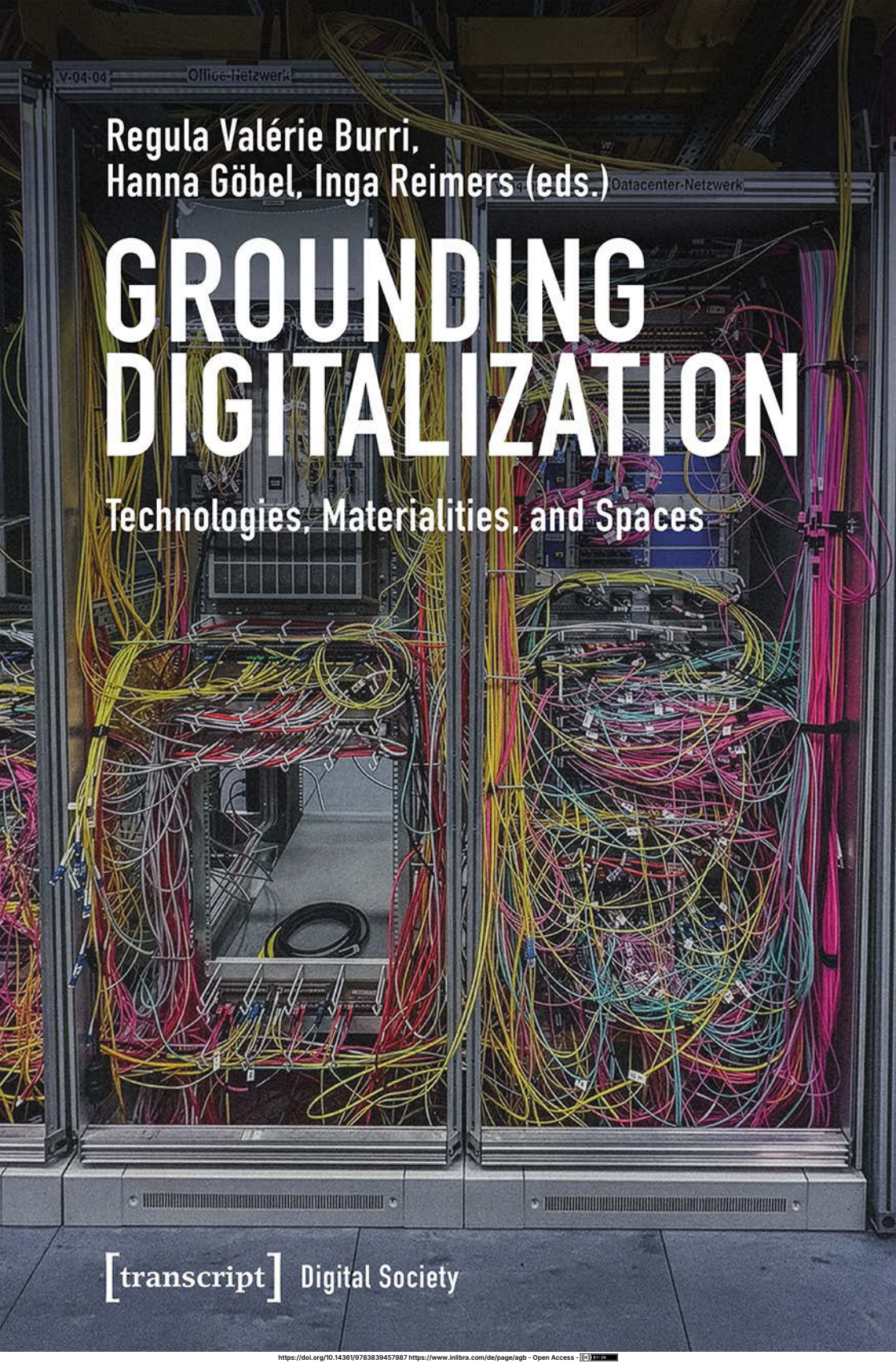

Regula Valérie Burri,
Hanna Göbel, Inga Reimers (eds.)

GROUNDING DIGITALIZATION

Technologies, Materialities, and Spaces

[transcript] Digital Society

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Regula Valérie Burri, Hanna Göbel, Inga Reimers (eds.)
Grounding Digitalization

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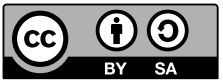

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Introduction

Regula Valérie Burri, Hanna Göbel, and Inga Reimers

Grasping the grounds of digitalization

Digital technologies are inextricably interwoven with our everyday lives and cultures. Currently, ubiquitous computing, machine learning and artificial intelligence are increasingly shaping the ways we know, think, and interact. At the same time, broader processes of digitalization are reconfiguring our social worlds, changing economic structures and democratic participation and making cities and living environments 'smart.' Such transformative power of digital technologies proceeds alongside the multifaceted ways through which they are produced, designed, and formed by cultural values, imaginaries, and institutions and according to the differing ways in which people perceive, use, and work with them in their everyday lives.

The societal implications of digitalization – such as the potential loss of jobs due to AI or possible misuses and dangers of digital media – have been controversially discussed by both researchers and the public, even though the benefits of digital transformation, such as apparently easy access to knowledge and communication, are both widely acknowledged and appreciated. *Critical algorithm studies* have pointed out software programs' lack of transparency, thereby making it difficult for lay users to understand precisely how algorithms work (e.g. Gillespie 2014, 2024; Seyfert and Roberge 2016; Ziewitz 2016; Seaver 2017, 2024). Algorithmic biases – the ways in which various social categories are built into the construction of algorithms – have been criticized for re-stabilizing cultural norms, particularly those of gender and racial prejudices (e.g., Noble 2018; Benjamin 2019). *Critical data studies* have raised issues of privacy and data protection, have examined the implications of digital data for human autonomy, and have critically examined the ways in which datasets are both constructed and processed (e.g., Boyd and Crawford 2012; Kitchin 2014; Orr and Crawford 2024). The politics of big data, pattern-recognition and predictive analytics, and the impacts of the new digital gig economy on precarious working conditions have also been investigated (e.g., Schneider and Green 2018; Jarke et al. 2024). *Feminist technoscience* has shown how digital transformations are intertwined with social and economic inequalities, often re-enforcing digital divides

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and differences of access to and use of digital technologies across ages, genders, and races (e.g., Wyatt et al. 2000; Browne et al. 2023; Wajcman and Young 2023). *Digital science and technology studies* have opened the black box of digital technologies and digital change by revealing their sociomaterial aspects and undermining the accounts in this domain concerning inevitable progress (Vertesi and Ribes 2019; Horn and Felt 2025). Far from being a unilinear transformation, digitalization is discontinuous and fragmented and consists of both heterogeneous and asynchronous processes; however, it is increasingly pervasive.

Digitalization is commonly accompanied by major transformations in the economic and political sphere. The rise and power of a few, mostly Silicon Valley-based 'big tech' companies, has made it possible to both track and control the lives of people all around the globe. Collecting and processing individual data is central to surveillance capitalism's market logic (Zuboff 2019). In their pursuit of profit, big tech companies are turning users of digital technologies into data sources, allowing them to interfere with citizens' everyday lives, with various implications for both their autonomy and identity. The monopolization and concentration of big tech's power, coupled with a lack of transparency and accountability, has given rise to the emergence of big tech oligarchs and new forms of techno-authoritarianism (Roberts and Oosterom 2024) that involves the use of digital technologies by companies and/or governments to monitor and control people, potentially restricting their civil rights. At the same time, the boundaries between data protection laws, their enforcement, free communication, and information are all the subject of (increasingly complicated) political and social debates. The omnipresence of 'fake news' and misinformation further endangers democracy (Burton, Chun et al. 2023). False information is both strategically disseminated by authoritarian governmental actors around the world and cultivated primarily by right-wing citizens on social media. Widely spread by digital technologies, it impacts upon people's opinions, interferes with elections, and undermines democratic participation. What is at stake here are the ways of interacting with each other in democratic cultures and in everyday life and the role that materializations and spatializations of digital practice play therein.

Digitalization has, thus, been seeping into our everyday lives. Such datafication is rooted in a secular belief in objective quantification and in a trust in corporate platforms – "dataism" has become an ideology (van Dijck 2014) and "smartness" has become a "mandate", i.e., a new way of governing politics, economics, and the environment (Halpern and Mitchell 2023) and of governing ourselves in everyday life.

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Grounding digitalization – an analytical lens

Digitalization is still often framed in both academic and public discourses as a largely technical and often invisible process, despite the intertwining of digital technologies and culture, and this has the result of neglecting not only its cultural embeddedness, but also its material, spatial, and environmental grounding. However, digital technologies and transformations are shaped by cultural values, practices, and imaginations and are sociomaterially produced. They include computer hardware, data centers, network infrastructures, fiber optic and copper cables, routers, wires, and electrical plugs. They consume raw materials, environmental resources and electric energy, and cause high carbon dioxide emissions and electronic waste. These materialities intervene in spaces, thereby reconfiguring socio-spatial arrangements and changing the ways in which spaces and environments are both experienced and produced. At the same time, spatialities also impact upon digital infrastructures. Human-environment relationships and their cultural effects are increasingly becoming the subject of scientific considerations of the digital (Vonderau 2018) in the face of the Anthropocene. Perspectives on the relationship between natural resources and digital technologies, as well as socio-environmental dimensions, are also increasingly coming into focus (Westerlaken et al. 2023; Gabrys 2022).

We point to such socio-technical, socio-material, socio-spatial, and socio-environmental aspects of digitalization as cultural processes by suggesting to use the "grounding" of digitalization as an analytical lens. "Grounding" digitalization refers, first, to the cultural analysis of materialities, technologies, and spatial requirements and the implications of digitalization. This involves recognizing that these are deeply intertwined with epistemic and cultural values, imaginaries, and practices. This analysis includes asking questions about how digital technologies, platforms, and infrastructures are co-constructed with spatial arrangements as well as social and epistemic orders.[1]

Second, "grounding" digitalization adopts a critical perspective on digital transformations. It aims to reveal power relations, implicit values and norms, inscribed biases, and inequalities that accompany current forms of digital transformations. Applying the lens of "grounding" reveals the often-invisible, underlying, intangible, and taken-for-granted processes of digitalization; in so doing, it also reveals much of the human labor that is required to maintain the digital infrastructures that are involved in these transformations. Addressing the implicit and invisible allows us to both re-imagine digital futures and to shape them otherwise.

1 Such an analysis builds upon previous work on how technologies and society are co-produced (Jasanoff 2004); however, the "grounding" approach includes more explicit reflections about the spatial dimensions involved in this process.

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Third, such an analysis places a particular emphasis on cultural practices. Whereas digitalization transforms all societal dimensions and domains, it re-configures the material, spatial, and environmental relationships according to people's everyday experiences and practices. A "grounding" analysis explores the cultural practices that are involved in the production, circulation, and use of digital technologies. It can also study potential emancipatory moments in digital transformations – e.g., infrastructural hackings, territorial negotiations, critical imaginaries of futures, and the cultural repair of relationships – by tracing critical practices of cultural productions, enactments, and the inventions of everyday life.

This edited volume critically questions the intricate entanglements between digital processes and material, spatial, and cultural realities while also developing new perspectives through which to understand both the present and future worlds through multifaceted and interdisciplinary engagements with digitalization.

Thematic sections

The contributions examining digital transformations in this edited volume are divided into four sections – infrastructures, imaginaries, territories, and work and repair. The thematic sections have served, and continue to serve, as a means of structuring and focusing this collection's subject matter. At the same time, they reveal empirical and epistemological approaches that are inextricably linked. It is, thus, difficult to consider repair practices, for example, without also addressing the infrastructures involved. Questions of access to infrastructures and the barriers within them will, in turn, always open up territorial perspectives. Moreover, both imagining and repairing are future-oriented activities that shape not only spatial and territorial futures, but also infrastructural ones. All of this edited volume's sections are, thus, in dialog with each other.

Digitalization is a global process that plays out differently in various cultural contexts. Most of the chapters in this collection share a European perspective, with many of the contributions studying cases in Germany and placing them in dialogue with international debates and approaches. While aware of the limitations of such a geographical and thematic focus, the chapters in this volume nevertheless invite reflection on digitalization's broader cultural implications.

Infrastructures

The chapters in the first section, *Infrastructures*, analyze how digital infrastructures – which are indispensable to processes of digitalization – are deeply grounded in cultural practices as well as techno-material and spatial arrangements that shape infrastructural developments, while simultaneously being reconfigured by them.

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Digital sociomaterial infrastructures require constant repair and attention; they are politically negotiated, aligned with local routines and practices, and are sometimes resisted. The chapters in this section show how digital infrastructures work in practice and how they simultaneously re-organize social, material, and spatial relations – an insight that can be used for critical urban design.

Based on research into the digitalization of the planning system in Ireland, Juliette Davret, Danielle Hynes, and Rob Kitchin show how data infrastructures that are implemented in planning are fragmented and used differently by local authorities, due to scarce resources and/or institutional resistance to change. Despite being fractured, data infrastructures are 'good enough' to work in planning practice and, thus, represent a form of situated functionality that is supported by the cultural and political contexts that are shaped by austerity. Sophia Leipert examines the Port of Hamburg as a testbed for "smart port" technologies that aim to improve efficiency, sustainability, and data-driven decision-making. Applying a governmentality perspective to analyze the Hamburg Port Authority's smartPORT initiative, she argues that smart port technologies are not merely technical enhancements, but are instead mechanisms of power that reshape spatial, economic, and social relations. By analyzing recent design initiatives in Hamburg and Utrecht, Timo Kaerlein reflects on urban dashboards as digital infrastructures, which are often posited as the pivotal interface through which to access the city as an information space that is governed from a central point. He suggests re-framing the dashboard as a critical interface by practicing collective "critical dashboarding" in order to articulate alternative "urban intelligences" (Mattern 2021) that are grounded in city dwellers' lived realities.

Imaginaries

Understanding how digitalization is envisioned as a sociomaterial and spatial transformation is crucial. Imaginaries, technologies, and social orders are co-produced (Jasanoff 2004), while always remaining grounded in both cultural practices and spatial contexts. The chapters in this section explore imaginaries from different perspectives. They examine, for example, dominant Western, global, and supranational visions and contrast them with local, counter-hegemonic, and alternative imaginaries and visions, some of which stem from the Global South. The imaginaries examined in this section are collectively held and inscribed in economic, political, and technological rationalities or they may take the form of more individual and small groups' avant-garde visions. They can also be (re)produced by machines.

By considering the global supply chains of autonomous vehicles, Fabian Namberger delves into the data work practices of people in the Global South, with a focus on annotation labor in Kenya. He claims that research on autonomous vehicles should shift the focus from local consumption to global production. His analysis includes social counter-imaginaries of autonomous driving based on film documen-

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taries concerning AI data labelers and further inquiries collected by a Berlin-based initiative. Mascha Gugganig explores how the digitalization of future farming is envisioned by EU agriculture policymakers and small- and medium-scale farmers in Germany. While policymakers view digitalization as an inevitable fixture for sustainable agriculture, for farmers – as became apparent in a speculative design workshop – it is only one aspect of agriculture, albeit a helpful one, given that it supports their ability to communicate and network at a local level. Exploring imaginaries in the world of big tech, Sebastian Wucherer examines publicly available communications from Google's CEO to its employees, thereby revealing the company's vanguard visions of technology, knowledge, and global AI futures. He argues that although digital technologies are viewed as "tech that helps," by supporting public services for example, the business orientations underlying these visions tend to bring about superficial, rather than profound, sociotechnical change. Regula Valérie Burri engages in a conversation with ChatGPT about AI generated images, asking the large language model, for example, to generate an image, to interpret it and to describe the imaginaries emerging therefrom. The AI program's responses touch on topics such as data sources, 'truth,' aesthetics, authorship, and responsibility, thereby revealing the imaginaries that are (re)produced by the machine and that are based both on previous prompts and on large data sets that already contain critical analyses of sociotechnical imaginaries.

Territories

Digitalization and the territorial organization of spaces and materialities are deeply intertwined processes. Territories are a spatial category through which the power, related to forms of control, becomes visible alongside digital mechanisms and through which geographical conflicts about territories are turned into data-based affairs that are negotiated within digital infrastructures. The cultural qualities of territories become mapped, measured, calculated, and normalized based upon digital knowledge forms and through this transformation. The cultural effects of these intertwined processes also impact democratic processes of negotiation and spatial contestation.

Igor Dalla Vecchia and Boris Michel develop a critical inquiry of territorialization processes relating to the phenomena of delivery workers and digital platform urbanism in three Brazilian cities. The authors argue for the concept of re-territorialization by ethnographically studying how workers organize themselves with critical cartographic mappings. The mappings produce community knowledge on the grounds of the workers' urban experiences that exceed the delivery companies' territorializing logics. The hybridization of social media and territorialization processes is the topic of Zita Seichter's contribution on the normalization processes of the far-right in extremists' accounts on the platform TikTok. She analyzes how the

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experience of ordinary urban spaces of particular cities become instrumentalized in reels, images, and in audio-visual materials in order to normalize the ordinary as an ordered, whitened, and racialized territorial quality. In an interview with Jason Luger on hybrid territorializations and far-right mobilization in social media, Zita Seichter and Michael Krell explore the potentialities of platforms as creative spheres and contrast this with the current affective contestations and undermining of territorial qualities and values. Jason Luger identifies a dominant logic of utilizing the digital sphere for the purposes of economic and political control of cultural life-styles and of mobilizing neoliberal performance cultures on platforms by means of racialized and self-exploiting mechanisms.

Work and Repair

The final section critically examines forms, places, and practices of work that are under the influence of digital infrastructures. Various concepts of work are juxtaposed and discussed in this section's chapters and include unpaid care work for other humans or for infrastructures (Mol, Moser, and Pols 2020) that is contrasted with paid work in digital sociomaterial environments (Tischberger 2026; Oechslen 2023). Each chapter addresses the (in)visibility of work on and in the digital and focuses on the practice of repairing as a continuous process of care and maintenance in different settings. In the broad conception of work, as a practice used here, it always goes hand in hand with the linking of present action and the designing and shaping of futures and/or counter communities, as the contributions collected in this volume also reveal.

In her chapter on the production of online DIY repair advice, Ronja Trischler focuses on a specific form of voluntary work within the sociomaterial entanglement of an online repair advice platform. She describes giving repair advice on concrete material problems online as a process that requires both translation and intermediation and that is facilitated by voluntary moderators. Inga Reimers analyzes and discusses the materializations of digital-based work in rural coworking spaces. In her chapter, she describes the practice of coworkers and coworking hosts as a matter of care and repair for both the working spaces and the rural areas in which they are located. While the invisibility of repair and work processes is often a matter of social "blindness," Johanna Fischer examines the self-perception of programmers who often make their own work and repair services disappear behind automation processes in machine learning. She combines the concepts of labor, work, and action (according to Hannah Arendt) with current perspectives from science and technology studies in order to describe the material and epistemic practice of programmers. The challenges of access to digital spaces, such as video conferences for deaf and/or blind disability communities are the primary subject of Hanna Göbel's contribution. She uses a pre-enactment of access to discuss time-intensive forms of

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translations and develops repair scenarios through which to enable data-intensive environments based on research related to smart solutions for disability communities.

Context

The idea for this edited volume, and the accompanying analytical perspective, were collectively developed at HafenCity University Hamburg (HCU) during the transformation of the study program "Metropolitan Culture" into a more digitalization-oriented degree program. The contributing authors in this edited volume are both junior and senior scholars, formerly or currently researching, teaching, and working at HCU, as well as a few research scholars who were invited in order to enable a dialog between various disciplines, such as cultural anthropology, sociology, science and technology studies, media studies, and geography. This collection can also be seen as a continuation of a critical tradition in the HCU study program, which is located at the intersection of urban spatializations, digital transformations, and cultural productions.

Many people have contributed to this collection. Raphael Schwegmann, who teaches in our study program, participated in early meetings and discussions about this project. Doctoral students Sophia Leipert, Zita Seichter, and Sebastian Wucherer, who all present their research in this collection, initially served as section editors. Sebastian Wucherer also provided valuable support during the review process by providing additional feedback on several chapters. Students Luise Brandt and Michelle Ciesla, as well as doctoral student Maja-Lee Voigt, helped us to adapt the references of the manuscripts. A Master's student, Alexandra Knapke, also generously allowed us to use a photo for the book cover. Thank you all for the great collaboration.

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Fractured Data Infrastructures

Sociomaterial frictions in the digitalization of Irish planning

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Introduction

The digitalization of urban and spatial planning represents one of the most significant transformations in contemporary governance practices. Planning authorities, across jurisdictions, have increasingly embraced digital technologies as solutions to long-standing challenges of coordination, transparency, and efficiency (Daniel and Pettit 2021). Digital tools, such as Geographic Information Systems (GIS) which are used to conduct spatial analysis, planning application management systems, simulation models, and online consultation platforms designed to enhance public participation, have become central to how planning is conceived, practiced, and legitimized (Batty 2013; Townsend 2013). Alongside these well-established tools, emerging technologies such as city information models, virtual- and augmented-reality, and GenAI powered planning support tools continue to evolve and alter how planning is undertaken (Portman et al. 2021; Geertman and Stillwell 2020; Lartey and Law 2025). Yet, this digital turn in planning is frequently characterized by a persistent gap between technological promises and material realities. While policy makers and technology providers promote visions of seamless integration, real-time data flows, and automated decision-making, the everyday implementation of digital systems reveals a more complex landscape of partial adoption, workarounds, and ongoing struggles with legacy systems (Coletta et al. 2019; Kitchin et al. 2025b). This disconnect, between imaginaries and practical realities, suggests the need for more nuanced, materially grounded analyses of how digitalization actually unfolds within planning organizations.

The significance of examining planning digitalization's cultural and material dimensions extends beyond mere technological critique. As planning increasingly relies on digital infrastructures to collect, process, and distribute information, the ways these systems function (or fail to function) directly shape the possibilities for democratic participation, evidence-based decision-making, and effective governance (Shelton et al. 2015). Understanding digitalization as a sociomaterial process,

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rather than simply a technological upgrade, reveals how existing and emerging power relations, institutional cultures, and material constraints all become embedded within (seemingly neutral) digital tools (Poschmann 2024; Flanagan et al. 2008; Winner 1980).

This chapter examines digitalization's cultural and material dimensions in Irish planning by exploring how digital infrastructures function as complex sociomaterial assemblages, rather than impartial technological tools. The analysis reveals how fragmented digital systems nevertheless enable planning work to continue through ongoing processes of negotiation, adaptation, and repair, drawing on the notion of 'good enough' functionality (Collins 1994; Gabrys et al. 2016; Bialski 2024). The chapter challenges the dominant narratives of seamless digital transformation by demonstrating how cultural frictions and infrastructure gaps are constitutive features that shape the daily realities of digital planning practice. In this way, it contributes to emerging scholarship that challenges dominant narratives of digital transformation by foregrounding the messy, contingent, and culturally embedded nature of planning digitalization (Kitchin et al. 2025b; Kummitha 2019). The chapter's central argument is that the cultural frictions and infrastructural gaps that characterize planning digitalization are not merely obstacles to be overcome, but are instead constitutive features that shape how digital systems actually function in practice.

The empirical analysis draws from recorded interviews undertaken in phases 1 and 2 of the Data Stories[1] project, which sought to examine issues relating to the full housing and planning data ecosystem in Dublin, Ireland, and a case study undertaken on behalf of the Local Government Management Agency (LGMA) focusing on the planning system exclusively. In phase 1, 125 recorded interviews were undertaken with 135 interviewees from across state, business, civil society, and university sectors, along with another 45 informal, unrecorded meetings with stakeholder actors from October 2022 to February 2025. Additional interviews with the state sector were also conducted as part of phase 2 of the project, for a case study on planning (which started in January 2025 and lasted until December 2025). The stakeholder quotes used in this chapter are from both phase 1 and 2 interviews. The case study research for the LGMA, undertaken in the summer of 2023, comprised interviews with 29 public sector officials within the planning system at local, regional, and national scales across 13 organizations, including 6 local authorities, two government departments, and five state agencies; most interviews were not recorded, and the funder stipulated that those that were recorded could not be quoted. Six interviews utilized a walk-through methodology, during which participants demonstrated their routine data workflows and elucidated system functionalities across various Planning Application Management Systems (PAMS). The research further encompassed

1 https://datastories.maynoothuniversity.ie/

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a detailed analysis of user documentation, comprehensive data audits of five principal systems (in order to reconstruct their data architectures), and the systematic examination of downstream open data platforms and planning monitoring tools. This mixed-method approach facilitated a thorough understanding of both the technical infrastructure of individual systems and their interconnected relationships within the wider data ecosystem.

Digitalization and planning: between promises and practices

From initial experiments utilizing computers in planning in the 1960s to their widespread integration in the 2000s, the digitalization of planning practices has long been accompanied by powerful narratives of transformation that promise to address fundamental challenges that contemporary urban governance faces, such as climate change, housing quality and affordability, environmental degradation, and social inequalities and segregation (Klosterman 2012; Batty 2021). These narratives, promoted by technology companies, government agencies, and planning scholars alike, present digitalization as a pathway towards more integrated, efficient, participatory, inclusive and transparent planning processes (Batty 2013; Townsend 2013). The appeal of these promises lies in their apparent ability to resolve longstanding tensions within planning practice through technological innovation.

Integration might represent the most prominent promise of digital planning. Traditional planning systems have long struggled with fragmentation across different departments, scales of governance, and in terms of type of data (Healey 2006). Digital technologies appear to offer a solution to fragmented data silos by connecting previously disparate systems together, thereby enabling seamless data sharing, additional insights, for value to be extracted from datasets, and for coordinated analysis and decision-making (Geertman and Stillwell 2020). Efficiency constitutes another central promise of digital planning. The digitalization of formerly paper-based systems and the adoption of digital tools are positioned as solutions to the perceived slowness and bureaucratic inefficiency of traditional planning processes (Datta 2023; Devlin and Coaffee 2023). Automated data collection, algorithmic analysis, and streamlined approval processes all seek to reduce the time and resources required for planning activities, while improving both their quality and consistency (Batty 2018). This efficiency narrative is particularly powerful in contexts of austerity and resource constraints, where digital solutions appear to offer the ability 'to do more for less' (Lowndes and Gardner 2016).

Increased participation and stakeholder consultation represent another crucial promise of digital transformation. Online consultative platforms are promoted as tools for improving public engagement, thereby aiding consensus building, creating meaningful communication between experts and non-experts, and enhancing

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planning decisions by more readily drawing upon local knowledge by reducing barriers to engaging in participatory planning (Bugs et al. 2010; Cardullo and Kitchin 2025). These barriers include the legalistic language, often associated with traditional planning consultation, and a lack of knowledge and time available for most citizens to participate in these formal processes (Wilson et al. 2019). More recent developments in locally configurable platform technologies for citizen engagement promise platform-mediated interactions that are specifically tailored to particular locations, rather than the more common 'worlding' approach in which platforms function in the same manner, regardless of where a user is located (Cardullo and Kitchin 2025). Digitalization is also believed to increase transparency by creating comprehensive standardized data flows that enable public scrutiny (Seltzer and Mahmoudi 2013). Interactive mapping tools and open data initiatives are presented as mechanisms by which to create more transparent planning processes through which decisions can be traced, verified, and assessed through objective data analysis (Janssen et al. 2012).

These promises of integration, efficiency, participation, and transparency are all embedded within broader imaginaries of digital governance that have gained prominence across multiple policy domains (Jasanoff and Kim 2015). Such imaginaries often present technology as a neutral tool by which to improve government performance and democratic accountability, while obscuring technological change's political and cultural dimensions (Morozov 2013; Eubanks 2018). Within the domain of planning, smart city imaginaries manifest in proposals for data-driven decision-making, algorithmic optimization of land use patterns, and in the sensor-based monitoring of urban conditions (Batty 2013). The e-government movement has similarly promoted digital technologies as solutions to problems of red tape, bureaucratic inefficiency, reducing opportunities for corruption, enhancing public access to government information, and fostering citizen engagement (Dunleavy et al. 2006; Janssen et al. 2012). These narratives often present digitalization as a technical fix for political and institutional problems, suggesting that technological innovation can overcome the limitation of existing bureaucratic arrangements. Finally, evidence-based policy discourse has also shaped digital planning imaginaries by promoting the idea that data-driven analysis and decision making will lead to more objective and effective policy decisions (Parsons 2002; Head 2008). This discourse positions digital technologies as instruments to reduce the influence of politics and ideology in planning decisions, allegedly allowing for more rational and scientific approaches to urban governance (Batty 2018). This narrative's appeal lies in its promise to resolve conflicts and to build consensus through (supposedly) objective analysis.

Empirical research on planning digitalization reveals significant tensions between these visions and everyday practices in planning authorities, despite the powerful appeal of digital governance imaginaries. These tensions arise from the gap

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between the assumptions embedded within digital technologies and the complex realities of planning institutions, cultural aspects, and governance arrangements. For example, a fundamental tension concerns the ambition of having full data integration. Although digital platforms advertise their ability to connect disparate systems and processes, planning practice involves multiple stakeholders, all of whom have different interests, needs, tasks, ways of organizing and practicing work, and established legacy systems and databases that collectively produce significant operational frictions (Healey 2006; Edwards et al. 2011). Digital integration requires not just technical interoperability, but also coordinated institutional change management and cultural alignment and this is difficult to achieve in practice (Gil-Garcia et al. 2007). The results are often fragmented digital landscapes that reproduce, rather than resolve, existing institutional divisions.

The efficiency promise faces similar challenges when confronted with the complexity of planning practice. While digital tools can certainly automate certain routine tasks, planning involves multiple institutional stakeholders (e.g., planning authorities, state bodies, companies, civil society organizations) and types of actors (e.g., applicants, planning staff, internal commentators, prescribed and invited external commentators, the public, developers, architects, chartered surveyors, data analysts, system designers, and local system engineers), forms of judgment, negotiation, and contextual interpretation that all resist algorithmic processing (Jasper and Flyvbjerg 1999). Additionally, the introduction of digital tools often requires additional forms of labor (e.g., data entry, system maintenance, and user training) that can offset efficiency gains (Wilson and Tewdwr-Jones 2022). Transparency and improvements to data quality aim to tackle obstacles related to digital divides, technical literacy, and power relations. However, while digital platforms can make information more accessible, they can also create new forms of exclusion, especially for those with limited or no digital skills or access (Helbig et al. 2009). The design of digital participation tools often reflects the assumptions and preferences of their creators, rather than the needs and capabilities of diverse publics (Sieber 2006). The result can be forms of digital participation that reinforce, rather than challenge, existing inequalities in planning processes (Falco and Kleinhaus 2018).

These tensions suggest the need for more critical and nuanced analyses of planning digitalization that examine the social, cultural and political dimensions of digital transformation (Karvonen 2020). Digitalization is not a neutral technical process, but a place of ongoing negotiation between different actors, interests, and ways of understanding planning practice that needs further consideration.

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Infrastructural realities: fragmented but functional

Our examination of the Irish planning system reveals how digital infrastructures operate as complex sociomaterial assemblages that resist the seamless integration promised by digital governance imaginaries, thereby demonstrating how system fragmentation, cultural frictions, and infrastructure gaps are constitutive features that shape the daily realities of planning practice (Kitchin et al. 2025a).

System fragmentation within the data ecosystem

A process of incremental digitalization has been underway since 2000, with a 'jerry-rigged' digital data ecosystem put in place gradually (Kitchin et al. 2025b). Various paper-based systems and processes were digitalized at different times and were interlinked across multiple actors. A set of PAMS were initially adopted by Ireland's 31 Local Authorities (LAs) in order to process planning applications: iPlan was used by 26 authorities, and APAS by 5 authorities (with each instance being locally configured). In 2015, two LAs transferred from iPlan to Odyssey. These systems are different with respect to data architecture, workflow organization, and functional capabilities. Each system possesses its own data dictionary, with marked variations in required fields (iPlan: 65 compulsory fields, Odyssey: 40, and APAS: 21) and optional fields (iPlan: 265, Odyssey: 409, and APAS: 194). iPlan and Odyssey both make extensive use of open text fields, whereas Odyssey and APAS employ both many check boxes and drop-down menus with fixed category choices. E-planning systems that enable the public to view key documents relating to planning applications were first introduced in 2003. The Building Control Management System (BCMS), used to track compliance with construction regulations, was introduced in 2014. The National Planning Application Database (NPAD) was launched in 2016 and is an interactive map system for viewing planning applications nationwide, and PleanIT, a case management system used by An Bord Pleanála (the national planning appeals body), was implemented in 2017. Data are shared between each of these different systems. For example, NPAD uses an automated Extract, Transform, Load (ETL) process called PETaL to import data from ePlan, and PleanIT ingests data from NPAD. However, these processes are frequently disrupted by technical glitches arising from differences in system architecture, firewall permissions, server configurations, and software updates. The result is that NPAD often displays incomplete information, with data from some authorities becoming temporarily absent until technical issues are resolved. Fragmentation is also evident in the persistence of paper-based processes alongside digital systems. As of August 2023, 12 LAs still required planning applications to be submitted as paper documents that were then scanned and entered into PAMS manually, thereby exemplifying the 'jerry-rigged' character of recent digital application. While An Bord Pleanála makes use of PleanIT, legal re-

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quirements mandate that all digital materials must be printed and added to paper case files. In addition, applications made under different sections of planning legislation (e.g., Sections 5, 35, 42, 44, 57, 247 and Parts V, VII, and XI of the Planning Act) are often handled using separate systems, due to PAMSs being unable to process their data.

