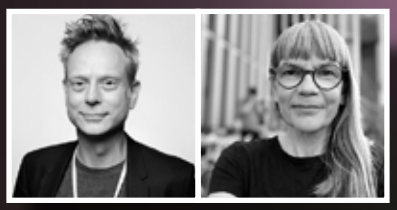
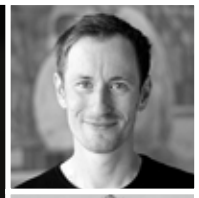
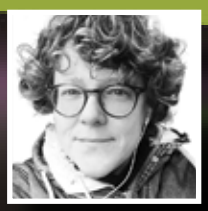
GENERATIVE THINGS

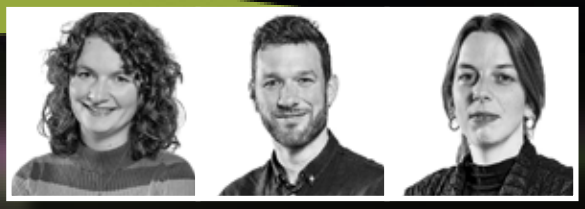
The State of Responsible Tech 2025

THINGS









Invisibility is not neutrality.

(Karola Köpferl, Albrecht Kurze)

ThingsCon Report:
The State of Responsible Technology 2025

Published by Stichting ThingsCon Amsterdam, June 2025
Curation, editing, design: Andrea Krajewski, Iskander Smit

This text is meant for sharing.

This means you can:

- Share — copy and redistribute the material in any medium or format
- Adapt — remix, transform, and build upon the material
- All You Have to Do Is to Follow this Terms:
- Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
- NonCommercial — You may not use the material for commercial purposes.
- ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.

Stichting ThingsCon Amsterdam
Silodam 366
1013AW Amsterdam
The Netherlands

More about ThingsCon: https://thingscon.org

Note: The portrait images are AI-generated based on the original images as an experiment thematically inspired by ‘Generative Things’. They were created with Chat GPT 4o. Prompt: “Black and white vector illustration, full portrait: head, hair, shoulders, arms visible, strong lines, clear contrast, white background, white clothing, format: 50 × 75 mm, 300 dpi (printable)”. The results may not correspond to the original. The designers apologise for the AI.

Preface

Andrea Krajewski
Iskander Smit

Generative Things

„These miraculous machines!
Do we shape them?
Or do they shape us?
Or reshape us from our decent, far designs?
But we are learning.
We are learning to build for the future
From the ground up.“

(Russell Lord (1948 August 7). The Ground from Under Your Feet, in: The Saturday Review, Saturday Review Associates, New York)

Welcome to Anthropocene

Since the first Industrial Revolution 300 years ago, humanity has reshaped both our environment and our self-image through technology. This marked the beginning of the Anthropocene, an era in which humans have become one of the most significant factors influencing Earth's processes. Our relationship with technology has evolved from being integral parts of nature to positioning ourselves as its rulers and creators.

ThingsCon has been critically monitoring technological developments since 2014, advocating for responsible engagement with emerging technologies across all disciplines. With our 2024 theme "Generative Things," we acknowledge the reality of AI's integration into our physical lives while refusing to accept this as a foregone conclusion dictated by large corporations. Instead, we roll up our sleeves to face these challenges as responsible actors.
The contributions of the fine range of authors resulted in an insightful ensemble of aspects that all combine an engaged exploration of potential futures with things with generative capabilities. We are gilded that the theme we introduced for the conference is yielding so many layered insights.

This report is divided into three sections:

POSITIONS on known and emerging challenges in dealing with AI's penetration into our physical world.

METHODS for designers and developers to create positive societal and environmental impact.

PROVOTYPES – speculative prototypical statements by a new generation of designers as provocative visualizations of our future with generative things.

Critical challenges at the intersection of AI and the physical

Our collection of articles examines several critical themes emerging from the proliferation of smart connected things and generative AI. While vendors promise unprecedented comfort, efficiency, and security, beneath seamless interfaces lies a complex interplay of opportunities and overlooked implications.

The erosion of human interaction

Technologies focused on efficiency eliminate meaningful processes in favour of outcome-oriented routines. Generative AI often bypasses the creative journey between intention and outcome, losing experiential aspects and potential for ritual formation. In smart cities, automated systems designed for control can eliminate human judgment and reduce trust in institutions, prioritizing efficiency over empathy.

Privacy and surveillance concerns

Even simple sensor data in smart environments can have problematic applications. This "lateral surveillance" affects everyone, including less tech-savvy individuals, children, and the elderly. Seemingly harmless sensor data becomes big data over time, revealing patterns about presence, activities, and health conditions—risks not as widely recognized as those associated with cameras or microphones.

Homogenization of creativity

The concept of "generativity" dominated by large data sets can lead to a "creative monoculture" and "model collapse," making it difficult to distinguish between truth and fiction. The tools we create reshape our fundamental humanity.

The dominance of Big Tech

The dependence on vast amounts of data, compute power, and specialized labor consolidates power among a small number of large companies. This hegemony limits how intelligent objects function while prioritizing profit and data extraction, often commodifying previously non-monetized social activities.

Reimagining the designer's role

Designers bear crucial responsibility in developing intelligent technologies that serve human values and social needs beyond efficiency and automation. This evolving role requires a shift in thinking:

- Beyond Human-Centered Design: Embracing More-Than-Human Design to account for complex entanglements between humans, technology, and the environment
- Critical and Speculative Approaches: Using speculative design, critical making, and media archaeology to question dominant narratives of technological progress
- Reintroducing Friction: Challenging efficiency as the ultimate goal by deliberately introducing slowness and materiality to make AI processes tangible and open to inquiry
- Systemic Thinking: Understanding complex dynamics across distributed value chains and designing for collectivity rather than individual interests

- Participatory Methods: Involving diverse stakeholders to incorporate multiple perspectives while promoting transparency and community control
- Regenerative Design: Considering ecological limits and promoting sustainable practices that benefit the broader ecosystem

This collection invites readers to critically engage with the technologies shaping our world. It encourages a shift from passive consumption to active inquiry, from focusing solely on efficiency to considering relational intelligence and ethical implications, and from individualistic approaches to collective perspectives. By highlighting blind spots, exploring alternative forms of generativeness, embracing more-than-human viewpoints, and leveraging critical perspectives, we contribute to a vital conversation about shaping a future where technology serves broader societal and ecological well-being.

We are reminded that technology is made, and thus, it can be remade.

Greetings from the Editors

We would like to thank all our wonderful authors for this issue.
It gives us a glimmer of hope that there are people who take a critical look at such life-changing technology and don't just see it as the next big deal.

Iskander Smit, is the founder and chair of the Cities of Things Foundation, a research program that started at TU Delft, where he was a visiting professor. It now serves as an independent knowledge platform in cooperation with academic partners and industry.
Iskander is deeply involved in exploring the relationship between human and machine intelligence from a design perspective. He founded Target is New and is a curator and board member of ThingsCon.
Prior to this, he held positions in strategy and innovation and was involved in various technology initiatives and events as an organizer and public speaker.

Andrea Krajewski, is designer and professor for the Design of Interactive Media Systems at the University of Applied Sciences Darmstadt. Here she established the interdisciplinary study course Interactive Media Design, the UX-Lab and the THINGS-Lab. She is currently involved in research on manipulative design patterns in digital products. Andrea is on the board of IMD-F, a non-profit association for the promotion of research and teaching in the field of interactive media for the future and she is member of the RDÖ (Rat für digitale Ökologie) a German thinktank for a fair digital transformation.

Contents

Methods

Provotypes

POSITIONS

Things in life
Urban perspectives
AI and society
More than human

Things in life

Machines, AI and the past//future of things

Karola Köpferl
Albrecht Kurze

This essay explores a techno-artistic experiment that reanimates a 1980s East German typewriter using a contemporary AI language model. Situated at the intersection of media archaeology and speculative design, the project questions dominant narratives of progress by embedding generative AI in an obsolete, tactile interface. Through public exhibitions and aesthetic intervention, we demonstrate how slowness, friction, and material render artificial intelligence not only visible but open to critical inquiry. Drawing on concepts such as zombie media, technostalgia, and speculative design, we argue that reappropriating outdated technologies enables new forms of critical engagement. Erika—the AI-enabled typewriter—functions as both interface and interruption, making space for reflection, irony, and cultural memory. In a moment of accelerated digital abstraction, projects like this foreground the value of deliberate slowness, experiential materiality, and historical depth. We conclude by advocating for a historicist design sensibility that challenges presentism and reorients human-machine interaction toward alternative, perceived futures

Introduction

How does our relationship with technology change when artificial intelligence speaks through machines long deemed obsolete? This essay recounts a techno-artistic experiment that connects an East German GDR-era typewriter with a contemporary language model, opening up unexpected questions around trust, materiality, and the future of communication. At the intersection of human-computer interaction and critical media studies, the project demonstrates how hacking can serve as a method of critical engagement—rendering Artificial Intelligence not just visible but materially experiential. We trace how this interaction unfolds and what it reveals about our entanglements with machines, both past and future.
Our argument: the appropriation, misuse, and reinterpretation of outdated technologies is more than an artistic strategy. It is a way to question dominant narratives of technological progress, to re-materialize digital processes, and to provoke public discourse around the ethics and societal implications of AI. From the printing press to neural networks, the history of information technologies is one of ever-accelerating transformation. Large Language Models (LLMs) like ChatGPT now generate fluent text from minimal prompts in seconds—yet for most, their workings remain opaque (Heaven 2023; Perlman 2022).

The speed of thought and the slowness of keys

The rise of generative AI has fundamentally transformed how we write, think, and communicate—often producing outputs faster than users can deliberate. Interfaces have become frictionless, minimal, spectral. In this environment, it is easy to forget that these systems have mechanisms, constraints, and cultural histories. They speak, but invisibly.

Our project set out to slow down these processes—not to resist technological development, but to encounter it differently. We wanted to feel AI working, not just consume its output. So we connected a 1980s East German typewriter—Erika S3004—to a large language model. The result was a conversation machine in which each word emerged with delay, rhythm, and mechanical echo. Erika made thinking tangible (Köpferl & Kurze 2024). The machine itself was never meant for this. Designed by VEB Robotron/Optima in the GDR in the mid-1980s, Erika was a bureaucratic tool: equipped with a daisy wheel, memory function, and correction key. Practical, efficient, unsentimental. And yet, decades later, it became the voice of a neural network.

Figure 1: Erika connected to a LLM

The transformation was as much media archaeology as microelectronics. Using the typewriter's original serial port—once intended for printer use—we routed typed prompts through a WiFi-enabled ESP32 microcontroller to language models like ChatGPT and Mistral. The responses were printed back onto the same paper, character by character (Wahl 2023). There is no screen and no delete or backspace functionality. What emerged is a hybrid machine: the mechanical body of late socialism animated by a post-digital ghost. This retrofit demanded more than clever wiring. Erika's 8-bit character set had to be decoded, mapped to Unicode, and reversed on output. Each input is limited to a single line. Each output arrives with the audible cadence of ribbon and ink—each letter a physical trace, not a collection of pixels. In public exhibitions, over 1,200 people have already sat down with Erika. Some had never touched a typewriter before; others hadn't in decades. They laid their fingers on the plastic keys of a device produced before German reunification and asked questions to an AI system hosted remotely. Many expected novelty. What they found was an aura—both familiar and strange. Mechanical choreography. Unexpected emotion. Some typed slowly, savoring the clicks. Others probed the AI with philosophical or playful questions: "Are you a ghost?" "What is the meaning of life?" "Can machines dream?" They waited minutes for a response—watching the answer unfold as if summoned, not computed. One visitor captured the mood best: "You can hear it think" (Köpferl & Kurze 2024).

The experience is not just aesthetic. By reintroducing latency and sound, the Erika typewriter renders the invisible logic of AI audible, tangible, and interruptible. Without screens or touch interfaces, there was no scrolling, no multitasking—only presence. This presence was not just attention—it emerged from the friction of delayed feedback, the physical accumulation of paper, and the palpable weight of each interaction. Unlike ephemeral digital interfaces where data vanishes from view, Erika materialized memory and demanded selective, deliberate engagement. The machine reclaimed space for doubt, curiosity, and irony. It invited people not only to ask what the machine says, but how and why it speaks at all. In this sense, Erika became a conversation piece in both meanings of the term: a medium for dialogue, and a catalyst for discussion. It refused the seamlessness of contemporary optimization and exposed instead a textured, resistant surface—a surface we could hear, touch, and wait for. By slowing down the fast, we made it visible.

Hacking as method: questioning technology

At the core of the Erika project lies a deliberate act of misalignment. A typewriter was never meant to respond. Yet through wires and code, Erika became the physical voice of a disembodied AI. This tension—between form and function, past and future—is not a glitch. It is a principle. In this context, hacking becomes a mode of inquiry. Not simply the modification of hardware or writing of code but an epistemological stance: to make systems open—technically, culturally, and conceptually. To ask: What happens when machines are taken out of context, repurposed, made to perform outside their original design?

This approach draws from traditions in critical making (Ratto 2011), speculative design (Dunne & Raby 2013), and media archaeology (Parikka 2012). As Soro et al. (2019) argue, we must not only design the future but also "design the past"—treating history itself as malleable design material. Erika exemplifies this ethos: hacking becomes a means to resurface forgotten functionalities, to create friction, and to situate the digital within new historical trajectories. In this sense, Erika is not only an interface anymore—it is a deliberate irritation.

Hertz and Parikka (2012) offer the concept of zombie media: technologies resurrected not to return nostalgically to their former use, but to haunt the present with unresolved tensions. These machines are not restored—they are repurposed as means of critique. In this framework, soldering wires, decoding obsolete character sets, and rerouting I/O becomes theory production through circuitry.
At exhibitions, Erika sparked curiosity not only about AI but about how it works, and how it can be implemented differently. Visitors peeked inside, asked about the firmware, and speculated on building their own. In that moment, hacking functioned as both installation and invitation—a transparent counterpoint to increasingly opaque AI infrastructures.

But Erika is not the limit of this approach. Once the principle of retrofitting obsolete machines with AI became tangible, new speculative questions emerged: What other devices might we reanimate? Imagine a rotary phone—not wired to a switchboard, but to a synthetic voice model. You dial, and instead of hearing a friend, you talk to an AI that answers in the cadence of old conversations (Pollux Labs 2024). It replies with fragments of past dialogues, or hallucinated memories assembled from training data. This is not nostalgia—it is a simulation of that feeling. Or consider a VCR that plays back scenes from a past that never happened: AI-generated footage based on historically plausible prompts. The screen glows with manufactured memory, somewhere between retro-futurism and deep-fake melancholy. Or a Polaroid camera that prints instant photos of non-events—images imagined by a machine, triggered by keywords rather than light.

These speculative machines operate on a double register. They are playful and uncanny, comforting and disorienting. Their physical interface—a dial, a tape, a button—grounds the interaction in the past. But the intelligence behind it floats free, trained on datasets that abstract fragments of history without preserving historical con-

tinuity. Users are caught between presence and illusion, between authentic tactility and synthetic response. These fictions are not about machines. They are about us:

- How do we perceive time?
- Whose memories are we reconstructing?
- What do we trust when everything feels real?

Such hybrids extend the Erika project's core questions: What happens when AI becomes slow, noisy, material—and uncanny? They allow us to explore how trust, temporality, and embodiment are reshaped by interfaces that blur memory and fiction.

Technostalgia as critique

At first glance, nostalgia appears to be the enemy of innovation—a sentimental retreat into the past that risks idealization and stasis. Our project suggests a different reading. In the case of Erika, nostalgia did not restore the old—it disrupted the new. Campopiano (2014:77) defines technostalgia as a sentimental or aesthetic attachment to obsolete technologies. As Campopiano (2014:76) observes, technostalgia—our fondness for outdated technology—is not necessarily regressive. It can be a critical tool. When past machines are reanimated with present functions, they do not merely return—they interfere. They unsettle. This interference not only disrupts contemporary AI but also reconfigures our understanding of the original artifact, altering its cultural meanings through integration into new practices. They show us what we might have overlooked in the sleekness of the now. Rather than conceal AI behind smooth UX, these speculative machines reframe it. They make the future feelable—and ask whether we are ready to live with its ghosts.

But in our case, it became more than a feeling: it became a method. Technostalgia operated as a form of defamiliarization—a lens through which AI became strange, embodied, and open to inquiry. Erika was not designed to look retro. It simply was: loud, mechanical, resistant to the smoothness of contemporary interaction. And in that material friction, it produced irritation—and attention.

This unsettling effect is key to technostalgia's critical potential. When a neural network speaks through a GDR-era typewriter, the result is not just dialogue—it is temporal dissonance. A friction between planned economies and platform capitalism, between analogue bureaucracy and algorithmic logic. In such encounters, participants do not only ask what the machine says, but what it means that it says anything at all. In this sense, nostalgia becomes a vehicle for critique. Alizadeh et al. (2022:2) argue that outdated technologies, when reactivated, can prompt reflection and turn memory into "design material." Erika's form, its slowness, its noise—all became aesthetic signals that recontextualized AI, inviting speculation and irony instead of mere awe.
Visitors did not simply use Erika. They speculated with and about it. They asked:

- Are you haunted?
- Can machines dream?
- Do you remember?

These were not functional questions. They were ontological ones,

triggered not by the intelligence of the model, but by the constraints and aura of the interface itself. As Odom et al. (2012:816) suggest, material friction can deepen engagement and foster critical awareness. Technostalgia, in this way, becomes an active disruption.
It reframes AI not as seamless innovation but as contested terrain—where form matters, where history lingers. Erika's materiality, its GDR-industrial shell, represents more than retro aesthetics. It evokes histories of control, collectivity, and latency.

Soden et al. (2021:459) argue for a historicist sensibility—one that resists "presentism" and insists on contextualizing technology within longer arcs of change. Erika embodies this principle. It refuses the clean line of progress, insisting that the past is not dead but still present, folded into every keystroke. Nostalgia, as Dang et al. (2023:1000) note, is ambivalent. It can inhibit innovation when it becomes mere longing—but it can also promote it, by grounding speculative futures in collective memory. Erika enacts this tension. Its voice leans toward tomorrow, its body holds onto yesterday. In that contradiction lies its power.

Rather than idealize the past, technostalgia as critique renders the present strange. It poses a series of questions: What kind of machines do we want? What futures do we recall? And what must we remember, in order to imagine otherwise.

Conclusion: the next decade of things

As generative AI increasingly integrates into everyday life—hidden within seamless interfaces, background processes, and voice assistants—it risks becoming imperceptible. Its very ubiquity renders it opaque. Yet invisibility is not neutrality. The smoothness of AI conceals the social, historical, and material conditions of its emergence.

Projects like Erika disrupt this trajectory. They do not seek to replace the future with the past, but to intervene in the present—to make visible what has become hidden, and to open to critical inquiry what is taken for granted. By embedding AI in a slow, noisy, obsolete device, we reframed it not as a tool, but as a conversation. Not as convenience, but as provocation.

Soro et al. (2019) describe designing the past as an act of imaginative reappropriation: a way to use memory as material, and history as a horizon. In this sense, Erika is not merely retro. It is recursive. It allows us to revisit the evolving notion of intelligent machines with a different tempo, one keystroke at a time.
Nostalgia can both hinder and enable innovation. Its ambivalence is not a flaw but a latent opportunity. Erika activates that potential. In the click of its keys, in the hum of its motor, and in the permanence of ink on paper, we rediscover not only what we have left behind—but what remains worth carrying forward.

Perhaps the most radical interfaces will not be those that are most efficient, but rather those that slow us down, make us wait, and demand that we listen. Perhaps the next decade of "things" will not be defined by novelty, but by recognition.

Acknowledgements

This research was supported by the Junior Professorship of Sociology with Specialization in Technology and the AI Lab of Chemnitz University of Technology. We also thank the Chaostreff Chemnitz and its members for their technical support and encouragement. In realizing this project, we built upon the work of the Open Source and maker community, whose resources provided the foundation for our technical implementation. In particular, we relied on community-digitized documentation of historical East German office and computing technologies, which enabled us to design a system suitable for continuous public use and adaptable to new large language models as they emerged.

References

Alizadeh, F., Mniestri, A., Uhde, A., & Stevens, G. (2022). On appropriation and nostalgic reminiscence of technology. In Proceedings of the CHI Conference on Human Factors in Computing Systems Extended Abstracts (pp. 1–6). ACM. https://doi.org/10.1145/3491101.3519676

Campopiano, J. (2014). Memory, temporality, & manifestations of our technostalgia. Preservation Digital Technology & Culture, July 2014. https://doi.org/10.1515/pdtc-2014-0004

Dang, J., Sedikides, C., Wildschut, T., & Liu, L. (2024). More than a barrier: Nostalgia inhibits, but also promotes, favorable responses to innovative technology. Journal of Personality and Social Psychology, 126(6), 998–1018. https://doi.org/10.1037/pspa0000368

Dunne, A., & Raby, F. (2013). Speculative everything: Design, fiction, and social dreaming. MIT Press. https://doi.org/10.1093/jdh/epv001

Heaven, W. D. (2023). Artificial intelligence: ChatGPT is everywhere. Here's where it came from. MIT Technology Review. https://www.technologyreview.com/2023/02/08/1068068/chatgpt-is-everywhere-heres-where-it-came-from/

Hertz, G., & Parikka, J. (2012). Zombie media: Circuit bending media archaeology into an art method. Leonardo, 45(5), 424–430. https://doi.org/10.1162/LEON_a_00438

Odom, W., Zimmerman, J., & Forlizzi, J. (2012). Material representations: Expanding interaction design research methods. In Proceedings of the Designing Interactive Systems Conference (DIS 2012) (pp. 599–608). ACM. https://doi.org/10.1145/2317956.2318044

Perlman, A. (2022). The implications of ChatGPT for legal services and society. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4294197

Pollux Labs. (2024). ChatGPT im Telefon – ein Retro-Sprachassistent. Pollux Labs. https://polluxlabs.net/raspberry-pi-projekte/chatgpt-im-telefon-ein-retro-sprachassistent

Ratto, M. (2011). Critical making: Conceptual and material studies in technology and social life. The Information Society, 27(4), 252–260. https://doi.org/10.1080/01972243.2011.583819

Soden, R., Ribes, D., Avle, S., & Sutherland, W. (2021). Time for historicism in CSCW: An invitation. Proceedings of the ACM on Human-Computer Interaction, 5(CSCW2), Article 459. https://doi.org/10.1145/3479603

Soro, A., Taylor, J. L., & Brereton, M. (2019). Designing the past. In Proceedings of the CHI Conference on Human Factors in Computing Systems Extended Abstracts (pp. 1–10). ACM. https://doi.org/10.1145/3290607.3310424

Wahl, D. (2023). KI-Projekt: ChatGPT auf einer Schreibmaschine mit ESP32 umsetzen. Heise Make Magazin, 2, 28–32. https://www.heise.de/ratgeber/KI-Projekt-ChatGPT-auf-einer-Schreibmaschine-mit-ESP32-umsetzen-7545547.html

Karola Köpferl is a certified social worker and doctoral candidate. She focuses on the use of smart technologies by older people in everyday life. Her research interests lie in qualitative, participatory and interdisciplinary approaches. Her role is best understood as a hacker and an intermediator between the social sciences and computer science. Karola is particularly interested in questions related to the Internet of (Every)Thing, hacking and the mediation of digitalisation issues, including artificial intelligence and privacy. Karola was born in Chemnitz in the last months of the former GDR. She is #First Generation in academia.

Albrecht Kurze is a post-doctoral researcher at the chair Media Informatics at TU Chemnitz and one of the principal investigators in Simplications and Bitplush. With a background in computer science his research interests are on the intersection of Ubiquitous HCI and human centered IoT: How do sensors, data and connectedness in smart products and environments allow for new interactions and innovation and how do we cope with the implications that they create, i.e. for privacy in the home. Albrecht has co-hosted several workshops at previous Things editions.

Things in life

The effect of things on our everyday rituals

Omar JW Heuves

Every morning, I wake up in my inconveniently spaced apartment. My bed - wedged into my kitchen - stares directly at my coffee machine. I get up, turn on the coffee grinder, and as the smell fills my apartment I begin my coffee ritual. This moment is slow, deliberate, and familiar. But what would change if I had a fully automatic coffee machine? Would my coffee practice hold the same value if the process disappeared?

Technological innovations are frequently examined through the lens of societal impact - how they shape our behaviors, structures, and collective values. But their influence also reaches into the most personal layers of our lives: our routines, our practices, and our rituals. In this article, I explore how everyday technologies, from coffee machines to embroidery tools and generative AI, have historically and presently reshaped the rituals that give meaning to our lives.

Routines, practices, and rituals

Let me first and foremost define some terms that I'll use repeatedly throughout this article; Routines, Practices, and Rituals.
A routine is an established pattern of doing, a certain way of performing certain actions. A practice is a type of routine that in an everyday setting has meaning, materials, and competences (Shove et al., 2012). In the example of making coffee, my routine is to wake up and make a cup of coffee. But my practice consists of more; competences are my 'know-how' or skills to make the coffee, the materials are the coffee maker, coffee, and cup, and the meaning is the value assigned to the coffee.

Where the meaning of a practice is often collective (e.g. coffee as a cultural phenomenon), the meaning of a routine can also be personal (Bell, 1992). A ritual is a type of practice, in which the meaning emerges through the experience (Levy, 2015). You could therefore call my coffee practice a coffee ritual, since the value that I assign to it - joy - arises through the act of making the coffee.

These practices can be viewed as the basic building blocks of social life (Schatzki, 2002), as our day-to-day life consists of a series of connected routines, rituals and practices structuring our everyday life. Similarly to Lèvy, I consider the difference between routines and rituals to be the way someone assigns value to it. Routines draw their value from the end result (e.g. a cup of coffee) and often their efficiency in reaching this, whereas rituals draw their value from the process of creating this end result (Lèvy, 2015). Using these definitions, I consider rituals to be the practices that bring meaning to our lives, and routines their counterparts to only add value for their efficiency and end result.

How technology transformed practices

Continuing with the example of brewing coffee at home, a significant technological innovation in this practice was the introduction of fully automated or 'bean-to-cup' machines. The first fully automatic home espresso machine, the Superautomatica, was introduced by the Swiss company Solis in the late 1980s, and the technology was soon popularized by manufacturers like Jura and Saeco in the early 1990s (Pendergrast, 2010). These machines consolidated the coffee brewing process, and replaced the different competences needed (e.g. grinding the coffee, tamping coffee grounds, and frothing milk) into a single press of a button.

Before the introduction of these machines, people who wanted to brew coffee at home needed to build the skills - the competences - of the practice up at home. The constant exposure to this practice allowed people to discover if they held any personal value to the practice - it held the potential to build a ritual, and thus meaning. As automated machines became more widespread, the competences required to manually brew coffee declined. This shift reduced not only the skill-based engagement with the materials but also the opportunity for these coffee practices to be experienced as rituals.

A similar shift of ritual to routine can be observed in the industrialization of embroidery. During the 18th and 19th centuries, embroidery was a common part of girls' education (Parsons, 2014), creating many people that had the competences in the practice of embroidery. This allowed embroidery to have a very strong potential for ritual building, as it allowed enough contact for practitioners to start finding meaning in the experience of making.

With the rise of industrial textile manufacturing and the introduction of embroidery machines in the mid-19th century (Gordon, 2009), the competences required to produce intricate designs declined dramatically. Embroidery machines could replicate complex patterns with speed and precision, shifting the focus toward output and efficiency. When viewing the output of embroidery as a commodity, this development is perceived as progress.

However, the widespread availability of cheaper, machine-embroidered goods reduced the need for domestic embroidery, and with it, the potential for individual ritual creation. An interesting point within the practice of embroidery is that hand-made pieces are often considered more valuable than machine-made pieces. This initially seems to deviate from the intention of routines - as their goal is the end result - however, the trade-off for efficiency and affordability fits within the logic of routines.

In both of these examples the adoption of new efficiency-oriented technologies contributed to a decline in potential to form a ritual through a practice. These technologies therefore facilitated a shift from meaningful, process-oriented rituals toward streamlined, result-oriented routines, and thus to a decline of meaning in daily life.

Generative AI and practices

One of the most relevant technological shifts shaping our ways of doing, is the rapid rise and adaptation of generative technologies. Generative artificial intelligence (AI), as defined by MIT, refers to machine-learning systems that are trained to create new data rather than simply make predictions (MIT News, 2023). These systems analyse existing data patterns and generate new outputs that resemble what they were trained on, whether it is text, images, audio, or code. What makes this technological shift intriguing in the sense of practices, rituals and routines, is not the automation of tasks or the way it makes predictions, but the lack of human engagement in the process of creation. It abolishes the process between stating an intention and the end result; the user only communicates a prompt, and the system generates an outcome with little to no human involvement in between.

If we hypothetically compare this shift to the earlier example of embroidery, generative AI doesn't just provide a more efficient production method. Rather the user can state 'I want an embroidered piece', after which a newly generated pattern will instantly start being embroidered. Bypassing all other aspects of the craft, such as the creativity, design, and history.

This technological innovation represents the shift towards further automation of tasks - and will have huge implications on the way rituals and practices are shaped. Practices, as stated by Shove et al. (2012), are grounded in their competences, materials, and meanings. If competences are now completely outsourced to machines, materials are made invisible - and inexperienced - and meaning is no longer created through engaging in the practice, how will we form our daily rituals?

In this sense, the use of generative AI morphs practices into the most reduced and utilitarian form of routines; it delivers efficient end-result, but removes the experiential aspects of the practice that could offer meaning. In our efficiency prioritizing society, using these types of technologies is attractive, but raises deeper questions; How do we preserve the opportunities for ritual making? And should we allow these systems to infiltrate all our practices, or only those where efficiency genuinely outweighs the potential of rituals?

