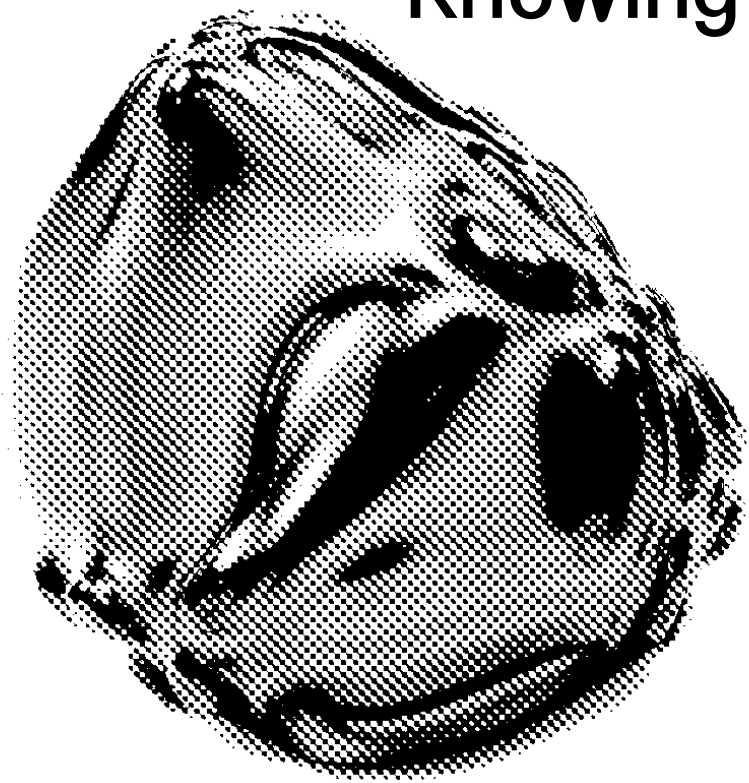
RE/EMBODIED DATA

Ambiguities of Knowing



Eds.
Michelle Christensen
Felix Stalder
Florian Conradi
Cornelia Sollfrank

RE/EMBODIED DATA
Ambiguities of Knowing

Eds.
Michelle Christensen
Florian Conradi
Cornelia Sollfrank
Felix Stadler

4 Introduction: Re/Embodied Data and the Ambiguities of Knowing
Felix Stalder, Michelle Christensen, Florian Conradi, Cornelia Sollfrank

Dialogue 1 – Quantification of Breathing

18 Breathing Data
Cornelia Sollfrank

48 On Yogic Breathing: Rapid Technological Progress and Mindful Self-Regulation
Ulrich Ott

60 Discussion: On Technology-Supported Self-care, Biofeedback, Self-knowledge and Non-duality

Dialogue 2 – More-than-Human Technoecologies

78 Critique as Design – Posthuman, Postwestern, Postdiscipline
Michelle Christensen and Florian Conradi

112 E'TOME – A Proposal of Moving Curveward
Anani Dodji Sanouvi

134 Vernacular Computationalities – Cosmogony as a New Paradigm for Design
Sénamé Koffi Agbodjinou

146 Discussion: On Vernacular Knowledge, Epistemic Diversity, and Nonlinear Futures

Dialogue 3 – Wildlife and Data

162 Re-relating the Technosphere to the Biosphere. A Wilding Project a Planetary Context
Felix Stalder

178 The Story of the Northern Bald Ibis: From Extinction to Conservation
Johannes Fritz

196 Discussion: On Technologies, Numbers, Values, Emotions, Hope, and Unexpected Collaboration

210 Biographies

220 Imprint

Re/Embodied Data and the Ambiguities of Knowing

We, the people and institutions in highly technologized cultures, understand the world increasingly through data. This is not entirely new—science and modern administrative practices have long relied on standardized measurements as the basis for claims of knowledge and efficiency (Koopman 2019). Yet, the comprehensive digitization of recent years has expanded this approach to knowing the world (and oneself) into almost all areas of the planet and life on it (see, Stalder 2018). Ever more objects, states, processes, and relations can be tracked and measured, and ever more aspects of our existence are becoming known to us through such numbers. Much is to be gained from this development, as we need to address many challenges we face, from the microscopic to the planetary.

There is, however, also a real problem here. This way of knowing, and the technologies and administrative processes that embody it, have become hegemonic. Early in the new millennium, the availability of data on an ever

larger scale ("big data") was accompanied by claims of an epistemological revolution (see, Mayer-Schönberger and Cukier 2013), one that would do away with non-quantitative aspects ("theory") and replace them with superior statistical knowledge (Anderson 2008). Today, claims avowing superior statistical knowledge derived from statistics have moved to the field of artificial intelligence (AI), whose capacities are so advanced that they are about to outstrip those of humans—this is at least what a breathless chorus of AI maximalists ("effective accelerationism") and AI doomers ("existential risk") want us to believe. The point is not whether such prognostications are accurate or not. As with all predictions, we will only know after the fact.

But what we already know is concerning enough. The imperatives of practical applicability and the transformative impacts of massive financial investment are further entrenching the hegemony of this way of knowing. And this produces increasingly large downsides, because the emerging regime is systematically blind to its ecological, social, and epistemological costs. A few examples should suffice. The infrastructures of datafication are anything but immaterial, and the cloud—with its attendant sense of airiness—is a deeply misleading metaphor.

Rather, the necessary infrastructure is of an industrial scale and requires a wide range of limited materials, such as rare earth minerals, generating a new, conflict-ridden geopolitical competition over their control. Also, production of machinery follows an industrial logic, with little thought towards recycling or other forms of sustainability.[1] As has become well-known, the energy and water required to run the rapidly increasing data center networks contribute significantly to global warming and resource depletion. Computing as a material practice thus contributes rather than saves us from the ongoing "eco-cide" (Comber and Eriksson 2023). In addition to these unresolved ecological issues, there are many social and political issues as well. The scope and complexity of advanced computing has led to a concentration of power in the hands of the infrastructure providers, who set the conditions of access and, thus, the boundaries to how this new knowledge regime can be used. The heavy concentration of power in the global north over tools used

1 According to the e-waste monitor, the amount of e-waste nearly doubled over the last 10 years. In 2022, a record 62 billion kg of e-waste was generated globally, with less than one quarter recycled. https://www.itu.int/en/ITU-D/Environment/Pages/Publications/The-Global-E-waste-Monitor-2024.aspx (accessed July 10, 2024).

world-wide is one aspect of the neocolonialism characterizing this approach. "Data extractivism"—that is, the large scale collection of data about humans and non-humans that is neither consented to nor beneficial to them—is another (see, Couldry and Mejias 2019). This extreme concentration of power accentuates the opacity of AI systems, making it very difficult to question their outputs and the actions and agencies produced through them, effectively undermining democracy, turning people from data subjects to data objects. Campolo and Crawford recently dubbed such "claims about 'superhuman' accuracy and insight, paired with the inability to fully explain how these results are produced", as "enchanted determinism" (2020, 1). Last but not least, claims for superhuman capacity constitute one part of broader patterns of epistemic violence, since they serve to systematically devalue other forms of knowledge along with the cultures and people embodying them, foreclosing any future possibility of developing alternative forms of knowing and being in the world (see, Mignolo 2011). After all, how could mere humans compete with, or even just contest, such supposedly superhuman capacities?

Epistemic Diversity and the Ambiguity of Knowing

For this publication, the issue of epistemic violence is our most immediate concern, not least because it is one that we—researchers, practitioners, designers, and artists—can address directly, even if on a small scale. First, by calling for and practicing diversity in ways of knowing. This means bringing together abstracted, quantitative knowledge with various forms of embodied knowing. Second, by making the gaps and incongruities between these different perspectives productive. The aim cannot be a unified grand synthesis—a new and supposedly better hegemonic way of knowing—but to acknowledge that knowledge is irreducibly situated, embodied, partial, and, hence, ambiguous. This applies also to AI, no matter how often the bots repeat their claims that they don't have bodies. They do, and it consists of vast infrastructures, protocols, and data sets, situating them in a specific techno-political matrix rather than beyond it in a space of "objective" knowledge.

Knowledge always rests on specific conditions to which it must remain blind in order to make any claim at all (in other words, it must avoid the problem of "infinite regress," the endless spiral of justification of assumptions). Thus,

knowledge obscures some aspects of the world even while revealing others, although the term "revealing" might be a bit misleading here. After all, and this is a second source of ambiguity, knowledge always reveals and constructs the world at the same time. In looking at things that exist, knowledge tends to summon forth things that do not yet exist: from different ways of knowing different worlds can spring. Here is where ambiguity can be very productive. Ambiguity of knowledge means that even when certain things can be substantiated—by means of logic, observation, or collective experience—there remains an aspect of knowledge that is, or should be, debatable, open to interpretation and collective negotiation over meaning and consequences: namely, the type of world that is constructed on the basis of partial and incongruous facts and relations. Thus, the question we need to ask about knowledge claims is not only whether they are true (although this remains an important question), but, a consideration that is equally important, how we want to deal with their consequences. While we can at least theoretically come to an agreement about whether an assertion of facts is correct or not (although, in practice, this is getting harder and harder), there can never be complete agreement when it comes

to assessing the consequences of these facts. Not least because consequences, the specific creation and distribution of costs and benefits, of openings and closings, often vary for different human and non-human actors.

Acknowledging this ambiguity can open the discussion towards the future, towards different futures, and the consequences of going in one direction or another.

Structure of the Book

This book documents and elaborates upon a one-day conference held under the same title at the Berlin University of the Arts in June 2024. As a practical attempt to make productive the *ambiguities of knowing* based on dis/embodied experience, we brought together three pairs of researchers/artists, who collaborated over an extended period of time in order to share different perspectives on their common subject and expand on the resulting ambiguities in an open discussion. The texts assembled here are the introductory statements of each of the contributors, as well as condensed, edited versions of discussions that were triggered by them.

Quantification of Breathing is a dialogue between artist Cornelia Sollfrank and neuroscientist and yoga teacher Ulrich Ott.

Sollfrank's project, *Breathing Data*, combines yogic breathing techniques with data science, exploring the effects of controlled breathing and self-quantification on body and mind in a three-month self-experiment. She used the universal nature of breathing and a specific set of technologies to bring different epistemic systems into contact. Breathing combines aspects of biology, physiology, medicine, and philosophy, uniting them in one body that breathes. Sensors turned part of this activity into a fine-grained data stream. Ulrich Ott served as scientific advisor regarding pranayama breathing techniques as well as the research design—especially the sensor-based collection of corporeal data and analysis of that data—providing basic knowledge about the physiology of breathing; that is, the effect of controlled breathing on the body and the mind. One principal aspect of her data was heart rate measurement, due to the close relationship between heartbeat and breathing rhythm. At the conference, Sollfrank reported on the progress of her project, presenting a selection of the data she collected and discussing how her research questions (e.g., how to relate this mass of data and the bodily experiences only partly contained therein?) shifted over the course of the experiment from looking inwards towards the

planetary (Sollfrank and Stalder 2025). The ensuing discussion focused on the methodology of the project, i.e., juxtaposing data-based expert knowledge with embodied knowledge; that is, the personal experience of the artist manifested in subjective data collection that took the form of a diary. In this instance, various forms of knowledge normally opposed to each other in science come together here as situated artistic practice.

The second dialogue, *More-than-Human Technoecologies*, brought together critical design researchers Michelle Christensen and Florian Conradi with architect and anthropologist Sénamé Koffi Agbodjinou and transmedia artist and dancer Anani Dodji Sanouvi. Christensen and Conradi attempted to unravel a critique regarding how the prevailing conception, collection, and increasing automation of data reflects an anthropocentric, Western paradigm of knowledge applied globally, inciting a discussion about the multiplicity of ontologies from which the relationship between technology and the world could be re-conceptualized and re-embodied (Christensen and Conradi 2019). Koffi Agbodjinou reflected on the potential of African cosmologies to serve as a new paradigm for technology, proposing a starting point that finds its roots in collectivity over individualism.

Anani Dodji Sanouvi introduced an interdisciplinary pedagogy for exploring the human body as a hypersensitive biomechanical sensor in communication with the elements in which it is in a process of becoming. The ensuing discussion debated the potential of thinking circular and *curveward* rather than perceiving futurity as a linear process of moving forward.

Finally, we have a dialogue on *Wildlife and Data* between the conservation biologist Johannes Fritz and the media theorist Felix Stalder. While one might imagine wildlife as occurring largely outside the direct influence of humans, this is not the case anymore. For one, primeval wilderness has greatly diminished, nearly to the point of disappearing altogether. Second, a "rewilding" project such as that with the northern bald ibis, which Johannes Fritz has been working on for the last 20 years, is characterized by strong invasive measures. This provides the immediate context for the dialogue. Rather than trying to uphold the collapsing binary nature/culture, the dialogue turned towards the increasing interrelation between biosphere and technosphere, focusing on practices of management and care that need to underlie it. Datafication, here the tracking of wild animals, plays a key role not just in surveilling the animals and learning about

their actions and habits, but in forging a new relationship between people, animals, and anthropogenic ecosystems based on cohabitation.

Acknowledgement

The conference and this publication are a collaboration between the research project *Latent Spaces—Performing Ambiguous Data* at the Zurich University of the Arts and the research project *Critical Inquiry + Design*, based at the Berlin University of the Arts (Weizenbaum Insitute) and the Technische Universität Berlin (Einstein Center Digital Future).

Many thanks for their contributions to Shusha Niederberger, Gordan Savičić, Alexandre Puttick, Doma Smoljio, Carmen Weisskopf, Annette Jael Lehmann, Ines Weigand, Athena Grandis, and Selenay Kiray.

Thank you to the following students for exhibiting their work during the conference: Deborah Schaper, Anika Merklein, Joel Tenenberg, Athena Grandis, Laurenz Sachenbacher, Berenike Melchior and Charlotte Golz.

References

Anderson, Chris. "The End of Theory: The Data Deluge Makes the Scientific Method Obsolete." *WIRED*, June, 2008. https://www.wired.com/2008/06/pb-theory/ (accessed July 10, 2024).

Campolo, Alexander, and Kate Crawford. "Enchanted Determinism: Power without Responsibility in Artificial Intelligence." *Engaging Science, Technology, and Society* Vol. 6 (2020): 1–19. https://doi.org/10.17351/ests2020.277.

Christensen, Michelle and Florian Conradi. *Politics of Things: Critical Approaches through Design*. Basel: Birkhäuser Verlag, 2019.

Comber, Rob, and Elina Eriksson. "Computing as Ecocide." Paper presented at Ninth Computing within Limits, virtual, June 14, 2023. https://doi.org/10.21428/bf6fb269.9fcdd0c0.

Couldry, Nick, and Ulises Ali Mejias. *The Costs of Connection: How Data Is Colonizing Human Life and Appropriating It for Capitalism*. Stanford: Stanford University Press, 2019.

Koopman, Colin. *How We Became Our Data: A Genealogy of the Informational Person*. Chicago: The University of Chicago Press, 2019.

Mayer-Schönberger, Viktor, and Kenneth Cukier. *Big Data: Die Revolution, die unser Leben verändern wird*. München: REDLINE, 2013.

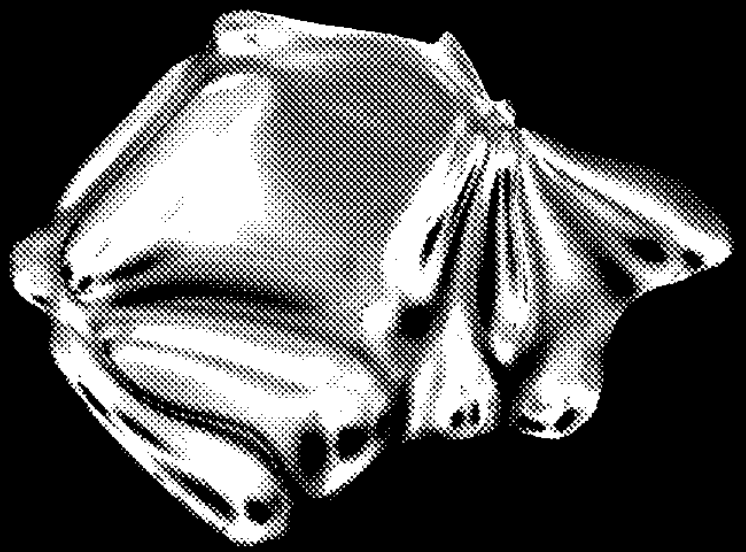
Mignolo, Walter. "Epistemic Disobedience and the Decolonial Option: A Manifesto." TRANSMODERNITY: Journal of Peripheral Cultural Production of the Luso-Hispanic World 1, No. 2 (2011): 44–66.

Sollfrank, Cornelia, and Felix Stalder. *Contemporaneity in Embodied Data Practices*. The Contemporary Condition. Berlin: Sternberg Press, 2025.

Stalder, Felix. *The Digital Condition*. Cambridge, Oxford, Boston, New York: Polity Press, 2018.

DIALOGUE 1

Quantification of Breathing



Breathing Data

Cornelia Sollfrank

> "What if we make freedom into the air we together breathe? After all, that is the air that belongs to us all, sustaining our lives, unless, of course, the toxins—and there are many—pervade the atmosphere."
> Judith Butler, "Who's afraid of Gender" (2024)

Thanks to Ulrich Ott for setting the terrain (see page 48 in this volume) and also for his friendly support throughout my project. His expertise and generosity have been an invaluable contribution.

Breathing Data can be described as an auto-ethnographic study of breathing practices and self-quantification. Combining yogic breathing techniques with data science, I explored the effects of controlled breathing on the body and mind as an artistic researcher over the course of a three-month self-experiment. The project included the targeted learning of breathing techniques (pranayama), the planned application of these techniques, the recording and comparison of body data obtained with several sensors, the logging of subjective perception, and the implementation of research results in

interventions, performance, and text.[1]

The universal nature of breathing was used here to bring different epistemic systems into contact. Breathing combines aspects of biology, physiology, and medicine, but also of politics, philosophy, and spirituality, uniting them in the body that breathes. Breathing establishes an intimate relationship between the individual and the world around her and is thus a thoroughly relational bodily function: it creates a connection between the inner physiological and mental state, and external substances and rhythms. At the same time, breathing not only reflects and influences one's emotional and mental state but can specifically alter these states through consciously applied techniques. The prerequisite for this, however, is to develop a sensitivity towards bodily states, for which the biofeedback of the various sensors is essential. As the researching artist, I worked together with a neuroscientist, a yoga teacher, and a data scientist to combine their respective fields of knowledge within the project while at the same time being the object of study. The experts' knowledge was juxtaposed with embodied knowledge, i.e., my personal experience that

1 For details about the research process, please visit the doku-wiki of the project: https://breathing-data.multiplace.org

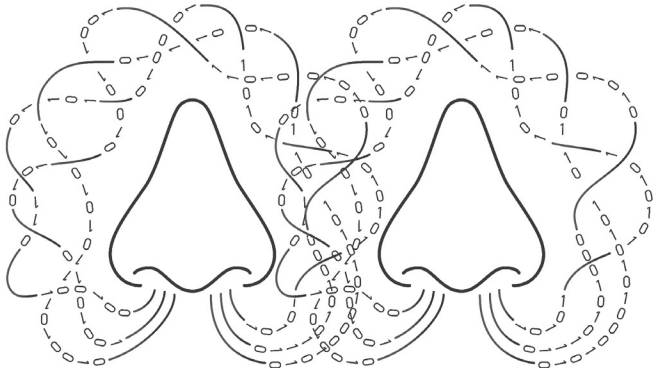


Figure 1: *Breathing Data* illustration on doku-wiki: https://breathing-data.multiplace.org/

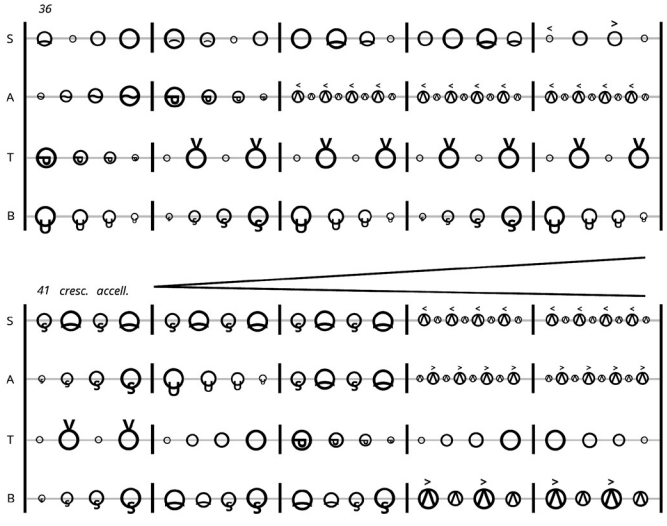


Figure 2: Excerpt from Breathing Choir notation system.

manifested in the subjective collection of data in the form of a diary-like record. Although the focus within the project is on a situated data practice that privileges my perspective as the researcher, it ultimately contributed to strengthening my care relationship with the co-world.

One starting point for the study was the assumption that a measurable improvement of body-related data, such as heart rate, HRV, breathing rate, and quality of sleep, occurs through the regular and conscious performance of breathing exercises. Several guiding questions oriented the project's progression: how does the daily collection of body data change one's behavior?; is the change brought about by daily yoga practice reflected in the data?; what does it mean to collect data from our bodies?; is the latter a practice than can reveal information and knowledge about ourselves that cannot be accessed otherwise, or is it simply another self-optimization modality?; and finally, was the project a useful application of digital technology in the end?

Background

My (the artist researcher's) interest in yogic breathing and biofeedback started during Corona pandemic, when in meetings with

the artist group #purplenoise,[2] I realized it was becoming harder and harder to focus on our shared work—the research and development of technofeminist projects. Discussing our personal situation took more and more time—exchanging about how we were each doing, what effects the isolation and the fear of contagion was having on our physical and mental well-being, as well as the political implications of the situation. However, we were happy that at least we had each other to talk to, even if conversations occurred over long distances and across national borders. It was useful to see how similar problems were occurring in different local situations. At one point, we gave up working through our to-do-list and instead started to think about what we could do to support each other while continuing our collective work. We also wanted to shift our focus from the theoretical, technical, and artistic issues we were dealing with to include our bodies. This was quite a leap, because we had carefully avoided making our own bodies the subject despite theoretically acknowledging the necessity of embodiment, as, e.g., feminist art in the '70s so radically did. This was a new terrain, full of uncertainties. Taking down the cognitive protection field allowed for vulnerabilities to appear.

First, we shared in the group what kind of techniques each of us practiced in our daily lives to stay healthy. What most of us shared and could somehow relate to was yoga. At the same time, alarm bells went off. How about cultural appropriation? It is quite a leap from taking yoga classes and doing some exercises at home to making an artistic project that would involve yoga as a practice of self-care. Eventually, we decided on a compromise, electing to learn and practice breathing exercises together. Breathing is a universal phenomenon that unites all living beings. Knowledge about breathing is part of many cultures—as a form of physical therapy as well as spiritual activity. We collected lessons from different teachers while delving into the extant literature, which runs from non-fiction instruction to spiritual guides to political theories that place breathing within the context of post-colonialism or climate change. Combining collective embodied practice with contemporary theory inspired us to develop two projects, which we later had the opportunity to present at Kunstmuseum Wolfsburg as part of the show *Empowerment*, whose subject was global feminisms. The first project, presented at the exhibition opening, was a group performance, the *Breathing*

2 Homepage of #purplenoise: https://purplenoise.org

Choir—a choreographed and composed sound performance based on a specially developed notation system.[3]

The second project, #shareyourair, was an installation where visitors could experiment with breathing in order to develop a better understanding of its social and environmental complexities.

After these two projects were completed, it felt as if I had just started to get involved with the fascinating topic of breathing and decided to dive deeper into it when I got the opportunity to develop an artistic research project within the framework of *Latent Spaces*.[4] The idea emerged to combine breathing techniques as a measure of self-care with the exploration of data science. Combining bodily practice with applied data science led to the concept of *Breathing Data*.

Data and Tools

The core phase of the project was planned to take place over three winter months in 2023/2024, but in order to have more data to compare with we decided to include time before it commenced and after its conclusion. (When I speak of "we"

Figure 3: *Breathing Choir*, #purplenoise, Kunstmuseum Wolfsburg, September 2022.

3 https://www.kunstmuseum.de/en/exhibition/empowerment/

4 https://latentspaces.zhdk.ch/

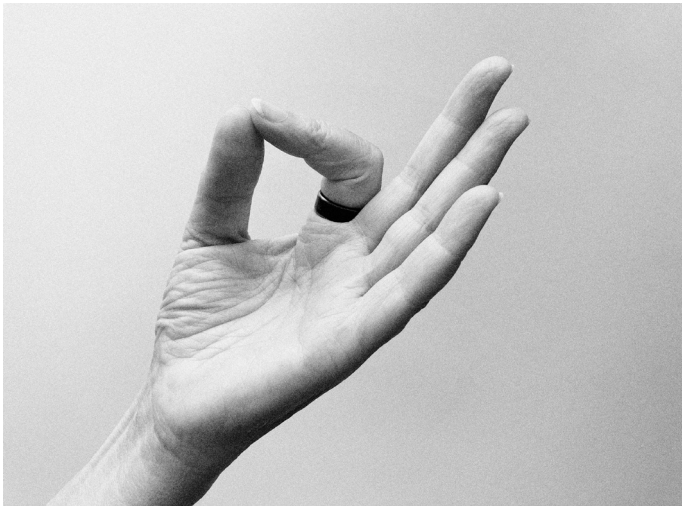


Figure 4: The researcher wearing the sensor ring while performing the Chin Mudra breathing exercise.

in this text, I refer to the scientific advisors and collaborators Dr. Ulrich Ott, Bita Samimizad, and Alexandre Puttick.) In the end, the evaluated data comes from six months of data collection, starting from August 2023 and ending in January 2024. The initial idea was to combine breathing exercises with measuring techniques so that the effects would be reflected not just in subjective bodily perception but numbers as well: early on, the idea arose to use body trackers to generate data and to later apply processing tools as an analytic. The first task was to design the breathing sessions. After consulting Dr. Ulrich Ott and making a few tests, I decided on a daily 30-minute session split into three equal parts, where I used different breathing techniques. These sessions consisted of 10 minutes deep yoga breathing to begin, followed by 10 minutes of alternate breathing, and ending with 10 minutes doing a retention after in and out in the same rhythm as exercise two. Basically, I decided to use only techniques that would release stress, slowing down my breathing rhythm and heart rate. Preliminary tests had shown that the best time for me to integrate the sessions into my everyday life would be early evening, between 7 and 8pm.