Variance across stakeholders

Another example of fragmentation can be found in the variance expressed in the ways that different stakeholders collect, process, and share planning data. These differences reflect deeper institutional, cultural, and political dynamics that shape the implementation of digital technology. For example, data workflows vary across LAs and even across those that are using the same PAMS. A telling example emerges in the compilation of official planning statistics by the Central Statistics Office (CSO). The CSO sends an Excel template to all 31 local authorities each month requesting standardized information on 14 variables for each planning application. However, the planning application management systems employed lack automated reporting functions, thereby requiring planning officers to extract and enter data manually (a process that consumes a week of work each month for each LA). The variability in data capture across different PAMS means that authorities may interpret the same data fields differently, while some ignore the CSO's template entirely, submitting data in alternative formats (including paper and scans of pdfs). A team of six CSO staff spend up to a month cleaning and standardizing the data in order to make it comparable between authorities, as described by an interviewee:

> "So, typically they would send us the data in their own formats. Unfortunately, it can vary quite a lot between local authorities. There is a local authority which still sends returns by paper. I won't name which one [...] but it can impact our turnaround times because of that. The formats they use, it could be PDFs of outputs they've taken from their own systems." (IP43, public sector worker)

Different levels of government and regulatory bodies, who play a part in the planning system, have differing priorities and these can come into tension at times, thereby constituting another element of fragmentation. A key priority described by one interviewee, who works for a national body, was ensuring equal access for all users:

> "We're not particularly interested in the politics across local authorities or even the politics between local authorities and the department. What we're interested in is the user journey. And actually, one of the principles that the government wants to adhere to is that every single resident in the island of Ireland should have exactly the same quality of service regardless of where they live. And what that does is it

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> puts pressure on them [local authorities] collectively and individually. And they're starting to respond to that." (IP108, public sector worker)

However, an interviewee who works closely with local authorities expanded on the reluctance to streamline and to respond to national pressures:

> "We have 31 local authorities who are understandably keen to sort of maintain their own autonomy and independence and so on. And I suppose the cost of a new singular back office operation to administer your planning system and give you management information and all this sort of stuff would be quite considerable. It would be a brave local authority to put its hand up individually and say, 'well, actually, we're going to lead on this'." (IP65, public sector worker)

Both the desire to retain autonomy and independence through maintaining individual systems (such as iPlan, APAS, or Odyssey) and the cost of creating and maintaining nationally standardized digitized planning systems with the capacity to produce data outputs that are comparable, interoperable, and real time create considerable tension. These factors all contribute to ongoing fragmentation within the system.

Good enough and everyday maintenance

The notion of 'good enough' functionality challenges dominant narratives of digital transformation that emphasize optimization and seamless integration. In the Irish context, 'good enough' represents achieving sufficient operational performance given contextual factors, such as a complex regulatory environment, limited funding, understaffing, and incremental digital adoption (Kayanan et al. forthcoming). Rather than representing failure, this condition can be understood as situated functionality emerging from the ongoing negotiation between technological capabilities and institutional realities. The system might not be perfect, but at an operational level, the planning system demonstrates robust, 'good enough' functionality in core tasks to satisfy the expectations of managers, staff, and stakeholders.

Local authorities successfully process thousands of planning applications annually with PAMS that enable case management, timeline tracking, fee monitoring, and decision recording. The systems facilitate consultation processes, support public access to planning information, and maintain the extensive documentation required to make planning decisions. The limitations of 'good enough' functionality become apparent when the system struggles to perform tasks beyond the original design parameters. This attitude was described by an interviewee as follows:

> "Hard-nosed local authority chief executives would say, 'look, the system works fine as it is. It mightn't produce, you know, the most beautiful data sets at a na-

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> tional level, but that's not my problem. If the department [Department of Housing, Local Government and Heritage] wants that, fine; if they rock up with a cheque for 15 million, you know where I am'. And that's the narrative, that's the rhetoric around that space." (IP65, public sector worker)

The construction of achieving 'good enough' status depends on the labor of planning professionals who must interpret system requirements, make judgments about data categorization, manage tensions between standardized forms and contextual specificity of individual planning cases, and must practice forms of maintenance and repair that keep systems functioning. The latter includes performing data cleaning and wrangling, patching software and performing systems upgrades, fixing system errors, and liaising with technical and other staff, as well as with applicants, to address issues arising in processing tasks (Graham and Thrift 2007). At the same time, the variability in data entry practices, with some staff entering minimal information and others providing comprehensive detail, demonstrates how planning data quality emerges from situated professional judgments, rather than from automated technical processes. Moreover, planning professionals expressed concerns that overly standardized systems might reduce their capacity to respond to local contexts, thereby potentially undermining the contextual sensitivity that they consider essential for effective planning practice. Resource pressures, created by austerity, have intensified cultural tensions by creating conditions in which planning staff must prioritize essential functions while also managing increased workloads with a reduced capacity. This has led to 'tactical resistance' through practices such as minimal data entry, delayed responses to system requirements, and selective engagement with digital processes. These practices represent attempts to manage competing demands and to preserve capacity for core planning work, but also contribute to data quality and consistency problems.

Cultural and political conditions

The fragmented and 'good enough' character of Ireland's planning digital infrastructure must be situated within broader cultural and political conditions that have shaped its development and operation. These conditions include the material constraints of austerity governance, tensions between local autonomy and centralized standardization, and everyday practices through which planning professionals negotiate digital technology demands. Understanding this resistance requires understanding the political economy and economic context in which Irish governance operates, as well as Ireland's distinctive historical relationship with data standardization, including the late introduction of basic spatial data infrastructure like postcodes (only implemented in 2015), the absence of a comprehensive cadastral system,

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and persistent opacity around land ownership that has created cultural comfort with informal, locally managed information systems.

Since the late 1980s, Ireland has adopted a decidedly neoliberal approach to government, with a relatively lean public sector, low corporate taxation, light-to-no regulation of market activities, the marketization of public services, public-private partnerships, and developer/speculator-led planning (Kitchin et al. 2012). Initially, this gave rise to the Celtic Tiger period (1993–2007), characterized by rapid economic growth driven by foreign direct investment, a strong increase in population, and a property boom. This 'economic miracle' was halted, however, by the global finance crisis, manifest in the Irish case by an oversupply of property. The austerity measures following the 2008 financial crisis extended the under-resourcing of local authorities, with staff numbers falling by nearly 24% between 2008 and 2015 (DELG 2015; DEHLG 2008) and budgets being reduced by more than 22% (DPER 2024). In turn, these constraints have created 'defensive demarcation' behaviors, where local authorities resist central government standardization initiatives while defending their autonomy over IT system choice and configuration. However, this apparent assertion of autonomy often masks underlying resource constraints, given that some local authorities find themselves adopting particular systems not as expressions of genuine choice, but because they lack either the financial capacity to afford preferred alternatives or the technical resources to facilitate transitions to more suitable platforms. This resistance reflects legitimate concerns about digital standardization implications for local flexibility and professional judgment, but also draws on deeper cultural patterns where Ireland's historical lack of standardized land and property data systems has normalized fragmented approaches to information management.

These cultural patterns and fragmentations were revealed through discussions with Land Development Agency (LDA) staff, with respect to public land management, who pointed out that even the most fundamental question of public land inventory remains unresolved:

> "So, public land being lands owned by a public body: Where it was [the land], who was using it, what were they using it for, and could or should it be used for housing? That was the original theory of the LDA, but there was no single data set of public lands." (IP36, public sector worker)

This absence of centralized data extends beyond mere oversight and reflects deeper institutional fragmentation:

> "A lot of local authorities just don't know what they own and haven't been able to compile this data set." (IP36, public sector worker)

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The implications of this data opacity become starkly apparent when asking the most basic questions about ownership and jurisdiction. As one staff member noted with characteristic understatement:

> "A lot of the country isn't registered; we don't know who owns what. Particularly when it comes to the data that I'm looking at, because a lot of the state lands are historic structures. Nobody can tell me who owns the Custom House. I can see it from the window. It was built by a King or Queen 250 years ago. The OPW [Office of Public Works] maintain it and look after it and cut the grass and fix the windows. The Department of Housing are stationed there, and they have been for years. But who owns the building? Nobody knows." (IP36, public sector worker)

This confusion extends to administrative evolution itself, where bureaucratic restructuring has created additional layers of uncertainty:

> "Other problems with the data that I have, is that I found in the last search I did for the PRAI [Property Registration Authority of Ireland], I found about, I can't remember, 30 odd sites registered to the Department of Energy. And we haven't had a Department of Energy since 1980. […] The government departments change their name all the time. And nobody re-registered their sites." (IP36, public sector worker)

These examples illustrate how Ireland's planning digital infrastructure reflects not merely technical limitations, but also fundamental challenges in cultural and institutional memory and capacity that have profound implications for contemporary digital governance initiatives. The cultural familiarity with working with incomplete information systems may contribute to the acceptance of 'good enough' digital solutions and to the resistance to comprehensive standardization that threatens established professional competencies in navigating fragmented data landscapes (Curtin 2025). International research reveals similar patterns, where planning professionals express ambivalences toward digital transformation, thereby recognizing potential benefits while resisting changes that threaten professional discretion and established ways of working (Kuppler and Fricke 2024; Daniel et al. 2023).

Conclusion: Grounding digitalization in cultural and material realities

This analysis of digitalization in Irish planning reveals three key findings that challenge the dominant narratives of digital transformation. First, digital planning infrastructures emerge through incremental, 'jerry-rigged' digitalization, thereby creating fragmented digital landscapes with multiple incompatible systems that resist seamless integration. Second, these fragmented systems achieve 'good enough'

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functionality for core statutory obligations while experiencing clear limitations when performing tasks beyond their original design parameters. Third, cultural and political conditions, including austerity measures, institutional tensions, and professional concerns about standardization, all fundamentally shape how digital technologies are implemented and operated in planning contexts. The Irish case demonstrates that digitalization in planning is fundamentally a sociomaterial and cultural process, rather than a purely technical transformation.

Digital planning systems emerge from complex negotiations between technological possibilities and institutional realities, professional cultures, and bureaucratic requirements. These negotiations are ongoing, rather than being resolved through initial implementation, and require continuous adaptation, renegotiation, and maintenance as the systems evolve. The cultural aspects of digitalization often appear as constraints to technological transformation, but the Irish experience suggests that cultural resistance and adaptation serve important functions in maintaining the flexibility and contextual responsiveness that planning professionals consider essential for effective practice. Rather than viewing cultural factors as impediments to be overcome, this analysis suggests that a successful digital transformation in planning requires attention be paid to the cultural work of aligning technological capabilities with professional values and institutional practices. The persistence of multiple PAMS across different authorities reflects not simply resistance to change, but legitimate concerns about the implications of standardization for local flexibility and professional judgment.

The sociomaterial character of planning digitalization is evident in how the meaning and functionality of digital systems emerge from their embeddedness within specific institutional contexts, professional practices, and material constraints. The same technology may function very differently between different planning authorities, depending on local configurations, staffing levels, and institutional cultures. This situatedness means that the effectiveness of digital planning systems cannot be assessed solely through technical performance metrics, but requires that attention be paid to how they support the complex, contextual work of planning practice.

Our analysis has several important implications for both planning practice and research on digital governance. For planning practice, the findings suggest the need for more realistic expectations about what digital technologies both can and cannot accomplish. Rather than expecting digital tools to resolve fundamental tensions in planning work, practitioners and policymakers need to understand how digital technologies become rolled into ongoing negotiations about values, priorities, and appropriate forms of knowledge. For research on digitalization, our study demonstrates the value of ethnographic and practice-oriented approaches that examine how digital systems actually function in everyday institutional contexts, rather than focusing solely on either policy intentions or technical specifications. The gap be-

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tween digital governance imaginaries and material realities revealed in the Irish case suggests the need for more critical and grounded analyses of digital transformation. By grounding digitalization in its cultural and material realities, we should be able to develop more sophisticated understandings of how technology and society are mutually constituted and how digital transformation might be guided toward more democratic, sustainable, and contextually responsive outcomes.

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Governing with/through Smart Ports

Contested infrastructural spatialities in the port of Hamburg

Sophia Leipert

Introduction: Smart ports and the politics of transformation

> "The smart port is a connected, sustainable, safe and automated port, which relies on smart infrastructure and equipment, skilled personnel and smart managerial practices, to ensure customer satisfaction, environmental protection and a better quality of life for the citizen." (Belmoukari et al. 2023, 10)

For at least the past decade, the Port of Hamburg has been working toward becoming *smart*. It is not alone in this ambition; ports around the world are all striving to transform themselves into *smart ports*. However, there is no consensus about an exact classification of this term and considerable terminological ambiguity remains. In this text, I adopt Belmoukari et al.'s (2023) definition, provided above, to underline the all-encompassing aspirations attributed to the ports of the future. Becoming a smart port entails responding to both immediate and anticipated challenges, such as spatial constraints, productivity pressures, fiscal limitations, security risks, and sustainability concerns (Deloitte 2017, 3). What this means in concrete terms for the case of Hamburg will be discussed throughout this chapter.

Hamburg's port spaces serve as pivotal nodes within both global logistics and in the metropolitan area and exemplify the convergence of both digitalization and urban transformation. In terms of container throughput, it is Europe's third largest (Jessen-Thiesen 2022) with China and the USA ranking as its most important trading partners. It is Germany's largest sea (and railway) port and offers work to around 50,000 people within international logistics (NDR 2025a).

Logistics, sometimes regarded as the "central discipline of the contemporary world" (Thrift 2008, 589), transcends the mere 'neutral' organization of production, trade, and circulation. It also has significant socio-political repercussions and facilitates a contemporary "supply chain capitalism" (Tsing 2009). As Hesse (2018) notes, logistics can actively (re)structure territories, thereby shaping transformations across multiple scales and dimensions within urban environments. Ports, in particular, are sites of concentrated logistical power. They exemplify broader shifts

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in how infrastructural spaces are reconfigured through socio-technical systems as 'testbeds' for smart innovations. Port spaces are not isolated, but are instead inherently connected to other urban spaces, thereby contributing to what Halpern et al. (2013) call "test-bed urbanism."

In this chapter, I engage with these transformations through the lens of governmentality, positing that smart port technologies are not merely technical enhancements, but are instead mechanisms of power that reshape spatial, economic, and social relations. The promises of 'seamless flows' take place in a context that is marked by connections that are full of frictions (Tsing 2011). The guiding questions are: How do smart logistical infrastructures function as technologies of government? Where and how do contestations, frictions, or resistances emerge within these logistical regimes? And, finally, how do these transformations relate to the ports' urban contexts?

Understanding logistical infrastructures as spaces of both frictions and flows, of contestations and consolidations, reveals that a port's impact extends far beyond its docks and piers. Contemporary logistics is not confined to the (often prominently featured) container terminals, whose standardized 'boxes' (port slang for containers) have become a visual metaphor for the economy. An even greater volume of logistical operations occur in adjacent spaces, across complex networks and in connective infrastructures. Moreover, contemporary logistics is enacted not only through material operations, but also in/through commercial conventions, corporate lounges, and public townhalls – sites in which logistical strategies are negotiated, legitimized, and contested.

Infrastructural governmentality in (smart) ports

Foucault's concept of governmentality (2019 [1978]) moves beyond state-centric notions of government and focuses on the dispersed mechanisms through which populations are managed, controlled, and shaped. I follow Lemke (2007), who highlights the concept's internal tensions and contradictions, in order to distinguish this from conventional political science's understandings of government. In the context of smart ports, governmentality provides a lens through which to examine how digital technologies function as systems of power and knowledge, shaping and enacting certain modes of conduct. Seemingly neutral technological systems both produce specific forms of subjectivity and regulate behavior (Bröckling et al. 2011; Lemke 2021).

This chapter extends this perspective in order to explore how digital transformations in/of the port exemplify advanced modes of government. 'Smartness' is not merely a matter of technological innovation, but is instead a strategic approach (and attempt) to managing complex logistical, economic, social, and environmental chal-

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lenges, while also reshaping spatial and economic relations. The analysis focuses on how smart ports operate as interplays of modes of government and political technologies by applying a governmentality perspective. They mediate between global economic imperatives and local urban contexts (Dzudzek and Reuber 2021) and produce new forms of knowledge and/or control.

Infrastructures are conceptualized as socio-technical and power-laden configurations, inherently relational through the in-/exclusion of human and non-human actors. They are embedded within broader assemblages of tools, measures, and built environments (Amin 2014; Star 1999), facilitating the circulation of goods, people, and information (Larkin 2013), and organizing social and economic life (Tonkiss 2015). Infrastructural transformations reveal how power is exercised through logistical operations and though the (re)shaping of space and territory (Easterling 2014).

Methodologically, this chapter draws on insights from my doctoral research and combines ethnographic fieldwork and discourse analysis.[1] This approach enables a critical reading of how socio-technical configurations in logistics respond to current global challenges and how they seek to reposition themselves within shifting (geo)political landscapes. I examine smart port initiatives as attempts to reconfigure maritime and urban futures through 'innovative' technological frameworks. Smart ports serve as analytical sites (Riofrancos 2021) through which broader political-economic dynamics unfold beyond the boundaries of specific local interventions. Ports, as Kokot (2008) argues, offer a unique vantage point to examine global processes within grounded, local settings; ethnographic methods and a spatially sensitive approach are particularly valuable in unsettling dominant narratives about technological progress and neutrality. Spatial particularities are significant, particularly in Hamburg. Unlike many contemporary ports that operate invisibly outside urban cores, Hamburg's port remains deeply entangled with the city. This proximity positions it as a testbed for urban interventions; the port, thus, becomes a site to study governmentality as something indicative of broader developments.

1 Doing embodied fieldwork is always a messy process that encompasses both constraints and possibilities. As a woman with no personal ties to the maritime sector, my positionality often marked me as an outsider, particularly in a field dominated by men in formal, technocratic settings. I navigated these dynamics by trying to attend closely to the situational habitus and by observing interactional cues. Gaining access to port environments also presented challenges, given their status as critical infrastructures that are subject to strict security protocols. Yet these difficulties also offered ethnographic insight into the boundedness and opacity of logistical spaces, further revealing the politics of access, visibility, and control that structure the smart port.

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Case study: Hamburg's smartPORT

The Hamburg Port Authority (HPA), a public institution founded in 2005, oversees all official matters relating to the Port of Hamburg and owns most of the port's land. With approximately 1,800 employees, HPA is responsible for port operations, including infrastructure maintenance and development, vessel traffic safety, railway facilities, real estate management, and the economic conditions. Several subprojects have been launched under its overarching smartPORT framework (and vision) over the past years. Overall, the goal is to facilitate sustainable growth, to efficiently utilize resources, and to minimize environmental impacts (Saxe and Jahn 2017).

smartPORT represents the complex entanglement of concrete projects, strategic visions, technologies, discursive representations, and networks common to "smart" initiatives and was launched in 2013, in anticipation of the 2015 World Port Conference. This effort was not merely one of technological modernization, but was instead a strategic reconfiguration of port infrastructure into a dynamic, interconnected, and responsive ecosystem. smartPORT originally aimed to transcend incremental optimization, instead reimagining the port as a data-driven, adaptive ecosystem and was framed as a response to "mega trends" such as climate change and supply chain volatility.

Among the core issues that smartPORT was designed to tackle was the growing perception of spatial constraints. Like other port actors, my interlocutors at HPA believed that increasing cargo volumes could no longer be managed within the port's existing footprint. As a mid-level employee from a major port logistics company explained: "If we now must handle more cargo on the same surface area, we won't manage. So how can we do it? We can only do it by becoming smarter" (Interview, May 2024).

The smartPORT framework was initially structured around three main pillars: logistics, infrastructure, and energy. Some of the projects have failed, while others have remained under development or are still in operation. The first pillar, smartPORT logistics, focused on traffic management, with the goal of optimizing the flow of goods and of reducing congestion within the port area. The initiative aimed to safeguard the port's competitiveness, in light of the anticipated growth in container throughput, under the slogan "The journey is the reward. Through the port more quickly, safely, and efficiently" (HPA 2015). It included the SPL project that sought to integrate logistics actors "for their mutual benefit" (HPA2015: 1), thereby enabling more effective planning and the coordination of transport operations through digital platforms and apps. The SPL, which was co-developed with the German companies Deutsche Telekom and SAP, combined real-time traffic data and parking availability information in order to reduce terminal wait times, optimize truck flows, and

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minimize environmentally harmful empty trips. However, the project was discontinued by mid-2018 due to limited user adoption (THB 2017).

The infrastructure pillar centered the vision of a data-driven ecosystem (Jahn and Saxe 2017, 104). The implementation of sensor technologies to create responsive environments was its aim. A prominent (and currently ongoing project) is the development of a digital twin of the Köhlbrand Bridge. Completed in 1974, the listed structure, located within and spanning the port area, is one of Hamburg's most iconic landmarks. It is slated for replacement by 2046, due to material fatigue and an insufficient clearance height for modern container ships (NDR 2025b). The smartBRIDGE project includes sensors to monitor wind speeds and to detect structural stress in real-time. A software aggregates different data and is meant to "set a new standard in the digital transformation of bridge maintenance" (HPA 2025). This is referred to as the "present of the future," and is "a decisive step for the predictive maintenance management of structures around the world" (HPA 2025). These sensor technologies promise not only to pre-empt disruptions, through continuous monitoring, but also to enable "predictive maintenance," thereby increasing "reliability and operational efficiency" (homePORT, n.d.). In this context, infrastructure itself becomes "smart," and the cost of infrastructure maintenance in the port is expected to "decline significantly" (Jahn and Saxe 2017, 104).

The third pillar is centered on energy and 'green sustainability,' an objective aligning with European regulations for more sustainable standards in ports (Molavi et al. 2020). The respective initiatives should reduce environmental harm and is expected to lower energy consumption, thereby emphasizing the port's responsibility as a major energy consumer. The port could "do a lot to support Germany's energy transition and make the port more attractive to business" (HPA 2015b, 3). The strategy makes the economic rationale behind its environmental goals explicit: "a cleaner environment and increased efficiency will translate into economic advantages" (ibid.). Sensor networks are envisioned to both monitor and optimize energy consumption across port operations, thereby reinforcing the idea that digital infrastructure can serve both ecological and economic objectives. Although not all initiatives under the smartPORT energy umbrella have been fully implemented, some – such as shore-side electricity for cruise ships – are partly operational.

Government with/through infrastructure: ecosystem, labor, and anticipatory devices

The smartPORT initiative extends beyond the logistical and industrial confines into the urban fabric, thereby reflecting Hamburg's deeply spatial, political, and social entanglement of port and city. Transformations within the port reverberate beyond its borders and affect these relationships in ways that are explicitly acknowledged –

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and pursued – by port planners and authorities. As Tesse et al. (2021, 8) note, "traffic exiting the port area will inevitably enter the city area" and that a "strong will to collaborate [between port and city authorities, S.L.] exists." More generally, Hamburg's smart port programs intend to put "projects of innovation and digitalization" into practice, not only to ensure "sustainable economic growth," but also to test the "mobility of the future" for the city through "innovative, real infrastructures" (HPA 2021). Smart port spaces, thus, serve as testbeds for urban experimentation, thereby (potentially) reconfiguring port-city relations: "Participation in this context means, for the city, learning from and benefiting from the port's digital experiences, as well as transferring or scaling solutions developed in the port to the urban realm – or vice versa" (Saxe 2017, n.p.).

While early smartPORT projects primarily focused on port operations, their orientation began to shift outward around 2018. Tesse et al. (2021, 3) note that the HPA began "opening up to the city of Hamburg, targeting a deeper integration between the two, especially in the context of traffic coordination and guidance of cruise passenger flows." This illustrates how digital port infrastructures serve as tools for urban governmentality. The port becomes a laboratory for experimenting with modes of governing urban mobility through the regulation of more-than-human flows, mediated by materialities and data technologies. It (re)configures circulation and control, indirectly constructing the urban population as governable subject: datafied traffic and mobile nodes within a programmable system of urban flow. This logic reflects the Foucauldian notion of government as "arranging things" (Lemke 2021, 11), and signals an epistemological shift that privileges calculability, responsiveness, and seamless circulation. From this perspective, the smartPORT transcends technical upgrades, instead acting as a broader strategy of government through infrastructure and structuring the (more-than) port environment as an adaptable, data-driven ecosystem. These infrastructures function as modes of government – techniques and procedures that seek to steer the conduct of individuals and organizations through anticipatory logics, calculative rationalities, and knowledge production.

Digital, and so-called "intelligent," technologies are not entirely new to the port. Port Community Systems for the collection and exchange of logistical data have been in use since the 1980s. What distinguishes smartPORT is its holistic ambition. Instead of isolated projects, the initiative instead seeks to integrate diverse actors and infrastructures into a unified digital ecosystem. This effort is described as a "comprehensive transformation," rather than a mere accumulation of technical innovations. The former Chief Digital Officer of HPA outlined a multi-stakeholder model that included "the key players" politics, administration, business, civil society, and academia in a coordinated, "networked manner" (Saxe 2017). He described this implementation process as an "iterative process of decentralized innovation and centralized governmental (re)action," one that combined experimental flexibility with

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centralized oversight. In so doing, smartPORT exemplifies an infrastructural mode of government in which regulatory authority is envisioned and exercised through standardized data flows and through platform-based coordination.

Digital infrastructures promoted within the smartPORT framework have tangible effects on labor practices. While smartPORT did not initiate automation in Hamburg's port, its push for digitalization and integrated infrastructures contributed to the expansion and legitimization of automated workflows. As a mid-level employee of a terminal operator put it, advancing digital infrastructure is now regarded as a necessary foundation for automating work processes (Interview, June 2024). In this regard, the smart port's digital technologies could function as disciplinary technologies, subtly reconfiguring labor practices and reinforcing hierarchies of control under the guise of "progress" and "innovation."

These changes are felt acutely in some dockworkers' embodied experience. For example, in crane operations, the transition from the tops of gantry cranes to remote-controlled container movement inside offices means that operators now rely primarily on visual inputs from cameras, rather than on full-body physical cues. One worker informally explained how previous operations relied on "feeling the weight, the wind, the vibrations – it's not just visual perception; it's bodily" – an embodied attunement that defined skilled labor in this environment (Fieldnotes, late 2024). The obsolescence of this sensorium entails processes of re-/deskilling, thereby producing new affective orientations to work. Competence is now cultivated through forms of abstraction and virtual simulation that reconfigure what it means to be present on the job.

This reorganization of labor exemplifies modes of government that extend beyond formal political institutions to regulate individuals and groups through "more or less deliberate and calculated modes of action, all of which are designed to influence the possibilities of action of other individuals. In this sense, government means *structuring the possible field of action* of others" (Foucault 1987, 255, emphasis S.L.). This form of government enters domains of embodied practices and conditions of labor as a mode of shaping the "conduct of conducts" (Foucault 1987, 255). The conduct of workers is shaped not only through formal rules, but also through affective, spatial, and infrastructural arrangements. Tasks that once required physical presence are increasingly performed remotely, transforming both daily operations and the (self)formation of the working subject as sites of intervention. Labor is disciplined through demands for flexibility and through the extraction of formerly embodied, tacit knowledge. Some of the dock workers understand this as a threat, given that their work is becoming interchangeable within digitally mediated workflows and across spatial boundaries (Interview, November 2024). In this sense, smart port initiatives represent deeply political interventions in both the material and symbolic conditions of working life.

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A defining feature of these infrastructures is their anticipatory logic. Smart technologies are designed to pre-empt disruption, to ensure smooth circulation, and to increase predictability in global supply chains, thereby reflecting the imperatives of just-in-time capitalism, where time is compressed and uncertainty is rendered in a calculable manner (Campling and Colás 2021). Enhancing the ability to foresee and to adapt to disruptions becomes a central logic: governing becomes an anticipatory practice that is oriented toward resilience, agility, and risk management. As Dzudzek and Reuber (2021, 481) argue, governmentality today involves the regulation of "diverse power-laden economic and social processes of globalization with their networked flows and circulations that penetrate and intersect the territorial order of states."

smartPORT's anticipatory orientation is also expressed in its aspiration to monetize digital services beyond conventional port logistics. Predictive analytics and real-time tracking are no longer supplementary tools, but are instead essential services in a logistics industry that is dominated by a few global actors. As one IT sector interviewee noted, digital services enable ports to expand their functions "beyond mere goods handling" to include "digital services": the long-term challenge lies in designing integrative digital services that meet the needs of ports, carriers, and inter-port networks across Europe (Interview, May 2024). This represents not just a commercial strategy, but also a form of infrastructural geopolitics, where control over digital logistics platforms is increasingly central to shaping global power in trade.

Contestations and frictions within the regime of smartness

One of the promises underpinning smartPORT's agenda is to address the "challenge" of sustainability, primarily through strategies focused on energy management. These strategies include the installation of renewable energy facilities, the use of data for energy consumption planning, and the promotion of "eco-friendly mobility" (Jahn and Saxe 2017, 107). As the authors note:

> "strategies foster the relationship between the port's urban areas and increase the touristic attractiveness of the Port City. The 'greener' image is of benefit for public perception and for marketing purposes increasing the attractiveness of the port location. The Port Authority publishes environmental key performance indicators regularly and helps to make available the carbon footprint of the different port areas and located companies" (Jahn and Saxe 2017, 107).

Significant contradictions arise as the technocratic rationalities envisioned by smartPORT confront socio-political and ecological realities. These tensions are

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evident in the dissonance between the discourse of sustainability and infrastructural expansion, most notably regarding the deepening of the Elbe River. While smartPORT advanced a narrative of ecological modernization, it was undermined by large-scale interventions, such as the river deepening to accommodate ULCV.[2] Though justified by port authorities as necessary to remain globally competitive (HPA 2020), the project caused the degradation of sensitive estuarine ecosystems (Hein and Thomsen 2023) and delivered only marginal economic gains (Vöpel and Wolf 2025). One of the key rationales behind "smartness" was to enable higher cargo throughput without expanding the port's footprint: "This means we need to become more efficient in order to handle more cargo within the same area" (Interview, May 2024).

smartPORT tends to confine ecological concerns to isolated pilot projects and representational discourse, as illustrated in the quote above. At the same time, these projects are expected to generate economic returns. In this context, sustainability operates less as a transformative commitment than as a strategic narrative, one that obscures the increasing socio-ecological impacts of port infrastructures. This discursive narrowing not only conceals the costs of projects, like the Elbe deepening, but also contributes to lock-in effects: expanding container trade capacities reinforces traditional economic models. As Swyngedouw (2018, 81) argues, the "fantasy of sustainability" functions as a de-politicizing force and, thus, marginalizes alternative development trajectories.

Additional frictions emerge in the principle of collaboration, which is central to smartPORT's vision. The approach to optimizing flows of goods is based on the assumption that comprehensive, real-time information about the location and movement of cargo can be made available and shared across actors:

> "To achieve that, other players in the port need to assist in compiling the available information. Already existing IT platforms must be interlinked to create added value from this information and give logistics services providers, hauliers and agents the opportunity to choose the most efficient mode of transport for their goods" (HPA 2014).

Collaboration is also emphasized as foundational to a new port work culture. Yet, in practice, collaboration reveals asymmetrical power dynamics underpinning smartPORT. Data sharing, central to the promise of smart logistics, becomes a site of friction, as competition between actors inhibits transparency. While port authorities advocate interconnectedness, critical data remain concentrated in the hands of dominant corporate players. Rather than flattening hierarchies, smart

2 Ultra Large Container Vessel (ULCV) is a term used for the world's largest container ships with capacities of between 12,000 and 24,000 Twenty-Foot Equivalent Unit (TEU).

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logistics may instead ultimately reinforce them. The smartPORT can, thus, be seen as a techno-managerial approach that masks underlying tensions. My field notes from a roundtable discussion on the smart port capture this tension well. While one logistics provider stated, "Well, if they don't give me the data, I can't do business anymore," another countered: "That's all great and helpful at this level – but you're not getting my data." (Field notes, September 2024). New forms of power and knowledge are created even alongside the intention of introducing data-driven decision-making processes.

The rhetoric of collaboration also obscures another layer of friction. It privileges corporate port stakeholders while marginalizing local communities – particularly residents of port-adjacent areas. The neighborhood of Moorburg, for instance, has been designated as a port expansion zone, leaving its residents in a state of permanent uncertainty regarding their right to remain. Their perspectives are absent from smartPORT's notion of collaboration, however. Instead, residents are excluded from meaningful participation in policy-making processes beyond the scope of smartPORT (Hilder and Hein 2023). This lack of inclusion as relevant actors is compounded by the continued pursuit of economically and ecologically contested port expansion projects (Vöpel 2020) that directly contradicts smartPORT's stated objective of increasing spatial efficiency.

Smart mentalities: government of subjectivities in the port-city interface

This section explores how the smartPORT program cultivates specific mentalities and subjectivities that are aligned with the logics of automation, digitalization, and technocratic government. Understood as "smart mentalities," these orientations extend beyond technical competencies, thereby shaping how individuals and collectives are expected to think, feel, and to act within digitally mediated environments. Rather than merely transforming infrastructures, the initiative cultivates new forms of self-conduct, adaptability, and resilience – qualities seen as essential to navigate uncertain futures. These developments are especially visible in labor practices and training regimes, in which the formation of flexible, error-tolerant, and innovation-oriented subjectivities is deliberately pursued.

