Liminal excavations – plain text version

June 25, 2024

https://sflab.eecs.kth.se/pub/pj7s6ahe

Edited by

Aksel Biørn-Hansen

Oliver Bates

A zine curated through the Sustainable Futures Lab and shared at the conference of ICT for Sustainability, Stockholm, Sweden, 24-28 June 2024

**Editor’s note:** This is a compilation of the plain-text versions of contributions to zine Liminal Excavations. It does unfortunately contain only 12 of 14 contributions in the plain text format due to lack of submissions. Participants were asked to submit plain-text versions of their own work, with image descriptions where needed. To respect the work of participants, only minor changes have been made to their plain-text zines, as we believe that participants best know how to translate their work for their readers. As such, you will find a variety of different transcription and image description style within these pages.

**Quotes from the editors on why (on the inside of the front cover):**

“When I saw that ICT4S had a Zine chair and it was Aksel I was immediately activated, I had to be involved. What I enjoy the most about a conference like ICT4S is the conversations away from the conference hall, meeting people who are excited to start creative collaborations around anything adjacent to sustainability and ICT. A conference programme can be quite technical and transactional, which limits the vibrant experiences that can be had when creativity is allowed to blossom. Creative spaces are where I started letting myself imagine futures that are different from the norm. A zine is just the start for ICT4S”. - Oliver Bates

”We were having lunch at our favourite spot in Stockholm at the start of the autumn reading period, reflecting on all the very interesting discussions and tensions expressed in-between the formal progam at the ICT4S 2023. From this grew the idea of giving space for these liminal expressions in the form of a zine. Going from jotting this all down in the form of a sms conversation, to a zine compilation full of ideas and alternative perspectives on sustainability and ICT is an amazing feeling!” - Aksel Biørn-Hansen

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**Introduction**

While academic papers give us space to express our knowledge and expertise, we also need spaces to express our views, feelings, and creative expressions towards a more sustainable life on this planet, where ICT is not always directly implicated.

We are therefore very excited to share the contributions from the ICT4S Zine 2024!

As an alternative to the official program and traditional, peer-reviewed publications, we have taken inspiration from zine culture to gather a set of alternative and DIY contributions that encourage authors to embrace creativity that might not always be encouraged in more traditional academic outputs focused on ICT and sustainability.

This zine is a result of a call for contributions to that explores alternative visions, ideas and critiques on the topic of sustainability and ICT.

We look forward to hear what you think about the zine.

Creativity is where new ideas can grow and be nurtured. Our hope is that the zine encourages the ICT4S community to build space for creativity and new ideas in the future.

Oliver Bates

Aksel Biørn-Hansen

**Title:** Surrounded by Plants: Towards Deeper Engagement With Plants

**Author names:** Katka Cerna & Gina Christopersen

**Notice:** No plain text provided

**Author:** Lupita Guillén Mandujano (LGM)

**File name:** Zine Values LGM.tiff

**Title:** Where your heart is, therein lies your treasure

**Main text in the image**:

* **Frame:** What you value moves you, your actions show who you decide to be.
* **Center:** Life, LOVE,Nature
* **Bottom:** (some values for creation) respect, empathy, trust, kindness, justice, equiality, hope, honesty and freedom.
* **Top:** (some results of living the values) wellneww, collaboration, diversity, happiness, restoration, flexibility, adaptability, peace, union, creativity and inspiration.

**Image explanation:**

Long term change needs to be lived, nor impossed, because violence only generates resistance. But to be able to live consciously and fully without falling into hopelessness, fear or frustration; To leave behind the bad cultural habits that are experienced as certainties imposed by the dominant socio-political and economic systems, it is essential to work on what moves us as human beings, what motivates us: our founding values. Depending on this, a paradigm shift will be possible, reflected in real actions and in the creation of technologies that are truly beneficial for sustainability.

Art, media and entertainment play a fundamental role in raising awareness, information and appropriation of these values; showing through narratives various attractive realities for people and their societies without ceasing to be part of the ecosystems, on the contrary recognizing ourselves within them and working in favor of their regeneration and resilience.

**Author:** Lupita Guillén Mandujano (LGM)

**File name:** Zine Tonantzin LGM

**Title:** We are not eternal, let's be fraternal

**Main text in the image:**

* **Center:** We are more tan just us. What we believe, what we communicate, what we decide?
* **Sides:** “*A memento that I leave*”, from Nezahualcóyotl

How should I go?

Shall I leave nothing after me on earth?

How should my heart act?

Do we come to live in vain,

to sprout on the earth?

Let's at least leave flowers.

Let's at least leave songs.

**Image explanation:**

Nezahualcoyotl was an Aztec tlatuani (ruler) who stood out for his philosophy and poetry. Despite being a leader of a military and conquering culture such as the Aztecs, he was distinguished by his profound sensitivity and natural knowledge; his thought has been passed down through generations and seems to me congruent with the vision of the finite but transcendental human being, fundamental within the complexity of life.

Tonantzin is the mother goddess in Aztec/Mexican culture; she embodies or converges many other manifestations of other feminine deities with other names and qualities. Tonantzin was the bond between the original cultures in Mesoamerica and Spain, sharing many attributes with the Virgin Mary, she became a symbol of cultural syncretism that brought peace and hope and made life possible despite the injustices of the European invasion under the name: Virgin of Guadalupe loving and protective mother, symbol of mestizaje.

I use her simplified image to resemble other feminine representations of the ecosystem: Mother Earth, Gaia, Pachamama, etc. Because I believe that the ecofeminist vision is fundamental to understanding sustainability from the pluriverse.

The two wavy spiral forms concentrated in the center of the image are Aztec (Mexica) speech glyphs, which I use in this composition to represent the importance of thought, language, and, above all, communication in making coexistence and collaboration between the inhabitants of this Earth possible.

**Title:** Environmentstrual Speculations

**Author names:** Nadia Campo Woytuk & Anupriya Tuli

**Notice:** No plain text version provided

TRANSTOPIAN WORLD-BUILDING

TEXT ON COLOR GRADIENT BACKGROUND:

Transtopian world-building is an iterative process where story-worlds and shared realities perpetually influence and transform each other. By embedding current situations and dilemmas into a story-world, this approach expands the boundaries of imagination and enables “worldings” (Taylor & Ivinson 2013) that challenge the hegemony of social realities. The methods draws on the film industry’s story-worlds and their potential for neurodivergent research, specifically in addressing ethical climate actions.

Transtopian world-building generates an iterative process where a story-world and a shared reality perpetually transform each other. A looping swirling movement, with an in-between position where the overlaps and possible contaminations are considered. Moving current situations and dilemmas from shared realities through the story-world can push the imagination and expand what is considered possible and enable transformations or “worldings” (Taylor &Ivinson, 2013) in the shared reality, challenging narrow definitions of the present.

In the film industry there is an increased focus on story-worlds rather than characters or stories, because a world concept can support multiple characters and multiple stories across multiple media (Jenkins, 2006). From a story-world, all kinds of products can quickly and coherently be developed as they comes into demand. Star Wars, Lord of the Rings, Marvel etc are all examples of this kind of transmedia storytelling, where everything from books to movies to toys are created, based on one and the same concept of a world.

This research employs the story-world format for its capacity to contain complex information and channel new scenarios. World-building offers neurodivergent ways to hold information and access memory, compensating for short-term memory deficits and facilitating modes of visual thinking. By using story-worlds as containers for speculative hypotheses, this research processes a continuously growing set of situated knowledge, enabling its application in new and unpredictable situations.

Based at Stockholm University of the Arts (SKH), the world-building method has been utilized on-site to identify potential ethical actions for climate transformation. Immersion into a hypothetical climate-just story-world decentered what was currently considered possible or real, embedding everyday dilemmas within this framework to identify and implement possible actions. These actions triggered new situations, which were processed through the story-world, thus intensifying and scaling up the results.

The underlying concept for this story-world emerged from a collaboration with Professor Ronald Mallett at the University of Connecticut. Learning in dept about Mallett's theoretical model for a time machine was eye opening for me. In short, you could say that if it were to be built, it would have completely different consequences than what we are used to seeing in Sci-Fi stories about time machines, where the main character travels back and forth in time on voyages of (self-)discovery. If we built this machine, we would never be able to travel with it, it would only open up a portal where the future would instead have access to us. As I saw it, the consequence would be that futures can intervene into our present time, and revolt against the “colonisation of the temporal”, which our current overuse of resources means in practice. It led me to develop a Story-world with the following premise: Future generations has, thanks to Mallett’s time technology, hacked the present so that the earth system updated herself into a New Reactive Earth, a cyborg Gaia. A conscious reactive earth that monitors and regulate how all inhabitants use resources & life-space, ensuring regeneration both temporally and spatially.