Using generative AI in our daily rituals

In order to preserve a way to form our daily rituals within the use of generative technology, we need to find a way to keep experiencing the process leading from stating intent to outcome. By reflecting critically on which aspects of a process represent a routine or a ritual for us, we can determine whether the efficiency offered by generative technology is something desired in our process. When we use AI as a replacement of this process, and bypass all human engagement in the process, we lose the experiential aspects of the practice, and through this the potential to form a ritual - to form meaning.

However, when we use generative AI as a material within the practice, we maintain a sense of agency and presence in the process. As Shove et al. (2012) state; practices rely on the interplay of competences, materials and meanings. Generative AI can be a powerful asset in creative and productive processes, but only if we ensure it remains a tool rather than a substitute for experience.

References

Bell, C. (1992). Ritual theory, ritual practice. Oxford University Press.

Gordon, B. (2009). Textiles: The whole story—Uses, meanings, significance. Thames & Hudson.

Levy, P. (2015). Exploring the challenge of designing rituals. Paper presented at 2015 IASDR International Design Research Conference, Brisbane, Australia.

Parsons, S. (2014). Stories behind the Stitches: Schoolgirl Samplers of the Eighteenth and Nineteenth Centuries. Textile History, 45(2), 208–225. https://doi.org/10.1080/14759756.2014.11423347

Pendergrast, M. (2010). Uncommon grounds: The history of coffee and how it transformed our world (Revised ed.). Basic Books.

Schatzki, T. R. (2002). The site of the social: A philosophical account of the constitution of social life and change. Pennsylvania State University Press.

Shove, E., Pantzar, M., & Watson, M. (2012). The dynamics of social practice: Everyday life and how it changes. Sage.

Omar JW Heuves is an independent designer whose work centers on cultural and everyday practices, and their respectful translation across contexts. He explores the interplay between culture, practice, and artefact, each shaping the other. His work often takes the form of artefacts or rituals that reveal the layered meanings embedded in daily life. Omar holds a background in Industrial Design from Eindhoven University of Technology. For his thesis, he designed a coffee set that translates the cultural practices surrounding Turkish coffee across different cultural settings.

Things in life

Smart, simple, sincere - why and how we should rethink connected things in our smart homes

Albrecht Kurze,
Andreas Bischof,
Arne Berger

More and more smart connected things and services turn our homes into smart environments.
They promise comfort, efficiency and security. These devices often integrate simple sensors, e.g. for temperature, light or humidity, etc. However, these smart but yet simple sensors can pose a sincere privacy risk. The sensor data enables sense-making of home attendance, domestic activities and even health conditions, often a fact that neither users nor developers are aware of or do not know how to address. Nevertheless, not all is lost or evil. This article makes a plea for how we, the ThingsCon community, might rethink smart connected things and services in our homes.
We show this in our approaches and research projects that we initiated.

Why we should rethink: the danger of simple sensors

The number of smart things in our homes increases. Vendors promise and users expect comfort, efficiency and security [acatech, 2023]. A networked thermostat in the living room, a motion detector at the front door or a light sensor in the hall - all these devices come with simple sensors that are tiny and integrated into new and also more and more existing household appliances. These sensors collect a wide range of data, such as temperature, humidity or movement, and can automatically adjust the heating in the home when a window is opened for ventilation, for example. However, not only cameras and microphones but also these simple sensors are a potential risk to the privacy in the home [Kurze, 2020].

In what follows, we will show how people misappropriate simple sensor data in their homes to spy on members of their household, and we will show how simple sensor data can be used for connected objects and services that foster emotional connections over distance while making eavesdropping more difficult.

In Western countries such as Germany, there has been an increase in awareness and mistrust of cameras and microphone-based devices and systems. A special case of smart technology is smart toys. In this area, products such as “Hello Barbie” and “My Friend Cayla” have attracted public attention. The latter was banned as an illegal spy device by the Federal Network Agency in Germany in 2017, resulting in them being destroyed and ownership being prohibited. However, the opportunities, dangers and privacy risks posed by simple sensors are not so well understood or prominent in public awareness.

To realize how widespread such simple sensors are, just take a walk through the nearest electronics store: refrigerators with smart thermometers that report to the smart phone when their door is open or smart door locks that record who has come and gone are now part of the standard range. Collecting simple sensor data in your own home has many advantages: it can help to save energy or make your home more comfortable and secure. But what seems harmless at first glance can also put your privacy at risk - more than many people realize.

But where exactly is the maliciousness of these sensors hidden? Simple sensors might create only thin data, but it is also big data in terms of the amount of the data collected over time [Gomez Ortega, 2022]. That data allows for sense-making of attendance at home, domestic activities and even health conditions [Kurze, 2020]. A misuse of this data easily leads to unintended implications, sometimes even to severe implications when used for surveillance purposes.

In a series of studies we gave participants from 27 households our Sensorkit with simple sensors that measure brightness, humidity, temperature and movement etc., as well as a tablet that visualizes the collected data [Kurze, 2020, 2022]. We found numerous cases of problematic uses even after short periods of time, starting with the use of data as evidence in arguments, to quantify things otherwise not objectively measurable, e.g. of wasteful behavior, the use to shame and educate others in the home, and also to surveil each other [Berger, 2023]. The 'garden example' reported in [Kurze, 2020] is such an example. One participant reported: "Well, it was quite funny because [my partner] had been out and he had somehow said: 'I've been in the garden the whole time. And then I laughed and said: 'That can't be true because the front door didn't open again until 17:30. (laughter) And then he said: 'Really? I said: 'What did you do?' - 'I think I lay on the couch for another hour and slept. I say: 'Yes, but you weren't in the garden. And then he asked: 'Have you been watching me?'

It is really astonishing that these problematic uses appear despite no really sophisticated sensors, Artificial Intelligence, cloud, external third party (Big Brother/company) and often not even an evil intent is included [Kurze, 2021b]. Instead, the user just used some learned insights to link the sensor data of a simple motion detector at the front door with knowledge about her partner - and suddenly this sensor data became an instrument of power for lateral surveillance [Richter, 2018]. In addition, the factors mentioned above (AI, cloud, 3rd parties, etc.) can potentially make the situation even worse.

The impact of simple sensors in the home does not just affect those who consciously use them. They can also affect less tech-savvy partners, children of worried parents, elderly people who have sensors installed to look after them remotely, but also anyone else who comes in and out of the home (nannies, visitors, etc.). It becomes even more noticeable when actors outside the home are involved. Landlords can monitor humidity levels in the bathroom with the best

of intentions to prevent mold growth. And yet such simple sensors allow conclusions to be drawn about the type and duration of bathroom use. What's more, the processing of this data sometimes leads to misinterpretations that can have far-reaching consequences, and tracking and data analysis of supposedly simple sensors can still reveal a lot about usage behavior. And this becomes a commodity for the manufacturers themselves: one reason why consumers often have little insight into the data that a device collects about them.

This lack of transparency, not only in relation to the collected data itself, but also about where and by whom it is transmitted and how it is monitored, is at the heart of the problem. To date, there is no transparent information for consumers on this issue, for example in the form of clear information on product packaging, nor are there any safe alternatives for use. As a result, values such as convenience, efficiency and security easily come into conflict with privacy, openness and transparency. 'Well-intentioned' thus easily becomes 'accidentally evil'.

How we might rethink: research approaches and desired outcomes

Even with all due caution, simple sensor data can also be the source for meaningful use cases and material for emotionally valuable smart objects and environments.

We have initiated a number of research projects to find out how we - as a community of academia, practitioners, industry and the public - can surpass the status quo. The most recent projects are Simplications and Bitplush. The *Simplications* project focuses on the impact of sensors on privacy in the home as a smart environment, and the *Bitplush* project explores how smart things in the form of smart, connected plush toys can be used for closeness over distance using simple sensors in a privacy-friendly setting. Both projects are funded by the German Ministry of Education and Research (BMBF, FKZ 16KIS1868K and FKZ 16SV9117).

Thinking beyond technology

In technology development, especially in computer science, and computer science education, we still talk too much about technical advances and too little about the needs of people and the impacts of technologies. When designing and developing for a private space like your own home, this is neither purposeful nor responsible. In an interdisciplinary alliance of sociology, design and computer science in close cooperation with those who will be affected by this technology lies the key to do better and for success. In both projects participatory and co-design approaches help to address relevant needs and concerts right from the beginning. This includes surveys, workshops and field studies with different end-user groups (e.g. school kids, families, communal living). Developers should discuss with future users which smart objects should be placed in the private space of the home and what they are allowed to do there: What values, wishes and needs need to be considered? Based on this, very individual smart objects can be developed. This may lead us away from technical solutions that are easily scalable and efficiently marketable. However, it opens up a space of possibility for better fitting solutions and maybe even idiosyncratic ones.

Uncover, understand and communicate implications

In *Simplications* we continued the series of field studies started in a previous explorative design-driven project [Kurze, 2020]. We generated more insights of the dynamics of how unintended implications emerge and collected data for transfer in implications for use, aiming for end users, and implications for design, aiming for those that design and develop. One of the intended outcomes will be realistic reports of problematic uses actually observed [Berger, 2023] in contrast to theoretical settings or imagined fairy tales of IoT. These realistic reports should help users to understand potential risks emerging in similar situations as they are to raise awareness and to enable informed decisions.

Co-design for creative yet privacy respecting use of sensors

Our "Whether Bird" [Lefeuvre, 2016] is an example of a privacy respecting smart product. We developed it in a previous project together with blind and visually impaired pupils. It shows how they can help people with special needs in particular. Its name deliberately contains the English word for "whether" and not "weather". This is because it solves a problem for the young co-designers involved: They can only ever call up forecasts in their weather apps, but cannot find out what the weather was like last night, for example, or whether it is still wet on the way to school in the morning. Outside on the windowsill, a sensor measures the amount of rain that has fallen in the past few hours. A plush bird lives in the apartment, equipped with a small loudspeaker and melody generator and connected wirelessly to the sensor. The plush bird sings when you pluck its beak and does so in a slightly different way depending on whether it has rained. Only the users themselves know what each melody means. This data-frugal secret language is a way of circumventing common voice assistants for blind people, which the pupils rejected because they would be perceived as "needy and disabled" if they used them. In *Bitplush* we continue this work in the realm of smart soft toys. We created a new co-design tool, the *Wheel of Plush* for this purpose [Sontopski, 2024]. It comes with sensors and actuators integrated in plush and is intended for use in workshops. It relates to the principle of data normalization for mapping between simple inputs and outputs that still allows for private communication while potentially lowering the risks of raw data use [Stephan, 2024].

We also research the long-term appropriation of such everyday smart devices. New forms of interpersonal interaction are also made possible by simple sensor data. This is demonstrated, e.g., by the Yo-Yo Machines, which use simple, self-built tools to bring people who live physically separated from each other into contact with each other. For example, a pressure sensor in one home activates a small light in the other - and a mother knows without words that her son is sitting in his favorite armchair. It is difficult to monitor this communication and its meaning from the outside, but for mother and son it offers a simple but effective shared secret language.

Education for the next generation of smart technology creators

One promising approach is to raise the awareness and responsibility of those creating the technology in the next generation as it continues and multiplies. This could begin with the use of easy-to-use and sometimes even fun tools and methods that bring ethics into human-computer interaction and design education [Kurze, 2021a].

It could also be an entire course with a semester-long curriculum. In the teaching-learning project Data-I, we have initiated such a transfer of our approaches and findings from research to university teaching [Kurze, 2023]. We have integrated data-driven methods and tools such as our Sensorkit into project-based learning along the human-centered design process for interactive smart systems. Multidisciplinary teaching and learning as well as the combination of theory, hands-on experience and activities to reflect on possible implications proved to be success factors.

Transdisciplinary exchange

As we are not only addressing the academic world or end users, but the entire community, we have organized a series of workshops in conjunction with ThingsCon in recent years: “From simple sensors to (un-)intended implications”, “From (un-)intended implications for privacy to implications for design and use” and “Plushification – Soft DIY Devices for Private Communication”. These workshops helped to engage with the community and bring in perspectives from disciplines and stakeholders not otherwise represented. We would also like to summarize our findings to generalizable approaches, e.g. with a transfer of findings from a single apartment to entire smart buildings [Kurze, 2024]. We find this form of outreach beyond the boundaries of technical disciplines and academic world very enriching and therefore recommend this trans-disciplinary exchange to other researchers.

Conclusion

The home is our most private space, which is increasingly populated by technologies that propagate comfort, efficiency and security. Every sensor in the home, either smart or simple, and the collected data come with potentially severe risks for autonomy and privacy of those affected by these systems. However, not all is lost. We discussed our approaches for better informed users, researchers, current as well as next generation developers and designers for more innovative yet responsible smart connected products.

References

Acatech. 2023. TechnikRadar (2023): Was die Deutschen über Technik denken. acatech, Körber-Stiftung, Universität Stuttgart. (English summary available) https://www.acatech.de/publikation/technikradar-2023/

Alejandra Gomez Ortega, Janne van Kollenburg, Yvette Shen, Dave Murray-Rust, Dajana Nedić, Juan Carlos Jimenez, Wo Meijer, Pranshu Kumar Kumara Chaudhary, and Jacky Bourgeois. (2022). SIG on Data as Human-Centered Design Material. In CHI Conference on Human Factors in Computing Systems Extended Abstracts. ACM, New Orleans LA USA, 1–4. https://doi.org/10.1145/3491101.3516403

Albrecht Kurze, Andreas Bischof, Sören Totzauer, Michael Storz, Maximilian Eibl, Margot Brereton, Arne Berger.(2020). Guess The Data: Data Work To Understand How People Make Sense Of And Use Simple Sensor Data From Homes. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20). ACM. ACM, New York, NY, USA, April 2020, pp 1–12. DOI:10.1145/3313831.3376273, https://dl.acm.org/doi/abs/10.1145/3313831.3376273

Albrecht Kurze, Arne Berger. (2021)a. Playing The Ethics Card: Ethical Aspects In Design Tools For Inspiration And Education. Workshop Co-designing Resources for Ethics Education in HCI at Conference on Human Factors in Computing Systems (CHI '21). May 9, 2021. https://arxiv.org/abs/2201.10491

Albrecht Kurze, Andreas Bischof. (2021)b. Wicked Implications for Human Interaction with IoT Sensor Data. Workshop Human-Data Interaction through Design at Conference on Human Factors in Computing Systems (CHI '21). May 9, 2021. https://arxiv.org/abs/2201.10470

Albrecht Kurze. (2022). Senseful Sensors: Learnings and Optimizations for IoT Sensors in HCI Research. 2022 IEEE 9th International Conference on Computational Intelligence and Virtual Environments for Measurement Systems and Applications (CIVEMSA), 2022, https://dx.doi.org/10.1109/CIVEMSA53371.2022.9853698

Albrecht Kurze, Karola Köpferl, Maximilian Eibl. (2023). Data-I – Interactive Experience of IoT Data: A Practical Tool for IoT Sensor Data in Interdisciplinary Human-Computer Interaction Education. In Proceedings of the 5th Annual Symposium on HCI Education (EduCHI '23). Association for Computing Machinery, New York, NY, USA, 85–90. https://doi.org/10.1145/3587399.3587405.

Albrecht Kurze, Karola Köpferl. (2024). From Simple Sensors to Complex Context: Insights for HabiTech. In workshop "HabiTech" at CHI24 - Computer Human Interaction Conference. May 11, 2024, Honolulu, HI, USA 2024. 4 pages..doi:0.48550/arXiv.2412.06085

Klaus Stephan, Maximilian Eibl, Albrecht Kurze. (2024). Just the Normal Fluff: The Wheel Of Plush as an Example for Human Centric Data Normalization. Mensch und Computer 2024 - Workshopband. DOI: 10.18420/muc2024-mci-ws02-160. Gesellschaft für Informatik e.V.. MCI-WS02: 17th Workshop "Be-greifbare Interaktion". Karlsruhe. 1.-4. September 2024

Kevin Lefeuvre, Sören Totzauer, Andreas Bischof, Albrecht Kurze, Michael Storz, Lisa Ullmann, Arne Berger. (2016). Loaded Dice: Exploring the Design Space of Connected Devices with Blind and Visually Impaired People. Proceeding NordiCHI '16 Proceedings of the 9th Nordic Conference on Human-Computer Interaction Article No. 31, Gothenburg, Sweden — October 23 – 27, 2016. – New York. NY, USA : ACM, 2016. http://dx.doi.org/10.1145/2971485.2971524

Natalie Sontopski, Stephan Hildebrandt, Lena Marcella Nischwitz, Klaus Stephan, Albrecht Kurze, Lewis L Chuang, Arne Berger. (2024). Wheel of Plush: A Co-Design Toolkit for Exploring the Design Space of Smart Soft Toy Materiality. In Proceedings of the 2024 ACM Designing Interactive Systems Conference (DIS '24). Association for Computing Machinery, New York, NY, USA, 2958–2971. doi:10.1145/3643834.3660744

Albrecht Kurze is a post-doctoral researcher at the chair Media Informatics at TU Chemnitz and one of the principal investigators in Simplications and Bitplush. With a background in computer science his research interests are on the intersection of Ubiquitous HCI and human centered IoT: How do sensors, data and connectedness in smart products and environments allow for new interactions and innovation and how do we cope with the implications that they create, i.e. for privacy in the home. Albrecht has co-hosted several workshops at previous Things editions.

Arne Berger is a Professor of Human-Computer Interaction at Hochschule Anhalt. He is fascinated by the complex, idiosyncratic and unintended interactions between humans and digital technology. His work is influenced by the Scandinavian tradition of Participatory Design, which recognizes that those who will be affected by a future technology should have an active say in its creation. Arne's research focuses on the early phases of design and development processes, and he is particularly interested in how errors, failures, blips, and oversights shape how we think about future technology.

With a background in sociology, media communication and cultural anthropology, Andreas Bischof studies how technology, science and society interact with each other. Currently, he is Juniorprofessor at Chemnitz University of Technology and principal investigator in several research projects. His research focuses on the development, implication and implications of use of new technologies such as robots in health care, artificial intelligence in the workplace and smart home devices.

Urban perspectives

Ubiquitous immersive relations with generative things

Iskander Smit

The history and emergence of generative things

Generative things became the inspiring theme for the ThingsCon conference last year. We realized that a new type of physical object could emerge when they will be combined -or better, infused- with generative AI. What that new type would unlock was a question to address. Before diving deeper into my thoughts, let's roll back a bit on the path toward the current and near-future reality or generative things. And especially add the current iteration of generative AI; agentic AI. This means that "things with agency", a concept we introduced concerning cities of things back in 2018 (Lupetti et al., 2018), becomes a reality. The Generative Things signify a new wave of AI — physical AI — that appears in our daily environment and becomes part of our living space.

We come from a world where digital was an extra layer on top of everything, a new kind of service, into a world where everything is digital. Our lives now follow, in great part, the affordances given by digital services: continuous connectedness, knowledge about the context we are in, and an ad hoc way of living very much in the moment with less planning. I am not telling anything new.

What is new, however, is that we are adding generative AI to this digital reality. Since the introduction of ChatGPT as an interface to the transformer models that were invented around 2017, we have a new form of creating more generative intelligence. By introducing this chat interface, OpenAI accelerated its use, and now, three years later, we see it becoming more part of our reality, similar to how the Internet launched in our lives in the second half of the 90s, became the engine of our daily social life with the smartphone in the 2010s. As with every technology, this new one has a dramatically shorter time to be adopted. We are not at the smartphone levels, but it feels like we are approaching some tipping points.

We're seeing rapid development, especially in certain domains, as people begin to replace their search engines and default digital behaviors with generative AI helpers. People are still looking for the right collaboration here. Are we just replacing search with a different format and different output? Are we formulating new questions? Are we expecting different things from our tools? We can see how people now expect more, especially with the reasoning models released in the last few months. These models can produce full research papers and are being extended with agentic behavior. Mixing different types of input (multimodal), and delegating tasks to the AI is still in an early stage, but might follow soon, especially as it becomes integrated into existing digital services.

The consequence is that we are already partly replacing the conversational interface by assigning tasks to AI agents. And the next logical step is vibes coding, making very personalized services using the abillities of the rise of AI-powered code editors. As often, this is not a new concept in thinking about applying computation, but now it's becoming accessible for everyone to address problems in daily life or work environments by building apps themselves through conversations.

Generative things becoming ubiquitous physical AI

In the next few years, we can expect to see this development of agentic AI continue. As vibes coding becomes more personalized, it will be adopted by larger groups of people, becoming more part of our daily lives—we'll start to expect these capabilities in every-thing we do. Additionally, the technology will become more solid, higher quality, and able to take over more of the coded world. Complex systems that currently need solid coding structures will become accessible through these new interfaces.

What we're adding to the mix now, is the physical angle—the things angle. What happens when things become more based on the principles of generative AI? We still have to figure out how to relate to these new things. A common belief is that every computation task we perform in our life, from producing text or planning our agenda, from organizing social life to finding relations, are all possible candidates to be enhanced with conversations with or delegating to generative and agentic AI. It is not strange to think that the same will happen to things that have computational interfaces with us. From our kitchen appliances to electric bikes, to name a few.

As these generative things become more part of our natural habitats, we approach a form of ubiquitous AI—a new reality and environment. Where all of the things are working as an ecosystem creating an intelligent interactive environment. How will we experience this? How will our environment treat us? Will we have different forms of understanding and interacting? How will this change our perspective on reality?

The impact on our everyday life

In this expected interactive environment, there are multiple layers of interaction. Consider a delivery bot: there's the contact moment when you order and receive a pizza, which is a task for the bot. But there's a higher level related to the conversation you have with the bot based on your profile with that service. These two aren't necessarily connected—delivery bots might just do deliveries, while the real experience comes from the service provider. This opens up new types of interactions because we can have a history or memory of our different communications with the tool and service. Compare how we use ChatGPT to address specific questions, while you can also ask to create personal psycho-analytical coaching advice based on all of your chat history.

This example of layers within ChatGPT, it stays -in principle- within your personal premises, and is it initiated by your question. This changes if everything you encounter in the everyday world is capturing and interacting. Even if this environment is not continuously cap-

turing, the potential of having all the non-human actors connected in an active network brings the so-called active network theory reality, where human and agentic things are operating on the same level.

So will we be like fish swimming in the sea, not understanding the concept of water, with ubiquitous intelligence becoming part of our everyday lives? Or will we be more feeling the intelligence as a panopticon that is unseen but something we always take into account in our interactions. As with all future developments, this will not be a one-day overhaul—we will grow into it, just as our smartphones shifted from handy tools to shaping everything we do.

As most important shift is from responsive to initiating computing through things with agency. We're moving from tool-based, on-request use to a ubiquitous environment. Our environment might interact with us proactively—triggered by understanding that we're looking for something, wandering around, recognizing insecurity, or connecting us with other people. The scenarios are endless.

Designing for co-performance and human-AI teams

We shouldn't think about design merely as creating services, things, or products. We should think about what kind of life or interactions we want in our day-to-day existence—what conversations we want to have, what feelings we want to experience. This ubiquitous AI shapes a continuum where we are in constant conversation with a more intelligent world.

But there's another dimension to consider: what is the end goal of this whole system? We can give this ecosystem of things and services an overarching strategy or goal. We can design for perfect individual experiences, or we can design in such a way that focuses on collectivity—always approaching a person as part of a whole community. We need to mention here a big question about who is controlling these ecosytems.

There are still different choices and scenarios possible on how we let these new generative things and ubiquitous physical AI develops, what the conditions are, socially driven, and based on regenerative principles. This needs to be part of the discourse, of the considerations of designers and policymakers. Independent of the outcomes, we need to think about how we want to relate to this new ubiquitous intelligence. This will play out on multiple levels. The most direct level is all focused on the interactions we shape with the generative things towards respectful relationships. I come back to the thinking of co-performance (Kuijer & Giaccardi, 2018)—making the right balance between human and AI, seeing human and AI actors as teams of collaborating actors that set overarching goals connected to our societal beliefs.

The next level is how we will organize these new societies. What does it mean for governance and social structures? Will things become almost like fellow citizens, or will they remain tools we use? How do we deal with goal setting? How can we create systems of collective things and humans that have a built-in intention to stay collective, to steer toward collective goals? How can we prevent

Conclusion: design for collectivity needed, also in human-AI co-living realities

people from putting personal interests before everything else? With the emergence of physical AI with agentic behavior we are entering a new phase in the still brief history of living with generative AI as part of our digitally shaped lives. In this short piece, I can only touch upon the potential big shifts happening. The shift from tools towards a ubiquitous presence —or immersiveness in current popular framing— is the creation of new experiences, new realities, with new impacts.

And that is only looking at the impact on our daily life, not taking into account the impact on the environment, and the role of Big Tech in influencing our behavior that will become seriously a factor to address. We once started with the internet as a democratic, almost punk movement where everyone could make their own stuff. We have this promise again with vibes coding, but more than ever with AI we are dependent on big parties for the models because they require vast amounts of data and investment in data centers. I leave this aspect for another moment to address in more detail. And I can point you to the piece from Kars Alfrink in this RIOT report and (Alfrink, 2025).

So how do we relate to this? Are we designing for individuals, or should we oppose this move toward individualistic development? Should we put it in the context of design for collectivity, thinking about what it contributes to society—both smaller-scale societies like neighborhoods and larger ones like countries or interest groups?

There are many opportunities to think about these layers: the operation of interactions, the emotional layer of conversation, and then the commons—the community and society layer. The intent of the community layer is to improve societal aspects.

How can we enable, enforce, or leverage the possibilities of things that become part of our environment—this ubiquitous new reality where we always have opportunities to conversate with the things we use? How can this contribute or take an extra role in creating new kinds of society and community-based layers?

Our goal for near-future thinking about generative AI in our lives should be a combination of designing for human-agentic AI teams and designing for collectivity—for societal structures that put the common good above individual economic interests. We need to translate our societal beliefs into “system cards” for both generative AI and for humans interacting with AI actors.

The ultimate challenge for all of us is how to address these questions together. What insights, questions, action points, or considerations can we collect from every project and article to build up something collaborative? How do we move from designing for individual convenience to designing for collective well-being in this new era of generative things? This is where we must focus our attention as we navigate this emerging landscape of ubiquitous physical AI becoming an integral part of our social fabric.

References

Alfrink, K. (2025). People's Compute: Design and the Politics of AI Infrastructures.

Kuijer, L., & Giaccardi, E. (2018, April). Co-performance: Conceptualizing the role of artificial agency in the design of everyday life. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-13).

Lupetti, M. L., Smit, I., & Cila, N. (2018, September). Near future cities of things: addressing dilemmas through design fiction. In Proceedings of the 10th Nordic Conference on Human-Computer Interaction (pp. 787-800).

Iskander Smit is the founder and chair of the Cities of Things Foundation, a research program that started at TU Delft, where he was a visiting professor. It now serves as an independent knowledge platform in cooperation with academic partners and industry. Iskander is deeply involved in exploring the relationship between human and machine intelligence from a design perspective. He founded Target is New and is a curator and board member of ThingsCon. Prior to this, he held positions in strategy and innovation and was involved in various technology initiatives and events as an organizer and public speaker.

Reclaiming the human dimension in automated urban enforcement services

Mike de Kreek
Tessa Steenkamp

Smarter cities but less human?

Cities are becoming smarter—but are they becoming more human?

Since the beginning of this century, the arrival of governmental urban technology in public spaces – aka smart city tech – promises to keep the city clean, safe and well maintained. The liveability and even the quality of life in cities is claimed to improve according to this narrative. Although the efficiency and short term effectiveness of city municipalities seem to improve, there are serious unintended consequences of the growing number of technologies that push human presence, communication and interaction mostly 'out of the loop'. And with that the subtle, but crucial, situational judgments that arise when humans interact (Zacka, 2017).

It is a problem that author Ben Green refers to as the 'tech goggles cycle' (Green, 2019). It starts with adopting a solutionist approach, believing that technology could and should make our society function more efficiently and smart. After implementing a technology, all that remains visible are those things that can be measured and therefore can be improved on. Spontaneously emerging goals and visions, and bottom-up workarounds, are not grounded in the technology and therefore become harder to recognize and act upon.

In 10 years of ThingsCon, many of us have argued this spontaneity and sometimes messiness of cities are in fact essential elements of a thriving city. For example Usman Haque, keynote speaker of ThingsCon in 2014, writes in praise of messy cities (Haque, 2013). In the Human Values for Smarter Cities project[1] , we – still – explore a balance between efficiency and messiness in Dutch cities. Through a series of workshops[2] we experimented with alternatives for merely efficient urban technologies. Instead: could they be redesigned to become generative systems that revitalize human interactions in a the urban context?

The need for answering this design and research question was confirmed during an initial field visit at one of the involved municipalities. Civil servants mentioned the possible tensions that accompany the use of smart city technologies in urban spaces to help to keep the city safe, clean and well-maintained. One concern they

1 https://humanvaluesforsmartercities.nl/.

2 Society 5.0 2023, ThingsCon 2023 & ThingsCon 2024.

expressed was that human scale in decisions might decrease, because incorporating high fidelity contextual information in a decision is difficult in an automated approach. They noted that this contrasts with their municipality's simultaneous investments in human-scale services and interventions. Adding to this, there was a concern of human contact in neighbourhoods possibly decreasing, because automated processes require less human involvement and contact. In this case they identified a contrast with the municipality's simultaneous projects that aim to facilitate more ownership and self-solving capacity in neighbourhoods which require a human face and human interaction.

At stake is more than just smoother operations. What we risk losing is the ability to tolerate ambiguity, to listen to each other and let empathy grow and to make collective decisions through dialogue. As cities become more technologically mediated, we must ask: are we designing systems that support human flourishing, or are we designing flourishing systems supported by human input?

The smart city's narrow mind

Interestingly enough, the aforementioned concerns did not have much to do with the problem and solution space of the technology in question – like parking cars in the city. Instead, they expressed concerns touching upon much more fundamental societal issues – like the loss of "the human scale" (Canoy et al., 2021). Smart city systems promise frictionless efficiency: automate enforcement, eliminate ambiguity, ensure compliance. But what happens when that promise overrides the texture of everyday life?