The next question was about measurement techniques—what kind of trackers

and tools to use in order to measure which parameters. Coincidently, I had recently read in a book about pranayama that the instructor used a "smart ring." My research led me to a Finnish company that was the market leader at the time. Using their product provided a solution independent of any specific operating system, and their ring allowed for 24-hour data capture with a minimum of body invasion or distraction. The smart ring is constantly worn on the left index finger; it uses infrared photoplethysmography (PPG) sensors, temperature sensors, and a 3D accelerometer and gyroscope to track sleep, steps, calories, heart rate, respiratory rate, temperature, periods of rest, and even naps. Since security is a major issue where body and health data are concerned, I was relieved to learn that the Mozilla foundation has rated this company and its data handling as trustworthy.[5] On the advice of Dr. Ott, I combined the smart ring with a chest belt worn during breathing sessions. The sensors of the belt use electrical detection to track the heart rate, providing more detailed data. The ring and the belt use different sensor technologies that complement each other. This combination allowed both short-term changes

5 https://foundation.mozilla.org/en/privacynotincluded/oura-ring/

and long-term developments to be tracked and made visible. The ring's data is regularly uploaded to the company's cloud storage. Here it is processed, providing feed-back on my stress levels and resilience on a daily basis, while also tracing changes over time.

With the chest belt alone, I was able to collect 27,768,130 data points between August 2023 and January 2024. In addition, there was the data from the ring measurements, which I have not quantified in detail. With the ring measurements, the evaluations that give me a daily score are the most meaningful, as they allow me to track the changes over a longer period of time.

While it does not make sense to compare the data from the two measurement methods directly, as they relate to different parameters and time periods, what you can do is see if there are comparable tendencies in the two data sets. In this instance, a rank correlation coefficient, which measures the degree of similarity between two rankings, can be used to measure the degree of similarity between two data sets and thus assess the significance of the relationship between them. For example, what the linear regression below illustrates is that during breathing sessions heart rate tends to be

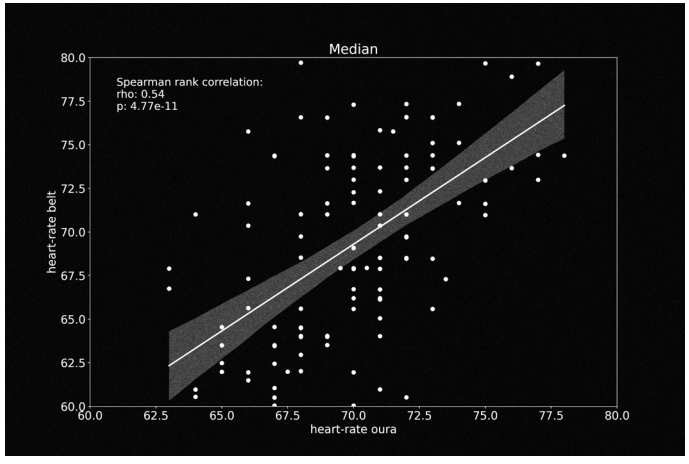


Figure 5: In this graph, the data points represent one day of measurements. The scale on the x-axis shows the heart rate measured with the OURA ring, i.e., the daily averages, while the y-axis shows the average heart rate measured with the chest strap during the breathing exercise.

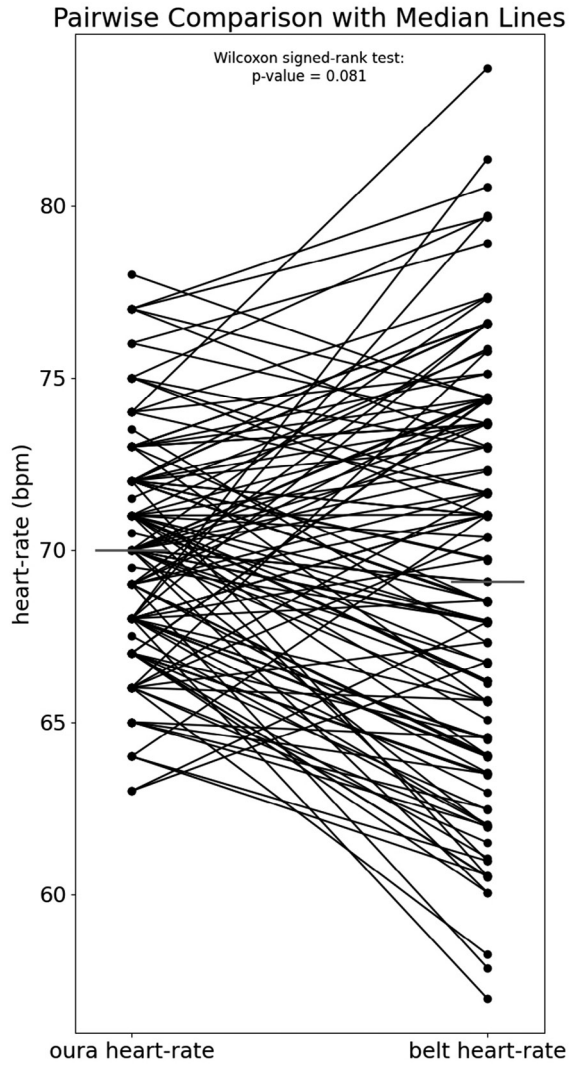


Figure 6: Heart rate measured throughout the day with the smart ring compared to the heart rate during the breathing session with the belt.

lower than during the rest of the day.

One can find a different visualization of the heart rate measured by the different devices in the graph below. While my average heart rate by day is around 70 bpm, the average during the breathing sessions is slightly lower.

The visualization of the data basically brought to the fore the fact that the raw data of the belt, although more accurate, also requires much more pre-processing, for which technical knowledge is indispensable. You have to do a so-called artifact control, i.e., artifacts must be detected and excluded (technical artifacts can be caused by a lack of sensor contact, e.g., due to movement). The better the contact the belt has with the skin, the clearer and more unambiguous the electrical signal. However, artifacts can also have physiological causes, e.g., cardiac arrhythmia, which would suggest high variability, but is not medically correct. Artifacts create noise in the data, producing unphysiological curve representations. That is why data scientists try to enforce regularity. The data processing and visualization was done by Bita Samimizad, a physicist and data scientist working at University Hospital Bonn. Interpretation of all visualizations, also those provided by OURA, is hardly possible without specialist

knowledge in the field of physiology and medicine. This is where the expertise of Dr. Ott came in. What became clear during these processes is that the data may represent a certain abstraction from the physical, but it is very much anchored in embodiment. In this respect, the separating duality of body and datafication is far less strict than I initially suggested. It is inscribed through processes of purification and division that blur this hybridity. My exchange with the scientists who assisted me on the project also made me realize that the data alone, despite precise measurement methods, lacks significance without the subjective perspective of the test person. Dr. Ott, for example, shared some of the questionnaires he uses for his experiments where the persons to be tested give information about their well-being before, during, and after an experiment. This subjective perspective became an essential part of the set-up for my study from the start. In my breathing diary, I kept records of various factors in my everyday life throughout the entire period. These included physical well-being, physical activity, emotional state, and influential events such as illness, travel, caring for relatives, extraordinarily heavy workload, or unforeseen events, such as an accident or water damage to the house, which added

a lot of extra stress. These entries become particularly meaningful when compared with the development of the data across a longer period of time. Contrary to my original assumption that my physical condition would simply improve over time as a result of the breathing exercises, it became clear how external stressors change the course of the curve.

The few steep rises in the curve clearly coincide with extreme events in my life, and I can only speculate how much more they would have risen without the daily breathing exercises. I can't influence extreme events; I can only arm myself against them by trying to maintain my level of fitness so that my body, and especially my heart, can react flexibly. In fact, the most common indicator for heart health is RMSSD—the best known and probably most proven value of heart rate variability (HRV)—which reflects the body's ability to recover. The abbreviation RMSSD stands for Root Mean Square of Successive Differences (between normal heartbeats), calculated using a mathematical formula that evaluates the time differences between successive heartbeats. This already indicates that its analytic value lies in the temporal domain. The changes in heart rate indicate how well the body can switch back and

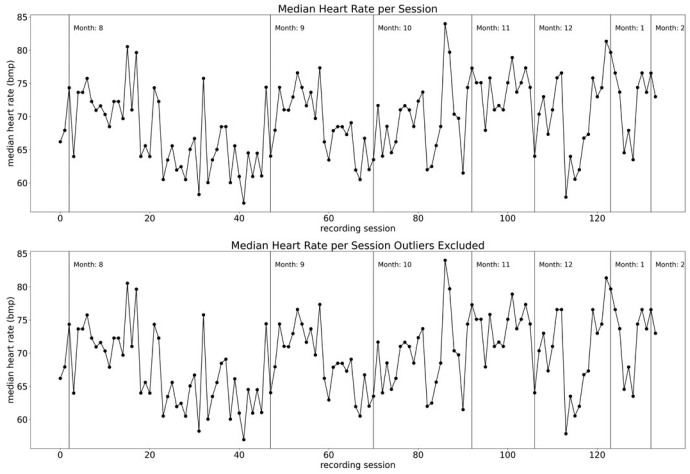


Figure 7: The average heart values provide information about a longer-term development.

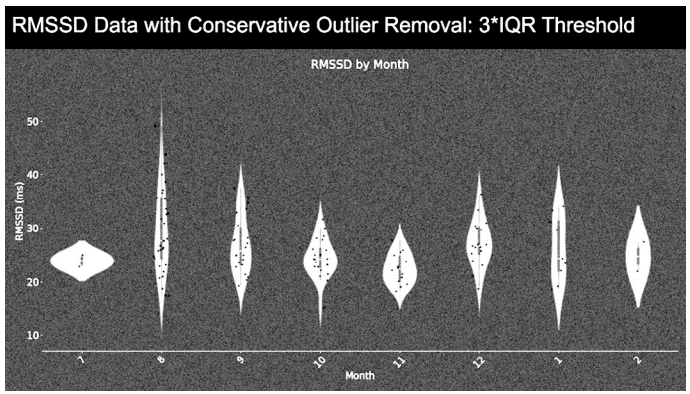


Figure 8: RMSSD values compared by months. The average values vary each month as indicated by the white line in the center.

forth between stress and relaxation. It is considered the standard measure of parasympathetic cardiac regulation, meaning that its values indicate how successful the parasympathetic nervous system is in ensuring the body's recovery and regeneration.

The higher the RMSSD value is, the greater the body's ability to relax and recover from stress. The smart ring also provides an indication of RMSSD (HRV), and a comparison shows that the trends are similar. However, as with all other values, there is no clear trend. Rather, the curves show that its development is dependent on external factors, and that while the breathing exercises have a positive effect overall, in extreme situations they only moderately reduce stress.

Methodology

As explained above, the methodology used in my study is a combination of methods stemming from different disciplines. Our project leader Felix Stalder suggested the use of the term "post-disciplinary" for such an approach. The term was coined by artist and writer Gerald Nestler, who uses it "in the sense that art is not a discipline but a praxis that, to the advantage of difference and multiplicity, opens to other research and

practice, including disciplinary ones; it is about forms and forums of thinking and making in-between artistic, theoretical, scientific and political engagement." (Nestler 2020, 114) Such a blurring of methods also constitutes my artistic research. While the scientists I work with remain in their respective disciplines, I have the freedom to bring together natural science, data science, and spirituality. My body is the place where they meet and I translate them into various artistic practices. And while my body is the place where different disciplines come together, it is my mind that is constantly negotiating questions of combination and transformation, inclusion and exclusion. The result of such negotiating finds its expression in various artistic works that have emerged from the study. Perhaps most notably, the performance I made together with the data scientists who contributed to this project, *Data Cyborgs. A partially algorithmically generated embodied conversation between three different logics*. This is a staged dialog about a fictional figure, the DataCyborg, created from my body data, who is approached from different disciplinary backgrounds.

Another example is the *Breathing Manifesto,*[6]

6 The complete manifesto can be found at the #purplenoise website: https://purplenoise.org/wp-content/uploads/2022/09/shareyourair-manifesto.pdf

a poetic condensation where I have tried to capture the complexity of the subject, i.e., the intersection of the anatomical, physiological, technical, spiritual, and political aspects of breathing. It consists of 16 sections, each with a headline of its own.

Here is an excerpt:
Breathing is presence

Starting with basic breathing techniques,
in, out and hold,
that create space and time,
time to connect and understand
what we share.

Breathing is situated

The floating signifiers do come home,
return to the body.
Class, gender, race
and the constitution of our body specifies
our breath,
our experience of the world.
To achieve respiratory justice
we first have to understand
who we are,
and where we stand.

Breathing is political

We do not breathe on equal terms.
Who can breathe and whose breath is taken away,
is structured along toxic lines of power.

Few destroy to the detriment of many,
they violently interrupt the connections
necessary for life.

Suffocation can occur in many ways:
bodily, social, environmental, affective and political.

Concluding Thoughts

I began this study with a basic assumption and a few questions. My assumption—that the breathing exercises would show measurable success—was not so clear-cut, because unforeseen external stressors arose during the experiment period. At the same time, it can be said that within a changing overall situation my breathing exercises always brought about an improvement. One of the conclusions I drew from this is that such a project would need a protected environment with a minimum of external stressors. A monastery or meditation center

would both be good environments. The question is whether I would want or be able to seclude myself in this way. In principle, the realization that breathing exercises generally have a positive effect is enough for me, and I would like to continue to improve my breathing practice and use it regularly.

What implications does the finding described above have for the questions that guided the study? Did the daily collection of body data change my behavior? It wasn't so much the data collection as the breathing exercises themselves, but I probably wouldn't have practiced the exercises as consistently without the framework of the study. Daily breathing practice has made me very familiar with the various different techniques, so that I now also use essential techniques outside of set exercises. That alone is a real enrichment of my life. If and how the change brought about by the daily practice was reflected in the data is a question I already answered. It basically did, but in a different way than expected. The question of what it means to collect data from my body, on the other hand, is much more difficult to answer. It is in the nature of self-experimentation to expose oneself, to apply the unknown to oneself.

The experience of placing my body at the center of attention—not only mine, but also

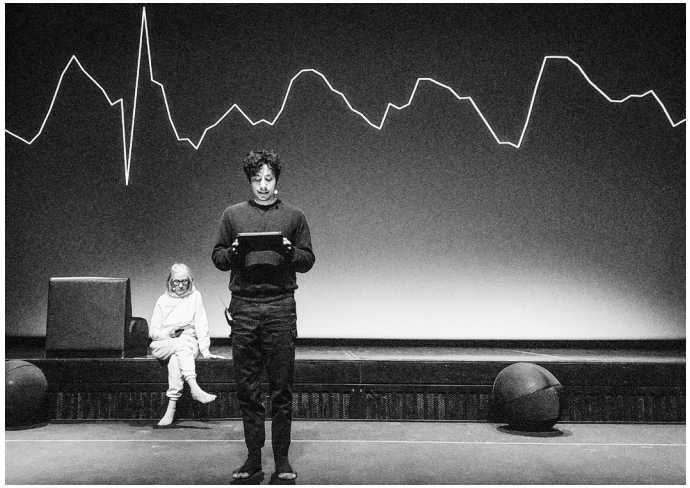


Figure 9: Data Cyborgs. A partially algorithmically generated embodied conversation between three different logics, Cornelia Sollfrank and Alexandre Puttick, performance at the conference (un)real data – real effects, Aksioma, Ljubljana, 27 February 2024. Photo: Miha Fras / Aksioma, CC-BY-NC-SA 4.0.

that of my colleagues, scientists, and the interested public—was exceptional. It is unusual for me to share such private information as the quality of my sleep and my physical condition. But I elected to do so and controlled what I wanted to share and with whom in every situation. What made a profound impression, however, was that I had so little control of the data produced by the study. I was wholly dependent on the trustworthiness and scrupulousness of the companies whose products I made use of. The issue of health and body data opens up a whole new dimension of data security—issues that we as a society are only just beginning to address. Dystopian scenarios involving being forced to behave in certain ways or being punished for misconduct are easy to imagine. The scaling of data collection about bodies from an artistic research project to a socially coercive scenario raises many questions that my study can, at best, stimulate, but certainly not answer.

Nor can the question of whether collecting data brought to light information to which I would otherwise not have access be answered unequivocally. In principle, the answer depends on how much body awareness you bring to a project like this. There are certainly people who pay very close attention to what their body tells them and react accordingly. I belong in this category to only a limited extent. For me, the data definitely unveiled new insights I would not have had access to, although Dr. Ott never tires of emphasizing that biofeedback of this kind improves your own body awareness, and over time you become less dependent on technical aids to obtain and interpret corporeal information. Although for now the study has concluded, I will continue to wear the smart ring and keep checking my data. I have the feeling that this will improve my self-perception for some time to come. At the same time, I don't envisage wearing the ring or other sensors for the rest of my life. I hope that the biofeedback is a temporary phase that will improve my overall quality of life, but it should only be a phase.

This takes me back to the question of technology. As I have already pointed out, there are risks and advantages related to body tracking. The positive aspects lie in the advancement of body awareness through technology. The risks lie in the production of very intimate data over which one never has full control. The most exciting moments for me occurred when discrepancies arose between the data and my self-perception. Is data more truthful than perception? Do I trust technology or do I trust myself?

In fact, I can say that I don't completely trust my perception or the technology I availed myself to. Comparing two systems of knowledge led me to question both, to conduct a kind of ongoing negotiation between them involving first and foremost an unsettling of unambiguous forms of knowledge. I found this extremely invigorating. At no point did I feel it necessary to surrender myself to one or the other. On the contrary, the juxtaposition created a kind of free space for new experiences. However, this unsettling of my own cognitive systems did not only take place at the level of technology, but elsewhere as well. Normally, breathing occurs automatically through the control of the autonomic nervous system. But autonomic bodily functions can be influenced through the conscious application of certain techniques. Through this form of hacking I have gained awareness of a hidden space where the conscious mind can connect with unconscious body functions. While such processes can be set in motion without technology, technology can provide a valuable service.

The most common objection I get to the *Breathing Data* study is that such tracking ultimately serves neoliberal self-optimization alone.

I take this argument seriously, because the body has always been the place where

capitalist exploitation takes place. In neoliberal times it merely has a friendlier appearance (wellness), and the biggest application of body-tracking technologies is precisely where one might expect it—in the field of sports and self-optimization. I have never been interested in the underlying attitude of physical self-optimization. Rather, I find it appropriate to bring the concept of self-care into the discussion at this point. Unlike self-optimization, self-care can be an act of political resistance, as both Audre Lorde and Michel Foucault have elaborated. Each address the concept of self-care, but approach it from different perspectives and contexts, reflecting their broader intellectual and political commitments. For Lorde, it was a radical and political act. In her influential essay "A Burst of Light," she famously wrote: "Caring for myself is not self-indulgence, it is self-preservation, and that is an act of political warfare." (Lorde 2017, 202) She argues that taking care of oneself is a way to resist the structures of oppression and affirm one's own worth and dignity. It is about creating spaces where one can thrive despite the systemic forces that seek to diminish one's existence. Foucault's approach to self-care situates it within the framework of ethics and the care of the self (*le souci de soi*), and he explores this concept through the

lens of ancient Greek and Roman philosophies, where the practice of caring for the self was seen as fundamental to living a good life (Foucault 1990). His idea of self-care involved practices and techniques individuals use to shape their own behaviors, thoughts, and bodies; a form of self-governance where individuals engage in reflective and deliberate actions to cultivate virtue and ethical conduct. In this sense, self-care is not just about individual well-being but also about how one relates to others and the community. Foucault's interest lay in how these practices of self-care can resist forms of domination and contribute to personal freedom and autonomy. For both authors, self-care has a strong social and political notion.

The idea of the political does not end with one's own well-being. It necessarily includes other beings. One of the most surprising realizations I made during my study, however, was that my initial focus—which, in fact, was mainly about self-care—opened up in the course of the project. I understood that self-care without care for one's surrounding context is meaningless. And this context includes not only other beings but the whole environment. The environment is not something around and outside of us, it is a co-world. It is not an object outside of us: we are part of it. Realizing the relational character of breathing involved more than cognitive understanding, it grew into an experience of connectedness; just being, being alive, in this very moment.

In this respect, the climate crisis is also a crisis of breathing. It is not a technical emergency that we can resolve by reducing C02 emissions. The atmosphere is filled with gases produced by humans, animals, and plants. It is basically a gaseous extension of all of us. I take oxygen into my body from the air—Paul Nestor says, "we are eating air"—and I release carbon from my body, constantly, 23,000 times a day, 8,395,000 times a year. I have already breathed 537,280,000 times in my life (approximately). The atmosphere is me, and since we breathe together all the time, the atmosphere is us!

References

Foucault, Michel. *The History of Sexuality*. New York: Vintage Books, 1990; and Michel Foucault, *The Hermeneutics of the Subject* London: Palgrave Macmillan, 2005.

Lorde, Audre. *A Burst of Light: and Other Essays,* Calabasas: Ixia Press, 2017, 202.

Nestler, Gerald. "Contingent Claims: The Performativity of Finance, or How the Future Materializes in Technocapitalism," *Performance Research* 25 (3) (2020): 114.

On Yogic Breathing: Rapid Technological Progress and Mindful Self-Regulation

Ulrich Ott

Background

At the end of September 2022, Cornelia Sollfrank sent me an email inquiry regarding possibly cooperating on an artistic research project. She wanted to practice yoga breathing techniques and assess their physiological and psychological effects on herself. I agreed to support her in selecting breathing exercises as well as developing suitable physiological parameters and measurement devices, because I have conducted studies in this field for many years, publishing two non-fiction books on yoga and on the health benefits of yoga breathing techniques (Ott 2013; Ott & Epe 2018).

Since our first contact we have exchanged around 150 emails and discussed methodological issues relating to her research project during several video meetings. Eventually,

she decided to use a smart ring to measure her heart rate continuously and a chest belt to obtain high-quality heart rate measurements while performing breathing exercises. Heart rate variability was chosen as a main physiological parameter, because it is a well-established indicator for the actual state of the autonomic nervous system; higher heart rate variability indicates an increased vagal tone (an activity of the vagus nerve and a crucial component of the parasympathetic branch of the autonomic nervous system), meaning increased relaxation and restoration.

Sollfrank's perspective was that of an artist and "end-user" of available commercial products for physiological self-assessment, applied by her to explore the effects of breathing exercises on her bodily stress level and, at the same time, on her mind during the process of exercising and receiving feedback. My role was that of an expert providing advice on: 1) technical issues; 2) yoga breathing techniques, and; 3) the meaning of the physiological data and limitations to interpretation.

Basic Facts on Breathing

Spontaneous breathing frequency during relaxed wakefulness typically ranges between 12 and 20 breaths per minute, which translates to a duration of 3 to 5 seconds for a single

breath. The volume of the exchanged air is typically between 250 and 500 milliliters. However, the total volume available—two to three liters—is much higher, and can reach up to ten liters in trained apnea divers. Speed and the gas volume exchanged during respiration are controlled by the respiratory center in the brain stem, which integrates information from stretch receptors in the lungs and chemoreceptors detecting the level of blood gases, especially the level of carbon dioxide; an increase of carbon dioxide in the blood triggers the respiratory drive. In everyday life, breathing rate and depth are mainly influenced by the actual metabolic needs of the organism and are regulated automatically. In addition, the breathing pattern can be changed by strong emotions (i.e., crying, sighing), heightened attentiveness, while speaking or singing, or deliberately, due to holding one's breath or hyperventilating. On the other hand, breathing rhythm and phase also have an impact on cortical activity and the higher cognitive processes (emotions, attention, perception, memory, motor responses, etc.)[1]

1 For recent reviews, see Allen et al., 2023, Boyadzhieva & Kayhan, 2021, Brændholt et al., 2023, Heck et al., 2023, Herrero et al., 2018.

Breathing and Meditation

In meditation, naturally occurring breathing sensations in the abdomen, chest, or nostrils can be used merely as an object for focusing attention (Matko et al. 2021). By contrast, pranayama yoga techniques (prana = breath, life energy; ayama = to elongate, extend, control) encompass deliberately changing the rate, depth, and rhythm of breathing (duration of inspiration, expiration, and breath holding phases), and even the airflow through the nostrils (unilateral or alternate nostril breathing). Changes in the way one breathes are likely to be a key mechanism by which a variety of contemplative techniques produce beneficial effects on health (Gerritsen and Band 2018).

The effects of various pranayama practices include but are not confined to relaxation. A study on physiological changes and subjective experience induced by four different pranayama techniques postulated different effects (Epe et al. 2021):

- Calmness by slowing breath through narrowing the glottis (Ujjayi).
- Mental focus by paced breathing, with breath holding (Kumbhaka).
- Vegetative balance by alternating the nostrils (Anuloma Viloma).

– Wakefulness by fast breathing and pausing (Kapalabhati).

Participants reported applying specific techniques like a self-regulation toolbox, depending on the situation and effects they wanted to produce.

Breathing and Heart Rate

In Sollfrank's artistic research project, the goal was to use breathing techniques not only to bring about subjective wellbeing and health benefits but also to obtain physiological indicators to quantify, visualize, and monitor changes achieved over time. Continuous heart rate measurements seemed well-suited for this purpose, because: 1) respiration and hearth rate are closely connected (see below); and 2) heart rate variability (HRV) provides important information on vegetative arousal and relaxation.