This premise led me to get acquainted with Life-Cycle Assessment as a model for the monitoring cyborg gaia. In collaboration with Anna Björklund, Professor in Environmental Strategic Research, we carried out several LCA’s on specific scenarios at SKH. Combined with transcorporeal (Alaimo, 2010) and sensory, embodied CO2 experiments, this worldbuilding resulted in shifted practices and tools for low-carbon film and art practices (see Persson, 2022). The story-world served as an interface to translate and apply neurodiverse knowledge into neurotypically structured research environments, allowing personal embodied experiments to be scaled up and implemented in organizational policies.

Our alter-life (Murphy, 2017) era demands us to rethink what research could be and how it can better serve life. In a world that recompose itself at an increasing rate, neuroqueer (Walker, 2021) perspectives are vital to widen the understanding of how our own protocols recompose what we research. To include them, we need to allow for personally customised practices and methods that can be attuned to their specific affordances (Gibson, 1979). As in the case of this research; (1) allowing for a certain withdrawal into constructing parallel alternative worlds where these perspectives can be shielded while developed, and (2) allowing for a more direct first-hand engagement with infrastructures, as opposed to go through the fixed protocols of new public management.

This artistic research (Persson, 2023) demonstrates how neurominor methods and strategies can shift assumptions about reality and possibility. Embodied and performative worldbuilding methods can tap into, safeguard, channel, and articulate perspectives not yet defined in the collective consciousness. It can also facilitate integration and application of this knowledge within neurotypically structured environments and structures, thus reshaping its protocols.

ILLUSTRATION:

diagram: orange line shaping an infinity symbol. At one end of the shape is the word “storyworld” in orange letters. On the other side is the word “shared reality” in blue color. At the center of the shape is the word “worlding” in a dark brown color.

ILLUSTRATION:

Full page of mindmap, lines connecting bubbles with texts. Two text bubbles lead towards next page:

1. off-boarding: off-board carbon power structures to open up space for new world.Prompt 1-4
2. on-boarding: on-board new world, prompt 5—8

ILLUSTRATION:

Full page of bubbles with text prompts and end notes:

1. In my daily existence, when things seem all wrong, when I face a painful dilemma and there seems to be no alternative, when I find myself trapped on a narrowing path; I world my way forward.
2. I direct my focus to energy currents. Are there any carbon emissions or fossil fuel extravagances permeating this situation?
3. Is there an exhale? Is there a car ride? No matter how insignificant it may seem, I focus on it.
4. What positions can I take to impede or deter the CO2 emissions of this situation?
5. I start to work toward a such positions, even if they seem impossible.
6. I let a void replace the removed carbon and I direct attention to what emerges there.
7. I try to not alter anything but my own shape, position, and relation to what is already there.
8. I only take actions that don’t require force and effort, waiting patiently, attentively until such autopoetical alternative reveals itself.

This is an excerpt from the story-world “New Reactive Earth” by Lina Persson. This world is neither a utopia nor a dystopia but a “transtopia”. A place to make a transfer, in order to get beyond the current, get a glimpse of what else could be; transform. With the included prompts 1-6, I invite you to join this shaping, to extend its interplay to your own environment.

**Title:** Remember: I am nature

By Birgit Penzenstadler

[Picture of green tree with lush leave crown and some vines ranking along the trunk]

By othering nature we created a large part of the dilemma that we are in societally instead of understanding ourselves as stewards like all the indigenous traditions that know we are part of the larger cycle and that lovingly tend to the other organisms around themselves the same as they would for family.

Immerse yourself in the forest, breathe and feel

Link to audio file on insight timer

https://insighttimer.com/blove/guided-meditations/forest-bathing-5

**Title:** Internet of Squirrels

by Vesna Manojlović

https://becha.unciv.nl/

[Image description: drawing of a squirrel chewing a cable]

If we want to have “sustainable Internet”, we have to “consider the

squirrels”!

Squirrels are a symbol for all more-than-human beings & ecosystems:

trees, rivers, soil, insects, fish, forests, cats, sea-weed…

Considering squirrels is an analogy for ecocentric attitudes.

Squirrels are a metaphor for all those humans with no own voice: the

disconnected, the marginalised, the exploited, the oppressed, those not yet

born… and who I take the responsibility to speak for.

“Internet of Squirrels” is a direct opposition to “Internet of Things”,

a reminder that we will not achieve SDGs & ESRs through the

technological fixes, but that the solutions to our technical problems are, in fact: social, political, ecological and spiritual solutions.

Squirrels symbolise “the other” - but taken to the extreme; in order to

“move the goal posts” of radical Diversity, Equity & Inclusion!

- for the engineer, squirrel is an “End User” => rfc-editor.org/rfc/rfc8890

- for the network operator, squirrel is a “customer” => forum.ripe.net

- for the academic, squirrel is a “research subject” => degrowthjournal.org

- for the content provider, squirrel is a “consumer”

I am a Speaker for Squirrels:

https://wiki.unciv.nl/index.php?title=Speaker\_For\_Squirrels

[Image description: drawing of a dormouse, sitting on a tree-branch]

On a technical level, Internet of Squirrels represents basic, modest,

green connectivity for all, within planetary boundaries, harmless for

squirrels: Internet “on the squirrel scale”.

Principles of Internet of Squirrels: ecology, sufficiency, reciprocity, empathy, anarchism, commons, altruism, ecocentrism (not anthropocentrism!), solidarity, degrowth, climate justice, decoloniality, intersectional feminism, stewardship, permaculture, regeneration, communality, radically open participation, caring, solar punk, reciprocity, animism…

On a metaphysical level, Internet of Squirrels acknowledges existence of

meaningful connections & communication and/or “networks” among (&

between) non-human species (murmurations of birds, mycelia networks, crows,

ant colonies, Wood Wide Web, dolphins, slime mould, parrots…), and

non-technological networks within human cultures.

While the first 50-60 years of the current Internet were based on

growth, I imagine next 50 years oscillating between dystopia & utopia:

due to polycrisis,

Internet has to function (or not) within many disaster scenarios: a war-thorn country, a refugee camp, an aftermath of a hurricane, a flooding, raging forrest fire, a pandemic… a series of collapses.

We have to rely on the equipment to function with little electricity & intermittent connectivity, within a broken supply chain for parts, no way to pay for licenses, and people who are focused on survival needs first, & then meaningful & minimal connections: making emergency calls, finding the loved ones, letting them know you are alive, looking up the direction to a shelter…

Counter-computing movement & alternative networks give me hope: frugal, slow-tech, minimalistic, off-the-grid, retro, low-tech, communal, repaired, DIY, shared, recycled, renewable energy, durable-tech, circularity…

For the distant future, I dream of “just enough” networks, healthy connections in a healthy biosphere, Eco-Net that supports all communities of life. Short-term, I am enjoying low-tech life in Lika, with the Puh, Lipa, Lisac & squirrels : you are invited to join: scan the QR code for more info!

[Image description: QR code in the shape of a tree]

Squirrels are symbol of innocent victims that are facing extinction, if we continue with developing “Internet of ecocide”, within the current social (economic, political, philosophical/spiritual) conditions.

High-speed Internet & other “advanced digital technologies” (quantum communication, 5G, 6G, HD video, VR, blockchain, AI, online gaming, etc), is what I call the “Internet of Ecocide”: a.k.a. Luxury, Excessive, Gargantuan, Gilded Internet… Internet of Affluence, Internet of Exploitation, Internet of Armageddon .

“Internet of Ecocide” is extremely damaging for the environment: burning fossil fuels for operations & shipping, over-consuming water (& energy & raw materials) for manufacturing & cooling, digging-up rare metals, occupying land, extracting value from many for the profits of the few, while externalising pollution (destroying habitats, dumping e-waste — even in space! —, generating excessive CO2 emissions)…

[Image description: ants crawling along the left side of the& the bottom

of the page]

ANTs against ANTi things:

ANTi Ecocide

ANTi Cloud

ANTi Data Centres

ANTi Big Tech

ANTi Fossil Fuels

ANTi Patriarchy

ANTi-Capitalism

ANTi Techno-Colonialism

ANTi Techno-Optimism

[Image description: ants in a spiral]

Quotes

“expansion of industrialized Internet production as separating organisms from their relational ecologies and coercing them into maximized production, under late capitalism’s growth imperative…”

“(I) approach Internet systems through the concept of more-than-human

freedom. (I) aim to bring together the focus on Internet sovereignty and a more-than- human perspective to the organisms involved in Internet creation.” ~~ https://morethanhumanfreedom.wordpress.com (paraphrased, replacing

“food” with “Internet”)

Degrowth is a social movement and a research framework

which advocates for a transition to sustainable and just forms of social

organization. The foundational insight of degrowth is that there cannot be endless growth on a finite planet.

“… humanity (must) give up some of its

core beliefs, from the fantasy that we

can control the planet, to the notion

that we are ‘above’ other beings.”