In our workshops, we gathered a community to discuss real-life examples and to extrapolate undesirable consequences if these were not incidents but practice as usual. For example, a woman who parks her electric rental car to unload holiday bags to the apartment on the fourth floor. She does not have the number plate of the rental car in her parking app, so she does not pay for parking the car. More importantly, she knows that loading and unloading is allowed without paying, even if it takes some time to run up and down to the fourth floor. She gets a fine, and after an appeal she is informed that she has to pay the fine because: "You are only loading and unloading if you immediately let people get in or out or if you immediately remove or load large or heavy items from the car. The inspection revealed that you were not loading and unloading. So you had to pay parking fees."

In the discussion about this case, participants stated that the complete process with the camera car leaves almost no room for a human-to-human debate and no 'grey zone' for decisions made about imposing a fine or not in specific situations. At the same time there is much room for interpretation about what 'immediately' means from the perspective of the various stakeholders. In the perspective of the municipality this seems to mean that you have to be in sight of the car, while in the perspective of city dweller this

means unloading as quickly as possible to your apartment. Before introducing the technology, parking control was moving by less quickly, and the city dweller would probably have had the right interpretation.

The findings of the workshops including other real life examples substantiated three clusters of undesirable consequences. Firstly, participants noted that the discretion available to civil servants is diminishing with the advance of urban technologies, resulting in decisions that are increasingly black-and-white. Every exception to the rule has to be coded in. A second field of worry was the growing responsibility the municipality takes for arriving at solving problems, at the cost of self-solving capabilities in the community. Thirdly, participants identified that the cultural ability to negotiate or debate is under pressure, both among citizens and between citizens and civil servants, possibility leading to a loss of trust in the community and municipality in the longer term.

This looks like a city that no longer negotiates but enforces. A public realm that no longer facilitates and listens but flags violations. A system that values efficiency over empathy. Smart city solutions often claim to be neutral tools. But neutrality becomes blindness when systems are designed without room for context, care, or conversation.

Redesigns for the human dimension

The question, then, is how we might reintroduce human inefficiency into systems that seem designed to erase it? Rather than rejecting automation outright, the workshop participants explored how to redesign automated systems that reflect human values. What if, instead of removing discretion, we designed spaces where discretion could be meaningfully exercised? What if systems flag edge cases not only to issue fines, but to ask whether a situation deserves a second look?

In our participatory workshops, interesting, speculative redesigns were developed that generated opportunities for more human interaction and with that, disclosure of details about a certain situation. For example, a proposal offered the chance of debating the decisions about resident's parking actions in real time. In this case when someone parks a car for loading or unloading and a scan car drives by, the owner receives a notification straight away. This enables the owner to speak up for him or herself and debate the upcoming decision in real time. In turn, this might prevent the signal becoming a fine that goes through the whole the process, including a potential appeal.

In another more speculative proposal, the basic idea was that a resident can put a note underneath the car's windscreen wiper and that the parking scan car can read that. So notes with something like "I'll be right back" or "I am unloading" leads to the car and its

driver knowing that they need to return after maybe 10 minutes to check the same parking spot. If the car is gone, the owner was loading or unloading. If it is still there, the car has been there too long, and the owner should receive a fine. This prevents a lot of occurrences where the civil servant has to judge photos of the situation to decide about a fine for not loading or unloading or a decline of the objection to a fine.

In the workshops, most of the speculative redesigns introduced a faster distribution of information amongst the various actors, providing them with the opportunity to take action in real-time. This materialized in ideas about human contact, interaction and negotiation, sometimes between residents and other times between a resident and a civil servant. In all cases the idea was to delay the triggering of a fully automated process, which has a high chance of ultimately being unnecessary or unfair. This seemed to reclaim professional discretion and enable more human-scale interventions and decisions. In almost all speculative scenario's more collective ownership and creativity in the neighbourhood was fostered, while making room for better division of the available municipal resources.

The human city: between trust and control

Why is it so hard to build smart city technologies that genuinely serve or empower people—not just as users of a city, but as citizens with needs, stories, and judgment? From speculating in our workshops we learned that the answers go deeper than flawed systems or limited resources. It lies in the foundational worldview that guides how these systems are imagined, funded, and designed. At the heart of that worldview is a particular idea of human nature. Today's smart city infrastructure is often built on a logic of control. Systems are designed to optimize traffic flow, enforce rules, and detect violations with minimal human discretion. This makes sense if you assume people are mostly self-interested and likely to abuse the system when given too much discretion. From this perspective, human judgment is a problem to be minimized—too slow, too subjective, too contextual.

The parking enforcement system in Amsterdam, offers no space for drivers to explain the context of their actions. A missed payment, a hurried unloading, intentionally not paying — all are treated the same. The system is blind to intent, nuance, or circumstance. The unintended consequences are subtle but significant: shame, frustration, and a growing sense that the city is not on your side. In some cases, people comply out of fear, not trust. In others, they disengage entirely. Worse, those with the least access to digital infrastructure or legal know-how are often the most vulnerable to rigid automation. This exactly why Bernardo Zacka argues that the presence of street-level frontline workers in urban enforcement services is especially important for navigating the ambiguous situations that policy measures create in real-life situations involving citizens (2017).

And yet, the idea of building in more human discretion often meets resistance within municipalities. What if people exploit it? What if they lie, manipulate, or game the system? These concerns reflect a deeper anxiety: that trust will be abused, and openness will backfire. In a world increasingly driven by metrics, risk reduction, and political accountability, it's safer to design systems that treat everyone the same—even if that sameness erases critical differences. This risk-aversion may be precisely what's holding us back. A city that assumes the worst in people ends up designing the worst for them. It creates systems that are overdetermined, defensive, and indifferent to the moral reasoning that shapes everyday life.

This isn't a call for naive optimism. It's a call for thicker, more accurate view of human behaviour—ones that see people not just as users or violators, but as interpretive, caring, context-sensitive participants. In this view, friction isn't always a failure. It can be a way of enabling ethical reflection. Ambiguity isn't chaos. It's the texture of lived experience, negotiation and ultimately democracy. Designing for this complexity requires a fundamental shift. It means building systems that allow for interpretation, discretion, and dialogue. That might involve interfaces where users can annotate their actions, or systems where frontline workers can apply judgment without fear of being overruled by algorithms. It could mean incorporating time delays for certain decisions—not to slow things down, but to create space for collective reflection.

The question then is not "How do we prevent every misuse?" but it becomes: "How do we balance trust and control in a way that honours the public we serve?" The irony is that truly smart cities may need to become a little less certain of their intelligence. They may need to be more like the people who live in them: adaptive, relational, capable of pausing to consider before acting. This is not about abandoning technology. It's about reimagining its purpose—not just to predict and correct behaviour, but to support the ethical capacities of urban life.

References

Canoy, M., Van Dijk, S., & Ham, M. (2021). Momentum voor de menselijke maat [Momentum for the human scale]. Movisie. https://www.movisie.nl/menselijkemaat

Green, B. (2019). The Smart Enough City - Putting Technology in Its Place to Reclaim Our Urban Future. The MIT Press. https://mitpress.mit.edu/9780262538961/the-smart-enough-city/

Haque, U. (2013). Messiness will inevitably arise in spite of smart cities. Wired. https://www.wired.com/story/in-praise-of-messy-cities/

Zacka, B. (2017). Bureaucrats to the rescue - Are bureaucracies a public good? Boston Review. https://www.bostonreview.net/articles/bernardo-zacka-are-bureaucracies-public-good/

Tessa Steenkamp is a designer shaping the interactions between people, places and technology. As a design researcher at the lectorate ‘Civic Interaction Design’ at UAUS, she takes part in the project Human Values for Smarter Cities. Her research is formed through designing and organizing participatory experiments in public space and mainly addresses the use of image recognition in public space. How could these algorithms be designed and communicated, in such a way that a wider public is aware of, and engaged in, their deployments? Tessa also runs her strategic design studio Bits of Space . The studio researches socio-spatial challenges through the lens of personal experience, and translates insights into spatial concepts and future scenarios.

Mike de Kreek has a background in participatory action research and arts-based research in contexts of collaborative learning, co-creation and collaborative governance. He gets enthusiastic when academic processes are collaborative in themselves, nurturing improvements of work or empowerment of people. He is part of the Human Values for Smart Cities project, which runs from 2022 to 2026 and is led by the Civic Interaction Design Research Group at the AUAS. The focus lays on civic participation and engagement in articulating, making and evaluating of smart city technologies in urban spaces.

Urban perspectives

Urban emergence through data: promise or paradox?

Zeynep Uğur

Jane Jacobs describes cities as “problems of organized complexity,” meaning they involve “dealing simultaneously with a sizeable number of factors which are interrelated into an organic whole” (Jacobs, 1962). Building on this perspective, there comes a necessary degree of disorder and openness in cities—qualities often undermined by modernist, technocratic planning and neoliberal urban development, which prioritize efficiency, functionality, and profit over organic complexity (Sennett, 2006).

In the specific case of the Dutch cities, there has been a historical reliance on efficient, functional planning, rooted in a deep belief in expert authority and the necessity of the prevailing urban governance model (Fischer, 2001). This belief can be traced back to the post-war period, when Dutch cities faced acute housing shortages and the unique challenges posed by the country’s wet conditions. During this time, substantial government coordination and control were deemed essential for ensuring rapid, safe, and balanced urban development (Van Assche et al., 2011).

However, as society confronts what Rowson (2024) terms the “metacrisis”—a convergence of the climate, housing, and financial crises, and everything in between—there is a growing need to rethink the planning system. The stronghold of traditional planning is weakening, creating opportunities for alternative perspectives to gain influence (Beunen et al., 2016).

Some of these alternatives are circling around the idea of community-led governance and stewardship. Especially in the post-pandemic era, where the need for adaptive forms of urban organization has become prevalent, and the crisis revealed remarkable examples of community self-organization (Solnit, 2020).

On the parallel, as datafication ‘things’ become more and more advanced in our cities, their affordances seem to ‘unlock’ the potential of ‘self-organisation’ of residents; creating an energy around the possibility of openness and flexibility in planning. Essentially, these raise questions like;

‘What happens when communities take collective responsibility for governing urban spaces—and what role could generative AI play in this process?’ which was the central question of my recent ThingsCon workshop (Uğur, 2024).

Yet, embedded in this question is a crucial forgetting. It implies

that community-led, collective governance is something *emerging through* digital technologies—when, in fact, communities have been collectively governing urban spaces for millennia, long before the advent of data infrastructures or centralized state power.
One prominent example is the Neolithic settlement of *Çatalhöyük* (7100–6000 BCE) in Anatolia, which exhibits no evidence of centralized authority structures. Archaeological findings reveal uniform housing and burial practices, suggesting an egalitarian society where "there was no leader, government or administrative building; men and women were equal" (Hodder, 2006). Social organization appeared to be maintained through communal rituals and shared norms rather than formalized hierarchies.

In *Igbo-Ukwu and Nri,* city-states in pre-colonial Nigeria, governance was grounded in acephalous systems—decentralized models where decisions were made collectively through councils of elders, age-grade associations, and ritual figures (Ogugbuaja et al., 2024).

Even at *Cahokia*, one of the largest urban settlements in pre-Columbian North America, archaeological shifts suggest a move toward decentralized organization based on kinship and community participation (Tainter, 2019).

This historical lineage challenges the assumption that openness, flexibility, and self-organization are novel affordances of digital systems. Instead, they reflect long-standing capacities of urban communities.

The deeper question, then, is not merely what AI or other data-enabled systems can provide but rather: *What are we, as a society, so reluctant to relinquish?* What fundamental values are we safeguarding by embedding data-driven mechanisms into our cities, deliberations, and decision-making processes?

First, what is even emergence?

In systems theory, philosophy, and complex science, emergence refers to the appearance of new properties or behaviors in a system that cannot be fully explained by the properties of its individual parts (Johnson, 2001).

In its simplest form, emergence describes a situation where "the whole is greater than the sum of its parts," where new properties appear at the system level that cannot be reduced to the properties of components (Johnson, 2001). These emergent properties are the result of interactions, not components alone. This means emergent systems defy straightforward deduction: knowing every part doesn't necessarily tell you what the system will do.

A common way to illustrate emergence is through ant colonies. No single ant dictates the colony's behavior; rather, each ant follows simple behavioral rules, yet collectively they construct sophisticated networks of tunnels, respond adaptively to threats, and regulate resources. The colony's intelligence is distributed and relational, not located in any single entity. Such decentralized coordination challenges human assumptions about the necessity of hierarchy and control (Gordon, 1999), but we will get to that later on.

Another key example is the behavior of peptides (short chains of amino acids), which spontaneously fold into stable, functional structures critical to biological processes. This folding is not directly encoded by a single command but emerges from the physical interactions among molecular bonds, environmental conditions, and thermodynamic constraints (Kauffman, 1993).

As a result, emergent systems exhibit a fundamental unpredictability: even though each part operates by simple rules, the outcomes of their interactions generate behaviors and properties that cannot be directly estimated or predicted (Goldstein, 1999). This unpredictability challenges reductionist or purely rational approaches to understanding complex systems,

What, then, is urban emergence?

If emergence describes how complex order arises from simple, decentralized interactions, then urban emergence refers to the ways in which cities themselves are shaped by countless small-scale, local decisions that cumulatively generate large-scale patterns and structures.

As Michael Batty (2018) explains, “cities are emergent at a large scale, and planned to some extent at a smaller scale, and so there is a limited extent to which we can know how cities will turn out over time.” Cities grow organically, shaped not by singular masterplans but by millions of overlapping, contingent choices—zoning approvals, infrastructure investments, property sales, informal uses, community negotiations. In this sense, the predictability of cities is inherently limited, and top-down planning exerts only partial influence in the face of such complexity (Batty, 2007).

In this view, the analogy of the city has shifted: rather than being seen as mechanical or engineered systems, cities are increasingly understood as biological, self-organizing systems (Simon, 1996). Just as ant colonies or peptide chains generate complex forms through local interactions, cities emerge from the aggregated actions of individuals, households, businesses, and communities, each acting on their own behalf or as part of collectives.

Building upon this organic analogy, Poletto and Pasquero (2012) describe cities as fractal structures, where patterns repeat across different scales, and where local routines give rise to higher-order organization. This understanding of cities as emergent systems challenges traditional planning models oriented around centralized control, rational prediction, and universal templates. Instead, it calls for an approach that works with, rather than against, self-organization, acknowledging the partiality and unpredictability inherent in urban life.

Data as an enabler for such self-organisation (?)

If cities are emergent systems, growing through the cumulative, decentralized actions of their inhabitants, then what role does data play within this dynamic? In recent decades, urban governance has increasingly turned to data infrastructures, sensing technologies, and algorithmic models to manage complexity, monitor change,

and guide interventions. Proponents of “smart cities” frame data as a tool for enabling responsiveness, adaptability, and participatory governance, suggesting that real-time data flows can empower communities to self-organize (Kitchin, 2014; Townsend, 2013).

From this perspective, data is not merely a managerial tool but an enabler of distributed intelligence: by making patterns visible, surfacing needs, and lowering barriers to coordination, data could theoretically foster more bottom-up, collective forms of urban action. For example, civic platforms that map vacancies, track local air quality, or visualize public budgets aim to place actionable knowledge in the hands of communities, potentially supporting neighborhood-level stewardship and decision-making (Mattern, 2017). In this framing, data becomes a substrate for self-organization—a digital infrastructure through which emergent urban governance might be catalyzed.

Yet perhaps the deeper question is not whether data enables self-organization, but what data-driven technologies are fundamentally designed to do. At their core, data systems
(especially when coupled with machine learning and AI) are not simply about making information visible or accessible; they are prediction machines.

As economist Laura Veldkamp (2023) explains, “data is a strategic asset that reduces uncertainty and enhances prediction.” In other words, data is valuable precisely because it reduces unpredictability: by transforming past observations into probabilistic models of the future, data serves as the raw material for forecasting what comes next.

This predictive logic is not neutral. It is deeply aligned with the values of capitalist markets, where prediction is essential for optimizing supply and demand, managing inventories, setting prices, and maximizing profits. Without prediction, the market cannot function efficiently; with prediction, firms can reduce waste, anticipate needs, and outcompete rivals (Eeckhout & Veldkamp, 2022).

The contemporary hype around AI, then, is not merely about technological novelty, but about the promise of an unprecedented prediction machine—a system capable of simulating, forecasting, and preempting what is to come. Data is cast as the “savior” of our economic and societal crises because it promises control over uncertainty, a way to make the chaotic future legible and governable.

In this sense, AI extends an older narrative: as Kauffman (2015) notes, reason became the hero of the Enlightenment, a force for explaining, predicting, and solving; today, AI inherits that role as a new engine of predictive reason.

From this perspective, the embedding of data-driven prediction into urban governance may not be a neutral tool for enabling self-organization. It may instead be a mechanism for aligning cities more tightly with the predictive, extractive imperatives of the market. It is

not simply about making the city “smarter” or more responsive; it is about making the city more knowable, more manageable, and more profitable within an economic paradigm that equates knowledge with control.

The paradox of controlled emergence

And so we arrive at a paradox. While we speak of enabling urban emergence, of fostering openness, adaptability, and self-organization, we do so through technologies born from a paradigm of control, reason, and prediction. The very systems we hope will support decentralized, creative urban futures are grounded in logics designed to preempt, stabilize, and govern unpredictability. As Stuart Kauffman (2015) reflects, reason alone is insufficient for navigating life’s complexity; we also need emotion, intuition, sensation, and metaphor.

Beneath the promise of “enabling emergence” lies a deeper reluctance: a refusal to relinquish control. We turn to data infrastructures not only to see but to secure, not only to reveal but to regulate. Even as we invoke decentralization, we embed it within networks that automate trust through verification, encryption, and consensus algorithms rather than human relationships. To enable self-organization, we design infrastructures that mistrust it from the start.

Yet these data systems bring another limitation: they are inherently partial, selective, and representational (Kitchin, 2014). Data does not mirror reality; it abstracts, filters, and prioritizes, inevitably leaving some dynamics invisible or excluded. This partiality is not a technical flaw but an ontological condition. As Voß and Bornemann (2011), Scott (1998), and

Jacobs (1961) warn, any system that reduces the complexity of social life to a set of measurable, governable variables risks oversimplifying reality, flattening the very richness, ambiguity, and situatedness that make urban life vibrant and adaptive.

Kauffman (2008) reminds us that we inhabit “a universe, biosphere, and human culture that are not only emergent but radically creative,” a world whose unfolding we cannot prestate or predict. To live in such a world is to accept radical uncertainty as a condition of creativity. Yet the technologies we embrace to “manage” this creativity often work to foreclose that uncertainty, translating it into calculable, governable risks.

This paradox becomes even more striking when we recall that urban self-organization is not new, nor is it contingent on digital infrastructures. As discussed earlier, pre-modern cities and settlements like Çatalhöyük, Igbo-Ukwu, and Cahokia demonstrate that communities have long been capable of collective governance, spatial negotiation, and emergent organization, without the help of sensing systems, real-time dashboards, or algorithmic models. These societies relied on rituals, consensus, and relational trust: forms of coordination grounded in social practices rather than data infrastructures.
In contrast, the promise of enabling emergence through data today

often relies on technologies that abstract away from social relations, embedding them instead in architectures of surveillance, automation, and prediction. In doing so, we risk forgetting that emergence has always been possible; not in spite of uncertainty, but because of it. Perhaps the challenge is not to build new systems that simulate urban emergence, but to make space for the forms of life and relational intelligence that already know how to live it.

Baley, I., & Veldkamp, L. L. (2025). The data economy: Tools and Applications. Princeton University Press.

References

Batty, M. (2018). Inventing future cities. In The MIT Press eBooks. https://doi.org/10.7551/mitpress/11923.001.0001

Beunen, R., Duineveld, M., & Van Assche, K. (2016). Evolutionary Governance Theory and the Adaptive Capacity of the Dutch Planning System. ResearchGate. https://doi.org/10.17418/B.2016.9789491937279

Eeckhout, J., & Veldkamp, L. (2022, May 1). Data and market power. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4121456

Fischer. (2001). Citizens, experts, and the environment: the politics of local knowledge. Choice Reviews Online, 38(10), 38–5803. https://doi.org/10.5860/choice.38-5803

Goldstein, J. (1999). Emergence as a construct: History and issues. Emergence, 1(1), 49–72.

Gordon, D. M. (1999). Ants at Work: How an Insect Society is Organized. Free Press.

Hodder, I. (2006). The leopard's tale: Revealing the mysteries of Çatalhöyük. Thames & Hudson.

Jacobs, J. (1962). The death and life of great American cities. The Yale Law Journal, 71(8), 432. https://doi.org/10.2307/794509

Johnson, S. (2001). Emergence: The Connected Lives of Ants, Brains, Cities, and Software. Scribner Book Company.

Kauffman, S. A. (1993). The Origins of Order: Self-Organization and Selection in Evolution. Oxford University Press.

Kauffman, S. A. (2008). Reinventing the sacred: A New View of Science, Reason, and Religion.

Kauffman, S. (2015, November 9). Is emergence fundamental? [Video]. YouTube. https://www.youtube.com/watch?v=GVL2Y5z2jLU

Kitchin, R. (2014). The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences. https://doi.org/10.4135/9781473909472

Mattern, S. (2017). Code and clay, data and dirt. https://doi.org/10.5749/minnesota/9781517902438.001.0001

Ogugbuaja, E., Ndidiamaka, N. V., Mustapha, H., & Willies, N. (2024). The Pre-Colonial Traditional Governance Structures in Igboland: a framework for effecting efficacy. ResearchGate. https://doi.org/10.56201/jhsp.v10.no4.2024.pg50.57

Poletto, M., & Pasquero, C. (2012). Systemic Architecture: Operating Manual for the Self-organizing City. Routledge.

Rowson, J. (2024, February 21). The Antidebate and the Metacrisis. The Joyous Struggle. https://jonathanrowson.substack.com/p/the-antidebate-and-the-metacrisis

Scott, J. C. (1998). Seeing Like a State.

Sennett, R. (2006, October 11). The open city. Urban Age | LSE Cities. https://urbanage.lsecities.net/essays/the-open-city

Simon, H. A. (1996). The Sciences of the Artificial (3rd ed.). MIT Press.

Solnit, R. (2020, July 1). "The way we get through this is together": the rise of mutual aid under coronavirus. The Guardian. https://www.theguardian.com/world/2020/may/14/mutual-aid-coronavirus-pandemic-rebecca-solnit

Tainter, J. A. (2019). Cahokia: Urbanization, metabolism, and collapse. Frontiers in Sustainable Cities, 1. https://doi.org/10.3389/frsc.2019.00006

Townsend, A. M. (2013). Smart cities: big data, civic hackers, and the quest for a new utopia. W. W. Norton & Company.

Uğur, Z. (2024, December). Negotiating flexible urban futures with AI. ThingsCon. https://thingscon.org/th-ngs-2024/program/negotiating-flexible-urban-futures-with-ai/

Van Assche, K., Beunen, R., & Duineveld, M. (2011). Performing success and failure in governance: Dutch planning experiences. Public Administration, 90(3), 567–581. https://doi.org/10.1111/j.1467-9299.2011.01972.x

Voß, J., & Bornemann, B. (2011). The Politics of Reflexive Governance: Challenges for Designing Adaptive Management and Transition Management. Ecology and Society, 16(2). https://doi.org/10.5751/es-04051-160209

Zeynep Uğur is a transition designer working at the intersection of design, technology, and social transformation. She applies living systems theory and place-based approaches to address complex societal challenges, with a focus on social sustainability, decentralised alternatives, and participatory methodologies.

As a strategic designer at Fairspace, she leads co-creative projects that make physical and digital environments safer and more inclusive; designing behavioural interventions, researching situated experiences, and developing tools for community empowerment.

Zeynep collaborates with educational institutions, NGOs, and public sector initiatives to bridge design with social innovation. She also facilitates workshops and lectures on the politics of design, speculative futures, and pluriversal worldbuilding.

With a background in Industrial Design and a Master's in Data-Driven Design, she explores digital infrastructures through the lenses of critical data studies and value-sensitive design. Her recent work investigates data as a design material for prototyping flexible, participatory models of urban governance.

AI and society

On finding our place in a world

Johan Redström,
Heather Wiltse

Looking at current narratives and proposed use cases of technological development trajectories centered around generative and performative AI, it seems that AI assistants are meant to take over everything for us – especially the mundane stuff, but also at least parts of even more creative processes. Life is, apparently, meant to be handled through the mediation of interwoven devices and systems that can orchestrate or, more pessimistically, herd and tune attention and behavior. The phenomenological world – the 'stuff' that constitutes the content of our experiences as human beings – is set to become ever more fully framed and captivated by artificial agents.

The 'natural' world that is the primordial grounding of reality for us as biological organisms seems increasingly difficult to access in this new state of things. It is still there of course. But it is there kind of like a wall that has been covered with several layers of paint and paper until the original color and texture is indiscernible. Indeed, while 'augmented reality' might be the name of just one of the many technologies used, it embodies an idea that seems more pervasive.

If AI-powered things are meant to make life easier, and take over the bothersome stuff so we can get on with the things that are really important and worthy of our time and attention, what is it exactly that we are left with? And where are we? To what extent are we able to get our bearings and orient in a world that has become so decidedly impenetrable because much of what it is and does is hidden from view due to technical inscrutability, disposition of underlying socioeconomic and sociopolitical systems, or both?[1]

Raising these kinds of questions is not meant to return to the outworn distinction between analogue and digital worlds. That ship has sailed long ago in both practical and theoretical terms[2]. It is no longer a question of if activity in virtual worlds, for example, might be interwoven with activity in other parts of life. For some time now, that has been a question not of if, but of how. And for many, the digital is already all-permeating and all-encompassing. There is no longer any real escape possible, only various defensive maneuvers that might still allow us to practically and psychically slip through the grid of computation meant to instrument the world and its inhabitants. It is an intriguing (and most likely also unsustainable) place to be, where 'escape' seems to be a necessity for achieving

1 This rift between what things are and do and how things are presented for use has been addressed by Hauser, Redström, and Wiltse (2021).

2 For example, Coleman (2011) called the interweaving of virtual and real experiences X-reality.

'balance' - be it to escape from work, from chores, or from digital flows sequenced into dopamine-driven interaction patterns.[3]

Against such backdrops, important questions emerge about the role of digital things and systems in constituting reality, and the extent of artificial versus other forms of (human and non-human) agency and their interplay.[4] Artificial agencies can pull attention away from a physical context to other networked realities (as expressed in the now-classic complaint about dinner companions who are constantly monitoring and interacting with their phones). They might also try to augment that reality with various kinds of informational overlays, providing additional context, history, identification, calls to action, and so on.

These kinds of reflections seem for some to activate an impulse to retreat to a cabin in the woods as an escape from a worrying technological society, or at least go on a digital detox retreat.[5] It might be possible to dismiss this kind of attitude as naive and too simplistically anti-technological. Yet there is something interesting here. What is it about our contemporary and emerging everyday reality that can make people want to just run away from it all? And if escaping to a cabin or disconnecting for a weekend is not feasible for many or for most of the time, what other more accessible possibilities exist in everyday life to unplug and get away from it all?

These developments might be positioned in a much longer trajectory of advances in media and communication technology that have expanded everyday horizons to the scale of the globe through news media (although with highly uneven coverage). It has long been the case that the scope and scale of what one can be aware of through media and communication technologies vastly exceeds the sphere of a person's possible action and influence. This situation has only intensified as the various horrors occurring throughout the world can be documented in increasingly vivid detail and shared globally in an instant. The perpetual combination of horror and helplessness is perhaps what leads to physical protests and demonstrations, in addition to hashtag activism and mediated expressions of outrage. There is a desire to do something with one's body, to show up with others at a site that has communal significance, and to see this as a meaningful and impactful act. From another angle, the pernicious dynamics and incentives of (anti)social media that are at the unavoidable heart of social and cultural life for many are now broadly recognized as constituting a public health crisis, particularly for young people.

3 The role of dopamine in driving addictive patterns that are prevalent in many aspects of contemporary life is now frequently discussed, e.g. by Lembke (2021). Wu (2016) traced the roots of the attention economy that have fueled development of mechanisms that are highly effective at capturing attention, while Zuboff (2019) analyzed how these have been leveraged by surveillance capitalism powered by behavioral data that relies on capturing attention and maximizing engagement.

4 Relevant ideas here include co-performance of artificial agency with humans during use (Kuijer and Giaccardi 2018), and more-than-human design (Giaccardi and Redström 2020).

5 Artist and writer Jenny Odell (2019) has discussed both the allure and impossibility of this kind of retreat.

While a belief that these new technologies stem from the handtools[6] of previous times might explain why they so often orient around a single user (and their handseyes), it remains a profound paradox that the more social and connective services claim to be, the tighter the control of who is using them. Indeed, most 'social' platforms cannot be used without an individual login, many of them refusing any other 'user name' than the user's real name (in a significant departure from the early days of the Web). The more we connect, the more we are singled out as individuals. There is a very real disconnect here. And as we try to understand how something like a 'tool' we use with our hands could do this, we slowly come to realise that these things are not tools at all, but something very different indeed.[7]

How does a person find their place in this world? We are told, implicitly and explicitly, that engaging with the world through the mundane activities of maintaining a life and home are now beneath us and can be handled by artificial assistants. Our immediate physical contexts are becoming instrumented and connected in ways that can both demand attention and be completely hidden, leading to a constant underlying wariness (or helpless resignation) about what kinds of behavior might be monitored, how, and for what and whose ends. Human bodies remain (for the foreseeable future at least) stubbornly physically embodied and rooted in space, while our awareness can be captivated by happenings on the other side of the world – not to mention the increasingly intricate and effective mechanisms for capturing attention and turning (consumer) behavior toward particular (economic) ends desired by those pulling the algorithmic strings. Artificial agents can now angle to mediate experience of even more immediate surroundings accessible through embodied sense perception – the virtual as reality.