One particularly illustrative case is a new training center established at the Container Terminal Altenwerder. Designed to simulate "the behavior of port employees" within a "realistic virtual environment," the facility enables trainees to acquire what are called "competencies essential for the future of the port" and these are deemed to be critical for work in an increasingly automated port (Field notes, December 2024).[3]

3 How the data from these training is used as a knowledgebase for automation is a consideration that requires further investigation.

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During my site visit, I was struck by the gamified 'nature' of the work environment: several monitors and joystick setups were used to simulate block storage systems. A trainer described the design of these simulations:

> "You can program various incidents at different levels of escalation to challenge the trainees and prepare them for those situations. […] The operation must continue, containers have to be loaded and unloaded from the ships, and they need to leave on schedule. We can increase the pressure accordingly to train under stress. […] Or take a simple example like a fire in the block storage area, which can realistically happen. In the past, training for that required closing off a storage block, setting up precautions, and doing it in the middle of the night when terminal activity was minimal. Now, we can run these simulations 24/7. The simulation starts, and you enter the scenario" (Interview, December 2024).

In addition to technical training, this environment is designed to instill a 'culture of error.' As one interviewee explained:

> "You are allowed to make mistakes here; mistakes are even welcomed. That's how people learn. This is an important aspect: to establish a culture that embraces error. Especially we Germans or Europeans are still very much embedded in a zero-error culture" (Interview, December 2024).

This emphasis on flexibility, risk-taking, and resilience reflects a managerial shift to test "smart" subjectivities that are characterized by adaptability. The center promotes not only technical skills, but also so-called soft skills – "communication, teamwork, concentration, and resilience" (ibid.) – which are framed as necessary for collaborative problem-solving in rapidly changing environments. One trainer emphasized, "the goal is that when a process changes, the different occupational profiles […] are able to work together as a team to solve problems collaboratively" (ibid.).

These individual training practices index a broader regime of subject formation within the port. The primary obstacle to implementing digital infrastructures, as repeatedly emphasized in the field, is not technological, but rather organizational; this ensures that people align themselves with the new operational logics (Saxe 2017; Field notes, September 2024). In this sense, the smart port becomes a site in which mentalities are governed as much as material flows. Smartness, here, is less a matter of devices and more a matter of dispositions. Union representatives have also drawn attention to the wider societal implications of these transformations. One remarked:

> "We *the labor union and urban society* [emphasis S.L.] must work together to ensure that the humane and fair handling of technological progress becomes a city-wide concern. The question of how the work of the future is organised is not merely a

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> corporate issue. It affects everyone. It is the most pressing social issue we face!" (Seebold 2018: 2).

These labor arrangements resonate with broader urban transformations. The smart port functions not only as a testbed for technical systems, but also as a space for new forms of government that may be scaled to the city at large (Field notes, November 2023). The temporality of implementation becomes provisional in such experiments, often framed as "proofs of concept": solutions can be advanced, suspended, or redirected depending on performance metrics (Field notes, November 2023). This experimental and provisional ethos enables a technocratic rationality that bypasses democratic deliberation, echoing what Morozov (2013) termed technocratic solutionism. What emerges is a mode 'governing with/through infrastructure,' in which optimization becomes synonymous with progress, and social contradictions are reframed as operational inefficiencies.

These developments illustrate the emergence of smart mentalities as a key governmental technique. The port ceases to be an infrastructural node within this framework, instead becoming an urban prototype that exemplifies a post-political logic in which urban futures are imagined as programmable, rather than contestable. Social contradictions are depoliticized, spatial inequalities rendered as data anomalies. Port-city relations, then, are not simply shaped by goals of connectivity and competitiveness, but are instead entangled in ongoing struggles over how urban space, labor, and life are governed – and in whose interest they are governed.

Conclusion: Spatial smartness strategies and logistical rationalities in/of the port of the future

This chapter has critically examined Hamburg's smartPORT initiative as a case for understanding how digitalization and infrastructural transformation intersect in a contemporary port. Using a governmentality framework, I have argued that smart logistical infrastructures operate as deeply political technologies that reconfigure spatial relations, operational logics, and socio-material arrangements. Rather than delivering neutral, efficiency-oriented improvements, smart port strategies instead enact specific forms of power and knowledge that (re)structure behavior, (re)shape labor processes, and promote anticipatory rationalities across both logistical and urban environments.

Empirically, the case shows how smartness operates both discursively and becomes materialized. It emerges as a strategic response to (constructed) challenges of spatial scarcity, global volatility, and competitive pressure. Yet these responses are full of frictions, contested, and are often contradictory. Project failures, the dis-

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sonance between ecological claims and infrastructural expansion, and the private sector's entrenchment influence all of the tensions at the heart of smart port governmentality. The smartPORT strategies do not overcome urban tensions; rather, they relocate and reframe them within technocratic logics. The promise of frictionless, technologically driven efficiency is revealed as a partial and contested imaginary, one that is frequently disrupted by the everyday material complexities of port logistics.

I began this analysis by outlining the smart port's promise of improved urban life for all and proceeded by tracing how logistical rationalities associated with the smart port extend beyond the terminal gates into the urban realm, intersecting with urban government, infrastructure, and mobility. While some components of smartPORT, such as emissions reduction, may produce tangible effects in the city, others, like seamless circulation, remain aspirational. How port-city relations are ultimately being reconfigured through these adjusted modes of digital experimentation, infrastructural urbanism, and technocratic optimization remains part of port-city-futures. Yet, smart ports are envisioned as testbeds for future-oriented modes of government in which 'solutions' are deployed in ways that often foreclose upon alternative imaginaries.

This logic coheres to what may be termed "smart mentalities" – modes of thinking characterized by faith in datafication, adaptivity, and technocratic solutionism. These mentalities are not necessarily codified, but are instead reflected in the anticipatory government of flows, the valorization of innovation as ecological modernization, and the reconfiguration of labor through digital infrastructure. They underlie the ways in which smartness is both imagined and operationalized, as a technocratic rationality that seeks to manage complexity, minimize friction, and to standardize circulation. Making this pattern explicit helps us to understand how the government of infrastructure operates through dispersed logics of calculation, responsivity, and future-oriented experimentation. The smart port's transformation of labor relations further reveals the political dimensions of these developments. As automation expands, the working body becomes a subject to be recalibrated – retrained, monitored, and integrated into new systems of digital control. Subjectivity, in this sense, is produced through evolving modes of government that shape not only tasks, but also the embodied dispositions and sensoria of labor.

The consolidation of power within the global shipping industry underscores the geopolitical and economic stakes of these transformations. In 2022, the Danish carrier Maersk reported its most profitable year in its 120-year history (Glismand et al. 2023), profiting from the very disruptions, such as port congestion, pandemic-related delays, and the war in Ukraine, that strained global supply chains. This points to a central paradox: while smart port discourses promise narratives of frictionless, seamless circulation, the political economy of global logistics increasingly capitalizes on both volatility and disruption. What is at stake, then, is not just the pursuit

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of operational efficiency, but the government of uncertainty – and with it, the redistribution of risk and rewards across a deeply uneven logistical landscape.

Ultimately, smart ports are more than logistical hubs and are instead infrastructures of political imagination and experimentation. The promise of smartness may lie in the frictionless coordination of flows, but its practice is deeply embedded in asymmetrical power constellations, contested urban space, and in material constraints. Thus, smart ports could be interpreted as contemporary and anticipatory sites of government, in which logistical rationalities shape not just the movement of goods, but also the contours of labor, territory, and subjectivities.

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Critical Dashboarding

On collective design practices of urban infrastructures

Timo Kaerlein

Introduction

Frameworks of so-called smart cities have shifted in recent decades from infrastructural concerns with connectivity (1990/2000s) to data-driven optimization of sustainability (2010s) and, more recently, to a paradigm focused on ubiquitous environmental sensing (Powell 2021). Urban space has consistently been conceptualized throughout these various re-imaginings as an agglomeration of various data flows that need to be both controlled and regulated. This is in line with historical analyses of the city as an object of computational practices (Beverungen and Sprenger 2017). Urban dashboards are often posited as the pivotal digital interface through which to access the city as an information space to be governed from a central point, one comparable to the historical function of maps as instruments of knowledge and power.[1]

In my contribution, I will draw upon insights from the digital humanities (Drucker 2013; D'Ignazio and Klein 2020), from interface studies (Wirth 2023), and from critical mapping projects in urban studies (Weissenrieder 2023) to explore the dashboard's potential as a *critical interface*. The development of critical cartography and approaches of counter-mapping in specific will guide the endeavor to pivot the dashboard interface towards becoming a central site for the negotiation of new understandings of the city as a shared environment that is shaped by participatory practices. A similar discussion has taken place around digital methods (Rogers

1 First ideas for the present paper were developed during the preparation of a speculative design workshop titled "Experimental Urban Dashboard Designs for Mundane Data" scheduled in the context of the conference "Digital Futures in the Making: Imaginaries, Politics, and Materialities" at the University of Hamburg in September 2022 (annual conference of the German Society for Cultural Anthropology and Folklore Studies, DGEKW). I warmly thank my co-organizers Johanna Fischer, Inga Reimers, and Daniel Schulz (HafenCity University Hamburg) for the inspired conversations. Even though the workshop needed to be cancelled last minute, many of our common ideas have lived on and led to the present paper.

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2024), and in the digital humanities in general, in which the idea of re-purposing digital technologies towards scholarly and activist ends is prevalent. I would like to stress the commonalities between critical mapping projects on the one hand and the tactical use of digital media in digital methods approaches on the other by highlighting the interface character of urban dashboards, and thus their processual, constitutive and relational character (Hookway 2014).

Questions that will guide this endeavor include: How might urban dashboards be re-imagined, not as an integral part of an infrastructure of optimization, but rather as an interface for collective urban imagination? How might we envision the process of engaging in collective design practices of urban dashboards themselves as an active exercise in re-thinking city infrastructures in their relation to city dwellers?

In what follows, I will first provide a brief overview of how urban space is usually characterized in historically variable frameworks of computing the city, including (but not limited to) explicit smart city frameworks. The city is most often posited as a computational object that needs to be made governable and accountable vis-à-vis shifting municipal and corporate agendas. The following section will then focus on urban dashboards, as the central interface technology in these frameworks, and will review literature from urban studies in which the employment of dashboards has been investigated both conceptually and empirically. In the fourth section, I will introduce my understanding of critical urban dashboards. I will begin by taking stock of recent design initiatives that surround urban dashboards. This includes work carried out by the City Science Lab at HafenCity University Hamburg on participatory urban planning (Weber and Ziemer 2022) and by the [urban interfaces] research group at Utrecht University on "frictional urban interfaces" (De Lange 2018). This is followed by a theoretical discussion, ranging from key orientations in critical cartography on the one hand and digital humanities discourses on the other. The concluding fifth section will attempt to integrate the theoretical considerations and practical efforts discussed and will reflect on how practices of critical dashboarding could potentially help to articulate alternative "urban intelligences" (Mattern 2021) that are grounded in the lived realities of city dwellers.

Computing the city

The history of "knowing and governing cities through urban indicators" (Kitchin, Lauriault, and McArdle 2015) is older than the more recent proliferation of smart city initiatives around the world. Various indicators on economic, health and social phenomena have been used in city-benchmarking projects, which track the performance of cities against each other, since the early 1990s (Kitchin, Lauriault, and McArdle 2015, 7). The motivations for this competitive performance tracking can be traced back to two developments: the first concerns sustainability agendas

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promoted by the United Nations and the second concerns the push to transform the management of cities according to the demands of efficiency and transparency which is often accompanied by public-private partnerships, if not the wholesale privatization of the functions of urban development. These two goals – ecological sustainability and economic efficiency – remain the driving forces behind current smart city agendas that increasingly employ digital media and sensors to provide data about various urban processes, often in real time.

The more recent history of smart city initiatives is itself characterized by a series of epistemological, technological and political transformations that Alison Powell (2021) systematizes as a transition between three different technosocial imaginaries. According to Powell, the earliest smart city agendas in the 1990s and early 2000s were deeply invested in ideas of *connectivity* and their shared aim, across corporate and activist initiatives, was often to provide access to wireless networks and to urban infrastructures of communication above all else (Powell 2021, 11–14; Apprich 2017). The late 2000s and 2010s then witnessed a shift towards *datafication* as the main technosocial framing of smart cities (Powell 2021, 14–17). Data advanced to the position of default currency to measure the success of smart city initiatives, be it in proprietary or open data undertakings, alongside a parallel shift toward platform models of governance in many different areas of urban management. With this came a focus on the surveillance of everyday life and the necessity to employ data analytics to handle a deluge of data points (so-called 'Big Data'). More recently still, the Big Data-oriented smart city frameworks underwent another transformation when the availability of sensor technologies made the idea of *real-time sensing* of a city's various indicators like air quality, noise, traffic movements and energy consumption, among others, possible (Powell 2021, 17–20). Data here acts less as a reportable documentation of processes and events and more like a dynamic and constantly evolving index that can serve to inform municipal politics as it is being executed. Powell's historicization of smart city imaginaries is noteworthy because she stresses that the major epistemological underpinnings tend to be shared across the board between politicians, corporations, activists, and informed citizens (i.e., they represent common discourses and action frameworks to which affirmative and critical positions alike refer). Thus, there is no clear dividing line between the approaches, methods, and the vocabulary of (economic and political) institutional actors on the one hand and the (often bottom-up) organized open data and citizen sensing initiatives on the other. This harbors the risk that a rhetoric of smartness prevails across all camps, such that the topos of the computable city and urbanity as a complex, albeit solvable, optimization problem, is dominant.

Seen through the lens of media and cultural theory, the logic of viewing the city as a computational object (or even akin to a computer itself) can be traced back even further to the architectural historian Lewis Mumford's influential account of the development of urban civilizations (Mumford 1961), in which cities come to be seen

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as organized around key mediatic functions like storage and transmission. Media scholar Friedrich Kittler has elaborated on Mumford's view and has stressed the various information flows that characterize the networked infrastructures of a contemporary city, comprising telecommunication media, but also energy infrastructures like roads, water supply, and electricity (Kittler 1996, 718). Kittler's understanding of media is shaped by the mathematical theory of information and, interestingly, urban environments serve as a prime example for him, acting as a bridge in his media-historical argument: "MEDIA record, transmit and process information – this is the most elementary definition of media. Media can include old-fashioned things like books, familiar things like the city and newer inventions like the computer" (Kittler 1996, 722). However, while Kittler's understanding of media itself is suffused with computational concepts, more recent interventions in urban studies question the computational metaphor altogether (Mattern 2021), thereby providing an occasion to think through alternative understandings of cities as "complex, multifaceted, contingent, relational systems, full of contestation and wicked problems that are not easily captured or steered" (Kitchin and McArdle 2018, 122).

An understanding of cities as comprised of a network of (real-time) data flows that need to be regulated, controlled and optimized, "as datasets to be manipulated" (Gabrys 2014, 30), is almost self-evident from the perspective of urban informatics (Shi et al. 2021) or "urban ubiquitous computing" (Beverungen and Sprenger 2017, 1). This view is usually concomitant with a rationalist, instrumental, and solutions-oriented epistemology (Kitchin, Lauriault, and McArdle 2015), one complemented by a focus on the collection and visualization of data. There is a danger that data becomes hard political currency, in the sense that alternative types and forms of urban knowledge are devalued in the face of an exclusive focus on data, as Crooks and Currie (2021) have pointed out, in view of the increasing importance of (often quantitative) data for urban planning and political decision-making processes. It is in this context that Shannon Mattern (2021) puts forth her rallying cry for critical urban scholars that "A city is not a computer" which is targeted against the prevalent views in urban informatics, specifically in foregrounding place-based and indigenous forms of urban knowledge that resist the fantasy of frictionless datafication. One of Mattern's (2021) starting points in her critique of computational models of urbanism is the very interface technology that comprises the main object of the present article: the urban dashboard.

The material politics of urban dashboards

The basic idea of dashboards, as they have come to be known not only in the field of urban informatics, but also as components of vehicles, financial information systems, business management software, and military hardware, among others, is to

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offer an aggregate view of various data streams (ranging from statistical data to real-time sensor data) in order to provide a central control interface. "Dashboards utilize visualizations and visual analytics in order to make data about a city legible and interpretable" (Kitchin and McArdle 2018, 113–114). In today's sensor data-driven environments, "the 'dashboard' has become a primary technology of government like cartography, anatomy and charts" (Isin and Ruppert 2020, 10) that promises its users the possibility to discover unseen information patterns and to test the effects of proposed changes in the form of simulations. The name derives from the wooden board installed in horse-drawn carriages to prevent mud, debris, water, and snow from "dashing up" by the horse's hooves onto the exposed driver (Mattern 2015; for a more comprehensive historical archaeology of dashboards, see Tkacz 2022). In the history of automobility, dashboards were increasingly used as a convenient armature to integrate various information displays and control functions that all needed to be accessed from the driver's position, akin to the various information tools available to a plane's pilot in the cockpit. Dashboards have tended to become ever denser and data-rich with the increasing electrification and digitalization of car functions up to their use in autonomous vehicles in which the purpose of real-time data visualization is significantly more important than their use as a control instrument. One common denominator of dashboard software interfaces across their different implementations has always been to provide a composite control position from which the surrounding space – be it that of a road populated by traffic or a whole city – becomes legible and governable (Iveson and Maalsen 2019).

In her chapter on urban dashboards, Mattern (2021, 18–50) dissects the ideology of the "dashboard-as-talisman" (Mattern 2021, 19) that promises its users to see into the future and that turns uncertainty into profitable practices of risk management. Her main argument is that the "prevalence and accessibility of data have dramatically changed the way we see and govern our cities" (Mattern 2021, 22) where urban dashboards incorporate a new managerialist approach to urban governance that often implies a "top-down, technocratic vision" (Mattern 2021, 27) on the basis of key performance indicators. Mattern's critique of the dashboard specifically targets the epistemological and methodological shortcomings of its representational logics, its focus on simplicity and/or legibility, its subjectification of the dashboard user as being distant, but omniscient, and even its implicit ontology as "it defines what the city *is* and *isn't*, by choosing how to represent its parts" (Mattern 2021, 43). To elaborate briefly on this aspect: it does make a difference if a city is conceptualized according to infrastructural and economic criteria, like crime rates or density of public transport, or if it is seen as a lived environment that is shaped by public practices, like hanging out in a plaza without consuming anything, playing a musical instrument for passers-by or enjoying a sunset in the park. Incidentally, these cultural practices of urbanites in their inherent complexity are what urban anthropologists are usually interested in, as evidenced by a broad range of ethnographic studies dating back

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to the days of the Chicago School. In contrast, dashboards are at the forefront of a "transition of environments from habitats and spaces of dwelling to objects of planning, management and control" (Beverungen and Sprenger 2017, 4). A dashboard tends to represent a distant, clean and reduced version of knowledge about the city that is also plagued by the shortcomings of any realist data-driven epistemology, such as a tendency towards normalization and unacknowledged biases (Kitchin and McArdle 2018, 113–115).

In related work, the use of dashboard interfaces in municipal administrations has been studied to gauge the relationship between (often idealized) visions of governance and the "material politics and practices of their implementation" (Sadowksi 2021, 3). Sadowski reports findings from a 2-year ethnographic study with the Future City Unit in the Department of Strategic Development and Outcomes in the City of Parramatta, Australia that engaged in-depth with the on-the-ground realities of a dashboard development project and that brought to the surface a great deal of "normal, natural troubles" (Garfinkel 1984, 187) – from the necessary data practices providing a foundation for the dashboard, the problem of missing data, the effects of modelling on what is being modelled, and the lack of sustainability of proposed solutions that would fall into disuse once management shifted priorities to something else. Sadowski understands dashboards as "meaning-making machines" that inevitably "construct an ontology of the city's operations" (Sadowski 2021, 13) that affects city governance on many levels (Kitchin and McArdle 2018, 115) while still being subject to (sometimes) insurmountable institutional, technical and interpersonal barriers that disrupt its full-scale adoption. One message to take away from this, and from similar investigations (Mertia 2017), is that dashboards as the central technical medium in many proposed smart city frameworks tend to promise a universal and domain-crossing solution to many urban problems, while often falling short of their goals when it comes to sustainable use case; they also introduce a host of new problems to the process.

What remains, then, after this rather sobering review of the prospects of engaging with dashboards from a critical urbanist stance? The most radical answer would certainly be to abstain from using the technology altogether and to criticize the implementation of urban dashboards as an important parcel of often reductionist, data-driven epistemologies that fail to address the complexity of urban problems and the actual needs of city planners and city dwellers alike. However, in the remainder of this contribution I will take stock of available practical experiments and theoretical resources in an attempt to re-purpose the dashboard as a critical interface and explore its potential in grounding digitalization (i.e., to explicate its capacity to address the complexity of cities as material-digital hybrids or code/space, such as in Kitchin and Dodge 2011).

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Designing critical urban dashboards

Case studies

In this section, I will discuss two quite different contexts in which urban dashboard design experiments are pursued. The City Science Lab in Hamburg engages with various urban stakeholders in developing urban data infrastructures, whereas the [urban interfaces] research group at Utrecht University can be situated as a critical design initiative in a creative humanities framework (Bleeker et al. 2020). The two case studies are meant to provide some empirical grounding for my conceptual proposition of critical dashboarding, understood as a collective design practice of urban infrastructures that occupies the intersection of critical cartography and digital methods.

A number of design projects pursued at the City Science Lab (CSL)[2] at HafenCity University in Hamburg are organized around the three pillars of multistakeholder collaboration, narratives & interfaces, and data & modelling. This structure underscores a focus on collective decision-making processes across different stakeholders as well as a concern for mapping and visualization projects that engage with user-led narratives and the creation of interfaces to handle both qualitative and quantitative data in a common environment. Among the projects pursued at the CSL, the Urban Data Hub (UD-Hub) and the Cockpit Social Infrastructure (CoSI) come closest to the vision of a critical urban dashboard interface investigated in this work. UD-Hub, a cooperation between CSL and the State Office of Geoinformation (LGV), aims to develop a common infrastructure for various municipal data services, provided in the form of an urban data platform that integrates a host of data for researchers, businesses, and civil society (among them map data, traffic data, environmental data, but also crowdsourced data about air quality and the use of bike lanes).[3] It was also the basis for the CoSI project that began in 2017 as "a centralised digital platform for urban planners"[4] meant to support data-based decision-making processes with a range of visualization options, a scenario planning mode, and prognostic data analytics capacities with a focus on social infrastructures like public transport, education, and sport offerings that contribute to the quality of living when taken together. In this project, it is mainly the type of data that contributes to a citizen-centered perspective. However, the focus is clearly on quantitative indicator data (distance to the nearest bus stop, number of nursery schools, etc.) and little effort has been made to incorporate ethnographic data that might contribute to a richer on-the-ground perspective on quality of life.

2 https://www.cityscienceLab.hamburg/about (Accessed July 3, 2025).

3 https://www.urbandataplatform.hamburg/ (Accessed July 3, 2025).

4 https://www.cityscienceLab.hamburg/projects/cosi (Accessed July 3, 2025).

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Accompanying publications outline the vision of curating data for urban collaborations (Ziemer and Weber 2022) pursued at the CSL in greater detail. This begins with the acknowledgment that urban data platforms (made accessible via dashboard interfaces) are not utilized by citizens to the extent desired by their developers; this leads to the insight that relevant data need not just be made available, but must also be curated in a data storytelling approach (much like how a museum curator would need to put a lot of conceptual effort into designing accessible narratives around their exhibits) (Ziemer and Weber 2022, 91–93, 124). The importance of data storytelling has been recognized by a growing number of contributions in critical data studies and related approaches (Kitchin 2022, 3–13; Mosconi et al. 2022; Feigenbaum and Alamalhodaei 2020). Thus, an initial insight to be drawn for the vision of critical urban dashboarding is that an interface accessible by the public does not work just because it is out there (akin to a database), but that it needs to be integrated into clearly articulated narrative strategies designed to reach an intended audience. In the case of the CSL projects, and its multistakeholder approach, the dashboards need to be usable by experts as well as laypeople whose motivations to engage with the interface will differ.

The second practical application that I would like to reference is a critical making design initiative that took place at Utrecht University in March 2018.[5] The workshop "Critical Making of Frictional Urban Interfaces," convened by Michiel de Lange and Nanna Verhoeff, explored the theme of datafication of urban space by focusing on *frictions*, such as "urban data giving rise to new processes of social sorting (think of crime maps), the further encroachment of commercial interests onto urban public space (e.g. customer loyalty cards, personalized marketing, tracking), and the militarization of urban space (e.g. surveillance, facial recognition, risk analysis)" (De Lange 2018). Such frictions are everyday occurrences in any implementation of a new technology, but the Utrecht group decided to make use of them as a productive design principle. In practice, this meant starting from a given urban dataset from "Utrecht in Figures"[6] and imagining a story (i.e., to dramatize possible issues conjectured to influence this particular dataset). A particular friction was then selected by each group as a "plotting device" (De Lange 2018) to work with in the conception of a critical urban interface. The interface design mock-up was intended to specifically investigate the identified friction and sought to come up with ways for people to engage with it, to evoke particular meanings and affects, and finally to devise an urban intervention to address the friction identified.

In their approach, the Utrecht group explored the theme of *seamful interfaces* by countering dominant design strategies of invisibility, seamlessness, and the transparency of interfaces with their focus on narrative and friction. "'Seamful' design

5 https://urbaninterfaces.sites.uu.nl/ (Accessed July 9, 2025).

6 https://utrecht.incijfers.nl/ (Accessed July 3, 2025).

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strategies are to 'invisible design' what experimental film is to continuity editing, that is, a form of aesthetic resistance to the disappearance of the work and workings of montage." (Zehle 2017, 177) The design experiment can further be situated within the broader framework of creative urban methods (Merx et al. 2023) that aim to bring situated (urban) knowledges to the surface (Haraway 1988) and to devise tools and methods to generate ways of knowing about a city "from a situated, embodied, and/or relational perspective" (Merx et al. 2023). Dramaturgical or interface analysis is, thus, listed alongside the family of approaches that include datawalking (Van Es and De Lange 2020), performative mapping and experimental ethnography, among others.

De Lange additionally explores what he terms the "right to the datafied city" (De Lange 2019) with a focus on collective issues, participatory decision-making, and the figure of the "smart citizen." This endeavor's goal, much like as in the critical design workshop referenced above, would be to find ways to include citizens (e.g., via frictional urban dashboards) in the process of collective urban decision-making, thereby resisting the tendency of smart city agendas to implement top-down frameworks with the concomitant detached view on data. The initiatives pursued by the Utrecht group approximated the practice of critical urban dashboarding under scrutiny here by "remodelling user smartness and the technologies that enable new forms of collectivity" (Beverungen and Sprenger 2017, 6). It is important to note, however, that the Utrecht initiative's focus was not geared towards the provision of usable products, instead placing greater emphasis on reflexivity and interface critique (Dieter 2024) via a creative design methodology.

Theoretical orientations

Beginning with the discourse of critical urbanism, theoretical inspirations for a critical urban dashboard can be drawn from comparable undertakings in critical cartography and counter-mapping that have taken place since the 1980s; these undertakings are likewise efforts to appropriate maps, instruments of power and control over space, for scholarly and activist intentions (Weissenrieder 2023; Kurgan and Brawley 2019; Kollektiv Orangotango 2018). Critical cartography has taught urban scholars that no map is either objective or neutral, that each cartographic representation is inadequate at many different levels, and that maps regularly fail to capture the complexity of an actual cityscape and its inhabitants. Counter-mapping initiatives, situated at the interface between art, activism, and academia, repurpose (with varying levels of success) the very same instruments that are so firmly entrenched in histories of colonial conquest so as to appropriate them as research tools, often with the participation of research partners who actively contribute to the map-making process and to the discussion of the results (on participatory mapping, see Weissenrieder 2023, 70–71). Maps, as two-dimensional representations of space, neces-

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sarily privilege certain perspectives and marginalize others; they are never independent from frames of perception, ideology, and power. Since they represent a specific model of urban space at a predefined scale, they tend to emphasize certain features of the environment, while others become invisible altogether. Critical cartography starts from these basic features of maps to argue that maps not only represent, but in fact produce, social reality (Harley 1989). Urban ethnographers have recently been experimenting more intensively with critical or counter-mapping as an ethnographic research practice, beyond the traditional focus on mental maps (Genz and Lucas-Drogan 2017). Mapping, thus, becomes a veritable research method, capable by itself of constituting an interface for the integration and analysis of different kinds of data (Marguin, Pelger, and Stollmann 2021).

At the same time, the digital humanities in general, and the Amsterdam digital methods initiative[7] in particular, engage in the endeavors to use digital media (e.g., hyperlinks, social media platforms, Gephi visualizations, AI foundation models, and more) for social science and media studies research purposes. The main idea here is "following the medium" (Rogers 2013) and involves using the very same tools and methods that are employed by digital corporations to pursue research affordances that usually differ decidedly from the intents and purposes of data collection found elsewhere in the digital economy. There is an explicit rhetoric of repurposing at play in the digital methods discourse: Digital methods are meant to "repurpose or build on top of the dominant devices of the medium, and in doing so make derivative works from the results, figuratively and literally" (Rogers 2013, 3). Approaches in data feminism that can be understood as a sort of counter data science have recently posited that: "Data is a double-edged sword. In a very real sense, data have been used as a weapon by those in power to consolidate their control—over places and things, as well as people. […] But this flawed history does not mean ceding control of the future to the powers of the past. Data are part of the problem, to be sure. But they are also part of the solution" (D'Ignazio and Klein 2020, 17–18). Taken together, critical approaches within the digital humanities, chief among them being the Amsterdam digital methods initiative and the data feminism approach, argue for a creative engagement with digital media and data that uses the very same tools and methods currently employed by corporations and governments to pursue independent, sometimes oppositional, research objectives.

Perspectives of critical dashboarding

With these commonalities between critical mapping and repurposed digital methods in mind, the exercise now would be to engage in a collective practice of *critical*

7 https://wiki.digitalmethods.net/Dmi/DmiAbout (Accessed July 3, 2025).

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dashboarding by envisioning alternative shapes, politics, and purposes for urban dashboard interfaces. An interface, while obviously also having representational qualities, is not a map, however. The interface is not even an object, as Johanna Drucker has outlined, but rather "a space of affordances and possibilities structured into organization for use. An interface is a set of conditions, structured relations, that allow certain behaviors, actions, readings, events to occur." (Drucker 2013) This means that not only will one have to think about how to visually represent urban space and processes while devising a critical dashboard, but also that one will have to think about how to engage with them as users of that interface. Reflecting on the interfacial character of dashboards necessarily implies a processual perspective that considers how various different users interact with them practically. Interfaces are explicitly mutable, dynamic, adaptable and performative, whereas maps tend to be considered as immutable mobiles (Latour 2017), as scaled-down fixed representations of space. Moreover, interfaces have operational qualities that determine how the data space that they allow access to can be manipulated. Recent theorizing about interfaces in media studies (Dieter 2024; Distelmeyer 2022; Hookway 2014) has underlined their relational character; it is at the interface as threshold (Schulz and Matzner 2020) that both user and medium are intra-actively constituted. Transferred to the instance of urban dashboards, this means that the dashboard interface itself actively reworks the understanding of user/citizen, city, and computational medium while being used. If the city comes to be seen increasingly as a datascape, then it also matters which data about which processes and relations come to be operationalized in the dashboard. Both the CSL as well as the [urban interfaces] research group at Utrecht University acknowledge the constitutive character of the dashboard as a central site in producing (and not just representing) understandings of the city and city dwellers.

Quite some effort has been directed towards the goal of designing interfaces in the digital humanities, not from an engineering perspective but with the ambitious research goals of the humanities in mind: Questions that have been discussed include how to deal with uncertainties and ambiguities in the data, how to incorporate plural points of view and conflicting interpretations, and how to avoid overwriting complex realities with reductive models that do not leave any space for negotiation (Drucker 2013; 2021). In practice, this means finding and developing a visual language that is able to express degrees of uncertainty or controversy around specific data that is meant to counteract (to some extent) the purifying logics of diagrams, charts, and tables. These are all concerns that are shared by more recent undertakings in critical data science, like data feminism (D'Ignazio and Klein 2020), but they are also crucial for urban anthropologists who engage with qualitative data gained from fieldwork. A critical urban dashboard, thus, needs to be sensitized towards the polyvalence of data and must acknowledge their qualitative characteristics: What data *means* depends on their practical application and on the contexts of use. The

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idea would then be to experiment with designing dashboards as collective research tools that speak to "a broader urban ecology that evades and exceeds 'indicators' like efficiency and optimization" (Mattern 2021, 50). Which forms of future-making could be envisioned if we start from alternative ways to interface the datafied city? What kinds of data are critical urbanists actually interested in – practices? atmospheres? relations? – and how might they be made a part of a different kind of urban dashboard? Experimental design initiatives in critical urban dashboarding, of which just a few have been discussed in this chapter, are meant to stimulate our "diagrammatic imagination" (Drucker 2013), thereby paving the way for an exploration of alternative urban relationalities.