— Timothy Morton: HumanKInd

Consensus includes “the Voices who spoke for the Four Sacred Things:

Deer, Hawk, Salmon, Coyote” — Starhawk: The Fifth Sacred Thing

Like all punk, solarpunk goes against the current ruling philosophy

and requires a full system change. It lets care be the guide instead

of greed. Solarpunk sees humans as part of the natural ecology, not

apart from it as our current industrialized society does. There is

great emphasis on getting your hands in the dirt following bio-dy-

namic permaculture and regenerative principles, to tend to your

environment and grow your own food. Care of each other, care of

ourselves and care of our environment are all intertwined. Solar-

punk holds technology in its heart as a way to support this equal,

care-driven, non-polluting meaningful life. It focuses on hyper-lo-

cal, small, self-governing networks while also making the best of

being connected global citizens. Without the capitalist push for

the biggest economic benefit but with the eco-socialist spread

of resources and benefit for all. Life would maybe have a slightly

slower pace, but there would be much more to enjoy along the way.

— By Priscilla Haring-Kuipers

“… those who have no physical voices, but whose biological presence

keeps us breathing…” — “My Octopus Teacher” video

“imagine… a society with a modest standard of living, conservative of

natural resources, with a low constant fertility rate and a political

life based upon consent, a society that has made a successful adaptation

to its environment, and has learned to live without destroying itself or

the people next door.” — Ursula K. LeGuin

[Image description: Safety Sign: DANGER: No internet on a dead planet ,

with an image of “no phone” & ; an image of “dead fish dead tree”

environmental poison warning]

[Image description: Safety Sign: WARNING: Stop doing ecocide! an image

of “dead fish dead tree” environmental poison warning]

[Image description: Safety Sign: CAUTION: No internet on a burning

planet ; images of fire & “no phone” ]

[Image description: Safety Sign: NOTICE: Internet of Squirrels:

www.unciv.nl ; images of “gather here”: 4 people & for arrows pointing

at them & “read the manual”: person holding a booklet]

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**Title:** “We Can’t Fix It All” “Okay But What If We Try?”

What can HCI learn from the source-pathway-receptor framework?

Alice Ashcroft, Lancaster University

Zoe Detko, Ardea Eco-innovation

Pollution linkages are the connections between sources of pollution, pathways through which pollutants travel, and receptors that are impacted by pollution. These linkages are often broken down into three stages in environmentalism into the source, pathway and receptor (SPR) framework. This zine will share how, with an understanding of this framework, HCI researchers can ensure equitability in their developments both in terms of the environment but the users and those in marginalised groups.

Source: The origin or point of emission of pollutants into the environment.

Pathway: The route the pollutants travel from the source to the receptor.

Receptor: The entity that is exposed and potentially affected by the pollutant.

Okay... SPR. How does this apply to tech though?

1. Recognising the Interaction

Recognising the interaction between digital technology and environmental impact sheds light on how, in reducing negative environmental impacts, the positive social impact can be increased. An example of this can be seen with the creation of website that produce fewer greenhouse gas (GHG) emissions, also aiding individuals with slow internet connections or limited data plans. A single visit to a 30 MB homepage would use both an entire day's worth of data for someone for someone on a 1GB monthly plan, and emit 12g of CO2e (Lowe, 2021).

So we need to design websites with reduced emissions!

Reducing image sizes, avoiding auto-playing videos (Lowe, 2021), minimising automatic chatbot usage, and not integrating live social media feeds, are (great/good/another adjective of your choice) strategies for reducing GHG emissions; contributing to environmental sustainability as well as enhancing website accessibility from a data and design standpoint.

Images are the biggest source of GHG emissions on websites (Greenwood, 2021). However, only by optimizing them from JPEG, PNG or GIF to WebP formats, emissions can be reduced significantly (Hiskey, 2022), and less data is needed to access the website.

This is just one example.

**Knock On Effects - They knock marginalised groups even harder.**

Emissions affecting the lives of people isn’t a thing of the past:

https://www.instagram.com/reel/C7QvJTBtM8u/?igsh=MXBibjlrb3MwYzlmZA==

2. The River Parallel

Using the SPR framework, we can see that each stage of this three stage process can have unintended consequences both environmentally and socially.

For example…

**Poisoned water?** If you have a limited water source, you’ll have no choice but to drink the water. You might not have the data, but you still have to log on to pay your bills. Choice is a right, but still a privilege.

**Smog in the air?** Cloud Computing is often seen as a cheaper alternative, but what is rarely considered is the environmental impact of this. Do we have to send data across the world and back? - That’s a lot of energy!

**Know what’s grown?** When you eat plants grown near a factory, do you know what you’re eating? When you consume content online, do you know the quality of that too?

3. So many parallels

There are so many parallels when it comes to Intersectionality and Pollution. Let’s define the following, shall we?

**Bioaccumulation:** when contaminants build up in organisms, becoming more concentrated than in their surrounding environment.

**“intersectionality”:** linguistically means the overlapping of more than one characteristic.

These are each affects of impacts building up, but the disproportionate nature (pardon the pun), of this can be seen in these definitions…

**Biomagnification:** when the concentration of a chemical in an organism is higher than in its food, mainly because the organism gets exposed through its diet.

**Intersectionality:** theoretically means how each overlapping characteristic has affected each lived experience in the person’s life, often disproportionately.

TLDR: things are not always proportional…

**The Polar Bear Parallel**

If you have some infected micro-organisms, which are consumed by small fish, let’s say they might end up being 20% infected. When some bigger fish come along, due to them eating more than one of the smaller fish each, they might end up 40% infected. Because seals then eat a lot of fish, they might end up, let’s say, they end up 80% infected. And because that’s all the polar bear is eating, they end up 100% infected.

the effect is magnified!

sound familiar?

(\*cough cough\*

Biomagnification

\*cough cough\*

intersectionality)

This parallel can then be drawn to explore how multiple marginalised groups can often be neglected when it comes tot he use of technology. For example society’s treatment of multiply marginalised groups will affect their access to education, which may well affect their ability to earn income, which will in turn affect their ability to access technology.

…and there are so many more examples of this!

4. What can we learn from The Parallels?

Consider the environmental impact of each stage of your developments.

Understand that the environmental impacts are directly linked to the accessibility of your systems.

Physical accessibility should always be considered. But how is social access considered in your work?

All references can be found at: aliceashcroft.com/s/ict4s-zine-refs.pdf or below.

You can follow the authors work on LinkedIn:

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**References**

Ashcroft, A. (2023). Reflexivity, interactions and intersectionality in HCI and CSCW. In Proceedings of the 36th International BCS Human-Computer Interaction Conference.

Dabiri, E. (2021). What white people can do next: From allyship to coalition. Penguin UK.

Freitag, C., Berners-Lee, M., Widdicks, K., Knowles, B., Blair, G. S., & Friday, A. (2021). The real climate and transformative impact of ICT: A critique of estimates, trends, and regulations. Patterns, 2(9).

Greenwood, T. (2021). Sustainable web design. A Book Apart: New York, NY, USA.

Hiskey, T. (2022). How I decreased my website’s carbon emissions by 88%. [Online]. Medium. Last updated: 7 November 2022. Available at: https://tomhiskey.medium.com/how-i-decreased-my-websites-emissions-by-88-e7eadc72200c [Accessed 26 March 2024].

Loach, M. (@mikaelaloach). (2024, May 22). Activist at Shell's AGM asking a question about alleged crimes in the Niger Delta [Instagram video]. Instagram. https://www.instagram.com/reel/C7QvJTBtM8u/?igsh=MXBibjlrb3MwYzlmZA==

Lowe, S. (2021). Council website emissions. Open Innovations. https://open-innovations.org/blog/2021-05-28-council-website-emissions

Robertson, R. (1994). Globalisation or glocalisation?. Journal of International Communication, 1(1), 33-52.

Schlesinger, A., Edwards, W. K., & Grinter, R. E. (2017, May). Intersectional HCI: Engaging identity through gender, race, and class. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (pp. 5412-5427).

**Page 1: Cover page**

**Zine title:** Dear Garden Dear Earth

**Author:** Rodrigo dos Santos (PhD Candidate at the UBC School of Information)

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**Year:** 2023

[Image description: The image on the cover page is a collage made from colour scans of two dried flowers (a tobacco jasmine nicotiana flower, and a red and yellow petaled chrysanthemum flower), as well as a fern leaf and a domestic chicken feather.]

**Pages 2 and 3: Dear Garden**

Dear Gardenis a journal booklet created to inspire urban community gardeners to witness the relational stories that happen in garden spaces. These are stories of interdependencies and collaborations among more-than-human entities such as:

* heat
* water
* soil
* plants
* critters
* people
* tools

that permeate their garden selves.