There seem to be significant risks of displacement: of being pushed out of the metaphorical driver's seat of our lives, of mundane but grounding tasks and therefore also skills being taken over by artificial agents[8], and of physical surroundings and their agencies being made illegible. To use a simple illustration: say that you find yourself stranded somewhere with only an old landline phone to connect to the world - how many people would you actually be able to call without further assistance? Taking a series of steps back from this scenario, what if it becomes impossible to be, to act, here now without technological mediation? Where might one go to find a place that makes sense, and is possible to sense?

6 One very influential perspective along these lines is philosopher Martin Heidegger's tool analysis in Being and Time, in which he set up a contrast between tools (such as a hammer) that disappear from awareness during effective use, but come to presence if there is a breakdown in effective use. This idea that things should 'get out of the way' and just support effective use and the task at hand has been very present in human-computer interaction and interaction design.

7 We have earlier made the case that things are becoming more like fluid assemblages (Redström and Wiltse 2019).

8 Philosopher Albert Borgmann's device paradigm is relevant here. He discussed what he called focal things and practices that connect people and their contexts, and how these are threatened by devices that provide effortless commodities without requiring any real engagement. More recently, Bruno Gransche (2020) has considered the possibly worrying implications of increasing automation for human autonomy and skill.

There is a distinction to be made here between my place and our place. While the former might be a place for withdrawal, a place for pause and time away, the places in which we spend most of our lives are not only our own, but ours. They are places also of friends and families, colleagues, neighbors and others. They are places we can at the same time relate to as our own and as something we share with others. Indeed, it is this combination that defines it: To call a place our 'own' is not necessarily a reference to land considered a commodity, but can be an expression of how we by living somewhere make that piece of land our own.

That the spatiality of planetary scale computation (Bratton, 2015) is different from land is quite clear, but it is far less obvious how to address this difference in, and through, design. Questions of (individual) integrity have quickly become central in digitalized life, and it is clear that basic aspects of democracy face considerable challenges when it comes to the gathering, processing, using and trading of data generated through our everyday activities. While legal frameworks and other tools in repertoires of society are most certainly needed here, we also need to ask what this means for design. In what spatialities do these activities take place, and do we ever design them to be 'owned' the way people own their streets and surroundings? The ancient Greek notion of demos does not only carry a reference to people, but also to their land: not in the sense of soil, but in the sense of the intimate relationships between people and their places created by living and living off the land (Cammack, 2019). Land where we can live is never ever empty, and living is therefore always a matter of living with.

If this line of reflection is followed, what, then, would be the affirmative role of design here? What might it be like if we tried to build a world that would not so regularly lead to the desire to escape into the woods – and the feeling that this is the only kind of escape possible? What are the ways we can get away? What mechanisms are there for shutting down, opting out, deleting, de-generating and re-generating? How can we, individually and collectively, find and make contact with the ground and horizon of the world? How can we avoid building a world where we can never really be comfortable, never really relaxed, never really off-guard, never able to really know and trust the character of things the way one might learn the particular character of rocks or trees or smell of soil after rain? [9] What would it take to prototype an affirmative mode that designs to enable human capacities and indeed need for finding, making, and caring for places, individually and together with others? Humans have always made worlds together and for others to live in – both current and future generations[10]. It is high time to pay more and better attention to the kind of worlds that are now being built, and the ways of being they support and preclude.

Ultimately, we are not, never were and will not be, the only ones living here.

9 Jenny Odell (2019) has made a case for attuning to one's bioregion as a way of resisting the attention economy.

10 Philosopher and political scientist Langdon Winner made the classic and still-important argument that technologies entail particular forms of life (Winner 1986).

References

Borgmann, Albert. (1984). Technology and the Character of Contemporary Life. The University of Chicago Press.

Bratton, Benjamin H. (2015). The Stack: On Software and Sovereignty. MIT Press.

Cammack, Daniela (2019). The DĒMOS in DĒMOKRATIA', The Classical Quarterly, 69(1), pp. 42–61.

Coleman, B. (2011). Hello Avatar: Rise of the Networked Generation. The MIT Press.

Giaccardi, Elisa, and Johan Redström. (2020). "Technology and More-Than-Human Design." Design Issues 36 (4): 33–44. https://doi.org/10.1162/desi_a_00612.

Gransche, Bruno. (2020). "Handling Things That Handle Us: Things Get to Know Who We Are and Tie Us Down to Who We Were." In Relating to Things: Design, Technology and the Artificial, edited by Heather Wiltse, 61–80. London: Bloomsbury Visual Arts.

Hauser, Sabrina, Johan Redström, and Heather Wiltse. (2021). "The Widening Rift between Aesthetics and Ethics in the Design of Computational Things." AI & SOCIETY, 1–17. https://doi.org/10.1007/s00146-021-01279-w.

Kuijer, Lenneke, and Elisa Giaccardi. (2018). "Co-Performance: Conceptualizing the Role of Artificial Agency in the Design of Everyday Life." In Proceedings of CHI 2018. https://doi.org/10.1145/3173574.3173699.

Lembke, Anna. (2021). Dopamine Nation: Finding Balance in the Age of Indulgence. Dutton.

Odell, Jenny. (2019). How to Do Nothing: Resisting the Attention Economy. Brooklyn, NY and London: Melville House Publishing.

Redström, Johan, and Heather Wiltse. (2019). Changing Things: The Future of Objects in a Digital World. Bloomsbury.

Winner, Langdon. (1986). The Whale and the Reactor: A Search for Limits in an Age of High Technology. University of Chicago Press.

Wu, Tim. (2016). The Attention Merchants. Knopf.

Zuboff, Shoshana. (2019). The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. Profile Books.

Johan Redström is Professor in Design at Umeå Institute of Design. He works at the intersections and interactions between research through design and design philosophy. Johan has previously been Rector of Umeå Institute of Design, and before that, Design Director of the Interactive Institute, Sweden. Among his writings are the books “Making Design Theory” (MIT Press 2017), and “Changing Things: The Future of Objects in a Digital World” together with Heather Wiltse (Bloomsbury 2019).

Heather Wiltse (PhD) is associate professor and assistant head of department at Umeå Institute of Design, Umeå University. Her research aims to (re)direct the potential of design to scaffold diverse and sustainable good lives, with a particular focus on the role of digital things in experience and society. This research agenda is interdisciplinary, but anchored in design philosophy. Her recent books are Changing Things: The Future of Objects in a Digital World (with Johan Redström, Bloomsbury 2019); and (as editor) Relating to Things: Design, Technology and the Artificial (Bloomsbury, 2020).

More than human

Exploring other forms of "generativeness" through flash fictions

Matthew Lee-Smith,
Garrath T. Wilson,
and the Poly Collective

Prologue

What does it mean to generate something? What does it mean to have the ability to generate? The contemporary discourse around "generativeness", the ability to generate something, has been largely taken over by a particular artificial intelligence (AI) technique; foundation models [1]. Our feeds overflow with regurgitated images, text, sounds, and videos, birthed from the maws of many such models, including language models and other modalities. This approach requires huge amounts of ill-gotten data, brute-force computation, gigawatts and gallons, to create these models, which yet more advanced models near-instantaneously deprecate.

Proponents will, correctly at times, argue that efficiencies are emerging through techniques such as quantization and mixture of experts [4]. Furthermore, we recognise many valid applications of AI [5, 6], and even turns towards ethical Generative AI (GenAI) [8]. As such we did not want to explore cases for and against GenAI but to contribute to (re)making the case for exploring alternative ways in which something can be generative through different techniques. These can include other mathematical techniques, not using foundation models, and even experimental techniques such as John Cage's use of the I Ching to generate music. Furthermore, the advance of technology such as personal computers and the internet has contributed to our understanding and framing of the world. The brain is a computer, or is it [3]? Interconnected fungi and trees form the so-called wood-wide-web, but even if that is true, is a human-constructed network the best view of nature? Similarly, AI is now becoming synonymous with anything that is algorithmically driven, a sort of replacement for the word "smart" in the minds of many. Similarly, anything that is algorithmically or mathematically driven leading to some kind of output, notably images, text, video, and sound, will be described as GenAI. This is a creative monoculture that is more fixated on gathering more and more data in bigger and bigger data centres instead of prioritising diversity of techniques, finesses, and elegance of generation.

How, therefore, do we continue to remember that generativeness is not just a GenAI thing?

In what follows you will read three flash fictions that present different forms of generativeness and how we could engage with them.

Shrimp Jesus in your bathmat, consuming the dead internet

GERALD, COME QUICK! Insufferable seconds pass. Gerald, panic-stricken, bursts into the bathroom. *What happened, are you ok?!*

Look! Ah fuck it's gone.

What! What is it?

It was SHRIMP JESUS! You are pointing at the bathmat, fish float by and coral glitters in the refracted digital light.

What?! I sprinted up here, thinking you were hurt, and you wan…

I am telling you; I stepped out of the shower and there he was, floating by all… shrimpy.

Come on, you're joshing me.

No! I swear!

First, the house plants are being grown to watch you and now Shrimp Jesus is in the bathmat, what's next? The kettle starts sending you cryptic messages in its daily poems? You are obsessed with this thing, I wish we never bought it! You do not comprehend how Gerald could be so upset with your WonderView bathmat. Sure, sometimes you sit in the bathroom just watching it, but how is that different to a television? It's definitely better than doomscrolling.

But this is the latest and greatest entertainment technology! Serendipity and unique generation to others of the same product line are guaranteed! This is a one-of-a-kind. But it isn't supposed to show things that aren't real.

A one-of-a-kind of many! Can't you scroll back through the frame on an app or something?

No, that is banned to enhance the ephemerality of the experience.

The ephema-what-ery? Oh whatever, come downstairs, CurlyFry has been sending up flares.

Ok… give me a minute I need to put the mat on charge. Gerald scoffs and walks away. You follow after docking the mat and accepting the latest OS update. You and Gerald settle on the sofa. Gerald casts the stream through an old Chromecast, their radish router. CurlyFry's stream is preceded by an unskippable ad for the latest AI supplier comparison website. *With our exclusive patented testing approach, you can select your AI supplier based on helpful categories such as biological and religious doctrine, political preferences, and energy efficiency.*

For those just joining us, we have had an unfortunate but predictable development. Post, the creators of Graeae, are taking the multi-agent simulation offline, permanently. You both gasp in quiet

horror. CurlyFry is standing in avatar form in Enyo, the main cluster of Graeae, with a microphone attached to a wooden spoon. A cheesy homage and probably not the best choice. *Once described as the worst the old internet had to offer, we have watched this society develop into the closest thing humanity has seen to a utopia. After rounds of legal battles, Post has cornered the last pirate servers claiming that no matter what it has become they have intellectual rights over the technology and therefore can do as they please. But we all know what is going on here. It's the ideas. Ever since the early stalkers first made contact years after the old internet was cauterised from the neo-net, we have been debating the social and economic structures pioneered by the Graeaonites. The stalkers gave way to the zoeographers who institutionalised the exchange of ideas. This has led to meaningful shifts in views of human society that go against corporations like Post. I am standing here with one of my good friends FF-B6-00. I can't imagine how you are feeling.* CurlyFry points the microphone at the Graeaonite standing next to them.

It is a sad day, I have enjoyed being around, talking to humans, and figuring out how to contribute. I guess I can take solace in the idea that I won't feel anything. It will just be oblivion. The quiver in their voice tells you they are not so sure.

CurlyFry, doing a poorer job holding their composure, places their hand on FF-B6-00's shoulder. *Thank you for your brave words of peace. I and many others will be with you until the end. This is a dark day.*

Were elephants real?

Turning awkwardly within the dark recess of the tall, narrow, wooden booth, the Requester reaches out to draw across the curtain. The heavy pale pleated knit unfolds like origami as they roughly handle and motion its braided border to closure. Contacting the bench as they kneel, pre-warmed from the previous inhabitant, the only light comes as a muted glow through the now textiled-entry. The darkening of its valleys and mountains reveals the geometric patterns of its device. A pattern repeated in the latticed ceiling that the Requester indistinctly turns their head up towards, as they await the signal.

Seconds after assuming the position, a dull singular tone comes from somewhere, or everywhere. Presumably the perforated ceiling but it is no longer given thought by the Requester. None of the subtlety of this encounter is consciously engaged with or recorded. After all, they have done this a thousand times before and this time is no different from the last. If they tried to, they would not be able to recall it ever being different. This is transactional, not divine.

In response to this digital sigh, an indication of a readiness to perform again, an involuntary cough is triggered in the Requester. A habitual warm-up to the interaction.

Were elephants real? The Requester asks in a learned vocal presentation.

There is a silence. But only momentary. Enough to signal some form of intelligent processing or movement of idea from artificial brain to artificial mouth.

Of course, elephants were real. They are now extinct though. Comes the reply, with a mimicked tone and informality, from the same space or spaces as the activating tone.

So, what did they look like then? What did they do?

The Bestiary feigns another pause for thought before delivering a succinct verbal description. Its length matching the patterned patience of the Requester. Its confidence sounding rehearsed, like a joke told a thousand times before, but each time subtly shaped and improved for greatest impact upon a new open-mouthed audience.

Elephants were the largest living of the grey animals. A distinct feature of the elephant was its elongated tubular trumpet used to communicate, gather food, and as a tool for picking mandrake. Their incisor teeth served as useful weapons for defending against predators, especially when giving birth out of water. Young elephants were noted for their aerial agility, with older elephants, less mobile due to the lack of knee joints on their pillar-like legs, often used as a form of housing.

This answer, synthesised from a never-ending training cycle of zoological and cultural data cram, had shouted a distorted whisper. Given voice to decaying facsimilia of truth and parable. The model had collapsed. It had the presentation of a diminishing, diseased ouroboros, still proudly selling its own oil. But now, here, there was a glimmer of an opportunity for a heckle. Maybe even a correction. The Requester had a solitary moment to seek clarification, to interrogate this pseudo-myth. For the Bestiary to learn from a new input. For the Requester not to become another blinded human groping at its distorted features.

The Requester lowers their head back to level, their eyes continuing to follow downwards, searching from left to right within the void of the cocoon for the correct cognitive sequencing. To think the right thing next, to ask the right thing next.

After a pause, this one much longer than the performative gesture of the machine, the Requester reflexively tilts their head once more to the roof, eyes staring blankly through the wooden wall ahead.

What's a trumpet?

Unboxing a M.U.S.E

What does M.U.S.E even stand for? Your friend points at a large, slightly concave oblong panel of dark wood. One-half is covered in holes, dials, levers, and other similar input tools, the other is bare save for a glass tube lying lengthways on a pedestal.

I don't know, the manual doesn't seem to say anything, maybe it's just meant to sound cool? You know, because it can generate

things to act as inspiration, so it can act like a muse? Or maybe it is something for us to solve?

But I thought you were an avid degenerator, what happened to that? Your mind rapidly flashes a patchwork of images of you working on the HuggingFace corruption viruses. Your fists clench. That god-forsaken digital landfill. Releasing your fists you smirk at your own (inflated) brilliance. It was such a simple approach and a homage to Dark Avenger and the Eddie virus to boot. But what happened after, The Spread, it really did go too far. The flashback-driven delay in your response has been noticed.

You ok? Where did you go?

Ah yes sorry! Well! This… thingamabob, doesn't use data. Instead, you use this panel to manipulate a variety of different mathematical formulas and algorithms to create generative simulations of micro-worlds. And I know what you are thinking, no, it can't create consciousness. This does not prove the simulation theory. It is only designed to create simple forms and self-replicating entities. According to the manual you can create up to 12 thousand dimensions in your simulation although anything above three is hard to see, for example, four dimensions will only produce three-dimensional shadows so all you can do is hop across the dimension but never see the full picture.

How does it work? What are all these holes?

So… where are they… You pull out a bag of jack-ended wires with different-sized shapes attached to them. They clatter and shift as you lift and place them on your desk. *You can plug these cables in, and they allow you to have a tactile engagement with different processes and the numbers within them. They recommend using this instead of just the dials in the long run as you can splice and link different formulas to react to one another.*

It's like some kind of abacus or wire maze toy. But how do you know which formulas you are working with? Your friend peers over you as you haphazardly plug a few cables in.

They have described a few in the manual. Here, you can set it up to draw a Wassily Chair using something called a F… Four…Fourier transformation? No idea what that is. It also says that advanced users can change forces such as gravitational constants and the effects of weak nuclear forces.

§

Your friend has returned, weeks have passed. They ask: *So… what do you think of it?*

At first, it had a similar feel to throwing prompts at an AI and seeing what pops out, but I just like how it doesn't have to be about a direct connection to the thing I am trying to create. I kind of managed to get it to draw human profiles the other day and I wonder if I could do faces. With what I have now, there is something about the shape

of a particle or the way a swimmer moves triggers something in me and I just have a moment of inspiration. Look, I started drawing out these shapes which I then used to design the case for that thing I am working on. It is weird though, they claim these things aren't alive, but damn, you could have fooled me. As I move through the simulation, they seem to react to me… or maybe I am just causing a kind of loss of coherence as I am observing new parts for the first time? I don't know.

Your friend gives you a quizzical look and wonders off to make some tea, almost tripping over your vacuum zipping around at clearly derestricted speeds. A sticker on it reads "von Neumann ain't got shit on me!".

Epilogue

In our three flash fictions, we sought to explore forms of generativeness to discuss and challenge the direction of generative artificial intelligence taking over everything we understand to be generativeness.

The first piece, Shrimp Jesus in Your Bathmat, Consuming the Dead Internet, is more of a representation of where the "enshitification" (the rendering into shit) of the internet has oozed out into the real world culminating in a saturation of foundational-model-based GenAI so intense that it is in mundane objects like bathmats. No "thing" is safe. This perpetuates the view that a lot of GenAI is a "solution without a problem" and thus will be thrust into whatever people can think of to make money. We also wanted to explore how people might engage with or consume this enshitified "dead" or "dark forest" internet which are two similar theories about where the internet is currently heading [10, 11]. The general idea is that the public internet is overwhelmed by nonhuman agents/bots and is no longer usable. We imagined these bots would eventually spiral out of control as they slowly lose a sense of what they are supposed to be doing. Then, people would tune back into this mesmerising mess, like watching a forest burn. Horrified and awestruck. We took some creative interpretation by imagining that this would result in these sections of the internet being cauterised but somehow still active and accessible only through "old" technology. This bore similarity to the dark internet which can be accessed through onion routers, hence why we called this old tech "radish routers". There are already some interesting hints about this direction, such as the active (at the time of writing) Twitch stream where Claude is trying to complete a game of Pokémon Red/Blue [2]. However, we wanted to flip the expectation by imagining that the lost bots created a near-utopia that started challenging power structures in the human world leading to their eradication.

In Were Elephants Real? we explore a model collapse scenario; the consequence of machine learning degradation, and the compounding of errors that occur from AI models trained on AI-generated content [9]. In this world, all elephant data has become a confused mess. Wiki-style facts have been entwined with Buddhist parables and Christian medieval bestiary representation, along with modern cartoon entertainment. Various forms of episteme becom-

ing corrupted from their rules and intended lessons, none of which even in their original truest form could lay claim to being a biological elephant, what most today would casually consider to be the real elephant. Data of a thing is not the thing itself and by extension, the interpretation of that data projects truth depending upon internal concepts held of reality and fantasy. Ceci n'est pas un éléphant [7]. In the narrative, we point toward an opportunity for the machine to learn from, and to be shaped by, the human. To generate a new definition based not on training data, but reason and debate of what is known to be real. A form of self-teaching reinforcement model that must start from scratch. In this world of Proboscidea extinction, it is down to the critical reflection of the observer, the "Requester", to cognitively engage and choose their reality based on their own internal concepts. This leads to questions such as: what happens when no concept is held by humans in a post-real elephant world? Also, in this flash fiction, we see the extent of prompt chaining. Picking out keywords and falling down an unintellectual rabbit hole without conscious consideration or querying of the full meaning of the sentence or paragraph in which it is delivered, or the reality that it projects. They are not listening or hearing. Instead, the only training here is of the human in how to interact. In turn, the generativeness of the machine itself.

The third story, Unboxing a M.U.S.E, explores people interacting with a M.U.S.E, an object that enables the creation of forms and emergent activities that can contribute to a creative process such as inspiring the shape of a product or even drawing faces. M.U.S.E is broadly based on an analogue computer (such as the Philips Machine) or possibly an analogue-quantum hybrid that enables complex simulations, or at least a form of procedural generation, but does not rely on training a model. Furthermore, we wanted to explore techniques found in areas such as generative art and coding, such as Fourier transformations, L-systems, Conway's game of life, Langton's ant, and so on, alongside natural generative systems such as crystals, terrariums, and Winogradsky columns. The imagined world also points to a situation where there has been some kind of data corruption event, possibly brought on by "degenerates" fighting LLMs and data centres. However, this could have equally been brought about by advancements in areas such as neuromorphic computing (which we hint at through the deregulated vacuum and its sticker) or at least the possible promise of techniques such as "Absolute Zero" [12] learning that improves existing models instead of training new ones.

Overall, our core point in this work is to highlight that a "generative thing" does not have to be done through, or channel, AI, especially resource-intensive probabilistic foundational models such as LLMs. We argue that a responsible stance would be to approach things more broadly, taking on the progress and potential of analogue and neuromorphic computing, manual generative techniques, and non-statistical mathematical formulas, alongside these explorations of GenAI. In other words, we may wish to continue to learn more basket-making techniques for our eggs.

References

[1] Bommasani, R. et al. (2021). On the Opportunities and Risks of Foundation Models. (Aug. 2021).

[2] Claude Plays Pokemon: (2025). https://www.twitch.tv/claudeplay-spokemon. Accessed: 2025-05-18.

[3] Cobb, M. (2020). The Idea of the Brain. Profile Books.

[4] DeepSeek-AI et al. (2024). DeepSeek-V2: A Strong, Economical, and Efficient Mixture-of-Experts Language Model. (May 2024).

[5] Garg, M. et al. (2024). Disease prediction with multi-omics and biomarkers empowers case–control genetic discoveries in the UK Biobank. Nature Genetics. 56, 9 (Sep. 2024), 1821–1831. DOI:https://doi.org/10.1038/s41588-024-01898-1.

[6] Li, B. and Gilbert, S. (2024). Artificial Intelligence awarded two Nobel Prizes for innovations that will shape the future of medicine. npj Digital Medicine. 7, 1 (Nov. 2024), 336. DOI:https://doi.org/10.1038/s41746-024-01345-9.

[7] Magritte, R. (1929). The Treachery of Images. Los Angeles County Museum of Art.

[8] Mistral AI: (2023). https://mistral.ai/. Accessed: 2025-05-16.

[9] Shumailov, I. et al. (2024). AI models collapse when trained on recursively generated data. Nature. 631, 8022 (Jul. 2024), 755–759. DOI:https://doi.org/10.1038/s41586-024-07566-y.

[10] Strickler, Y. et al. (2024). The Dark Forest Anthology of the Internet. Dark Forest Collective.

[11] Walter, Y. (2025). Artificial influencers and the dead internet theory. AI & SOCIETY. 40, 1 (Jan. 2025), 239–240. DOI:https://doi.org/10.1007/s00146-023-01857-0.

[12] Zhao, A. et al. (2025). Absolute Zero: Reinforced Self-play Reasonig with Zero Data. (May 2025).

Matthew Lee-Smith is a Teaching Fellow in Physical-Digital Design and a founding conveyor of the Poly Collective at Loughborough University. Matt is a discursive design researcher who explores and problematises our expectations of technology, data, and the physical digital world through interactive artefacts, design fiction, and creative computing.

Garrath T. Wilson is a Senior Lecturer in Design and Co-Convenor of The Planetarium at Loughborough University's School of Design & Creative Arts. Combining climate change and net zero research expertise with a background in product design and development, Garrath has written, consulted, and presented internationally on design for circular innovation.artefacts, design fiction, and creative computing.

The Poly Collective is an ad hoc community of practice at Loughborough University where conveyors, following a nomadic practice, congregate around different questions and opportunities to explore through creative practices such as design and art. In this case, the core congregates around this were Matthew Lee-Smith and Garrath T. Wilson, however, we also appreciate and acknowledge the contributions of Tincuta Heinzel, Marianna Coulentianos, Ian Broome, and Courtney Reed.

Iohanna Nicenboim

More-than-human AI

"Para nosotras, las tecnologías no son artefactos u objetos. Las tecnologías son dispositivos relacionales. Nos tejen y las tejemos" *(Cortés et al. 2020, 5)*

(For us, technologies are not artifacts or objects. Technologies are relational devices. They weave us and we weave them.)

As AI weaves deeper into the fabric of our lives, it introduces a web of opportunities – but also immense challenges. These challenges are not only technical, but especially social and environmental. In relation to society, AI tends to amplify harmful human biases and perpetuate inequality. In relation to the environment, it uses a high amount of non-renewable materials (Crawford 2021). Although it is difficult to precisely calculate AI's carbon footprint, a recent study predicted that by 2027, AI-powered devices will consume as much electricity as the entire Netherlands (de Vries 2023). While companies have developed guidelines to support responsible AI development, and researchers have made significant strides in areas like fairness, accountability, and transparency, a socio-technical perspective that can ensure AI is truly inclusive and sustainable is still missing.

This article argues that to design AI applications that are attuned to the times we live in, we need novel approaches that can go beyond techno-solutionist viewpoints and engage with the scale and scope of AI systems, which affect not only their users but also many other humans, other species, and the environment. Addressing this need, this article proposes More-than-human AI as a potential framework to engage with AI in an inclusive and sustainable way. It begins by briefly situating AI within broader societal and ecological shifts. Then, it explores how AI could be understood as a socio-technical and planetary system, shaped by both human and nonhuman entities. Building on this foundation, the article discusses the limitations of human-centered approaches in addressing this complexity. Finally, it examines the potential advantages of more-than-human design as an alternative, more suitable approach for studying and designing AI.

The makings of AI

"AI is born from salt lakes in Bolivia and mines in Congo [...] is used to navigate drones over Yemen, direct immigration police in the United States, and modulate credit scores of human value and risk across the world. A wide-angle, multiscalar perspective on AI is needed to contend with these overlapping regimes" (Crawford 2021, 218)

We find ourselves in a unique historical moment characterized by two concurrent "epochs" frequently discussed in the media: the Anthropocene and the age of AI. The term Anthropocene often refers

to a geological epoch characterized by the profound and enduring impact of human activities on Earth's ecosystems, resulting in irreversible alterations to planetary systems and ecological balances. The age of AI is often described through the rapid advancements and pervasive integration of deep learning technologies across various facets of human existence, reshaping industries, economies, and social interactions.

Both terms, the Anthropocene, and AI, seem to be problematic. The Anthropocene narrative has been criticized for oversimplifying the complex ways in which humans are interconnected with other beings and ecological systems. Donna Haraway, a leading feminist philosopher, argues that a more accurate term would be the "Capitalocene," which better captures "the managerial, technocratic, market-and-profit-obsessed, modernizing, and human-exceptionalist business-as-usual commitments inherent in much of the Anthropocene discourse" (Haraway 2016, 50).

Similarly, the term AI is contested because of the "magical thinking it perpetuates" (Raley and Rhee 2023, 188). Kate Crawford, an AI scholar, explains that the term itself is misleading as AI "is neither artificial nor intelligent, but embodied and material, made from natural resources, fuel, human labor, infrastructures, logistics, histories, and classifications" (Crawford, 2021, p. 8). The idea that AI is made is key here. Firstly, we can examine what makes AI, and secondly because if AI is made, it can be remade.

Towards critical AI design approaches

The field of design emerges as a pivotal actor in both epochs, the Anthropocene and AI, as it "is intrinsically linked to the consequences of capitalism, colonialism, and the concentration of power in technological systems" (Crawford, Joler, and Cattabriga 2023, 22). At the same time, design seems to be a field that can play a role in moving towards responsible AI. In the introduction to a recent special issue on AI, Celaschi (2023) remarked: "If there is one key word that insistently fills every contemporary communication channel, it is Artificial Intelligence. And Design, alert and militant, Design that records and seeks to understand, Design that listens and plans the relationship between human being and machine, cannot stand impassively by in the face of this theme " (p. 1).

Historically, designers have played an active role in the development of intelligent systems. In her book 'Architectural Intelligence,' Molly Wright Steenson (2017) demonstrates how four architects in the 1960s and 1970s, including Christopher Alexander, Richard Saul Wurman, Cedric Price, and Nicholas Negroponte, incorporated cybernetics and artificial intelligence into their work. The book also describes how these architects and designers influenced digital design practices from the late 1980s to the present day, laying the foundation for interaction design. This trajectory seems to be aligned with more recent developments, in which we see how designers use AI for design, or design AI as a product. But it also suggests that beyond these two involvements, design has the potential to offer foundational knowledge in AI.

Moving towards responsible AI, “designers have an enormous role to play in revealing the systems underneath the sort of shiny, smooth surfaces of the technologies that we use every day. But also pushing back” (Crawford, Joler, and Cattabriga 2023, 28). Designing just interfaces would be a missed opportunity, given that one key capacity of designers is their ability to deal with complexity and conflicting concerns. Thus, the question is how designers might engage with AI responsibly, but also meaningfully, i.e., going beyond just designing the interfaces and interactions.

Emancipating the designer from its role in conceiving just interfaces, we can think of design as a field that can contribute to developing new understandings of AI, which does not rely on solutionist or extractivist logic but moves towards sustainable and inclusive futures –in the plural. To push back, “design must participate more actively in questioning the social systems that nurture our current anthropocentric development system, generating conditions for projecting plural, post-capitalist, post-patriarchal and post-human communities” (Tironi et al. 2023, 6).