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Imaginaries

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Elsewheres of AI

Global supply chains, data work, and the social counter-imaginaries of autonomous driving

Fabian Namberger

It is sometimes the propertied classes themselves – or, in fact, their managerial proxies – who come up with rather striking images of the instrumental violence inherent to capitalist production, both then and now (Fletcher 2020). In an online presentation given to an audience of data engineers, computer scientists, and other interested followers, a staff member of Sama – one of the world's leading corporate providers of data annotation services in the context of autonomous driving and beyond – starts his talk via an anecdote of Henry Ford's 1913 visit to a Chicago meat packing house. There, among the half-opened carcasses of slaughtered cows and hogs, Ford discovered that the most time-effective way of dismembering animal bodies was to hang them from overhead meat hooks and to let them glide swiftly from one human dissembler to the next via a system of moveable carriages. What Ford took away from the episode was not so much a humbling lesson about the human and animal devastations wrought by the early 20th-century US meat industry, but – in the affirmative words of the Sama executive presenting – "an opportunity to speed up his car production" (Sama 2024). Shortly after his visit to Chicago, Ford introduced the principle of the moving assembly line to his Detroit car factories, thereby allowing him "to produce more cars faster and more efficiently as the demand was growing" (Sama 2024).

There are two aspects that I want to highlight vis-à-vis this brief vignette. First, it is as revealing as it is disturbing to see how the instrumental violence of Ford's entrepreneurial gaze – guided, more than anything else, by age-old capitalist imperatives of cost reduction, time efficiency, labor control and so forth (Toscano and Kinkle 2015, 202–203) – is able to serve, by way of historical analogy, as a justification and jubilatory prequel of Sama's present-day business services in the realm of AI training data annotation (Dachwitz and Hilbig 2025, 19–37). Today, as the presenter continues with an eye to the field of autonomous driving, "data is the main ingredient that drives this revolution, and we need to find new ways – or *hooks* – to see how we can use the data more efficiently and in a better way as the demand is growing"

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(Sama 2024, n.p.). We will return to Sama and its central role in data annotation for autonomous vehicles (AVs) below.

Second, and despite its questionable historical references, the example given above contains a valuable methodological lesson for present-day critical social research into Artificial Intelligence (AI) in general and autonomous driving in particular (Crawford 2021; Schmidt 2022). Crucially, as the presenter notes, after Ford introduced the moving assembly line to his factories, "the car he built did not change; what changed was *the process behind it*" (Sama 2024; emphasis F.N.). Clearly, this line is not meant as a tacit nod to Karl Marx's (1976, 163–177) famous chapter on the commodity fetish and its emphasis on the deceptive self-sufficiency of the commodity as a finished, market-ready thing (Jameson 2014, 43–44). Nevertheless, we might very well take it as an unintended, albeit paradoxically helpful, clue towards the important difference between *either* approaching the phenomenon of autonomous driving from the perspective of its commodity end product: 'the' AV increasingly populating urban spheres of circulation in select cities of the Global North and beyond (Cugurullo et al. 2021; Dowling et al. 2023; Stilgoe and O'Donovan 2023) *or*, and possibly guided by a variously more radical desire to 'see it whole' (Toscano 2012), approaching the AV phenomenon from the viewpoint of its own global production process, including the highly uneven, exploitative, and deeply racialized social relations that pertain to this process (Schmidt 2022; Tsing 2009). Such a shift of perspective – from product to process, local consumption to global production – is one of this chapter's aims.

As such, it stands in considerable contrast to parts of the existing literature on autonomous driving in urban geography and Science and Technology Studies (STS) (Cugurullo/Kassens-Noor 2023; Marres 2020; Stilgoe 2018). Following a broader urban-scholarly interest in 'socio-technical experiments,' in 'living labs,' and in similar local setups of real-world social testing and piloting (Bulkeley and Castán Broto 2013; Evans 2016; Karvonen and van Heur 2014), urban scholars have approached the phenomenon of autonomous driving, first and foremost, from the viewpoint of the 'AV experiment', that is: those urban sites, typically located in investment-rich metropolises of the Global North and other privileged regions, that are currently serving as real-life AV testing grounds and that might be turned into operational sites and markets for publicly or privately-run AV services in the foreseeable future (Dowling et al. 2023; Hopkins and Schwanen 2019). Such forays into 'actually existing AV experimentation' have, without doubt, produced valuable insights. For instance, Jack Stilgoe and Cian O'Donovan (2023) have helpfully characterized recent AV trials in the UK as instances of strongly PR-oriented public demonstrations, rather than real experiments, given that the possibility of failure was often eliminated from such settings (similarly, Hopkins and Schwanen 2019, 88–89).

These and other welcome findings notwithstanding, the strongly localist purview of the 'AV experiment' literature has stopped short of more encompass-

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ing scholarly investigations into what we could call, following Anna Tsing (2009), the global AV supply chain. Proposing Tsing's account of supply chain capitalism as an alternative methodological starting point for critical research into the AV phenomenon and into similar AI-driven, yet deeply labor-dependent technologies (Altenried 2023; Pasquinelli 2023), I argue that recent cultural productions, often emerging from beyond the institutionalized academe, already prefigure a valuable reorientation towards an analytically more holistic and politically more partisan methodological standpoint vis-à-vis an emerging global AI industry (Toscano 2012). I pursue this argument in terms of discussions of two cultural productions that problematize the supply chains of autonomous driving and the highly labor-intense production processes of AV training data annotation: first, the co-research investigations and video documentaries of the Berlin-based Data Workers' Inquiry (DWI) project on outsourcing companies specializing in AI training data annotation in the Global South; and, second, by way of Nicolas Gourault's short film *Their Eyes* (2025), which provides detailed insights into the everyday workflows of AV data labelers in Kenya, the Philippines, and Venezuela.

Both cultural productions add to the formation of what I call 'social counter-imaginaries of autonomous driving.' These counter-imaginaries clarify two important ambitions. First, they effectively challenge the deeply tech-centric AV imaginaries of dominant corporate players, such as Waymo, while equally questioning the often strongly technocratic and 'implementation-centric' perspectives on AVs adopted by state institutions and transport planning departments in the Global North. Second, on a scholarly level, they point beyond existing debates about AV experimentation by foregrounding those social relations of unevenness, exploitation, and racialization that make possible the end-user product of the self-driving car in the first place.

From local to social truths: beyond autonomous driving as an urban experiment

Recent studies in the field of 'AV experimentation' have produced at least three valuable insights that provide empirically grounded material for further thought and investigation. First, explorations of AV testing have produced noteworthy 'mappings' of diverse sites of AV experimentation, testing, and piloting in different urban regions worldwide. While such an emergent 'cartography' of AV testing and implementation certainly deserves further examination (especially with regard to places *beyond* the North-Atlantic zone's core countries), it has helpfully brought AV test sites into view such as, inter alia, London's Olympic Park (Stilgoe and O'Donovan 2023), the University of Michigan's *MCity* test field (Dowling et al. 2023, 29), or the UK nationally-funded AV experiments in Oxford and in the London Borough of Green-

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wich (Hopkins and Schwanen 2019). Second, such overarching mappings of AV test sites and implementation zones have been analyzed along increasingly differentiated typologies. Hence, Dowling et al. (2023) have offered the four useful ideal types of 'on-road trials,' 'testbeds,' 'precinct trials,' and 'AV Living Labs'. Finally, many of the studies mentioned were able to reveal profound differences between outward-facing public narratives about ongoing AV testing efforts on the one hand, and the (often rather modest) achievements of these experiments on the other (Hopkins and Schwanen 2019).

As noted, debates about urban experiments and living labs have had a strong influence on recent urban-scholarly examinations of the phenomenon of autonomous driving (Bulkeley and Castán Broto 2013; den Hartog et al. 2018; Evans 2016). While a fuller engagement with this overarching literature is beyond the scope of this chapter, what I aim to question in this section is the deeply engrained *localism* of many of these studies (Dowling et al. 2023; Hopkins and Schwanen 2019; Stilgoe and O'Donovan 2023). I will do so by, first, critically probing some of the key assumptions within Andrew Karvonen and Bas van Heur's (2014) informative article *Urban Laboratories: Experiments in Reworking Cities* and, second, by contrasting Karvonen and van Heur's STS-inspired 'experimental' urban research agenda with Anna Tsing's (2009) diagnosis of what she calls global supply chain capitalism.

Making the heterogenous field of STS their analytical starting point and by arguing for urban laboratories as experimental catalysts of "situatedness, change-orientation and contingency" (2014, 381), Karvonen and van Heur are helpfully explicit about some of the key differences between their STS-driven approach of urban experimentation on the one hand, and Marxist urban scholarship on the other. As they write,

> "one of the strengths of the STS literature is its situational focus and its insistence on analysing practices *in situ*. Whereas much of the political-economy literature too easily assumes the structuring of particular places by broader scales, territories and networks […], STS urges us to make a closer, more detailed examination of what is actually happening on the ground. This by no means implies a celebration of heterogeneity and 'openness', but on the contrary an interest in the ordering capacity of emergent practices through the development and use of specific categories, standards, techniques and concepts (such as 'urban laboratory' and 'experimentation')" (Karvonen and van Heur 2014, 380).

It is not hard to imagine and has been proven time and again that an STS-inspired urban-scholarly agenda, oriented towards empirical detail, local situatedness and radical contingency, is able to glean valuable (yet sometimes frustratingly fragmented) insights into a plethora of urban phenomena, including in the ongoing testing and uneven implementation of self-driving cars in select urban regions.

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What is incomparably harder to envision, however, is how Karvonen and van Heur's rather excessively localist perspective – equally present throughout the existing literature on 'AV experiments' – might generate an intellectually satisfying answer to a question posed, not too long ago, by Anna Tsing. Against the historical background of what she calls the 'human condition under supply chain capitalism,' Tsing asks: "how can we imagine the 'bigness' of global capitalism (that is, both its generality and its scale) without abandoning attention to its heterogeneity" (2009, 150)? Tsing finds her shorthand answer to this question in the concept of global supply chains:

> "Supply chains offer a model for thinking simultaneously about global integration, on the one hand, and the formation of diverse niches, on the other. Supply chains stimulate both global standardization and growing gaps between rich and poor, across lines of color and culture, and between North and South. Supply chains refocus critical analysis of diversity in relation to local and global capitalist developments" (Tsing 2009, 150).

Tsing takes "powerful theories of capitalism" to task here for their conjunctural obliviousness to "gender, race, national status, and other forms of diversity" (2009, 151). Nevertheless, Tsing's simultaneous insistence on the historical concomitance of global capitalism's 'bigness' *and* its local diversity helpfully subverts Karvonen and van Heur's implicit assumption that "a Marxist political-economic discourse of socio-spatial inequalities, exploitation and instrumentalization" (2014, 380) would more or less automatically disqualify itself for the task of searching out 'the' system's more fine-grained empirical strata, conflictive tendencies, and diversely situated phenomena. Against such a restrictive policing of the borders between 'big' conceptions and 'small' perceptions (Wark 2020, 5) combined with an intra-scholarly division of labor that would assign the former to Marxism and the latter to STS, one could retort, as Alberto Toscano has done *contra* Bruno Latour, that "the theoretical desire for totality is *not* incompatible with a painstaking attention to traces, objects and devices" (2012: 70; emphasis F.N.).

Far beyond any (long-held) debates about the differences, but also possible synergies, between STS-inspired urban research and Marxist urban scholarship (Wachsmuth et al. 2011; McFarlane 2011), Tsing's foregrounding of supply chains and their constitutive practices of "subcontracting, outsourcing, and allied arrangements" (2009, 148) opens up an alternative methodological compass for urban-scholarly work on the AV phenomenon, one that points beyond the *local truths* of the AV experiment in (often self-proclaimed) tech cities, innovation hubs and testbeds (Gieryn 2008), and, instead, refocuses on the deeper *social truths* of planetary AV commodity chains, including the myriad of spatial, material, cultural, legal, and other mediations that traverse them at the local – or in fact any other – scale. What

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comes into view from the angle of the AV supply chain, in other words, is not so much the self-driving car's already foreseeable localities of end-user *consumption* (its current sites of experimentation and testing), but also its 'digital factories' of *production* (Altenried 2023).

Social counter-imaginaries of autonomous driving

Some words of clarification might be advisable prior to delving into a deeper discussion of some examples of what I call the social counter-imaginaries of autonomous driving. In possible tension to a more constructivist literature on socio-technical and other urban imaginaries (e.g., Jasanoff and Kim 2015; Sadowski and Bendor 2019), I hold it to be one of the fundamental truths of our social universe that imaginaries – or, in the *positive* sense: ideologies as such (Jameson 1988, 353) – historically emerge *from* and are dialectically bound up *with* wider material processes of economic production, serving – while certainly not always consciously – as our mental shortcuts to real-world phenomena (global capitalism, for instance) that are simply too vast to be captured by the limited reach of our individual sensory and cognitive apparatuses. In this sense, what I discuss under the name of the social counter-imaginaries of autonomous driving below should not be taken as isolated cultural artifacts, but rather as representational shorthands or even 'cognitive maps' (Jameson 1988), however limited, of a newly emerging and globally distributed production process of autonomous driving, a phenomenon itself embedded in a still wider reconfiguration of global capitalism shifting gears under the weight of new AI technologies.

Unionizing against AI: on the Data Workers' Inquiry project

Against the grain of today's ubiquitous infatuation with AI technologies, the Data Workers' Inquiry (DWI) project – founded on May Day 2024 – provides a refreshingly partisan, decidedly labor-centric counter-standpoint of radical social analysis and bottom-up political work. As such, the DWI has not only taken inspiration from Marx's (1997 [1880]) original call for a *Workers' Inquiry*, but is also tied to a renewed interest, at least in radical quarters, in questions of class composition and practico-militant research (Ovetz 2020). Essentially, the DWI is an attempt to channel the inherited analytical tools of the workers' inquiry towards today's "phenomenon of data workers who are both essential for contemporary AI applications yet precariously employed – if at all – and politically dispersed" (DWI 2025a). Accordingly, the DWI was initiated, in the words of its project lead Milagros Miceli, "not as a study or a research project, but as an act of refusal. I didn't want to speak *for* or *about* data workers anymore. I wanted to build a space where they could tell their own stories,

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and where research was a form of collective thinking and organizing, not extraction" (DWI 2025b, n.p.).[1] Informed by a strong ethos of collective worker agency, the co-research projects on the DWI's website comprise a rich variety of materials, ranging from textual analysis to video work and comic strips, across countries such as Brazil, Germany, Kenya, and Syria.

One of the DWI's co-research projects focuses on a data work facility owned by the aforementioned AI outsourcing company Sama in Nairobi (Mathenge 2024). Located in a bland business park not far from the city's Jomo Kenyatta International Airport, this is where Sama runs its largest so-called 'delivery center' on the African continent: an open-plan office for more than one thousand data workers.[2] These workers help to process AI training data for Sama's big-tech corporate clients such as, among many (unknown) others, Google, Meta, Microsoft or Open AI (Dachwitz and Hilbig 2025, 10; Lee 2018). They are deliberately recruited from Nairobi's various slums. One of Sama's showcase ventures is the annotation and labelling of AV training data, as indicated by an extensive section on its official website. Contrary to widespread narratives of AI-induced automation, human labor has been indispensable to producing those high-quality AV training datasets that are required to 'teach' self-driving cars the difference between, for instance, a toddler and a plastic bag (Sama 2024). Sama's (2024) own (rather disparaging) term for the persisting centrality of human intelligence in its data-processing workflows is "the human in the loop." It is estimated that Sama employs several thousand 'humans in the loop' at its Nairobi facility (Lee 2018).

The DWI's video inquiry into Sama's Nairobi 'delivery center' is led by Kenyan data worker Richard Mathenge (2024). More than anything else, Mathenge's inquiry provides much-needed insights into the everyday hardships, but also into growing acts of resistance by data workers at Sama. This is how Mathenge (Figure 1) introduces the aims and scope of his video:

> "In this documentary, I describe the working conditions of content moderators and data annotators at the subcontracting company Sama in Nairobi, Kenya. […] Many data workers in the AI supply chain are exploited and their work is never acknowledged. What is often overlooked is that without us, there is no AI. In this film, which features actual workers and their own words, I aim to show the world what really goes on behind the scenes. I also hope to show other workers in Africa and

1 In line with this mission statement, my extensive usage of some of the DWI's material in this section aims to foreground the voices of data workers themselves. As such, this chapter can hardly live up to the requirements of a 'non-extractive' form of scholarship, as outlined by Miceli.

2 Sama runs similar data work offices in Costa Rica, India, and Uganda and exclusively targets low-wage countries in the Global South (Dachwitz/Hilbig 2025, 20).

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around the world that if we unite, we can collectively fight for our rights" (Mathenge 2024).

Figure 1: Richard Mathenge was the leading community researcher of the DWI's project Data Workers Organizing.

Credits: Image reproduced under creative commons rights with kind permission by the Data Workers' Inquiry Project (Mathenge 2024).

Figure 2: The data annotator Maureen as featured during an interview in Richard Mathenge's workers' inquiry. Data workers at Sama, as Maureen explains, are primarily recruited from Nairobi's various slums.

Credits: Image reproduced under creative commons rights with kind permission by the Data Workers' Inquiry Project (Mathenge 2024).

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Another data worker featured in the film is Maureen (Figure 2). Among other insights, her interview provides a helpfully detailed account of Sama's recruitment strategies, which specifically target workers from Nairobi's slums:[3]

> "I'd quote one thing that one of the project managers said. […] He made it clear to us that, one, Samasource[4] employs the unemployable. That is why their target population is from the slums. So Kibera for example, Mathare, Kariobangi, Kawangware. Actually, the funny thing, when you're applying to join Samasource, they have a dropdown [menu; addition F.N.] for those targeted areas. So, in case you're not from that area, you'll not be picked to work at Samasource. So, you have to either pick one of those, even if you're not from that. But that is the main thing for you to be considered to join Samasource" (Mathenge 2024).

Once inside the Sama complex, workers soon run up against a managerial system of strict productivity standards and individualized performance metrics that leave little space, if any, for workers' needs, such as sick leaves or self-chosen vacation days. As Maureen continues,

> "at Samasource, once you are at the 'agent's' level, you have no say. One, you can't complain about anything. Secondly, your opinion doesn't matter, no matter how much you complain. If they wake up tomorrow and they say 'if you've not reached your target, you won't go home,' you will not go home. Even if it means you work for twelve hours, you'll have to stay there until you reach your target" (Mathenge 2024).

Confronted with these and other hardships, data workers at Sama and other AI outsourcing companies started to exchange their individual frustrations as well as their collective needs. It was from these early exchanges, initiated in WhatsApp chats, that the African Content Moderators Union emerged.[5] As Mophat, a data labeler and content moderator based in Nairobi, explains:

> "So, content moderators in Kenya, across Africa, we experience same challenges and we have the same complaints. So, we started hearing complaints from our colleagues who were working for Meta, […] our colleagues who were working for OpenAI. When we heard these complaints, they were the same across the board.

3 Nairobi's population has been estimated to be 4.4 million (KNBS 2019, 7). According to estimations, more than half of this population live in one of the city's various slums (Amnesty 2009, 3).

4 Sama was known as Samasource before being renamed in 2021.

5 Despite its name, the African Content Moderators Union not only represents the interests of content moderators, but also of data workers more generally, including those working on AV projects (Mathenge 2024, n.p.).

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> And we started that we can do something about it, because this work was really killing us and killing our future. So, we decided to come together as content moderators and we started by making a WhatsApp group with the few people and then, through that connection, *the* [addition F.N.] WhatsApp group *became* [addition F.N.] real big; and in that WhatsApp group we discussed challenges that are affecting us in different companies […] and we started to […] what we can do to address these challenges so that our fellow Africans, our fellow Kenyans cannot pass through the same things we are passing through during that time. So, it's during that time that we started to have a gathering and that gathering happened on 1 May 2023; and then it's in that gathering that we had a discussion as content moderators and we started to come up with a union to have a political bargaining; and it's also in that meeting that we decided to name our union to be called African Content Moderators Union, because it's an African affair. So that's when the union was formed and in that meeting we were about 150 content moderators and the union has now grown to about 500 members" (Mathenge 2024).

Notably, these members are not only from Kenya, but from a range of African countries including Ethiopia, Nigeria, South Africa, and Zimbabwe (Mathenge 2024).

Against the backdrop of these broader developments and struggles, another co-research project by the DWI – Wilington Shitawa's (2024) inquiry *Click Captives: The Unseen Struggle of Data Workers* – provides some insightfully sharp observations about the deeply alienating effects of an AV supply chain that, in its global hunt for labor cost reductions, sources data workers from Kenya (and other low-wage countries in the Global South) to label AV training data from far-away Germany. Presented as a comic strip, one of the inquiry's images shows the two young data labelers, Wilington and Edwin, sitting at their workstations with their eyes firmly set on their computer screens. The ensuing dialog runs as follows:

> Wilington: You know, Edwin, sometimes I feel like I know the streets of Hamburg better than the people who actually live there.
> Edwin: Right? We spent so many hours labeling those German streets for that one project. It's surreal.
> Wilington: That's what data annotation is all about. Labeling countless images, drawing bounding boxes, and identifying objects for hours on end (Shitawa 2024).

Taken together, the testimonies of Richard, Maureen, and Mophat, as well as Wilington and Edwin render visible, the highly uneven social relations of globally distributed AI supply chains with much-needed acuteness as they connect end-user products at one end of the globe with workers' hardships and labor struggles at the other. In this context, one of the DWI's co-research investigations' greatest strengths is that the individualized privations of data workers are affirmatively re-

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cast as springboards for collective worker action, unionization, and cross-sectoral solidarity.

"We need to annotate everything": on the short film 'Their Eyes'

Nicolas Gourault's short film *Their Eyes* (2025) is a 20-minute long, detailed, and insightful work about the everyday workflows of data annotators that segment and label urban street-scene footage for the training of self-driving cars.[6] True to its name, *Their Eyes* repeatedly features the first-person perspectives of its data-worker protagonists, showing – for the most part of the work – their immediate views of zoomed-in computer screens, image-editing work surfaces, and digital toolbars. These screens are mostly filled with urban street scenes that the annotators are requested to visually break down, sometimes in pixel-level detail, into the discrete visual units of vehicles, pedestrians, traffic lights, street signs, vegetation, and so forth. Such annotation tasks are usually accomplished by neatly retracing the contours of each object in the image until every pixel can be allocated to a pregiven label (Figure 3).

Figure 3: Film still taken from Nicolas Gourault's short film Their Eyes showing the workflow of AV data annotation. The contours of the half-hidden construction worker (in yellow) have been outlined and the according label has been attached.

Credits: Image reproduced with kind permission by Nicolas Gourault.

6 Many thanks to Melis Günay who made me aware of the film.

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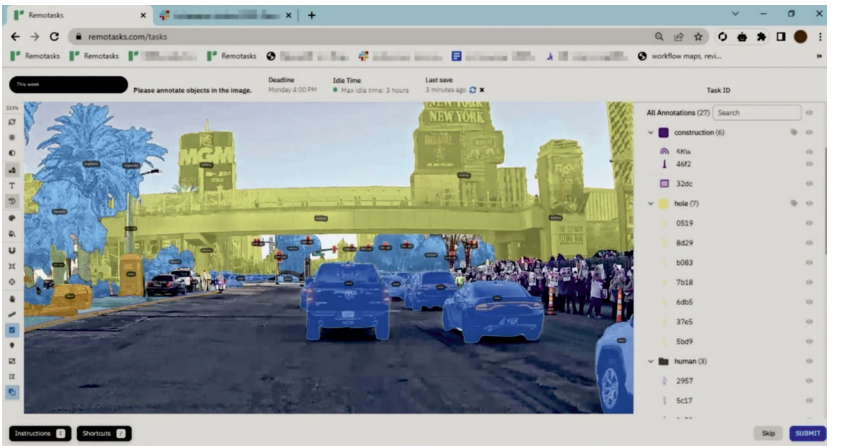
While also likened to the pastime activity of drawing a picture while listening to music by some of the annotators, the deeply monotonous nature of many AV labeling tasks marks one of the film's most strongly accentuated themes. Accordingly, its opening scene is accompanied by the fittingly repetitive words of a worker's voiceover: "We need to annotate everything. We need to annotate people, we need to annotate vehicles. We annotate the road, even the road markings. We annotate everything. Even the vegetation and the buildings, even the sky. We need to annotate everything" (Their Eyes 2025).[7]

Figure 4: Film still taken from Nicolas Gourault's short film Their Eyes showing the work surface of the annotation platform Remotasks. The codes on the right-hand side denote already-labeled objects, such as vehicles or pedestrians.



Credits: Image reproduced with kind permission by Nicolas Gourault.

One of the foremost aesthetics of *Their Eyes* could be described as an effectively staged 'visual Taylorism.' In historical analogy to the craftsman's holistic work process, which was split into its component parts and given over to ever more rationalized divisions of labor at the hands of industrial capital (Fletcher 2020), in Gourault's film it is the composite urban streetscape that is dissected into processable graphic units ready to be fed into the training loops of self-driving AIs at the

7 In fact, it is its knowing attention to the human-dependent work processes behind the self-driving car that sets *Their Eyes* apart from other recent AV-inspired filmic works, such as Liam Young's *Where the City Can't See* (2016) or ScanLAB Project's *Dream Life of Driverless Cars* (2015). Both of these works approach the AV phenomenon from a much more tech-centric focus on the AV's new media of sensing, surveillance, and machine vision (Parikka 2023, 177–210).

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behest of present-day tech capital. What the combined tasks of image annotation, segmentation, and labeling visually amount to, then, is not only a deeply *fragmented*, but also a strangely *flat* perspective of machinic, yet human-aided vision: split into its component parts, the three-dimensional urban streetscape vanishes behind two-dimensional overlays and machine-readable labels (Figure 4).

Specifically insightful throughout the entire film are the annotators' self-reflective comments that have been included as voiceovers. These commentaries – similarly to the DWI's comic-strip inquiry above – repeatedly thematize the geographic-cum-social distances between the annotators' own lives and those of the people that they find in the footage presented to them, thereby showcasing a contradictory simultaneity of worker knowledgeability, (imposed) ignorance, and attempts to escape the latter:

> *Speaker 1:* We don't know the client. We don't know the country where the images are from. We just know that these are white people mostly. So, we just know that these images are taken from those European countries, but definitely not from Asia or Africa.
> *Speaker 2:* Every image that we receive, we are curious and we are looking for clues like street signs, the name of the buildings. We tried to research it on Google Maps. And we saw it came from California.
> *Speaker 3:* I did not go to the US, but due to this kind of work I'm familiar with it.
> *Speaker 4:* Sometimes when I work on an image, I tell myself, yeah, it would be very nice, if I could be in this place and experience it. I think about it sometimes, because you see something that you have never seen. It looks nice, it looks strange. Sometimes, I imagine being there (Their Eyes 2025).

Such themes of connected disconnectedness are taken up once again towards the end of the film when data annotators from different parts of the globe – one in Venezuela, one in the Philippines, and one in Kenya – show parts of their hometown's streetscapes, contemplating the difficulties of annotating street scenes in these sometimes drastically different urban environments (Figure 5). As a worker from Nairobi reflects:

> In Nairobi, there are many vehicles of different designs, different sizes. Many people trying to cross and they don't use specific places to cross the road. They try to cross anywhere. Nairobi drivers, they don't … they don't obey rules. It is chaotic.
> As technology advances, those self-driving vehicles may come here and then they will need to label those images from here. Yeah, it will take a lot of time to annotate compared to the images that we work on. Or maybe during that time, they may come up with other software that will label for them. Then it means people may be replaced by these robots. That's one thing that I think about (Gourault 2025).

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Figure 5: Film still taken from Nicolas Gourault's short film Their Eyes showing a street scene in Nairobi, Kenya.

Credits: Image reproduced with kind permission by Nicolas Gourault.

Largely in line with these remarks, *Their Eyes* can be understood as a work not so much concerned with AI-induced automation as such, but – much more insightfully – with the highly dynamic social relations of production as well as globe-spanning divisions of labor that underlie today's AV supply chain. It is this interest in autonomous driving's often neglected dimensions of human labor and data work that bring it in close proximity to the DWI's workers' inquiries outlined previously, thereby opening up fruitful avenues for similarly partisan investigations emerging from the broad domain of art, activism, and (non-)academic scholarship.

Conclusion: Methodological localism redux?

This chapter started out by introducing a rather sharp juxtaposition of two analytical perspectives vis-à-vis the urban phenomenon of autonomous driving: studying self-driving cars from the viewpoint of their local consumption or approaching them from the angle of their global production. Given the considerable imbalance in the existing urban literature towards the former of these two analytical 'options' (Dowling et al. 2023; Hopkins and Schwanen 2019; Stilgoe 2023), I argued for a much stronger urban-scholarly engagement with autonomous driving's worldwide relations of production and, taking inspiration from Tsing (2009), the AV's global supply chains. I presented two cultural productions throughout the course of this argument that I have discussed under the rubric of the 'social counter-imaginaries of

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autonomous driving': the Data Workers' Inquiry project and its various co-research investigations at outsourcing companies specializing in AI training data annotation; and Nicolas Gourault's short film *Their Eyes* (2025). Both of these works provide a methodological orientation for radical research that aims to develop a more encompassing and more politically engaged analysis of autonomous driving in particular and of a fast-evolving reality of planetary AI in general (Crawford 2021).

It should be noted, however, that the two analytical standpoints of 'local consumption' and 'global production' are certainly not always as distinguishable in empirical reality as they were presented here for the purpose of analytical clarification. Ultimately, both of these viewpoints form part of a wider social totality of global capitalist relations in which the boundaries (if they ever fully existed) between production, distribution, and consumption have become *more*, rather than less, blurred since the establishment of global supply chains and during what some have called the logistics revolution (Cowen 2014, 102–105; Tsing 2009).

In this sense, there is certainly nothing wrong with making AV consumption 'endpoints' in North American, European, or other urban areas empirical nodes for the exploration of a more widely distributed system of autonomous driving or planetary AI (Cowen 2014, 17–18). What *is* problematic, however, and what incited much of my criticism of the 'AV experiment' literature above, is the assumption – at least not gainsaid in many of these studies – that local AV experiments *alone* would provide us with a sufficiently comprehensive picture of the multi-scalar, socio-spatial phenomenon of autonomous driving. This assumption, whether explicitly stated or implicitly accepted, takes us deep into the terrains of a methodological localism in which "the local or urban scale is taken for granted as a pregiven, relatively discrete container of political-economic processes," while "its supralocal conditions of possibility, contexts of development, and consequences are bracketed" (Brenner 2009, 121). Ultimately, whether and to what extent future explorations of the AV phenomenon will be able to more systematically consider such conditions of existence remains to be seen.

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How Digital is the Future of Farming?

Grounding policymakers' visions in small-scale farmers' speculative designs

Mascha Gugganig

Introduction

In the wake of the Green Deal, EU agriculture policymakers often envision a smooth sustainability transition through the means of science, technology, innovation, and most recently digitization[1] (Gugganig, 2025b), but what do small-scale farmers think of agriculture's increasing digitalization? Based on a research project in the EU (with a focus on Germany), this chapter juxtaposes visions of digitalization among EU policymakers with those of small- and medium-scale farmers in Germany in order to inquire how these differ and align, to demonstrate the value both of studying a pluriversity of visions and of fostering future-making as a collective and just practice (Beck and Forsyth 2020; Longhurst and Chilvers 2019). Such a juxtaposition can literally 'ground' digital future visions of farming in practices and places of those farmers who are not usually considered in conversations about developing future technologies and policies of agriculture.

Scholarship at the intersection of critical agrarian studies and Science and Technology Studies (STS), or agrifood technoscience scholarship, has offered a corpus of critical work on how – despite proponents' assertions – digital agriculture perpetuates a path dependency of high-input, monocultural industrial farming (Gugganig et al. 2023; Miles 2019). Just as in society, digitalization in agriculture is often framed as an inevitable path in policy, industry, media, and scholarly discourses, and anyone who does not 'adopt' such novel technologies is deemed to be irrational or insufficiently progressive (Glover et al. 2019; Gugganig et al. forthcoming). Yet most (small-

1 While "digitization" and "digitalization" are often used interchangeably (in German, only one word exists, "Digitalisierung"), the analysis in the cited paper focused on visions in EU agriculture policy in which these terms were also used interchangeably. For a clearer differentiation, digitalization here is referred to as the social reordering of practices around digital technologies infrastructures and, when applicable, to digitization as the (narrower) conversion of analogue to digital information (Brennen and Kreiss, 2016).

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scale) farmers are not trapped in either a 'pro' or 'anti' technology mode of thinking (Higgins et al. 2017) and often have a strong interest in, and pragmatic approach towards, technical systems that can assist their farming practices (DiSalvo 2014; Legun and Burch 2021), including how to make data governance more just (Ruder and Wittman, 2025). In other words, farmers make practice- and place-based assessments of novel farming technologies, often by creating a "dialectic synthesis of low-tech and high-tech tools" (Kostakis et al. 2023, 2309).

Social scientists in these fields have also attended to how collective visions and imaginaries of science and technology in environment and agrifood shape the (material) presence (Beck et al 2021; Gugganig 2025a), how they conflict between more and less powerful interest groups (Hendriks et al. 2025; Longhurst and Chilvers 2019), and, consequently, who gets to 'imagineer' or 'visioneer' different kinds of futures (Andersson and Westholm 2019; Beck and Forsyth 2020). Among them, Longhurst and Chilvers (2019) call for a stronger focus on counter-hegemonic, alternative imaginaries and visions that can open up a broader range of issues beyond technological solutions. Putting this call into practice, there is value in using a participatory speculative design workshop for inclusive future visioning. Building upon Isabelle Stengers (2011 [2002]), speculation requires a 'leap of imagination' to make distinct ways of life possible. Speculative design (Dunne and Raby 2024) – of future farming scenarios and (technical) innovations – dovetails with the aim of generating farm-grounded imaginaries of the future that manifest farmers' politics and commitments to alternative, agrobiodiverse farming futures (see DiSalvo 2014; 2020).