The journal is part of a speculative, yet participatory design research that takes non-anthropocentric perspectives into consideration through:

* the myriad forms urban community garden[er]s can express themselves;
* the interactions they engage with;
* their learnings and responses to each others’ stories.

stories of unity

reminding

we are entangled

not apart

stories that bring upon

our imaginative capacities

speculative why not?

one truth is that people

often struggle envisioning

as you might

or even pretend to

then we hear whispers

it’s you shouting to all

we are one

and many more

interdependent

stories

[Image description: The image on pages 2 and 3 shows a collage with some of the contributions to the Dear Garden journal. These are hand written and illustrated entries to the journal. Placed as a collage, there are several possibilities of reading this page. One of which is:

Dear garden, as you may know, today you inspired me to take things one at a time. While working with you, I have witnessed magic of return; Insects, birds, and animals live hand in hand. I express how much I care for you by showing my curiosity and inviting others in. Others tend for you when they sing compliments over the fence, dance in your blooms, digest in your compost, aerate your soils, rain on your leaves, tickle your roots, celebrate your gifts. And you've been responding to our love by making our world more peaceful.]

**Pages 4 and 5: Dear Earth**

Dear Earth is inspired by the Dear Garden journal, and invites you to reflect on some of the relational stories you share with the Earth. While contemplating these stories, you may consider how your design practice—or your Information and Communication Technology-related work—is entangled with the social and ecological perspectives that:

* you nurture and/or
* nurture you.

Any responsible form of expression to engage with Dear Earth is welcome.

[Journal prompt description: Following this invitation, there is a textual prompt or a form for engagement with the Dear Earth section of this zine. The journal prompt suggests a story in format of a narrative, or a letter to be written to Dear Earth. It reads:

Dear Earth,

There is so much care around ourselves

You know you have my attention when I…

(Space for reflection)

But I confess that sometimes it is hard

to have you in mind, especially when…

(Space for reflection)

This may incite you to…

(Space for reflection)

In order to embrace your whispers

and shouts, I might...

(Space for reflection)]

**Page 6: back page**

Dear Garden journal evokes ways of building responsible and reciprocal relations with the land—practices that are shared in many places, and by many communities in their own ways.

It was created as part of my dissertation research project. The research happened in the Summer of 2023 in two urban community gardens in Vancouver, Canada—the traditional, ancestral, and unceded territory of the Tsleil-Waututh (website: [twnation.ca](http://twnation.ca)), Squamish (website: [squamish.net](http://squamish.net)), and Musqueam peoples (website: [musqueam.bc.ca](http://musqueam.bc.ca)).

The relational stories that arise from the interactions that urban community garden[er]s witness and engage with can broaden understandings on the importance of assessing and/or envisioning perspectives that are often unacknowledged by social, economic and political systems that support dominant—technocentric—solution-based interaction design practice. These are perspectives from:

* bees
* weeds
* worms
* soils
* apples
* tomatoes
* potatoes
* peas
* fireweeds
* peoples
* places
* ants
* house
* plants
* of varied
* colours
* and shapes
* mushrooms
* above and
* underground
* rue
* rhizomes
* compost
* stones
* that reflect
* different
* moments

and many more.

Dear Earth is a nascent initiative built on learnings from the Dear Garden journal and on calls to address the social and ecological climate crisis we are immersed in...

* raising sea levels
* melting glaciers
* draughts
* floods
* hunger
* et al.

If you would like to start an informal conversation, or share your Dear Earth reflections, please email Rodrigo dos Santos, PhD Candidate at the UBC School of Information (email: [rodrigo.dossantos@ubc.ca](mailto:rodrigo.dossantos@ubc.ca))

[Image description: The image on the back page shows a collage made from colour scan of a Japanese Anemone dried flower.]

**Zine: What might a more sustainable Internet of Things look like?**  
Plain text version

Page 1

Title – What might a more sustainable Internet of Things look like?  
The redundancy and lack of repairability of IoT devices has led them to become major contributors to the electronic waste crisis.

Figure – Circuit diagram connecting the following subheadings: 1) Policy and regulation, 2) How IoTs become meaningful artefacts, 3) What happens at the end of their life?, 4) How IoTs are designed in practice, 5) More-than-human futures of repair

Decorative figure – a toaster with mushrooms growing out of it.

Author list – Fixing the Future collective: Christopher Boniface, Teresa Castle-Green, Paul Coulton, Dimitrios Darzentas, Nidhi Dubey, Susan Lechelt, Joseph Lindley, Violet Owen, Namrata Primlani, Neelima Salaija, Michael Stead, Melissa Terras and Lachlan Urquhart.

QR code leading to <https://ftf.wp.horizon.ac.uk/>

Page 2

Figure – An image of a piece of legislation, with the title Right-to-Repair

Text – EU and UK Laws are targeting different stages of the IoT lifecycle to improve sustainability.

Figure – a cable with data, software and hardware wires running through it. The wire is configured in a spiral, with the following headings running through it: design/before sale, sale/in use, end of life, recycled/reimagined, reuse, end of life 2

Text corresponding to the design/before sale heading – The French Index of Repairability 2020 – “How fixable is this? You’re going to get judged!”, Provides IoT device fixability ratings to consumers

Text corresponding to the sale/in use heading - EU EcoDesign Law – “Harder to break, easier to replace, parts galore” – how can IoT have more resilient components and screens?

Text corresponding to the end of life heading – EU Cyber Resilience Act – “stop selling insecure devices, make them and keep them secure” – how can IoT be kept secure across its span?

Text corresponding to reuse heading – EU Right to Repair – “make sure there is bettera access to spare parts” – how can IoT manufacturers support access to spare parts and repair services?

Page 3

Title – Functional device to meaningful artefact

Poem text: Design dictates devotion, aesthetics alter attitudes, Shoddy style, swift scrap, beauty begets bonding, tacky tech, throwaway toy, sleek and serviceable, sustained and saved, alluring and accessible, admired and attended, form and function forge the future.

Figure: Four blank quadrants on two axes. Axis one: perceived as repairable versus perceived as not worth repairing, Axis two: repairable aesthetics versus non-repairable aesthetics.

Text: List of words to be written into the blank quadrants. The list includes: utilitarian, functional, industrial, clinical, practical, replaceable, get while it lasts, one-use, disposable, cheap, rubbish, waste, modular, fixable, customised, keepsake, buy fro life, mine, beautiful, seamless, expensive, warrantly, closed, waste

Figure: images to be cut out and placed in quadrants. The images include: a smart meter, an iPhone, a smartwatch, a smart speaker, a modular Fairphone, an iPod and an NFC tag.

Page 4

Title: What are the drivers that will stop or discourage use of a particular product or service?

Figure: A graph with the axes strategic motivation and scope of analysis (scale). Top left shows an image of a My Friend Cayla doll with the annotation “banned artefacts, surfaces and processes” alongside the question “why was My Friend Cayla banned?”. Top right shows an image of a Sonos smart speaker with the annotation “change to business models” alongside the question “Why did Sonos stop supporting older models?” Bottom left shows an image of a NERF dash button with the annotation “abandoned artefacts” alongside the question “Why does no one use Dash buttons?” Bottom right shows an image of a Violet Mir:ror device with the annotation “system erosion” alongside the question “why did Violet not make its service open source?”

Text: Nothing lasts forever! Whilst physical hardware failure was largely driven by its electronics it is now driven by the business choice (or failure) as to whether to continue software support

Figure: Bathtub curve – electronic failure rate versus time. A bathtub shaped curve with the axis of time, showing, from left to right: 1) Infant mortality, decreasing failure rate; 2) normal (useful) life, low (constant) failure rate, 3) end of life, increasing failure rate.

Page 5

Title – How IoTs are designed in practice

Figure – Comic strip.

Comic strip box 1 - the Design brief, showing an interaction between the manager, data dude, software engineer and hardware engineer. Mr Manager says “I need a keyring to give out at a trade show. I need it small and blue with our log on and IoT connected.” Data Dude says “Why connected?”. Software engineer thinks “Is she serious?”. The hard ware engineer puts his hands on his head in worry. Mr. Manager says “People like connected things!”.

Comic Strip box 2 – showing the hardware engineers’ discussions and process. Hardware engineer one says “Let’s iterate now and get it perfect before we put it out there.” Hardware engineer 2 says “this is a low value item so costs need to be kept to a minimum.” Engineer 3 says “If we glue parts together we can save loads!”

Comic strip box 3 – showing the software engineers’ discussion and process. Software engineer 1 says “Let’s just get the basics in place and we can modify the interface and functionality after launch”. Software engineer 2 says “Let’s do some development sprints. We need to do a mobile app, right?”

Comic strip box 4 – showing the data scientists’ discussions and process. Data scientist 1 says “Right, so what data could we collect and how can we make it kind of useful?” Data scientist 2 says “It needs to be reliable and secure. What contexts will it be used in?”