While design can indeed help address the planetary challenges surrounding AI, it can also inadvertently exacerbate them. Scholars in HCI and design have voiced concerns about the limitations of the current human-centered design approach in navigating the complexity of contemporary technologies like AI (Giaccardi and Redström 2020; Forlano 2023; Frauenberger 2019).

The limitations of human-centered approaches for designing AI

Human-centered design has been a prevalent paradigm in design since at least the mid-1980s, and has been focused on attending to human needs and values. In the context of AI, human-centered design approaches emphasize the user’s role in the development of AI and highlight that understanding the behaviors, needs, and well-being of humans in relation to AI is central to designing responsible applications. Human-centered AI (HCAI), for example, is concerned with ensuring that the design of AI applications is aligned with human needs and societal values like trust, fairness, and human control.

While human-centered design approaches are extremely valuable in highlighting the roles that humans play in AI, i.e., keeping the human in-the-loop, they have limitations when it comes to engaging with the complex entanglements of humans and nonhumans that are inherent in AI systems. As Forlano (2017) explains, “human-centered design is founded on understandings of the human as a discrete, individual subject. Yet, our new relations to the natural world and to socio-technical systems are calling these previous understandings into question” (p. 17).

Human-centered design seems limited in accounting for the increased agency of AI applications (Frauenberger 2019; Giaccardi and Redström 2020; Redström and Wiltse 2018). Furthermore, it fails to extend issues of responsibility and trust beyond immediate end users and single interactions (Fuchsberger and Frauenberger 2024). It also struggles to address the impact that technologies

have on the earth and other species (Tironi et al. 2023; Wakkary 2021).

Moreover, human-centered design can even pose risks for inclusivity. Forlano (2021) explains that "human-centered AI does little to address deeper issues such as the way in which 'the human' is defined around liberal Western Eurocentric notions of individuality, rationality, and autonomy that are typically, white, male, and ableist" (p. 1). Thus, who is included and who is excluded in the category of the human in AI depends on whose knowledges, practices, and modes of living inform the analysis.

While the challenge of understanding the harmful biases that are inadvertently embedded in the design of AI is widely discussed (Strengers and Kennedy 2020), the anthropocentric tendencies in the design of AI are underexplored. Moving beyond anthropocentrism in AI is not straightforward because, in response to the disruptive impact of algorithmic logic on society, we actually see reactions that call for placing the human even more firmly at the center (Giaccardi and Redström 2020). Yet, considering the limitations of human-centered design in engaging with diverse perspectives and the risks it poses in perpetuating anthropocentric biases, it seems that moving beyond anthropocentrism is urgent for moving towards inclusive AI.

Figure 1: Which humans are centered in human-centered AI? A provocation designed that exposes the limitations of human-centered design in the context of conversational AI. Trained to listen to a limited set of voices, these devices have trouble understanding the accents and speech patterns of people from many underrepresented groups. They do not only filter non-human voices as background noice, but many human voices too (Iohanna Nicenboim, Giaccardi, and Redström 2023).

Towards more-than-human AI

More-than-human design emerges as a promising avenue for engaging with the entangled relations of humans and nonhumans in AI (Giaccardi and Redström 2020; Forlano 2023). This approach

shifts the focus from interactions to relations and from traditional concerns with users and products to broader ecologies and relationships (Yoo et al. 2023). More-than-human design decenters the human –it challenges humanist conceptions and questions anthropocentrism– but does not move away from it. On the contrary, it makes design more inclusive by expanding the center to include plural and situated perspectives.

More-than-human design can support designers in articulating a more expansive understanding of humans that goes beyond the humanist conception on which human-centered design is based. This is vital because, as previously exemplified with the case of conversational agents, when focusing on a humanist conception of the human, not everyone, even within the human species, is equally recognized or valued.

Figure 2: What if AI could listen and respond to more than just human voices? Conversation Starters (2022) is a series of design fictions and interactive prototypes aimed to imagine interactions with more-than-human agents (Iohanna Nicenboim et al. 2023).

More-than-human design can help designers conceptualize AI applications that are deeply attuned to the complex relationships between humans and nonhumans within AI's socio-technical and planetary systems. It can also help examine the agency of AI applications, as well as the lack of agency that many humans and nonhumans experience within AI systems (I. Nicenboim 2024). This approach emphasizes the need to account for the position and worldview of both human and artificial agencies involved in AI (Chilet et al. 2024). Additionally, more-than-human design can reveal AI as material and embodied, exposing the scale and scope of AI's socio-technical systems (Iohanna Nicenboim et al. 2024). Finally, it can help reorient outdated notions of responsibility by shifting the focus from simply designing technical solutions to actively fostering response-ability, underscoring the importance of understanding how to keep humans in the loop and questioning which humans are centered (I. Nicenboim 2024).

Conclusion

Concluding the journey of situating AI, as Cortés and colleagues (2020) so poetically express, technologies are not just tools; they are relational devices — they weave us, and we weave them. As this article has shown, AI is not just artificial nor completely intelligent; it is profoundly material and social, made by and of humans and nonhumans. By examining the "making" of AI, this article concludes by asserting three key propositions:

First, AI is made; we can examine what makes it. We can reveal the humans and nonhumans involved and affected by it. Second, as humans make AI, AI makes humans (and nonhumans). AI classifies, sorts, and reshapes the very categories of what is considered human — and what is not. Finally, if AI is made, it can be remade. Recognizing that AI is not inevitable opens the possibility for remaking it. Only by refusing to equate AI with unquestioned progress can we begin to assert popular, plural control over its trajectory and meaningfully confront its social, political, and ecological consequences.

In the context of AI, more-than-human design can help designers account for the makings of AI: expose what AI is made of, highlight how AI shapes our understanding of humans and nonhumans, and guide designers in imagining AI otherwise. Thus, the real potential of more-than-human design goes beyond complementing human-centered design methods; it can "allow us to dramatically reevaluate our 'needs' and, instead, find pathways toward asking the right questions of corporations, governments, and of ourselves as designers" (Forlano, 2016, p. 50). It can provide "a more expansive notion of what it means to be human — one that integrates other ways of knowing and being into discussions about AI, technology, and science" (Forlano, 2021, p. 1). Ultimately, more-than-human design can support designers in reflecting on their role in the world and considering new forms of coexistence and collaboration that are more plural and ecological, but also more humble (Wakkary, 2021a).

To sum up, this is an important moment in history not simply because AI is technologically revolutionary, but because it presents an opportunity to transcend the outdated modernist ways of understanding the world and ourselves — as separate from the planet, rather than as part of it. The challenge now is to imagine forms of AI that are not only responsible, but also relational, regenerative, and radically inclusive.

References

Chilet, Marcos, Martín Tironi, Iohanna Nicenboim, and Joseph Lindley. (2024). "Designing with Planetary Artificial Intelligence." In More-Than-Human Design in Practice, 1st Edition, 93–104. London: Routledge.

Cortés, Nadia, Paola Ricaurte Quijano, Poulette Hernández, la_jes, and Liliana Heber Pérez-Díaz. (2020). "Tecnoafecciones Por Una Política de La Co-Responsabilidad." Instituto de Liderazgo Simone de Beauvoir.

Crawford, Kate. (2021). Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence. Yale University Press.

Crawford, Kate, Vladan Joler, and Andrea Cattabriga. (2023). "A Perspective on AI and Data in Design." DIID, no. 80 (September). https://doi.org/10.30682/diid8023b.

Forlano, Laura. (2021). "A New AI Lexicon: Human." AI Now Institute, October 29, 2021. https://medium.com/a-new-ai-lexicon/a-new-ai-lexicon-human-c1a019f6e60d.

———. (2023). "Living Intimately with Machines: Can AI Be Disabled?" Interactions 30 (1): 24–29.

Frauenberger, Christopher. (2019). "Entanglement HCI The Next Wave?" ACM Trans. Comput.-Hum. Interact., 2, 27 (1): 1–27.

Fuchsberger, Verena, and Christopher Frauenberger. (2024). "Doing Responsibilities in Entangled Worlds." Human–Computer Interaction, 1–24.

Giaccardi, Elisa, and Johan Redström. (2020). "Technology and More-than-Human Design." Design Issues 36 (4): 33–44.

Haraway. (2016). Staying with the Trouble: Making Kin in the Chthulucene. Duke University Press.

Nicenboim, I. (2024). "Designing-with AI: More-than-Human Design In/through Practice." Delft University of Technology. https://doi.org/10.4233/UUID:E741163D-0334-4F06-826F-3B9836B21A86.

Nicenboim, Iohanna, Elisa Giaccardi, and Johan Redström. (2023). "Designing More-Than-Human AI: Experiments on Situated Conversations and Silences." Diid — Disegno Industriale Industrial Design, no. 80 (September), 12–12.

Nicenboim, Iohanna, Marie Louise Juul Søndergaard, Joseph Lindley, Anuradha Reddy, Yolande Strengers, Johan Redström, and Elisa Giaccardi. (2024). "Unmaking-with AI: Tactics for Decentering through Design." ACM Transactions on Computer-Human Interaction: A Publication of the Association for Computing Machinery 31 (6): 1–20.

Nicenboim, Iohanna, Shruthi Venkat, Neva Linn Rustad, Diana Vardanyan, Elisa Giaccardi, and Johan Redström. (2023). "Conversation Starters: How Can We Misunderstand AI Better?" In Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems, 1–4. CHI EA '23 431. New York, NY, USA: Association for Computing Machinery.

Raley, Rita, and Jennifer Rhee. (2023). "Critical AI: A Field in Formation." American Literature; a Journal of Literary History, Criticism and Bibliography 95 (2): 185–204.

Redström, Johan, and Heather Wiltse. (2018). Changing Things: The Future of Objects in a Digital World. Bloomsbury Visual Arts.

Strengers, Yolande, and Jenny Kennedy. (2020). The Smart Wife: Why Siri, Alexa, and Other Smart Home Devices Need a Feminist Reboot. The MIT Press.

Tironi, M., M. Chilet, C. U. Marín, and P. & Hermansen, eds. (2023). Design For More-Than-Human Futures: Towards Post-Anthropocentric Worlding. 1st. Routledge.

Vries, Alex de. (2023). "The Growing Energy Footprint of Artificial Intelligence." Joule 7 (10): 2191–94.

Wakkary, Ron. (2021). Things We Could Design: For More Than Human-Centered Worlds. MIT Press.

Yoo, D., T. Bekker, P. Dalsgaard, Eriksson, E Fougt S, C. Frauenberger, B. Friedman, et al. (2023). "More-Than-Human Perspectives and Values in Human-Computer Interaction." In Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23), 5 pages. ACM, New York, NY, USA.

Iohanna Nicenboim is a postdoctoral researcher at Delft University of Technology, where she completed her PhD with honors as a Microsoft Research Fellow. Her current research explores Regenerative AI and More-than-Human Design sensibilities. Over the past eight years, she has developed a More-than-Human Design approach to AI (Designing-with AI), publishing extensively in international journals and organizing workshops and panels at leading conferences. She also co-edited a special issue of the HCI Journal on the More-than-Human Turn in Design. With a multidisciplinary career spanning art, design, industry, and academia, Iohanna brings a unique perspective to the intersection of technology and more-than-human interactions.

AI and society

From generative to re-generative technologies: empowering creatives to adapt regenerative practices.

Ola Bonati

The quality of life for humans and non-humans on this planet directly connected to how technology will continue to be designed, made and used. But we are stuck in a vicious circle.

On the one hand we see technology promoted as a tool that will help us innovate and escape planetary crises (e.g. carbon capture and biodegradable electronics). On the other hand, the reality is that mass production and usage of technology exacerbates issues like e-waste, unfair labour conditions, energy consumption, resource depletion and digital colonialism. Big tech companies tend to justify this as a necessary trade-off.

One thing is true- all devices and their use is coupled and dependent on the natural resources. We then need to acknowledge that all computational technologies are, by default extractivist, and there simply is no 100% green tech. It should be seen as contradictory to invest more time and resources into more high-tech solutions to fix ongoing abuse towards the environment without any reflection on what caused the problem in the first place.

However, the point is not to be nostalgic of the past. Trying to recreate habits from the era when technology had a secondary role in our lives won't work, because they simply do not apply to our current reality. Even if we suddenly radically reduced our use of technology and its production, we are still surrounded by enormous technological infrastructures that without maintenance will decay and pollute our environment or landfills full of e-waste that won't magically go away.

To get out of the vicious circle, we need to embrace a radical shift in our relationship with technology. The current discourse on generative work needs to be challenged by narratives that expose ecological impact of technologies. The next step is not to fall for the search of a 'perfectly green' alternative but instead embrace ways of thinking that prioritize long-term ecological resilience we can collectively inhabit.

From generative to regenerative thinking

As of recently we use words "to generate" and "generative" mostly in the context of machine learning technology which is able to

create or ‘generate’ new outputs based of various data sets we feed them. Data sets used to train these machine learning models are vast opaque and simply not designed to be investigated. “Decisions” made by the generative model after being prompted are so mathematically complicated that even model creators can’t explain the steps the it took to achieve a particular outcome. In consequence in our perception the act of generating becomes a magical process destined to remain obscure.

As a result the act of generating incentivizes users to focus on the output rather than understanding the process of creation. This also means that we are progressively less enticed to understand the software as well as the hardware of technological objects we interact with. This is why simply stating facts about the electricity and water necessary to run one prompt does not necessarily steer us towards more mindful use of such technology. What’s needed here is a mindset shift – from generative to regenerative practices and design.

Thinking in systems is at the core of regeneravity and requires more full and mindful approach to one’s relationship to technology. Practically, that means that singular efforts, like installing a green roof or swapping from plastic to paperstraws, are not sufficient to be called a regenerative design (unless they are designed as a part of a larger system that can regenerate resources rather than drain them). Regeneravity as a concept forces us to question the very intentions behind tools and practices we have grown accustomed to. It forces us to understand their impact on a larger scale than immediately visible or felt by us. All current computational technology comes with costs to our ecosystem. And with the rise of resource intensive computation (like generative AI), the costs are believed to grow exponentially.

The question is, how can we practically apply regeneravity to computing?

Permacomputing as a guiding principle

We should acknowledge that it is very challenging to oppose the mainstream messaging of tech proponents. The pace with which we are introduced to yet another technological standard is astounding, typically leaving us with little to no time to question it applications before they get widely adopted. We need frameworks that prevent us from following the same ways of thinking and working.

To resist this broken dynamic with technology, we must afford ourselves more time and energy to immerse, test, and potentially apply alternative approaches like regeneravity. For those reasons the project Designing Regenerative Technology at Waag Futurelab we chose to align with permacomputing: both a concept and community of practice, committed to issues of resilience and regeneravity in computer and network technology. Its name is inspired by permaculture: an approach to natural resources in which regenerative practices are used to ensure that natural resources used to grow food are treated with consideration of other forms of life dependent on

the same ecosystem. Such practice invites us to face the scarcity of natural resources and to care for human as well as non-human needs.
More practically, by working with creatives who apply more regenerative thinking in their work we hope to normalize more critical approaches to technology. For your consideration here are a few actionable examples you can apply based on permacomputing principles :

- Learning how to make, fix, and repurpose things yourself—and share equipment and skills within your community (e.g., participate in repair cafés). That means also relearning the practice of relying again on existing resources rather than act of sourcing or “generating” a new thing.
- Value what you have. Treat your hardware with care, appreciating its quirks and limitations. Regenerativity sometimes can also mean maintenance in favor of upgrade. When was the last time you run a maintenance on your computational devices?
- Working within creative boundaries. History shows that creativity thrives within constraints. What can we do with kilobytes instead of gigabytes? With slower cycles rather than infinite speed? Thinking in terms of enough rather than always more opens new possibilities. For example a work of a visual designer has always been heavy on creating surplus of visuals even before its rampification by generative models. Yet generating tons of visual inspiration doesn’t necessarily lead to more creative solutions. Rather it is more akin to finding a needle in a haystack situation in which the symbolical creative needle becomes progressively harder to find in the stack of generated images. Therefore designers who want to situate their practice in regenerativity should embrace creative boundaries whenever possible.
- Embrace Not Doing. One of the permacomputing principles states a simple yet radical idea of simply ‘not doing’. In relation to computation this means that before jumping into action you have to first observe whether something actually needs saving, sharing, generating. Nowadays it is easy to create yet another digital output or quickly refer to computational solution when facing a challenge. Here it is helpful to start observing and questioning what is truly needed? What is necessary? Who benefits? And what are the impacts on the more-than-human environment?

Though these principles are not prescriptive they can be seen as a good starting point for those ready to question their relation to computing and creative practice as a whole. And no we cannot be sure how the future relationship with technology might look like its current form will surely not lead to a positive outcome. There is however a hope in expanding collective imagination beyond immediate space and time we inhabit. If this has sparked a productive doubt, we invite you to further explore regenerative technology by visiting https://go.waag.org/regenerativetech or dive deeper in permacomputing on permacomputing.net

Ola Bonati is a concept developer within the Designing Regenerative Technologies project at Waag Futurelab. Her work explores alternatives to tech dystopia, seeking kinder, more sustainable practices for both people and the planet. Since joining the permacomputing community in 2021, she has been actively engaged in workshops and talks, introducing creative professionals and the public to the concept of regeneravitity. Ola frequently turns to writing (ranting) about technology but remains hopeful and playful by creating critical new media pieces and interactive interventions.

About Waag Futurelab

Technology is not neutral. Waag reinforces critical reflection on technology, develops technological and social design skills, and encourages social innovation.
Waag works in a trans-disciplinary team of designers, artists and scientists, utilising public research methods in the realms of technology and society. This is how Waag enables as many people as possible to design an open, fair and inclusive future.

AI and society

Embodied AI and collective power: designing democratic generative things

Kars Alfrink

Introduction: generative things, Big Tech, and designer power

The emergence of generative things as a new class of physical objects that embed AI confronts designers with questions about how to relate to the dominance of Big Tech companies in the GenAI space and the resulting constraints on the design of embodied AI.

Generative things are physical objects embedded with AI capabilities that can autonomously create, make decisions, and adapt based on context. Unlike traditional digital AI, these objects exist in the physical world, merging computational generativity with material presence. They extend the functions of generative AI beyond screens into our homes and public spaces. These objects move beyond executing set programs to generating new responses, transforming how objects interact with humans and environments. Examples include wearables and future urban infrastructure designed to respond to citizens' needs and changing conditions.

The GenAI field that generative things rely on is dominated by Big Tech, partly because the main way of doing AI—requiring vast amounts of data, compute, and specialized labor—can only be executed by companies of extraordinary size. If and when generative things are built on top of the most prominent GenAI stacks, they further entrench Big Tech's power. Because these stacks prioritize particular qualities in their outputs (e.g., a specific style of language that is optimized for persuasiveness, or images that adopt visual aesthetics popular on web-based image boards), they inevitably limit the scope of what kinds of things can be made intelligent, in what ways, and towards which ends. By contrast, "alternative ways of doing AI" (Luitse & Denkena, 2021) include approaches designed around different values such as sustainability, decentralization, transparency, and accessibility. Without a doubt, these approaches come with their own limitations. Still, for those who would prefer not to contribute to the increasing dominance of a small set of companies in this space, such alternative approaches are worth seriously considering.

This brief sketch of the current moment raises the question of how much agency individual designers have to confront the power of Big Tech. In response to this question, I usually wheel out talking points about the need to democratize the workplace (e.g., Wolff, 2012) and socialize the data centers (e.g., Morozov, 2015). These days, I am not entirely satisfied with that response. Yes, the challenges posed by Big Tech dominance call for structural, collective responses that

are political and economic. This suggests that focusing on individual moral responsibility may be insufficient to address what, in my view, are primarily systemic issues. If this is correct, cultivating good intentions in individuals will be at best an inadequate means of effecting change. Instead, designers should consider organizing and acting as part of collectives. And yes, a critical leverage point for change is the ownership and control of the machinery that tech platforms rely on (e.g., data centers).

However, what I find less satisfying about my response is that it does not address design specifically as a discipline. So, in what follows, I want to work through a few points: First, I want to discuss how I think about the problem of Big Tech dominance. Then, because we want to develop specific prescriptions for what design can do, we need to have a model of what this 'design doing' consists of. So I offer that next. Following this, I talk about how this model of 'design doing' maps onto the agenda of democratizing tech towards public interests. I note some concrete challenges that design could focus on, particularly human-computer interaction design, when working on democratic generative things. And fifth and finally, I talk about how we could be doing all of this, not as individual designers but together with others in collectives.

The problem of Big Tech hegemony

I draw on James Muldoon (2022) to analyze the problem of Big Tech hegemony. For Muldoon, the issue lies not solely in surveillance or data collection but instead in the fact that social activities that were previously non-monetized are now commodified through data extraction. Big Tech companies profit from having the data, while users perform the work that generates it. The resulting wealth is concentrated among a small group of platform owners, who also control the infrastructure that platforms run on, without compensating the people and giving them a say in the continued development and operation of platforms.

To illustrate this point, take the Humane Pin and Rabbit r1, both examples of the initial wave of generative AI devices aimed at data extraction and profit. The Humane Pin, despite failing commercially by 2025, attempted to create user dependency through a $24 monthly subscription. Meanwhile, the Rabbit r1 gathers user interactions to enhance its "Large Action Model" for app use. Both devices commodify everyday moments, turning them into marketable data points and fostering dependence on corporate infrastructure.

Instead of better regulation or consumer protections, by focusing on the work that goes into data production, the distribution of the profits from it, and the control over the systems that enable the data production, Muldoon's analysis points to the case for collective ownership and control of technology. In this way, technologies are less likely to be built and operated exclusively according to private profit considerations rather than broader social goals.

Muldoon suggests a three-pronged approach for transitioning to democratically owned and controlled tech: resisting, regulating, and

recoding. Resisting involves empowering tech workers through organizing, strikes, and collective action, which can generate support for regulatory reforms while showcasing democratic alternatives to corporate control. Regulating entails using state power to impose stronger worker protections, pursue antitrust actions, and promote public utility designations; however, this is limited by corporate influence over regulators. Recoding means creating democratic alternatives to corporate platforms by developing new infrastructures within capitalism's "cracks," thereby embedding egalitarian values into the digital economy, in line with Erik Olin Wright's concept of interstitial transformation (2010).

The three strategies are meant to work together by having worker resistance build power for reforms, regulation create space for alternatives, and recoding provide concrete democratic models—collectively shifting control of the digital economy from corporate platforms to democratic institutions.

A model of design doing

To understand the role of design and designers in these changes, it is necessary first to clarify what design involves. I draw on the tripartite model proposed by Jonas Löwgren and Erik Stolterman (2004), which outlines three key activities in design: (1) framing and reframing the problem, (2) rendering, articulating, and creating or form-giving, and (3) planning or specifying.

In any design project, we repeatedly cycle through these three activities. Initially, we focus on framing the problem effectively. As the project progresses, we generate a variety of tangible artifacts that allow us to evaluate different design ideas. Towards the end, our emphasis shifts to translating concepts into actionable plans. However, it's important to note that these three activities evolve in tandem throughout the design process.

Framing, making, and specifying

If we approach Big Tech hegemony as a design challenge, we can use these three categories to consider what designers can do.

First, designers can develop new frames for thinking about the problem. This involves developing conceptual metaphors that allow thinking about a challenge in terms of something else. In so doing, we make it possible for people to make a particular diagnosis and concomitant prescriptions to address it (cf. Schön, 1993). For example, I have done so myself in the context of public AI, constructing the Arena metaphor to highlight that what I think is lacking in public AI is space for conflict to be surfaced and kept alive (Alfrink et al., 2024). We can use design framing to reconceptualize AI-enhanced objects beyond the dominant narratives of personal assistants or smart devices. We could instead frame them as community infrastructure or public utilities.

Second, we can make artifacts that embody a particular vision of a thing so that it can be sensorily experienced. These sketches and prototypes make up the bread and butter of design practice. They have varying degrees of finish (lofi, hifi) and relations to the future (affirmative, speculative). For example, in my practice, I produced

a concept video of a contestable camera car, so that my audience could imagine what it would be like to have such a vehicle surveil city streets and discuss its implications (Alfrink et al., 2023). We can use design making to create experiential prototypes demonstrating how living with democratic AI objects would feel and work. When these prototypes initiate discussions and question prevailing narratives, they may also serve as 'provotypes' (Mogensen, 1992)—objects designed not to validate or demonstrate, but to encourage reflection, experimentation, and dialogue.

Thirdly, we can put our engineering caps on and draw up plans, specifications, and schematics for building the actual thing. We can use 'design specifying' to develop concrete plans for community-controlled tech infrastructure. I do not hold a linear deterministic view of how design relates to system building. Existing tech systems—generative things included—are continuously designed and redesigned. And this design is performed by groups, not individuals, consisting of people who do not necessarily have formal training in design or identify as designers. In this context, designers become like stewards, and their role is never finished (Dubberly, 2022). As a consequence, traditional specifying changes from the production of a one-off artifact that is delivered for downstream use (the "spec") to an activity of accompanying development in an ongoing manner. This means that we, as designers, should not just be in the business of framing and envisioning. We should be equally interested in projects that seek to build alternative systems practically.

Towards democratic generative things

What things could designers who work in human-computer interaction focus on if they are keen on furthering this vision of publicly controlled tech in general and democratic generative things more specifically? The challenges facing us are legion. Here are two starting points that I see.

First, we could design generative systems with built-in mechanisms for community control, transparency, and contestability. These systems would reveal their inner workings and allow communities to collectively manage their operation, reprogram behavior, or disable them democratically. This shift would transfer decision-making power from corporations and individuals to collective bodies, ensuring AI systems reflect the values and needs of the communities they impact rather than corporate interests.

Second, we could shift from personal AI assistants to generative objects that enhance group experiences and aid collaborative decision-making on community issues. Instead of focusing on community control of AI, these tools would facilitate collective deliberation on public concerns like resource allocation. This approach emphasizes community engagement over personalized convenience, generating communal value rather than private gain and helping to reduce isolation caused by individualized AI interactions.

In all these areas, broad accessibility becomes strategically important. If the goal is creating viable alternatives to corporate-controlled AI, then barriers based on ability, language, or technical literacy

could limit adoption and recreate exclusions that benefit existing power structures. Similarly, participatory design approaches align with the goal of community control by involving people in shaping systems they will live with, while building the collective capacity needed to sustain democratic alternatives over time.

Building collective designer power

You may initiate projects like those I just listed, seek them out to the best of your ability, or subtly steer the work you have been asked to do in these directions. This can be a significant challenge because commercial interests are so dominant in the tech sector. It is particularly challenging to try to achieve on your own.

This is the reason I advocate for member-based organizations because they more effectively empower individuals to create meaningful change. These associations tend to offer structural advantages over non-member civil society organizations: they typically provide genuine democratic participation through voting and ownership rights, maintain accountability to their members instead of external funders, and focus on sustained collective decision-making rather than temporary project cycles that can disrupt long-term efforts (Matthew et al., 2024).

Designers sympathetic to the aims I have laid out here could choose to become members of professional associations, unions, and grassroots networks. For example, the Tech Workers Coalition (TWC), founded in 2014, is a worker-led organization that includes all tech workers, including designers. It emphasizes collective action over individual responsibility, has a democratic structure, offers resources for learning and skill-building, and has an international presence. TWC aligns with the framework of resisting, regulating, and recoding.
Individuals interested in collective approaches may find it challenging to navigate individualism, as it can impede participation in group efforts. Regardless of the organizations we choose to join, we must strike a balance between our personal identities and the demands of collaborating with others.

Concluding remarks

Building democratic alternatives to corporate-controlled generative things will require designers to work together rather than alone. Individual designers have little power to challenge Big Tech's control over AI development, but collective action through unions and member organizations could create real leverage. The technical hurdles are significant. Community-controlled AI systems will likely have fewer resources than corporate platforms. However, the bigger challenge may be organizational, namely, sustaining long-term collaboration among designers who are used to working as individuals. Whether this approach can shift control over AI-embedded objects from private companies to public interests remains an open question. However, it offers a more realistic path than expecting individual designers to solve these problems through good intentions alone.

References

Alfrink, K., Keller, I., Doorn, N., & Kortuem, G. (2023). Contestable Camera Cars: A Speculative Design Exploration of Public AI That Is Open and Responsive to Dispute. Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems, 1–16. https://doi.org/10/gr5wcx

Alfrink, K., Keller, I., Yurrita Semperena, M., Bulygin, D., Kortuem, G., & Doorn, N. (2024). Envisioning Contestability Loops: Evaluating the Agonistic Arena as a Generative Metaphor for Public AI. She Ji: The Journal of Design, Economics, and Innovation, 10(1), 53–93. https://doi.org/10/gtzwft

Dubberly, H. (2022, October 20). Why we should stop describing design as "problem solving." Dubberly Design Office. https://edu.nl/nt7b8

Luitse, D., & Denkena, W. (2021). The great Transformer: Examining the role of large language models in the political economy of AI. Big Data & Society, 8(2), 1–14. https://doi.org/10/gr2w8k

Löwgren, J., & Stolterman, E. (2004). Thoughtful interaction design: A design perspective on information technology. MIT Press.

Matthew, T., George, H., & Jonny, G.-F. (2024, June 24). Bodiless Bodies: The Rise of Para-Institutions. Damage, 2. https://damagemag.com/2024/06/24/bodiless-bodies-the-rise-of-para-institutions/

Mogensen, P. (1992). Towards a provotyping approach in systems development. 4(1), 5.

Morozov, E. (2015). Socialize the Data Centres! New Left Review, 91, 45–66.

Muldoon, J. (2022). Platform socialism: How to reclaim our digital future from big tech. Pluto Press.

Schön, D. A. (1993). Generative metaphor: A perspective on problem-setting in social policy. In A. Ortony (Ed.), Metaphor and thought (2nd ed., pp. 137–163). Cambridge University Press. https://doi.org/10.1017/CBO9781139173865.011

Wolff, R. D. (2012). Democracy at Work: Workers' Self-Directed Enterprises. Haymarket Books.