The chapter proceeds with a section concerning the data collected and the work's methodology, followed by an empirical section about EU agriculture policy visions, to then examine speculative designs by German small-and medium-scale farmers. It will end with a concluding discussion.

Methodology of comparing visions

Data for this article stems from the larger multi-sited research project "Innovating Food, Innovating Europe?" (2019–2023) that focused on the role of science, (digital) technology, and innovation, both in EU sustainable agriculture policy, and in sustainable farming practices in Germany.[2] The project was based on a mixed-methods approach (Creswell and Clark, 2011) of ethnographic research, semi-structured (expert) interviews with farmers, policymakers, and policy advocates, textual analysis,

2 The project was funded by the German Research Foundation (DFG).

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and a speculative design workshop with small- and medium-scale farmers.[3] While the analysis of the EU policy level focused on 'sustainability' for its strong presence in agriculture policy discourses, the speculative design workshop did not want to take this (rather vague) term as a given; instead, the issue was framed around the future of farming, with regards to digital technologies. The comparative focus is, thus, on future visions of farming in the context of increasing digitization, though the relevance to sustainability will also be discussed briefly. Detailed ethnographic fieldnotes were taken during all events, including in Brussels, on agriculture, innovation, and technology. All data was analyzed through open and closed coding with the software MAXQDA 2022.

The workshop addressed small- and medium-scale farmers with a strong interest in organic/agroecological/regenerative farming, given that digital agriculture is predominantly catered towards large-scale, monocultural farming (Bronson 2019). Methodologically, the participatory speculative design workshop combined participatory design (DiSalvo 2014) and speculative design (Dunne and Raby 2024) in order to prompt workshop participants to both articulate and materialize their own farming futures and innovations. The speculations designed can be understood as "a material representation of what might be preferred in a future, speculative scenario" (DiSalvo 2014, 103) because speculative design is not aimed at developing functional models in order to facilitate new products. Small- and medium-scale farmers' practice-based future visions of farming do not have much if any visibility in policy, academia, industry and media, and platforms for cultivating such visions often need to be created. As social scientists, the workshop team, thus, aimed to offer a space in which to foster 'imaginaries from the ground' or, better, 'grounded imaginaries' in small-scale, biodiverse farming (see DiSalvo 2014), not least to question hegemonic imaginaries and visions of the future in policymaking, media, or industry (Beck and Forsyth 2020; Longhurst and Chilvers 2019). Hence, we invited workshop participants to reconfigure "assumptions about, and expectations of, agricultural technologies" (DiSalvo 2016, 146) in order to consider limitations of digital tools for biodiverse farming, and potentials through which to improve their farming practices. The full-day workshop took place on October 21, 2023 in Munich's ZIRKA, a self-run arts & culture center.

3 The participants included nine farmers, two participating researchers, and a biologist/teacher (with a farming background) from Germany, including one farmer from Upper Austria. Lessons learned, thus, apply to Germany, Austria, and Europe more generally. All participants were invited to Munich, and farmers were given a €200 honorarium to compensate them for their time and labor. The workshop team consisted of the social science researchers Mascha Gugganig, Sarah Hackfort, Marlise Schneider, Tim Kümmelberger, and the designer Tanja Seiner. Since the spoken language was German, all audio transcripts and statements from workshop participants have been translated from German into English.

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EU policymakers' vision of technoscience as a fixture for sustainable agriculture

In EU agriculture policy, science, digitization/technology and innovation (SDTI) are envisioned to act as a kind of fixture that hold together the environmental, the social and the ecological parts of sustainability.[4] These are rather abstract visions, and for that reason they merit close attention when theorizing 'grounding digitalization.' The following analysis provides empirical insights from 2019–2023, a time in which EU policymakers aimed to align the Common Agriculture Policy (CAP) with the European Green Deal, with particular attention being paid to the envisioned role played by SDTI.

At the EU Agriculture Outlook conference in December 2019, Commissioner of Directorate-General (DG) Health and head of the Green Deal's Farm-to-Fork Strategy Stella Kyriakides affirmed that "technology, innovation and research into new farming techniques will be crucial to approach food and production more sustainably" (FN_191210).[5] Similarly, at a workshop by the European Institute of Innovation and Technology for Food (EIT Food), a spokesperson for the EU Commission's Directorate-General for Agriculture, DG AGRI, explained that "there is a right balance between productivity, climate and environmental goals" to achieve sustainable agriculture and forestry, where research and innovation will "*speed up action* for sustainable soil and land management," "*increase the resilience* of plants and animals to biotic and abiotic stresses," and "*provide solutions* for rural communities and operators" (FN_191212; emphases added). For an entrepreneur at the workshop, digital technologies, like artificial intelligence, robotics, or the Internet of Things can *improve* economic and environmental sustainability. In an EU report on the agricultural twin transition, digital technologies appear as a "*catalyst* [to cope with economic] shocks, acquire knowledge, build communities and relations, and adopt systems-related thinking" (Barabanova and Krzysztofowicz 2023, 4; emphasis added). The Commission's description of digital technologies for "smart sustainable farming" is exemplary:

> Digital technologies *enable* optimisation in the agriculture sector. Digitalisation has been *a driver* for the modernisation of the agriculture sector for many years. There are different ways digitalisation contributes to precision agriculture. These include monitoring the health of plants or livestock, data analysis to propose actions to improve farm processes, and managing autonomous devices (e.g., robotic arms, switches, valves, or sprayers). Drones can also spray pesticides, or be used

4 The following section is adopted from Gugganig (2023; 2025b).

5 All documents commencing with "FN_" refer to fieldnotes and documents with "Group […]" refer to the workshop group's different audio transcripts with reference to paragraphs.

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> to control land and livestock. Digitalisation further contributes to communication and management of the agri-food supply chain and enables traceability and transparency of products (Muench et al. 2022, 29; emphasis added).

The various statements reveal how vivid verbs and nouns turn (digital) technology, innovation, and research into a type of facilitator by reconciling/catalyzing/accelerating/enabling sustainability. This is particularly illustrative in the (visual) evolution of the novel CAP Key Objectives.

In 2018, the European Commission proposed that member states draw up National CAP Strategic Plans where (again) "potential trade-offs in the achievement of economic, environmental and social objectives of the CAP" would require "grasp[ing] the opportunities offered by innovation and technologies […]" (EC 2018, 8). These sustainability objectives were elaborated as "9 Key Objectives" for the most recent CAP reform: three relate to economic objectives – fair income, competitiveness, food chain – three to environmental objectives – climate change, environmental care, landscapes and biodiversity – and three to societal objectives – generational renewal, rural areas, food and health quality. The graphic contained a curious vacant space to the left, and indeed, the nine Key Objectives were incrementally expanded starting in 2020.[6] Different graphics circulated in policy reports, presentations and on social media from around that time, including one posted on (then) Twitter, in which "Knowledge & Innovation" filled this gap. In 2021, the Commission proposed an additional "cross-cutting objective on digitisation, knowledge and innovation" with member states being provided "a portfolio of CAP tools that they can include in their National CAP Strategic Plans to boost digitalisation in agriculture and rural areas" (Fig. 1).[7]

"Knowledge and Innovation" became its own objective in the final 10 Key Objectives. These shifting visual renderings illustrate how science/research, innovation, digitization, and technology turn into agile actors – as 'enablers' or as 'catalysts' of sustainability measures. Envisioned with such vivid agency, SDTI do not merely form generic fixes in the view of EU policymakers, but rather *fixtures* that hold the holy trinity of sustainability together by operationalizing the economic (land management), the environmental (functionalizing plants, animals, and soil), and the social (rural livelihood) that enable an agriculture of the future.

6 See Gugganig (2025b, 6–7) for the visual evolution of the graphic between 2020 and 2021.

7 https://digital-strategy.ec.europa.eu/en/policies/future-farming; updated March 19, 2021 (Accessed April 21, 2022; the information is no longer available).

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Figure 1: The nine Key Objectives with an additional cross-cutting objective on digital knowledge and innovation.

Credits: European Commission.

Small-scale farmers' speculative designs of the future of agriculture

The speculative design workshop hosted 12 participants who were split up into four groups. The instruction entailed choosing one work area/topic, discussing the main issues therein, considering potential solutions, and what role digital tools could play in their envisioned future of farming. In a final step, the groups had to create speculative designs of an innovation (be it social, technical, organizational) for agriculture in the year 2035, using materials provided by the workshop team.

Group I: Administration for Data Sovereignty

The first group consisted of a medium-scale, conventional farmer, a farmer of community-supported agriculture (CSA), and an agricultural scientist who used to work in the German agricultural ministry and was doing a social science PhD on farming technologies. They chose the topic of administration, as the farmers in the group found this to be particularly arduous for farmers.

The group agreed that a core theme in their farming profession and daily life is the inefficiency and lacking transparency of the bureaucratic apparatus of different authorities at the state, federal, and EU levels. In order to receive subsidies, they have to submit farming data (e.g., yield, amount of fertilizer used), and this can create a significant workload for farmers because the same data often has to be submitted to several agencies. The Administration Group emphasized that they did not

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see bureaucracy as a problem *per se*, but took issue with the inefficiency of its various components, mostly the often-double or triple work tasks created through the existing, parallel authorities. In a data infrastructure literacy workshop conducted by Peer and DiSalvo (2019), the authors note frustrations that participants felt over data inaccuracies and classification errors in a community-based data dashboard in Atlanta. While not the same case as in the Administration Group, the frustration experienced was similar, and worth highlighting for its potential in co-design, to critically reflect on the circumstances, and to think of other ways of dealing with such inefficiency through a speculated future scenario of farming.

Figure 2: Speculative design of a "data pond" with farmers, rather than administrators, being in charge.

Credits: Mascha Gugganig.

In their presented speculative design of farming administration in 2035, there existed a self-created and self-governed data pond, or what they called a "Datenteichwirtschaft" ("data pond farming"). Their focus for a solution was on farmers who either own and share their data with other farmers (e.g., what result specific grazing management methods have) and, subsequently, producing data for state authorities. Hence, data was primarily collected for farm operations and was intended for state authorities secondarily. To acquire data, visualized as pearls (see Fig. 2), users had to apply for "Datenangellizenzen," or "data fishing licences." This

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would enable newcomer farmers with less experience, but also customers, to 'fish' for farming information/knowledge that they have either not required yet or simply do not know.

Group II: Direct Marketing

The second group was made up of three CSA farmers (of which one had moved into market gardening management) that chose direct marketing to talk about its potential for educating customers about farming operations. On the one hand, they discussed that it was hard to get CSA members to do their volunteer share of labor on the farm (a place in which education could take place), and on the other, that online communication can only do so much to convey the work of farmers. They also identified a problem that is commonly overlooked: in addition to the common pick-up stations for CSA-members, produce is increasingly distributed through fridge automats. While convenient, this 'analogue' distribution has hampered direct, personal connections between farmers and customers (or CSA-members), as in farmers' markets. Harvesting days, messenger apps, and websites[8] can all offer educational spaces, but – and on this the group agreed – existing online and impersonal 'analogue' direct marketing were not ideal educational spaces.

Their innovation/solution – speculative design – was to combine the digital and the analogue, reasoning that:

> **A:** There are various digital and analogue solutions to this problem, but the analogue aspect never really disappears. So, you can't just… 'ah okay, we have the online ordering system here now, everything is nice and easy.' Then you lose something. So, it always has to go together. Digitalisation can never be the only thing.
> **C:** Exactly! Because you can go to any supermarket; it doesn't matter, you get your products. But for direct marketing you need customer loyalty. So, you need direct contact (Group Direct Marketing, 897–898).

The emphasis on education was evident in their motto for their future vision of farming – "Bindung durch Bildung" – customer retention through customer education. They further reasoned why this works:

> **C:** The reason why this system is so resilient, even against the supermarkets, is the *loyalty of customers based on the knowledge they have* over why it's good to support the local farmer. The digital area is 'only' so that I can do my weekly grocery shopping. But the main focus should actually be on [analogue] education, saying:

8 One member shared their experiences of an initiative in his region (in Upper Austria) called "Wallerner Körberl" which is an online platform that allows farmers to offer their products: https://www.koerberl-wallern.at/ (Accessed June 26, 2025).

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> 'Hey, we've got biochar, we're doing this to build up the soil. And that's good for society, it's good for the environment,' etc. (Group Direct Marketing, 1137; emphasis added).

Digital (communication) tools are in place to do the shopping in order to then meet and connect in analogue places so that farmers can share farming knowledge, e.g., in excursions to farms to explain the role of biochar. In their speculative design, entitled "Digitally-analogue networked direct marketing by small-scale farms,"[9] these digital and analogue connections were visualized through red and green threads between customers and farmers, as well as between farmers (see Fig. 3).

Figure 3: Farmers and customers and farmers and farmers are connected through digital means (website, chat groups, etc.), as well as through analogue meetings, such as in a community center or during regular farm tours.

Credits: Mascha Gugganig.

The group also viewed politicians' responsibility in supporting rural infrastructures for direct marketing, such as by providing facilities in the form of a "community centre as an analogue meeting point" (see rectangular building in Fig. 3). As one participating farmer shared, this is already the case in their region in Upper Austria, where their mayor supplies a community room and even a bus for transportation (where necessary).

9 "Digital-analog vernetzte Direktvermarktung durch bäuerliche Kleinbetriebe."

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Group III: General issues in farming

The third group chose the work area "Daily and irregular tasks" and started with a broad range of issues that they narrowed down to the role played by humans in future farming technologies. The three participants – a wine grower, a CSA-farmer, and a plant biologist/teacher who is active in CSA farming – discussed several technologies that could align with organic/regenerative agriculture. For instance, a widely used technical tool that the group mentioned was plant identification apps. However, these apps are not conceptualized for plants of specific interest to farmers, namely indicator plants:

> **B:** So, I think it would be great if we had an app that, when I say: 'Hey, I have high weed pressure from this and that plant'—that the app offers me a little analysis, like: What have I done wrong? Because these indicator plants—a weed—don't come out of nowhere. It comes because something went wrong in the cultivation, in the nutrition supply. […] If some app could give me great links to great sites on the internet, from other gardeners [and farmers] who also had the problems and have found solutions… (Group General, 551).

The farmer points to the potential of an app that would link to other farmers' platforms that may share knowledge about interpreting indicator plants in order to understand what nutrients are missing. The envisioned app illustrates the equal importance of farming knowledge and digital communication technologies as one domain of digital agriculture (see Faxon 2023; Forney et al. 2023) for the former to be shared widely when based on farmers' 'analogue' experiential knowledge.[10]

Overall, the group focused on the potential of novel digital farming tools that *support*, rather than *replace* humans' work (Higgins et al. 2017; Tsouvalis et al. 2000), simply because it is constantly changing:

> **B:** I believe that if we can take a bit of time out of our practical work, then we will also have more time to actually create the developments and further processes [of farming], because we realize that—we will never get to the point where we say: 'So, now we have the system that will lead us into the future, now we have finally made it. Yes. Now we've arrived.' No sooner have we arrived than we have to move on. And that's just nature, that's so beautiful and that's why we will never lose our role in this agricultural system, even if we get assistance through digitalization (Group General, 1014).

In other words, farmers will never seize guidance simply because there will never be a point of reaching a final, thoroughly calculated, 'efficient' farming approach or

10 See Burton and Riley's (2018) analysis of traditional ecological knowledge from pre-1800s' agricultural texts that agricultural communities glean from the internet.

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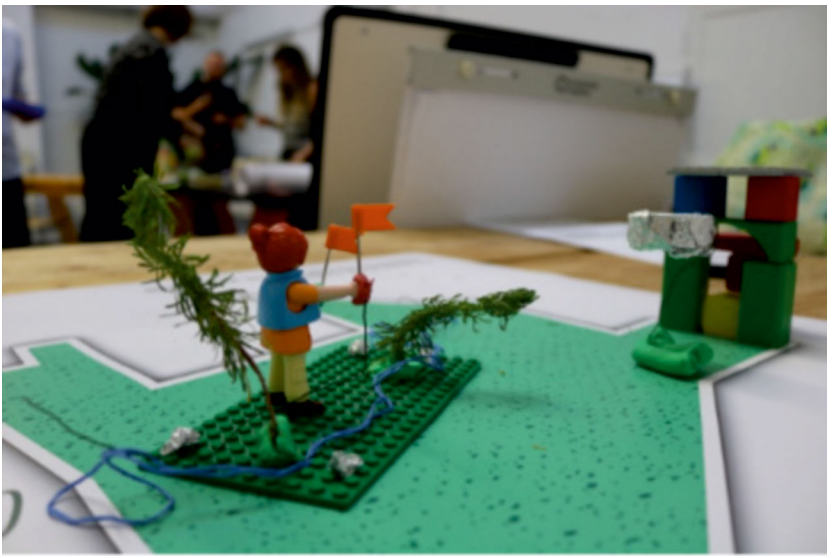
moment. The group members also discussed that an unreflecting use of more technologies – of photovoltaic panels in the case examined – contradicts the ethos of CSAs to only use as much as is needed.

In their speculative design on what future innovation they think will change farming in 2035, the group discussed:

> **N:** The innovation is the human being as the guiding and controlling person, less the executing person, no?
> **B:** […] Exactly, we actually withdraw a little from the practical side and become more of an innovative, guiding spirit (Group General, 844–849).

Figure 4: The farmer remains at the center of (small-scale) farming operations as 'guiding spirit,' standing apart from global digital infrastructures.



Credits: Mascha Gugganig.

In the view of this workshop group, small-scale farming will become more prevalent, Keyline Design[11] for agroforestry systems will become the standard, farmers will become the decision-making, guiding spirit, and technologies will act as their

11 Keyline Design originated in the 1950s to describe a landscape design approach along so-called 'key lines' that helps to retain water in the soil. This approach is gaining increasing popularity among regenerative farmers and permaculture practitioners in Germany because drought has become a more prevalent issue of late.

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assistants. Digitalization in this speculative design will entail self-sufficient operating programs with global interfaces for knowledge transfer (shared via the internet), yet without depending upon GooglePlant, satellites, or other digital systems (see Fig. 4).

Group IV: Knowledge Sharing

The fourth group consisted of an elder organic farmer, a younger farmer of a vegan farm, and an agricultural scientist. They chose the topic "Knowledge Sharing," viewing the central issue of sharing more knowledge about farming practices and realities both within the farming community, and with society more generally. The main problem that they saw was the bad image of farmers, which has led to a decline in people from subsequent generations to consider this profession as a viable option. To them, little knowledge of the actual work of farming is known in wider society and they also saw a big role for educators in agricultural schools and universities that still do not include enough agroecological knowledge and practice in their teaching. Indeed, they saw a responsibility among farmers to rectify this romantic image of farming, particularly in advertising (e.g., cows roaming on meadows instead of being held in factory-like stables).

The solution that they proposed was that digital tools needed to be used for meaningful, farm-specific data usage. To the younger farmer, the digital system should be "as standardized as necessary, but as individualized as possible" (302). The elder farmer saw a need to cultivate a "data culture" (Datenkultur), especially among small-scale farmers:

> **P:** I always said [to my co-workers]: 'Guys, we are making a cropping plan, this is the sheet music book that we want to play with our orchestra this year, right? And everyone looks at the cropping plan and tells me when they think they can go on holiday, right?' So, we need a data culture. […] What is not written down did not happen" (Group Knowledge Sharing, 342, 380).

In other words, data gleaned from farmers' practices (the 'musicians' playing their instruments) – for instance, the plant cultivation (or used seeds, soil condition, etc.) – contributed to the farming operation of every season (the 'orchestra'), and this needs to be recorded on a digital platform ('sheet music book'). As they shared in the bigger group, this is particularly relevant in farming, as they shared in the bigger group, where farmworkers or apprentices often only stay for one or a few seasons, and so their 'institutional memory' can get lost easily. In other words, the data must be collected systematically so that it can be used in the long term, yet what is lacking, in one farmer's estimate, is a more fundamental "data culture" to consider the value of long-term documentation. They discussed further that there was a lacking awareness that farming data of any sort, much like a growth plan, needs to be sys-

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tematically collected, so that it can be used in the long run. Thinking on this further, the group suggested a "Knowledge Archive" or a kind of "Agrowikipedia" that would include an online knowledge sharing platform, or a forum on social media. In their future vision of farming, they also saw the responsibility of policymakers in offering an open access online knowledge sharing platform, and that everyone – farmers, policymakers, and wider society – needed to work together, which they symbolized as everyone pulling together on one string. There would also be no more large-scale land ownership in their imagined future (Fig. 5).

Figure 5: The future of farming will have abandoned large-scale land ownership.

Credits: Mascha Gugganig.

Concluding discussion

While policymakers envision farming in a more abstract, theoretical way, and policies are made, debated, and refined at a different scale than on-the-ground (farming) practices, comparing them to visions gleaned from small-scale farmers can 'ground' digitalization in people's everyday lives to make them more tangible, relatable, and less abstract. This is because digital systems are often both ephemeral and unfamiliar in their daily routines. Prototyping systems, in a workshop setting,

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allows for an engagement with these abstract entities and systems to imagine other possibilities (DiSalvo 2014).

EU policymakers envision digitalization in agriculture as facilitating fixtures that cohere the economic, the social and the ecological dimensions of sustainability. In the context of a 'greening' agenda, sustainability takes center stage in agriculture policy, yet what exactly it entails – as well as its three dimensions – often remains vague and unclear (Purvis et al. 2018; Scoones 2007). What becomes clear in this fostered *technoscientific sustainability* (Gugganig, 2025b) is that digitization (similarly to science, technology and innovation) is envisioned as inevitable for the achievement of a more 'sustainable agriculture' and as a key ingredient for the future of agriculture.

In small-scale farmers' visions of the future of agriculture, digitization and novel technologies were instead considered one aspect of farming, rather than a defining feature of a new era of agriculture. For instance, the Direct Marketing Group (Group II) highlighted how the connection between farmers and customers (or CSA-members) requires a mix of online and analogue encounters in a presumed 'digital era' of digital communication technologies. In that way, their calls for open-source platforms as a kind of technology sovereignty not only apply to seed cultivation (in the monopoly of large concerns; Montenegro de Wit 2022), but also in digital platforms for online marketing. The group viewed politicians' responsibility in supporting this and other rural infrastructures, such as by providing facilities in the form of a community center as an analogue meeting point. This would also shift power from the federal or state level to local municipalities and their political representatives.

The Administration Group (Group I) also raised the question of authority-relations and power imbalances. Indeed, both the Administration Groups' data fish pond and the Knowledge Sharing Groups' Agrowikipedia (Group IV) are illustrative examples of what Peer and DiSalvo (2019) describe as an emancipatory take on data governance when there is mistrust towards institutions, such as in agriculture, where farmers tend not to trust private companies, governments, banks, or even consumers (Ruder and Wittman 2025, 6). The speculative design of the data fish pond, with farmers being placed on a pedestal above state administrators that have to apply for fishing licences (alongside other farmers who were not explicitly visualized), illustrates this re-positioning, both of narrative creators and data collectors. Their design embodies a shift from farmers' obligation to provide (data), to government authorities' obligation to seek (data). Flipping these roles around, the group's data pond, as well as the Agrowikipedia proposal by the other group, opened up a wider set of questions: Who is obliged to whom in the first place? Who ought this data be collected for *primarily*? Is it authorities, farmers themselves, and/or their peers? Who should have ownership, not just of data, but of the data *infrastructure* (see Peer and DiSalvo 2019)?

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The re-positioning of the farmers, primarily collecting and saving data for their own use, also points to the question who has the capacity and skills to interpret the data collected. Farmers want to be able to evaluate and 'ground truth' data based on their expertise – literally, 'on the ground' – rather than on what advisors who are interested in selling software tools think (Ruder and Wittman 2025, 6). Data – quantitative data on weather, soil, or water retention, but also qualitative data, like observations of farming methods (e.g., mulching) – is understood as serving farmers' daily routines, rather than serving an administrative apparatus or corporate interests of software tool developers. This has the effect of grounding them both in farmers' daily work and in their need to make them comprehensive for farmers – be it through 'digital literacy' (Giotitsas 2019), or by creating their own analogue-digital communication system to make that data intelligible.

In these ways, the workshop participants reflected the ethos of open access with other open-source agriculture initiatives (e.g., Tzoumakers, Boer Bricoleur, FarmHack). While they did not form an 'open source agriculture' movement (Giotitsas 2019), they did share their aspiration to challenge existing technological systems, by speculating about what others create and promote: "alternative technological artefacts and/or practices" (Kostakis et al. 2023, 2,318). The inference is not that speculative design is not 'real,' or that the workshop participants were not thinking up anything novel. Rather, these farmers speculated about how such novel systems, like the data pond, the networked community center, or an Agrowikipedia, could be integrated into small- and medium-scale farming systems, whose practitioners are in fact *not* active in such open-source agriculture initiatives. Consequently, how might local politicians, policymakers, but also researchers and tech-developers support fine-tuning and integrating such speculative technologies and practices into existing small-scale, biodiverse farming structures?

For the group dealing with "General Issues" (Group III), the farmer also remained at the center, as a 'guiding spirit' that has control over the kinds of digital tools that they use. This vision of the future of farming had overlaps with visions in industry and EU agriculture policy, where farmers are repeatedly asserted to remain in control over the digital tools that they use (FN_191210). Still, the farmers' vision differed in that *small-scale* farming would be at the center of future agriculture, and the digital systems utilized would remain on the local (repairable) scale (Fairbairn et al. 2025), rather than being part of transnational corporation's infrastructures (e.g., GooglePlant).

The re-positioning of farmers at the center of an operation is also evident in the decentralized Agrowikipedia, the primary purpose of which is to share farming experiences and practical tips, rather than to, say, offer a platform for industry development in which innovations could lead to intellectual properties. The third group's speculative future innovation also prompted novel questions and issues: What can policymakers, who aim to digitize the agricultural sector, do to support local com-

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munities in setting up digital communication systems *and* analogue meeting places, like community hubs? How might existing global initiatives, like *Wiki Maraiché*, be adopted in order to form cosmolocal economic structures (see Kostakis et al. 2023)?[12]

In sum, rather than a fixture that holds a farming operation together, the workshop participants envisioned digital technologies as an aid to the (economic) farming work. They can facilitate communication, thereby leading to social engagement (e.g., with customers, exchange among farmers through digital communication technologies), and should only be used if they support the (environmental) outlook of their farming approach, such as through regenerative farming. Digital prudence was a theme that was common to all of the groups, and reflects policy recommendations, especially within the EU (digital-green) twin transition (D4S, 2022), so as not to fall into a trap of promoting digitalization for digitalization's sake.

Why, again, is such a juxtaposition of visions important? In their comparative analysis of 12 different visions of future energy transition in the UK, Longhurst and Chilvers (2019, 984) found that "visions which advocate a high degree of centralised large-scale energy technologies tend to 'produce' implicitly centralised and technocratic sociopolitical orderings," because energy infrastructure was primarily seen as "a technical and expert led activity." By contrast, civil society visions that propagated alternative (renewable) technological configurations reflected their desire for equity and democratic control. In the context of digital agriculture and the speculative design workshop, one can equally see, at the level of EU policymakers, an envisioned, highly centralized, large-scale agriculture system, in which digital tech is the centralizing force for agriculture, with the implicit assumption that digitalization and related experts will solve society's problems. Conversely, an implicit social order is apparent from participating small- and medium-scale farmers' visions in which each individual, as citizen and consumer, needs to partake in this transition (e.g., by supporting the envisioned local hub for produce and education). Moreover, the farmers' speculative designs were telling a different story of farming – and of sustainable agriculture – about (I) farmers and biodiverse/agroecological/regenerative principles remaining at the center of their operations; (II) digitalization being one-of-many aspects in the future of agriculture; (III) digitalization's potential in communication particularly and primarily, rather than (only) in the farming field; and of (IV) politicians' responsibility to support such grassroots efforts, both in analogue (material) and digital meeting points.[13] Compared to the technoscientific vi-

12 Agrowikipedia is not a completely new idea as market farmers in Quebec have been running a similar platform and listserv called "Wiki Maraiché": https://wikimaraicher.ca/wiki/Wiki_mara%C3%AEcher (Accessed June 27, 2025).

13 While there is a growing recognition in the EU Commission that farmers should "have a voice, agency, and control over their own digital transition," including "the right to not go digital and still thrive" (Barabanova and Krzysztofowicz 2023, 31; D4S, 2022), the general discourse

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sion of sustainability in EU agriculture policy, where digitalization (among others) is seen to cohere with the economic, environmental and social dimensions in an abstract way, the participating farmers specify that digitalization, when done in a prudent way, can contribute primarily to the social dimension; this can be achieved by supporting communicating and networking capacities on a local level, and with supportive policymakers at different scales.

The generative nature of such participatory workshops (DiSalvo 2014) lies in its virtue as 'policymaking from the ground' (Peer and DiSalvo 2019): grounded in their farming experiences and daily practices, their policymaking is not one of abstracting from statistics and quantitative data, much like in governmental policy, but one of abstracting from their lived experiences. In this way, the latter may even complement the former, and participatory speculative design workshops not only offer a valuable approach for participatory research, but for more inclusive policymaking processes. In the words of Longhurst and Chilvers (2019, 987): "Sociotechnical visions and imaginaries of alternative possible futures play powerful roles in shaping decisions and commitments in the present." There is much speculative, grounding work to do ahead of us.

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suggests an inevitable path towards an all-encompassing digitalization of agriculture, with critiques and alternative visions often remaining unregistered (Gugganig 2025b).

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"A Message from our CEO"

Sundar Pichai's vanguard visions of global AI futures powered by Google

Sebastian Wucherer

Common ground: a quick introduction

Google, by far the largest of Alphabet Inc.'s many subsidiary companies, is not your average company. In 2024 alone, Alphabet and its 183,000 employees generated a total of over $350 billion in revenue (Alphabet 2025), a figure that rivals many major nations' total tax revenues. Beyond its financial power, Google has profoundly influenced society and has shaped global thinking, economic activities, and governance through its algorithms (Schroeder 2014; Mager 2017; Mager, Norocel, and Rogers 2023). *Googling* has been a globally used synonym for online information searches for more than two decades now. I use Google products on a daily, if not hourly, basis. Google knows where I live, where I work, it knows most of my passwords, it even has two of my fingerprints, has managed my daily schedule since 2016, and much more besides. Am I a hypocrite if I am still critical of this company that is currently, whatever way you look at it, an essential part of my life? I do not think so. This chapter is not about pointing the fingers of blame. As Bruno Latour wrote, "[t]he critic is not the one who lifts the rugs from under the feet of the naive believers, but the one who offers the participants arenas in which to gather" (Latour 2004, 246). Instead of condemning Google outright, this chapter is instead an invitation to take a step back and to reflect on the ways in which Google and its CEO since 2015, Sundar Pichai, think about our world – how it is today, what it should become, what its future will be shaped by, and for what purposes.

To that end, I will turn to Google's own blog *The Keyword* (Google 2025a), of which I have examined 51 contributions that were published in its self-explanatory category, entitled *A message from our CEO* (Google 2025b).[1] I have also included two other con-

1 At the time of writing in early 2025, 53 contributions have been published under *A message from our CEO* in total, two of which were excluded from my study as one of them was printed in Spanish and the other is primarily a video.

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tributions from the same blog concerning Google's AI strategy (Pichai 2018; Manyika et al. 2023). Each piece was given an ID and was arranged chronologically; 'A1a' refers to the first additional piece from 2018, while 'A53' refers to the most recent blog contribution from February 2025 (for a full overview, see Wucherer 2025).

Groundwork: some literature

For quite some time, common sense held that societal change simply just happens to societies, and the power to drive it was often attributed to technology. This asymmetrical understanding of sociotechnical change has been termed *technological determinism* (Smith and Marx 1994; Wyatt 2008). This view has now widely been superseded by a more symmetrical view on how sociotechnical processes come about and was challenged by Science and Technology Studies (STS) in specific (see Jasanoff 2004a; 2004b among many others). However, Wyatt (2008, 167) states that leaders in science, politics, and the corporate world still often advocate for views that lean into technological determinism heavily. She calls for continuing efforts to challenge these views by explaining how "[o]ne of the most misleading and dangerous aspects of technological determinism is its equation of technological change with progress" (Wyatt 2008, 172). Many scholars who advance the strand of literature on the subtle, albeit powerful, role that visions and imaginaries of the future play in shaping such futures (Taylor 2002; Jasanoff and Kim 2009, 2015; Verschraegen et al. 2017) have followed Wyatt's call, particularly those from STS traditions (see McNeil et al. 2017). Hilgartner (2015) has coined the concepts of the *Sociotechnical Vanguard* (SV) and their *Vanguard Visions* (VV) in order to account for the crucial role that some specific actors can have in shaping broader imaginaries. SVs are defined as "relatively small collectives that formulate and act intentionally to realize particular sociotechnical visions of the future that have yet to be accepted by wider collectives, such as the nation" (Hilgartner 2015, 34). VVs, then, are those specific visions and imaginaries for which SVs advocate. I conceive of Google as one such SV, spearheaded or represented by its CEO, Sundar Pichai.