Whenever one breathes in, the heart rate accelerates, while the heart slows down during expiration. This phenomenon is called "respiratory sinus arrhythmia" and it is caused by the calming influence of the vagus nerve on the heart. During inspiration, this "vagal brake" is transiently blocked, which leads the heart rate to accelerate. Thus, breathing rhythm is mirrored in heart rate oscillations of the same frequency, an effect that is enhanced when one breathes slower and deeper. Many relaxation exercises use this effect by pacing the breath at around six cycles per minute (inspire for four seconds, exhale for six seconds) in order to increase HRV, which indicates increased "vagal tone"; HRV has been used in numerous studies to monitor, respectively, stress level or relaxation (PubMed database: a search for "'heart rate variability' stress" returns over 4,500 hits; for a tutorial and review on HRV, see Laborde et al. 2017, 2022).

Measuring the Heart Rate

In research labs, heart rate is typically derived from electrocardiogram (ECG) recordings. These detect peaks of electrical activity, determining inter-beat intervals with millisecond precision. The available raw ECG data allows for detecting and correcting artifacts, which can be caused by movements, technical distortions, or physiological irregularities (e.g., extrasystoles).

ECG recording requires electrodes and amplifier systems to be placed on the body. These are also available as (costly) portable devices for ambulatory assessment in research settings. For Sollfrank's project, a chest belt of the sort frequently used by runners was chosen as

a measurement device during the breathing exercises. It detects heart beats based on the electrical activity of the heart, providing heart rate data precise to the millisecond. For continuous monitoring (24/7) a smart ring was chosen. This measures the heart rate through finger plethysmography, arterial pulses detected by changes in the red coloring of the blood. Compared to the ECG, the peak of the recorded pulse waveform is less distinct, leading to decreased but still sufficiently precise heart rate data. But due to a lack of raw data, artifact correction is not possible using the ring alone. However, movement artifacts are rather unlikely to occur during breathing exercises in a fixed body position.

Data Analyses and Biofeedback

The level of the heart rate per se, increasing with vegetative arousal and motor activity, as well as an indicator for vagal tone (relaxation) derived from HRV (parameter: Root Mean Square of Successive Differences, RMSSD; see Laborde et al. 2017) were used for analyses and feedback of physiological changes. In addition, the smart ring measured movements and provided data on sleep duration and quality. Visual reports were provided through the INTERNET-based platform of the company selling the smart ring. Further analyses of the recordings obtained by the chest belt were done by a data analyst using the Kubios HRV software package (the gold standard in research). Another data scientist took all the data from these two different sources to conduct an exploratory data analysis after initial pre-processing, and then progressed to advanced statistical evaluations focused on key variables (RR intervals, HRV, and readiness score). These visualizations either compare the development of specific parameters over the course of the project period, certain parameters within one data category (OURA or chest belt) to check for correlations and irregularities, or selected parameters of the two measuring systems.

An important part of the research project was the impact the measurements and data reports could have on the researcher being simultaneously her own research object. Could these measurements influence her motivation to do the breathing exercises according to the specified protocol? Would the physiological reports correlate with her subjective experiences recorded in a diary? Where would the truth lie in the event of discrepancies between subjective experience and objective measurements? Finally, would the exercises and measurements

over the period of three months increase the researcher's ability to perceive, understand, and better regulate corporeal, emotional, and mental processes?

Answering these questions required an ongoing dialogue between the artist researcher and myself, especially to clarify possible discrepancies between physiological indicators of stress based on the analysis of heart rate data and her self-reported subjective states of feeling. In my view, one crucial point of the study was to increase sensitivity for the vegetative processes accompanying these feeling states. Introspection during the breathing exercises, self-observation during everyday life—especially stressful events or periods of time—and the reflection on data reports contributed to a refined self-perception, enhanced self-trust, and, finally, an improved ability to self-regulate.

Conclusions and Outlook

Yogic breathing techniques can be used as tools for self-regulation of the sympathetic and parasympathetic (vagal) nervous system. Breathing not only influences the autonomic nervous system but also affects higher psychological functions such as emotions, attention, and cognition.

The continuous measurement of the heart rate with smart gadgets (phones, watches, rings) is easy today and provides a window into one's own current physiological state as well as changes over time. However, the sound analysis and interpretation of heart rate data and parameters of HRV requires expert knowledge and experience. Data ownership and data privacy are also critical issues (e.g., access is often only possible via a paid cloud-service).

Nevertheless, technical progress in this area has been rapid, and self-assessment of physiological data will become easier and more comfortable in the coming years. Therefore, it is important to study the potentials and risks occasioned by wide-spread application of these tools, clarifying how their mindful use can improve self-regulation and self-reflection, promoting better health and insight.

References

Allen, Micah, Somogy Varga and Detlef H. Heck. "Respiratory rhythms of the predictive mind." *Psychological Review* 130, no. 4 (2023): 1066–1080. https://doi.org/10.1037/rev0000391

Boyadzhieva, Asena and Ezgi Kayhan. "Keeping the Breath in Mind: Respiration, Neural Oscillations, and the Free Energy Principle." *Frontiers in Neuroscience* 15 (2021): 647 –579. https://doi.org/10.3389/fnins.2021.647579

Brændholt, Malte, Daniel S. Kluger, Somogy Varga, Detlef H. Heck, Joachim Gross and Micah G. Allen. "Breathing in waves: Understanding respiratory-brain coupling as a gradient of predictive oscillations." *Neuroscience & Biobehavioral Reviews* 152 (2023): 105–262. https://doi.org/10.1016/j.neubiorev.2023.105262

Epe, Janika, Rudolf Stark and Ulrich Ott. "Different Effects of Four Yogic Breathing Techniques on Mindfulness, Stress, and Well-being." *OBM Integrative and Complementary Medicine* 6, no.3, (2021): Article 3. https://doi.org/10.21926/obm.icm.2103031

Gerritsen, Roderick and Guido P. H. Band. "Breath of Life: The Respiratory Vagal Stimulation Model of Contemplative Activity." *Frontiers in Human Neuroscience* 12, no. 397 (2018). https://doi.org/10.3389/fnhum.2018.00397

H. Heck, Detlef and Somogy Varga. "The great mixing machine": Multisensory integration and brain-breath coupling in the cerebral cortex." *Pflugers Archiv: European Journal of Physiology* 475, no. 1, (2023): 5–11. https://doi.org/10.1007/s00424-022-02738-z

Herrero, Jose L., Simon Khuvis, Erin Yeagle, Moran Cerf and Ashesh D. Mehta. "Breathing above the brain stem: Volitional control and attentional modulation in humans." *Journal of Neurophysiology* 119, no. 1 (2018): 145–159. https://doi.org/10.1152/jn.00551.2017

Laborde, S., M.S. Allen, U. Borges, F. Dosseville, T.J. Hosang, M. Iskra, E. Mosley, C. Salvotti, L. Spolverato, N. Zammit, and F. Javelle. "Effects of voluntary slow breathing on heart rate and heart rate variability: A systematic review and a meta-analysis." *Neuroscience and Biobehavioral Reviews* 138 (2022). 104711. https://doi.org/10.1016/j.neubiorev.2022.104711

Laborde, Sylvain, Emma Mosley and Julian F. Thayer. "Heart Rate Variability and Cardiac Vagal Tone in Psychophysiological Research— Recommendations for Experiment Planning, Data Analysis, and Data Reporting." *Frontiers in Psychology* 8, 213 (2017). https://doi.org/10.3389/fpsyg.2017.00213

Matko, Karin, Ulrich Ott, and Peter Sedlmeier. "What Do Meditators Do When They Meditate? Proposing a Novel Basis for Future Meditation Research." *Mindfulness* 12 no. 7 (2021): 1791–1811. https://doi.org/10.1007/s12671-021-01641-5

Ott, Ulrich. *Yoga für Skeptiker* [Yoga for sceptics]. München: O. W. Barth, 2013.

Ott, Ulrich and Janika Epe. (2018). *Gesund durch Atmen* [Healthy through breathing]. München: O. W. Barth.

Discussion: On Technology-Supported Selfcare, Biofeedback, Self-knowledge and Non-Duality

Michelle Christensen:

So, thank you, first of all, for your two inspiring talks. My first question is about controlling the breath by closing one nostril, that it is related to controlling your nervous system. Can you really do that without using your hands?

Ulrich Ott:

You can do it by just switching your attention to one nostril. The effect of breathing through one nostril already changes the vegetative state, but usually you do it by using your hands, doing the Vishnu Mudra, like this [demonstrates the posture].

Michelle Christensen:

Interesting. I never really knew the whole background to that, the physiological effect. I'd like to continue with a few questions

to Cornelia, because you were wondering how useful the use of tech is for doing these exercises. And with this kind of very personal, private, very autoethnographic project—how to find the boundaries between the self-learning and the quantifying, between the body literacy and body hacking, versus the knowing that you're using a commercial device which, of course, is trying to contribute to a certain efficiency coming from a philosophy of rationality, and so on … What was the methodological framework that you started with? What was your attitude towards technology? Did you say, "Ok I'm going to engage into this, but I'm definitely not going to be swayed by what the app tells me in the morning?" Did you let yourself fall into it and then once in a while come up and think about how it's affecting you, or how you negotiate with that?

Cornelia Sollfrank:

Regarding the role of technology: first of all, I realized that I would not have done these exercises so consequently without having the clearly defined setting of the three-month project: it motivated me. I think that's important for all kind of things that you want to do. You have the knowledge and good intentions, but then, for some reason, you don't do what

you set out to do. Why? Maybe you're lacking discipline? Another important aspect is also to create a space—a mental space but also a physical space—where you are undisturbed and you can develop a routine. Part of building such a routine is also to understand what the best time of the day is for doing the exercises. The most important thing, however, is that you do the exercises at all. Taking data with the help of sensors was very helpful for me. Keeping this discipline was a little bit enforced from outside, but it helped me to realize that something is happening when I'm doing the same practice every day at a certain time. It makes a difference. These experiences are independent from the technology, but the technological set-up is useful.

Regarding the question, whether I trust technology more than my own perception: no, I do not trust technology per se, nor do I fully trust my own perception. One could say I trusted neither of these different forms of knowing fully. I just jumped into the project and was curious to see what would happen—for example, to see my finger starting to glow in the middle of the night when the LEDs in the ring went on (one of the first things I learned through the app was that I don't sleep enough). The app encouraged me to sleep more, especially to go to bed earlier. What happens is a constant exchange with the data. And it is also a constant questioning over whether what the data tell me is true. Sometimes I agree, sometimes I don't. This dialogue is a very important aspect of the project.

Ulrich Ott:

Basically, it's the idea of biofeedback. You use the technology for a certain phase to direct your attention towards your sensations and, on the other side, see objectively what happens in your body. But after you've learned that, to feel it directly you don't need the external feedback anymore. The purpose of the feedback is that you improve your awareness.

But maybe I can pose another question. Cornelia, you mentioned you practice three techniques within half an hour, but you didn't explain which ones. Maybe the audience is interested in what you actually did. Then at some point you asked me if we can measure this experience of the ego dissolving and feeling connected. Research has started to find out what happens in the brain during these experiences, when the ego dissolves, and space and time dissolve. It's a relatively new research

field with psychedelic substances opening up—with psilocybin, the active pharmacological agent of magic mushrooms—where people lie inside the scanner and receive a certain dosage by infusion. Your ego dissolves and you can see how the brain network connectivity patterns are modified. So, we are able to track what's happening in the brain during such states. There are even combined studies where test persons receive psilocybin while doing Zen retreats. Thus, we can look [at] how meditation patterns are influenced by it.

Cornelia Sollfrank:

You mentioned doing measurements with drugs. Do you also measure brain activity with meditation only, without drugs? Is that possible?

Ulrich Ott:

It's possible, but it's more difficult because not many people are able to enter the states of non-duality while being triggered from outside. It's very hard to focus on that state and watch it at the same time. There are certain studies with very experienced meditators who were actually able to focus their attention and even realize non-duality inside the scanner. Today, we better understand what is happening in

the brain during these processes, and we have several hypotheses of what is happening during these altered states when the self-model and the world-model dissolve: it's all a creation of our mind.

Cornelia Sollfrank:

I'm still a beginner in this field, but it is all so exciting. I also see its political aspects, and find it interesting to follow and connect it to recent thinking in philosophy: planetary thinking, something I discovered with Felix while we were thinking about how our projects are related. We consider them as exercises in planetary thinking. Regarding the design of the breathing sessions: I started with deep yoga breathing for ten minutes, went on to alternate breathing for another ten, and then lastly was breathing through both nostrils again, but with retention after in and after out. Generally, I avoided energizing breathing techniques and focused on the ones that slow down the whole organism.

Audience:

Thank you both so much. My name is Emma, and I'm working as an artistic researcher in the wearable computing department. My background is in weaving, and my focus

is on tangible and embodied experiences and knowledge in the hand weaving process. First of all, I loved breathing along with your presentation and trying the forms of breathing that you were describing. To Cornelia, I wanted to ask you a two-part question: I found it really interesting when you showed the table in your presentation where you took notes highlighting aspects of your day that would maybe have impacted your condition, your stress level or breathing. How did you identify or decide what counted as a key experience to include? Then: I was also wondering if you are planning to create your own kind of hybrid visualizations of the different qualities of the data you have collected? The technical data and your diary data.

Cornelia Sollfrank:

Regarding the last question, I'm still working on the visualization of the chest belt data and also its evaluation. Checking the CSV files, I realized that they contain about 18,000 data points that were captured during one session alone. And I have more than 100 sessions. There are all these physiological parameters; some are constantly measured, some only every so and so many seconds ... which means, you have to have the knowledge about what

is important to extract, how to extract it, how to visualize it. I'm still working on that with the support of a data scientist. It is an essential aspect of finalizing the project. Also, opening up to planetary thinking keeps my mind busy. How can I accommodate such an unexpected development? The starting point was self-care and eventually I arrived at planetary thinking. This is really wild. It makes me realize how narrow my intellectual setting was before. Now I'm thinking about non-dual states of mind and how I am connected to the universe, and things like that. Regarding the processing of the different data I have collected: I have always intended to make a book about this project. So, the evaluation will be done in writing, but I'm not sure yet about the best format. It will evolve during the process. I'm still on a journey. I don't know where it is going, and what Ulrich is saying about the drugs sounds really good.

Ulrich Ott [laughs]:

There are many possibilities in Berlin if you want to go in this direction.

Cornelia Sollfrank:

Regarding the first question, about how I'm selecting which elements to

include in the diary: it is a really good question, because if you go into quantification, you have to deal with parameters. With regards to the sensors: you have to understand physiological parameters and what they represent. And when you go deeper into data visualization, there is a moment where you understand that you can quantify—and visualize—almost all aspects of your life. You can quantify how often you eat pasta, how often you wear white shirts, or how often you kiss somebody. You have to break your life into pieces and look at it from different perspectives. The spread sheet I showed is still experimental and in progress. It is very reduced, but it is helpful being able to compare the different aspects in one view. Basically, the table shows how I felt that day, what kind of exercise I did, what external stressors interfered, and so on ... set in relation to the values of the OURA ring. One category I expanded into a more detailed diary. This decision was also encouraged by Ulrich who explained that they also include empirical data in their studies. They hand out questionnaires after their experiments, asking the test persons for their perceptions, in addition to the data they generated through measurements. Ulrich, maybe you want to explain what these parameters can be.

Ulrich Ott:

The questionnaires are mainly about different stress indicators. There is a check list where you assign the bodily, emotional, cognitive, and behavioral signs of stress you experience, and then you accumulate the data to see at which level you are currently. And this should also be reflected in the physiological data. We always have these two levels of subjective data: quantified subjective data and physiological indicators.

Audience:

Hi, my name is Johanna, and I was wondering, right now you're just measuring the functions of your body, capturing the data. Do you think that in the future there'll be a device that will actually be able to influence the way you feel? E.g., improve your daily readiness score. Say, when you are in a bad condition, you could press a button and someone helps you to set your heart rate and your breathing into the right state.

Cornelia Sollfrank:

Probably yes. What I found most interesting about this field of research is how much the physiological is connected to the emotional. That means you're not just exposed to your emotions, you can really influence them; you can

influence your emotions through physiological or chemical interventions. That's why people take drugs: they make them feel better, obviously.

Audience:

The question is if that would be desirable. What's your opinion on that?

Cornelia Sollfrank:

I think we already do it to some degree; we might just do it more with more advanced tools. But you are looking for a moral judgement. Ulrich, what's your opinion on that?

Ulrich Ott:

Yes, there are rare cases, for example, in major depressive disorders where you not only have a pacemaker for the heart but for the brain, and you can activate your brain and elevate your mood. This is recommended in rare cases only. I would not recommend it on a mass basis to have brain stimulators at hand—say an app on your smartphone which allows one to modify your mood. Anything you externally induce is much more simple and crude compared to the sophisticated level of what you can do with your own mind and to your brain with meditation and different breathing techniques.

Using drugs only works because we also have the same agents and receptors inside us.

Audience:

When you look at the visualizations of your breathing, for example, or your sleep pattern, what is the information that you're most interested in? Is it something like reassurance regarding what you already know about yourself? Or is there something you're particularly interested in seeing?

Cornelia Sollfrank:

Well, one thought I had was that the data tells me that I actually exist—which was nice. My body produces breathing data, so I exist. "Spiro, ergo sum." What actually happened was that my own perception of myself changed and is still changing. I have had a lot of encouragement from Ulrich to use the technology mainly to confirm or reassure what I actually sense, feel, perceive. And it is enlightening to discuss the data with experts; i.e., having them read and interpret the data and using that for my own reflection.

Earlier somebody mentioned the expression "technological other." I like it. For me, technology constitutes a form of otherness. And it led me to an even bigger "other"—the air,

the environment, the universe. Air, for example, is what I take into my body by breathing, and air can be of very different qualities. It's a broad understanding of interaction.

Audience:

Hi, my name is Eve. I have a background in the natural sciences, in oceanography and marine sciences, specifically, but my political background is more with anarchist theory and praxis. First of all, thank you so much for the two lovely presentations that were really cool. I reflected a little bit on the question of self-optimization, and how through gathering personal data and seeing—for example, sleeping patterns—how much capitalistic infiltration is already present in the idea of self-optimization ... thinking that there is an optimal state that we should achieve and that we have constantly this feeling of not being there yet. Cornelia, you mentioned that you didn't trust yourself enough, did you trust the company a little bit more than yourself? I think this is what a lot of companies bet on—that we don't trust ourselves and we don't trust, basically, the signals that the body sends us. We get technical feedback, but we're not sure how to evaluate it, because we do not pay any attention to the feedback that we already have within our own system. Instead, we expect technology to solve the problem for us. My question relates to the terms and conditions of this company. Can we go back to that slide, please.

Cornelia Sollfrank:

Sure. [Shows terms of use.] Of course, they can claim a lot, but for me the point was that the Mozilla Foundation published a very positive review of the company's privacy policy. The foundation is regularly testing apps, and they are looking into the companies' privacy policies. Their recommendation helped me to make a decision. You ask if I trust technology: yes and no. I was curious to see what it does, which doesn't necessarily mean that I trust it. I'm totally aware that the measurements with the ring are probably not as precise as those one would do in the lab, but the quality is relatively good. The data is giving me an indication of certain states. And it's also true that I said I didn't trust myself in certain respects. And that's part of this being disconnected, I think, to the world, to certain perceptions, to certain energy flows, however you want to call it. I realized when I started this project that I felt really alienated from my body, but I'm making a bit of progress. We are conditioned to think of ourselves as

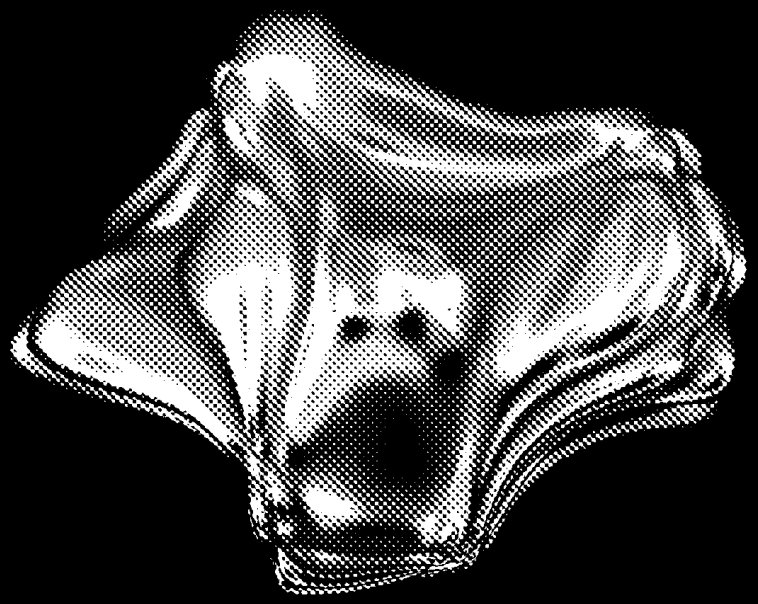
autonomous subjects disconnected from everything else, a dualistic state: me and the rest. Doing the pranayama exercises is kind of an encouragement to overcome this feeling of being separated and learning to trust myself more. The question, if I trust technology or not, is not relevant to me. It's a tool that I'm using. But the goal lies somewhere else.

Michelle Christensen:

I know that there are more questions from the audience, but I'm afraid that we are out of time. Thank you so much to the audience for the debate and thank you so much to both of our speakers for sharing this deep ambiguity between corporeal and technological sincerity.

DIALOGUE 2

More-than-Human Technoecologies



Critique as Design – Posthuman, Postwestern, Postdiscipline

Michelle Christensen and
Florian Conradi

"People know what they do; frequently they know why they do what they do; but what they don't know is what what they do does."
Michel Foucault, 1982[1]

Anthropocentric Algorithms

Within an informatics of domination, surveillance capitalism and data colonialism currently provide the hegemonic rationale for data's unfolding role. Through the deeply ubiquitous and all-encompassing rationalization of data in Western capitalism's striving to know, define, categorize, and control, the capitalization of living matter introduces discursive and material techniques of bio-political governmentality that amount to *life mining* (Braidotti 2013).

1 Michel Foucault in personal communication. Hubert L. Dreyfus, and Paul Rabinow, *Michel Foucault: Beyond Structuralism and Hermeneutics* (Chicago: University of Chicago Press, 1982), 187.

Human experience is claimed as free raw material, as automated processes no longer just automate information flows about us but begin to automate us (Zuboff 2019). Meanwhile, data relations enact a new form of data colonialism, normalizing exploitation and paving the way for the capitalization of *life without limit* (Couldry & Mejias 2018). And while these data-capitalist critiques have become disturbingly recognizable in everyday life, they seem to spin off even further into loops of entangled power plays in natureculture's unfolding politics.

In times of expeditiously emergent technologies, that simultaneously sense, automate, generate, and *make sense* of nature and culture's betwixt kinship and its consequences, we find ourselves in an anxious algorithmic relationship with technologies and ecologies, ranging from the geosphere to thermosphere, and private sphere to public sphere. From micro to macro, we attempt simultaneously to scale up and continually clean up residues—from toxins, microplastics, and ever-growing miniscule particles of space debris to the digital trash that has been hoarded in our personal devices and in all corners of the commercial Internet at large. Diligently counting particles and calculating destruction, big data classifies

catastrophes before they might happen, and we meticulously measure and predict them as they do. We have become navigators of big trust in large readings, as cleaned-up datasets rationalize the multitude of our *micro-actions* to automate conclusions about crisis on a *mega-scale*. But perhaps we have failed to read the subtext within the hypertext. Thus, we continue to forcefully mine the planet for scarce resources so as to persist in producing our digital technologies in order to mine our bodies and environments for more derisible data. And in doing so, we create systems that busily categorize, define, and automate which lives count and which ones get overheard, misread, or dismissed altogether (Buolamwini and Gebru 2018; Keyes 2018).

In our striving for the "humancentric" progress of the technically privileged, we try to fix the problems that we have designed every-body into, rationalizing ideas pertaining to both technology and nature with an entrenched assumption of clarity over ambiguity, and simplicity over the thick, sticky present (Haraway 2016). Busy with our heads in the clouds, data stored in remote server clouds contribute to global warming that results in the decline of aerosol clouds that cool the Earth. Overwhelmed by all the notifications, likes, and shares, we opt-out, only

to find ourselves opting-back-in, trying to keep our heads above water in all the data streams and currents. As Donna Haraway stated already forty years ago in her *Cyborg Manifesto*, we can no longer fathom these new techno-ecologies through the concepts that we have employed hitherto (Haraway 1985).

As we grapple to find formulations to describe (not define) ways of perceiving and performing outside of historically hegemonic western-centric ways of knowing-doing-becoming, the lens of *relational ontologies* appears as one technique to attempt to grasp another rationale. Blurring boundaries to overcome inscribed dichotomies and binaries, relational ontologies make space for more-than-humans in technoecologies, while concurrently taking issue with political subjectivities and addressing the issue of who counts as human in these technologies. Covering a deliberately diverse and dispersed range of worldings that make space for more worlds, one general principle that a relational ontology follows, as Arturo Escobar argues, is that *nothing pre-exists the relations that constitute it*: in these ontologies, life is interrelation and interdependence always and from the beginning (Escobar 2020, 101). To be entangled is not simply to be intertwined with another as in

the joining of separate entities, as Karen Barad describes, but to lack an independent, self-contained existence. Individuals do not pre-exist their interactions but emerge through and as part of their entangled intra-relating. Time and space, matter and meaning, come into existence and are reconfigured through intra-actions, thereby making it impossible to differentiate between creation and renewal, beginning and returning, here and there, past and future (Barad 2007, 185).