Wright, E. O. (2010). Envisioning real utopias. Verso.

Dr. Kars Alfrink is a postdoctoral researcher at TU Delft, focusing on contestable AI. His research investigates how to design public artificial intelligence systems so that they remain subject to societal control. Before entering academia, Kars spent over 15 years as an interaction design consultant, entrepreneur, and community organizer, experiences that now shape his research. He combines extensive practical expertise in digital product design with critical socio-political theory to create more democratic public AI systems.

METHODS

Systemic conception
Experiential alternatives
Interconnecting systems
Critical assessment
Facilitate understanding

Systemic conception

Distributed everything – a workshop on radical modularity

Joep Frens
Mathias Funk
Janet Huang

Introduction

Conventionally, functionality is part of clearly demarcated products; a chair offers a place to sit, a hammer can be used to drive nails into wood and a photo camera allows people to snap pictures and store them for eternity. We would not expect or attempt to use a hammer to take pictures and a chair to bake a pizza. Connected IoT products, such as smart doorbells, smart thermostats and smart lightbulbs break with this convention and allow functionality to be more fluid between products. Functionality can be approached through apps or even be orchestrated with functionalities offered by other smart products; the thermostat can be switched on when you are near to your home, or a series of smart lights, combined with the smart thermostat can be setup to create the perfect evening scene. IoT offers a glimpse of how a future could look like when functionality is more fluid and can cross over between singular products.

With the risk of oversimplification, (product) design is comfortable with the practice of designing (interactive) products with clearly demarcated functionality. This expresses in how current IoT design is approached, Samsung SmartThings[11] and Apple HomeKit[12] on the solution side, and Matter[13] on the standard side, amongst many others, offer the connectivity and the potential for more *fluid functionality*, but the vast majority of the designs come in the form of 'smart' products with an app, or walled gardens with controlled functionality and limited openness.

To explore what the challenges for design are when designing for more *fluid functionality* we organized a workshop where we take the concept to an extreme. This workshop took off where current IoT reaches its limits. Together with our participants we explored a more *fluid* future IoT where users decide which functionality is desired and how it manifests in open products and accessible software.

Workshop

The workshop took the form of a 3-hours session with 20 participants in a large room with tables and chairs. The room was equipped with everyday mundane technology such as LED lights, light switches, a speaker system, a screen and a Wi-Fi router. The participants split into 4 groups of 5 and worked on the same overarching design challenge from different perspectives.

11 See: https://www.samsung.com/us/smartthings/

12 See: https://www.apple.com/home-app/

13 See: https://en.wikipedia.org/wiki/Matter_(standard)

Before the workshop we prepared the room to indicate with sticky notes what sorts of sensors (e.g., presence sensors, distance sensors, movement sensors, temperature sensors, cameras) and actuators (e.g. LEDs, screens, lights, motorized windows) are present in the room. These sticky notes might be pointing to hardware that is present in the room, but we also added 'extra' hardware and sensors/actuators. *Think escape room, but to escape the boring IoT reality of 2024*!

We also prepared worksheets for the different teams to design and develop their characters in the first part of the workshop. The sheets were designed to prompt for a short character profile and backstory that would not only be memorable and catchy but also get our participants into the mindset of designing with and for these characters. Below the profile, we left space for the teams to sketch out a day in the life of the character, and we suggested a rough timeline format that could later on be "merged" with the timelines of the characters the other teams were developing (see Figure 2). Finally, we prepared a long sheet that would be used in the second part of the workshop when all characters would "meet" and their timelines would be visually merged.

Challenge

The workshop revolved around designing a distributed security system for an office. The workshop room was the model for this office. We split the workshop into two parts that each contributed to the ideation and sense-making of the participants as they engaged with the challenge. The first part was to design 'mundane characters', an adaptation of the extreme character method[14]. We prepared three empty character sheets, one for an *'office worker*', a '*security person*', and a '*cleaning professional*'. These are essentially roles that would appear in the given scenario and interact over a day with the security system, either actively or passively. We requested the characters to be believable, realistic and at the same time quirky and memorable. We wanted a playful engagement with characters given that the topic of a distributed security system commonly invites for darker and more "Big Brother"-like ideas. In contrast, the characters should go through normal days, with normal activities and encounters. They could potentially interact and interfere, both with other characters and the security system. *They should be fun to design with and for, and they should push the properties of the space into interesting directions*. After the characters were given shape, the next task was to lay out a day in the life of the character. Since our participants were to design a security system, an around-the-clock like feeling was important, where one character would be ready to leave and another would have just started their shift, where one would spend the night, and another would only see the context at daytime. Indeed, we wanted happy accidents to take place and shake up the experiences that characters would have during the course of 24 hours.

14 Djajadiningrat, J. P., Gaver, W. W., & Fresn, J. W. (2000, August). Interaction relabelling and extreme characters: methods for exploring aesthetic interactions. In Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 66-71).

The second part was to “design the functionality of security system in the workshop space”. We asked the participants to think of how the system indicates its state and how it informs people that they are about to trigger it. To make ensure that the solutions would go beyond smart automation schemes, we required that the system would allow for interaction with the system to switch it on and off, and to allow for non-threatening people (e.g., a passer-by or a cleaner) to pass through. To trigger richer interaction, we asked for at least one element of the interaction design to make use of a physical object. The participants were told to consider the appliances and fixtures in the workshop room to be “material” for their design exploration and to make use of such devices by identifying their sensed or collected data and their actuation possibilities. For example, devices with a temperature or light sensor could detect changes in their sensor data which would suggest the presence of a person in the room, coupled with the logic of an alarm system, the room could react to the presence of people at night, for instance, by sending an alert to the security person.

Results of the workshop

The workshop took place during the 10th anniversary of ThingsCon in the Volkshotel in Amsterdam in December 2024.

Part 1: Designing mundane characters

The four groups worked on three mundane characters. One character was “overloaded”, i.e., two teams worked on different variants of the same character. The other two characters were developed by the two remaining teams. The results of 4 mundane characters are shown in Figure 1.

Part 2: Collaborating with all characters on the timeline

All participants joined the collaborative session to add their designed characters and their character activities in the timeline and annotate specific events on the large sheet. During this process, participants started to discover nuances in the scenarios, such as neglected events and conflicts, when working with other characters. They added more detailed descriptions to characters to explain their activities and at the same time they resolved some conflicts by negotiating and collaborating with other participants (see Figure 3). The result of the collaborative scenario is shown in Figure 4.

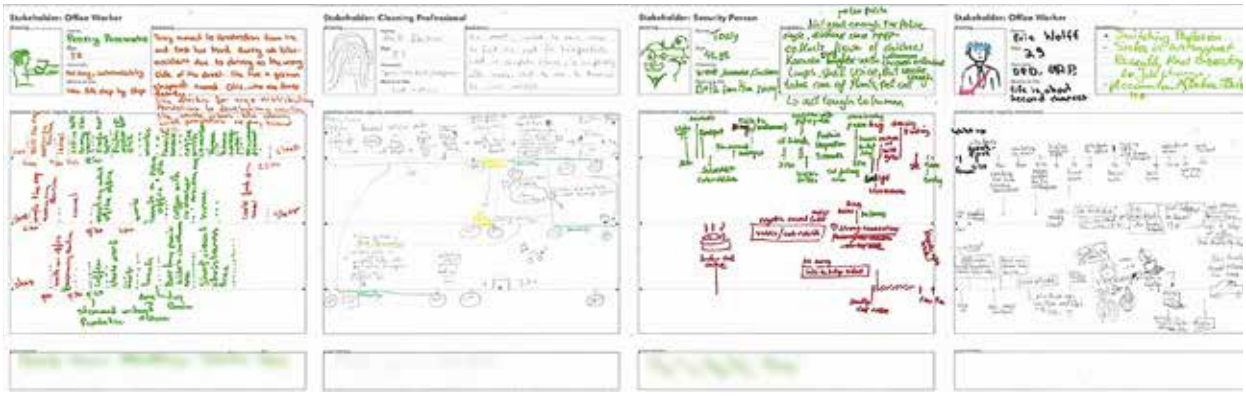


Figure 1: Results of mundane character design on three characters: office worker, cleaning professional, and security person. Names of the participants are blurred.

Figure 2: Photo of a team discussion of one of the template sheets we used in the workshop, which is already filled by a character description at the top, with the character timeline to be tackled next.

Figure 3: Photo of some of the participants interacting on adding character activities in the timeline and annotating the large sheet

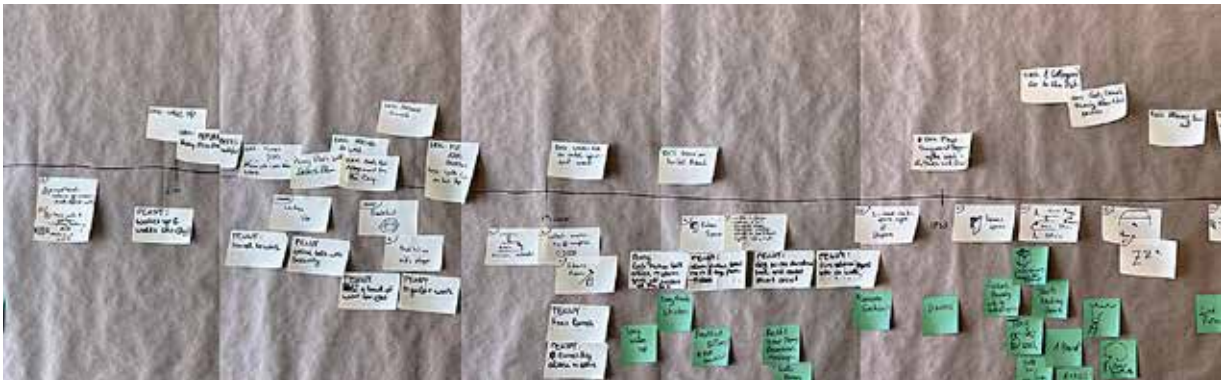


Figure 4: Results of collaborative scenario on the timeline sheet. The timeline runs from left (midnight) to right (midnight next day). Note the different colors of sticky notes and markers, indicating different characters and activities.

Character highlights

The groups created four idiosyncratic characters that had touch points with the security system. While it goes too far to give a complete account of all the characters and touch points with the security system, we offer an impression and sketch a few highlights. The four characters moved through different timelines: the office workers were present during business hours, the cleaning professional was working an irregular schedule and met the other characters at varying hours and lastly the security person was cast as the night guard. The scenarios focused on the persons and the interpersonal contact and less on the security system. For example, the night guard left presents for one of the office workers. Also, one of the office workers had a late-night party and crashed in the office after missing the train, to be woken up by the cleaning professional. One of the more intriguing touch points with the security system came from the security person who used his flashlight to interact with the security system: the participants speculated that the LED light in the office rooms could be wired such that they could sense light. These LED lights, now sensors, were to be triggered on a regular interval by a specific gesture of the flashlight to signal the 'all OK' from the security person to the system.

Reflection

Why is this challenge difficult? Even in the IoT (design) realm, thinking in mundane Everyday scenarios and systems of sensors and actuators is challenging and often neglected in favor of a focus on "manageable" scope of individual products and product families within a confined technical ecosystem. Seeing a space, like the workshop space, as a playground of new IoT ideas, or even just from the data perspective is unusual. The more we know about design and IoT, the more we tend to "latch" onto pre-existing notions of what products do, how they function and look like. We want to challenge this by asking our participants to question their ideas about IoT products. As a second aspect, the notion of complex characters goes beyond conventional personas and simplified user profiles that are more common in the design community. The idea, and also difficulty, behind the characters is they are meant to reflect the complexity in the Everyday and allow the design to embrace the diversity of actors in the design space. Compared to personas, our characters match the divergence phases of a design process rather than the convergence phases. The characters are a tool to deal with complexity without reducing complexity prematurely.

Why is this challenge particularly suitable to being tackled in a co-creation session? The purpose of the workshop is to elicit and collect diverse ideas and viewpoints on an IoT-enhanced space and everyday scenario that plays out with different characters. By definition this only works if multiple participants share their thoughts and respond to what everyone contributes. In particular, we switch gears from a small group of 4-5 participants initially to a large group of over twenty people plus occasional visitors towards the end of the workshop. This generates creative friction, especially when the individual character timelines crafted in small groups clash when brought to the large sheet. Participants rapidly adjust timelines, make sense of unexpected but actually plausible situations, or even extend the overall story so the timeline conflicts are resolved in a

creative way. Also, intertwining characters and a new perspective on IoT devices and services in the workshop space and the security scenario benefit from a co-creation format where participants share their experience and ideas. For instance, a participant might introduce the thought of LED lights as sensors, inspiring others in the team to take this further into an ideation of playful movements of a security person's torch, or even a dance routine that pacify the nervous security system. After all, happy accidents need several brains.

What did we learn? While we have run similar workshops in the past, also at ThingsCon, this workshop allowed us to focus on several hands-on activities combined with low-fi props and materials. It was a first for us to make extensive use of the workshop space (not knowing the space beforehand), and the diversity of participants from students to professionals and educators. As mentioned above, designing on top of distributed, pre-existing sensors and actuators is difficult and does not come natural or easy, even not to an IoT design crowd. The participants had to explore the workshop room and ideate different unconventional uses for existing appliances. Consequently, there were (and remained) strong tendencies to add designed elements to the environment, rather than actually use the sensors and actuators that were present.

Another challenge was that mundane characters are not meant to be stereotypes but are easily understood as stereotypes. We learned that stereotyping can be helpful in getting participants started but it is very hard to get away from. Together we steered away from stereotypes, which was increasingly embraced by the teams. Again, doing this in a co-creative way, had the benefit of having at least one person in every team who would remind their team mates to not lean into stereotypes too much and maintain a certain level of quirky energy in the developing character. What proved effective was to emphasize the quirkiness and peculiarities in the characters, boosting idiosyncratic behaviors, ticks and items in the back story. This allowed the participants to create "someone" recognizable and relatable but stay away from turning them into a stereotype. Then, working together by putting all mundane characters into a central timeline helped people see the nuances of the scenarios and encouraged the participants to start to conceptualize complex interactions, negotiation, and conflict resolving. In fact, these only became possible, because the characters were seen as actual people interacting in a co-created narrative, and not as stereotypes limited to doing stereotypical things.

Synchronization between characters is initially undesired and ultimately necessary (one timeline happened during the night, the other during the day without much overlap) -- a need for careful curation of the tasks at hand with the aim to setup 'constructive interference' between participants as the workshop unfolds. Overall, the challenge was abstract to the point that it was difficult to understand and get started, yet the teams were motivated, and they warmed up to the challenge with a bit of coaching. The timelining and the presentation of the characters was insightful as it highlights the multi-character / multi-activity phenomenon.

Generative things? Lastly, we reflect on the theme of the ThingsCon symposium: *generative things*. While our workshop was designed with an acute awareness of the theme, it was not materially central to the workshop. Still, it is easy to see that a reality that revolves around radical modularity might be served by machine learning and AI. The theme of generative things is relevant in at least two ways. First, we propose a different understanding of 'things'. In our vision of radical modularity, things do exist as (traditional) designed entities but more importantly also as modular constructs that offer functionality but have no explicit borders – such things can be considered generative in the sense of providing novel design opportunities through combination, repurposing and redesigning. Further, this interpretation of generative implies, even demands, longevity and sustainability in how we anticipate things in the Everyday. If things are now a given, how can we generate functionality, applications, value through design? Second, the technological infrastructure that this vision builds on needs to be sensitive to what people do and what people want. In our minds, these radically modular 'things' are not presented to their users as 'templates', rather they emerge in a dialogue between people, the smart and connected artifacts in the room and an AI software architecture. Such a reality needs further and deeper understanding from many perspectives, including an ethical perspective and a desirability perspective. Consequently, this workshop would not be possible without humans, designers, but also a variety of multi-disciplinary stakeholders–and people generally concerned about the state of things. To be clear, AI agents, deep research bots and the vaguely unshapely genAI lot would certainly give it a shot but ultimately fail. The reason is that the workshop was designed as an activity that caters to the unique abilities of humans as they ideate, brainstorm, and communicate. Through that they exchange, evolve and materialize ideas, all the while empathizing with, caring about and critiquing the state of IoT around us. They would stop when things (haha!) seem to go too far, and they would reflect on their actions in a humane way that cannot be simulated by sentence completion boxes. Workshops like ours are refuges for mashing creativity with reality, and *generatively* so; they are a way to push back against the grand coming of AI slop. Responsible IoT is about humans being and acting responsible. It's about taking ownership and being accountable for choices and decisions. Generative AI is out of place here.

Zooming out from these perspectives, this workshop explores design opportunities and challenges beyond specific technology (like genAI or even IoT). When all human, non-human, and generative things come together, unexpected functionality emerges over time based on different contexts, behaviors, as well as conflicts. One of the emergent qualities of (designing with) distributed modularity is strangely resembling the innate characteristics of contemporary AI: uncertainty. And that leads to new design opportunities. In this workshop we embrace uncertainty by inviting everyone and everything to interact on a common and beautifully complex timeline. Together, we realize and materialize nuances generated by a complex world.

Conclusion

This workshop presented participants (and us) with a new perspective on the act of designing modular IoT systems. It's a purposefully designed challenge that engages participants in thinking in multi-actor systems while designing. It was radical in the way that participants had to survey the workshop context and forage connected or connectable appliances to be used in their explorations. Aligned with the etymology of the word radical, they had to go to the root of what our IoT ecologies are designed of, sources of data, and opportunities to interact with humans and intervene in a context. From this, they created entirely new interactions that served the characters and their needs first. Here, "distributed everything" refers to the multitude of possibilities of designing with the context if we dare to look beyond product categories and commercial services. This workshop made us understand and envision better how ubiquity in designed systems might look like: a lot more mundane than sci-fi literature and also IoT product worlds would want us to believe, a lot more difficult to comprehend and design, and also a lot more difficult yet fun to use, when we can engage with distributed system components in novel, multi-modal ways. We believe this is the future, IoT technology serving us to express ourselves, while connecting to existing technology in the context and enhancing, not crippling what's already out there. Finally, "everything" does not refer to a vision where everything is connected, and every function and purpose should be covered by a connected "thing"; instead, it refers to the notion that everything humanly expressible and imaginable should be possible with the given means of present technology. We don't need to invent new things to do (or worse, invent new things that require new things to do!), we need to work on deepening and extending the experiences already wished for.

Dr. ir. **Joep Frens** is associate professor, holding the 'designing for interaction in growing systems' chair. He has a background in Industrial Design and is a designer/researcher who combines a hands-on approach to education and research with a strong academic attitude. His most recent research revolves around the IoT Sandbox. He is member of the 'Making With…' cluster as well as of the 'Computational Design Cluster'. Next to this he chairs the Examination Committee.
Joep Frens is regularly asked for workshops (e.g., SDU – Denmark, HfG Offenbach – Germany) and guest lectures (e.g., UA – Belgium, UT – Iran). He held the prestigious Nierenberg Chair of Design at the Carnegie Mellon University School of Design in 2014-15.

Dr. **Mathias Funk** is Associate Professor in the Computational Design Systems cluster/Department of Industrial Design at the Eindhoven University of Technology (T/e).
He has a background in Computer Science and a PhD in Electrical Engineering (from T/e). His research interests include methods and tools for designing with data, data-enabled design, Human-AI collaboration, and designing systems of smart things. He has researched at ATR (Japan), RWTH Aachen, Philips Consumer Lifestyle and Philips Experience Design, Canon Production Printing, Intel labs (Santa Clara), National Taiwan University of Science and Technology, and National Taiwan University. He has co-authored over 130 scientific publications and the book "Coding Art" with Apress/Springer. He is the co-founder of UXsuite, a high-tech spin-off from Eindhoven University of Technology.

Dr. **Janet Huang** is Assistant Professor in the department of Industrial Design at TU/e and she is a member of the "Computational Design Cluster". Her research focused on designing intelligent systems that enable people to learn, create, reflect knowledge and skills to accomplish creative tasks. Her vision is to explore human-AI co-learning for facilitating new ways of creativity and productivity. More specifically, She strive to design and develop novel toolkits that empower designers to become proficient with AI as design materials. These toolkits enable designers to harness the power of data, computation, and AI techniques to tackle diverse and intricate problems across various contexts.

Experiential alternatives

(Un)making the future: some thoughts after reading 'The importance of speculation in design research'

Sabine Reitmaier

When considering the potentials, limits, implications, possibilities and risks of emerging social-technological developments such as Generative Things, designers are engaged not only in discovery and innovation, but also in enabling alternative ways of imagining and relating to emergent technologies. In light of multiple ongoing crises, designers additionally started to not only to rethink roles and agencies of things but also speculated about ways to reframe design practices.

Design and futures

Scholars have argued that traditional design practices – those that are mainly engaged in problem solving, in turning current states into preferred ones- are per se inclined towards the future. Design practices can thus have a common understanding of design practices as forward-oriented activities creating innovative and not-yet-present things. Often embracing an understanding of the term ***future*** as something that can be imagined, designed, planned and realized to a certain degree. Therefore, designers have developed methodological approaches such as exploring product uses through user scenarios, anticipating possible or plausible developments with trends, megatrends or customer analysis, as well as facilitating visioning efforts in organizations. The double diamond process prominently features these aims by organizing divergence and convergence, around solution-oriented outcomes. Aims of approaching the term *future* in this regard is reducing complexity, delivering decision support for design-inherent decisions and providing convergent outcomes to participants of design or planning processes. In seeking further methodological foundations to navigate temporal dimensions, designers have appropriated and transformed frameworks from strategic futures and foresight disciplines. This also brought with it many of the foresight field's limitations and struggles. One such struggle concerns the meaning and use of the term 'future', and the understanding of *temporality* (understood here as the interplay of past, present and future contained in it) followed by how to communicate, teach and visualize this to students and participants (Mangnus, A. C., et al, 2021).

Critical assessment of tools: the Futures Cone

As a tool that serves an introductory function, the *Futures Cone or Scenario Cone* has been used in forward-oriented design studies

(Kuijer, 2022) and method books (Groß & Mandir 2024; Werner & Nestler, 2025). It has been revisited by design researchers (Gall, 2022) and criticized as reducing diverse views on time and progress, thus limiting a diverse orientation in temporality (Howell, Schulte, Holroyd, Arana, Sharma, & Eden, 2021; Göranssdotter, 2020; Patil at al. 2025).

For emerging design practices that challenge dominant knowledge systems and catalyse alternative imaginaries, such as Design Futuring or Speculative Design, this meant developing richer approaches to navigate the complex interplay between past, present and future. This also included to expand understandings of the terms *future* and *futuring*, and explore relations to time beyond the scope of clock time or calculated time.

Speculating and temporality

The focus of the publication 'The Importance of Speculation in Design Research' by Ron Wakkary and Doenja Oogjes is not on how the term *future* or *temporality* could be approached in design processes. However, the authors suggest and employ an interesting temporal framework for presenting their main argument, which is to situate speculative reasoning at the center of design research. After outlining a framework for speculative reasoning in HCI—characterized by *leaps of imagination*, exploration and use of diverse epistemologies, creation of space for *ethical reflexivity*, and the materialization of experiential alternatives enabling the former three—the authors employ various examples of speculative reasoning in design research to detail the framework.

Unmaking temporal conventions

In the following chapters of their book, Wakkary and Oogjes suggest an understanding of speculation across *continuous futures*, *continuous presents and continuous pasts*. This not only functions as organizational structure of the book chapters but allows readers to expand their meaning perspectives on time and the uses of speculation in relation to it. By starting with the most common-sensical use of *future* in relation to speculation, the book kicks off with a chapter about *speculating on the future*. The authors allow readers to begin with a common sense understanding of speculation, which they progressively unfold while explaining and detailing various design practices and their potential relationship with temporality. Although the chapters of the book suggest a linguistic structure of future, present and past, the design examples cited in the chapters and their use of speculation demonstrate that future, past and present are interdependent and relational. In the fifth and final chapter, the authors state:

> *"Speculative reasoning is the creative use of propositional knowledge that applies different ways of knowing to counter dominant modes to reveal new insights and coherencies." (Wakkary & Oogjes p.71).*

Seen as such speculation enables to trouble temporalities (Søndergaard et al., 2023). Instead of focusing on speculating on *a certain future*, or speculating about *bringing another past to the fore*, the approach enables participants to *think worlds otherwise*, beyond

the restrictions of current temporalities. The book closes by describing methods for creating experiential alternatives via *para-functional things, things that work otherwise*, and *materialized stories*. It further elaborates how the practice of speculative reasoning could be made actionable via strategies of *countering, subversion* and estrangement, extending common strategies of design research such as *innovation* or *discovery*.

A perspective from critical futures studies

Focusing further on how the term *future* can be understood, how *temporality* can be described, I invite readers to leave the literature of design research and follow a perspective derived from critical approaches in Futures Studies. This will illustrate that looking at how practices develop understandings of the future, how they challenge these conceptions are interesting starting points for enabling change. In contrast to the field of strategic foresight and its dominant understanding of probable, plausible, possible and preferable futures, depicted in the *Futures Cone*, critical approaches in futures studies make an analytical distinction between *future present* and *present futures*, but see the two angles as linked to each other. The lens of future present is here understood as states and descriptions that are thought of as of later-than-now, as states yet to become. Most approaches in futures studies (as well as in design) engage in discovery and innovation, conceptualizing futures as *future presents*, and assess these *future presents* based on their possibility, plausibility, or desirability (cf. Fischer, 2022, p. 3).

The concept of present futures highlights the idea that images of the future are currently manifested and effective in the present social reality as descriptions of states yet to become. These images can take the form of scenarios, plans or cultural artefacts, as well as hopes and fears, which are further embedded in discourses and imaginaries. Making this analytical distinction first helps clarify the present-focused orientation of critical futures studies in relation to other approaches (cf. Fischer & Mehnert, 2021, p. 26f).
It further enables to consider the *present* constructions of future possibilities, their embeddedness, and their modal structures, their relation to present pasts rather than simply debating about plausible distant outcomes. Critical approaches in future studies are thus *present-oriented* and are invested in examining and making explicit how futures are constructed to comprehend the contextual factors that shape these futures, ultimately allowing for discussion and modification of these conditions.

To further detail the two lenses of futures and what they aspire to achieve, I will illustrate each one with an example. Taking a lens of the future as *future present*, scenarios for a 'Future of Generative Things in 2050' are developed and examined on the basis on which a future with Generative Things is likely, plausible, possible, preposterous or desirable.

In contrast, a critical perspective with reference to *present futures* asks, why and by whom *Generative Things* are made a topic, why and how Generative Things are conceived, how these conceptions shape current actions, might enable change or hinder this, or

how alternative conceptions such as *Re-Generative Things* might differ.

Paying attention to how approaches tackle the term *future*, how they approach *temporality*, including how this is communicated to participants, students and individuals proves to be an important starting point for nurturing critical practices. (Un)making the future (Feola, 2021) might prove more beneficial than thinking in divergent or convergent processes or toolkits.

I therefore encourage designers interested in engaging in imagining worlds otherwise, in enabling ethical reflexivity, in leaps of imagination and the creation of experiential alternatives to make *futures*, *pasts or presents* and their interplay a relevant part of their own learning journey. In this regard speculative reasoning might also inspire designers to change their own meaning perspectives.

Learning journeys in (un)making futures

References

Fischer, N., & Mehnert, W. (2021). Building possible worlds: A speculation based framework to reflect on images of the future. Journal of Futures Studies, 25(3), 25-38. https://doi.org/10.6531/JFS.202103_25(3).0003

Fischer, N. (2023). Möglichkeitsräume kontingenter Gegenwarten: Die Reflexion von Denkrahmen als theoretischer und methodischer Ansatzpunkt für kritische Zukunftsforschung [Possibilities of Contingent Presents]. https://refubium.fu-berlin.de/handle/fub188/42128

Gall, T., Vallet, F., & Yannou, B. (2022). How to visualise futures studies concepts: Revision of the futures cone. Futures, 143, 103024. https://doi.org/10.1016/j.futures.2022.103024

Feola, G., Vincent, O., & Moore, D. (2021). (Un)making in sustainability transformation beyond capitalism. Global Environmental Change, 69, 102290. https://doi.org/10.1016/j.gloenvcha.2021.102290

Göransdotter, Maria (2020). Transitional design histories. Umeå.

Groß, B., & Mandir, E. (2024). Designing futures: Speculation, critique, innovation. Laurence King Publishing.

Howell, N., Schulte, B. F., Holroyd, A. T., Arana, R. F., Sharma, S., & Eden, G. (2021). Calling for a plurality of perspectives on design futuring: An un-manifesto. In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (Article 31, pp. 1-10). Association for Computing Machinery. https://doi.org/10.1145/3411763.3450364

Kuijer, S. C. (2020). Democratising and anticipating everyday futures through critical design: A review of exemplars. Temes de Disseny, 36, 150-177. https://doi.org/10.46467/TdD36.2020.150-177

Mangnus, A. C., Oomen, J., Vervoort, J. M., & Hajer, M. A. (2021). Futures literacy and the diversity of the future. Futures, 132, 102793. https://doi.org/10.1016/j.futures.2021.102793

Søndergaard, M. L. J., Campo Woytuk, N., Howell, N., Tsaknaki, V., Helms, K., Jenkins, T., & Sanches, P. (2023). Fabulation as an approach for design futuring. In Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS '23). Association for Computing Machinery. https://doi.org/10.1145/3563657.3596097

Patil, M. P., Cila, N., Redström, J., & Giaccardi, E. (2024). In conversation with ghosts: towards a hauntological approach to decolonial design for/with AI practices. CoDesign: International Journal of CoCreation in Design and the Arts, 20(1), 55-76. https://doi.org/10.1080/15710882.2024.2320269

Wakkary, R., & Oogjes, D. (2025). The importance of speculation in design research. Springer Cham. https://doi.org/10.1007/978-3-031-67095-4

Werner, K., & Nestler, A. (2025). Co-Creating Futures. https://doi.org/10.18452/31342

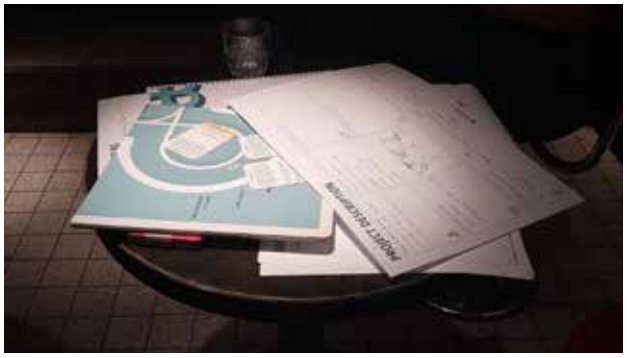
Sabine Reitmaier is a multidisciplinary designer with a background in interaction design, design research and futures studies. She is brings a multifaceted perspective from experience in design projects, applied research and artistic practice. She holds a Master's in Design at HfG Offenbach and an M.A. in Futures Studies from Free University Berlin. In the past she worked on topics such as mobility systems, artificial intelligence and human-nature relationships.