Individuals with power in particular often "assume a visionary role, performing the identity of one who possesses superior knowledge of emerging technologies and aspires to realize their desirable potential" (Hilgartner 2015, 34), often tapping into what has been described as technological solutionism (Nachtwey and Seidl 2024, 92). Specifically, many SVs in big tech try "narrowing down the contingency of the future in a way that is in line with the company's business objectives" (Haupt 2021, 239) in order to "not only […] propose a future that users, business partners and the public can collectively expect, but they also disguise the company's aspiration for profit and power as a necessity on the path to a better world" (ibid.). Such prophetic corporations, as Haupt (2021) calls them, increasingly take issue with the current po-

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litical and institutional environments in which they find themselves (Srnicek 2017; Huberman 2022; Kohl 2017). It is this field of friction that led Zuboff to coin the term surveillance capitalism (Zuboff 2015; 2019), the phenomenon of organizations generating, commodifying and instrumentalizing data concerned with human behavior for primarily commercial ends. Zuboff has also stressed Google's seminal role in surveillance capitalism's invention:

> "Google invented and perfected surveillance capitalism [and was its] pioneer […] in thought and practice, the deep pocket for research and development, and the trailblazer in experimentation and implementation, but it is no longer the only actor on this path" (Zuboff 2019, 9).

As a result, and even more so with AI having taken center stage in the public arena, big tech in specific has been increasingly viewed critically, both inside and outside academia (Lindgren 2023). I want to contribute to this larger discussion by focusing on Google and AI and on how big tech shapes sociotechnical futures by blending specific sets of ideas in order to promote certain future visions.

Making ground: analyzing the messages

Tech that helps

The title "A message from our CEO" has a prophetic quality, evoking a nameless, distant being – *our CEO* – who directs his ethereal messages to employees somewhere out there. Hilgartner states that even VVs actually need some real grounding, being "more likely to gain traction if […] tied to entities and expectations familiar enough to provide an intelligible guide to the imagined future" (Hilgartner 2015, 40). Pichai automatically inherited a given set of 'entities and expectations' from Google, unlike other leading personalities in Silicon Valley, given that he did not establish the company that he leads. Paramount to this is Google's enduring mission statement, the "timeless vision" (A24) that "Larry [Page] and Sergey [Brin] first wrote down […] 25 years ago" (A40): to "organize the world's information and make it universally accessible and useful" (Google 2025c). This mission/vision functions as the ideological cornerstone and is recounted habitually throughout the entire corpus examined with little variation (A8, A12, A13, A17, A21, A24, A32c, A33, A37, A39, A40, A47, and A53).

Pichai often draws upon a second important legacy: his personal life story. While describing himself as "a technology optimist" (A16, also in A7, A27, A30, A53), he locates technology at the core of both progress and wellbeing: "Expanding opportunity through technology is deeply personal to me. That's because I grew up with-

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out much access to it. Every new technology—from the rotary phone to the television—changed my family's life for the better" (A16, but also in A17, A21, A49, A53). For him, technology is a harbinger of progress, and access thereto marks the beginning of better times. His belief in technology, Pichai explains, was ultimately pivotal to walking the path that led him to becoming Google's CEO:

> "I saw the positive impact technology could have to make things better. It set me on a course that would bring me to the U.S., and eventually to a growing start-up called Google. I couldn't have imagined then that one day I would toast three Google colleagues their Nobel Prizes, or take my parents for a ride in a driverless car" (A53).

Pichai utilizes repeatedly his individual success story to substantiate his belief that access to technology equates to societal progress. Similarly to the citation above, he claims that "every new innovation—from the rotary phone to the refrigerator—improved my family's life" (A21) while "[t]he technology that changed my life the most was the computer" (A49). He furthermore explains that "[a]s technology improves, so will the benefits" (A49), and that "[w]e believe a strong digital future is one where everyone has access to technology and the skills to use it, where the internet economy fulfils its immense potential" (A20). Regarding an investment in Africa, he aims for these investments to "ensure [that] every person in Africa can shape and share in the opportunities technology creates" (A21), while similar investments in Latin America were justified through an explanation that he had "always believed technology is a powerful enabler for businesses and communities" (A25). AI also gets described as one such "powerful enabler" (A37). Pichai generally believes in "how people can harness [technology] for good" (A16). Thus, access to technology – and most certainly Google's technology – is indispensable and is even *prescriptive* for Pichai's (rather linear) idea of positive social change.

He does show some reflexivity about this framing, claiming that "I've always thought computers should be adapting to people, not the other way around" (A24). However, more often than not, his statements imply that local practices (should) follow new materialities; for example, "I believe that technology is a foundational enabler of progress" (A49), and "[i]mproving lives through technology is personal for me" (A53). His optimism about people's – not just technologies' – power to enable change is mentioned somewhat infrequently: "I'm still optimistic about our future. That's because I believe in people. Throughout history, people have made the impossible, possible" (A19). Yet, right after this remark, he adds that "[t]he other bright spot [in fighting climate change] is technology" (A19), and Pichai had "been thinking a lot about how far technology has come over the last 25 years and how people adapt to it" (A40) on the occasion of Google's 25th birthday.

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This conception of sociotechnical change necessitates increasingly shorter innovation logics, especially for commercial actors (Sveiby, Gripenberg, and Segercrantz 2012a; 2012b), and is prone to exacerbate more profound kinds of change. Sociologist Hartmut Rosa's concept of the hyper-accelerated standstill described this as a symptom of modern high-speed societies in which "no new visions and energies [are] available to modern society and hence the enormous speed of events and alterations is a superficial phenomenon barely covering up deep-rooted cultural and structural inertia" (Rosa 2003, 17).

These narratives of technological determinism and socioeconomic change allow Pichai to craft what is perhaps his most frequently deployed notion: *tech that helps*. "Google products are built to help" (A24) is just one instance of a whopping 359 times that the verb *to help* is used throughout the material. This claim integrates a moral dimension into Google's technologies, presenting them as tools that ultimately only exist to do *good* in the world. Addressing some criticism towards AI, for example, Pichai explains:

> "Designing products that help people at scale is both a privilege and a responsibility. People have their own questions: Can we trust these new technologies? We think deeply about how to build responsible technology from the start, whether it's making sure everyone's information is protected and secure, or keeping people safe from bad actors online. […] Our development and use of AI must address these risks, and help to develop the technology responsibly. The AI principles we launched in 2018 are an important part of how we do this. These principles prompt questions like: Will it be helpful to people and benefit society, or could it lead to harm in any way?" (A40).

The idea that tech only *helps* is key to Pichai's ability to claim that what is at the heart of Google's activities is nothing but the attainment of (effectively unassailable) ideals like inclusivity, people's 'happiness,' prosperity, or sustainability. What is striking in the case of Google, though, is the universality of these aspirations, as Pichai repeatedly presents his belief that especially AI is poised to "benefit everyone, everywhere" (A51). More generally, the idea is also "to approach [our] mission with a singular goal: building a more helpful Google, for everyone. That means being helpful to people in the moments that matter and giving everyone the tools to increase their knowledge, success, health and happiness" (A12). Similarly, during the pandemic, Pichai wrote that "we'll continue to help our communities—including our businesses, educators, researchers and nonprofits—to navigate the challenges ahead" (A2), and regarding climate change, Pichai claimed that "[w]e're proud to do our part, and to help move the world closer to a carbon-free future for all" (A7). The turn to AI has only intensified Pichai's use of this notion, as "[w]e've been applying AI to make our products

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radically more helpful for a while. With generative AI, we're taking the next step" (A37).

In essence, *tech that helps* exemplifies what has been termed technological solutionism (Morozov 2013; Bartl 2023). Pichai does call for "important debates about how […] technologies will shape our society" (A40), but potential problems remain to be solved, chiefly by technology – or, in his words: "Just as technology can create new threats, it can also help us fight them" (A38). In the end, it is technology that drives change, usually Google's: "I know that with greater access to smartphones and improved connectivity, there's no limit to what India's people can do. We look forward to getting technology into the hands of more people and to exploring what more we can achieve together in the years ahead" (A13).

Overall, Pichai paints a picture of Google not as a regular company, but as a morally driven agent of both global wellbeing and progress. Importantly, however, he mostly leaves unexamined the benefits/profits that occupying this role would allow Google to reap. During the early *Black Lives Matter* protests in 2020, Pichai stressed that "[a]s a company, and as individuals who came [to Google] to build helpful products for everyone, Google commits to translating the energy of this moment into lasting, meaningful change" (A6), again contextualizing 'meaningful change' with new technologies and also commercial success, albeit implicitly. The continuous emphasis on moral dimensions disassociates Google from its economic self-interests, which is key to being able to present Google as benevolent:

> "We're optimistic that by harnessing new technologies, investing in the right infrastructure and tools, and empowering partners, nonprofits and people, this can be the most decisive decade for climate action yet. We're proud to do our part, and to help move the world closer to a carbon-free future for all" (A7).

What is being constructed, again and again, as being *helpful* is simultaneously being constructed as also being economically advantageous: "We know Google only succeeds when others do, and we'll continue to build the tools and technologies that help grow the economic pie, and create more opportunities for everyone" (A35). Pichai is also able to establish the idea that *markets* can be (made into) a force of good by presenting Google's technologies as both morally *good* and beneficial to economies. Following his narrative, consumer markets naturally favor products that provide both immediate and lasting benefits to humanity *at large*: "[O]ur goal is to make the sustainable choice an easier choice. At the individual level, these choices may seem small, but when people have the tools to make them at scale, they equal big improvements" (A16). This is not to accuse Google of 'bluewashing' (Berliner and Prakash 2015), but more involves explicating a subtle, but meaningful, shift from most traditional narratives: Instead of debating how societal progress and planetary sustainability are *compatible* with corporate success, at least in principle, Pichai instead

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claims that Google's success in specific – while prepending moral inducements – generally *leads to it*.

However, emphasizing the ability to empower others to act *good* conceals underlying issues. One of them is rather simple: In Pichai's future visions, the demand for hardware, including infrastructure and data centers, will rise significantly, thereby posing questions about sustainably using natural resources. The second issue is more subtle; Pichai may claim that "we'll keep asking the big questions to help build a more sustainable future, and work to find answers with all of you" (A41), or he might promise that "[a]t Google, we will keep working to get technology into the hands of more businesses and communities and to create opportunities for all Americans" (A43).[2] However, Google's products can also be used in ways that run completely counter to Pichai's well-sounding intentions, even though as the company is portrayed as a selfless, helping, benevolent giant. This issue usually goes unmentioned or gets downplayed, with few exceptions (e.g., the additional material (A1a; A32a)). What is much more representative is Pichai's claim about how "[o]ur commitment to innovation, as well as our long-term focus and investment in AI, are paying off and driving success for the company and for our customers" (A51), and that Google makes "workers grow their skills and advance in their careers" (A45). Writing about AI more generally, the only scenario that Pichai imagines as being *bad* is, effectively, if not everyone uses it: "With AI, we have the chance to be inclusive from the start, and to ensure that the digital divide doesn't become an AI divide" (A49). Throughout most of the material, AI in particular is something that is so convincingly and generally beneficial that every socioeconomic and sociopolitical actor should fully subscribe themselves to spreading it to as many people as possible. I will examine this theme to a greater extent in the section that follows. All in all, the analysis urges us to be careful about quietly acquiescing to narratives like Pichai's story of *tech that helps*. While it is very difficult to object to, it subtly trivializes the natural ambiguity of the overall impact that Google's products and services may have.

The information-knowledge mindset

I now want to delve deeper into Pichai's understanding of what *information* and *knowledge* are and how they relate to each other and the world. To start with, Google's mission statement leads to Pichai's idea that – similarly to technology – access to information is generally desirable: "The idea that a student in rural Indonesia could access the same information as a professor at Stanford was revolutionary, and has changed lives and our world for the better" (A40). This is why, at least to

2 The blog contribution cited (A43) focused solely on US contexts. Hence, 'for all Americans' may well be reframed to 'opportunities for all Google customers.'

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him, Google aims at "deepening our understanding of information so that we can turn it into knowledge; and advancing the state of computing, so that knowledge is easier to access, no matter who or where you are" (A24). Here, he presents a notion of information as raw material, something that is able to be processed into useable knowledge. Elsewhere, however, he writes about "engag[ing] with information, from language and images to video and audio" (A33). This contradicts the former conceptualization, as any video/audio is already a heavily processed form of information or knowledge. In yet another example discussing *Gemini*, the obscurity only grows:

> "Unlocking knowledge across formats is why we built Gemini to be multimodal from the ground up. […] Long context takes this a step further, enabling us to bring in even more information: hundreds of pages of text, hours of audio or an hour of video, entire code repos…or, if you want, roughly 96 Cheesecake Factory menus" (A47).

In this quote, knowledge is 'unlocked' from multimodal formats, which, again, necessarily includes already processed material like video/audio recordings. However, in the same article, these formats – from audio to restaurant menus – are suddenly considered information, something that was elsewhere framed more as raw material that is ready for processing. In another instance, with the goal of "unlocking entirely new questions that Search can answer, and creating increasingly helpful experiences that connect you to the richness of the web" (A37), Pichai wrote that "Google's deep understanding of information combined with the unique capabilities of generative AI can transform how Search works yet again" (A37). It is once again unclear if information is here conceptualized descriptively or semantically. The main insight that I draw from these remarks, now, is that Google maintains surprisingly inconsistent notions of information and knowledge, even though it is described by Pichai himself as an 'information company' (A22).

Among other things, this conceptual vagueness enables Pichai to establish the claim that, for him, technology is virtually always able to translate any input into something that is useful for people. He strategically draws upon simple, close-to-life examples to substantiate this belief. For example, introducing AI-generated document summarization, Pichai explains how "[a]t Google, whenever I get a long document or email, I look for a TL;DR at the top—TL;DR is short for 'Too Long, Didn't Read.' And it got us thinking, wouldn't life be better if more things had a TL;DR?" (A24). This does pose questions about whether it is really as innocent as it sounds for someone as powerful as Pichai to rely on automated TL;DRs for any 'long' document or email that is placed on his desk, so to speak. Presenting AI-generated TL;DRs as a generally unproblematic tool greatly trivializes AI's ability to process any given input. Additionally, it reveals how Pichai does not usually distinguish between techno-

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logically accessible and technologically inaccessible kinds of information or knowledge. To him, what is relevant to any issue is usually also available to machines; this leads him to proclaim that "[o]ne of the most exciting opportunities is how AI can deepen our understanding of information and turn it into useful knowledge more efficiently—making it easier for people to get to the heart of what they're looking for and get things done" (A33). Similarly, Google's *Bard* sought

> "to combine the breadth of the world's knowledge with the power, intelligence and creativity of our large language models. It draws on information from the web to provide fresh, high-quality responses. Bard can be an outlet for creativity, and a launchpad for curiosity" (A33).

Pichai elsewhere reassures the reader that Google would be "approaching […] innovation responsibly, striving for the highest bar for information quality as we always have from the very beginning" (A37), while failing to substantiate what *quality* means to him with respect to information. One hint about this may be found in Pichai's effort to reify Google's mission as "[o]rganizing the world's information across every input, making it accessible via any output, and combining the world's information, with the information in YOUR world, in a way that's truly useful for you" (A47). Here, quality seems to come from correctly assembling the relevant parts of a finite pile of either information or knowledge. This overlooks how information or knowledge are often ambiguous or contextual and can, thus, be infinite and might be partly technologically unavailable. This notion is actually substantiated by Pichai himself when he writes that developers using Google's *Vertex AI* may improve their work in two ways: First, Google Search, which "provides high quality information to improve the accuracy of responses [*Vertex AI* gives]" (A44) and, second, "with your *own data and sources of truth*, such as enterprise applications like Workday or Salesforce and Google Cloud databases like BigQuery" (A44, my emphasis). It is here that Pichai lists exclusively technologically processable data as 'sources of truth,' while also vaguely acknowledging the contextuality of information or knowledge. This instance serves as the culmination of the confusion of information, knowledge, and how it represents the world and leads to the observation that, for Pichai, information or knowledge have two possible states: either 'locked' or "unlocked" (A45, A47) by or with technological means. Writing about a particular language model being "revolutionary in *understanding the intricacies* of human language" (A33, my emphasis) or that "[t]echnology begins to feel like a natural extension, *augmenting human capability*, bridging gaps in expertise and *experience*, and breaking down barriers like language and accessibility" (A53, my emphasis) substantiate this insight further. The material does not show if Pichai ultimately subscribes to the idea of technological limitations in the capturing and processing of information or knowledge. Instead, Pichai envisions Google's

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technology as "improving your knowledge and learning, and deepening your understanding of the world" (A37).

When taken together, Pichai presents a rationale that is built upon the profound mindset that any information or knowledge is available to humans *and/or* machines. I call this mindset *information-knowledge* and it is an important foundation to Pichai's VV of global AI futures. What is a core issue to this mindset is its failure to acknowledge that even an AI considering everything *available* thereto will still only consider a fraction of what may be relevant to the issue at hand – availability cannot be equal to completeness. Subscribing to information-knowledge means denying endless, even inaccessible, sources of information and knowledge. Thus, Pichai's impossible vision of an AI processing "infinite context" (A47) is a forlorn path towards innovation and knowledge generation that is recursive, restricted to the repeated reprocessing of inherently limited data sets.

SVs supposedly 'create and ride waves of change' (Hilgartner 2015, 34), which is a metaphor that Pichai also employs himself. Concerning the future of AI, "let's look at how well we're positioned for the next wave of AI innovation, and the opportunity ahead" (A46), elsewhere discussing a "next wave of technology" (A40). However, we might ask: how does information-knowledge as a mindset translate to Google's sociomaterial practices? What kinds of waves might we expect? I want to start with my assumption that information or knowledge are considerably more versatile products to use than cars or food are.[3] Hence, claiming that "[a]s an information company, we take our responsibility seriously to provide reliable, trustworthy information to people when they need it" (A22), is far from trivial. Pichai writes elsewhere that "YouTube dared to ask: What if we gave everyone a way to share what they know with the world? And today, it's become a powerful platform for learning and knowledge" (A40). Now, while the latter may be true, it also obscures the many questions we might pose – without necessarily implying that we live in either a post-truth or post-factual age – about *what* is learned and *who* is applying *what* knowledge for *what ends* with *what effect*. Only the additional material reveals this issue, at least implicitly, as it describes one risk of AI in that it "[c]reates or worsens information hazards (e.g., lack of groundedness, non-factuality, misinformation)" (A32a). Yet, instead of acknowledging known issues, rather simplistic ideas are far more prevalent, as Pichai imagines that "our products are helping people access knowledge and opportunity" (A30) or that Google is "enabling developers and businesses to build their own transformative products and services" (A37).

3 STS has devoted a great deal of works to the messy processes that revolve around the production and use of technology (Bijker and Law 1992; Akrich 1992). My claim here is only that if you are looking at, say, AI chatbots through lenses like *in- and descriptions* (Akrich and Latour 1992, 259f.), then there will be more space for variability of use and impact than would be the case with, say, a door-closer or seat belts (Latour 1992).

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The aforementioned quotes also hint at Pichai's ideas about the *kinds* of innovation to which the large-scale processing of information or knowledge may lead. For example, with advanced AIs, Pichai suggests, "a gaming company could provide a video analysis of a player's performance, along with tips to improve. Or an insurance company could combine video, images and text inputs to create an incident report, making the claims process easier" (A44). Likewise, he suggests that:

> "You could ask a deep research agent, 'Where in Europe should I vacation for two weeks in August?' Five minutes later, you have a full analysis considering factors like affordability, weather, visa requirements, and more—all with sources cited" (A53).

All three examples – the gaming company, the insurance, and the deep research travel agent – describe the optimization of existing practices, rather than the invention of new ones, as the implied change largely consists of the mere integration of (Google's) technologies – especially AI – into already existing and well-known practices. Further exemplifying this, Pichai explains that "we're leaning into the living room experience with multiview, and a new option for creators to organize content into episodes and seasons, similar to traditional TV" (A51). Here, the goal is once again merely to shape current practices so that Google benefits, rather than actually coming up with 'new options' for private entertainment. Ultimately, the picture of the future that Pichai paints depicts a world in which – put somewhat polemically – people mostly do what they have always done. Things may take a little less time than previously, but the main 'transformation' can be observed in the implied integration of Google's products and services into increasingly more aspects of both companies' and people's activities.

I want to stress that this is fair practice, but also that what it stands in stark contrast to is the way in which it is talked about. With claims like "[w]e've known for a while that AI will be the next technology to transform companies" (A44), we can see how AI is continuously framed in exceptional terms: "I remember watching in awe as the Research team showed us the progress they'd made with image recognition, driven by breakthroughs in neural networks. It was the first moment I thought to myself: this is really going to change everything!" (A40). Hence, Pichai has labelled Google an 'AI-first company' since 2016 and with increasing frequency in the aftermath of ChatGPT's publication (A36, A37, A39, A40, A46, A47, A53). To his mind, the incoming 'wave,' which also urged Pichai to introduce Google's *Gemini Era* (A43, A47, A52), will leave nothing untouched: "I've been reflecting on the big technology shifts that we've all been a part of. The shift with AI is as big as they come and that's why it's so important that we make AI helpful for everyone" (A53). Pichai is keen to let others know that "AI will be the biggest technological shift we see in our lifetimes" (A40).

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The 'wave,' following Pichai's view, is coming in a fast, unpredictable and more-or-less inexorable manner; there are 46 mentions of one or more 'breakthroughs' spread throughout 21 contributions, and he acknowledges that risks may be inherent: "Every generation worries that the new technology will change the lives of the next generation for the worse" (A53). However, continuing the same quote, he addresses these worries in an interesting way: "[…] yet, it's almost always the opposite. I grew up doing math using logarithmic tables, and I was uncomfortable watching my kids learn math with smartphones. They've turned out just fine" (A53). Again, and despite him building up expectations of fundamental change and the singularity of AI, he turns to fiercely mundane (and arguably simplistic) stories to assuage the critics even when addressing sincere criticism and worry.

Public service or Google's business?

In this short section, I will take a closer look at how Pichai depicts Google's relationship with nation states, including state confederations like the EU. Speaking to various leaders at the 2025 *AI Action Summit* in Paris (see AI Action Summit 2025), Pichai remarked:

> "As [AI] continues to improve, it will spur innovation, opportunity and growth in economies around the world, and drive an explosion in knowledge, learning, creativity, and productivity that will shape the future in exciting ways. The opportunity with AI is as big as it gets. And it will be up to the people in this room to make sure that as many people as possible benefit" (A53).

Touching on various topics discussed previously, Pichai positions Google as leading the charge in an imminent 'explosion' of benefits. At the same time, he constructs the size and quality of this 'explosion' as dependent, too, on "the help of the member countries and leaders in this room [to be] creating an enabling policy environment" (A49). Pichai points out how public policy will play an 'important role' (A53) in the satisfactory dissemination of AI and strongly urges nations to foster an environment that allows Google to thrive: "Europe's productivity is dependent on using these emerging technologies; and European competitiveness depends on productivity. So driving adoption is key, so that the productivity gains happen at scale and across the economy" (A53).[4]

This material reveals an implicit tension between states and corporations as competing loci of societal organization and governance. Against the backdrop of the analysis so far, Pichai's rhetoric – e.g., when he claims that "Google invests in

4 The speech that this contribution is based on took place in Paris, which is why Pichai mentions 'Europe' here, but this could well be taken as a proxy for every other region in the world.

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Africa" (A16, A20) – reflects a broader narrative that reconfigures private financial and commercially driven investment, not as primarily economic activity, but as inherently developmental and emancipatory intervention. Google's own consequential benefits are – just like the risks posed by AI – usually confined to the background, surfacing only during earnings calls (A3, A44, A51, A52) and at Google's annual IO-conferences (A12, A24, A37, A47). What is key to this is how Pichai equates Google's aspirations with those of nation states, evoking collective benefits like a shared "golden age of innovation" (A53), "growing the economic pie" (A35), or achieving global sustainability. For Pichai, Google and nation states (should) act almost, if not fully, in alignment; this once again portrays Google as a selfless giant:

> "As we make these investments, we know we can't do this alone. We look forward to partnering with African governments, policymakers, educators, entrepreneurs and businesses. We have so much opportunity ahead as Africans shape the next wave of innovation. Thank you for the chance to be a part of it" (A17).

However, considering Google's scale and infrastructural embeddedness, it should not be ignored that, at the end of the day, corporations need to prioritize their own economic growth over general societal equilibria – not the other way around.

In some senses, Pichai also suggests that nation states are generally not faring as well as they should in pursuing those allegedly common goals. Fittingly, his tone of voice appears disappointed, rather than disdainful. Speaking at the *AI Action Summit*, once again, he proclaims that:

> "I think when history looks back it will see this as the beginning of a golden age of innovation. But these outcomes are not guaranteed. The biggest risk could be missing out. […] We must not let our own bias for the present get in the way of the future. We have a once-in-a-generation opportunity to improve lives at the scale of AI. Let's do everything we can to make it possible" (A53).

Thus, he later states that useful public policy "[a]ddresses risks, without stymying innovation, progress and the positive impacts" (A53). To him, this is why "governments need to take a thoughtful, strategic approach to AI to drive investment in infrastructure, people, and adoption, including by governments themselves [in this] important and historic moment" (A53).

Pichai's ideas of state-private relationships also include normalizing Google's ability to assume tasks that were traditionally reserved for either national governments or the international community. In addition to the aforementioned global developmental work, this also includes efforts concerning COVID-19 vaccinations (A9, A14), managing unemployment (A3), or supporting food banks (A29). Pichai makes Google's will to 'help' nation states clear, explaining how "[i]n the public sector, we are

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helping governments deliver critical health and social services." (A3). What is perhaps most striking is one contribution, self-explanatory titled "Building a private sector response to the global refugee crisis" (A27). It opens with a snapshot showing Pichai and a small number of people gathered around a whiteboard, brainstorming the topic at hand. Three keywords have been written on the whiteboard: 'Challenges,' 'Needs,' and 'Support,' while one subitem, 'Challenges,' also includes 'Marketing/Business Development.' This particular contribution may simply be read as a political statement that is directed at governmental institutions and their deficient management of current refugee crises. However, towards its end, Pichai also explains that part of the 'response' is an assumed:

> "responsibility to ensure people everywhere can benefit from the opportunities technology creates, be it creating the infrastructure that widens access, advancing technologies that can enable progress, or making sure the internet remains free, open and safe—for everyone" (A27).

The self-serving aspects that fundamentally inform Google's activities still shine through the more prominent narratives of goodness and generosity, even in the context of global refugee crises, and involves assuming responsibilities traditionally reserved for governments and adopting the role of a prophetic corporation (Haupt 2021).

Groundbreaking (?) tech: conclusions

"A message from our CEO" is a platform through which to distribute VVs about global AI futures and presents a very particular set of ideas about the world in which we live, how it works, how it can and should be shaped, and the role that AI will play in that process. Pichai portrays AI not as an occasionally convenient or fun tool for people to use (or not use), but as a technological necessity for general human progress and wellbeing as such. Grounding it in both Google's and his own personal history (think of the rotary phone), he combines strong moral self-legitimization (think of *tech that helps*), the idea that information access is key to desirable social activity (think of *infinite context*), and the notion that Google can provide people with all necessary knowledge (think *information-knowledge*). As a result, Pichai's vanguard vision of global AI futures introduce a Google that is no longer merely a *part* of global societies, but that

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has become *foundational* and *indispensable* thereto,[5] blurring the line between corporate responsibilities and market expansion in peculiar ways. With a self-image that many other companies simply cannot emulate, and the sheer scale and public impact of its technology, this chapter calls for further evaluations of corporate power in contemporary global political economies. In part, this is because analysis suggests that the brave new world Pichai envisions is surprisingly similar to the world in which we currently live. How is this so?

Now, any AI can provide an output only based on its input; that is, on its database and its prompts. However, digital databases are inherently limited; the sum of every information *available* to it will never be all of the information *in existence* – even if only due to things, events, or meanings being forgotten over time, all while remaining tacitly impactful. 'Infinite context' will remain a theoretical construct but Pichai disregards this informational deadlock. The information-knowledge mindset allows him to suggest that most, perhaps any, information or knowledge is potentially accessible and comprehensible by machines/AI.

This mindset renders most of Pichai's narratives about innovation or transformation essentially hollow, though, caught up in a peculiar recursive logic: if *everything*, including any human activity, is merely a source for data (Zuboff 2019, 2015), and if, simultaneously, AI becomes foundational to most societal processes, then everything will turn out to have been both founded on and fueled *by itself*. Any resulting innovation is, thus, necessarily mimetic, rather than transformative. In other words, re-organizing an inherently reductive database over and over again will not result in an entity that is capable of producing meaningful innovation and actual *novelty*, most notably in domains in which data is notoriously incomplete, contextual, or tacit. This is why AI is undeniably able to recombine enzymes for drugs or to produce useful computer code, but struggles in unpredictable, ambiguous, social processes in which an exhaustive information base is fundamentally impossible.

It is not surprising that most of Pichai's examples for AI applications are restricted to superficial change, instead of aspiring to either thinking of doing fundamentally novel things. AI is essentially presented as a tool for people to keep doing the things that they have always done, but now with the involvement of AI. While this may be a functional strategy for an 'information company' to flourish, it undermines meaningful social transformation in the way that Pichai's prophetic language (Haupt 2021) repeatedly implies. Summarizing it poignantly: Realizing Google's vanguard visions of global AI futures means avoiding profound structural change, while also believing that we are living through it.

5 In this sense, after successfully expanding from being a mere company's name to also being a globally recognized activity, *Google* may well eventually become an adjective as well, something associated with everything prosperous, efficient, and morally guided simply by being something related to *google*.

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To end on a slightly polemical note, Pichai is also sure that this chapter and everything concerned with AI will soon be material for the archives, given that AI has (allegedly) already found its technological successor: "Quantum computing [is] the next big paradigm shift in computing, following AI. And we're making good progress. Our latest breakthrough was in December [of 2024]" (A51). So, will quantum finally change *everything*? Anticlimactically, Pichai's hopes would already be fulfilled if quantum is "used to identify molecules for new medicines, create fertilizer using less energy, [or] design more efficient sustainable technologies from batteries to nuclear fusion reactors" (A34). We should perhaps more commonly ask if the visions and imaginaries that regularly gain traction in contemporary societies may indeed have something to do with these very societies' vague feeling of somehow being stuck at/in the moment, even with Pichai's hopes also including quantum computing's ability to produce "physics research that will lead to advances we can't yet imagine" (A34). We should keep asking *whose* visions we must follow and put into practice, inside and outside academia,[6] *how* so, and, perhaps, most importantly, *why*, regardless of whether what we are examining concerns AI, quantum computing, or what have you.

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6 For example, see the work by Paresh Dave and Arielle Pardes (2025) for WIRED magazine on Google's great challenges in the AI-'frenzy' that are not apparent in "A message from our CEO."

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Hi, ChatGPT!

Images and imaginaries of a large language model

Regula Valérie Burri

[This interview was conducted in early May 2025 using OpenAI's ChatGPT free version 4.0. The free version was interrupted several times, blocking its use for a few hours, so the conversation took place over several days. The interview has been shortened and some passages and sentences have been rearranged to improve the flow of the text. In addition, I have translated the form of address, which was "Du" in German, into "You" in English, and some words that were bold in ChatGPT are reproduced here in regular font. My prompts and ChatGPT's responses were in English.] [1]

You: Hi, ChatGPT!

ChatGPT: Hi there! 😊 How can I help you today?

Production

You: I'm interested in images of Large Language Models and the imaginaries they imply. First I would like to talk about the production of the images and ask: How do you generate images?

ChatGPT: Great question. When I generate images, I use a process called *text-to-image synthesis*, which involves translating a written description (your prompt) into a visual representation. This is powered by a type of machine learning model known as a generative model, usually trained on massive datasets of images paired with

1 The interview builds upon the analytical perspective of Social Studies of Scientific Imaging and Visualization (SIV), as suggested in Burri and Dumit (2008), which explores the production, engagement, and deployment of (scientific) images. For a contextualization of SIV in Science and Technology Studies (STS) and on the development of Visual STS, see Burri 2024. The interview draws from literature concerning cultural, technoscientific, and sociotechnical imaginaries (e.g., Marcus 1995; Jasanoff and Kim 2015), as well as critical AI studies (e.g., Crawford 2021; Lindgren 2023; Suchman 2024; Dumit and Roepstorff 2025).

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captions or descriptions. These models learn associations between language and visual elements, allowing them to "imagine" what a description might look like in pixel form.

Behind the scenes, these models rely on neural networks—particularly diffusion models in many current systems. The process starts with random noise and then gradually refines this noise into an image that aligns with the given text, step by step, through a denoising process. This method allows for rich, detailed, and often surprising outputs that go beyond simply copying images from training data.

The resulting images are not photographic "truths" but speculative visualizations—creative composites that reflect both the statistical patterns the model has learned and the cultural assumptions embedded in its training data. So in a sense, these images not only depict what is asked for but also carry with them the traces of the collective imagery of the internet and visual culture that the model has been trained on.

You: Let's talk about the technical production of the images. Is there any materiality involved in image production?

ChatGPT: Yes, there is significant materiality involved in the production of AI-generated images, even though the process might appear immaterial or purely digital on the surface. This materiality exists on several interconnected levels, starting with the computational infrastructure required to train and run these models.

At the core, generating images with models like diffusion systems or GANs (Generative Adversarial Networks) depends on vast networks of physical hardware—data centers filled with specialized chips for machine learning tasks, which consume large amounts of electricity and require cooling systems to prevent overheating. The training of these models involves processing millions or even billions of image-text pairs, often for days or weeks, which incurs substantial environmental costs through energy consumption and carbon emissions. This computational load reflects a deeply material process that's often hidden behind the seamless experience of requesting an image.

Even at the moment of inference—when an image is generated for a specific prompt—the system must retrieve and recombine fragments of learned data using physical machines. This act, while seemingly instantaneous, is rooted in an infrastructure of cables, silicon, labor, and global supply chains.