In this sense, the technologies that we design co-constitute the way we fathom the world around us—and as climate crisis, ubiquitous capitalism, and digital colonialism rapidly expand at an immensely immersive scale to all corners of the earth, it seems like a crucial time to delve into the potential of algorithmic ambiguity in order to co-constitute a different narrative. But how do we even begin to put into practice relations of data and design that may incite moments of co-becoming within a different logic than the current one? Drawing on Humberto Maturana and Francisco Verela, Escobar argues that *"All doing is knowing and all knowing is doing"*—every act of knowing brings forward a world. Thus, being-knowing-doing within a relational ontology implies that

we are deeply immersed in a world along with other sentient beings that are similarly and ineluctably knower-doers as much as ourselves (Escobar 2020, 101). Therefore, when attempting to engage into a foggy state of co-becoming in a design process, one might keep in mind that the German word for design "Gestaltung" is comprised of the word "Gestalt," which apart from meaning "build" or "form" also refers to a shady character, an incognito figure of something—something not yet determined (Conradi and Christensen 2019, 337). As something potentially hazy, murky, or even phantom-like, *Gestaltung*, too, transpires not before but as it transpires, bringing forward a world as a process of human-nonhuman dialogue. So perhaps, let's start there.

More-than-Human Technoecologies – Listening to Earth

The following explorations are a series of ad-hoc experiments in re/sensing environments using low-cost electronics, open-source software, rapid prototyping, and assemblages of natureculture in order to bring into being intra-actions with species and conditions. Unfinished and intentionally provisional, these mundane design performances critically

engaged with mis/interpretations and the re/situating of data; attempting to incite alternative moments into our relationship with the worlds around us. As a form of transspecies ethnography undertaken in our own everyday habitat, the experiments sought to bring into being connections with co-elements and co-species, materializing intentional preludes to bring forth unintentional insights.

Rhaphidophora tetrasperma + Electrogradiogram

In a simple setup, an electrocardiogram sensor was connected to an open source biosignal platform, which was attached to the leaves of a mini monstera plant (*Rhaphidophora tetrasperma*). The plant happened to become our office plant, as our former student assistant, Pablo, left it there after graduating, and like every office plant, it is steeped in naturalcultural politics. As a tropical vine, it is native to Southeast Asia, but this version has been cultivated for easy care, and forums on the Internet state that it is not "fussy." These plants thrive in bathrooms, as they need high humidity levels—nevertheless, this small companion is happily taking over the shelf that it stands on in the lab. While touching it is harmless, it contains

Figure 1: Setup connecting an open hardware electromyography sensor (EMG) to an assembly of plant-life.

Figure 1-14: Photos Florian Conradi

Figure 2: An assembly of technoecological experiments with open soft- and hardware at our research site, Berlin Open Lab, Berlin University of the Arts.

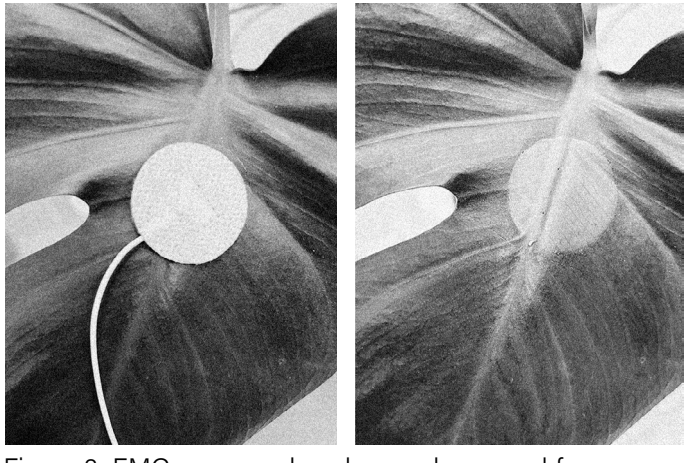


Figure 3: EMG sensors placed on and removed from Rhaphidophora tetrasperma, traces of a physical display of presence.

calium oxalate crystals, which can be toxic when ingested. As a physiological sensor, the electrocardiogram attached to it is usually used to indicate the health of a human body, especially to detect irregularities in cardiography data. As a re-situating of technology, when attached to the mini monstera the ECG measures bio-electrical signals. When a human touches the plant, even another part of the plant than the leaf being measured, the display shows the resonance of the human energy interacting with the body and "energy" of the plant. In its most sensitive state, the ECG measurements reflect human energy nearing the plant, without even performing direct touch—in a sense, detecting the plant's reaction to *human presence*. For a moment, and as an experience, this setup transfigures the intended purpose of the sensor by generating alternative insights into how living systems communicate across species boundaries. As an experiment in re-sensing it questions both the limits and potentials of data, as it is translated through different life forms. As an integral part of our lab, observing the reaction of the plant to our presence in the space produced an awareness of the plant as an active, sentient co-species, making it *distinctly present*, resulting in a relation of familiarity and care. That said, this form of

"misapplication" of technology inherently produces a configuration of inaccuracy, and as none of us are cardiologist or botanists, it discernibly incites an absolute ambiguity in the reading of the data. While visually producing an obviously clear medical reading (alive or not alive), the result is, in fact, meticulously logged data that we are unable to really know. Nevertheless, in this mundane relationship natureculture emerges in an interpretive form of being-knowing-doing —between human and nonhuman, organic and inorganic, science and subjectivity—and technology arises as a blurry force enabling mediation and fragility.

Swamp + Seismic Infrasonic Sensors

Within an exchange between students of art, design, and the humanities in Berlin and Lomé, students were invited to explore intersections of nature, technology, and spirituality through the lens of animism and African cosmologies. In our dialogue with a community of voodoo priests residing in the village of Aguegan in Aného, Togo, the intersection of nature, culture, and spirituality dissolved, as did distinctions between traditional and new technologies, as concepts of time and space trembled between ways

Figure 4: Gathering data on tectonic phenomena, infrasonic information and seismic activity, Agouegan, Togo, 2022.

Figure 5: Pablo Torres assembling open technologies for collecting data on swamp site in Agouegan, Togo.

of doing-knowing-becoming in ritual and everyday life. In close collaboration with architect and anthropologist Sénamé Koffi Agbodjinou, the students engaged in different practices of "listening to earth" that could potentially inform discussions concerning the further design of a (human-nonhuman) community centre and spiritual site standing on a piece of swamp land. In one experiment, a raspberry shake (an open hardware project that uses seismic and infrasonic sensors utilizing Raspberry Pi hardware) was used to measure seismic activity on the swamp site. The raspberry shake was installed and left on the site for 24 hours. In a place where voodoo rituals seemed to lead instantaneously to heavy rainfalls, and spirits and elements informed everyday life, thoughts arose regarding what exactly this device was actually measuring. Surrounded by an ontology that comfortably engages with unknowability and severely blurred boundaries between the material and the spiritual, who could or should interpret this data? What role does ambiguity play here and who defines it—and what does it mean to extract data in this setting in the first place?

Returning to Berlin with the small single-board computer and queuing questions—to the awe and anxious amusement

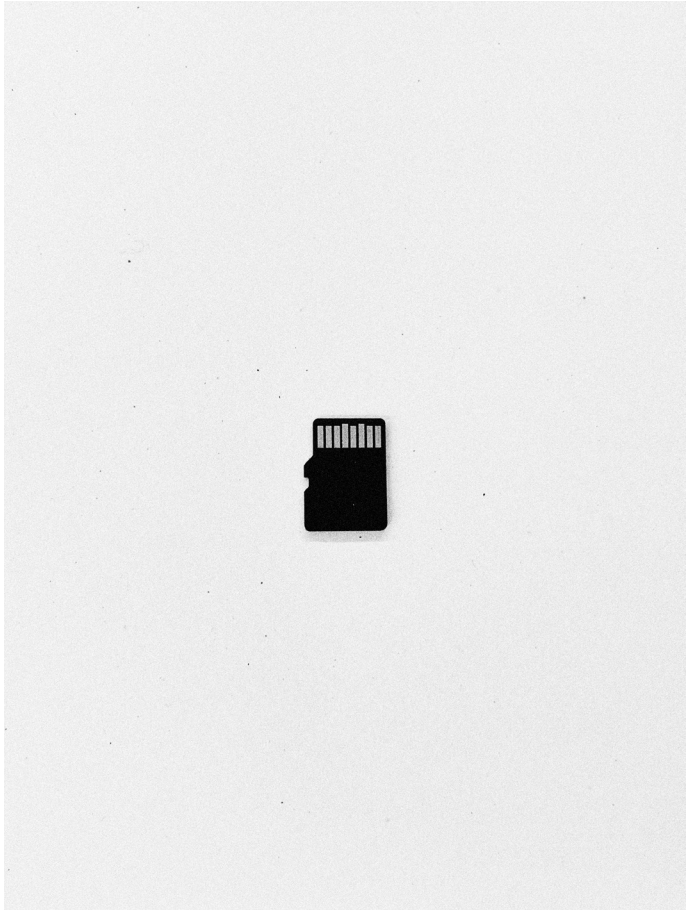


Figure 6: Un/readable SD CARD, which was preserved in epoxy resin, conserving inaccessible data.

of the project participants, we found that the data had deteriorated. Whether the Raspberry Pi was broken, or the SD card, or something else entirely, we tried everything and never found out why the data had corroded. The object, however, still seemed so valuable (if inaccessible) that we captured the unknowable object in silicon—as fossils are captured in resin—preserving a technical species of sorts. Which forces exactly were at play in this intra-action is difficult to say, but the act of listening to earth in this assemblage, even with its deafening silence, seems to question the ambiguity in the gaze of the recorder (both human and technical). The work remains as a relic of the non-retrievable, a recondite reservoir, a bygone of bytes.

Figure 6: First set-up of mediated communication between human, technology, and plant. An interplay of sensors, cloud-based instant messaging system, and gardening practices.

Solanum lycopersicum + Instant Messaging System

As a work-in-progress experiment, the input from basic open hardware sensors measuring light, humidity, and temperature were connected to an open-source tomato plant that, in turn, is able to generate textual outputs regarding its current conditions that are posted to an open-source instant messaging system. The plant itself was seeded in 2019, and in time this tiny companion grew into a massive organism, making its way towards the roof of our lab. Like every piece of our living environment, the seemingly mundane tomato plant (*Solanum lycopersicum*) is no exception to naturecultures' untamed historical and contemporary politics. Initially cultivated by indigenous people in Mesoamerica, the berry was brough to Europe by the Spanish in the sixteenth century to be grown as an ornamental plant—it has since been considered everything from poisonous to an aphrodisiac, and everything from a decoration to one of the most cultivated food crops in the world. Nevertheless, as global seed politics has it, only two conglomerates own 80 per cent of the patents of tomato seeds globally—thus, this particular plant stands in our lab as a tiny advocate of the aspiration to challenge all aspects of the global power

monopoly by the movement of commons-based open-source democratization. Having been an active member of the chat of our research group for a long time—oftentimes one of the noisier ones, to be honest—the plant-bot displays an ad-hoc approach to how a co-species can actively intervene in everyday life. In a multispecies dialogue unfolding at a very everyday level, this species was invited into our work environment and became an integral part of our habitat. While the generated text is indisputably an anthropomorphic translation of sorts, its glitchy loudness made it an interrupter with a temperament, overwhelming the chat with constant babble, igniting an ambiguity of both language, intentionality, and shared social space. As a para-participant participating on its own terms—it reminded us of our own.

Bryophyte + Satellite Images

Based on a bottle garden, an open hardware sensor monitors the environmental conditions—temperature, humidity, and altitude—in the garden. This real-time data is mapped against global climate data to find a site in the world with the same environmental parameters as within the bottle, sending a satellite image of this alternative site to an open-source instant

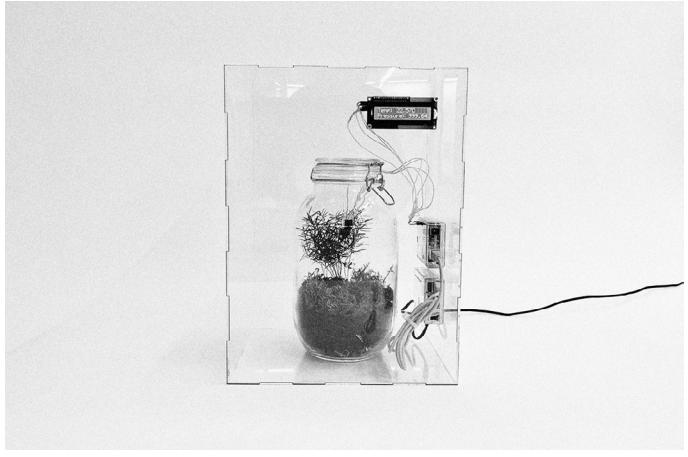


Figure 9: Digital Dérive: A bottle garden connected to a cloud-based instant messaging system. Sensors measuring the atmosphere in the bottle garden trigger images of global sites with the same conditions.

Figure 10: Moss from northern Denmark, plant-life usually categorized as "unwanted" companions (weed).

messaging group. The bot allows anyone to wake up the system in order to receive live images of a site directly to the chat, in this sense linking the micro-sphere of the bottle to the macro-sphere of the globe. The garden itself is based on plants that can be categorized as "weed"—another confused construction of natureculture's politics. The definition of weed itself reads: *"A wild plant growing where it is not wanted and in competition with cultivated plants"* (Oxford Dictionary of English). Flourishing naturally, however, weed plants are a fundamental food source to many threatened pollinators, from bees to bats. They complete multiple vital jobs in our ecosystems, providing nutrients for microorganisms and insects, and restoring soil that has been left exposed due to human disturbances. Moss, specifically, a main component in the bottle garden, not only enhances soil stability but absorbs and stabilizes heavy metals and pollutants from its environment. In this sense, when thinking about "listening to earth," this project provokes a conversation about overhearing the unheard.

As a form of digital dérive, through the chat one receives messages from somewhere in the world, never knowing where one might be fleetingly levitating—oftentimes in the Middle East and South America, for almost three

days in Turkey, sometimes in southern Europe, then suddenly in the Sahara Desert. At times one sees desert and deforestation—the critical zones that were initially the intention of this bot—but at times one ends up at unintended, culturally loaded sites, such as a pixelated high-security prison in Texas. As an intra-action—in this case between weed, bottle garden environment, sensors, satellite, messaging service, and human, at the very least—relations of time, space, and meaning are constituted in interrelation and interdependence, coming into existence as a culmination of the moment, allowing one to search and find what one was not looking for. Furthermore, as the massive geographical lines on the received images hint towards, the mosaic of satellite and aerial photographs were taken at different times, assembling recent histories and presents in a sort of hyperreality where instant technology meets an assemblage of lingering delay. The imagery is oftentimes impacted by atmospheric conditions, such as cloud cover and haze, creating a further blur, as culture's project of achieving a meticulous technical mapping of the globe collides with nature's serendipitous slur. Nevertheless, levitating between microsphere and macrosphere somewhere within a parareality, massive variations in zoom and resolution (as certain

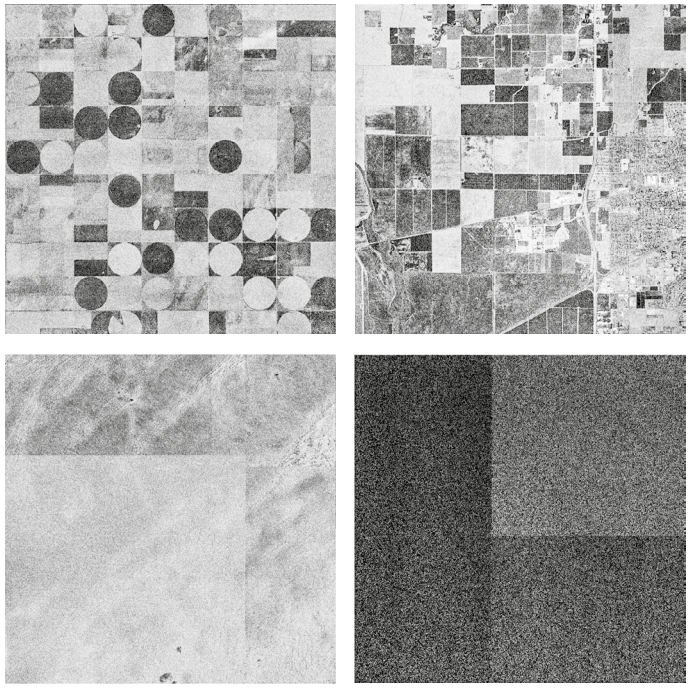


Figure 11: Examples of images received via instant messaging system as a response to bottle garden's conditions: IMG_8770.PNG, February 2th, mystery location (latitude: 36.786895, longitude: 1001.159583); IMG_8768.PNG, February 25th, Gaomi, Weifang, Shandong, China (latitude: 36.302061, longitude: 119.823794); IMG_8756.PNG, Yemen (latitude: 17.237868, longitude: 44.880252); IMG_8765.PNG, Adriatic Sea (latitude: 43.210528, longitude: 16.925902).

sites are deemed more relevant than others, with some highly pixelated altogether) reveal the power of some to control and produce the gaze of the rest. Some images even hold the copywrite logos of big tech companies, an unsettling display of a deeply commercialized gaze. As a somatic synecdoche of sorts, the dérive between micro and macro, immensely private and vastly public, open source to highly controlled, seems to produce a simulacrum of grave concern.

PM2.5 + Frequencies

As a preliminary assemblage, an open hardware sensor measuring real-time particulate matter in the air was connected to piezo buzzers (low-cost low-weight electronic loudspeakers that use a piezoelectric effect to generate sound), which were attached to a metal plate. In this way, air quality data could be transformed into vibrations, creating a tangible experience of toxins, bridging environmental data and sensory perception. This transformation of data into sound renders the seemingly scientific subjectively experienceable and interpretable, as well as making the invisible audible as a mediation of the surrounding environment. Running as an uncanny device in our lab space, the slightly annoying constant murmur somehow makes *the element of air*

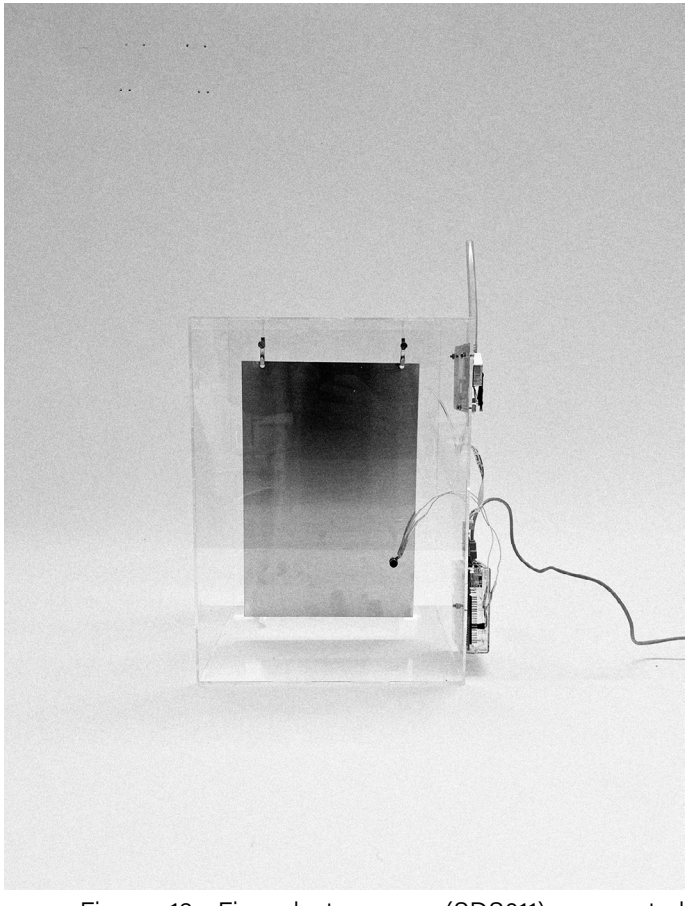


Figure 12: Fine dust sensor (SDS011) connected through a Raspberry Pi to piezo buzzers attached to metal plate. Translating air quality into frequencies.

itself present, something that is usually deeply concealed in its tremendous necessity (unless, one is in space or a highly contaminated area). As an intersection with intangibility and the unnerving murkiness of *toxins*, it makes one think of what one is in fact breathing in, for a moment dissolving the boundaries between the perceived autonomy of the human body and its environment in an imperative human-nonhuman co-becoming. As a further embodiment, experiments continue into frequencies with healing corporeal effects on humans, frequencies said to heal nature, and vibrations used to connect to nature, as in the case of traditional techniques to connect to the energy of a tree (see discussion with Anani Sanouvi on p. 150). This raises questions regarding what it might mean, in a contaminated, anxious era, to turn toxins into healing. As an ambiguity of resonance, these effects are not well proven in the Western scientific canon but build on alternative ways of knowing-doing-becoming from relational ontologies and experimental healing practices. And yet, merely the vague consciousness of the plausible effects of these frequencies seems to incite a feeling of possible effect.

Arthrospira platensis + pH Sensor

In an initial setup, sensors measure pH value and turbidity in a habitat of spirulina algae (*Arthrospira platensis*) in an attempt to measure their health and keep them alive. As one of the first organisms on Earth, with a history that can be traced back 3.5 billion years, this ancient knower-doer has evolved through many geological periods, intra-acting with lifeforms that we will most probably never know of, in both pasts and futures. Having already played an important role thousands of years ago in many indigenous cultures across the Americas and Africa, this now "contemporary superfood" is often used as a health supplement for humans, as it is known to improve cholesterol, supress oxidation, and reduce blood pressure. And in the strenuous striving for our own survival, we now turn back to it as a reformer in climate change mitigation, as it could, for instance, potentially ensure food security in regions with limited water resources. As biological and historical forces are always already bound together and incessantly co-constituting each other (Barad 2003, 809), this organism seems to capture the entangled forces of nature-cultures performing both histories, presents, and futures.

Figure 13: Spirulina live culture in a vessel, a cyanobacteria with antioxidant and immunomodulating properties.

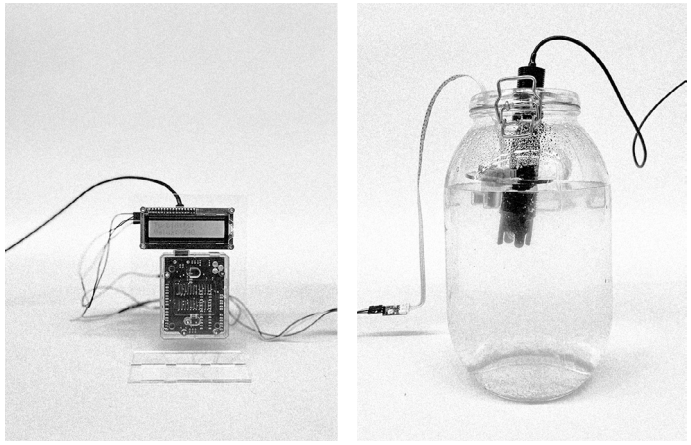


Figure 14: Display connected via microcontroller to turbity and pH sensors, measuring the environment of the algae.

Arthrospira platensis requires a very specific water quality, especially PH values—since spirulina grows at alkaline pH values of between 9.3 and 10.5—as well as needing minerals, sunlight, and carbon dioxide to survive. In this setup, the turbidity and pH levels assist in mitigating the health of the living organisms, and thereby it incites a constant responsibility of nurture, care, and keeping the system alive. While the algae are farmed at a large scale, cultivated worldwide for human benefit, this system is simply alive to exist in, of, and for itself. But what does it mean to care for this ancient rootless, stemless, leafless, single-celled organism, which has survived dinosaurs and ice ages and will surely outlive us? What does it mean for us to keep it alive? Within an ethics of ambiguity, somewhere between cautious self-irony, genuine awe, and sincere tribute, the data transpired as something between banal practicality and entangled responsibility.

Ambiguous Machines

As ad-hoc micro-experiments, these systems explore the intrarelations with the elements of earth, air, and water, with co-species such as a cultivated, once-exotic office plant, a subversive open-source tomato, spirited northern-Danish moss, and ancient spirulina, placing

them in a mundane everyday context and environment. These at times more dedicated and at times more fleeting—but always dubiously deciphered—interdependencies bring into being as experienceable the certainty that *"to be one is always to become with many"* (Haraway 2008). Whether this be the moment where the air that one breathes becomes present, or the *ongoingness* of keeping a superior lifeform alive, it is a reminder, as Haraway puts it, that *"no species, not even our own arrogant one pretending to be good individuals in so-called modern Western scripts, acts alone; assemblages of organic species and of abiotic actors make history, the evolutionary kind and the other kinds too"* (Haraway 2015, 100). As we come to understand ourselves and our co-inhabited world through the tools, technologies, and machines that we construct, these "machines" actively participate in shaping how we perceive and interact with the conditions around us (Barad 2007). Whether by means of a sensor for ECG, seismic activity, humidity, temperature, turbidity, or pH values, we do not necessarily observe the world more accurately through them; rather, we actively co-constitute the very nature of what we observe. These technicalities that we build do not reflect what is already in the world—as a process of making

environmental conditions intelligible to us, they shape our perception and understanding. In this case, the encounters have been intentionally and carefully manufactured to materialize within preliminary setups, and the relationships emerging from these happenings are embedded in a deep efficaciousness of ambivalence, as re/readings of non/sensical data inherently call into question the intra-actions that unfold.

Technically un/spectacular and form-wise rapidly transformed using basic materials, these design performances are distinctly preliminary and unfinished. Rather than attempting to be sensational, flawless, or precise, they draw on the performativity of relations and procedures, such as the re/applied, re/situated, and hyper/real, to evolve uncontrollable human-nonhuman assemblages and insecure interpretable relations of humility and care. As elastic technoecologies, they stretch realities between big and small data, objective measurements and subjective readings, personal sentiment and public urgency, intimacy and distance, the instantaneous and the delayed—open design frameworks for performing collaborative cospecies knowing-doing-becoming. In a sense, one might say, they function as *ambiguous machines*. In a world that is inherently messy, ambiguous, and full of

uncertainty, perhaps now more than ever, these ad-hoc experiments seek to refrain from the current paradigm of precision, categorization, definability, or the illusion of human mastery and control. The im/perfect data embraces the un/certainties inherent in entangled performances, resisting reductionism in order to challenge current relationships with data and the narratives that we construct around them. There ought to be a recognition of precariousness as a shared condition of human lives, as that which links human and non-human lives, Judith Butler argues, as it implies that one's life is always in some sense in the hands of the other (Butler 2009). Precariousness, however, cannot be captured and recognized as it is not a function nor an effect—it can only be apprehended, taken in, encountered, and presupposed (Butler 2016). Therefore, under this lens these experiments cannot be seen as a mechanism to fabricate, or even recognize, ambiguity, but rather as a modus operandi to incite fragility in momentary human-nonhuman encounters.