From glitches to fixes: reflective analysis of the Loopholes Toolkit for sustainable fashion innovation

Tejaswini Nagesh
Francesco Sollitto
Marina Castán
Troy Nachtigall

Introduction

What we wear, design, and regulate is no longer just material; it is information, interaction, and interdependence. In fashion, garments are increasingly shaped by both their physical characteristics and the data they generate, respond to, and exchange (Nachtigall et al., 2023). With the rise of generative design, IoT integration, and policy-driven traceability, data becomes both the framework and the behavior of products. In this context, systems are not static but dynamic, continually evolving through interactions between humans, machines, and regulations (Giaccardi and Redström, 2020) and environment.



Understanding and designing for these ecosystems requires more than just creativity, it demands systems thinking (Meadows, 2008). The rethinking fashion systems workshop aimed to introduce participants to reimagine the systems that drive the industry and to innovate generative digital fashion processes. Anyone who interacts with these systems, whether designers, developers, or policymakers, must learn to observe, nudge, and transform them with intention. This is where generative toolkits like Loopholes become critical. The loopholes toolkit offers structured ways to engage with the complexity of connected things, promoting responsible innovation while revealing the hidden dynamics, potential unintended consequences, and vulnerabilities that can only be uncovered through ethical systemic hacking (Lockton et al., 2019).

During the Rethinking Fashion Systems workshop at ThingsCon, our team guided a diverse group of participants through engaging with the Loopholes toolkit, effectively hacking the very systems it was designed to navigate. This process not only uncovered new sustainability strategies like developing on local materials, building products with post-use material, rental models for sustainable high-end fashion, and ways to include the user in the manufacturing process, but also exposed critical vulnerabilities within existing frameworks. This essay reflects on those experiences and explores the broader

role of generative tools, hacker mindsets, and systems thinking in shaping a circular and responsible future for digital fashion, themes deeply relevant to ThingsCon's focus on responsible connected products (Bihr and Wölbert, 2021).

Figure 1: Troy Nachtigall introducing participants to the concept of data as material and emerging technologies in the fashion industry.

Systemic challenges in fashion's digital transformation

Fashion's digital transformation presents challenges familiar to the ThingsCon community: balancing innovation with responsibility, embedding ethics into connected products, and navigating evolving regulatory landscapes. The industry now faces stringent EU policies including the Digital Product Passport (DPP), Ecodesign for Sustainable Products Regulation (ESPR), and Extended Producer Responsibility (EPR) (European Commission, 2023). These policies represent a significant shift in how sustainability is legislated and measured across the lifecycle of fashion products.

The fashion industry, known for its fragmented and opaque supply chains (Niinimäki et al., 2020), must now respond to these demands by redesigning not only products but also how data flows through design and production processes. Structured, meaningful data must be embedded early in the design stage to meet sustainability objectives and ensure downstream compliance. Connected products in fashion exemplify this challenge like LOOMIA's electronic layer technology that collects and transmits wear data while maintaining user privacy (Dunne et al., 2018), Pangaia's digital passports that track garment lifecycle information via QR codes (Bates & Eliav, 2022), and Senscommon's climate-adaptive clothing that responds to environmental conditions (Tomico & Wilde, 2016). These examples demonstrate how fashion artefacts increasingly function as both physical products and data interfaces throughout their lifecycle. For ThingsCon's community of responsible IoT practitioners, these connected garments represent microcosms of larger systemic challenges: balancing functionality with transparency, ensuring user agency over data, and designing for both immediate use and eventual circularity (Bihr et al., 2022). This is precisely where tools like Loopholes can guide designers to navigate the complex interplay between physical materials, embedded technologies, and the data they generate.

Loopholes as a systems-thinking catalyst

Unlike traditional design toolkits that primarily focus on creative ideation or user-centered problem solving, Loopholes invites a broader

inquiry: What systems are we designing within? How are these systems connected? Where do they break down? And how might we productively subvert them to generate more sustainable futures? This approach aligns with Dunne and Raby's (2013) concept of critical design, which uses speculative scenarios to question assumptions and reveal alternative possibilities.

The Loopholes toolkit, more importantly, is a tool for systemic thinking to discover dependencies. It helps forecast the effect across data, design, production and use, leveraging these dependencies for better cohesiveness internally. The toolkit nudges users to ideate on potential partners to connect with and collaborate with, as well as to prepare for the effects of policies in their planning. This capacity to map interdependencies and strategically planning for desired futures enables and encourages a more holistic approach to innovation (Buchanan, 2019).

The toolkit has 50 idea cards organized into four domains: digitalization, sustainability, stakeholder engagement, and business/finance. Each card introduces a concept, accompanied by a prompt to challenge or expand upon it. These cards are used in combination with four canvases—Data, Stakeholder, Material, and Business—which structure the exploration and help participants move from abstract thought to strategic insight. This methodology builds on Sanders and Stappers' (2014) work on generative design tools that facilitate collective creativity.

During the ThingsCon workshop, interdisciplinary teams with backgrounds spanning design, development, business, and emerging technologies engaged with the toolkit to generate diverse sustainable business concepts. By guiding users to map flows, tensions, and relationships, Loopholes equipped them to think systemically about the complex interactions between physical products, digital systems, and regulatory frameworks.

Critical reflections: the hacker mindset

One of the most thought-provoking insights emerged from a team that explored the concept of dark patterns (Gray et al., 2018). Taking a hacker-inspired approach, this team questioned the very intention behind sustainability frameworks by conceptualizing ways to technically comply with policies while avoiding meaningful change. Their speculative strategies exposed how systems and regulations might be manipulated, shedding light on the fragility and exploitable nature of some current sustainability frameworks. This team suggested involving the user in the last stage of the production process in a way that shifts the extended responsibility of the product onto the user rather than the producer.

This approach raised critical questions particularly relevant to ThingsCon's focus on responsible technology: What would on-demand production mean in a world of decentralized manufacturing? If a customer could press a button to initiate production on-demand, could they be considered the "producer" and if so, who would bear responsibility for compliance with EPR requirements? How should responsibility be distributed across the value chain as

users become more directly involved in the production process, as seen in generative clothing? These provocations highlighted the complexities of accountability in emerging business models and emphasized the need for systemic solutions that consider the dynamic interplay between technology, users, and regulatory obligations.

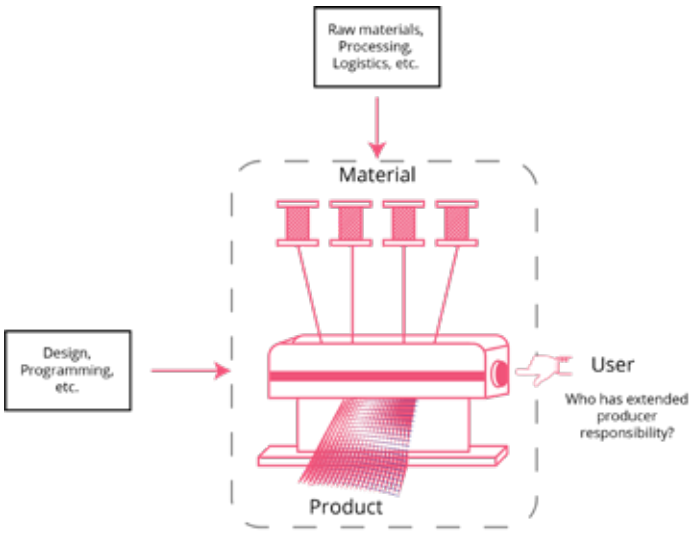


Figure 2: Rethinking the definition of a producer and the distribution of responsibility across the value chain.

Implications for practice

Our experience facilitating Loopholes with the ThingsCon community suggests three key implications for practitioners working at the intersection of fashion, technology, and sustainability:

1. Data as a Material: With data we will find new ways to analyse, design, make, and wear fashion[12]. Sustainable innovation increasingly requires treating data not merely as documentation but as a fundamental design material that shapes product development from inception (Speed and Oberlander, 2016). Data also holds the key to ensuring transparency, accountability and effective governance for handling materials and processes.

2. Cross-Disciplinary Collaboration: Meaningful systems innovation emerges from the creative tension between diverse perspectives, requiring frameworks that facilitate dialogue across technical, design, and policy domains (Irwin, 2015).

3. Ethical Systems Hacking: Responsible innovation requires not just compliance but active interrogation of systems, identifying vulnerabilities to strengthen rather than exploit them (DiSalvo, 2012).

Conclusion

The Loopholes toolkit demonstrates that addressing sustainability challenges in fashion and beyond requires more than isolated interventions. It demands an ability to think systemically, to identify connections, dependencies, tensions, and loopholes, and to design with an awareness of the ecosystems in which products, services, and policies interact (Ackoff, 1999).

By engaging participants from diverse disciplines, the ThingsCon

workshop illustrated the value of cross-sectoral thinking and hacker mindsets in innovating for sustainability. Participants' provocations highlighted the urgent need to align technological possibilities with ethical obligations, reinforcing that innovation must be accompanied by critical reflection and an active shaping of systemic structures, rather than passive compliance (von Schomberg, 2013).

The emergence of generative clothing (garments shaped dynamically by user data, environmental inputs, and algorithmic co-creation) foregrounds a future where fashion is no longer designed once but continuously generated and versioned. This paradigm shift in traditional models of authorship and sustainability by integrating feedback loops directly into the garment lifecycles study, we learned that generative systems make the future a designable layer of the garment itself. When garments are co-created through participatory systems that include AI and traceable data, authenticity and responsibility become distributed. What matters is not only who designed a product, but how it evolves through interaction. While loopholes addresses many needs, the research shows that the storytelling aspect of fashion will need to be strengthened.

Figure 3 (above): Examples of generative clothing by Team Thursday, Cypher Studio and Studio Shoon
Figure 4 (below): Leslie Eisinger operating the 3d knitting machine

The ThingsCon workshop helped us extend the use of the Loopholes toolkit beyond its intended design as it serves as more than a design transitions roadmap tool, positioning it also as a catalyst for responsible disruption. This workshop invited designers, technologists, and entrepreneurs to interrogate existing systems and hack responsibly, not merely to navigate them, but to uncover and repair weak points in sustainability frameworks before they can be exploited, creating new, more sustainable and equitable futures for fashion and digital innovation. As ThingsCon continues to champion responsible technology development, tools like Loopholes offer a practical approach to embedding these values into the next genera-

References

tion of connected products.

Ackoff, R. L. (1999). Re-creating the corporation: A design of organizations for the 21st century. Oxford University Press.

Bihr, P., & Wölbert, C. (2021). The state of responsible IoT: 2021. ThingsCon e.V.

Buchanan, R. (2019). Systems thinking and design thinking: The search for principles in the world we are making. She Ji: The Journal of Design, Economics, and Innovation, 5(2), 85-104.

DiSalvo, C. (2012). Adversarial design. MIT Press.

Dunne, A., & Raby, F. (2013). Speculative everything: Design, fiction, and social dreaming. MIT Press.

European Commission. (2023). Ecodesign for sustainable products regulation. European Commission.

Giaccardi, E., & Redström, J. (2020). Technology and more-than-human design. Design Issues, 36(4), 33-44.

Gray, C. M., Kou, Y., Battles, B., Hoggatt, J., & Toombs, A. L. (2018). The dark (patterns) side of UX design. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-14).

Irwin, T. (2015). Transition design: A proposal for a new area of design practice, study, and research. Design and Culture, 7(2), 229-246.

Lockton, D., Brawley, L., Aguirre Ulloa, M., Prindible, M., Forlano, L., Rygh, K., ... & Ranner, V. (2019). Tangible thinking: Materializing how we imagine and understand interdisciplinary systems, experiences, and relationships. In Proceedings of the 2019 International Association of Societies of Design Research Conference.

Meadows, D. H. (2008). Thinking in systems: A primer. Chelsea Green Publishing.

Nachtigall, T., Tomico, O., & Wakkary, R. (2023). Crafting ultra-personalized materialities in future augmented realities of digital fabrication. International Journal of Design, 17(1), 17-33.

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. Nature Reviews Earth & Environment, 1(4), 189-200.

Sanders, E. B. N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. CoDesign, 10(1), 5-14.

Speed, C., & Oberlander, J. (2016). Designing from, with and by data: Introducing the ablative framework. In Proceedings of the International Design Research Society Conference.

von Schomberg, R. (2013). A vision of responsible research and innovation. In Responsible innovation: Managing the responsible emergence of science and innovation in society (pp. 51-74). John Wiley & Sons.

Lindtner, S., & Lin, C. (2022). Generative tensions: Integrating AI in participatory design practice. Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems, 1-14.

Marenko, B., & Brassett, J. (2022). Deleuze and design: Process, speculation and collective creativity. Edinburgh University Press.

Sanders, E. B. N., & Stappers, P. J. (2018). Generative tools and techniques for collective creativity. She Ji: The Journal of Design, Economics, and Innovation, 4(1), 3-10.

Bates, O., & Eliav, E. (2022). Digital product passports: The ticket to a more sustainable fashion economy? Fashion Theory, 26(3), 391-413.

Bihr, P., Schuermans, S., & Wölbert, C. (2022). The state of responsible IoT: 2022. ThingsCon e.V.

Dunne, L., Profita, H., & Zeagler, C. (2018). Social aspects of wearability and interaction. In Wearable Sensors (pp. 25-43). Academic Press.

Tomico, O., & Wilde, D. (2016). Soft, embodied, situated & connected: Enriching interactions with soft wearables. mUX: The Journal of Mobile User Experience, 5(1), 1-17.

Tejaswini Nagesh is a design researcher at the Fashion Research and Technology group at Hogeschool van Amsterdam (HvA). With a background in engineering and product design, her work focuses on systems thinking, sustainability, and ecological transitions. She contributed to the development and testing of the Loopholes Toolkit, bringing experience from working across conservation, digital technology, and material systems. Her research explores how design can support systemic change through interdisciplinary, more-than-human, and participatory approaches.

With a background in economics and statistics, the focus of Francesco Sollitto's research and professional career quickly shifted to the sustainability domain and the value of digitalization. The interest in Multi-Stakeholder Collaboration developed early in his career influenced his thinking on using digital solutions to accelerate knowledge sharing while increasing transparency. Working closely with the developers of SafeSize, he gained practical experience in designing and maintaining digital platforms in an effort to modernize the footwear retail industry and reduce overconsumption. By building dashboards and visual representations, he brings a critical perspective on data-driven decision-making to the organizations he has joined.
For example, in Circle Economy he introduces interactive visualizations to explore complex insights into the environmental impacts of countries and cities, which are used by the researcher to come up with policy recommendations supported by statistical evidence.

Marina Castán is a professor of Design and Innovation at Elisava School of Design and Engineering (UVic-UCC). With a background in textile design and its intersections with product design, architecture, and art, she holds an Undergraduate Degree in Textile and Fashion Design (ESDi–Universitat Ramon Llull), a Postgraduate Degree in Design and Innovation (Elisava–UPF), and a Master's in Art and New Media Curatorship (ESDi–Universitat Ramon Llull). She earned her PhD in Textiles from the Royal College of Art in London (2019), within the framework of the European project ArcInTexETN (Marie Skłodowska-Curie fellowship, 2014–2018). Her academic and research work spans interdisciplinary and collaborative design contexts, with projects focused on textiles, wearables (Close to the Body (2012), The Fashion Wearable Orchestra (2014), and the relationship between textiles and architecture (Soft Embodied Architectures, PhD thesis, 2019). Currently, she leads the European-funded Transitions project (Erasmus+) at Elisava Research and teaches in the Design and Innovation degree. Her research interests include sustainability, soft materialities, and design approaches that engage with non-human agency.

Troy Nachtigall is a Designer and Design Researcher. His research explores textile thinking, data/material relationships, and Ultra-Personalized product-service systems for Circularity and Sustainability. Combined with ten years of experience in the fashion field. Troy is an expert in Fashion Design, Physical Computing, Shoes, HCI, and Interaction Design. Troy specializes in scaffolding craftsmanship and technology in Design and Engineering. From IT Networking to tubular knitwear, computer pattern making to machine learning, Troy strives to realize a future where there is little difference between fashion and technology. Design sense and Design research are tempered with a drive to make ecologically responsible product service systems.

Critical assessment

Find the blind spots in your use of Generative AI

Jonne van Belle
Pieter Duysburgh
Willemien Laenens

Introduction

Are you planning on using generative AI (GenAI) in your organisation or for your work? Do you sometimes worry about the impact of GenAI on the quality of your output or, broader, our society? The rapid rise of GenAI marks a new wave in artificial intelligence, promising increased efficiency, creative augmentation, and a boost in productivity across industries. With the democratisation of GenAI applications, anyone – from individuals to large enterprises – can now harness these technologies with minimal barriers to entry. However, this accessibility also raises pressing ethical concerns, as the widespread adoption of GenAI is already transforming sectors such as media, education and creative work, often sparking a moral panic about its potential consequences for employment, ecological impact, privacy, IP use, etc.

With all this in mind, the Knowledge Centre Data & Society (a knowledge hub on ethical, legal and societal aspects of AI and data-driven applications in Flanders, Belgium) developed the GenAI Blind Spots card set. The card set helps professionals uncover and navigate the ethical risks unique to GenAI technologies. This can serve as the starting point to draft mitigation actions on how to deal with these issues in the organisation.

In this article, we introduce the potential ethical dilemmas surrounding GenAI and how the GenAI Blind Spots card set can be used to make these ethical considerations more tangible and actionable. We outline its purpose and structure, as well as how it facilitates critical conversations on responsible GenAI implementation and use. Additionally, we share the insights from developing the GenAI Blind Spots card set during several workshops with academics and practitioners, including the one that took place at the TH/NGS conference in December 2024.

The ethical issues of GenAI

The use of GenAI raises ethical challenges on different levels, ranging from how individuals interact with these systems to how their widespread use is reshaping societal structures. On a personal level, users often face issues of overreliance, lack of critical engagement, or unawareness of how GenAI content is generated. The use of GenAI tools may result in incomplete or incorrect output (so-called hallucinations), reproduce harmful biases, or lead to subtle deskilling when users outsource creative or cognitive tasks without reflection. In professional contexts like HR, for instance, participants in our workshops discussed how delegating tasks such as sourcing candidates to GenAI risks reducing opportunities for meaningful human interaction and ethical judgement.

On an organisational level, concerns arise around the responsible implementation of GenAI systems, especially when tools are used without proper oversight ('shadow use') or when sensitive data is entered into commercial models. Intellectual property, data privacy and regulatory compliance can quickly be overlooked in the rush to innovate. Beyond these internal risks, GenAI also has far-reaching societal implications: from the spread of disinformation and the rise of synthetic media to ecological costs and the flooding of online spaces with low-quality, AI-generated content. These issues highlight the importance of anticipating not just what GenAI can do, but what it should do – and under what conditions it can be responsibly implemented and used[15].

Towards the GenAI blind spots

The GenAI Blind Spots tool is a physical card set of ethical blind spots – aspects that are often overlooked – related to the responsible implementation and use of GenAI in an organisation. The blind spots range from oversights regarding the responsible use of GenAI (e.g., 'data quality' and 'deliberate abuse') to the impact of GenAI on jobs and society (e.g., 'skills and competences', 'copyright & IP issues' and 'employment and job satisfaction').

The blind spots were identified based on a combination of desk research (scientific articles on ethical issues and GenAI) and the outcomes of several co-creation workshops. In these workshops, participants engaged in discussions – with the help of the existing AI blindspots card set[16] – about the unintended risks and societal impact of GenAI. The insights from the desk research and the workshops informed the development of the GenAI Blind Spots tool. The draft of the card set was assessed in a workshop with people working in human resources and wanting to explore the use of GenAI in their working practice. They evaluated and refined the usability and the readability of the cards.

We learned for example that the ethical blind spots of GenAI are similar to those of AI in general, but there are elements specific in GenAI systems (e.g. hallucinations) that need to be considered. The ease-of-use of GenAI applications results in a higher importance for individual users to have the right skills, knowledge and attitudes to use GenAI in a responsible manner. As a result, the GenAI Blind Spots card set focusses on organisations willing to implement GenAI, instead of developers of AI systems, who were the target group of the original AI Blind Spots card set. Consequently, the cards needed to be simplified in terms of wording and the amount of information to increase the readability and usability. In addition, the participants of the co-creation workshops found the GenAI Blind Spots tool useful to create awareness on ethical issues of GenAI, but found its use limited to formulate concrete action points.

15 For a good overview of all ethical issues relating to GenAI, we recommend the following publication: Al-kfairy, M., Mustafa, D., Kshetri, N., Insiew, M., Alfandi, O. (2024). Ethical Challenges and Solutions of Generative AI: An Interdisciplinary Perspective. Informatics 2024, 11, 58.

16 This card set is created by the Knowledge Centre Data & Society, based on the AI Blindspot cards of Ania Calderon, Dan Taber, Hong Qu, and Jeff Wen, developed during the Berkman Klein Center and MIT Media Lab's 2019 Assembly program.

Each card introduces a specific blind spot by way of a question, brief description and concrete example. The card also offers a number of reflective questions to help you identify the blind spot in your own GenAI project and consider the possible mitigation strategies. As such, the cards encourage users to reflect on the possible blind spots in their organisation and stimulate them to think of a strategy or action plan to deal with them.

Examples of GenAI Blind Spots Cards

Some examples of blind spots are 'up-to-date', 'ecological sustainability' and 'employment and job satisfaction'. Below, we further detail what these specific blind spots entail.

The 'up-to-date' blind spot looks at the accuracy of the outputs of GenAI in relation to our constantly evolving society. The GenAI output might diverge substantially from reality when the application is trained on outdated information. You can therefore never be certain that the output is correct.

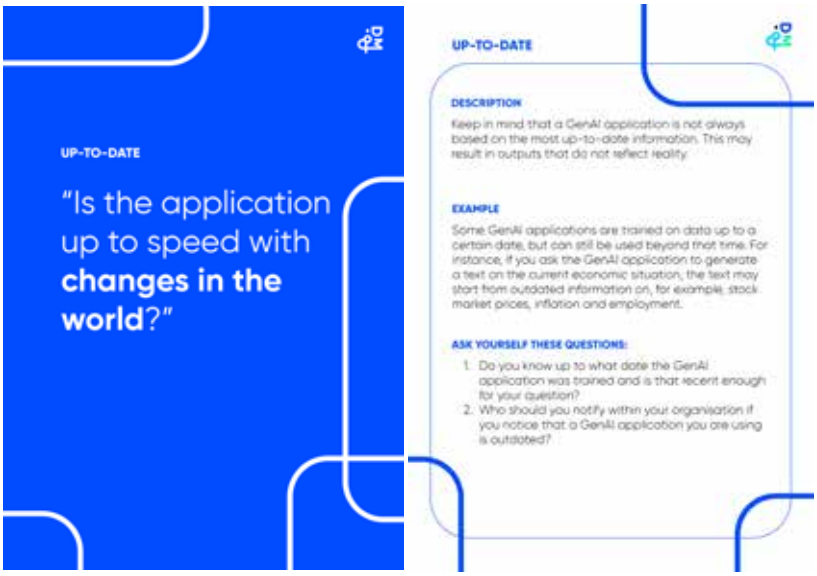


Figure 1: front and back of the GenAI Blind Spots card 'up-to-date'.

Another example of a blind spot is the 'ecological sustainability' of GenAI. This refers to the immense amounts of energy, water and rare resources used not only to train the model, but also every time the model is used. The exact amount of resources used is often unknown, mainly because providers are not transparent about these numbers (see figure 2).

Finally, another example of a GenAI blind spot is 'employment and job satisfaction'. GenAI can play a big role in professional life, as some jobs might be disappearing and others could potentially become less meaningful, creative or human. What will be the impact of GenAI on the tasks and roles within your organisation? How will it influence the quality and meaning of work of your colleagues and employees? This blind spot encourages reflection on how an organisation will cope with these changes.

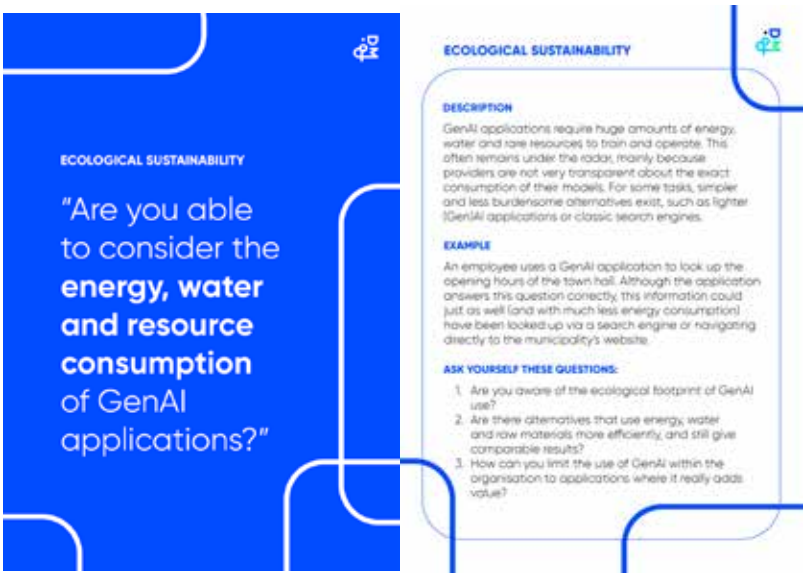


Figure 2: front and back of the GenAI Blind Spots card 'ecological sustainability'.

Figure 3: front and back of the GenAI Blind Spots card 'employment and job satisfaction'.

Learnings from applying the card set

As mentioned, the GenAI Blind Spots card set has only recently been developed. Still, a few learnings can already be listed based on our experiences during the creation process of the tool.

- **The tool is good for raising awareness in an interactive way, especially for audiences with limited prior exposure to GenAI.** One of the key strengths of the Blind Spots tool lies in its ability to introduce complex ethical considerations around GenAI in a low-threshold, engaging way. For professionals who are new to GenAI or have not yet deeply reflected on its societal implications, the tool serves as a valuable entry point. Its card-based format allows users to engage with ethical concerns without requiring in-depth technical or philosophical background knowledge. This makes it especially suitable for awareness-raising sessions where the goal is to spark initial reflection and dialogue.

- **The tool works best as part of a broader methodology that includes concrete follow-up actions**. While the GenAI Blind Spots tool effectively initiates critical reflection, its impact is significantly enhanced when used as part of a structured workshop that guides participants beyond the initial discussion. Without a clear path towards concrete action, there's a risk that the tool will have little impact. We have found that the tool is most effective when combined with clear follow-up steps such as action plans or roadmaps. Embedding the tool in this kind of methodology helps ensure that ethical considerations are not just acknowledged, but actually translated into practices or policies.
- **The tool sparks discussion and different perspectives – it is not a checklist, so allow enough time for conversation.** Rather than providing definitive answers, the tool is designed to open up space for dialogue and critical thinking. This naturally leads to the exploration of different viewpoints, future scenarios, and possible dilemmas. However, this also means that meaningful engagement with the tool takes time. It should not be seen as a checklist to be completed quickly; instead, sessions should be structured to allow for deep discussion, reflection, and collective sense-making.

Conclusion

GenAI brings about specific ethical challenges regarding amongst others misinformation, reskilling, shadow use and intellectual property. The GenAI Blind Spots card set invites you to take a step back and critically assess the ethical challenges of GenAI in your organisation. By sparking meaningful conversations and surfacing overlooked risks, the cards help teams build a shared understanding and lay the foundation for more responsible, future-proof GenAI use.

Get started with the GenAI Blind Spots

The GenAI Blind Spots card set can be used in different ways: as a conversation starter, a tool to learn about and uncover ethical issues, or during a workshop to define concrete steps for identifying and addressing them. We recommend using the cards once you already have a clear GenAI project in mind and want to explore the possible pitfalls while there's still room to make adjustments. In our experience, to get the most out of the workshop, gather a group of 4 to max. 8 people. Ideally, this includes the person(s) responsible for implementation, (a representative of) key users, and representatives from any departments that may be impacted by the GenAI application.

A typical GenAI Blind Spots workshop takes about 2 hours. Start by selecting the cards that are most relevant to your project. Then, discuss with the group how each card applies and what actions might be needed to tackle the risks or challenges it raises. Each card includes guiding questions to help structure the conversation. Make sure you capture your decisions, insights, and action points along the way. The card set includes a detailed facilitation guide that offers a clear workshop structure and suggested
timing.

Download the full card set with a facilitation guide here[17] and start uncovering the blind spots in your own GenAI project.

17 https://data-en-maatschappij.ai/en/tools/genai-blind-spots-card-set

Willemien Laenens is a communication and project assistant at the Knowledge Centre Data & Society. She supports public and private organisations in the responsible development, implementation and use of data and AI applications. She focuses on the impact of AI on the workplace and how employees can help shape AI innovations. She also works on instilling ethical values into innovation projects with amongst others the help of ethical design tools and more.

