heterogeneous internally coupled algorithms that react in a non-direct way to ambient perturbation. *Körper α* uses a number of continuous-signal ultra-sound circuits, *Körper β* uses a video camera image.

1. OVERVIEW

Körper is an evolving series of objects or installations that pursue and materialise algorithmic bodies (German: Körper, singular and plural). The fundamental concept of corporeality lying beneath this work is that of an emergent phenomenon arising from an ongoing exchange between a perceiving and cognising entity, its environment and other entities. A body is not only occupying space, but it continuously reproduces space and presence in negotiation with other bodies. It thus touches upon the problem of individuality and how, as a living and not a dead body, it “presupposes a plurality of other forms in relation to it” (Canguilhem 2008 [1952], 106).

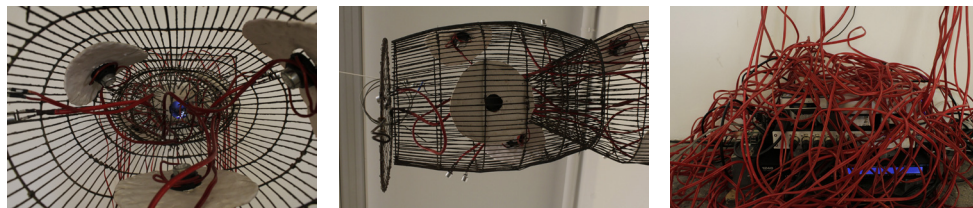
Computational processes, on the other hand, can also be understood to occupy abstract spaces which are interwoven with physiological spaces. What does it mean that a body is living or alive when we attribute corporeality to computational processes? Surely, we do not want to be trapped by the assumption that we could even remotely “model” human or animal bodies, which seems as problematic as equating computational process with disembodied brains or the mind (cf. Dreyfus 1972). Instead, what we call bodies are configurations that partially explore what bodily qualities could possibly emerge from a digital–physical assemblage, with the aim of eventually bringing these partials together and thus “fulfil” in a certain way the requisite plurality of forms.

The bodies we create and experiment with should become entities that not just passively receive and process stimuli, but that actively sound out their surroundings, ringing them out for interventions. These interventions are multi-modal, for example incorporating sound and vision, but also ultra-sound as a tactile medium. The bodies absorb and process impulses passing through their environment and emit sensible variations of responses. Instead of searching for the definite form that satisfies this criterion, the modularity is meant to allow us to implement and “prototype” ideas such that modules can be iterated over time, and iteration may also take place by accepting a “partial” module and moving forward to an additional module. In other words, the idea of the body re-enters the work as a structuring principle, allowing us to “create a body of works”, to give us space and presence to experiment.

The modules produced so far can be understood as a sort of organism, i.e. a set of interconnected organs or heterogeneous processes, engaged in a reiterated feedback loop of action and sensing. They are situated in an environment with which they interfere. Moreover, their structure is entangled with our experimentation and thought processes, producing thus two distinct interfaces from which a sort of materiality emanates. The instance we present here consists of two modules which are to be placed in vicinity of each other, allowing them to network (perhaps just through their physical arrangement and not necessarily through a digital link). The texture of the installation’s visual and acoustic presence is not meant to be overpowering, and it will only partially and changeably occupy its space. The primacy is to often become visible and audible only in selected and constrained regions of environmental

Fig. 1. *Körper α* , as shown at Lydgalleriet Bergen.

activity, relying on modes of co-presence and mutual shaping rather than relations of action-reaction. The first module, *Körper α* , has been exhibited before at the event *Thresholds of the Algorithmic*¹ in Bergen, Norway, and thus has a more definite shape, although subject to change and adaptation, whereas the second module, *Körper β* , will be premiered at xCoAx, consequently having a more vague description.



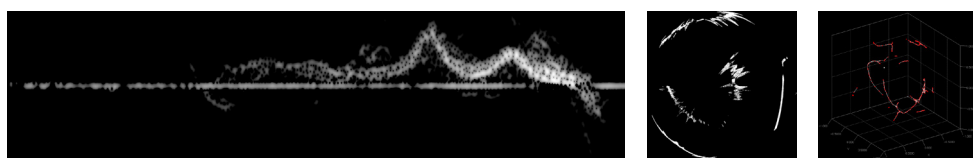
2. KÖRPER α

The first module realises an installation with multi-channel sensors and sound, and mono channel video in a suspended metal structure (see Figure 1). It explores an extension into space and the materialities of corroded metal, white unvarnished porcelain and red wires. It employs a tactile layer by creating multi-directional ultra-sound feedback circuits which become perturbed by the presence and motion of visitors around the object.