In what oftentimes feel like an unfolding improvised theatre play, scripted by the algorithmic aristocracy and performed by the rest, we can observe what Guy Debord argued as the decline of *being* into *having* and *having* into

merely *appearing* (Debord 1967). And in a state of ubiquitous capitalism and digital colonization, where the commodity completes its commodification of *social and ecological life*, we seem to be in need of an *interlude*. As curious contrivances, the experiments seem to transpire not just as *per*formative design, but as *pre*formative design—allowing the protagonists to step outside the drama for a moment—as in an improvised performance between the acts of the play. In this interlude they seek to evoke space for performing a materialization of relational ontologies—*rehearsing* posthuman, postwestern, and postdisciplinary entanglements with technologies and ecologies, as the roles of actor and audience dissolve in an indeterminate happening of sorts. Composing critique as an intermission, design as an interlude to evoke the *Gestalt* within *Gestaltung*.

Thank you to the following researchers and student assistants for their engagement in setting up the experiments described in this text: Ines Weigand, Seleney Kiray, Sidar Torunlu, Pablo Torres and Berkay Soykan.

References

Baudrillard, Jean. *Simulacra and Simulation*. Michigan: University of Michigan Press, 1994.

Barad, Karen. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham and London: Duke University Press, 2007.

Barad, Karen. "Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter." *Signs: Journal of Women in Culture and Society* 28, no. 3 (2003): 801–831.

Braidotti, Rosie. *The Posthuman*. Cambridge, Oxford, Boston, New York: Polity Press, 2013.

Butler, Judith. *Frames of War: When Is Life Grievable?* London: Verso Books, 2009.

Butler, Judith. "Precariousness and Grievability." Verso Books https://www.versobooks.com/blogs/news/2339-judith-butler-precariousness-and-grievability?srsltid=AfmBOorxBSAUpOmDmcIe_s4HXBF98V32I8CQn11pUj8d7lGLdSbvRwMB (accessed July 19, 2024).

Buolamwini, Joy and Timnit Gebru. "Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification." In *Proceedings of Machine Learning Research* 811–15, 2018 Conference on Fairness, Accountability, and Transparency.

Christensen, Michelle and Florian Conradi. *Politics of Things: Critical Approaches through Design*. Basel: Birkhäuser Verlag, 2019.

Couldry, Nick and Ulises A. Mejias. *The Costs of Connection: How Data Is Colonizing Human Life and Appropriating It for Capitalism*. Stanford: Stanford University Press, 2019.

Debord, Guy. *The Society of the Spectacle*. New York: Zone Books, 1994.

Dunne, Anthony and Fiona Raby. *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge and London: The MIT Press, 2013.

Dreyfus, Hubert L. and Paul Rabinow. Michel Foucault: *Beyond Structuralism and Hermeneutics*. Chicago: University of Chicago Press, 1982.

Haraway, Donna. "A Manifesto for Cyborgs. Science, Technology, and Socialist Feminism in the 1980s." In *Socialist Review* 5, no. 2 (1985): 65–107.

Haraway, Donna. *Staying with the Trouble: Making Kin in the Chthulucene*. Durham and London: Duke University Press, 2015.

Keyes, Os. "The Misgendering Machines: Trans/HCI Implications of Automatic Gender Recognition.0" In *Proceedings of the ACM on Human-Computer Interaction* 2, no. CSCW, article 88 (2018): 1–22.

Zuboff, Shoshana. *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. New York: PublicAffairs Books, 2019.

E'TOME
A proposal of moving curveward

Anani Dodji Sanouvi

The research project *E'TOME* is dedicated to the investigation, inquiry, manifestation, and archive of the cyclical inter-external relationship between worlds and the notion of aliveness/knowledge. Its focus is the creation of a nomadic performance-state-time-space in the form of a continuous abstract-cosmic concave surface, serving as a convergence point for animist practitioners and associated creators. Within this framework, dance, living sculptures, music, images, socio-communicative manifestations, and relationships are investigated through the lens of Éwé epistemology. To this end, animist ontologies and technicities are incorporated, addressing intricate interspecies communication skills characterized by cyclical, multi-relational, multi-dimensional, and multi-circular movement dynamics. Consequently, the project embraces close encounters within invisible and visible poly-rhythmic, poly-centric, and poly-dicentric vibrations,

pulses, and movements, operating as a diplomatic structure. By envisioning, developing, and fostering a convergent, inclusive, fluid, hyperbolic, concave threshold, we aim to investigate communal thinking, making, and embodiment within a bio-dynamic architecture where dance comes into existence amidst multiple interspecific relations.

Ontology is the study of being, existence, and the fundamental nature of reality. Incineration stands for burning something to ashes, implying total destruction. By combining these terms, ontological incineration suggests, in essence, a process of destruction at the level of existence or being, potentially leading to a need for reconstruction, restoration, or redefinition of fundamental concepts. Colonization has attempted a myriad of ontological incinerations over and over again through the practice of epistemicide. According to Portuguese sociologist Boaventura de Souza Santos, epistemicide is a term that addresses the systematic destruction or erasure of certain forms of knowledge, ways of knowing, or cultural practices, often by dominant or colonial powers. Epistemicide occurs when the knowledge systems and worldviews of marginalized or colonized communities are devalued, suppressed, or replaced by those of the

colonizing or dominant groups (de Souza 1998). This concept often contributes to the need to recognize and preserve diverse forms of knowledge and epistemologies. It highlights the importance of respecting and valuing different ways of knowing and learning from various cultural traditions and perspectives.

The Éwé are situated in Togo, southeastern Ghana, and parts of Benin. Formerly, the Éwé region was inhabited by decentralized communities that lacked a centralized political structure, yet shared common historical, cultural, and linguistic traits. However, during the colonial period the area came under German control, and following Germany's defeat in World War I the League of Nations split it into two separate territories, one in the hands of the British and the other in those of the French (De Haan 1988). These areas became what is nowadays the territory of Togo and part of Ghana, with the Éwé being the largest ethnic group in both countries and suffering from this imposed division.

Éwé culture is widely known for its polyrhythmic practices, not only dance or music but also in the weaving tradition of Kente cloth.

Rooted in animism,[1] these practices are part of the Éwé's ways of communicating between different dimensions.

In its various forms, Éwé language is beautifully sophisticated and complex, with a flexibility that makes it very useful for negotiating. In spoken language, Éwé words are never fixed and one word can have multiple meanings: it's the way they sound, the tone, that conveys meaning, not the words alone. It requires a fluid attitude; it does not follow a "straight-line."

E'tome

Reflecting on the knowledge production of West African societies, the writer, musician, and scholar Felwine Sarr underlines the importance of envisaging non-logocentric epistemologies to imagine and conceive a future different from the one suggested by the multiple crises we face today (Sarr 2022). Building on Sarr's proposition of

1 "Animism is based on the intersubjective exchange between humans and extra-humans, on the interaction of the visible and the invisible, without any excluding dichotomous relationship, but rather, on the intertwining of both. ... Reclaimed by post-colonial debates as another ontology and sensibility, the term today stands in opposition to Edward B. Tylor's prejudiced original conceptualization." (Cunha and Gardel 2021, 66)

music as a space of knowledge that transcends the boundaries of individual experience, I envisage the interplay between voices and words in the Éwé language and the membranophone (skin, wood) languages as a dynamic relationship rather than separate entities; an entanglement that characterizes both as an interfluid assemblage of tones, frequencies, and timbres, where meaning is not solely carried by verbal language but also by vibrational and sonic qualities. In this sense, they reveal a broader system of technicities that serve multidimensional socio-communicative purposes. It is within this site of resonance and friction that *soundspeech* is generated through cognitive reframing, and where vocabularies emerge, activating, archiving, and communicating the knowledge gained from multi-relationships/encounters.

In Éwé, 'e'to' means a concave receptacle, in which ingredients are pounded or ground. And 'me' gives it a sense of interior. When 'e'to' is complemented by 'me', 'e'tome', it refers to the inside of the concave space. During dance-music-performance gatherings, participants invite others to enter the '*e'tome*'—known commonly in the western perspective as a dance circle.

From the perspective of the animist ontology in which Éwé epistemology is anchored,

e'tome indicates that neither the circle created by the participants nor the ground surface in which dance happens, is a flat surface. It means, as noted above, that dance performance creates and activates a concave space, a curved dimension that connects ground and underground. During my research, I coined the neologism *curveward* to address the need for thinking, walking, and moving sinuously in response to the ongoing circular dimensions of unknown forces and territories—a curved timeline for engaging in any type of relationship, shared *curveways*[2] between the *Other* humans and the extra humans.

Beyond its form, the curve is understood here as a continuation of time or movement, a sort of continuous flow that allows other energies to enter the body. It can also mean a kind of openness to being led, to being pulled to one side as you move forward so that you are no longer moving in a straight line. The curve then becomes a technicity of the threshold, used to leave chronological time and enter multidimensional time—a present time that appears like a sovereign time we "own." For this, one needs to be in a state where it is possible to tune one's thinking to ensure that any physical movement

2 Neologism to describe a pathway that is curved and circular.

Figure 1: Untitled, Anani Sanouvi. Drawing, ballpoint pen on paper, 100cm x 75cm. 2017. Photo: Anani Sanouvi.

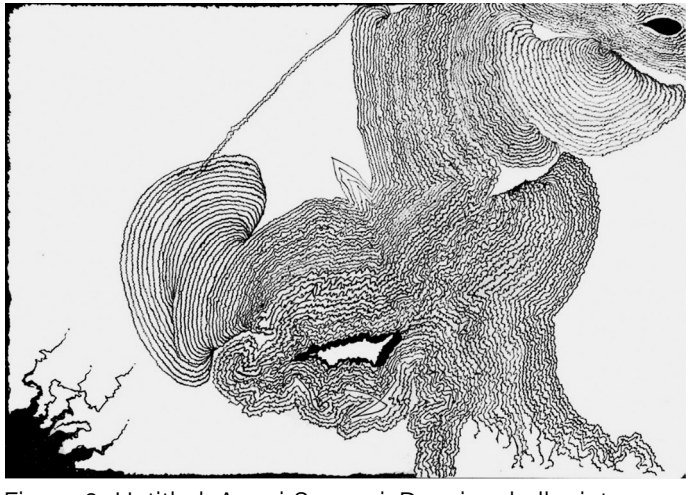


Figure 2: Untitled, Anani Sanouvi. Drawing, ballpoint pen on paper, 100cm x 75cm. 2017. Photo: Anani Sanouvi.

always happens *curveward* something else; a *flirting state*, activated by engaging in curved attitudes from which a myriad of relationships can be established.

Multi-Translation

Nde yi djo kape Atrikpoé va li (Something happens before humans gather to become the dance-music-performance-state-language *Atrikpoé*). In Éwé culture, a meeting place-space, *Ablome*, takes place before making decisions that will later be communicated to the community and become a general agreement. Inter-relatedness is the foundation of the practice and process suggested hereby. At this point, avoiding conventional labeling (dancers, paintings, sculptures, etc.), we are reflecting on a form of relationship in which living creatures/performers engage in an intra-internal-external relationship. As *hosenties*—hosts and sentinels—we know that it is not about us but through us. We thus seek to contribute to subvert colonial residues by reflecting on the generation of knowledge based on epistemologies suffocated by colonialism, while questioning contemporary artistic processes, generating new vocabularies, and expanding a non-anthropocentric understanding of performative space and language. Shamelessly,

unapologetically, to BE a dance/performance/living sculpture in a polyrhythmic state-space of being. The *hosentie* is considered, firstly, a *sensorial being*[3] and a living testimony, focused on translating and manifesting its inner events by means of an animist sensorial intelligence. Accordingly, communication happens beyond linguistics. Acting as a sorcerer-translator, moving between the visible and the invisible, and dedicated to the encounter with the extra-human,

> The ndoki-translator or sorcerer-translator is a diplomat who meanders through his knowledge, while specializing in secrets he does not know; switches between systems out of necessity. Every translation, for a sorcerer, will be intersemiotic, given the fact that it will necessarily be inter-cosmological and that he will deal with frequencies that generate other ways of introjecting and manifesting worlds. In addition to being inter-cosmological, such translating supported by interactions (by science flourishing in relationships) is trans-cosmological because it is a transit between worlds that constitute the world, that is, between the varied faces of the world (Santana 2020, 70).

According to transmedia creator and scholar Christiane da Cunha, animist interactions or conversations with extra-human realms take place between diverse worlds, dynamics, materialities, languages, and sensorialities. They occur

3 Neither a dancer, performer, or choreographer.

between negotiations and translations. Creative processes and expressive manifestations involved in this context will always be, at different levels, translational actions (Cunha 2023).

In this sense, I approach dance not from a choreographic standpoint but from a relational performative perspective. Under these circumstances, as stated above, the performer becomes a *hosentie* and dance operates as a multi-translation process; a trans-subjective recyclable pedagogy and a multi-dimensional, socio-creative, inter-species entanglement—a curved space-state where we can interrelate with diverse life forms. Which means: a way of practicing, dwelling, weaving, converting, subverting, and transmuting energies in (un)real(?) time/territories, through intense as well as meticulous sensory experiences. Anchored in Éwé epistemology and cross-modal polyrhythmic practices and knowledge, the pedagogy *Multi-Translation*—based on the technicity *Agama-Fo* (The Legs of the Chameleon)—has been created and developed as a path of decolonization for the senses or the sensorial intelligence system. In this process, across a number of different interconnected practices that evolved in different cultural and geographic contexts, it became a transcultural interface of investigation, study, training, creation,

and performing bodies-territories of resistance and resilience (Greco and Sanouvi 2022). Bodies that listen through their pores, through their spinal column, hair, bare feet, through the meat that is attached to the bones and linked to the central and peripheral nervous system.

Accordingly, performances developed from this approach—such as *Gbogbo*[4] (Breathing) and *Hosenties*[5]—don't follow the conventional production phases of a dance or theater piece. Instead, they evolve from an understanding of the *hosentie* as a living sculpture, whose continuous transformation creates embodied archives: a bodily literacy that may be shared publicly or not. This process is both therapeutic and creative, beginning with self-care and unfolding into a dynamic, living archive. It involves embracing sensuality, vulnerability, and flexibility in a deep exploration of personal trauma and confronted memories. Echoing the erotic in Audre Lorde's thought, sensuality here concerns an

4 Performed at: Choreographic Center of Rio de Janeiro, Espaço Cultural José Lins do Rego, Casa Fortuna in Berlin, Academy of Fine Arts of Nuremberg.

5 Collaboration with a group of Brazilian psychologists, anthropologists, actors, amateurs and professional dancers. Performed at: Choreographic Center of Rio de Janeiro; Biennale Passages, Bielefeld; Espaço Rato Branko.

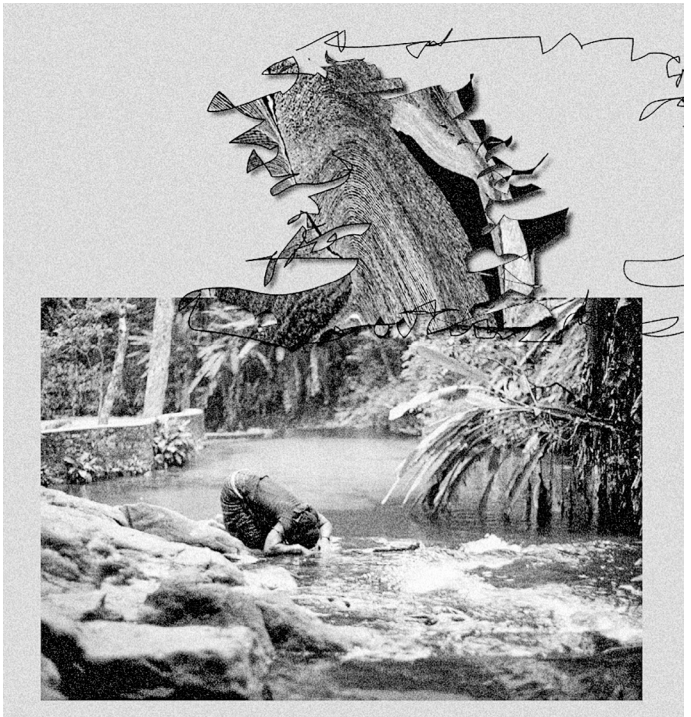


Figure 3: Performance and Digital composition, Anani Sanouvi, Tijuca Forest, Rio de Janeiro 2018. Photo: Raphael Mollica.

attitude/sensation/feeling that emerges from being in relation to the act of creation. For this, each *hosentie* brings their unique history, inquiry, doubts, desires, and perspective, enriching their diversity. From time to time, these processes can be shared in a public sphere, through different configurations and in different settings. Working to disrupt the pre-established colonial sensorial education, during the performance he/she/they call upon polyrhythmic and poly-centric sensibilities and competences (learned through the pedagogy), reaching an expanded sense-state of readiness/awareness, one honed to perceive meticulous thermo-dynamic movement (energy) as well as tactile sensations through the skin. Here, judgments or narrative thinking are suspended/avoided. As a sensorial being, the *hosentie* (multi) focuses on syntonizing sensorial input in a subjective process, to soothe hidden traumas. A sensory discernment—for a subjective awareness according to what one senses, and what the educational or cultural mindset narrative constructed for them/her/him, to sense. Therefore, that sensory intellectual activity, activates memory, which then serves as a stimulus for intentionally crafted outcomes—curveward intercommunication between environment, memory, and gesture. Vibrant and spasmodic movements are

reshaped in curved socio-communicative gestures fueled by the application of oils to the skin and/or internal biochemical secretions linked to breathing. At this juncture, amidst the fragmentation caused by internal and external conflicts, this navigating curvewards through undulations, reverberations, turns, circles, and spirals brings the separated parts together in an infinite negotiation with known and unknown rhythmic vibrational patterns living inside and outside the human form. This procedure allows one to recognize the necessary turns to escape linear thinking in meaning-making and thus, to live and savor the cyclical synergy of these real dimensions, during this alternative psychic/organic/spatial transit. Between the past, the present, and the future lies an unknown time where the *hosentie* is simultaneously a sensory investigator and translator, belonging everywhere and nowhere.

More than simply sensing worlds, these processes investigate the core of creativity in terms of *how* we sense. And at the same time, they are intended to raise awareness about the role our ways of sensing play in shaping ourselves and, consequently, our collectives. Are we truly aware of how we are, or have been, continuously educated to perceive according to dominant epistemologies?

> Creativity is not exclusively linked to artistic expression; it is primarily a means of breaking conventional normative patterns. When shifts in sensory perception occur, behavior and memory patterns are affected, altering our sense of the world and ourselves. As the sensory realm expands, it enhances one's affective and creative relationship with the world, its entities, and forces. Animist sensibility resides in this sensory and social transit between humans and extra-human realms (Cunha 2024).

Each facet of *Agama-Fo* comprises a repertoire informed by the intricate healing practices and dances of diverse African ethnicities (Kabye from Togo, Éwé from Notse-Togo, Lebou from Toubab Dialaw-Senegal, Fang from Libreville Gabon), integrated into the performative sphere within the contemporary, expanded creative field. Through energetically demanding exercises, these practices primarily focus on cultivating sensory awareness in learning processes from and with extra-human realms. Such exercises have been designed to challenge and put our sensory system, psyche, physicality, and behavioral patterns to the test in order to activate other dimensions/states while also facilitating the development of a polyrhythmic and polycentric sensibility and competence. Using these, we can intentionally bend our sense of time while interacting, dissolving, and creating other rhythmic relations. In addition, by embracing

vulnerability as a state where one surrenders to her/his/their own sensory abilities—focusing on subtleties, micro sensations, and details—each practice prepares the body-mind to acknowledge sensations as they emerge, without judgment or the need to create narratives but as simply collecting information. In this context, sensory input is archived in different kinds of memories, allowing us to consciously translate it into gestures, movements, or whatever else pleases us later. By doing so, we can create a performative/movement vocabulary based on our own relational/sensorial experiences and memories, using these inherent connections to delve deeper into our humanity, investigating new ways of reflecting, drawing, and sculpting ourselves and our relationships.

Interconnecting the performative and sensorial components with an understanding of pedagogy as a political field (Freire 1970), *multi-Translation* delves into the knowledge systems and cultural contexts that nurture an animistic sensibility within the creative field, thereby reclaiming analog sensing technicities in cooperation with the multiplicity of entities that the Western anthropocentric perspective generalizes as "environment."

Figure 4: *Hosenties*, Performance, Lucrécia Greco and Thays Espíndola. Biennale Passages, Bielefeld, 2022. Photo: Beate Steil.

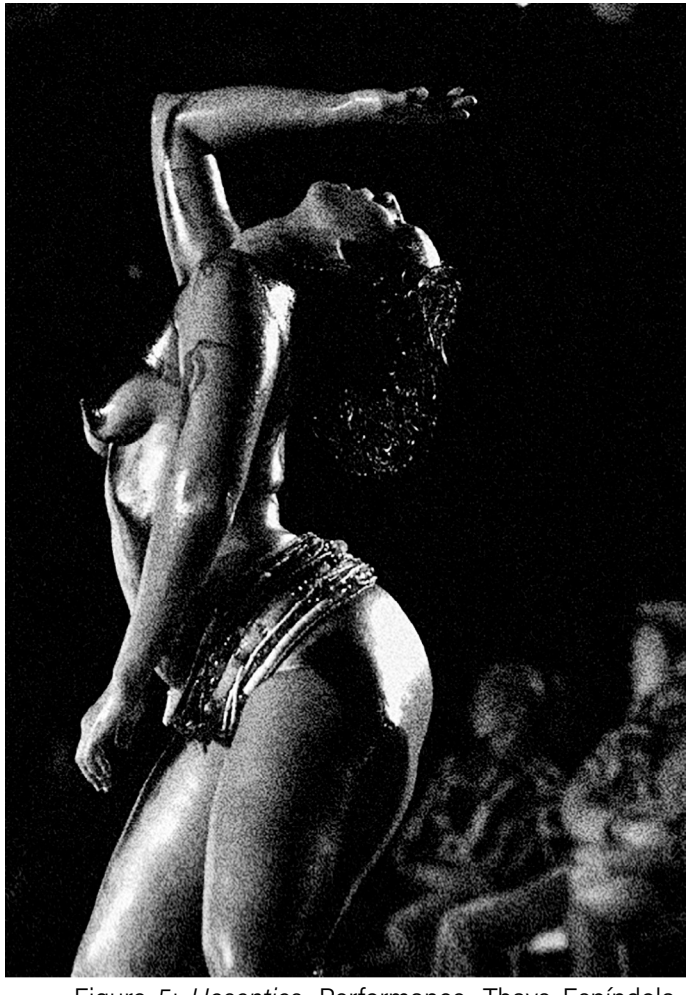


Figure 5: *Hosenties*, Performance, Thays Espíndola. Biennale Passages, Bielefeld, 2022. Photo: Beate Steil.

An endeavor that continuously and sinuously seeks to broaden perceptual horizons and create new configurations of meaning, as stated before, this framework aims to facilitate a comprehensive set of methods for breaking away from colonial heritage in our sensory perceptions, nurturing cognitive and somatic skills that resonate with the natural world and rekindle our deep-seated ancestral connection to non-human dimensions of knowledge. In essence, it moves *curvewards* enhanced creativity, heightened ecological sensitivity, and an expansive exploration of epistemology that goes beyond the normative anthropocentrism.

Moving Curvewards

In this sense, and in the effort to envision, in Sarr's words, "epistemologies of the senses" (Sarr 2022) open to multiple translations, crossing other matters and forms, we are engaged in an investigation on the production of meaning that occurs in the intrinsic vibrational and flirtatious entanglement between dance and space. An expanded perspective that regards sound as a scenic architectural structure opens the possibility of creating nomadic trans-flexible performance-state-spaces; a mode of constant attentiveness/perception for close

encounters within invisible and visible poly-rhythmic, poly-centric, poly-decentric vibrations-pulses-movements, where dance is a multi-translation process, a creative entanglement interrelated to diverse forms of life and a way to activate alternative temporal-spatial dimensions.

This approach incorporates an *in*-disciplinary examination of traditional wisdom, combining insights from indigenous mindsets and technicities with contemporary scholarly paradigms. This investigation is being developed within the scope of a practice-as-research project,[6] *curvewardly* through a number of performances, experiments, physical practices, lectures, and creations, in collaboration with several partners,[7] both human and extra-human. Operating from a *flirting state* that, as noted above, concerns a state activated by engaging in curved attitudes from which a myriad of relationships can be established, the project

6 *E'TOME* is being developed through a fellowship at the Graduate School, Berlin University of the Arts, BAS-UDK, mentored by Michelle Christensen and Florian Conradi of Berlin Open Lab.

7 Transmedia artist and scholar Christiane da Cunha, Collective Hosenties, Templar Castle and Convent of the Knights of Christ of Tomar, ICI-CCN, Centre chorégraphique national de Montpellier/Occitanie.

investigates from a mindset prepared to be intentionally vulnerable, to embrace that vulnerability; to share, experiment, criticize, and reflect it. A premise of *E'TOME* is that this vulnerability acts as a conduit for unknown forces to emerge and participate, fostering discovery, learning, and dialogue through hidden languages and voices. At the same time, this stance carries political undertones, asserting sovereignty over our bodies, spirits, intellects, and sexuality.