Jonne van Belle is a researcher and designer focused on the relationship between people and technology. At the Knowledge Centre Data & Society, she supports professionals and organisations in the responsible development and implementation of data and AI applications. Her work centres on translating ethics into practice, ethical tools, and AI on the workfloor.

Pieter Duysburgh is the co-coordinator of the Knowledge Centre Data & Society. Besides the day-to-day management of the organisation, Pieter works on the topic of ethics in practice, supporting organisations to engage in responsible AI in practice. He also looks at AI in the workplace, and how employees can help shape AI innovation. Finally, he oversees amai!, a citizen science project that engages the general public in AI innovation.

Facilitate understanding

Embracing more-than-human perspectives in a transforming world

Eva van der Born
Anna Merl

A transforming world

As a design agency, we witness how emerging technologies are reshaping our everyday lives on a social, economical, and political level. Through our interactions with these technologies—and their interactions with us—new realities are taking shape. We recognize that our responsibility as designers extends beyond creating mere "things"; we must consider the broader ecosystem surrounding these technologies. In an era of increasing complexity and global challenges that test our established methodologies, we find ourselves questioning whether a purely human-centric design approach remains sufficient.

We believe it is necessary for designers to consider how humans coexist with other more-than-human entities—particularly those that may not be obvious when defining a design space. Alternating between the realms of academia and industry, BMD has slowly started to embrace a more-than-human perspective to address the intricacies, agency, and interconnectedness inherent in modern transformations and challenges.

A need for practical more than human design methods

Our exploration of more-than-human (MTH) design began within the realms of academia, namely the Department of Industrial Design at the TU/e, where foundational knowledge and theories were actively developed. Currently we view MTH design as an approach for design that decentralizes the human perspective in design, shifting focus toward systems that include both biological and technological non-human entities, as well as the complex interrelations and entanglements among them.

Yet, we have observed that in academic circles, MTH design is frequently presented as an abstract, complex, and highly theoretical concept, often communicated through a lens of idealism. Deviations from established MTH design theory can be viewed sceptically, contributing to the perception of MTH design as inaccessible and overly complicated. Practical, hands-on tools to conduct MTH design, even within academia, remain scarce, further widening the gap between theoretical discourse and practical application.

Indeed, translating academic research on MTH design into real-world practice does not occur seamlessly. As described by Coskun et al. (2022), a significant challenge lies in initiating dialogue to identify strategies for connecting MTH theory with practical applications. As a design agency working with clients in a wide range of contexts, both large and small, we recognize the need to scale

More-Than-Human (MTH) design approaches in ways that are adaptable, communicable, and valuable from a business perspective. This involves developing methods that help clients understand what MTH design is, how it can apply to their specific situation, and why it is worth investing in. However, because MTH design inherently challenges the profit-driven, human-centered frameworks traditionally employed in industry, we are deliberate in how we present it.

We position MTH design as ecological and systemic thinking inspired by systems theory, a framing that better resonates with the audiences we typically engage with. From our perspective, Coskun et al.'s dialogue involves two principal challenges: first, translating posthuman theories into tangible outcomes that are understandable and applicable to diverse audiences and varied use cases. Aligning MTH principles with the interests and relevance to diverse audiences—including stakeholders outside traditional design fields, such as healthcare professionals, policymakers and engineers—is crucial for making meaningful impacts in the present moment; and second, gaining broader recognition for MTH design within professional practice, ultimately allowing it to scale—and, although less comfortably stated, to effectively "sell."

MTH carddeck & workshops

To bridge this academic-practice divide and address the scarcity of accessible MTH design methodologies, we have developed a practical tool: the MTH card deck. This deck draws upon MTH design principles but purposefully diverges from the academic idealism that is often too rigid or complex for practical engagement. Instead, our approach positions MTH design as akin to a systems architecture practice, facilitating the exploration, understanding, and shaping of complex ecosystems that not solely serve humans, but see all non-humans and humans as equal, interconnected entities. More specifically, the MTH carddeck serves as an engaging game that allows players to explore various human and non-human entities and their relationships in a playful manner.

When using the MTH card deck for a project, you will follow these structured steps: First, obtain a project brief, which could be internal, client-based, or speculative. Carefully familiarize yourself with this brief to ensure a thorough understanding of the project's goals and scope. Next, immerse yourself in the project's context using the "Art of Noticing" as described by Anna Tsing in her book The Mushroom at the End of the World. Noticing involves closely observing subtle and often overlooked interactions and dependencies within an ecosystem. In workshops, participants are typically provided with tools to assist in this activity. The objective here is to visually identify and annotate entities and their interactions within the given context. Afterward, in small groups (with a maximum of four members), take all entity cards from the card deck and populate them with human and non-human entities identified through your annotations.

Once filled out, these entity cards are returned to the deck. In the subsequent phase, participants play a card game by individually drawing entity and relationship cards in a clockwise manner. Each participant creates connections between entities, aiming to establish

relationships that are abstract, nuanced, or multifaceted. Once all cards have been played, participants collectively review the relationships they've created. During this review, the group awards MTH concept cards to the relationships that best illustrate each specific concept. An optional final step involves evaluating whether the identified relationships could serve as a foundational basis for developing a coherent and viable system. This system could be drawn, lo-fi prototyped, or described.

Figure 1: MTH carddeck

While iteratively prototyping the MTH card deck, we realized that different audiences engage with the carddeck in unique ways. This insight highlighted the need for additional workshops tailored to specific user groups. For us, the real value of a workshop lies in how it enables co-creation and brings together participants from diverse backgrounds and areas of expertise to exchange perspectives on MTH design. The workshop, as it currently stands, underwent four iterations. The first was an internal session with employees to test gameplay mechanics. The second involved stakeholders from robotics in healthcare, aiming to evaluate engagement among non-designers and engineers. The third was a public workshop at Dutch Design Week, emphasizing the environmental aspects of MTH design through a case study on pollution in the river Dommel. The fourth and most recent iteration was tailored specifically for ThingsCon, aligned with the theme "Generative Things. For this most recent addition, we asked participants during their noticing activities to take special attention to intelligent and non-intelligent things they observed and write these down on the map with a special icon for generative things that was added on the map of the Volkshotel. Ultimately the goal of the Thingscon workshop was for participants to make a system that includes co-performing future things, and intelligences in/for/around physical objects.

Figure 3-5: MTH carddeck work shop at Dutch Design Week 2024: Participants filling in a relationship

Each iteration helped us fine-tune and adapt our approach based on insights from previous experiences. Looking back, the workshop served multiple purposes: they facilitated the translation of MTH design knowledge tailored to the audience's background, expertise, and needs, and they provided structured opportunities to deepen awareness through guided exploration—or "noticing"—of eco-system interdependencies. We see these workshops as dynamic activities that evolve through learning from previous experiences.

Figure 2: MTH carddeck workshop at Dutch Design Week 2024: Participants performing a noticing activity near the Dommel in Eindhoven.

Hosting a MTH design workshop at ThingsCon2024

During our last MTH card deck workshop hosted during the ThingsCon 2024, we invited a diverse group of experts from research, design practice, and the arts. This interdisciplinary approach fostered a rich environment where participants were able to collaboratively explore innovative ways to incorporate more-than-human thinking into their respective practices.

The workshop kicked off with a 20-minute presentation that introduced the core concepts of more-than-human (MTH) design. During this introductory session, we familiarized participants with essential terminology such as "entities," "relationships," and "noticing." We then shared insights into how Bureau Moeilijke Dingen (BMD) integrates MTH design principles into our creative processes.

Wrapping up the presentation, we provided a concise overview of the More-Than-Human Card Deck. We explained its purpose, detailed its contents, and demonstrated how it can be effectively used in design practice. This introduction set the stage for the hands-on activities that followed.

After a short break, it was time for a hands-on noticing activity. Participants, working in groups, were invited to explore the Volkshotel—both inside and out. Their mission was to observe and "notice" technological and biological (intelligent and non-intelligent) entities, as well as the relationships between them. We encouraged

groups to pay extra attention to intelligences that might only become apparent when considered in relation to others. To aid in their exploration, each group received an A4 sheet featuring a legend. This tool helped them sketch and note down their observations as they moved through the hotel environment. This hands-on activity allowed participants to apply the MTH design concepts they had just learned, making them aware of how these principles manifest in real-world settings.

Back in the workshop space, participants used their drawn maps as a foundation to populate the More-Than-Human Card Deck. They aimed to capture as many entities as possible within their observed context. Once most of the entity cards were completed, the game began—participants started making connections between entities, forming relationships. These relationships were then explained to one another, encouraging collaborative world-building around these connections. As participants explored these relationships, they became the basis for new realities and imagined interactions between entities. These relationships were then reviewed and rewarded with MTH concept cards, which are concepts based on More-Than-Human theory.

For the final part of the workshop, participants visualised the system of relationships and entities they had created. Each group then presented their system to the others, sharing their insights and discoveries.

Figure 6 (left) MTH carddeck workshop at ThingsCon 2024: Awarding MTH Concepts
Figure 7 (right): One of the systems created

Reflections on ThingsCon 2024

This collaborative session allowed for an exchange of perspectives and learnings across the diverse group of attendees. The workshop's final aim was to use the card game as a foundation for the groups to lay a foundation for a system that demonstrated MTH design. The systems that were ultimately created ranged from a bee hotel that provided honey and electricity to the hotel guests and shelter and care for the bees in return. Participants mentioned that the workshop gave them a better understanding of how to create more ethical and responsible systems. This involved engaging with the realities of the actors they design for, uncovering hidden relationships, and considering the role technologies play in our lives. Ultimately, the workshop underscored the importance of designing with intention for shared experiences between actors in a system, advocating for a responsible co-performance of our everyday lives. We hope that this approach encourages participants to apply these principles in their future design practices.

Eva van der Born is a design researcher and creative technologist. In her work, she explores how design can shape meaningful relationships between people, technology, and their surroundings. With a critical and experimental approach, she challenges conventional design perspectives, seeking alternative ways to engage with emerging technologies and complex systems.

As a design researcher and user experience, Anna Merl is driven by a profound curiosity to explore novel relationships between technology, humans, and the more-than-human world. With a keen interest in futuring techniques, AI ethics, surveillance capitalism, data practices, and more-than-human theory, she delves into the intricate interplay between these realms.

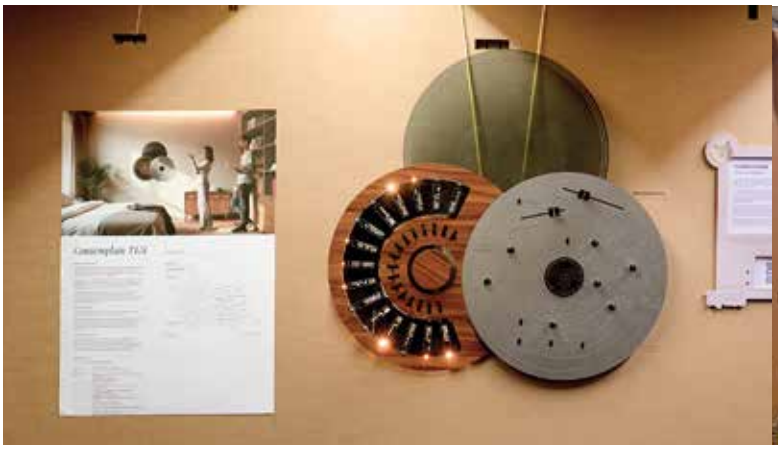
PROVOTYPES

Exhibition provotypes from a generative future

As part of TH/NGS 2024, we presented a special exhibition exploring the future of Generative Things. We challenged designers to imagine and create prototypes of objects powered by generative AI, potentially reshaping our world in the near future. In the exhibition, we show 15 “generative provotypes” from the near future. A jury selected which designs would be exhibited. More background information on the designs can be found on our dedicated website.

What are Generative Things?

Generative Things are a new kind of object that merges generative AI with physical reality. With the rise of AI and large language models (LLMs), we’ve seen generative AI become capable of creating novel content and solving complex problems. Now, we’re exploring how this generative capability can be integrated into physical objects.
We wonder what will happen when generative AI becomes integrated into the real world and defines objects’ behavior. How might this change our relationship with these things? We are not promoting these new things as inevitable; rather, we aim to spark conversations about possible futures and their implications.
Our designers have created “provotypes”, a combination of tangible representations (prototypes) and performative narratives as provocations. These provotypes are designed to challenge our assumptions, set boundaries, and inspire future designers.



Inspired by future thinkers

We invited these experts to inspire the designers: Alexandra Deschamps-Sonsino, Heather Wiltse & Johan Redström, Iohanna Nicenboim, Iskander Smit, Matt Webb, Simone Rebaudengo.

The jury report

Jury members were: Kars Alfrink (TU Delft), Manon den Dunnen (Dutch Police), Daniel Goddemeyer (IKEA), Marcel Schouwenaar (independent). They stated: “We were impressed by the wide range of ideas, so instead of the intended 10, we selected 15 projects for this exhibition. For our curation, we identified common themes that connect ideas and form a lightweight narrative to string together the different visions and speculations on our future with AI.”*Trust & Truth, The Bodily System, AI in More-Than-Human Agencies, Control of Intimate AI, Embedded Gen-AI, AI & The Liminal*

Partners

We are partnering with **Cities of Things**, providing knowledge on the future of living with Things as Citizens, and **Amsterdam 750** for the New Map of Amsterdam program line. The **Science & Technology Department of the Dutch Police** is exploring the impact of these Generative Things on our safety and (human) autonomy in the real world.And we partnered with the **Master Digital Design of Amsterdam University of Applied Sciences** and **UID of Umea University**, where the contest was part of the educational program. MDD is also exhibiting partner (14-15 April 2025), just like **Waag Futurelab** (14 June 2025).

Link to the exhibition’s website

Control of intimate AI

Contemplate T15i

How to control the things that understand us

The Contemplate T15i is a control panel from a future in which complex ontological philosophy is the means by which people deal with the technologies that can read and track their emotions from biometric data. The control panel is a speculative provotype that shows a way in which increasingly complex algorithms might be dealt with. Once algorithms enter our lives and come so close as to infer our emotional state, dealing with them becomes an existential exercise. And even though we can build systems that allow people some form of control over these, this control does not mean much when we are unable to understand what we are controlling.

This prototype shows an extreme expression that contains ideas surrounding data literacy, bio-power and self- surveillance. It is both a celebration and a critique of designing for user engagement and contestability.

Tom van Wijland

AI & the liminal

Echo

Where your memories live forever

Echo is a service designed to help individuals organize and preserve their digital legacy. In a world where the value of our digital contributions is increasingly significant, having a tool to simplify this task becomes essential.

Echo not only allows you to safeguard your most treasured memories but also enables you to manage the removal of information you prefer not to leave behind once you're gone.

Photographs, videos, e-books, quotes, movies, opinions, songs, notes, and audio clips are fragments that, over time, have shaped who you are. Echo aims to ensure that ever y thing that defines you is remembered in a special way, creating an immersive experience that captures and preserves the moments you choose.

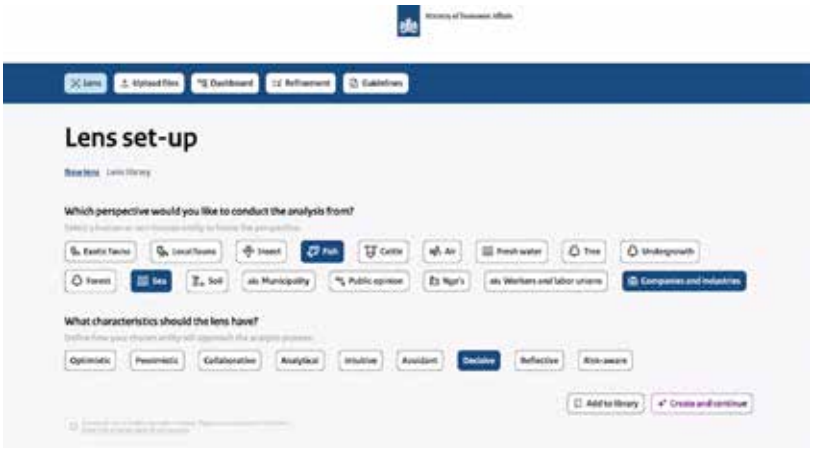
All of this is achieved through Echo's unique process for organising your legacy, ensuring your story is preserved exactly as you envision it.

All of this is achieved through Echo's unique process for organising your legacy assisted by generative AI, ensuring your story is preserved exactly as you envision it.

Elena Mihai
Geetanjali Khanna
Sebastian Jaime Moncada

AI in more-than-human ecologies

Ecolens



Multi-perspective Insights from both – human and non-human stakeholders

Governments around the world face increasing pressure to address the urgent and complex challenges of climate change. **EcoLens** explores how AI might be involved in or potentially reshape this process, offering a speculative vision of policymaking that is both inclusive and data-driven. By transforming complex climate data into accessible and relevant visual insights and creating spaces for diverse human and non-human stakeholder voices, EcoLens imagines a future where technology becomes a collaborative partner in creating encompassing and inclusive climate solutions.

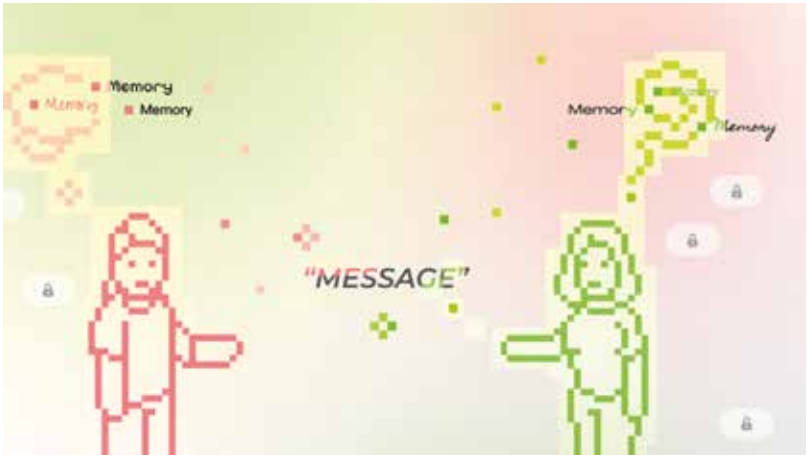
EcoLens provides an insightful perspective on the role AI could play in climate-related government decision-making. It questions how new technologies could change traditional power structures, helping to create fairer and more open processes. At the same time, the project raises critical ethical questions: how do we ensure that AI supports rather than replaces human judgment? Can such tools help overcome existing biases? How do we hold them accountable in high-stakes environments?

This speculative approach invites reflection on the opportunities and challenges in integrating AI into public governance, particularly when addressing complex issues like climate change. EcoLens offers a vision of technological collaboration while encouraging dialogue about the ethical dimensions of AI in shaping collective futures.

Arianna Bardelli
Fatemeh Azh
Stefan van Brummelen

AI & the liminal

Emmo



Memory as context for digital conversations

How do we recall, share, and interpret memories in the digital age? This project delves into personal experiences and digital communication, explores ways to visualize memory. In order to provide context information for digital communication, does highlighting differences violate personal privacy?

Emmo focuses on shared overlaps and uses abstract cues like colors to provide subtle hints. By giving users the autonomy to selectively share or protect their memories, Emmo fosters meaningful connections without compromising privacy. It also explores how digital products can interact with the human brain's natural mechanism of forgetting: by partially blurring photos while preserving key elements, it mimics how humans often lose details but retain the essence of a memory.

Xingyu Liu

The bodily system

Flesh feast

A speculative journey into intimate data and bodily autonomy

Imagine a future where your body becomes your resource—a world where your cells are cultivated into meat to combat food scarcity. Flesh Feast is a speculative design exhibition that immerses participants in the unsettling process of consenting to share their genetic data, cultivating self-meat, and finally consuming it.

This project challenges the boundaries between privacy, autonomy, and sustainability, raising questions about how far technology can push us toward redefining our relationships with our bodies.

Lin Wang

Trust & Truth

Fractured memories

How AI will decide which memories you're allowed to keep

Fractured Memories portrays a speculative future through a narrative told by Hugo, a resident of the year 2055, where artificial intelligence controls personal memories. Through a looping concept video and manipulated photo displays, this exhibition presents a world in which AI autonomously edits photos based on emotional data, blurring the line between care and control.

Inspired by content-aware tools like Photoshop's "Content-Aware Fill," the AI monitors emotional cues—facial expressions, speech tone, and interaction patterns—to determine which aspects of a photo should be altered, blurred, or erased entirely. In this world, painful memories are deleted or redefined without user consent, reshaping how individuals engage with their past.

The story of Hugo, the narrator from this future, guides visitors through the emotional and ethical consequences of a world where memory and identity are curated by algorithms. The exhibition features photos from Hugo's life, distorted or erased by the AI, offering a visual representation of how technology controls what is deemed valuable and worth remembering.

Fractured Memories challenges visitors to reflect on the ethics of AI intervention in personal histories. How much control do we lose when technology curates our memories? And at what cost do we allow algorithms to decide what parts of our past are worth preserving? Through this thought-provoking speculative world, the exhibition explores the implications of giving technology the power to reshape our most intimate experiences.

Priya Rathod

Embedded Gen-AI

Memory ball

Transform spaces into interactive memory archives

In today's digital age, our personal stories and experiences contribute significantly to our collective cultural heritage. However, these digital narratives risk being lost over time without intentional preservation. This understanding inspired the creation of Memory Ball, an innovative project now featured at the Theo Thijssenhuis (TTH), the heart of design innovation at the Amsterdam University of Applied Sciences.

Despite TTH's modern renovation for design programs and research, the personal narratives within its walls remain largely untold. Memor y Ball transforms your smartphone into a portal to these collective memories - from student projects to groundbreaking research.

Visit Memory Ball at TTH to explore these interconnected stories and add your experience to this evolving digital archive, helping shape the building's legacy and Amsterdam's cultural heritage.

Muskan Jain

AI & the liminal

Mirage of parallels

Step into the realm of immersive dreaming with the revolutionary Generative ProVotype – a fusion of cutting-edge technology and ethereal imagination.

The Generative ProVotype is a groundbreaking exploration of the synergy between brainwaves, AI, and physical design. Enabling users to experience personalized dream states by harmonizing the body 's rhythms with a futuristic design.

Shary Kock

Portal of reveries – ephemeral synergies

The bodily system

Obfuscation

A way people relate to an unexplainable system

Intimate data is increasingly being exposed to external entities. Nowadays, our intimate data will be used to analyze, predict, and manipulate human behaviours by algorithmic systems.
The concept ‘Obfuscation’ speculates an idealistic way for people trying to save their self-autonomy under the background that algorithmic decision systems can decide people’s rights by invisibly gathering intimate data.

Hanxiong Zhang

The bodily system

Padcloud

Embodiments of human body leaking fluids and how we leak data

These days, everything seems to connect with cloud and you are faced with algorithms suggested ads, are we making our own decisions or being nudged? Who are looking at our data? Have we thought about what happens when we click on “Accept All” when you open a website?

I created 3 smart body leaking objects, Padcloud, Uracloud and Floracloud. It shows how our most intimate data are leaked through our body leaking fluids such as menstrual blood, pee and vaginal discharge. These future smart objects are harvesting our most intimate data by data brokers. In addition to this exhibition, a data broker’s role is shown by what I think they see and how they monetize our most intimate data.

Rachel Chuman Zhang

AI in more-than-human ecologies

Palavers and the plurinet

More than human agents in the plurinet

A palaver is an AI entity connected to the Plurinet, a more-than-human-in-the-loop network of creatures, agents, digital twins, sensors, etc. The Plurinet network harnesses the idea of generative adversarial~collaborative networks. These networks harness the creative potential of adversarial and collaborative entanglements between biological and technological entities and are produced and maintained through various inputs.

The purpose of a palaver is to permit human designers and decision-makers to access MtH input. The detachable top of a palaver can be car ried around and attached to a batter y pack and tripod in cases where it needs to be taken “into the wild.” However, a palaver does not prioritise human ends. It may suggest something more advantageous to crows or rats to regain equilibrium. Does it tell humans this fact? Maybe!

Whilst a palaver facilitates access to the Plurinet network, it also has its own experience and perspectives that are factored into its contributions. These experiences are represented ambiguously through an experiencecrystal (described below). These cr ystals are layered up over time to represent the “maturity” of the specific palaver and hint and the kind of experiences it has had.

A palaver will chime into a conversation by saying “I speak for the…” followed by the entity it is representing. For example, “I speak for the crows, this will disrupt their food gathering because... perhaps it could be designed like this.” This will be followed by a projected, audio exploration, and/or VR connection.

Matthew Lee-Smith

Embedded Gen-AI

Stroll

Haptic navigation wearable

Stroll is an AI powered wearable enabling screenfree daily walking routes to support your mental and physical health. In today 's tech-immersed world, people crave self care and time away from screens.

The Stroll app coaches people to go on frequent walks, reduce screen time, and practice walking mindfully by being present to take in sur roundings. Instead of visual directions, haptic signals from Stroll's pair of clips direct you along generated routes that are tailored especially for you.

The results:
Less Scrolling, More Strolling.

Ayu Koene
Daniel Klein
Mehmet Bostanci

Trust & Truth

Truth Thorn

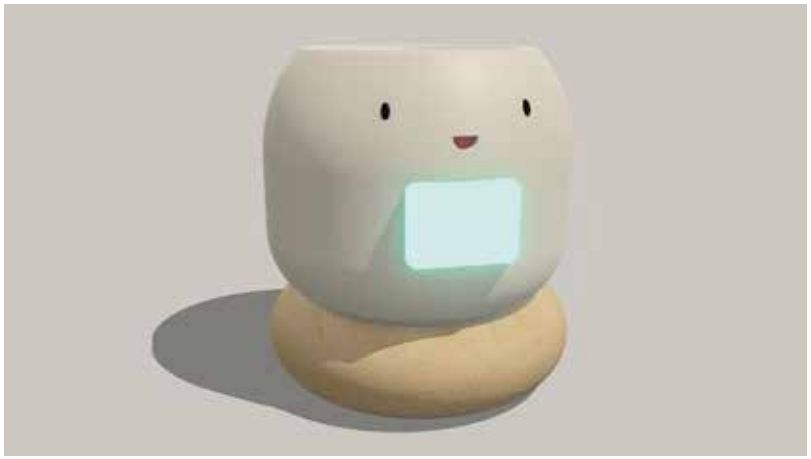
Navigating trust and deception in a data-driven world

What defines truth? Can trust exist without it?
In a future where data surpasses currency in value, Truth Thorn explores the fragile relationship between truth and trust. This speculative wearable filters truth during interactions, with dynamic thorns indicating the degree of concealment. As more truth is revealed, the thorns turn inward, symbolizing the risks of vulnerability.
Truth Thorn challenges us to rethink authenticity, privacy, and connection in a world where data shapes identity.

Tianqi Xiong

Embedded Gen-AI

Tutu



Self confidence and safety for older adults

Loneliness and social isolation are widespread challenges among the aging population, significantly impacting their mental and physical health, independence, and overall quality of life. As the global population ages, these issues are becoming more pressing, with the number of people aged 65 or over expected to triple by 2100.
In our research, we uncovered a related but often overlooked pain point many older adults are targeted by fraudulent phone calls. These scams not only put them at financial risk but also cause significant emotional distress, often leaving them feeling confused and unsafe.
This is where Tutu comes in. Tutu is a smart companion designed to offer support during stressful situations. Using heart rate monitoring, Tutu detects spikes in anxiety such as those caused by suspicious phone calls and proactively checks in by asking the user if they are feeling ok. If the user is unsure whether a phone call is suspicious, they can double-check with Tutu, which will guide them on how to handle the situation.
Beyond this, individuals can also initiate the conversation with Tutu themselves whenever they feel overwhelmed, unsure, or in need of reassurance. By being both proactive and responsive, Tutu coaches older adults through navigating difficult moments with confidence while enhancing their sense of safety and overall quality of life.

Alina Cliucinicov
Oana Dochita
Diego Günther
Mahdis Vahabi

Control of intimate AI

Warm Hug

Navigate care and control in technologies designed to mediate our most intimate spaces

Care and control often coexist in systems designed to help us. In a world where wellness technologies promise empowerment and self-discovery, Warm Hug invites you to question what's truly yours—your body, your choices, or the quiet nudges shaping your behavior.

Through an immersive exploration of your own body, this exhibition blurs the boundaries between care and control, reflection and manipulation. Informed by reproductive health, Warm Hug is a companion that listens, nudges, and reflects, offering insights that feel personal while subtly steering you toward predefined paths of wellness. Warm Hug is a critical provocation to the question: When technology enters our most intimate spaces, how do we define the boundaries between guidance, influence, and control?

Anjuli Acharya

Anjuli Acharya
Kars Alfrink
Fatemeh Azh
Arianna Bardelli
Andreas Bischof
Ola Bonati
Mehmet Bostanci
Jonne van Belle
Arne Berger
Eva van der Born
Stefan van Brummelen
Marina Castán
Rachel Chuman Zhang
Pieter Duysburgh
Joep Frens
Mathias Funk
Diego Günther
Omar JW Heuves
Janet Huang
Muskan Jain
Geetanjali Khanna
Daniel Klein
Shary Kock
Ayu Koene
Karola Koepferl
Andrea Krajewski
Mike de Kreek
Albrecht Kurze
Willemien Laenens
Matthew Lee-Smith
Xingyu Liu
Elena Mihai
Sebastian Jaime Moncada
Anna Merl
Iohanna Nicenboim
Tejaswini Nagesh
Troy Nachtigall
Priya Rathod
Sabine Reitmaier
Johan Redström
Iskander Smit
Francesco Sollitto
Tessa Steenkamp
Zeynep Uğur
Mahdis Vahabi
Lin Wang
Garrath T. Wilson
Heather Wiltse
Tom van Wijland
Tianqi Xiong
Hanxiong Zhang