Comic strip box 5 – showing the service and experience designers’ discussions and process. Service designer 1 says “Let’s get these design teams together to ensure a cohesive user experience throughout the whole customer journey.” Service designer 2 says “Okay” but thinks “This keyring is so overengineered”.

Comic strip box 6 – title – “but what about repairability?” person 1 says “Oh it’s broken, is this product repairable?” Manager says “Well yeah, um, we kind of thought about it…” A hardware engineer says “It wasn’t in the design brief, right?” Another engineer says “Nope”.

Decorative figure – Word search for terms related to repair: repairers, data, privacy, repair, context, support, diagnosis and modular.

Page 6

Title – More-than-human futures of repair

Figure showing the past, new possible present and future of repair. The annotations include: 1) algorithms, data, regulations, policy, business models, etc., 2) plurality of human perspectives, 3) climate biosphere, etc., 4) infrastructures

Text – The things in the Internet of Things are not simply the physical products but include algorithms, business models, regulations, resources, etc. to form a network of human and non-human beings.

Text – “We do not understand the things we create go on designing after we designed them”.

Figure – UKRI logo and link to website <https://ftf.wp.horizon.ac.uk/>

**Peering**

By: Tim Cowlishaw

[Page Background Image: A slightly-out-of-focus image of a middle aged white man’s face, eyes visible looking into the lens, cropped just below the nose]

A face peers down at me, tinted blue by a bright sun which bleaches the sky behind a hazy featureless white. The face wears an expression of concern, or perhaps of puzzlement in the eyes. It’s a familiar face, although not one I’ve seen from this angle. Below it, a question: “Do you remember this moment?”. I don’t - but it must have happened - there’s photographic evidence after all.

It’s a photo of me, revealed by the “memory reel” notification that Google Photos occasionally sends me, without my asking. But it’s a strange type of memory, one that diverges so entirely from what I thought that I recalled. I’m peering into the lens, perhaps caught by surprise, perhaps attempting to diagnose some problem, but the overall impression is of someone peering into the mechanism, trying to see what’s on the other side.

This hidden mechanism is on my mind now - receiving this notification was a moment of Infrastructural uncanniness [Footnote: 1] - a sudden, jarring reminder, that my phone, familiar, and personal, is one tendril of a much larger digital infrastructure, through which other agencies apart from my own operate. If I didn’t knowingly take this photo, then who, or what did?

[Page Background image: A map of the spanish fibre network, the outlines of the peninsula, the border with portugal, and the balearic islands are all visible. The density of the lines on the map and the points where they intersect identify the locations of major cities. On top of this, a hand drawn line from Barcelona to Madrid traces the route of the train line, which closely follow a tangle of fibre links on the map below]

Perhaps if I understood where this photo is now, then I might better understand how I’m entangled in this infrastructure. In my work investigating the material footprint of discarded data, one thing still eludes me: how the footprint of my own digital waste contributes to it. This photo offers an interesting glimpse of that involvement precisely because it offers no easy answers: it’s “my data”, but I never chose to store it, and wasn’t aware of its existence until just now.

[Image: A screenshot of an article in the spanish daily newspaper *El Periodico* entitled “Así es el primer Data Center de Google en España” (“This is the first Google Data Centre in Spain”)]

My phone gives me few clues: the photo was taken on the 29th of December 2020, at a point on the map I know: my home. The moment I don’t remember lasted 1/100 of a second, a click of a shutter. But Google’s interface tells me nothing about the photo now - not even a file size.

Recalling Anne Pasek’s methods for getting into fights with data centres [Footnote: 2], I open Google Photos on my laptop, and locate the photo. From the photo, a URL, from the URL, a domain, from the domain, an IP address, and from the IP, a location: Madrid.

This all seems too simple, too definite, each inference bringing more uncertainty. The domain of the image might point to one IP, or several, it might be a proxy, a CDN. Now, looking at a point on the map in the centre of the Puerta del Sol, I realise it offers a comforting illusion of specificity. There is definitely no Google data centre here.

Still: it makes sense for my particular photos to be stored in the country where I live: these are not public images, distributed around the world for access from anywhere. In the face of uncertainty, an abductive leap: It is probable that my photo is in a Google facility in Spain. So, if not in the Puerta del Sol, where?

[Image: A screenshot for the Bing maps page for “NABIAX DATA CENTER”, a data centre in Alcalá de Henares, Madrid. It’s a wide, grey, crenellated building on the edge of an industrial park, with empty lots surrounding it]

Google does have a data centre in Madrid: it was announced to great fanfare in the press [Footnote: 3] when it opened in 2022. The article mentions a partnership with Telefónica, and I soon locate another article [Footnote: 4] which places it in a Telfónica facility in Alcalá de Henares.

A map search for “data centre Alcalá”: squat grey buildings on the outskirts of town, with unfamiliar names. No sign of Telefónica or Google, but a search for “Telefónica Alcalá” yields an elegant brochure5, describing a state of the art facility with distinctive turret-like structures along the edge. I notice that one of the grey outlines on the map, named “Nabiax”, has a similar crenellated profile, switch to Street View: It's the same building.

[Image: Screenshot of google street view image of the Nabiax data centre. It is in the middle distance, the other side of an empty lot, and the squarish crenellated towers are visible on the side facing the camera]

I try to imagine its enormity: 15 square kilometres of usable space, and 100 MW of installed electrical capacity. 22 tonnes of CO2 [Footnote: 6] (five passenger flights from Madrid to Santiago de Chile, or 44 square metres of lost arctic ice) per hour.

More searches, more documents: Everything that helps keep my photo online 24/7. The frustrations of the technicians working there [Footnote: 7], the layout of the control room and the enormous diesel tank for backup power [Footnote: 8], the local council’s generous offer of a new dedicated power line and substation, now open for tender [Footnote: 9]. These installations are built to scale [Footnote: 10], their footprint and power supplies expanding continuously.

Trying to comprehend everything keeping this giant machine running is dizzying, as is knowing that I am, every time the shutter on my phone clicks, implicating myself in it further. But seen framed by the laptop screen, zoomable with a pinch of the fingers, I can’t comprehend the scale of the place, nor the extent of my own involvement. To really get a sense of this, I reason, I have to go there, to stand alongside it.

[Page Background image: Hand drawn map of the layout of the Tecnoalcalá technology and science park, centred on the Nabiax data centre. Overlaid on the map is the electrical infrastructure plan of Nabiax itself, transformers, backup generators and diesel tanks visible]

So, a few weeks later, I take a train to Madrid: It tickles me that I'm likely following the same path along which my image had passed, from fibre optic to fibre optic, peer to peer. Tung-Hui Hu [Footnote: 11] describes how the railway and the fibre optic network are often intertwined, and this is the case here: overlaying a map of fibre infrastructure [Footnote: 12] on to the railway network, and tracing the thread of a backbone link following the AVE line beneath me.

On the second leg of my journey, I approach Alcalá de Henares Universidad. An outskirt of an outskirt: Alcalá is a suburb of Madrid, and the Universidad station is in an outskirt of Alcalá: bordered on one side by warehouses, and on the other by the university campus and a large expanse of green scrubland.

Looking out of the window, I’m struck by the number of trasteros (self-storage units) I see. They and the data centre make good neighbours: Both need large amounts of cheap space, proximity to transport infrastructure (or the fibre under it), and they’re both peripharal places, in the terminology of Discard Studies [Footnote: 13]: the “away” where unwanted things can be sent, out of sight and out of mind.

[Image: Photograph of weathered street sign, pointing to “Calle punto mobi”, “Calle Arroba”, and “Calle WWW”]

I trace an L-shaped movement along the edge of the wasteland (I could cut across, but I feel like an interloper, and don't want to draw attention to myself). As I walk, a low hum, barely there at first, but growing in intensity to the identifiable major-third drone of industrial air-conditioning. I turn a corner and see a weathered billboard welcoming me to “Tecnoalcalá Technological and Scientific Park”. Below it, a sun-bleached street sign pointing to “WWW street”, “Arroba (@) street”, and ”.mobi Avenue”, already familiar from the map. I’m on ”.com Avenue”, the street, where at number 23, the Google Cloud region which I’m pretty certain holds my photo resides.

“You are entering a private complex - respect the instructions”. That same feeling of being an interloper again: I’m not being turned away, but I’m definitely not being welcomed in either. Security, and secrecy: the "bunker mentality" of the cloud [Foonote: 11], needs the figure of an outside threat from which we're being protected. It feels weird to inhabit both roles at once: I’m one of the people whose data is in there, but I’m also the interloper.

The weathered, sunbleached quality of the road signs can be seen on everything, and I can feel its cause in a very bodily way - even on an early February morning, it is uncomfortably hot, and I can feel the back of my neck burning. Curiously though, the road verges are more verdant than the surrounding scrubland. A closer look reveals the black serpentine tangle of an automatic watering system under these green borders: the clean, sustainable imaginary of the cloud must be maintained where it meets the material reality.