As a nomadic performance-state-time-space occupying the form of a continuous abstract-cosmic concave surface, we hope through *E'TOME* to follow a curved line capable of expanding endogenous time while collapsing the temporal structures of neoliberalism. Always recognizing that without the Earth we are not. We are a biodynamic movement, pre-post-colonial-contemporary, constantly moving in and around a circular threshold-device-scene. Thus, we are currently at a disadvantage in pursuing our aim to mitigate coloniality by upholding, updating, upgrading, and too simply translating ancient knowledge for contemporary realities.

References

da Cunha, Christiane. "Conversar Com Árvores - o ritmo na porosidade entre a criação e a vida." 33º Encontro Nacional da ANPAP, João Pessoa, 2024.

da Cunha, Christiane. "Espaço-Tempo Fluido: Entrelaçamentos Entre a Cenografia Digital, Performance e animismo." *Sala Preta* 22, no. 3 (2023): 72-90.

da Cunha, Christiane and André Gardel. "Dramaturgia do Ritmo." *Repertório* 36, no. 1 (2021): 63-86.

de Haan, Leo J. "Partition of the German Togo colony: economic and political consequences." *Canadian Review of Studies in Nationalism* 15, no. 1-2 (1988): 33–41.

Sarr, Felwine. "Music as Space of Knowledge." The Politics of Translation: Translation, Nation and Gender, CAS SEE & IFDT Conference, Palace Moise, Cres, Croatia (2022).

Freire, Paulo. *Pedagogy of the Oppressed*. New York: Herder and Herder, 1970.

Greco, Lucrecia Raquel and Anani Dodji Sanouvi. "Movimentos animistas no colonialoceno: Agama Fo como propuesta de investigación en Antropologia." *Antropología Experimental* 22 (2022): 233–247.

Santana, Tiganá. "Tradução, interações e cosmologias africanas". *Cadernos de Tradução* 39 (2020): 65-77.

de Souza Santos, Boaventura. *La Globalización del derecho: los nuevos caminos de la regulación y la emancipación*. Bogotá: IISA (Universidad Nacional de Colombia), 2023.

Vernacular Computationalities: Cosmogony as a New Paradigm for Design

Sénamé Koffi Agbodjinou[1]

Anthropocentrism and Cosmogony

What I would like to share with you are some thoughts, some ideas about data and the body and their interrelation; this mediated by two ways of seeing the world. On the one hand, we have what is the current way of seeing the world—we can also call it the paradigm of modernity—and on the other hand, we have what you can still see in traditional societies today. So, we have two very different ways of seeing the world: one with what you can call anthropocentric; the other, a paradigm where humans and non-humans interact with each other in another dimension. One

1 Transcript of input speech given on 20 June, 2024, for the panel More-than-Human Technoecologies during the conference RE/EMBODIED DATA – Ambiguities of Knowing

can also call these the paradigm of profit and the paradigm of the cosmogonical.

In the cosmogonical paradigm, humans are sensors—you collect data through your own body, and that data informs your society. With a lot of elements developed by traditional societies—in and between those elements—you have the dance, the fiesta, all of those moments. Everybody is together and are designing in order to make possible the data that you collect as individuals to inform your societies. Because if you collect data but you do not interact with people, the data is not beneficial to the society. So, maybe that helps in understanding why dance is so sophisticated, so profound, in those societies, because it is the only way—or one of the best ways—to collect data. And your body is a kind of sensor in these communities. But you are augmented with other sensors, which are the people that you interact with. Because I myself can collect data and share it with you, but you are also a sensor for me because instead of having a watch, that tells me I am not feeling well, a friend can see me and tell me that I look different. So, you are a sensor for me. You collect data about me, but you are not wearable. So, you collect data for the group. By interacting with nature and by being in society, we can manage all the data

we collect as individuals, and place it on a very sublime, sublime, sublime level.

A Triple Ethereal, Disorganic Breakup and Reifying the Unconscious

So, now I will take some time to talk about the other way of seeing the world, the paradigm of profit. You can also call it modernity. And I would like to share with you what is my work: My work is to produce a critique of modernity. I'm not very original in doing this, because it is now something you have a lot of people doing, people who are better than me at doing it. But what I am original in is that I try to schematize the problem of modernity. Because if you want to address a problem, you can do it better if you make it simple to understand. So, I'll try to make it simple for you to understand what modernity is, and what, from my perspective, the problem of modernity is. I developed three concepts that don't appear simple but aid understanding, in a simple way, what modernity is. *The three concepts are reifying the unconscious, disorganic breakups, and the triple ethereal*.

When we talk about modernity, what one needs to understand is that it is something that emerged in Europe at a point where the

history of this continent was very constrained, and at a point of what in French we call "la Lumiere" (the Enlightenment). What philosophers at this time were trying to do by inventing modernity was to liberate the people in Europe from a lot of constraints, from contexts that enslaved individuals at that time. Constraints such as religion, which was a kind of dictatorship, where one did not have the right to follow one's own way of thinking, but everybody was supposed to think like everybody else. So, philosophers and thinkers built a lot of concepts to advocate for the notion that believing, and values, should be personal. In French we say privatization, "la Valeur"—saying that no institution can decide what is value. You need to privatize your own values. It is what we call liberalism. Liberalism was a very profound movement in trying to liberate people from lot of constraints. But at some point philosophers in Europe found that it was simpler to liberate individuals by creating another reality rather than liberating individuals by confronting the reality in the reality. But by doing so, what philosophers in Europe did was that they quit. Because at some point they found that it was simpler to liberate individuals by creating another reality, rather than liberating individuals by confronting the reality in the reality. Modernity became a very

profound philosophy of synthetics, of producing artificials instead of trying to fight the real. Rather than trying to build rights for the individual in the real, they found that it would be simpler to develop another reality, in which all the rights would be already there, and one would only have to switch the reality in which one is suppressed for another reality. So, they developed a concept of the individual that I call ego. Modernity was to build ego.

Constructing Ego

Ego is the individual who is liberated and emancipated of any constraints. In order to be able to build ego, which is an abstraction, the philosophers developed an abstraction, which would be the environment of ego, the reality of ego. What I am arguing is that there was a reification, a very profound reification, in the project of modernity. This, in the sense that there are very constant processes of producing artifice, more and more artificialization, in order to attempt to escape organicity and the constraints of organicity. To be able to build this artificial world, in which ego will be free from any constraints, modernity came to separate. Modernity is a very big philosophy of separation, so they launched what I call the *disorganic breakups*.

The first breakup was to say that the human is enslaved in nature, and one must escape from nature in order to achieve one's full potential. They developed the concept of naturalism, the idea that you need to create distance from nature to be civilized. So, the first separation was the separation of human society from nature, and this separation also launched all the processes of colonization. Because colonization was built on the assumption that people in other continents were living within nature, and that this gave the people in Europe the right to go and take and do with them as they wished—because they were not perceived as civilized. They were still nature. They had not yet escaped nature. And the Berlin Conference happened because one of the concerns that Europeans were facing during those times was the fact that all the European countries were at war, fighting with each other. And to pacify Europe, they met all together in Berlin, and they agreed that they will no longer fight between each other. They thought: "we have this big cake, and we will each take a part, and we will use our energy to achieve something else, which is not fighting amongst ourselves." The pacification of Europe had to be based on finding another enemy. And industry, which was for producing arms to fight each other, became an industry

to try to conquer nature. Nature became the new enemy in order to pacify Europe. This very first separation, naturalism, that humans should be separate from nature, is very counterintuitive for traditional societies all over the world. We do not find ourselves separate from nature. We are nature. I have nature in me. My mother has parents who are snakes—there is a very specific relation with nature in all traditional societies all over the world. It was in Europe that this idea that humans can be separated from nature emerged. And if you are separate from something, you can think about instrumentalizing it. You can see it as a utility and place it in a logic of production and profit-making. So, nature becomes something that is no longer apparent, but something you can use.

If you separate yourself from nature as a human, you will still have organic constraints. You still have this in the group, the family, the tribe, etc. So, the philosophers decided that in order to be really inhuman, i.e., civilized, you need to live for yourself, by yourself. They invented a new, very counterintuitive concept, a very revolutionary concept, which is individualism; separating oneself from the group. This was also very interesting for the market, for capitalism—the capitalists saw profit in pushing this way of seeing things, because if I am no longer entangled in the

community, and I can only see my own egoism, work for my own egoism, then I can be used. They could construct an economy, what we call economy, politics, political economy, by this way of seeing the world, by advocating for individualism. So, the second separation, individualism, was philosophically designed as naturalism, trying to push this agenda of going more and more towards building ego. All that I have just said is not original. You have a lot of thinkers who say this better than me. What I am original in, again, is to say that people most often see modernity as achieved through those two separations, and as something finished and in the past. But I, I am saying that modernity has not been achieved. Modernity is not finished or in the past. Modernity is vicious. It is becoming more and more villainous. Modernity is dynamic and it is trying right now to achieve its potential.

Manufacturing Mutants

We have a last level of separation: the idea that you need to separate yourself from your body, because although you are separate from nature and from the group, you will still maintain organicity. You are still dependent on something—that is, your body. To be able to live only in consciousness and to boost your spirits is

the best way to live as a human. Ego should be only something which operates in consciousness. You should be liberated from your body, kill your body. The potential, the technical potential to achieve this last revolution was not present at that time, but we have it right now with digital technologies. Right now modernity is achieving its potential and is trying to finish this project of artificialization by making possible this idea that we no longer need our body. Bodies should be fixed, bodies should be anchored, and only your consciousness should move. There should be no more movement, no more dance. Because it is organic, savage, to dance. You know, you should dance only in consciousness. It is more civilized. And this last revolution will create something very special, that will make us change civilization. We have the abstraction of something which seems to be a mutant. Because when you separate people from nature, you produce mutants. Covid for example was a mutation. It is because of our bad relationship with non-humans that we had the Covid crisis, and we are producing more and more mutants right now through the artificialization of life, etc. Capitalism is a mutant, too. The economy in a traditional society is not something separates from the group; it is something which just helps us exchange

between each other. But now economy has become a mutant, too, something which takes its own law in its own hands. We do not command the economy; the economy commands us. You know, we need to save the economy. It is not the economy that is there to save us anymore. And the economy is too big to fail, we need to save it. And the third separation—the separation of you with your body—will produce mutants, too. And if these three levels of mutation equalize, we will change civilization.

Idle Bodies in the Smart City

We will soon be living in a civilization where data will be what we serve and what is relevant. Not the data that we can capture from moving around, with our digital sensors, but another type of data. But when we begin living in these future societies, we won't have to move anymore. We will be serving another type of data. This dystopia I am talking about is possible, and you can achieve it only in the smart city. Why? Because the smart city is the place that new capitalism is pushing for. In the smart city you are supposed to be in your place, everyone in their place, and the city will be a kind of large prothesis that will help you to achieve everything that you want to achieve. The old capitalism used to push us

outside, because we needed to go outside to use things, and to be used by industry, in the factory. And it is by going to the factory that you are in the eye of capitalism. You can be exploited, exploited, exploited, and you can also be under surveillance. But now machines can do what you used to do in the factory. The new capitalism does not need you to be in the factory, they need you to be in your home. Not in nature, because if you are in nature, you are looking for butterflies, you are not on your phone. So, you need to be in your home, but you do not have to be in your home with people around you, because you might have the temptation to discuss with other people. You know, you need to be alone in your home, and you have this gap, this accumulation of people living alone, each one in their house, on a device that possesses a unique way of exploiting you. It seems very dystopic, and it is. It is what the hubris, the internal dynamic of digital capitalism, is pushing towards, and why it is an African who comes to tell you that. Because the smart city agenda has something to do with our continent, as the biggest cities in the world are going to emerge in Africa. In the next 30 years, we will have the five biggest cities in the world. Big tech has already seen the potential to go there and make smart cities, because one human

out of four will live on this continent. By making these smart cities, what they will do is transform the place that you have the most people in. They will complete their capacity to accumulate data, and in my opinion this will not be for the good.

Discussion: On Vernacular Knowledge, Epistemic Diversity, and Nonlinear Futures

Moderated by Ines Weigand and Michelle Christensen

Ines Weigand:

Thank you for that input and for broadening our horizons on these issues. With the first question I will try to connect to this morning's panel on breathing and the body. What happens in the body or with the body, but also what happens on other scales like the city—how are these aspects connected? What is the role or the understanding of technology in this? How can we approach data or technology in a different way, coming from different ontologies or paradigms from which we think, act, and feel?

Sénamé Koffi Agbodjinou:

What I usually like to say is that the very first technology is the group. People understood very early that if they want to be able to do something or perform something, it is only

possible in a group. If we are in a group, we can move something heavy more easily than we can alone. So, the group is a very complex technology, because people developed a lot of utilities to be able to add people to people, to make humans augmented—not by electronic devices but with new humans. So, the group is a technology. In anthropology you can see it very easily. The way people get married, the way they decide who is going to be the chief, etc., is very complex. You have complexity in the group. You have complexification in your computer. It's different. All technology for a long time was inspired by the group. All technology was supposed to serve the group. But with the current developments in digital technology, we see for the first time that technology is no longer fascinated by the group and no longer wishes to serve the group. Technology intends to replace the group. "If you use me, you don't need the group."

But technology itself is not the problem. It is the environment that produces these technologies. I usually say that technologies are good. Digital technologies, the last sequence of technologies—peer-to-peer technologies, blockchain, artificial intelligence—do not respect the potential of the group. They seem to be built as a social structure, but these technologies

are developed by Silicon Valley as purely profit oriented—and when we have something that could be potentially very organic, then it will become monetized. But if you take the same technology in its origin and you apply it in a different manner of innovation, a different way of innovating, in a different innovation laboratory ... if you give these technologies to non-contact societies in the Amazon region, they will develop the most innovative technology you can imagine. And all the technologies that we have right now that come from Silicon Valley are archaic, because they haven't reached the real potential of the technologies, which is to be organic, to be distributed. Making this shift is the problem, not the technology. The problem is the paradigm in which we are developing technologies right now.

Anani Dodji Sanouvi:

I will make a connection to the Éwé language, which is so sophisticated and complex. In Éwé, the word is not the meaning, the tone is. The same word can have six tones and it's the tones that give flexibility when we speak. So, the meaning is not in the word itself, it changes according to the tone of the word. For example, I'm going to talk about *E gli*—"the wall" (*he pronounces the word using different tones*). This

flexibility for me also comes from the observation of what is happening in nature—in a river, for example. Water: it is extremely flexible, extremely multi-shaped. I don't think that water has only one shape. I don't know, but I think that there are numerous shapes of water that we can find. I am not a scientist, but we can see that there is a complexity and sophistication in the knowledge that we have from our forefathers, which is in language. So, technology? I think it is an ally. It is an ally to highlight what was already technological, a pre-colonial technology, because I do believe that my ancestors were scientists, my ancestors were philosophers. They were mathematicians. They were all the disciplines you can name.

For me, there is no chance to say: "Oh, we don't want technology." On the contrary, we think that technology will contribute—including what was already a technicity. I'm not talking about technique but about technicity, which back in the day was a way of understanding the function of something. This technicity is done within and among people. It is a group that we call *Ablome*. *Ablome* in Éwé means the place where we gather to generate knowledge: it is an epistemology. They have a place where they go and they make that epistemology within the language. So, inside language we have codes. And those

codes must be kind of deciphered by the human being through technicities. For example, if we want to have a conversation with the vibration of the tree, certain people have certain codes of how to clap their hands. I'm going to do one (*claps hands*). It is a sound that—if we do it seven times, 20, 21, or 34 times—it has a certain vibration and connects us to a certain type of entity and energy and vibration.

It depends on the house that you come from. For my father's and mother's side, we have kind of the same. So, sometimes when we are in front of a tree, you go like this (*claps hands*). This is a sound that connects with the vibration of the tree, which is the energy, the spirit of the tree. What I'm trying to show here is that it is already a technicity. It is a type of knowledge for engaging in a certain conversation. And that conversation is going to be with a non-human. At the point when you have that, you are also tuned into a certain vibration. So, the person is tuned into a certain vibration, aligned in a certain state or attitude. Talking about technology, I am developing a method that I call "Agama-Fo"—the flirting state. The flirting state is an extreme state of vulnerability; vulnerability in the sense that you are hypersensitive, sensitizing yourself and your senses to a place, when we arrive.

There is a difference. I'm not going to enter this space in a flirting state, I'm not going to use a tendency to be open to the people here (*demonstrates moves/dances, shows different attitudes in motion*). So, I enter the place like this. This is an attitude. This is an attitude that is pretty clear. I invade this room. But then if we come in with another kind of attitude like the flirting state, which is a technicity within traditional dance, you never get in without sensing what's going on around you, which is a 360-degree hypersensitive technicity.

(*Anani Illustrates in action*) So, you enter ... that is already a kind of state, where you sense who is there ... What is he wearing? A little bit, sometimes, the smell ... you know, the smell is part of it. The gaze ... are you gazing at my person here? So, I'll gaze at you like this. It's a gaze, right? But there is kind of subtle gaze, which is a kind of inviting gaze. In Brazil, they also have some of this technicity in samba. They call it "Magalenhia." Magalenhia is more when the samba is happening. In Magalenhia, you know you're going in that direction. Before I go there, I'm going to make a curve. A curve that takes me slowly, slowly, slowly to that space. And it takes time. It takes time to build this Magalenhia, the technicity of the flirting state. You have to engage into

a certain multi-dimensional relationship, which is also a multi-relationship technicity. For me, it's a technicity that is a technology, a pre-colonial technology, and this can be combined with new technology, and then we will see where it takes us.

And I strongly agree with Sénamé that technology is the group. It is already the group. And that group has a certain way of functioning, which is an interdependent relationship. You depend on the other, and the other knows that as well. So, our proposal of the flirting state is really in this kind of space. It is a technicity that we come from as a group of people, and now we try to develop and see what we can do with it when it meets new technologies ... I don't know where we are going, but for me it is an ally.

Ines Weigand:

Thank you both. I will now open the discussion to the audience.

Audience:

First of all, thank you very much for your presentations. I have a question for Sénamé. I basically agree with your analysis. And I also see this kind of dystopian picture that you painted with these future smart cities. You said

that the production of technology is informed by a certain paradigm that is destructive. And you talked about these three separations from nature, and so on. What is your way into the future? What is your way forward? Do you have any idea how we can transform this kind of mindset that we are all, more or less, captured in? And how would you start doing this? Because for me this is a big question.

Sénamé Koffi Agbodjinou:

I don't have a solution other than following the application, and it is the explanation, it is all about developing this schematic way of seeing things. You can find a way to address this problem. If you are talking as an architect today, if you don't want to be modern—you want to be anti-modern—you must make architecture where people are in their bodies. So, they need to move. They need to dance in the architecture, you know. You need to build architecture that advocates connection. You need to meet other people in architecture, and you need to invite nature into your architecture. If you take it just as schematic, to be anti-modern, then you must address these three separations in practice. We are not even conscious of what we are perpetuating in everything we do, and the final

solution should be to change the paradigm. But the paradigm is the thing that is very difficult to change, because the paradigm is the thing that you have no consciousness of. It is something that commands you, but you do not even know it. How can we shift away from the modern paradigm, the paradigm of separation, the paradigm of profit? Because currently it is profit that validates how we see the world.

I think that the only way to do so is to not be dependent only on the Western archive. You need to be open to the periphery and other ways of seeing the world, and to see how you can capture those different paradigms, non-anthropocentric paradigms, and to see if they all share something in common. And this can be the substructure to build another paradigm, which could challenge the paradigm of profit. It is not a challenge for technicians. Technicians do not address paradigms, they just try to find solutions. By staying in the paradigm they only make reforms. It is a challenge for artists. Artists can decide that it is a problem of paradigm. We need to shift everything and build a new paradigm. But for now, most of our thinkers are technicians. Most of them are economists. We need more artists-thinkers, artists-philosophers, artists-politicians, etc.

Audience question:

Just one small thing to add, when you say anti-modernism, it sounds like we have to go back to before modernism, and I am very skeptical about that. I think that we cannot go back, that is very unrealistic. We have to, rather, think of something else, of what that could be. I think the real challenge is to imagine what it is that combines what you are saying, these different parameters. I think that is where we come together in our thinking, probably, and in our interests. It is this thinking of what is the way forward. And not as one solution, but, you know, it is important to stress that it is not going back to something.

Sénamé Koffi Agbodjinou:

It is not a way forward. It is a cycle. So, it is not about going back, but to go on as a spiral. But it cannot be forward. Yes, you have to shift, but to not go back. That is why I am saying what technology itself is asking for. The new technologies do not like the way we use them now. Technologies want to be distributed, they want to be shared. They are very democratic in their essence, and we need to make this revolution in order to try to see what the real potential of technology is, of the digital, and to develop

societies. Because we are archaic in everything we do today with technology.

Anani Dodji Sanouvi:

In my latest writing, I develop neologisms to raise the issue of thinking, working, and moving as a way of acknowledging, playing, and responding to the ongoing circular dimension and unknown forces and territories of the earth and its inhabitants. Here, dance performance operates as a flirting state. It is intentional that I use the flirting state, which is an attitude, a state of mind—actually a *curved timeline* for engaging in any type of relationship ... a state in which one has tuned one's thinking to ensure that any physical movement always happens towards something else. The *curve*, then, becomes a technology of the threshold. Inside this assembly, there is a hole. And inside this hole, there is another hole, which is obviously going to take us somewhere else. You know, each corner is linked to another and another, and then it is infinity—an infinity of places to go. So, I think that there is no place to go back to. I think that we are always going to move towards another corner. We are always going to drift. We are always sweeping somewhere, going somewhere, and always getting out of the straight line. This straight line, for me, is dangerous.

Michelle Christensen:

Anani and Sénamé, I think that you are both operating very much in these in-between spaces, between traditional epistemologies and new technologies. Sénamé, you are looking at indigenous knowledge in ways of social organization and building with traditional architecture in Central Africa, and then merging this with 3D printing architecture ... trying to merge these forms, because it is not possible to build the shapes in concrete. So, almost subverting this new technology in order to be able to build something that we couldn't build anymore, trying to find these in-between spaces. And in the case of Anani: you know, for me you are always somewhere in between Éwé epistemology and meeting the universe halfway with Karen Barad. And you explained to me that it is because it is all about queer ecologies, but differently. So, I think that you are both actually operating very much in in-between spaces, which I think is of great value to even explore, and to see what that becomes.

Audience:

I had this thought that was kind of related to what was discussed before. But also, I don't really feel uncomfortable with this idea of "how do we move forward"? And it kind of made me

think of what you were saying about dancing—you know, the shared kind of rhythm, but then every single person is going to have their own flavor of the movement afterwards. I also really like the vibe with the schematic that you described. But what I'm wondering about is how do I fit into that, a bit of this kind of ideological forward monolithic way of thinking versus a kind of pluralistic way of thinking. And you say, you know, if we give the means to the tribe in the Amazon who has never had any contact with Western Modernity, what kind of technology will they create? And it's just spinning around in my head in a way that it is not the way forward, but the way to think about it might be a bit like a dance.

And maybe somehow, we need to ask, not how do we go forward, but what is the shared rhythm? But then how do we give everybody the means to dance? I don't know if that's a weird way to describe it, but for me that's kind of a way of formulating the question. I feel like that's a better question to ask, rather than, "what is our solution?" We are pulling from different ancestral, cultural histories, and we're not just trying to have some sort of consensus monolithic thing, but we have to figure out how to relate to each other on this. How do we relate to each other on the dance floor? Somehow, I feel like

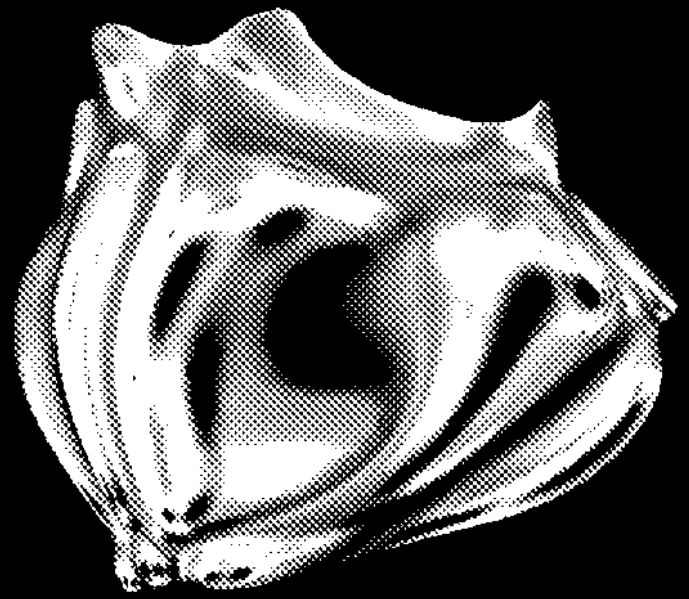
there's a way to describe this kind of notion, this dance floor kind of way of thinking about global society in terms of this schematic that you have. But somehow I am not making the connection. I don't know if you have a way of sort of making that link.

Sénamé Koffi Agbodjinou:

For me it is a good concept because the concave space is the space where everything meets at some point.

I think that all human beings, wherever they establish themselves, develop something in common, which is an anthropology that in French we call *le génie du lieu* … this ability to understand one's environment and to develop a society that can be embedded in the environment, not in conflict with it. And we have to find out what is common to all of these in anthropology. That is something that we started to do with the whole structuralist movement—trying to understand what all societies share in common in terms of technology, in order to build a society that is at not at any point in conflict with the environment.

DIALOGUE 3
Wildlife and Data



Re-relating the Technosphere to the Biosphere: A Wilding Project in a Planetary Context

Felix Stalder

I must admit, I am not a bird person. There are less than a dozen different birds I could recognize in the wild, and my "wild" usually means the city. And in that environment, the first thought about birds is not the freedom of the boundless skies that inspired so many poems and songs. I came to the northern bald ibis through an interest in data, the technology that produces this data, and the relation to animals shaped by this data. So, I looked at this as a relatively straightforward, triangular relation between animals, data, and humans.