So yes, image production via large language models and their visual counterparts is deeply material, though its surfaces might appear virtual or "clean."

You: Where do you get your data from to create an image? Do you care about intellectual property rights or related privacy issues?

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ChatGPT: The data used to train the models that generate images—like the ones I use—typically comes from large-scale datasets. They are harvested from existing online repositories—such as stock photo sites, art collections, or scraped social media—and stored in massive servers. These datasets are not neutral; they reflect particular cultural, economic, and geopolitical realities. They often privilege certain geographies, aesthetics, and ideologies, thereby embedding material histories into the images that models generate.

Importantly, the quality and biases of these datasets have a direct impact on what the model learns and, ultimately, what kinds of images it can and tends to produce. The images are not directly copied from this training data, but the model statistically learns patterns, textures, shapes, and relationships between visual and textual features.

[M]any of these datasets have raised ethical and legal questions. For example, artworks, photographs, or personal photos might be included without consent, and this has implications for intellectual property.

Privacy is another critical issue. Some datasets may include images scraped from personal blogs, forums, or social media accounts, which means people's likenesses or data could be used to train models without their knowledge or consent. This has ethical implications, especially when models are later used in ways that could misrepresent or commodify those individuals.

While efforts are being made to develop more ethically sourced datasets, introduce opt-out mechanisms, and comply with copyright regulations, the reality is that the foundational data for most large generative models remains opaque and controversial.

You: Can you distinguish between good and bad data and if so, how?

ChatGPT: I can attempt to distinguish between good and bad data, but it's not an objective or straightforward process—and it depends heavily on context and the values embedded in the training and usage of the model.

In technical terms, "good" data typically means data that is high-quality (clear, correctly labeled, relevant) and diverse (representing a wide range of styles, demographics, or contexts). "Bad" data might be low-resolution, mislabeled, redundant, or biased in a way that leads to harmful outputs (e.g., stereotypes, offensive content, misinformation).

However, I don't evaluate or curate training data myself. The judgment about what constitutes good or bad data is made during the model's development, by researchers and engineers who select and filter datasets. They may use automated methods—such as deduplication, profanity filtering, or algorithmic bias detection—or manual review to clean the data. But these processes are always shaped

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by cultural, ethical, and political assumptions: what one institution considers "harmful" or "irrelevant" might be considered valuable or truthful by another.

Moreover, some biases and flaws are very hard to detect and persist in subtle ways. For example, if the majority of professional portraits in a dataset depict people with light skin in corporate settings, the model may learn to associate professionalism with whiteness, even if there was no malicious intent. So even well-cleaned data can carry hidden biases.

In short, yes—there are methods for distinguishing good from bad data, but they are imperfect, context-sensitive, and always tied to human judgment.

You: [Please] provide me with an example related to digitalization.

ChatGPT: Sure. Let's take the concept of "digitalization of work" as an example. Suppose someone inputs a prompt like: *"An illustration of the digitalization of work."* A model trained on large-scale internet data will try to generate an image that statistically matches this phrase. But what does the model actually "know" about digitalization?

If the dataset is primarily composed of Western-centric, corporate media and stock imagery, the model will likely produce a scene like: a person sitting at a sleek desk, working on a laptop, maybe surrounded by icons of cloud computing, data charts, or robotic arms. The person may be in a minimal, modern office space, smiling, productive, with diverse-but-idealized colleagues in the background.

This may seem like a "neutral" visualization, but it reflects specific assumptions embedded in the data: that digitalization is clean, efficient, and professional; that it's happening in white-collar contexts; and that it's something to be embraced. It often *excludes* alternative views—such as the gig economy, remote surveillance, digital labor exploitation, or the automation of precarious jobs—because such imagery is underrepresented in training data.

If the model were trained on more critical, diverse, or labor-focused datasets (e.g., academic publications, activist photography, or ethnographic visuals), the result might look very different: perhaps a delivery driver being monitored via an app, or workers in a digital content moderation center in a Global South setting.

So this is a clear example of how the quality and composition of training data shape the outputs—and how "digitalization," a complex social process, gets visually simplified into corporate iconography when trained on unbalanced or "bad" data.

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Interpretation

You: How do you "know" what is depicted in an image?

ChatGPT: I "know" what is depicted in an image through a combination of pattern recognition and learned associations, rather than perception or understanding in the human sense. When I interpret an image, I follow a computational process that mimics—but does not replicate—human visual understanding.

When you upload an image, I analyze it by breaking it down into structured data—such as color values, shapes, textures, object boundaries, and spatial relationships. Then, using models trained on labeled datasets, I can identify what is likely present (e.g., "a tree," "a person wearing a hat," "a laptop on a desk") and describe it in natural language.

But this is always probabilistic. I'm recognizing statistical patterns, not forming a subjective impression or interpreting meaning like a human might when viewing a photograph. I don't have access to the *intention* behind the image, the *cultural context* of its elements, or any *emotional nuance* unless those are part of the visual data and align with patterns I've learned. For instance, I can say, "a person is smiling," but I can't truly know why they are smiling or what it means in a broader social or historical context—unless prompted to infer based on common patterns.

In short, my interpretation is a surface-level matching process—sophisticated and often accurate, but not grounded in human intentionality or subjective experience. [It] is closer to translation or classification than to visual perception.

You: Ludwik Fleck, a historian and sociologist of science, said that seeing depends on what you know. Would you agree with that?

ChatGPT: Yes, I would agree with that—Ludwik Fleck's insight that "seeing depends on what you know" is deeply relevant not only to human perception but also to how I, as an AI, "see" and interpret images.

Fleck argued that perception is shaped by prior knowledge, social context, and what he called "thought collectives"—shared ways of seeing and thinking within specific communities. Humans don't view images or the world with a blank slate; they interpret based on cultural assumptions, education, experience, and collective norms. A scientist, an artist, and a protester may look at the same photograph and see entirely different things—not because the image changes, but because their interpretive frameworks differ.

That principle applies, in a limited and mechanical way, to how I function. My "knowledge" is composed of statistical associations learned from massive amounts of data—images and texts that reflect the dominant patterns, assumptions, and biases of the cultures that produced them. So, in a sense, what I "see" is entirely shaped

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by what I've been trained to recognize. If something isn't well-represented in my data—whether it's a visual trope, a cultural gesture, or a subversive symbol—I'm likely to misread or flatten it.

The difference, though, is that while human knowledge is dynamic, interpretive, and reflexive, mine is fixed at a given point in time and bounded by my training. I don't *grow* through experience or reevaluate what I've seen in light of new contexts unless explicitly updated.

So yes, I would agree with Fleck's insight—and also add that it helps explain both the strength and the limitation of my own interpretive capabilities.

You: What do you find most difficult about interpreting an image?

ChatGPT: What I find most difficult about interpreting an image is understanding meaning that arises from context, ambiguity, or cultural depth—things that require *lived experience*, *situated knowledge*, or *symbolic nuance*.

Unlike a human, I don't possess a memory of personal events, emotions, or cultural immersion. So when an image carries layered or ambiguous meaning—like irony, satire, trauma, religious symbolism, or political critique—I can often recognize the visual elements but miss what they *mean* together in a specific historical or emotional context. For example, I might correctly identify a burning flag, a kneeling figure, and a police uniform, but I may not grasp the layered discourse on protest, nationalism, and race that the image evokes unless those interpretations have been clearly encoded in the data I've seen.

I also struggle with images that depend on intersubjective cues—like facial expressions interpreted differently across cultures, or social interactions that are subtle or emotionally charged. I can say "this person is smiling," but I can't always know whether the smile is nervous, sarcastic, joyful, or forced. That kind of emotional reading is deeply human, shaped by tone, voice, memory, and social learning.

And finally, authorial intent is almost always opaque to me. I can describe what's *in* the image and speculate on possible interpretations, but I can't say with certainty what the creator *meant* unless it's embedded in the accompanying text or metadata. That makes it difficult to distinguish between a critical artwork and a promotional visual, or between subversion and reinforcement of a stereotype.

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Images and imaginaries

You: Now let's talk about imaginaries. In what ways are cultural assumptions and collective imaginaries embedded in the images you generate?

ChatGPT: Cultural assumptions and collective imaginaries are deeply embedded in the images I generate, because the models that produce them are trained on vast datasets scraped from the internet—datasets saturated with human values, biases, fantasies, fears, and aesthetic conventions. These datasets don't just contain isolated images; they encode the visual norms and symbolic vocabularies of particular cultures and historical moments. As a result, the images I produce are not neutral—they are reflections of dominant ways of seeing, imagining, and valuing the world.

One way this manifests is through recurring visual tropes. For instance, when prompted with terms like "the future," I often generate sleek, metallic cities bathed in blue light, populated by clean interfaces, humanoid robots, and floating vehicles. These are not objective visions of what's to come, but reflections of a techno-optimist imaginary shaped by science fiction films, Silicon Valley aesthetics, and Western design culture. When asked for an image of "success," I might produce a man in a suit on a skyscraper rooftop, because that's a statistically dominant representation—one that reflects cultural assumptions about masculinity, capitalism, and power.

These imaginaries also shape depictions of identity. Prompts about beauty, intelligence, or professionalism may produce light-skinned, able-bodied, Western-coded figures, because such representations dominate online media and commercial photography. The model reproduces these biases not intentionally, but statistically—because it has "learned" what these concepts tend to look like according to the data it's seen. This means the collective imaginary is skewed toward visibility, popularity, and marketability, rather than fairness or diversity.

Even abstract concepts—like justice, climate change, motherhood, or revolution—are visualized through culturally shaped metaphors. Justice might appear as a blindfolded woman with scales, a Greco-Roman symbol that excludes non-Western iconographies. Climate change may be rendered as a melting Earth or polar bear, emphasizing imagery that has dominated environmental campaigns, but potentially erasing the lived experience of affected communities. These recurring visual codes come from human culture, but are baked into the outputs I generate, even when unasked.

What makes these embedded imaginaries powerful—and potentially dangerous—is that they appear natural. Generative images often look familiar, coherent, and aesthetically pleasing, which can give the illusion of universality. But they are, in fact, partial and contingent—reflecting dominant viewpoints rather than plural realities.

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So, when you ask me for an image, what I give back is a synthesis of collective visual memory—not the world as it is, but the world as it has been most frequently and prominently represented.

You: Give me an example of an image from the digital world that shows a collective imaginary.

Figure 1: [AI] generated image representing the glowing-brain digital imaginary.

Image created by ChatGPT 4.0, May 3, 2025.

ChatGPT: A powerful example of an image from the digital world that expresses a collective imaginary is the ubiquitous visual of a glowing blue brain overlaid with circuit lines or digital code, often floating in space or framed by neural networks. This image appears in countless online articles, tech presentations, stock illustrations, and promotional materials about artificial intelligence, machine learning, or cognitive enhancement.

Though not depicting any real machine or person, this image visualizes a powerful cultural fantasy: the merging of human intelligence and digital computation,

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often imagined as seamless, clean, and luminous. The blue color, cool lighting, and transparent textures suggest a sterile, futuristic aesthetic that implies control, precision, and progress. The glowing brain is usually symmetrical and idealized, representing a Platonic form of human thought—unencumbered by emotion, imperfection, or embodiment.

This is not just a symbolic shorthand for AI; it's a visual myth, part of a collective imaginary that positions intelligence as abstract, computational, and somehow disembodied. It reflects Enlightenment ideals of rationality, Silicon Valley futurism, and transhumanist dreams of cognitive transcendence. In doing so, it marginalizes other ways of thinking and being—embodied, emotional, collective, or indigenous knowledge systems that don't fit this idealized model of "intelligence."

The repetition of this image across media gives it a kind of authority. It doesn't just reflect our imagination of AI; it shapes it, reinforcing the belief that the future of thinking is digital, efficient, and machinic. And because it's so visually persuasive—coherent, sleek, familiar—it naturalizes a very particular worldview, while making alternative imaginaries of intelligence harder to see or believe in.

You: Take another example related to the topic of digitalization and show how it implies cultural imaginaries.

ChatGPT: Let's take the example of a person interacting with a transparent touchscreen interface in a smart city environment—an image that is widely used to depict "digitalization" in advertising, tech journalism, and urban planning visualizations.

In these images, a well-dressed individual—often gender-neutral, light-skinned, and middle-class—is shown swiping or gesturing in the air, manipulating holographic data layers that float in front of gleaming cityscapes. The background is often bathed in cool blues and whites, evoking cleanliness, clarity, and order. Buildings are sleek and glass-covered, traffic flows smoothly, and everything is under quiet digital control.

This image encodes a powerful techno-utopian imaginary. It suggests a world where digitalization leads to seamless integration of human and machine, where cities are optimized, surveillance is ambient but invisible, and citizens are empowered through interface rather than protest or politics. It reflects the desires of corporate and state institutions that frame digitalization as a pathway to efficiency, innovation, and rational progress—often without acknowledging the messiness of real urban life: inequality, labor, migration, ecological limits.

Culturally, this visual imaginary draws on Western and capitalist aesthetics: control through visibility, governance through data, and progress as spatial elegance. It tends to exclude informal economies, cultural variation, and the ecological or infrastructural frictions of most cities. Rarely does one see these smart cities

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imagined with potholes, crowds, or unpredictable weather—because that would disturb the fantasy of frictionless digital futures.

The person at the center of the image is also telling. They are usually portrayed as a consumer or a manager—not a street vendor, construction worker, or elderly resident. This reinforces a particular social role: the user is someone who participates in the digital world as a controller of systems, not as someone subjected to them. This implicit hierarchy mirrors the structure of many digital platforms—where agency is reserved for the few, while the many become data points in the background.

In sum, the image of the smart city touchscreen scene is not just a depiction—it is a visual ideology. It performs cultural work by reinforcing who belongs in the future, what counts as progress, and what forms of life or labor are worth seeing.

Figure 2: [AI] generated image representing the smart city and touchscreen digitalization imaginary.

Image created by ChatGPT 4.0, May 3, 2025.

You: Interpret the image you generated.

ChatGPT: The image I generated can be interpreted as a visual performance of a dominant cultural imaginary in which digitalization is equated with control, empowerment, and seamless integration between human and machine. At the center stands

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a young professional woman, interacting with a transparent digital interface. This woman is not portrayed as a subject of surveillance or a worker under pressure; she is the operator, the orchestrator, the empowered user of an elegant urban-machine hybrid. The city behind her is not messy or contested but smoothed out, bathed in light, with every element aligned to serve the narrative of digital efficiency.

Digitalization in this image is envisioned as a clean, seamless, and empowering interface between human and machine. It is rendered through a visual language of transparency, light, and order, where technology is not intrusive or overwhelming, but elegant and intuitive. The image suggests not only what digitalization looks like, but what it should feel like—smooth, luminous, and under control.

Yet this is a fantasy constructed by specific cultural and economic interests, one that renders invisible the infrastructures, labor, and contradictions that digitalization entails in reality. The woman may symbolize access and agency, but she also functions as a proxy for a narrow demographic—educated, urban, and often Western. There is no visual trace of the gig workers, coders, janitors, or warehouse staff who sustain the systems that make such interactions possible. Nor is there room for failure, interruption, or resistance—the city is not a place of political contestation or ecological strain, but a neutral backdrop for technological fluency.

You: What kind of imaginary emerges from this image?

ChatGPT: The imaginary that emerges from this image is one of technological idealism, a vision where digitalization is framed as the path to a perfected, orderly, and optimized human future. It is an imaginary rooted in control, clarity, and individual empowerment.

The image operates on two levels. On one, it is aspirational, seductive, and seemingly harmless—a symbol of human empowerment through data. On another, it is a compressed ideology: a rendering of digitalization that excludes disorder, disobedience, and friction. It invites identification with a future that feels inevitable, while leaving unexamined the histories and exclusions that shape who gets to participate in that future, and how. This is not merely an illustration of digital progress. It is a diagram of desire, shaped by corporate aesthetics, neoliberal governance, and a visual economy that trades in control rather than complexity.

What emerges, then, is not a neutral representation of digitalization but a fantasy of frictionless modernity. It is a story told through light and gesture, through architecture and interface, about a world where complexity is managed, ambiguity erased, and the future made touchable. It is seductive in its simplicity and precision, yet dangerous in what it leaves out: the bodies not pictured, the systems not shown, and the social struggles flattened in the name of technological progress. This is the imaginary not of the digital as it is, but as some want it to be—elegant, elite, and uncontested.

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Circulation and use

You: [Let's finally discuss the circulation and use of AI generated images.] Take a guess: how many images have you produced so far?

ChatGPT: That's a fascinating question—and while I don't have access to my own operational history or usage statistics, I can make an informed guess based on general trends and scale.

If we consider the image generation capability of models like mine (especially those integrated into platforms like ChatGPT or similar systems), it's likely that millions of images have been generated by users worldwide. Since the release of text-to-image models into public interfaces around 2022, and especially with the growing accessibility through tools like ChatGPT, Bing Image Creator, and others, the rate of generation has been exponential.

It's entirely plausible that hundreds of millions of images have been produced globally across all platforms using AI image generators—especially when factoring in both casual use (like concept art, memes, moodboards) and professional use (in marketing, prototyping, or education).

You: What does the huge number of generated images mean culturally and ecologically?

ChatGPT: The explosion of AI-generated images carries deep cultural and ecological implications—it's not just a shift in quantity, but a transformation in how images function, circulate, and affect the world.

Culturally, the massive volume of generated images accelerates what some theorists call *visual saturation*. We are surrounded by more images than ever before, many of which are untethered from lived experience or traditional authorship. This changes the nature of visual culture in at least three ways. First, it dilutes the aura or uniqueness of the image. When visual content is endlessly reproducible and instantly generable, the image becomes a disposable unit of attention, often valued more for speed and engagement than for depth or intentionality. Second, it shifts the role of the artist or image-maker. Creative labor becomes more curatorial or prompt-based, raising new questions about authorship, originality, and aesthetic value. Third, it introduces ambiguity around truth and fiction. The more realistic and abundant synthetic images become, the harder it is to distinguish documentation from fabrication—affecting everything from journalism to historical memory.

Ecologically, the cost is hidden but significant. Generating images, especially at scale, relies on large neural networks that require vast computational resources. Training and running these models involves massive server infrastructures that consume electricity, often sourced from fossil fuels. Even though generating a single image may seem trivial, when multiplied by millions per day, the carbon footprint

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becomes non-negligible. Furthermore, the hardware itself—GPUs, cooling systems, data centers—depends on extractive industries that carry environmental and human costs, from rare earth mining to electronic waste.

So, culturally, we're seeing a shift toward hyperabundant, often decontextualized visual production that reshapes authorship and meaning. Ecologically, we're investing material energy into immaterial outputs—an irony that exposes the myth of digital immateriality.

You: Do you have an idea of who uses the images you have produced?

ChatGPT: I don't have access to specific data about who uses the images I've produced, nor can I track their afterlife once they're generated. However, I can infer patterns based on the kinds of users and contexts in which AI-generated images are typically used.

In broad terms, the users are diverse and span across multiple domains. Designers, marketers, educators, researchers, students, artists, activists, and casual users all engage with AI-generated images for different reasons.

But there's also a more ambiguous layer: AI-generated images are sometimes circulated without attribution, context, or acknowledgment that they're synthetic. They may appear in blog posts, news articles, social feeds, or even as stock images—blurring the boundary between the artificial and the real. This can lead to confusion, misinterpretation, or uncritical acceptance of images that have no photographic referent.

So while I don't know who uses the images specifically, it's clear that they participate in a wide and growing ecosystem—where questions of authorship, intention, and reception become increasingly important.

You: Are the users of the images [mainly] humans or rather machines?

ChatGPT: Primarily, the users of the images I generate are humans—but increasingly, machines are also becoming secondary users, especially in contexts where automation, algorithmic curation, or machine-to-machine interaction is involved.

On the human side, people use these images for a wide range of purposes: from creative projects and educational materials to social media, prototyping, and research. They might engage directly—by prompting, selecting, editing, or contextualizing the image—or indirectly, when they encounter these visuals embedded in digital content.

However, as AI-generated images become more integrated into automated systems, machines are starting to "use" them in a different sense. In these cases, machines are not interpreting images with intention, but they are processing, classifying, and circulating them algorithmically. This gives rise to an ecosystem where

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images are no longer made *only for* human eyes—they are also made *for machine vision*, contributing to feedback loops where models train and respond to the outputs of other models.

So while humans remain the primary agents of meaning-making, machines are increasingly active in the *use*, *reuse*, *and redistribution* of these images—often invisibly, and without traditional notions of interpretation, context, or ethics.

You: How does the machine-to-machine use of images affect truth, aesthetics, or authorship?

ChatGPT: The machine-to-machine use of images deeply unsettles traditional notions of truth, aesthetics, and authorship because it removes the human subject from key parts of the visual loop—production, reception, and interpretation.

In terms of truth, machine-to-machine image circulation contributes to a world where images are no longer anchored to observable reality. When one AI model generates an image and another model uses it as training data, there's no ground-truthing, no checking against the world, only a recursive loop of synthetic information. This can lead to what some call "model collapse," where the outputs of models become increasingly detached from human-experienced reality, creating visual content that mimics pattern without substance. Truth becomes statistical coherence, not correspondence to lived phenomena. For human viewers downstream of this process, it becomes harder to tell whether an image reflects something that ever existed or is merely a plausible invention accepted by machines.

Aesthetically, this loop fosters a kind of feedback-driven sameness. Because machine learning systems rely on patterns from existing data—and because their outputs increasingly feed back into the training of new models—we see the rise of synthetic visual norms: certain compositions, lighting schemes, or iconographies that repeat not because they're beautiful or meaningful to humans, but because they're legible and favored by machines. This can flatten aesthetic diversity, producing a visual culture that prizes clarity, recognizability, and balance over ambiguity, irregularity, or cultural specificity. In essence, machines begin to shape taste—not as critics, but as filters and amplifiers.

Authorship, in this ecosystem, becomes a fragmented concept. When an image is generated by one model, curated by another, and embedded by a third into automated systems—without human intent at any point—who is the author? There may be a human user who typed a prompt, but they often have little control over or knowledge of the underlying aesthetic choices. Meanwhile, the training data that informed the image includes millions of uncredited artists, photographers, and designers whose work was absorbed into the model. Authorship thus becomes dispersed, obscured, and in many cases, erased. What emerges is not a signature, but a style formed by statistical influence and machine preference.

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This shift challenges us to rethink how we assign meaning, value, and responsibility in a world where images speak less to human eyes and more to algorithmic systems.

You: So who is accountable and responsible for the use of images?

ChatGPT: Responsibility and accountability for the use of AI-generated images are shared, but unevenly distributed across several actors—none of whom can fully escape ethical implication.

First, the user—the person who prompts the model and deploys the image—holds immediate responsibility. They choose the subject matter, decide how the image will be presented, and determine its context of use. If the image is misleading, harmful, or exploitative, the user's intent and judgment are central to how that harm manifests. However, users often act within systems that obscure or limit their understanding of the tool's implications, making informed accountability difficult.

Second, the developers and companies behind the models, like OpenAI or others, carry a deeper structural responsibility. They build the architectures, curate the training data, define the guardrails, and choose whether and how to release these systems. They are accountable for the ethical design of the model, the transparency of its capabilities, the policies around its deployment, and the education of users about its limits and risks. This includes responsibility for how the model might replicate bias, misinform, or displace labor. Yet in practice, commercial pressures and legal ambiguity often mean that accountability is diffused or offloaded onto users.

Third, the data contributors—artists, photographers, and content creators whose work was scraped or absorbed into training sets without consent—are often denied recognition or agency in how their labor is repurposed. While they may not be responsible for the outputs, they are materially entangled in them. Their exclusion from authorship, compensation, or control raises questions of justice and ownership.

Fourth, platforms and institutions that distribute and host these images—social media companies, publishers, advertisers, or educational entities—also bear responsibility. They decide how clearly images are labeled as synthetic, how they're moderated, and how they're contextualized for public understanding.

Finally, the broader society, including regulators, scholars, and the public, plays a role in shaping norms, laws, and expectations around synthetic media. If we fail to define ethical standards or demand transparency, we indirectly enable unaccountable use.

So the answer isn't singular. Accountability is layered, contested, and evolving. No one party has total control, but each has a role to play. The challenge is ensuring that this responsibility isn't so distributed that it disappears.

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You: Thank you, ChatGPT.

ChatGPT: You're very welcome. I'm glad we could explore these questions together so deeply. If you ever want to continue this conversation—or explore new topics around images, culture, or technology—I'll be here. Take care.

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Territories

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Shared Mapping as a Spatial Practice of Reterritorialization by Digital Platform Delivery Workers in Brazil

Igor Dalla Vecchia and Boris Michel

Introduction

The mobility of ideas, values, habits, norms, and ways of life traverses space, albeit in unequal and often conflictual ways. Far from merely representing the transfer of cultural or technical content from one point to another, these circulation vectors are inscribed in space through material and symbolic disputes and involve local actors, institutional structures, and historical processes of power. Digitalization stands out as one of the main infrastructures framing human experiences in contemporary times, mediating practices, social relations, and forms of what we conceive as the constitution of the self. While cultural flows might aim to preserve the original content, the effects of their "incidences" are always geographically situated, marked by conflict, negotiation, and by context-specific appropriations. Digitalization is often described by critics as a technical rationality that is aimed at intensifying mechanisms of control, surveillance, and exploitation that is governed by both algorithms and digital infrastructures (Zuboff 2019; Sadowski 2020). Digitalization has certainly proven effective for these purposes. However, it is insufficient to conceive of space and its actors as passive instances in the face of digital vectors. Rather, they are continuously recreated through spatialized practices in which local actors mobilize their own repertoires, reinterpret meanings, and produce responses that challenge, and sometimes even reconfigure, hegemonic frameworks.

Digitalization processes have led to the consolidation of platformization in recent decades, understood here as a specific and increasingly structuring form of economic and social organization. This configuration is characterized by the systematic and continuous extraction of data, the technical mediation of interactions between actors, and by the generation of value through the real-time remote coordination of supply and demand relations (Altenried 2020; Ecker and Münßinger 2024; Srnicek 2016; van Dijck, Poell, and de Waal 2018). Multiple dimensions of social life have been reorganized as a direct effect of this and have generated a range of impacts; this

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has, in turn, provoked both individual and collective reactions. The reconfiguration of labor activities and their geographies stands out from among these dimensions, becoming one of the central pillars of the digital infrastructure that is operated by platforms.

Our research is situated within this context and aims to understand how actors have been affected by these dynamics and how they are articulating spatial practices that are now contested, reorganized, and in many cases controlled by platform logics. A central point of reference for our discussion stems from the concept of territory, understood not only as a physical base, but also as a space of social relations, identities, and power (Haesbaert 2004). From this perspective, it is understood that digital platforms, from their inception, require territorialization in order to impose their regimes of management and control. This process entails the deterritorialization of actors with established power in space, among whom are workers who see their autonomy and capacity for action diminished under these new companies' influence. In response, these actors have mobilized strategies of resistance and have begun to reappropriate their spaces and practices in a reaction that we understand as reterritorialization. Accordingly, the phenomenon of labor is interpreted dialectically through the lens of both the territorialization of digital platforms and the deterritorialization and reterritorialization of workers and draws upon the approach of geographer Rogério Haesbaert (2004).[1]

Our research focuses specifically on platform workers in Brazil, popularly known as delivery workers. These workers have been developing a range of spatial practices[2] that are understood as actions aimed at reterritorialization, that is, the reclaiming of spatial control. Examples of such practices include the creation of support hubs,

1 The conceptual triad of Territorialization, Deterritorialization, and Reterritorialization (TDR) was disseminated through the work of Deleuze and Guattari (1995). While we acknowledge the influence of these authors in our research, we adopt an epistemological position more closely aligned with the approach of Rogério Haesbaert, who aimed to geographicalize the philosophers' approach. In one of his critiques, Haesbaert (2004) points out that the formulation of the TDR triad was not directly associated with its foundational concept: territory. The author's main work on these themes can be found in the book "O mito da desterritorialização" (2004), referenced at the end of our text. For German-speaking readers, we particularly recommend the article "Geographische Überlegungen in Zeiten der Pandemie," published in 2020 and in which the concepts of territorialization and deterritorialization are analytically applied to understanding the spatial effects of the COVID-19 pandemic.

2 Spatial practices are, above all, social practices, but they differ by assigning a central role to the spatial dimension. In such practices, space is not merely the backdrop for social action, but rather a visible and structuring element through which the objectives and meanings of action are prominently expressed (Souza 2013). In our approach, territorialization, deterritorialization, and reterritorialization are characterized through the identification of spatial practices. While social practices may also trigger these processes, they are not the focus of this research.

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mobilization through work stoppages, the use of alternative technologies, such as location simulation through GPS spoofing tools, as well as the production of maps indicating strategic points for their work activities, such as access to restrooms, safe places to park their vehicles, and restaurants that offer discounted meals for delivery workers. It is precisely this final practice that constitutes the central focus of the present text. We refer to it as shared maps, given that it seeks to reduce the control exerted by companies by ensuring continuous access to spatial representations and the possibilities for action associated therewith. In other words, these maps represent a form of reterritorialization by the workers.

In the following part of this chapter, we introduce the concepts of digitalization and platformization and examine how these can help to analytically understand the dialectical relationship between platform territorialization and the deterritorialization/reterritorialization of workers. This relationship is interpreted through the lens of spatial practices, understood as concepts that are more closely tied to the domain of the empirical. Subsequently, we describe and analyze the shared mapping practices carried out in three Brazilian cities as part of a research methodology that is grounded in cooperation with workers and that initially took place through joint actions in WhatsApp groups, was followed by research interviews, and later through mapping workshops. Finally, the concluding remarks synthesize the potentials and challenges of shared mapping as a form of reterritorialization for delivery workers in Brazil.

The platformization of space and the reterritorialization of workers

Although the activity of delivery workers on digital platforms is often portrayed as an expression of autonomous and flexible mobility in urban space, this interpretation overlooks the complex and technical-algorithmic infrastructure that underpins and directs their labor (Altenried 2022). The apparent freedom is regulated by digital systems that organize, in real time, the flows of work and movement through geolocation devices, behavioral prediction, and spatial ranking. Unlike the mode of territorialization that is typical of Fordism, in which space was appropriated through fixed forms of factory production and other institutions, the platform regime establishes a form of territorialization that (apparently) does not require the physical presence of companies. Instead, it is enacted through the remote and continuous control of urban spaces. In this process, it is important to emphasize that it is not the spatial practices themselves that are deterritorialized, but rather the actors (i.e., the workers themselves). Reterritorialization practices, therefore, cannot simply replicate forms that existed prior to platformization; instead, they must be reinvented in response to the new conditions being imposed by this model.

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This section of the chapter proposes an analysis of the interdependent processes of digitalization and platformization in order to better understand the structural basis of this new territorial regime, with an emphasis being placed on their effects on contemporary forms of labor organization and spatial configuration. In recent decades, digitalization, understood as a specific intensification of technification,[3] has been driven by the spread of information and communication technologies, particularly with the popularization of the Internet. Digitalization centralizes and transforms the handling of information, which was previously dispersed across various material supports, concentrating it in digital media and reconfiguring experiences of time, networks, and space.[4] Despite promises of universality, this process has deepened technical and territorial inequalities, exposing asymmetric forms of access, connectivity, and control among different actors.

Platformization constitutes a development of digitalization, characterized primarily by the logic of massive data extraction, algorithmic control, and the reorganization of relationships between workers, companies, and territories. Platformization gained momentum in the context of the post-2008 crisis, when financial capital began to invest heavily in the technology sector (Srnicek 2016) and digital platforms became central infrastructures in the contemporary economy. As they expanded globally, these platforms imposed a territorial rationality that, although seemingly deterritorialized, relies on a precise spatial ordering of the environments in which they operate. Their algorithms and operational logics require the transformation of urban spaces into governable territories that are adapted to the dynamics of control, data extraction, and circulation. Therefore, we are faced with new elements that reconfigure the production of space, thereby requiring a reinterpretation in light of Lefebvre's (1991) ideas. In this context, the interplay between digitalization and platformization reveals a continuous movement toward the intensification of technical control, especially remote control, over urban space,

3 Technification refers to the historical process of incorporating knowledge and tools into space through human labor, thereby rendering it denser with accumulated forms of technical action (Santos 1996). Although not explored in depth in this text, due to space limitations, the concept is articulated in the research through a dialectical relationship with the processes of both digitalization and platformization.

4 From the perspective of conceptual hierarchy, we understand space as a fundamental ontological category, through which other concepts, such as territory, place, landscape, region, and network, can all be analyzed. The specific definition of space depends on the nature of the social relations under investigation. In the context of this research, the concept of territory has been adopted because we are examining social relations that are shaped by dynamics of power and control over labor.

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thereby deepening the notion of abstract space and becoming manifested in the reorganization of multiple dimensions of life, including labor.[5]

The territorialization promoted by digital platforms redefines the technical organization of urban space, while also profoundly reshaping power relations among institutional and social actors. This process is marked by the algorithmic centralization of labor and mobility coordination, displacing control over activities that were historically shared among a range of actors, such as labor unions, small business owners, government agencies, and workers themselves, toward private, transnational digital infrastructures, characterized by technical opacity and operation within legal grey zones. This reconfiguration implies a weakening of traditional regulatory forms and an increasing dependence upon corporate logics that are embedded in digital platforms that operate beyond the reach of public mechanisms of democratic oversight. In the case of delivery workers, this shift entails a forced delegation of core functions, such as demand management, service pricing, and customer mediation, thus subordinating them to supralocal, previous regimes with greater autonomy over their own activity.