Rounding a corner, I see the now-familiar crenellated profile of Nabiax, and am struck by its scale. Not just the sheer size of it, but also the way in which I could see it scaling - one end of the building still under construction, and an expanse of unbroken but fenced off ground to its south reserved and waiting.

I arrive at the front entrance: a man-sized gate under the building’s address in large metal signage, and a smaller, more temporary sign, reading “Nabiax” (“Google” and “Telefónica” conspicuous by their absence). This gateway is the only human-sized thing about this building: there are no windows, nor any clues of human habitation: Of the 10,000 jobs which this installation supposedly enabled [Footnote: 14], few of them appear to be in this building.

Beyond the entrance, I see a row of pylons, stretching from the data centre across the field behind me, off in the direction of the substation. There’s also a curious empty space, maybe the size of half a football pitch, fenced off, within the perimeter of the data centre, but, meticulously lawned, and empty, right above where the plan told me the diesel tanks reside.

[Image: photograph of the profile of the Nabiax building, with construction site and waste land visible in the foreground]

Standing on the corner on the other side of the patch of grass, I try to take in the entire installation: not just the building, but the construction sites surrounding it, the fibre network snaking under the roads and train lines, the electrical grid behind me and the backup generators below. I’m very aware of all I don’t know, and can’t see: most notably what’s inside the building: the high fences and security cameras mean this is as close as I can get.

However, incomplete knowledge is still knowledge, and knowledge can be put into action. I may not understand the totality of this rhizomatic infrastructure, and I may never understand fully how my own digital traces are tied up with it, but I do now know two things.

The first, that scale, manifested in the impermeability, expandability and anonymity of these infrastructures, might prevent us from knowing them directly, but it also suggests other ways we might come to know and understand them.

I might never know for sure that my photo is in this data centre, but I know that it’s in one like it, and this logic of scalability [Footnote: 15] suggests that that other data centre will be much like this one: What I have learned and experienced here can still teach me something about the site my photo inhabits, even if I never know exactly where that is.

The second, is that this knowledge does not need to be complete to be useful: Partial knowledge can still give us reasons to act, to decide. And so, on finishing this text, pasting in the image below, and hitting save, I return to my Google Photos account, navigate to the 29th of December 2020, select the blue and white smudge with the traces of a face, and I hit delete.

[Image: my face, the original photo I discovered in my google photos account, alongside an image of the Nabiax data centre, silhouetted against the sun behind it.]

Thanks to Anne Pasek, for the methodological techniques outlined in Getting into Fights with Data Centres, for inspiration, and in general for tonnes of prior work I hope in some small sense I'm building on. Thanks also to Justin Pickard, for emergency ethnographic training and mentoring, extremely generative conversations, general moral support and commitment to the bit.

Footnotes:

1. Geoghegan, B.D. (2016) ‘Mind the Gap: Spiritualism and the Infrastructural Uncanny’, Critical Inquiry, 42(4), pp. 899–922. Available at: <https://doi.org/10.1086/686945>.

2. Pasek, A. (2023) ‘Getting Into Fights With Data Centers: Or, a Modest Proposal for Reframing the Climate Politics of ICT.’, White Paper. Experimental Methods and Media Lab, Trent University, Peterborough, Ontario. Available at: <https://tinyurl.com/PeeringPasek>.

3. https://tinyurl.com/PeeringElPeriodico

4. https://tinyurl.com/PeeringEuropa

5. https://tinyurl.com/PeeringBrochure

6. https://tinyurl.com/PeeringPower

7. https://tinyurl.com/NabiaxMapsReviews

8. https://tinyurl.com/PeeringPlan

9. https://tinyurl.com/PeeringTender

10. Tsing, A.L. (2012) ‘On Nonscalability’, Common Knowledge, 18(3), pp. 505–524. Available at: <https://doi.org/10.1215/0961754X-1630424>

11. Hu, T.-H. (2016) A Prehistory of the Cloud. Illustrated edition. Cambridge, Massachusetts London, England: The MIT Press.

12. https://tinyurl.com/PeeringFibre

13. Liboiron, M. and Lepawsky, J. (2022) Discard Studies: Wasting, Systems, and Power. Cambridge, MA, USA: MIT Press.

14. <https://tinyurl.com/PeeringVanguardia>

15. Hanna, A. and Park, T.M. (2020) ‘Against Scale: Provocations and Resistances to Scale Thinking’. arXiv. Available at: http://arxiv.org/abs/2010.08850.

**Title:** Systems thinking workbook

By: Laetitia Bornes, Marcia Smith, Oliver Bates.

**Contents:**

* Introduction
* Suggested indicators
* Fill your thoughts on the papers
* Conference feedback
* Design your own radar chart
* Thoughts on your own research

**Introduction**

Dear reader,

We invite you to fill in the "Systems Thinking Workbook" as part of your professional journey as a leader in ICT and sustainability. This workbook introduces six indicators for systems thinking and a series of activities for reflecting on the ICT4S 2024 conference and your own practice.

This workbook is born out of a series of conversations in liminal spaces at conferences and in other tech spaces about the focus of much tech research on technosolutions that lack any accompanying engagement in complex systems that encapsulate ICT and digital technology.

Use this workbook with academic papers, technologies, interventions and prototypes! Our hopes are that you use this workbook in a non adversarial manner to capture a more complete snapshot of whether the whole conference (and your own work) embraces a systemic perspective.

This workbook is for those of you who are interested in critically engaging with systems thinking for sustainability in both your own practice and the practice of the communities you are part of. It's both a form of feedback for conference organisers, and self-reflection on our own practices and perspectives. We hope to trigger in-depth and possibly provocative reflections that nudge our collective research to more radical and systems oriented perspectives.

Thanks for reading!

Oliver, Laetitia, Marcia

**Suggested indicators**

**Scale of intervention**

What is the scope of the intervention? Does this paper study or act on devices (e.g. smartphone)? Does it deal with services (e.g. internet service provider)? Is it interested in the infrastructure behind it? or is it looking at the whole socio-technical system?

**Scale of effects**

What effects are being considered? Direct effects (energy, materials and resources for production, operation and disposal)? Enabling effects (substitution, optimization)? Direct rebound effects (more intensive use due to gain in time or money)? Indirect rebound effects (other additional footprints enabled by these savings)? What about economy-wide rebound and systemic change (changes in production and consumption patterns at the societal level)?

**Beings considered**

Is the research user centric? Does it think about other humans, non-users? What about other beings? and the environment?

**Environmental impacts considered**

What environmental impacts does the research consider? Does it only consider CO2 or Green House Gas (GHG) as proxies for broader environmental impacts? or does it consider other environmental impacts such as water usage, pollution, land use change, resources depletion, etc.

**Social (in)equity**

Does this research reflect on notions of equality and equity? If so, is it positioned more in an equality or equity paradigm? For example, a fuel tax may be seen as egalitarian but not equitable, since it will be felt most by the poorest households, and in particular those who are car-dependent (in the countryside).

**Transformative power**

Is the aim of this research to bring about incremental change in the direction of transition, which can be implemented in the short term? Or does this research support a radical and profound change, probably planned for the longer term?

**Fill your thoughts on the papers**

[Image description: Radar chart with six axes and description of the scale of each axis.]

Description of the axes:

**Scale of intervention:** product - service - network - sociotechnical system **Scale of effects:** direct - enablements - rebound effects - systemic

**Beings considered:** users - humans - more-than-human - ecosystems **Environmental impacts considered:** only GHG - - - 5 and more

**Social (in)equity:** unequal - equality but no equity - equity

**Transformative power:** incremental change - - - paradigm shift

**Conference feedback**

Questions (answers to be filled by the readers):

Why are you here? What did you expect to find?

Is the conference diverse? Did you see any patterns? What is missing? What is left unsaid?

How could the conference be improved?

**Design your own radar chart**

[Image description: Radar chart with six axes (empty name, to be filled by the reader) and description of the scale of each axis (empty description, to be filled by the reader).]

**Thoughts on your own research**

[Image description: Radar chart with six axes and description of the scale of each axis.]

Axes: Scale of intervention, Scale of effects, Beings considered, Environmental impacts considered, Social (in)equity, Transformative power

Questions (answers to be filled by the readers):

Should/could you navigate on those axes? Which one(s)?

How could you do so?

Page 1:

**Title:** A Good Enough Data Centre? – by Sandra Abels, Leman Çelik, Stefan Laser, Estrid Sørensen. Artwork by Lynn Werner.

This zine features several skilfully made, black and white hand drawings. Texts are presented in graphic-novel style lettering and boxes with curved edges, creating a sense of asymmetry. The header of each page incorporates a purple colour as a nod to the primary colour of the research centre that supports this research and is depicted with its logo on the bottom side.