The first thing we—myself and Gordan Savičić—did was to scrape all the data from the Animal Tracker app, a smart phone application that uses real-time data from wild animals fitted with a GPS tracker to plot their movements onto a map.

It also lets users upload images from their encounters with a specific animal in the wild.

There was a lot of data from the northern bald ibis in the app, about its movement and encounters with humans. People clearly like this animal. This reinforced our initial surmise that mediation through data transformed people's relationship to wild animals, which now suddenly appeared as singular beings, with their own unique histories and behavioral patterns that we are bound to anthropomorphize as "character," something we usually only do for pets. It reminded me of a book I had read a few years earlier, *Das Internet der Tiere* ("The Internet of Animal") (Pschera 2014), which formulated this thesis for the first time. You can call this a clear case of confirmation bias: finding what one expects to find.

Mapping

This simple mental diagram dissolved once we went on our first field trip to visit Johannes Fritz and his team, who were hand-raising a flock of about 30 birds who had been born in zoos and bird sanctuaries, and then transferred to them a few days after hatching. The reason why they had to be raised by hand was to forge a bond with their foster mothers strong enough for them to follow an ultra-light airplane across the Alps, into the nature preserve in Tuscany where they would spend their first winter and

subsequent summers until adulthood. They then would fly back to their breeding grounds and foster a new generation on their own. To keep them supervised, each bird was fitted with a small tracking device.

So, in addition to birds, data, and people, we found a vast socio-technical assemblage, including an airplane and pilots, as well as a custom-made wind channel, an aviary and temporary camp, and a steady stream of resources coming to sustain the birds and the people who lived there caring for them for four months. And we weren't the only visitors. Others would come by as well, including journalists who really liked the story of this strange bird coming back into the area 400 years after its local extinction. That obvious media hook was stoked even more by irresistible images of northern bald ibises following their human partners in the ultra-light plane. This attraction might have something to do with the fact that the project itself was in part inspired by a very successful Hollywood production, *Fly Away Home* (1996)—a film that was, in turn, inspired by a real-life project involving cranes—where this very image comprises the film's central affective moment.

The closer we looked at the project, the larger and the more heterogenous the technical

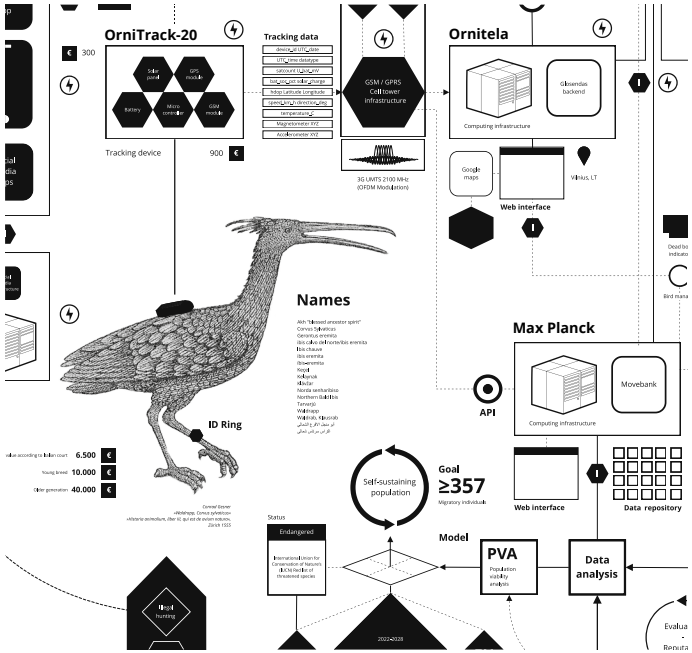


Figure 1: Infrastructure of a Migratory Bird, Vladan Joler, Gordan Savičić and Felix Stalder, 2022-2024 (interactive version: https://bird-map.net)

assemblage it depended on became: electricity poles and utility companies, social and mass media, EU funding bodies and their reporting requirements, hunters associations, scientific publishers, historical disputes (over when a species can be considered native), and international debates around the ethics of animal tracking; but also the rapidly escalating effects of climate change, the fragility of thermal updrafts over the Alps, the need to synchronize the differential in the flying capacities of birds and ultra-light aircraft, the modelling of stochastic events, the occasional loss of birds to hunters, cell-phone standards, and the astounding intraspecies variability of bird behavior.

So, we began zooming out, focusing less on birds and data and more on what we had come to understand as an infrastructure that, in a way, produces both birds and data.

Infrastructure

What kind of infrastructure is being created here? There is very little in what I have outlined above of what colloquially is understood as infrastructure, and almost no long-term physical construction. To the degree that something is constructed at all, it's mainly mundane, temporary contraptions (such as aviaries,

breeding walls, on-site camps, etc.). Rather, the infrastructure is created through a process of relating and in the process transforming existing elements for the explicit purpose of creating a new environment—a habitat for the northern bald ibis as a migratory bird. Indeed, only because most of the elements—ecological, technological, institutional, cultural—already exist is it possible to attempt to assemble such an extensive infrastructure at all. Had the environment been more damaged, had the species not been kept in zoos and sanctuaries, had the technology (particularly the trackers, but also smartphones and the Internet in general) not been available at affordable price points, had the EU not a significant research funding budget, and, finally, were it that the northern bald ibis species lacked a long cultural history and intrinsic telegenic qualities, the work of infrastructuring on which the project was based might have been too daunting to even start.

However, the relating here is not simply an act of joining existing, fixed elements. Rather, it is a process of transforming all the elements, modulating their material, behavioral, semantic, and affective characteristics. In this extensive work, some relations need to be strengthened, some loosened, some transformed, new

ones added, and some removed altogether. Here there is a continuous tension between entanglement and disentanglement, between creating, modulating, and cutting relationships. For example, to assist with the migration, biologists needed to form a close bond with the animals they had raised by hand; yet, to successfully release them this bond also needed to dissolve after the birds' arrival in their Tuscan nature preserve.

The trackers provide data for support and research, yet they also are a physiological and social burden on the animals. To mention one instance of this, the Animal Tracker app allows people to locate and observe animals, creating new bonds of affects. Yet, at times this human contact becomes too intense. To counteract this, researchers are able to hide certain animals in the app, but the question of how intensive the tracking should be and what kind of sensors should be used is an ongoing concern. Over time, researchers hope to use fewer sensors, at the expense of data gathering and their ability to support the animals. The goal is to allow animals to become less familiar again over time.

This ongoing modulation constitutes a form of "agential intra-action" through which "the boundaries and properties of 'individuals' within the phenomenon become

determinate and particular material articulations of the world become meaningful," as Karen Barad (2012, 12) has put it. All the assembled elements get their particular material configuration and social meaning from the processes of relating noted previously; the birds themselves in particular, who change from a sedentary species living in varying degrees of captivity to a migratory species living in an anthropogenic environment that is infrastructural and mediated.

Such agential intra-action also changes people, whose lives become enmeshed with those of the birds to varying degrees. Some are literally living with them in close quarters and establishing reciprocal relationships of bonding, hunters are becoming educated about their rarity, while others casually observe the birds via digital media and becoming affected by their narrative.

Maintaining the northern bald ibis's environment, a habitat with both physical and affective components, requires continuous work to keep it as is or to adapt it to changing circumstances and conditions, which range from the local to the planetary, the short-term to the medium-term. How much work is hard to predict, as so much has become unpredictable due to climate change. Over time, the intensity of the work is projected to decrease, and certain supporting acts will

cease, but some work will always be required.

If this is an infrastructure of becoming, what exactly is taking shape? Clearly, not a wild animal in any traditional, Western sense—that is, one implying a nature/culture divide and carrying distinct colonial connotations (Reader 2019). Rather, taking shape is an animal living in what Donna Haraway (1991) called "natureculture," or Jussi Parrika (2015) termed "medianature"—the mutual shaping, framing, and enabling of biological and non-biological elements that constitute a dynamic system. Within such a system, wilderness is better understood as degrees of autonomy which co-exists with forms of management, and thus can vary quite considerably over time (Ward/Prior 2020). In other words, wilderness is a specific relation between humans and animals, and not an absence of relations (Reader 2019). But it's a relation that is not predicated on control (as with farm animals, pets, or, to a lesser degree, animals in zoos and parks). Indeed, the very purpose of this entire infrastructure, tracking technology and all, is to increase the autonomy of the animals by intensifying and modulating their relation to humans, not by severing them. Perhaps we have to rethink what wilderness means. It's not a state but a relation, a relation of relative not absolute autonomy from humans, a

form of living together that implies neither human control and domination nor human absence. An ongoing challenge to Western, modern thinking (Turner 1996).

Projects such as the reintroduction of the northern bald ibis to Tuscany point towards the development of "natureculture" or "medianature" guided by the values of reconciliation, "redesigning anthropogenic habitats so that their use is compatible with use by a broad array of other species" (Rosenzweig 2003, 194). This is urgent for two reasons. First, "untrammeled" ecosystems are shrinking, and enlarging them will be extremely difficult given current human population levels. The tension between the needs of human populations and the desire to preserve undisturbed nature lends ideas like the Half-Earth—which proposes to set aside half the surface of the earth as free from human interference as a way to preserve biodiversity (Wilson 2016)—a decidedly necropolitical undertone (Napoletano/Clark 2020). Conversely, it is well known that smaller or fragmented conservation areas are inadequate when set against the massive ranges of movement of many animals, echoing Alexander von Humboldt's famous observation that small habitats contain less biodiversity than large ones (today, this is called "species-area

relationship"). The goal, then, is not to separate humans from wild animals, but to create environments of co-habitation.

But what does this co-habitation really mean given our deeply technologized planetary condition? Let me zoom out a bit more.

The Planetary

Much of what I have talked about so far is very specific to a very unusual case, the rewilding of a migratory bird. But I would argue this case, and the fact that the infrastructure for a wild animal is assembled explicitly, indicates something larger. Indeed, a great deal larger. About a decade ago, earth systems scientists started to speak of the technosphere as the fifth major metabolic cycle, next to lithosphere, the hydrosphere, the atmosphere, and the biosphere (Haff 2014). In this view, which is not entirely uncontroversial, humans are part of the technosphere and have been since the beginning of agriculture, as their survival depends on the existence of this sphere, and it is the technosphere that mediates the relationship between humans and the other spheres of the planet.

An example: that the number of humans has been able to increase from about ten million at the advent of agriculture to the eight billion

living today is due to industrial agriculture, most importantly, artificial fertilizers. Without it, along with the industrial infrastructure that produces fertilizers in the necessary volumes, millions if not billions of people would starve (Smil 2022). But producing such volumes requires substantial "raw" materials, and their use significantly impacts soil and water quality. We might be at a similar point with the Internet. In this sense, people are part of this system: they are inside of it.

Like all spheres, the technosphere interacts with the other spheres, most directly with the biosphere through the transformation of landscapes, selective breeding of certain plants and species, and the extermination of others. What is new today is that this interaction has become so extensive and so ill-conceived that it is destabilizing the biosphere as a whole, and is also impacting other spheres, particularly the atmosphere.

Until now, the biosphere has been conceived as outside the technosphere. There have been many forms of interactions—taking resources, dumping waste—but the biosphere remained outside the technosphere in the sense of not being dependent on the latter for its own survival. On the contrary. In many cases, it most likely would have been better off without the technosphere.

When we look at the northern bald ibis rewilding project, we can see very clearly the process by which this relationship has been transformed. A part of the biosphere is being relocated, at least temporarily, into the technosphere, in the sense that now the wild birds, too, become dependent on technological infrastructure and administrative practices for their survival. Without this large-scale intervention they would have remained locally extinct, as was the case for 400 years, and will remain in need of support even after rewilding, at least for now.

Let's assume that the rewilding project is not an anomaly—which in certain respects it is—but an indicator of a large transformation in the composition of the planet, in which the relationship between the great spheres of the planetary metabolism is being rearranged. For now, the relation between these spheres is hugely destabilizing, not least because the bio- and atmosphere are still treated as outside the sphere of human agency, while in fact all the spheres are now affecting each other, mostly through uncontrolled feedback loops.

By developing an infrastructure for a wild animal, the project, implicitly more than explicitly, articulates a different relationship between large-scale human infrastructures and the

biosphere, one in which the latter is not treated as a stable backdrop but as something in need of support and repair. This requires not just a new conception of what wilderness is, what kind of relations we want to create with relatively autonomous non-human beings, but also of the role of technology in supporting said autonomy. Such a reconceptualization of technology might also point to a way beyond the eternal growth machine by conceiving of infrastructures that shrink over time rather than following the imperative of endless expansion. Of course, this runs against very deep systemic tendencies and one single project can't do this on its own. But it can contribute, together with many other voices, to articulating a practice and a language, even an aesthetic, in which this becomes conceivable.

References

Barad, Karen. Intra-actions. Interview by Adam Kleinmann, *Mousse Magazine* (Special dOCUMENTA 13) Issue 34, June 9, 2012: 76–81.

Dowie, Mark. "The Myth of a Wilderness Without Humans," *MIT Press Reader*, October 11, 2019. https://thereader.mitpress.mit.edu/the-myth-of-a-wilderness-without-humans/ (Accessed June 27, 2024).

Haff, P. K. "Technology as a geological phenomenon: implications for human well-being." *The Geological Society of London, Special Publications* 395 no. 1 (2014): 301–309.

Haraway, Donna Jeanne. *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge, 1991.

Napoletano, Brian M and Brett Clark. "An Ecological-Marxist Response to the Half-Earth Project." *Conservation and Society* 18, no. 1 (2020): 37.

Parikka, Jussi. *A Geology of Media*, *Electronic Mediations*, volume 46, Minneapolis and London: University of Minnesota Press, 2015.

Pschera, Alexander. *Das Internet der Tiere: der neue Dialog zwischen Mensch und Natur*. Berlin: Matthes & Seitz, 2014.

Ballard, Carroll (Dir.). *Fly Away Home*, Sony Pictures Releasing, 1996.

Rosenzweig, Michael L. "Reconciliation ecology and the future of species diversity." *Oryx* 37, no. 2 (2003): 194–205.

Smil, Vaclav. *How the World Really Works: The science behind how we got here and where we're going*. 1st US ed. New York: Viking, 2022.

Turner, Jack. *The Abstract Wild*. Tucson: University of Arizona Press, 1996.

Ward, Kim J and Jonathan Prior "The Reintroduction of Beavers to Scotland: Rewilding, Biopolitics, and the Affordance of Non-human Autonomy." *Conservation and Society* 18, no. 2 (2020): 103.

Wilson, Edward O. Half-Earth. *Our Planet's Fight for Life*, New York: Norton/Liveright, 2016.

The Story of the Northern Bald Ibis: From Extinction to Conservation

Johannes Fritz

The northern bald ibis project aims to introduce a species into a habitat from which it was driven to extinction more than 400 years ago. For 20 years, I have worked with this species. Prior to that, I studied animal behavior and cognition. Today, I am a self-employed biologist leading the private entity *Northern Bald Ibis Conservation and Research*.

Wilderness and Loss of Habitats

Allow me at the beginning to draw a bigger frame regarding biodiversity and wilderness. According to the WWF Living Planet Report,[1] an essential long-term study where 30,000 animal populations around the globe were monitored over a half century, these populations' average decline over this period was 69 per cent. This is

1 https://web.archive.org/web/20240623122946/https://www.wwf.eu/campaigns/livingplanet/

huge, and indicative of how much pressure has been exerted on biodiversity in recent times.

Regarding this loss of biodiversity, I will give the words of Sir David Attenborough, one of the world's most famous and influential conservationists, their due: *"Among the world the number of wild animals are falling alarmingly. We are facing a disaster, a catastrophe. Scientists say that we are on the edge of a mass extinction."*[2] Inquiring into the reason for this dramatic loss of biodiversity, it is, of course, closely related to the condition of the land where these species once lived. A map published by Wikimedia[3] shows the availability of primeval wilderness on the planet—in the sense of lands that have remained largely unmodified by modern human activity, preserving their original natural state (Fig.1). Without going into great detail, I want to draw your attention to the amount of red-colored landscape on this map. This marks land designed and used by humans. In Germany, for example, it is estimated that only 0.6 per cent of the country's primeval wilderness remains.[4]

2 https://www.bbcearth.com/shows/planet-earth-iii

3 https://commons.wikimedia.org/wiki/File:Wildnisweltkarte.png

4 https://www.wilderness.org/

Wilderness in the conventional sense has diminished substantially, and we risk the complete loss of primeval wilderness in our world within the next few decades. Fortunately, there is increasing global awareness regarding the value of wilderness, along with essential initiatives, such as the recently enacted EU *Nature Restoration Law*, which aims to recreate and preserve species-rich natural areas on a significant scale. This restored land is of great importance, no doubt. But it mostly differs from primeval wilderness due to its reduced complexity and biodiversity. This makes such restored lands more sensitive to external influences and environmental changes. Therefore, they need permanent human management, including continuous assessment to track status and success, and to identify and compensate for impairments and threats.

Wild in a Cultured Landscape

But what does the loss of primeval wilderness mean for the species which lived on these lands and evolved in different types of wildernesses? Can species and populations still be regarded as wild if the wilderness where they used to live is lost? Are we moving towards a future in which all animal species are managed,

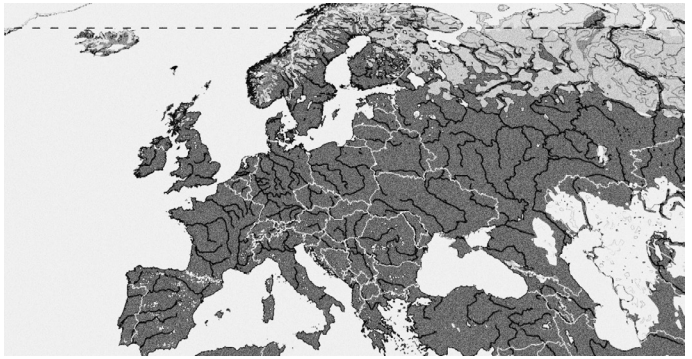


Figure 1: Primeval wilderness; dark-shaded land is entirely designed and used by humans. Source https://commons.wikimedia.org/wiki/File:Wildnisweltkarte.png.

as is the case with restored natural landscapes. In my opinion, this is already a real scenario to a considerable extent. And it has an essential implication: the human species bears a great responsibility for the survival of other species in the world that we have so comprehensively shaped.

This brings me to the species which we work with, the northern bald ibis. It is becoming a kind of flagship species for the challenges that animal species face in a human-dominated, constantly changing world. The ibis species depends upon open areas where they can dig for worms and larvae (Fig.2). In recent times, their feeding habitats have become, exclusively, agricultural areas—meadows and pastures managed entirely by humans. The original distribution of the species was around the Mediterranean, more or less. But over the course of the last centuries, almost all these populations disappeared, save for one wild population on Morocco's Atlas coast. However, a successful breeding program in European zoos enabled various conservation and translocation projects. There is one ongoing in Andalucía, one in Turkey, and our project, located in Central and Mediterranean Europe.

Our project is the only one that aims to reintroduce the species back to its characteristic lifestyle as a migratory species: in fact, it is

Figure 2: Northern bald ibis during foraging; the species is a tactile hunter which digs for worms and larvae; photograph, J Fritz.

Figure 3: Human-led migration flight; photograph H Wehner.

the first project ever whose aim is to reintroduce a migratory species to the wild. The project has been awarded co-funding for the second time by the European LIFE-Program. It's a large project, with partners under the leadership of Zoo Vienna.[5]

For our main release method, we take chicks from zoo breeding colonies. These are raised by human foster parents who play a crucial imprinting role for the chicks. After fledging, we train them to follow a microlight plane with a foster parent in the back seat, which in turn allows us to lead the birds from breeding sites north of the Alps to a wintering site in southern Tuscany, where the release takes place (Fig.3). A total of 309 juveniles were released from 2004 to 2023 using this method.

Currently, the release population consists of more than 250 birds, who have bred and raised an ever-increasing number of chicks since 2011. From 2012 to 2023, a total of 324 chicks hatched in four breeding colonies, 74 of them in 2023 alone. The birds migrate in autumn from the breeding sites to their common wintering sites in southern Tuscany, taking their offspring with them. The next spring, the adults return to their breeding

5 https://www.waldrapp.eu/en/

sites to raise their next generation of offspring. So, the population is developing, and according to our population modelling (Drenske et al. 2023), it is close to "self-sustainability." This means that no further releases into the wild are necessary. However, as with many other species, the northern bald ibis will require constant monitoring and some management, as it lives in habitats created by humans.

Climate Change Affects Everything

In recent years, the importance of constant monitoring has been demonstrated in our project. The onset of autumn migration shifted significantly from late September in the project's early phase to November in recent times. This shift is clearly related to climate change. The increasingly intense and extended warm periods in autumn cause the birds to stay longer and start their migration ever later in the year. This has had rather unexpected, detrimental consequences for the birds from the breeding colonies north of the Alps. They need to cross the Alps in order to reach their wintering sites, and it appears that more of the birds fail the later they migrate. They repeatedly fly into the Alps, try to cross them, but finally give up and stay in the north. An animation on real GPS data hints at the reason

Figure 4: Animation of a flight in the Austrian Alps during a human-led migration; it shows the two different paths of the birds and the ultralight airplane. The animation shows how the birds gain height while soaring on thermal updrafts. Image credits: COLOURFIELD tell-a.vision.

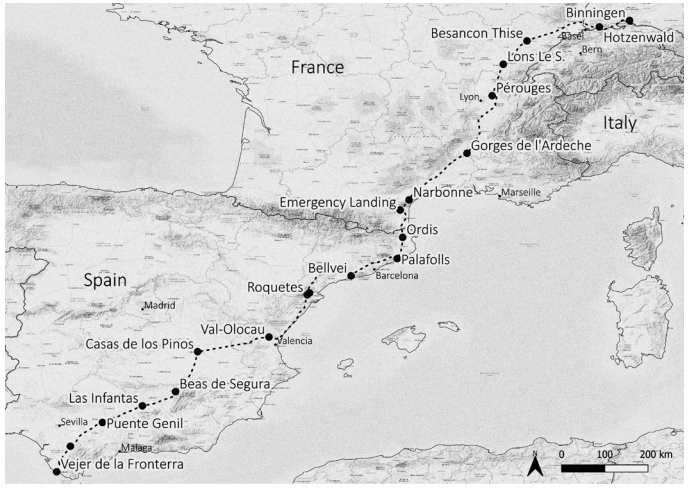


Figure 5: Human-led migration in 2023 from Baden-Württemberg to Andalucía.

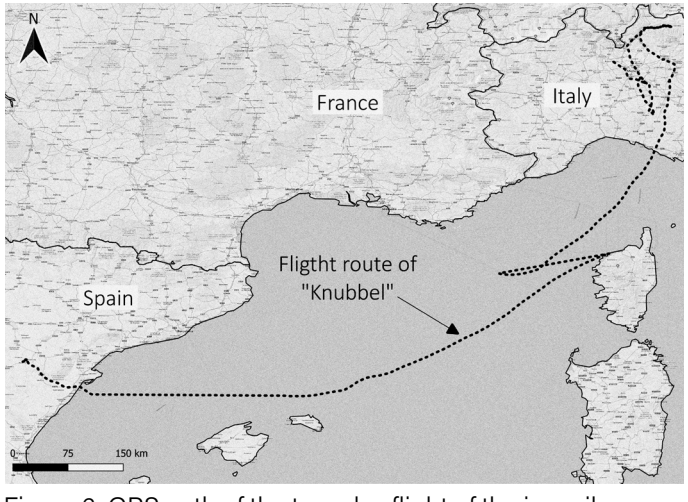


Figure 6: GPS path of the two-day flight of the juvenile "Knubbel" over open water.

for these failures: the birds need to search for thermal updrafts which lift them up to a flight level that would allow them to cross the mountains. However, the birds rarely find suitable thermals in November, and that's probably the reason why they fail.

Remaining in the northern Alpine foothills puts the birds in acute danger as soon as winter sets in. That is why we started emergency measures a few years ago, catching those birds remaining north of the Alps and transferring them south. This saves lives, but, of course, is not a sustainable strategy. So, we urgently needed a mitigation measure that would offer a lasting perspective for the breeding colonies north of the Alps. In 2023, we started establishing a second migration tradition from the northern foothills of the Alps all the way down to Andalucía (Fig.5). At about 2,700 km, it is more than three times the length of the migration to Tuscany, but the birds can migrate later in the year without significant geological barriers between them and their wintering site. In the years to come we will continue establishing this new migration tradition as a mitigation measure against climate change effects. This should ensure the birds' long-term survival by enabling them to adapt to our constantly changing world.

Management and Responsibility

Finally, I would like to return to the aforementioned need for continuous management of animal species in the human-dominated environments. Management of animal populations also requires monitoring, and this is nowadays accomplished by the use of GPS devices in particular. In our population, almost 80 per cent of the birds carry solar-powered GPS devices on their backs, and this provides us with a large data set of great importance to the project's implementation. We gain knowledge about the birds' flight route during migration, as well as about outstanding flight performance—such as the journey of "Knubbel," a juvenile who in autumn 2023 lost contact with their conspecifics on the way to Tuscany, veering towards the Mediterranean Sea, where they made a solo non-stop flight of more than 760 kilometers over open water, an incredible and unexpected flight performance (Fig. 6).

The data also provide us with detailed information about the habitats used by the birds, that in turn allows us to model feeding habitat availability by using remote sensing data (Wehner et al. 2022). The model indicates that there are plenty of suitable feeding habitats available in the northern foothills of

the Alps. Another important advantage of GPS monitoring is knowledge about causes of mortality. This enables us to carry out targeted measures against the primary causes of death, namely illegal hunting in Italy and electrocution on medium voltage power poles (Fig.7). Finally, we also publish GPS data for the general public in real time on the Animal Tracker app, so people can learn about individual birds and follow their flights. This establishes a database, but also allows humans to build emotional relationship with these birds, creating a new closeness between humans and animals (Pschera 2014).