Its internal computational structure is made up of three “organs”: The first sends out a signal to the ultra-sound actuators and picks up the reflections through corresponding sensors, then analyses the evolving spectra for changing energy above calibrated background levels, as well as Doppler shifts produced by the relative motions of visitors. It integrates the channels, using projections onto five Voronoi areas that cover the surface of a sphere (internal memory).² This signal is stochastically sampled by the second organ which produces a visual signal on a video screen installed at the base of the cage, using a wandering projection of the sphere which is emphasised by an optical lens. As movements towards the structure produce positive Doppler shifts, the energies of the channels move spatially towards one another on this sphere, whereas movements away from the structure produce withdrawals to the centres of the Voronoi, something that becomes relevant as the first organ continues to process the “raw” input signal, building an ever-changing topological reflection of the environment, as the signal is transcribed into a multi-graph through the use of a so-called Neural Gas process (Fritzke 1995). This unsupervised learning algorithm continuously adapts to its stochastic input signal, trying to form edges across denser areas of energies, and possibly uniting some of the input channels as sub-graphs (see Figure 2).

2. These areas were found using John Burkardt’s implementation of centroidal Voronoi tessellation (CVT) on the unit sphere, see http://people.sc.fsu.edu/~jburkardt/m_src/sphere_cvt/sphere_cvt.html (accessed 26-Jun-2018).

Fig. 2. Spectrogram of single reflected ultra-sound signal, Voronoi projection of five signals, and Neural Gas tracing.



A communication protocol is used to allow the reflection of this multi-graph in the third organ, a dynamical system consisting of a set of coupled and interacting oscillators. While the overall structure of this system remains constant, aspects of the graph produced by the Neural Gas process, such as the number of nodes, their positions and interconnections (edges), sediment steadily into the system transposed into each oscillator’s frequency and their matrix of mutual couplings. The organ performs numerical integration of the system at audio rate and projects an audification of the state changes of the compound of oscillators back into the environment through the five loudspeakers enclosed in the installation’s metal hull.

2.1. Observations

The dimensions of the object are in the magnitude of a child or a smaller mammal, and its placement, lifted to ear and eye level, invites a close engagement of listening and seeing. The animation of the sound — sometimes alluding to fluids, at other times resembling the rhythmic synchronisation of insects, and seldom breaking out of its stable trajectory — indeed produces the element of aliveness, which is only possible through the merging with the other modalities into one “thing”. There is intimacy and indifference likewise, for example, we would not walk so close up to the body of a stranger. We can see through the body; we must see through the body to reach the video image, and we must move our head to find a perspective in the image. Unlike a voice that is unison and emitted from a single track, the physical body is overlaid by a sonic body with its own extension, giving us a changing perspective in the sound as we orientate our ears.

There is a relative independence of the organs, and consequently a relative independence of the audio-visual production from the movement of the visitor, without eliminating the sense of exerting an influence on the object’s responses. It is not possible to think of the object as mechanically decomposed into its constituents, instead we can think, as Katerina Kolozova invites us to, of a “coexistence of unity and nonunity”, a coexistence “beyond relation” (Kolozova 2014, 25, 30) to one another, being simply co-constitutive for the perseverance of the body (to be sure, a *moment* of a body).

Fig. 3. *Körper β*, detail of xCoAx exhibition (left), and elements in development (right).



3. *KÖRPER β*

The second module realises an installation with video sensors, encapsulated small-scale real-time generated binocular video image, and three channel sound source reproduced by ceramics (see Figure 3). It explores a hybrid anthropomorphic and “instrumental” body with elements of eversion, and possibilities of dis- and re-embodiment.

Körper β will again be subdivided into three connected components or “organs”. A first sensing organ collects successive images captured by a video camera and, by differentiation, emphasises changes in the environment, trajectories and movements. *Körper β* embodies an algorithm of so-called *attractor reconstruction* that generates and parametrises a dynamical system approximating the spatial movements contained in the captured image sequences. The reconstructing system re-performs those trajectories in an attempt of iterative “remembering,” producing internal movement patterns whose traces are displayed by a video screen encased inside a wooden dummy head and visible through its eye apertures.

Dimensionality of the reconstructed dynamical system as well its changing structure is passed to the third element in this module’s system, the sound organ. It explores the limits of spatial differentiation at the distance between the listener’s position and porcelain speakers that are installed near the floor. Using occasional “colour cancellation” with respect to the plates’ impulse responses, physical and sonic bodies alternately converge and diverge. The sonic material will be a response and contrast to the nearby placed *Körper α*.

Acknowledgements:

This work was conducted within the project *Algorithms that Matter*, funded by the Austrian Science Fund (FWF AR 403-GBL). We would like to thank Espen Sommer Eide and Bergen Center for Electronic Art (BEK) for collaborating on *Thresholds of the Algorithmic* and for hosting the workshop, and Lydgalleriet Bergen for hosting the first exhibition. Credits to Nayari Castillo for allowing us to reuse the metal structure in *Körper α* that she originally conceived for the work *schwärmen + vernetzen*.

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