Two drawings illustrate the following process, described in a rectangular text box in the right upper corner of the first page:

"Moments before a workshop for international scholars to discuss draft papers stored in our university cloud…An excavator cuts a cable. Snap. No access. This is how we experienced our university data centre."

At the bottom of the page, I am looking at an excavator in action. It stands on an undefined heap of dirt, there are some bigger stones and rocks visible, some grass as well, and one tooth of the excavator bucket seems to just have sunk itself into a cable, leaving the cable with a loose end that oozes three strings of numbers. Ones and zeroes, in their specific order, float into thin air as they get smaller, then disappear. A speech bubble coming from the cab where the operator sits exclaims: "OOOPS!"

The other end of the cut cable leads up to the upper left and creeps into the picture there. It depicts a rather big server rack from an angle so that I get an impression not only of its front but of the rack's depth as well. The picture displays the left front part of the rack in more detail. I can see various surfaces, differing in shape and size but nonetheless with a certain order to them. They seem to be arranged in rows similar to the structure on the right side of the picture. But here, further detail avoids the eye. The background is shaded with fine black lines.

The last row on page one features the logo of Ruhr-University Bochum to the left, and the logo of our Collaborative Research Centre (CRC) to the right (brightly coloured in yellow, turquoise, and a deep dark violet, ie, the colour scheme). The middle of the row holds the link to the CRC's website: [https://www.sfb1567.ruhr-uni-bochum.de](https://www.sfb1567.ruhr-uni-bochum.de/).

Page 2: Experiences

On page 2, the content is arranged in three rows. The first picture, reading from left to right, portraits a person wearing an EEG sensor cap en face. Next to it, a text box that reads: "Data infrastructures are indispensable for science and research."

The next row starts with another text box: "Data centres challenge sustainable development." Two drawings follow: The first, a stylised close-up of what might be a motherboard, the second one little snippet from an aerial depiction of an urban area, both interconnected by a bunch of lines. Under the text box and picture one, another text box is asking: "How to make sense of data centres?"

The bottom row starts with another question: "How are data centres experienced?", followed by the statement: "We asked actors around a German university data centre." A human hand, seemingly emerging from this text box, touches a computer in the picture to the right of the text box.

Page two closes with the following sentence: "Three example groups help us rethink."

Page 3: Science

"Some of our simulations run for days, sometimes even weeks. And, of course, then if you shut down the server, then you can't run it, but often you can't even store the state of the simulation." Quote from a computational neuroscientist, 2023.

Below this, another quote: "If you switch off the servers that is the end of work" (Chemist, 2023). The text box that holds this statement is accompanied by a bigger version of the head portrait from page 2.

To me, as an observer describing the picture, the broad nose and thick eyebrows that rest over the closed eyes in two straight lines are the most prominent facial features. Long strands of hair spill under the EEG cap down onto the person's shoulders. Overall, the human looks strangely at peace. A cable, linked to the measuring device, runs from behind the person's back to the left side and out of the little box that contains the image to branch out into several strands. I am reminded of veins and arteries. Between the EEG-capped head and the visible cable ends: multiplicities of EEG waves, going up at times, then down, then up again. Both, the veined ends of the cable and the measuring curves, interconnect the human and the text box to the left of the picture, entangle both in multiple ways. The upper outline of the artwork gently touches the text box that holds the quote from computational neuroscientist while the longest strands of hair from the person's head not only cover their shoulders but extend to the text box on the bottom of the page where another quote is presented:

"An HPC cluster, you could run it for a few more years. But let's say within five years the hardware is getting outdated. So if you don't run it continuously… you also have to think about that aspect, right? Maybe you save electricity by shutting it off, but then you're not using the hardware to its fullest extent. And it takes energy to make the hardware, right?" (Computational Neuroscientist, 2023)

Page 4: Procurement

The top row of this page shows a bigger version of the drawn close-up of the motherboard described above. In the upper left part of the drawing, a microprocessor is surrounded by a diffuse web of multiple, intricately drawn circuit traces with nodes at their ends on all four sides. The tracks to its right lead out of the drawings frame and connect to the adjacent drawing, an aerial view of an urban area, represented by rectangular shapes of various sizes and structure and parallel lines that indicating pathways. The layout is messy in that it does not follow a specific blueprint – the area looks grown, not planned. Four streets transcend the edges of this sketch, tentatively expanding, suggesting connections to its surroundings, and at last finding one at the bottom in one of the two interlinked textboxes that display two quotes by a university DC operator from 2022:

"The conditions are discussed in a tender. You want to have so many nodes with at least this and this CPU performance, so much memory, then so many nodes with graphics cards, which are then specified, and so much storage and what you need there…

"…naturally, it's difficult to say in this context that we want to have energy-efficient computers. It's a bit contradictory to high performance."

The box with the latter quote in it is gently stroked by a pipe extending from the hand drawing in the lower right corner of the page that shows an underground utility vault. The image draws me inside a tunnel. A flock of seemingly unending pipes, some smaller, some bigger in diameter, to the left, stacked on the left, run on and on in the picture, with some hard-to-define structures doing exactly the same on the right. Smack in the middle of the picture, there seems to be a tiny opening through which the instalments escape my gaze, leaving me feeling vaguely claustrophobic.

The text box to the left says: "We basically handed over the building with IT racks, with power on the right/left and network at the top. That was our service, not the computers." (Data centre builders, a contractor, 2023)

Page 5: Data Centre Operators

The page contains three quotes from a university data centre operator from 2022. Number 1: "But some scepsis prevails: 'I can't get in there on my own if I have to.' Well, I think that's an unfounded fear, because: When do you ever have to access a server?"

Number 2: "You need to have a reasonable configured server and reasonable remote maintenance", directly above quote number 3: "I think you just have to overcome the anxiety that you have to pet your server every day. You don't have to".

Next to the last pair of quotes, I see a big version of the hand that touches a computer, as described on page 2. The computer here is a tower desktop; it features four slots (presumably USB), and what I interpret as the power button, some tiny LED lights, and a large part of the device's front is covered by what I imagine a mesh front that allows to cool down its innards by sucking in cold air. The human hand slightly bends, with the wrist functioning as a joint between the hand in the picture and the arm it is attached to in the upper text box. The index finger is slightly elevated while the three other fingers caress the top of the computer's shell with a gentle touch.

Page 6: Towards Good Enough

The last page features three text boxes:

1: More and more data. Access. Futile efficiency gains. Connections between actors that are made invisible. Where do we go from here?

2: How did you experience a data centre today? What is a good enough data centre for you?

3: Write about your data centre experiences in the cryptpad online form and read the responses of other participants. You can also scribble notes for yourself down below.

The link for the online CryptPad is shown both via QR code and as a written-out link: <https://cryptpad.fr/form/#/2/form/view/fi6xCq-6oxrShodCey79HkTpTEZUIHDzwa-GnHdeufg/>. In addition, there are five straight lines offered for taking notes.

The zine closes with the last lines of page one, giving credit to the contributors Sandra Abels, Leman Çelik, Stefan Laser, Estrid Sørensen, and the artwork by Lynn Werner, plus the logos of the Ruhr-University Bochum, the CRC 1567, “Virtual Lifeworlds,” and the website of the CRC in the middle of the bottom row: [https://www.SFB.1567.ruhr-uni-bochum.de](https://www.SFB.1567.ruhr-uni-bochum.de/).

**Title: Re-indigenise Re-generate Computing**

By: Samuel Mann of Otago Polytechnic and Mawera Karetai of the University of Otago.

Contents:

Computing and Colonisation are inherently intertwined

Re-tell Indigenous stories as computing stories

Productive possibilities of difference.

[Image description: this is a three-page visual, in a comic book style. The characters are hand-drawn stick figures with rectangularish torsos. The characters representing colonisers have square heads, while the colonised people have round heads. The colonisers are blue, and this colour is used to highlight colonising relationships with splatter and arrows.]

**Page 1: Computing and Colonisation are inherently intertwined**

The title is presented in a large comic font, with the “Re” spanning both “indigenise” and “generate” before coming back together for “computing”.

The page is arranged in two unframed columns. The left column is headed “Structural Colonisation”, and the right is headed “Technological Colonisation”.

The top left is a tableau of a round-head and a square-head signing a treaty on a desk - this scene is styled on paintings of the signing of New Zealand’s Tiriti o Waitangi or Treaty of Waitangi. There is a tall flagpole with a large flag with a blue square. The round-head is holding a taonga or treasure. They have a thought bubble showing maramataka or the phases of the moon. The square-head is holding a musket. Their thought bubble shows a table of information (it was intended as a calendar - but got too small).

Below the Tiriti-signing scene, an arrow from the square-head side leads to a scene where two square-heads dance on an elevated rectangular platform reminiscent of the table in the thought bubble. A round-head is trying unsuccessfully to climb onto the platform, while another dejectedly sits on the ground. The text reads “Structures to benefit of colonisers’ system”.