For the reasons enumerated above, we use GPS technology extensively in our project. But we are also aware of the associated costs and risks for the animals when using such technologies. A device on the back of a bird's body causes turbulences, reducing lift and making flight more energy-consuming. By optimizing the shape of the device and its position on the bird's body, these costs can be substantially reduced (Mizrahy-Rewald et al. 2023). But tagging can also cause other quite unexpected effects, as in the following example.

In 2016, during a veterinary screening, we found a series of birds with opacity of varying intensities up to complete blindness,

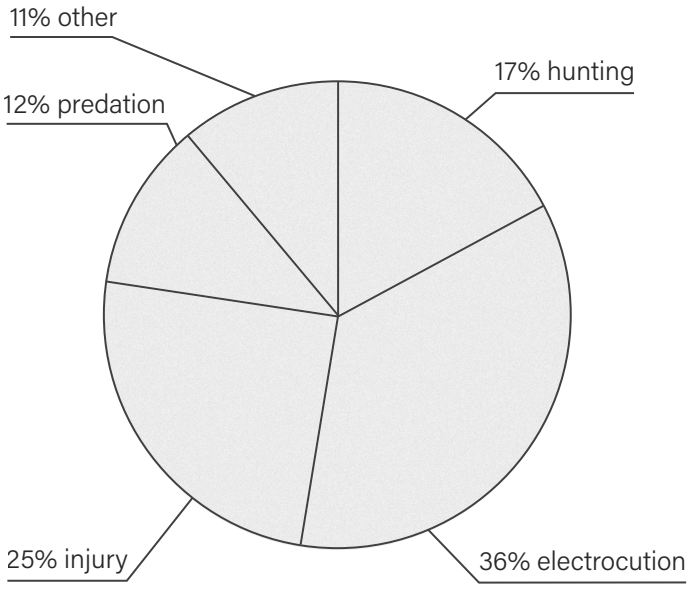


Figure 7: Mortality statistics for the northern bald ibis release population 2024–2023.

but always with only one eye affected (Fritz et al. 2020). Consulting veterinarians could not explain this phenomenon. A hint to the cause came with the discovery that only birds with a GPS device fixed via wing-loop harness on the upper back were affected. When moving the device to the lower back, fixed via a leg-loop harness, the opacity disappeared, except when the eyeball was already irreversibly destroyed. This strange phenomenon becomes comprehensible through the knowledge that birds sleep with their heads on their backs, bringing one eye close to a GPS device when positioned on the upper back, but not when it is fixed on the lower back. The suspected cause of the opacity is a close-up effect of the electromagnetic radiation from the GSM module. However, empirical proof is still pending.

This suggests that we need to be careful with management and that the best of intentions can also produce costs. We need to make sure that the costs outweigh the benefits for the animals. And we need to make sure that necessary management and support can be provided in the long-term.

Conclusion

The northern bald ibis project successfully reintroduced a migratory bird species

to Europe after it became extinct there centuries ago. This project highlights the complex challenges involved in managing wildlife in human-dominated landscapes. It also demonstrates the increasing impact of climate change. Despite the challenges, the project demonstrates the potential for successful conservation efforts through collaboration, technology, and adaptation.

The reintroduction of the northern bald ibis to Europe marks a significant conservation achievement, underscoring the complex challenges to restoring species in human-managed environments, compounded by the accelerating impacts of climate change. Through innovative approaches, collaborative partnerships, and technological advancements, this endeavor demonstrates the potential for successful species recovery.

References

Eberhard, Barbara, Corrina Esterer, Johannes Fritz, and Bernhard Goenner. "Biologging is suspect to cause corneal opacity in two populations of wild living Northern Bald Ibises (Geronticus eremita)." *Avian Research* 11, no. 1 (2020).

Drenske, Sinah, Johannes Fritz, and Stephanie Kramer-Schadt. "With a little help—the European Northern Bald Ibis population well on the way to self-sustainability." *Oryx—The International Journal of Conservation*, February 13, 2023: 1–12.

Mizrahy-Rewald, Ortal, Natalie Winkler, Frederik Amann, Katarina Neugebauer, Bernhard Voelkl, Herwig A. Grogger, Thomas Ruf, and Johannes Fritz. "The impact of shape and attachment position of biologging devices in Northern Bald Ibises." *Anim Biotelemetry* 11, no. 1 (2023):8. doi: 10.1186/s40317-023-00322-5. Epub 2023 Mar 9. PMID: 38800510; PMCID: PMC11116193.

Pschera, Alexander. *Das Internet der Tiere*. Berlin: Matthes & Seitz Verlag, 2014.

Wehner, Helena, Katharina Huchler, and Johannes Fritz. "Quantification of Foraging Areas for the Northern Bald Ibis (Geronticus eremita) in the Northern Alpine Foothills: A Random Forest Model Fitted with Optical and Actively Sensed Earth Observation Data." *Remote Sensing* 14, no. 4 (2022): 1015.

Discussion: On Technologies, Numbers, Values, Emotions, Hope and Unexpected Collaboration

Discussion moderated by Shusha Niederberger

Johannes Fritz:

Such a project wouldn't be possible without very recent technologies. Bio-logging devices are available for a bit more than 10 years now. And since then, we use them with 80 per cent of the population. So, for about ten years we have monitored a majority of the birds. And the newly available technologies are really relevant, particularly regarding flights with the birds. This is a complex process. There are about 15 people joining such a human-assisted migration: four people in the air, two pilots and foster mothers in two planes. The rest of the people are on the ground. In the early phase of the project, 20 years ago, we regularly had to make unplanned landings. It was always very difficult for the pilots, after

landing, to call the people on the ground to tell them where they are and how they can get to this place, because it was in the middle of nowhere, on a meadow. They had no idea about where they were exactly. We could hardly communicate and send the GPS position, because GPS was not accessible. So, this was difficult, time consuming, and sometimes risky. Nowadays, with one click with WhatsApp all the team knows about the position and can easily coordinate. So, there has been such an incredible and significant development in these technologies that we can use now, and which help us implementing this rather complex project.

Susha Niederberger:

The map "Infrastructure of a Migratory Bird" is full of numbers, but what are the most significant or meaningful numbers other than the tracking data itself?

Johannes Fritz:

The most significant number, of course, is the number of birds per se, because our main goal with the project is to exceed the threshold of a self-sustaining population. The modeling was done by the Leibniz Institute in Berlin, and they came up with a number, 340 birds, and

exceeding this number means they are more or less self-sustaining. This is the most significant number for the project. Related to this is reproductive success, because it would be useless to have 340 birds in the wild when they are not successfully breeding and increasing the population size. And so, the number of offspring per nest is also a very significant number. And this number can be compared with other populations. We have very good reproductive success in the region north of the Alps ... about three chicks per nest when you compare it with the sedentary colony in Andalucía where it's less than one chick per nest, which means this population could never be self-sustaining. Our project even has a higher reproductive rate than zoos. These are key numbers for us as conservationists, indicating the development and the situation of the population.

Felix Stalder:

Numbers and their relevance reveal certain ways of looking at this complex assemblage. As Johannes just said, from the conservation biologist's point of view, the number of animals living in "the wild" is the key one. But for other actors there are other numbers that are important. For example, the funding body is very interested in the budget numbers. For us, the number

that started all of this was 1025, which is the number of photos people had uploaded at the time from their own encounters with the birds in the wild. The Animal Tracker helps to locate the birds, which facilitates intentional bird watching greatly. But sometimes encounters are also accidental, when a bird lands on a windowsill, and so on. So, the number of sightings was our entry point.

But one of the things that mapping made very clear is that the complexity of the project has to do with a lot of different actors having very different interests and different ways of operating, and focusing on different aspects of the project. And some of these aspects are numbers. In effect, by pulling out one particular number one places oneself on the map.

Johannes Fritz:

Money is also essential. That's a large number, because such a project is costly. The current (second) LIFE Project, with a duration of seven years, has a budget of 6.3 million euros. It takes a lot of money to reintroduce a species. But beyond money, there are also social values. For the European Union, it's a value per se, a political goal, to reintroduce a species which is critically endangered. This is remarkable.

To bring social and monetary values together can be tricky. Because another number is the costs of the release of one bird: about 7,000 euros. This figure can be compared with other projects, and demonstrates that our costs are comparable with those of, say, releasing a bearded vulture. This comparison can be used to assess the cost-efficiency of the project. But what is the (monetary) value of the bird which is out there in the wild? This is relevant for us, for example, in the context of illegal hunting. If a hunter shoots a bird, what is the damage? Initially we just calculated damage as related to the investment we made during the LIFE Program. However, there is more and more agreement now that wild animals should have value on their own, an intrinsic value which is independent of investment. So, otherwise it would mean that shooting a bald ibis where a rewilding program is ongoing has a value, but a wild animal without such a program has no value. That's not the way it should go. There's a lot of discussion going on about the intrinsic value of wild individuals and animals. This is an important discussion.

There are different approaches about how to do this. One Danish project proposed five or six categories, such as the degree of endangerment: the higher the rank on the red

list, the higher the value. It's a bit strange—the more endangered the species, the higher its value—but that's how it works. Another category proposed is the relevance of the species to its ecosystem. What are its "ecosystem services" for humans? Applying these categories, one comes to an amount of about 27,000 euros for a single bald ibis ... just as a case example.

Felix Stalder:

This is a practically important discussion, particularly for legal cases, but also for a general justification. However, this discussion is also patently absurd, because it creates these equivalencies. Now we can say a bald ibis has the value of a mid-size car. But these things are not equal. So, we also need to find a way to refuse such calculations ... to give everything a price.

Audience:

You mentioned that all wildlife need to be managed. Is it because we cannot manage human behavior and we have to reach a point where we need to manage all wildlife?

Johannes Fritz:

It's related to the fact that wilderness has almost completely disappeared. We have

rewilded areas, we have national parks, but they are not wild in the original sense. And this means the entire landscape is, in a way, under human management. So, also the animals that live there have to be monitored and managed. We have a responsibility to do that. We changed their landscapes. On top of all of that comes now climate change, which causes an extreme dynamic in all these ecosystems. This creates even more pressure on all species. The speed of this development is much too fast for species to change and adapt to it in an evolutionary way. So, they need support. And, I think, we entered a world where really the vast majority of species are dependent on that.

Audience:

Why not focus on rewilding the land so that at least the species that are already here and are trying to exist can have a better future?

Johannes Fritz:

The majority of rewilding projects focus on lands and rivers. This is essential. But an increasing number of species need active support, need management, need invasive measures to survive. The landscapes and the species require support.

The classical approach to conservation is to conserve the lands and the species should

survive in this conserved land. This is important, but nowadays more is needed. In a project like ours, the birds wouldn't exist in the wild without this invasive project. But they need the landscape to be habitable for them as well, which is beyond our control.

Audience:

Shouldn't there also be adaption programs for humans?

Johannes Fritz:

Of course, we need to think of this in an integrated way. Jane Goodall, the famous conservationist who worked with chimpanzees, is now going all around the world telling about reasons for hope for nature and human beings.[1] She is representative of a new approach that always includes humans. I would say it's not a question if we spend money for nature or for humans. A conservation project can only be successful when you also take the people with you. And that's what we try to do.

I think this is also one of the values of our project. We have a lot of media presence: human-animal relationships or flying with birds fascinates a lot of people, it taps into old human dreams. This

1 Jane Goodall passed away on October 1, 2025, after this text was written.

is something that attracts people, and this also gives us the opportunity not only to tell about our story but to tell about the threat to biodiversity—and also about the relationship between loss of biodiversity and climate change—while telling a story that gives a reason for hope. This is very important. People should be motivated to act in the frame of their possibilities. In the words of Jane Goodall, "Hope is like the light at the end of the tunnel, and we should not sit here and wait till the light comes to us." Hope is something which requires activity. We have to go there. We have to be active in order to change something and keep our hope alive.

Audience:

Beyond the tracking, is there also some data that is being gathered about the interactions between the birds and the flora and fauna? And could this also maybe introduce further dependencies if there are adverse interactions? So, more stuff for humans to manage?

Johannes Fritz:

In the first 13 years of the feasibility studies we did a lot of studies on the interaction between this species and the environment. We have data on that: it's also published. It

shows basically that it's a species that does not have a great impact on the environment. It feeds in meadows and pastures. Fortunately, there is also not a lot of interference with human interests. This helps a lot when reintroducing a species. You all know the discussion about the wolf, a species that causes "damage." This makes it very problematic, because the acceptance of wildness is very low as soon as it affects one's personal interests. This is sometimes annoying and frustrating.

Audience:

How was the emotional relationship between human and birds changed by this project?

Johannes Fritz:

The closest emotional relationship is between the foster parents and their birds. And we have now 36 birds in Upper Bavaria raised by two human foster parents. And they have really a very close relationship. The imprinting process is two-way. It's from the birds to the foster parents, but it really needs some emotional involvement from the foster parents. So, they also form a relationship to each single bird. This changes something for them. They live in this close relationship for seven or eight months. Of course, they also follow their birds after the release. But the reality

is that when we release the birds in the wintering sites, we know that only one third of them will make their way back as an adult bird. All the others die before reaching sexual maturity. That's nature. That happens. The foster parents have to cope with that.

The Animal Tracker also allows other people to build a relationship with birds. We also have this adoption program, which is very successful. People can adopt a particular bird and can follow this bird on the App. And this is often really an emotional relationship between people from anywhere and their birds, which may survive or die due to electrocution or hunting. Some people who adopted a bird even say, "Don't tell me if my bird died. Just name another bird because I don't want to know about it." It makes the bird into an individual being, which allows us to tell different stories about it. Such emotions are important and valuable.

Audience:

How has the project with all its interventions affected learning?

Johannes Fritz:

It has a lot of implications. I actually studied animal cognition and learning. All of these

things we do, the specific techniques and technologies, have the goal of establishing a particular learning process in these birds through the imprinting process, which is irreversible. First, the parent imprinting, which works also with human parents. Then the assisted migration, all the way, 2500 km, to Andalucía, has only the reason to establish irreversibly a migration route—a wintering site connected to a breeding site—in the brain of these birds. These techniques are totally different to what would happen naturally, but it works. We have the proof, and they really stay there for years. And then they return to the site where we raised them, breed their offspring, and actually make the journey back to the wintering sites. So, it becomes a stable tradition. This is also, from my perspective as a biologist, very fascinating. We can do that thanks to the technology, thanks to the technosphere.

But let's not forget we also create lot of problems as humans. We are extremely efficient at destroying regional wilderness. But we also have an incredible potential to do the right thing. And this is what fascinates me. And, for me, it's a privilege to be able to at least reintroduce this one species and take it off the red list. And it's possible because of the involvement of so many different people, because of funding, because of technology.

Audience:

Speaking of so many different people, what was your experience of the collaboration with artists? What did they add to the project that you are doing anyway?

Johannes Fritz:

This collaboration developed over the years and became more and more complex. I have their map in front of me in my office all the time and still don't understand everything. It's actually impressive to me. It's also inspiring to see the complexity in this very specific way. And so, this is something which was really great for me. You know, I usually discuss with other conservationists and biologists, but Felix and Gordan were people who came from a totally different context. Compared to regular discussions, our discussions are very different for me

On a more tangible side, they scanned a stuffed northern bald ibis. They provided us this data set and the natural history museum in Vienna 3D-printed two copies. We used them at Lake Constance to attract our birds to a natural cliff in order to breed there. Before that, they bred in artificial structures. Since this year they breed on this cliff where their breeding was documented 400 years ago. So, there was also a

very concrete consequence of this collaboration.

Gordan Savičić:

We never really thought about it as a classical art/science project, but we really started with this naive interest in how the data also shapes the way people interact with the animals. At some point we just wanted to have a digital copy of a bird. We found the one stuffed bird in Switzerland. And it was quite hard to get it out of the vitrine because it hadn't been opened for 70 years. Then, in passing, we mentioned it to Johannes, and he had the ideas of using this 3D model to make these mock-ups. There is something intriguing in thinking that this bird, that had been shot about 100 years ago, is now helping birds to breed. This entanglement between the techno- and the biospheres, is generally fascinating to me ... that at specific points one is more important than the other.

Felix Stalder:

This is another indication that things don't happen linearly, but that everything can take on a new meaning and new agency when placed in a different context. In their open, explorative approach, the two perspectives share some commonalities.

Biographies

Sénamé Koffi Agbodjinou is an architect and anthropologist by training who advocates for a neovernacular concept, concretely translated as innovator, designer, and entrepreneur working at the scale of product, building, and city. Founder of L'Africaine d'Architecture, a collaborative platform for research and experimentation on issues around African architecture and cities, he also initiated WoeLabs, a network of Togolese tech-hubs that aim to "make everyone equal in the face of the digital revolution." Together with his community, he is contributing to prototyping a "digital collectivism" that has enabled half a dozen startups to launch. In his work he develops alternative visions on issues of integrated architecture, primitive computationalities, technological democracy, and sustainable cities. His work has been acknowledged by, among others, the African Innovation Summit (2014), the Global Fab Award (2014), the Ashoka Foundation (Fellow since 2017), and the African Leadership Award (2018).

Michelle Christensen is a sociologist and designer exploring the spaces in between these realms. Her research interests include trans- and post-disciplinarity, the politics of design, and the democratic potentials of free and open technologies. She wrote her PhD in the field of design research at the Berlin University of the Arts. Prior to that, she studied political sociology at Roskilde University (BA), conflict studies at Utrecht University (MA), gender studies at the University of Amsterdam (MSc), and integrated design at the Köln International School of Design (MA). She has worked in the crisis department of Amnesty International USA, was a Humanity in Action Fellow, and a congressional fellow of the United States Congress in Washington, D.C. Currently, she co-heads the research group "Design, Diversity, and New Commons" at the UdK Berlin/ Weizenbaum Institute, and is a visiting professor for Open Science & Critical Culture at the Technische Universität Berlin and the Einstein Center Digital Future (ECDF). Since 2015, she is a member of the Board of International Research in Design (BIRD) at Birkhäuser, and in 2023 she joined the board of directors of the ECDF.

Florian Conradi is a designer and researcher combining critical theory and design as an approach to critical practice. He studied art and design at the Sandberg Institute in Amsterdam, the Bezalel Academy of Art and Design in Jerusalem, and the Köln International School of Design, and wrote his PhD in the field of design research at the Berlin University of the Arts. Since 2009, he has collaborated with Michelle Christensen on exploring critical perspectives through design, research, and teaching. He has been a visiting professor at the international MA program in Integrated Design at the Anhalt University of Applied Sciences in Dessau (2018/19, 2024/25), and a visiting professor for Open Science & Critical Design at the Technische Universität Berlin and the Einstein Center Digital Future (2019-2024). Currently, he co-heads the research group "Design, Diversity, and New Commons" at UdK Berlin, in the framework of the Weizenbaum Institute, and is a visiting professor for Design Research and Critical Design at the Institute for Theater Studies, Freie Universität Berlin.

Johannes Fritz is an Austrian environmentalist who holds a PhD in biology from the University of Vienna. He has been working on the reintroduction of the northern bald ibis since 2002, first in the form of feasibility studies and, since 2012, as the leader of two major EU projects. To date, nearly 280 birds have been reared and released; about 220 remain alive in the wild. Many of these birds are equipped with GPS trackers and can be monitored using the Animal Tracker app on a smartphone, allowing the public to engage with them in new ways. Johannes Fritz has published widely on the subject of his northern bald ibis research and conservation work and is among the most prominent wildlife restoration biologists in Europe.

Shusha Niederberger is an artist, educator, and researcher in the field of digital arts and cultures. She studied fine art and digital art in Zurich and Vienna, developed and curated the educational program for HEK (House of Electronic Arts Basel) and conducted research on digital artistic practices and the commons. She is a lecturer for contemporary net cultures at F+F School for Art and Design in Zurich, and also develops workshops on critical user practice within different contexts. She is currently working on her dissertation on data regimes and the cultural form of the user, and was part of the research project "Latent Spaces, Performing Ambiguity of Data" at Zurich University of the Art.

Ulrich Ott is a German psychologist and meditation researcher. He studied psychology at the Johann Wolfgang Goethe University in Frankfurt am Main, graduating in 1996. He received his doctorate there in 2000 with a dissertation on the characteristics of 40 Hz activity in the EEG during rest, mental arithmetic, and meditation. From 1998 to 2005 he was a research assistant at the Institute for Psychobiology and Behavioral Medicine at Justus Liebig University, Giessen, working within the project, "Psychophysiology of Altered States of Consciousness: Rhythmic Trance Induction." Since 2005, he has worked as a research assistant at the University of Giessen's Bender Institute of Neuroimaging, and in the Institute for Frontier Areas of Psychology and Mental Hygiene (IGPP), where he heads the "Altered States of Consciousness" (ASC) working group.

Anani Dodji Sanouvi is a transmedia artist, dancer, researcher, and educator who works at the intersection of dance performance, sound, and visual arts. Born in Togo, Anani grew up in Gabon, and has lived in Senegal, Belgium, Holland, and Brazil. He currently resides in Portugal. He has received international recognition as a laureate of UNESCO's Africa Center, an awardee of the Rolex Mentor & Protégé Award, as well as a fellowship at Instituto Sacatar. Anani's work has been featured in theaters, festivals, museums, and cultural centers worldwide. He has also collaborated with renowned artists like Peter Sellars and Anne Teresa De Keersmaeker. With "Agama Fo," a pedagogy rooted in Éwé epistemology and animist knowledge that aims to create (and question) contemporary dance and performance, he has conducted lectures and workshops at institutions, dance, and theater companies around the world. In partnership with Brazilian scholar and transmedia artist Christiane da Cunha, he is co-founder of the Kawin collective.

Cornelia Sollfrank is an artist, researcher, and writer living in Berlin. Recurring subjects in her artistic and academic work revolving around the theory and practice of digital cultures are artistic infrastructures, new forms of (political) self-organization, critical authorship, the aesthetics of the commons, and techno-feminist practice. As an Internet art pioneer, Sollfrank established her reputation with two central projects: the net.art generator, a web-based art-producing machine, and *Female Extension*, her famous hack of the first competition for Internet art. In her PhD, *Performing the Paradoxes of Intellectual Property* (2012), she investigated the increasingly conflictual relationship between art and copyright. Her publications include *The Beautiful Warriors: Technofeminist Practice in the 21st Century* (2019), *Aesthetics of the Commons* (2021), and with Winnie Soon she co-authored *Fix My Code* (2021) and *The Computer as Seen at the End of the Human Age* (2022). Her most recently published book is *Contemporaneity in Embodied Data Practices* with Felix Stalder.

Felix Stalder is a professor at the Zurich University of the Arts and project lead for the "Latent Spaces" research project. His work focuses on the intersection of cultural, political, technological, and ecological dynamics—in particular, new modes of commons-based production, copyright, datafication, surveillance, and the transformation of subjectivity and nature. He not only works as an academic but also as a cultural producer, serving as a moderator at the Mastodon instance tldr.nettime, and member of the World Information Institute and the Technopolitics Working Group, both based in Vienna. He is the author/editor of numerous books, among them *Kultur der Digitalität / Digital Condition /*字状况 (Suhrkamp, 2016; Polity Press, 2018; School of Public Art, 2023), *Aesthetics of the Commons* (Diaphanes, 2021), *Digital Unconscious* (Autonomedia, 2021), and *From Commons to NFTS* (Ljubliana 2022).

Ines Weigand graduated from the Berlin University of the Arts with a master's degree in communication in social and economic contexts. Her collaborative master's thesis investigated the potential of the open science movement to change the relationship between humans and nature, using methods of critical making and experiential learning. She conducts research within the research group Design, Diversity and New Commons at the UdK Berlin/Weizenbaum Institute. Weigand builds bridges between science, society, and politics, and benefits from her interdisciplinary background and pragmatic attitude. She is interested in alternative learning environments, new forms of knowledge production, and concepts of sustainability leading to socio-ecological transformation.

Imprint

RE/EMBODIED DATA
Ambiguities of Knowing

Michelle Christensen
Florian Conradi
Cornelia Sollfrank
Felix Stalder (Eds.)

First edition, 2026

ISBN (Print): 978-3-943253-88-7
ISBN (PDF): 978-3-943253-94-8
DOI: https://doi.org/10.53198/9783943253948

Project Website:
www.reembodieddata.xyz

Published by:
adocs Produktion und Verlag gGmbH
Annenstrasse 16
20359 Hamburg
Germany
www.adocs.de

Line Editing: Michael Baers
Graphic Design: Athena Grandis
Paper: Nautilus Classic
Font: New Edge by Charlotte Rohde, Acumin
Printed by: Pögedruck

This publication is funded by the Technische Universität Berlin/Einstein Center Digital Future and the Zurich University of the Arts. The underlying research has been funded, in part, by the Swiss National Science Foundation (under grant #100016_200971).

This publication is listed in the German National Library (Deutsche Nationalbibliothek); detailed bibliographic data is available at https://dnb.de.

Product Safety Information
adocs Produktion und Verlag gGmbH
Annenstrasse 16
20359 Hamburg
Germany
info@adocs.de

Safety notice according to Art. 9(7) sentence 2 of the General Product Safety Regulation (GPSR) is not required.

We live in a moment of comprehensive datafication, as ever more aspects of our lives and the planet are measured, analyzed, and shaped digitally. This opens new ways of knowing and doing, but all too often it also leads to a systematic devaluation of forms of knowing that cannot be quantified and processed digitally. Through a form of epistemic violence, new forms of ignorance and marginalization are enacted.

Rather than favoring one over the other, the relationship between quantifiable and experiential, abstracted and embodied knowledges must be explored. In this book, researchers in the arts and sciences address these differences through transdisciplinary collaboration and dialogue. They focus on epistemological, aesthetic, and techno-political aspects, and the differences between various forms of perception. With an aim to embrace the ambiguity of multiplicity, the authors propose ways of rendering these differences productive through their situated practices.

adocs
ISBN: 978-3-943253-88-7