Below that scene, two round-heads carry a square-head on a raised sedan chair whose design can only carry squares. The text reads “Physical world of inherited bias and unconscious racism”.

At the top of the right hand “Technological Colonisation” column, some text reads “assumption that solutions only come from the centre”. A blue square is surrounded by another blue square containing some small squares. Some small circles are outside this box. An arrow comes from the centre of the box, curving down towards the next element.

A conveyor belt with a square machine in the middle takes in different shapes - a circle, triangle, and flower - and outputs square blue boxes. The machine is connected by arrows to the square-head’s thought bubble (from the Tiriti scene), and from the centre box of the centre/periphery element above. At the end of the conveyor belt, a square-smiling square-head holds up a rectangle (ie phone) displaying an image of a square-smiling square-head. The text reads “Technological imposition of universal logic and encoded solutions. An arrow labeled “supports” leads from this to the dancing square-heads on the square structure in the left column.

Beneath the conveyor element is a square-head holding a flag with a blue square. Text reads “computing profession” in a square font.

Arrows lead from the two columns to the centre of the lower third of the page. There, a round-frowning round-head holds up a phone displaying a square-smiling square-head. On the left, a speech bubble contains “F\*\*k this bro”. On the right, a speech bubble reads “The apparent lack of values does not mean technology is benign, rather, we have come to presume that efficiency, speed, and productivity are values that match societal aspirations”.

**Page 2: Re-tell Indigenous stories as computing stories**

The text “Re-tell Indigenous stories as computing stories” is in a large comic font.

The page is divided into the top two-thirds and a lower section. The top section contains an offset central rectangle with a curled corner - meant to represent a page from a comic within this comic (if it’s good enough for Shakespeare…!). It has a large number “1”. Around that central box are some characters, each with speech bubbles and a heading. Snaking around all that is a bolded sentence, starting with a large number “2”.

The number one at the top of the central page has the text “Listen”. The central comic page is divided into four frames. In each frame, characters are in a mini-scene with speech bubbles. The frames are independent.

Top left: A car, front on, shows a round-head teaching a smaller round-head to drive. There is an “L-plate”. The text reads “Most important lesson as a round-head how to behave when the cops pull you over”.

Top right: A round-head. The text reads “Massively underrepresented in every profession, but every positive action is seen as a racist threat”.

Lower left: Four round-head characters representing an intergenerational whanau (family). The text reads “Our mortgage was rejected b’cos the bank doesn’t allow collective ownership”.

Lower right: A round-head is being searched by square-head security. The text reads “My colleagues sail through, but I get searched, every airport”.

Snaking clockwise right around the central element, heading text reads “2. Write a computing person into the story to change the outcome for positive. Do this several times for different actors, different places in the story, and addressing different loci of impact”.  A small arrow leads from this to the next set of elements between the snaked words and the central element.

Clockwise are seven sets of figures representing loci of impact, each with a speech bubble and a heading.

12 o’clock: A square-head says “It’s the law”. The heading reads “Structural and systematic”.

1 o’clock: A square-head sitting on the central page says “We’ve always done it this way”. The heading reads “Institutional”.

3 o’clock: A square-head has two speech bubbles. The first says “There’s not a category for that”. The second is “The textbook example is for a Seattle Coffee Shop. Makes sense to follow that…”. The heading reads “Symbolic”.

6 o’clock: (upside down) A square-head hanging off the central page says “Our only concern is for efficiency”. The heading reads “Ideological”.

7 o’clock: (twist your head!). A square-head says “Your sort of people clearly don’t understand”. The heading reads “Interpersonal”.

9 o’clock: A round-head is standing on another round-head’s shoulders. The top round-head is wearing square glasses and says “We just need to fit in”. The heading is “Internalised”.

11 o’clock: A dejected round-head says ”I must be bad”. The heading is “Embodied”.

In the lower third of the page, there is a representation of a green mountain and a river. On the right, a box with spiralled edges reads “Atamai Iahiko”. Text on the left reads “If rivers and mountains are people, what possibilities are opened up for AI by a non-western view of sentience?” and the name “Karaitiana Taiuru”.

**Page 3: Productive possibilities of difference.**

A blue ribbon enters at the top of the page but twists and refracts into five earthy hues which cascade down the page filling the lower half. The centre of the page contains a large circle, with a series of expanding arrows stemming from the centre. There are two rings of characters (all round-head) in an inner ring and an outer ring, each pair on a radial arrow. Around the circumference of the circle, each arrow points to its label.

The arrow represents a transformation that can be read using the device familiar from the Agile Manifesto. For example: “In order to benefit from productive possibilities of difference we value socioecological regeneration over solely economic justification” (Note it doesn’t explicitly state this on the image). The outer ring represents the goal, and the inner ring is the weaker position.

Clockwise from the top:

Socioecological regeneration. Goal: figures of house, family, wind turbine, tree. Weak: Money.

Transformative system change. Goal: a tiny person with a long lever moving a representation of system (some cogs). Weak: Graph flatlining or decreasing.

Holistic perspectives. Goal: eye looking at the globe. Weak: Eye looking at single point.

Inclusive equity. Goal: Group people are drawn differently (one in a wheelchair). Weak: Small group all the same.

Respectful and collective. Goal: Small groups of people and trees, connected inside an amoeba. Weak: Individuals and a pair with walls between them.

Action-based. Goal: A figure stands atop a small hill, holding a flag. Weak: A figure in a box covers their eyes and ears to hide external forces.

Values-based change. Goal: A smiling figure with a red heart. Weak: A figure is pushing another forward.

Engaging Empowerment. Goal: A group of people, one is holding a spade, another a ladder. Weak: A helicopter dangles a package.

Living positive futures. Goal: Two people, happy. One presents the other with a flower. Weak: A person is overcome with negative feelings.

Humility and desire to learn. Goal: A person looking around, curious. Weak: A book, locked with a chain.

Beneath the circle is a rectangle representing a professional framework of practice. There are ten components, each with a drawn element and a label. The bottom-right corner of the rectangle is extended into a spiral as if the prow of a waka (boat). On that prow stands a character (round-head) waving a flag.

To the left of the framework of practice, the text reads “Capture these positive skills, behaviours, and mindsets to describe a new framework of practice for regenerative, re-indigenised computing”.

Elements of the framework of practice:

System. A person with input and output arrows.

Why. A question mark.

Scope. A person in a box with arrows in and out.

Network. A person with a network of arms.

How. A person lifts the globe with a rope and pulley.

Skills. A larger square containing “Competency” and “Capability” at the top and bottom, and “Transferrable” and “Specific” vertically on the sides. In the middle are a person with a clipboard (a skill - competency) and two people (doing a job in a difficult context - a capability).

Mindset. A cloud/brain.

Quality. A magnifying glass.

Future. A representation of backcasting - a circle with an arrow to a future state, with smaller arrows stepping back.

Underpinning. “Regeneration” is shown by a leaf; “Ethics” by a person with a balance scale, and “Culture” by a heart. All have a small staircase representing a maturity model.

**Title:** Climate Catastrophe, a Resource Guide for Computer Science

**Author names:** Patrice Reynolds, Jon Crescenzo, Bedour Alshaigy & Ian Pollock

**Notice:** No plain text version provided

**How we put together a zine (and timeline)**

If you’re thinking about compiling your own zine, here's an overview of how we put together the zine and the rough timeline, from call to conference.

* [23 weeks from the conference] Organize, scheme and make plans for the process
* [20 weeks from conference] Put out a call for contributions, asking for short pitches from contributors, with a title and short abstract (500 words max)
* [16 weeks from conference] Deadline for submitting pitches
  + We had a rolling submission and acceptance window, looking at and accepting/rejecting pitches as they came in
* [15 weeks from conference] Do a final review of all remaining pitches and send out notification emails, inviting authors to craft their submission
* [10-8 weeks from conference] Got together in three zine circles
  + Opportunity for peer feedback and to share ideas and information about the zine and how it was developing
* [7 weeks from conference] Find a friendly printer, or decide to print it yourself
* [5 weeks from conference] Final deadline for Zine contributions
* [4-2 weeks from conference] Compile contributions for printing (we used InDesign)
  + We offered 6 pages for each contribution, we think we would offer fewer pages in the future, 10 of 14 contributors used all pages
* [2 weeks from conference] Print the proofs
* [1 week from conference] Final Printing Run
* [Post-conference] Upload digital version of zine + plain text version to a stable, free online repository

**Printing details:**

* Stapled binding with a squared back
* Paper for cover -> 160g multicopy, matte
* Paper inside -> 100g multicopy
* Printed in colour

**Our values when curating the zine:**

* Include contributors at every decision that impacts the look and feel of their contribution
* Keep it simple, Do it yourself.
* Send contributors a copy
* Share it widely and freely