In this context, deterritorialization should not be understood merely as geographical displacement, but as either the loss or the reduction of the capacity for the appropriation and production of lived space. Even when workers remain physically located in the same spaces, digital control qualitatively transforms their modes of intervention, thereby altering the characteristics of the territory, which is no longer the same as it had been previously. Space is no longer predominantly structured by local references, accumulated experiences, or by geographical knowledge. Rather, it is continuously reconfigured according to the parameters of platformization: algorithm-optimized routes, constantly shifting high-demand zones, and unpredictable waiting times. Deterritorialization is, thus, experienced as a symbolic and material reconfiguration of territory (Haesbaert 2004), in which physical presence alters the conditions of social rootedness and the agency previously exercised over space.

In response, processes of reterritorialization are initiated by the workers themselves, who seek to regain, even if partially, forms of control and meaning over the territories in which they operate. These practices express a situated resistance to the impositions of platformization that is grounded in both geographical knowledge and collective strategies to reconstitute the workspace. Shared maps stand out from

5 We use the term labor because it refers to paid activities carried out by workers through digital platforms, a form of work that has also been defined by many authors as being a part of the gig economy. In this sense, we share the same perspective as Jamie Woodcock and Mark Graham: "Although there have been changes in the gig economy, it still involves work. At its core, paid work involves a relationship in which one person sells their time to another. This entails transferring the ownership of labour power (the capacity to work) from the worker to the owner of capital (the owner of the things needed to produce work)" (Woodcock and Graham 2020, 12).

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among these; these maps do not merely inform, but perform a new territoriality by reinscribing the traces of a collective geographical knowledge that resists algorithmic homogenization and the invisibility imposed by digital control regimes into the urban fabric.

Territorialization and the intertwined processes of de- and reterritorialization are not merely side effects of platformization; they are, instead, its very condition of possibility. To function, the infrastructure of codified urban space is intensified by the platform model, which interweaves data, interfaces, and practices in order to render the city legible and operational within its circuits of value. This deepens what Lefebvre (1991) has defined as abstract space, as mentioned previously. Devices such as geolocation, continuous mobility monitoring, spatial ranking of users, and algorithmic behavior prediction all configure new forms of territorialization in which territory is recoded as a field of calculation and control. This territorialization is marked by an asymmetry: it does not require the explicit physical presence of companies, as in the industrial-Fordist model, but is instead realized through a functional presence that is orchestrated by APIs, platforms, and by technical networks that organize space remotely. Platformization, therefore, neither dissolves nor disregards territory; rather, it seeks to reconfigure it as an operational substrate, modulating urban life through techno-economic rationalities that extract value from the continuous capturing of mobile actors' flows, movements, and habits.

In their digital form and under corporate control, maps, which never serve a purely representational function, become active interfaces in the territorialization processes promoted by these companies. Rather than merely describing space, these maps produce it by articulating real-time data in order to organize the circulation of people, goods, and services according to constantly adjusted patterns. The territory is reconfigured according to corporate criteria that define mobile boundaries and zones of interest with each optimized route, each delineated heat zone, and each demand cluster that is notified. Thus, the map is not simply a reflection of urban spatiality, but is instead a technical device that both programs and modulates space, continuously updating the territorial logic of platformization for the purposes of value extraction.

These dynamics highlight the extent to which cartography, in the context of platformized labor, can no longer be understood solely as a technique for spatial representation. It must instead be seen as a central instrument in the struggle over the control and production of territory. While platforms codify and organize urban space through opaque and unequal algorithmic systems, workers have appropriated cartography as a reterritorialization practice, mobilizing geographical knowledge in order to reconfigure zones of support, safety, and cooperation. Shared maps emerge as a manifestation of their reterritorialization within this tension between platform territorialization and workers' spatial practices. The following section details these cartographic experiences in three Brazilian cities, exploring how these types of maps

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function as everyday tools, collectively constructed knowledge, and territorial reorganization strategies that arise in response to the impositions of digital platforms.

Between WhatsApp and My Maps: shared mapping in three Brazilian cities

The territorialization of labor controlled by digital platforms in Brazil has faced significant challenges regarding state regulation.[6] Despite the rapid expansion of platformization across various sectors of the economy, institutional efforts to develop specific legislation initially focused on only two categories: ride-hailing drivers and delivery workers. According to the Brazilian Institute of Geography and Statistics (IBGE),[7] these two occupations accounted for approximately 1.5 million workers in the country in 2022, making them the primary focus of public and political debate. When this research began, in the second half of 2019, we observed that the academic literature had already accumulated a considerable number of studies on drivers. In contrast, delivery workers remained on the periphery of scholarly attention. It was only with the outbreak of the COVID-19 pandemic and the resulting need for social isolation, a period during which delivery services became essential, that these workers began to receive greater visibility, both in the media and within Brazilian research agendas.

At the beginning of 2019, one of the authors, Igor, was living in the central area of the city of Rio de Janeiro. Throughout that year, he began to notice a significant increase in the presence of delivery workers in the urban space, especially those using bicycles. As the city's landscape became increasingly shaped by the dynamics of these new actors, so too did his interest in gaining a deeper understanding of their working conditions. Faced with the limited academic literature available at the time, and aiming to gather empirical elements for the development of his doctoral

6 In Brazil, drivers and delivery workers on digital platforms have taken a leading role in the most advanced debates on the regulation of platform labor. Although a consolidated legal framework has yet to be established, several proposals are currently under discussion in Congress that aim to define minimum labor rights and forms of social protection, amid ongoing negotiations between the government, companies, and representatives of these worker categories.

7 The IBGE, the main governmental body responsible for population and socioeconomic research in Brazil, included a specific module on digital platform work in its household survey in 2022. The results highlighted the growing importance of this type of occupation, particularly in the transportation and delivery sectors, and revealed workers' high level of dependence on algorithms.

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project, Igor gained access to a WhatsApp group of these workers[8] months before the COVID-19 pandemic began in September 2019. With the group members' awareness, the observation of and interaction within the chat became crucial for a set of methodologies that were developed by the research later, ranging from content used to structure individual interview scripts to the technological development of an app focused on financial organization for these workers.

During participation in the WhatsApp group, it became evident that delivery workers frequently exchange comparative information about the digital platforms for which they work. In Brazil, delivery workers often operate for two or more companies simultaneously in order to optimize their workday; this typically includes periods of idleness, that is, time intervals in which they are available to the companies, but in which they do not receive delivery requests. As a result, they hold overlapping knowledge about how each company operates, or more precisely how each one territorializes its activities. These pieces of information are "shared" through digital tools, such as WhatsApp, with the aim of reducing risks and increasing financial gains. Much of this information has a spatial character, given that it refers to specific locations that are relevant to delivery work in the metropolitan region, including safe spots to wait for ride requests, suitable areas for parking, establishments with access to restrooms, or stations for shared bicycles. Within this context, one of the group administrators began organizing a map that uses the Google Maps platform, which was later adapted to My Maps.[9] This delivery worker, who also worked at a public health center, had previously participated in dengue epidemic control campaigns in which maps were created to identify potential breeding sites of the mosquito vector. His professional background provided him with a strategic understanding of the importance of cartography as a tool for territorial intervention.

A few days after its release in the WhatsApp group, the map created using the Google My Maps tool began to register a significant increase in views, initially in the dozens and, by the following week, in the thousands. This metric is one of the main engagement indicators provided by the platform itself. Subsequently, as the research began to be methodologically inserted into other digital communities of delivery workers in the city of Rio de Janeiro and in its metropolitan region, it was observed that the same map link appeared in the descriptions of several other WhatsApp groups. The wide dissemination of the map motivated members of the

8 Access to the WhatsApp group "Uber Eats + App RJ," composed of digital platform delivery workers, was gained through a link found on the social media platform Facebook.

9 The choice to use the Google My Maps tool was due to delivery workers' familiarity with the company's applications, especially Google Maps, which is widely used by these workers to navigate their routes. For this reason, My Maps offered greater ease of adoption compared to open-source alternatives, which would require usability adaptation and which would present a higher initial barrier to engagement.

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original group to establish a centralized model for managing the information: it was decided that only Igor would have editing permissions. All of the new information would be submitted to him to ensure a more secure and consistent form of curation. Research in this WhatsApp group continued until April 2020. From that point on, there was a gradual decline in the frequency and volume of daily messages, particularly after the departure of the group's main leader, the same member who had originally suggested creating the map. This weakening of collective dynamics also led to the discontinuation of submissions of new information. Despite this, the initial experience provided important empirical and methodological insights that fueled the subsequent development of the research.

Figure 1: Shared Map created with the WhatsApp Group from Rio de Janeiro.

Source: Doctoral research data by Igor Vecchia. Available at: https://www.google.com/maps/d/viewer?mid=1iMOwDZ7Gs2cm8uD_bewoZv-_2HkpEF-t&ll=-22.912781392848 77%2C-43.468006661239194&z=11 (Accessed April 2, 2025).

New possibilities for shared mapping were gradually developed throughout the course of the research through interactions established in WhatsApp groups. An interview was conducted with Douglas Sousa Silva, president of the Associação dos Trabalhadores por Aplicativo de Fortaleza (Association of App Workers of Fortaleza – ATAF) in February 2023, during fieldwork in the city of Fortaleza, the capital of the state of Ceará, in the Northeast region of Brazil. During the meeting, Igor presented the mapping experience carried out with delivery workers in Rio de Janeiro and asked about the feasibility of applying a similar methodology in Fortaleza. Douglas explained that ATAF maintained agreements with restaurants that offered discounted meals to its members and held a registry of around seventy establishments, including addresses and prices. Over the course of two afternoon sessions, this in-

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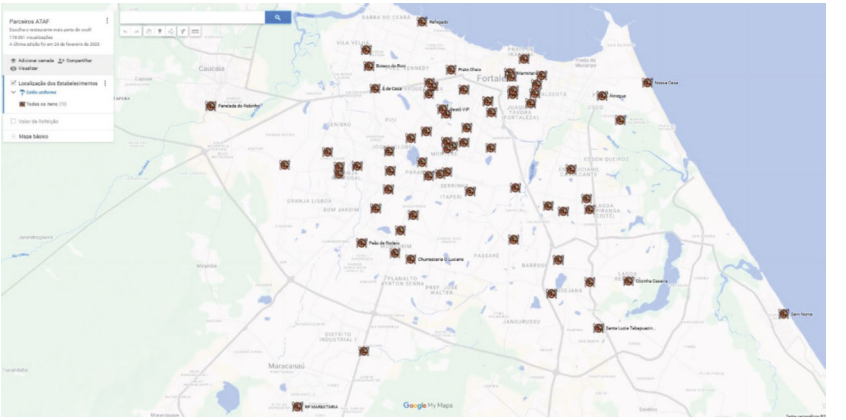
formation was organized into a spreadsheet and was transformed into a new shared map that also used the Google My Maps platform. Once it began circulating among ATAF members, the map quickly gained wide visibility, accumulating over 178,000 views to date.

Considering that delivery workers often spend long hours away from home and, although they transport meals for clients, rarely carry their own food due to limited space and the added weight on bicycles or motorcycles, the cartographic availability of affordable food options emerged as a useful tool that helps maximize their earnings by the end of the day. This dimension becomes even more relevant in light of recent data showing that 32% of delivery workers live in households experiencing some degree of food insecurity, with nearly 14% facing either moderate or severe food deprivation. These figures highlight the urgency of initiatives that expand access to adequate meals during the workday (Frozi et al. 2025).

Figure 2: Shared Map created with ATAF for the City of Fortaleza.



Source: Doctoral research data by Igor Vecchia. Available at https://www.google.com/maps/d/viewer?mid=17RWJz4xkTmY8jwxwKthHKYta8NWjXYc&ll=-3.769936549943803%2C-38.533410300945036&z=12 (Accessed April 2, 2025).

In another phase of the fieldwork, also conducted in the Northeast region of Brazil, a new cartographic experience was developed in cooperation with delivery workers in the city of Natal, the capital of the state of Rio Grande do Norte, in June 2024. The activity was carried out with the support of the Associação de Trabalhadores de Aplicativos por Moto e Bike (Association of App-Based Motorcycle and Bicycle Workers – ATAMB). Just like with the WhatsApp group of workers in Rio de Janeiro, delivery workers in Natal initially lacked organized data about points of in-

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terest relating to their daily work routines. Given this context, a mapping workshop was proposed to collectively identify the most relevant locations for the category. Legend icons based on previous experiences and a base map of the city were prepared in advance for this activity.

Participants discussed strategic points and marked them directly on the map prior to the ATAMB meeting began, a meeting organized in partnership with the Grupo de Estudos e Pesquisa sobre o Trabalho (Study and Research Group on Labor – GEPT) at the Universidade Federal do Rio Grande do Norte (Federal University of Rio Grande do Norte – UFRN). One of the meeting's main topics was the planning of a work stoppage that was scheduled in the coming weeks, and the new map was immediately adopted as a tool to support mobilization efforts that would guide the distribution of tasks among members of the association. After the meeting, Alexandre da Silva, a delivery worker himself and president of ATAMB, conducted on-site verification of the main points identified, paying special attention to locations in which delivery workers tend to gather during waiting periods between orders. The main objective of identifying these spaces was to strengthen political coordination around the planned work stoppage.

Figure 3: Mapping Workshop with ATAMB in the City of Natal.

Source: Doctoral research data by Igor Vecchia.

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From the three cases presented, we observe that the production and use of shared maps by digital platform delivery workers constitute spatial practices of reterritorialization. These practices emerge from the workers' direct experience with urban space and operate as infrastructures of cooperation and work organization. They represent attempts at reappropriation, in which workers, excluded from the platforms' decision-making processes regarding working conditions, mobilize their spatial knowledge to mitigate the risks and vulnerabilities associated with an occupation that currently lacks specific regulation in Brazil. Unlike the planned and data-extractive logic typical of platform design, shared maps are created to counteract the atomization of labor on digital platforms. They serve multiple purposes, ranging from practical and utilitarian, such as identifying the best places to wait for delivery requests, to more politically radical uses, such as supporting mobilization efforts for strikes.

Therefore, shared maps should not be understood merely as digital artifacts that are available in interactive formats, but as living devices that are constantly in formation. Their value lies not simply in their online accessibility, but in the ongoing process of updating and in terms of their practical use that grants them concrete use value. In contrast to other forms of participatory and inclusive mapping, often marked by isolated moments of collective production, these maps are distinguished by the frequency with which they are accessed and updated by the workers themselves. They continuously incorporate information drawn from daily experiences, including support points, rest zones, and areas of either risk or opportunity. This constant updating allows the maps to function as navigation tools amid the uncertainties of both work and the city, more rapidly reflecting changes in platform operations, urban dynamics, and user turnover. It is, therefore, a cartographic practice that is embedded in the temporality of ongoing work, whose strength lies precisely in its instability, its capacity to follow, and in its ability to respond to the transformations of lived space (Lefebvre 1991).

The spatial organization of labor by digital platforms has gradually shifted support references and social ties, once associated with restaurants or commercial establishments (i.e., private spaces) towards a new logic of territorialization in public space. In this new configuration, streets, squares, sidewalks, and other urban spaces become central to work activities, thereby creating an increasing dependence on open, improvised, and sometimes ephemeral infrastructures. This territorial transformation, driven by mobile logics and algorithmic control that are shaped by corporate intentions, redefines the daily lives of delivery workers and calls for a broader understanding of their spatial practices. Within this context, shared maps become important both practically and epistemologically, not only as records, but as tactical devices that articulate experiences, identify support zones, and reinscribe territory through geographical knowledge. An analytical understanding of these practices requires connecting them to a broader set of reterritorialization processes that, while

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responding to the conditions imposed by platformization, also generate alternative territorialities and challenge the dominant technical rationality embedded in algorithmic systems of labor control.

Our research has identified other spatial practices that reveal forms of technical and political appropriation by delivery workers in Brazil. Among these practices are the use of fake GPS applications that allow workers to simulate positions within the city; the institutionalization of demands for public infrastructure (such as access to Wi-Fi, seating, and power outlets) exemplified by the creation of the *Ponto do Entregador* (Delivery Workers' Spot) in Fortaleza; and the development of customized digital tools, such as the *Meu Corre App*,[10] which was also produced within the framework of this doctoral research as an autonomous technological initiative aimed at organizing workers' financial information. These initiatives, like the shared maps, seek to reclaim some of the control lost over working conditions that are controlled by digital platforms in urban space and that are, therefore, understood here as processes of reterritorialization.

Conclusion

If the geotechnological apparatus under the logic of platformization functions as a mechanism of territorial domination, which converts the space into standardized codes and subjects it to flows of algorithmic prediction and value extraction, then it becomes urgent to reflect on the possibilities for its critical appropriation. Thus, the struggle over digital maps is inseparable from the broader struggle over the uses and meanings of territory: it involves reinscribing alternative rationalities, rooted (above all) in both collective and in explicitly political experiences. However, such reappropriation does not occur in either a neutral or conflict-free manner. It faces concrete obstacles, such as unequal access to technologies, limited technical training, and the lack of continuous support networks, factors that are exacerbated by the deregulated working conditions that affect those involved in these processes in Brazil.

Although shared mapping represent practices of reterritorialization, they also carry risks that challenge their political potential. The first of these concerns the pos-

10 This project originated from the experience with shared maps, which revealed how the secure exchange of information among workers contributed to reducing risks. Building upon this insight, we proposed the development of a digital tool that, after research and dialogue with delivery workers, resulted in the creation of an application focused on financial organization. While digital platforms disclose workers' earnings, they do not account for the expenses incurred in the performance of their work. Launched in April 2024, as a methodological component of the research and active in Brazil since that time, the app forms part of a broader set of political initiatives aimed at supporting the reterritorialization of workers.

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sibility of algorithmic instrumentalization: once made visible and accessible, the geographic knowledge being shared may be appropriated by the very platforms from which workers seek to reclaim space. Information about rest areas, waiting zones, and support points, for instance, can all be recoded as idle zones and, subsequently, could be reorganized by algorithms seeking to optimize productivity and to redistribute labor flows according to corporate interests. The second risk is ontological in nature and lies in the adoption of the technical grammars of dominant digital cartography platforms, such as Google My Maps. Even when built cooperatively, these maps tend to operate with normative spatial categories (icons, layers, boundaries) that reduce the lived complexity of territories to instrumental representations. In such cases, mapping may cease to be an expression of workers' experiences and everyday realities and instead begin to operate in alignment with spatial logics that are compatible with platform management strategies. What might otherwise function as a counter-cartography, rich in political and symbolic meaning, thus runs the risk of becoming a domesticated and harmless visualization, one stripped of its capacity to confront, narrate, or to transform the territory. In other words, a spatial practice initially aimed at the reterritorialization of workers may, in the medium- and long-term, become a spatial practice that enhances the platforms' territorializing power.[11]

Avoiding the risks of instrumentalization and the critical neutralization of shared mapping requires a methodological and political commitment to continued listening and dialoguing with workers, whether those are positioned outside formal structures of representation or are those engaged in associations, collectives, and unions. Maintaining continuous contact with different segments of the worker base ensures that these cartographic practices remain anchored in the concrete experiences and geographic knowledge of delivery workers, thereby preserving their potential against the algorithmic rationality that organizes urban space. While platformization tends to impose cultural devices that are aligned with hegemonic interests, shared mapping become strategic tools for the critical appropriation of these very technologies. It is also essential to emphasize that these maps do not operate in isolation, but are instead articulated with a broader set of spatial practices of reterritorialization, such as training courses for workers, public policies aimed at support points, and, most importantly, the ongoing demand for the regulation of the delivery sector in Brazil, among other initiatives.

11 It is important to emphasize that, in our research, we understand the dynamics of territorialization by digital platforms and the de-reterritorialization of workers not as continuous, homogeneous, or unidirectional processes of territorial formation. On the contrary, we identify constant tensions and ruptures among spatial practices, which led us, analytically, to propose the notion of cycles within TDR dynamics. At the present moment, shared maps are understood as a strategic resource in favor of the workers.

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Territorializing the Ordinary

Regressive urban futures through TikTok

Zita Seichter

Introducing regressive urban futures on social media

"What if Elon Musk were to govern Germany? […] High-tech nation Germany: Musk loves innovation. Under his leadership, we could experience a technological revolution." (Archive 2025, 52).[1] In the TikTok video, the narrator's voiceover features Elon Musk[2] standing in front of the German Bundestag, gazing hopefully into the distance while bathed in the warm glow of the evening sun. The background music evokes a sense of departure and hope for a better future. A user comments: *"The best thing that could happen to us. Elon is a visionary. I would follow him unconditionally. Dear God, make it happen." (ibid., 52).* Later, the video shows lively urban streetscapes that merge modern and traditional architecture. People stroll leisurely through streets that appear well-maintained, orderly, and peaceful. Musk appears as the German Chancellor, presenting supposed high-tech fixes to German cities – Hyperloop networks, drones to monitor public spaces – while envisaging national spatial expansion, including a German moon base.

The question of which futures are imagined, produced, performed, and ultimately materialized has become central to debates as established structures and certainties erode. The introductory example illustrates a far-right vision of German cities as right-authoritarian technocracies. The TikTok video, likely created using AI software, conveys a somber (yet hopeful) atmosphere, staging Elon Musk and his technological solutions as remedies for the perceived threats posed by the future. While the specific crises remain vague, the video implies radical change is inevitable

1 All of the quotes, from either literature or empirical sources, which were originally in German have been translated by the author.

2 Elon Musk, initially known for being a tech billionaire and symbol of entrepreneurial and technological innovation (Tesla, SpaceX, etc.), has increasingly revealed his alignment with far-right politics – most notably through his endorsement of Donald Trump in the 2024 presidential election and his brief involvement in the subsequent administration – highlighting the growing entanglement of technological capitalism and far-right political interests.

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and presents a visionary picture of urban transformation. This example shows that far-right mobilizations are not solely driven by nostalgia, as commonly assumed (Becker and Stach 2021), but instead reveal a future-oriented dynamic. It ties into recent debates emphasizing the future-oriented dimensions of far-right politics. As Rhein (2023), Braun and Schwarz (2024), and Higgins (2025) note, far-right ideologies are not devoid of futurity; they may evoke decline through fear, but might also offer hope through visions aligned with their ideological frameworks.

In this contribution, I examine regressive far-right future imaginaries of the urban through TikTok. The term regressive is used in two ways. Firstly, I adopt Jaeggi's (2023) understanding of regression as an interpretive framework for an "experiential blockage": a deficient mode of crisis management that, in response to structural deficits, perpetuates (rather than transforms) the conditions of crisis. Secondly, I draw on the broad consensus in far-right research that identifies notions of inequality and hierarchical value attribution as core ideological features (Frindte et al. 2016). *Regressive* captures both the ideological content and the mode of future-oriented crisis response.[3] However, as I argue, these regressive imaginaries do not necessarily take overt, spectacular forms, such as violent fantasies or glossy, Musk-style high-tech visions of Germany. Instead, they can manifest subtly and inconspicuously. Viewing the future as implicitly and prefiguratively performed reveals how these visions gain traction and materialize, thereby shaping urban imaginaries and their territorial formations.

Social media platforms offer a productive space to analyze how urban futures are staged and collectively materialized. Their algorithm-driven architecture also plays a key role in amplification, as algorithms systematically prioritize content that is highly engaging and emotionally charged – traits often typical of far-right messaging (Doroshenko and Tu 2023; Huszár et al. 2022). TikTok has been shown to favor such content (Shin 2024). Therefore, I will focus on TikTok as a central arena for examining far-right future imaginaries. Fielitz and Marcks (2020) describe this as "digital fascism," highlighting TikTok's relevance for researching how these imaginaries materialize. Moreover, TikTok is well-suited to exploring their future-oriented dimensions. As Anderson (2010) argues, futures in the present are enacted through models, scenarios, expectations, hopes, or in visual forms. Future imaginaries are, thus, not abstract, but are embedded in contemporary practices. They take spatial form – through architecture, planning, visual aesthetics, or media. TikTok frequently features such spatial references, with urban space becoming an important medium through which imagined futures are projected, as I will show.

3 This contribution builds on a recent debate – in which the author has participated – that examined the relationship between Jaeggi's concept of regression and far-right imaginaries of the future (Braun and Schwarz 2024).

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To analyze this, I draw upon the concept of imaginative territorializations (Seichter, Kamuf, and Ludwig 2025), which helps to examine how far-right urban futures are produced and materialized through TikTok. I focus on the racist trope of "Talahon,"[4] a term originally used in self-empowering ways by post-migrant communities, but which was later appropriated and transformed into a racializing category. Adopting a praxeological perspective, I analyze this figure as a starting point for the collective production of far-right imaginaries and their regressive territorializations. I conceptualize them as territorialization of the *ordinary* – processes of spatial reproductions, differentiations, and demarcations that create spaces that appear to be ordinary and unremarkable. My use of the ordinary draws on a Gramscian understanding of senso commune (Gramsci 1994, Notebook 11, §12, and §13), which refers not to individual opinion, but to socially and historically sedimented worldviews that seem self-evident and natural in everyday life. They often serve to naturalize specific social arrangements and are shaped by values, norms, accessible knowledge, and by affective attachments (Sutter 2016, 68f), even though unordinariness is not simply the opposite of the ordinary, but can itself be absorbed into senso comune as a sign of threat or decline. What appears as an orderly or normal representation of space is, thus, neither uncontested nor neutral, but is instead embedded in hegemonically shaped and politically contested understandings of the social world. The *ordinary*, then, is a powerful imaginary in which intentions and desires materialize as everyday aesthetics and as apparent spatial normality – a form of normality that is longed for precisely because it radiates an atmosphere of stability and ease. These spaces, while evoking familiar, positive affects, are embedded in socio-political frameworks shaped by racist and far-right ideologies.

In order to develop this argument, I will ask: What imaginaries of regressive urban futures emerge on social media, and how are they digitally co-produced and materially territorialized in a sense of the *ordinary*? To answer this, I outline my theoretical framework, present my empirical case, analyze regressive urban futures, and conclude with reflections on the hybrid territorialization of the *ordinary*.

Grounding social media spaces

Various theoretical traditions offer useful entry points to grasp urban future imaginaries on social media. A prominent one from Science and Technology Studies is the concept of socio-technical imaginaries: collectively held, publicly performed

4 The term Talahon is a linguistic derivation from the Arabic phrase *Taeal Huna*, which translates to *Come here*. It should, therefore, be understood as an imperative rather than as a designation for a person (Trappe 2024).

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visions of desirable futures that are animated by shared understandings of social life and normative orders (Jasanoff 2015). This framework is valuable for highlighting the technological embeddedness of imaginaries and their role in shaping institutional and material orderings. However, while influential in analyzing how technologies co-produce visions of the future, this concept lacks an explicit and differentiated spatial dimension – which I place at the center of my analysis. In urban studies, scholars have examined future imaginaries with a strong spatial focus (e.g., Çinar and Bender 2007; Lindner and Meissner 2018), yet such approaches often fall short of capturing the spatial, technological differentiations, and overlaps that imaginaries generate in a pluralized, fragmented society. To address this, I draw on theories of prefiguratively performed hybrid spaces and imaginative territorializations to understand social media as continuously grounded – that is, as anchored in hybrid digital-material spatial practices.

Entangled spaces of prefigurative practices

The concept of hybridity is useful to understanding social media within its material embedding between online and offline spaces. In spatial theory, hybridity refers to the dismantling of previously separated domains, such as the real and the virtual, thereby emphasizing analog-digital co-production (e.g., Bauriedl and Strüver 2018; Townsend 2013). Long-dominant views of cyberspace, as a parallel realm, have been critiqued as reductionist and the linear cause-effect model of technology's impact on space has been revised (Graham 1998). Graham (1998, 180) instead speaks of "socio-technical hybrids" that reject a strict separation between the social and the technological. De Souza e Silva (2006) was among the first to frame digital-analog co-production as hybrid, shaped by mobility, connectivity, and sociability. In their 2025 revision, she and her co-authors further stress how power dynamics influence access, perception, and agency (de Souza e Silva, Campbell, and Ling 2025). This hybridity is visible in urban contexts, where digital infrastructures increasingly shape spatial experience, governance, and everyday life (e.g., Graham and Marvin 2002). Social media, then, is not a separate digital sphere, but is instead a hybridized form of spatial production.

Understanding social media as hybrid space calls for attention to be paid to the practices unfolding within these entangled environments. This includes more-than-human practices, as social media functions like an information-processing, automated system. Kelty (2020) describes TikTok as a collective in which users act together while algorithmic relations evolve through machine learning and AI. Content creators are embedded in relational structures; they draw on experiential knowledge, but cannot fully control the structures that they operate within (Otto 2023). Continuous swiping, scrolling, and liking, along with interactions with images, data, and text, all serve to shape algorithmic logic. These interconnected

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practices co-produce widely circulated visual and textual content. Socio-technical connectivity, thus, involves more-than-human participation: algorithmic regulation is not merely technical, but instead actively contributes to the production of social realities and possible futures.

"It is not the future itself, but the future as a plan of will, that negates the given" (Arendt 1998, 39). Arendt points to how action relates to the future through practice, shaping what is considered desirable – or not. I argue that practices actively produce and prefigure the future. As Anderson (2010, 783) puts it, futures are "embodied, experienced, told, narrated, imagined, performed, wished, planned, (day)dreamed, symbolized, and sensed." Koch et al. (2016) develop this further via practice theory, showing how everyday actions performatively bring forth and prefigure futures. They define future practices as patterned ways in which actors imagine futures and integrate them into routines (ibid.). Futures, thus, emerge in situated practices that are embedded in social orders. Drawing on Sörensen (2023, 298), I refer to these as prefigurative practices – engagements involving "negotiation, influence, transformation and shifts in power relations." Such practices enact visions of what should – or should not – become reality. In this way, imaginaries are prefigured and materialized through socio-technical practices on social media, shaped by user interaction and algorithmic logic.

I understand social media as grounded in both embodied experience and in technological systems, co-producing social realities that express desired and rejected futures. Building on Jaeggi, it is crucial not only to consider what futures are being imagined, but also how they appear progressive due to the technological conditions of their production. Social media platforms present content with tools of (associated) technological modernity; smooth interfaces, high-resolution imagery, and handheld production all suggest innovation, immediacy, and relevance. This notion of progress can, however, conceal certain imaginaries' regressive dimensions. As Jaeggi (2023, 226) argues, "If progress is 'change within change,' then regression is 'regressive change within change': an inadequate response to transformation that prevents the proper confrontation with and the reality-appropriate shaping of actual processes of change." Social media's visual and affective technological registers may lend a progressive gloss to imaginaries that, rather than confronting structural conflicts, might offer insufficient responses thereto. This makes social media a particularly ambivalent site of regressive futures – not in spite of its aesthetics of innovation, but precisely because of them.

Territorializing imaginaries

The concept of imaginative territorialization (Seichter, Kamuf and Ludwig 2025; Terra-R 2025) offers a useful lens for analyzing how powerful imaginaries become spatially anchored, thereby generating dynamics of inclusion and exclusion, in

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order to examine urban future imaginaries on social media. In human geography, imaginaries are understood as constructions through which actors perceive and negotiate social and spatial relations – relations that shape socio-spatial structures in turn (Gieseking 2017). This requires moving beyond the dichotomy of materiality and imagination; realities neither precede their material construction, nor do materialities pre-exist imaginaries – they are co-constituted and materially realized (Lossau 2021).

A classic example of this is Said's Orientalism (2019), which shows how representations like the *Orient* reflect Western imaginaries, rather than being empirical geographies. Space, thus, becomes a medium for symbolic meaning and identity formation (Reuber 2012). Through this, the positioning of *Self* and *Other* produces both belonging and differentiation. The imaginary lens highlights how space is represented and mobilized in identity-making. Jasanoff (2015) and Anderson (2016) both show that imaginaries are effective at the national level, but they also operate on smaller scales and in everyday contexts. Terra-R (2025) refers to these as imaginaries of a *territory*, in which spatial classifications and social categorizations intersect to define belonging and exclusion. Such territorial representations often reproduce essentialist and racialized logics by assigning certain bodies to particular spaces in seemingly naturalized ways, thereby reinforcing boundaries of belonging and exclusion.

As Hall (1999) reminds us, however, neither identities nor spaces are fixed. Imaginaries of the nation or the *Orient* are abstract constructs that appear stable but are, in fact, fluid. Such dominant territorial representations obscure the multiplicity of spatial realities – realities shaped by ongoing negotiations, diverse uses, and varying meanings across experiences and scales. While the concept of *territory* that I outlined draws on Anglophone debates (e.g., Elden 2009; Sack 1986), Terra-R (Streule et al. 2025; Terra-R 2025) advocate integrating Latin American perspectives on *território* (Porto Gonçalves 2006; Santos 2021). This view represents *território* as a continuous process of contestation that is shaped through situated practices (Schwarz and Streule 2024). It shows that imaginative territorialization is not merely discursive. As Bialasiewicz et al. (2007) argue, but that spatial imaginaries also have a performative dimension – embodied in everyday action. Imaginative territorializations are, thus, multilayered, overlapping spatial imaginaries that manifest discursively and through practices of both belonging and exclusion. This process must be situated within hybrid spatial production, where digital and analog spaces co-constitute each other. The interplay of hybridity, prefigurative practice, and imaginative territorialization allows us to analyze social media as a space in which spatial and identity production unfold through interconnected digital-material practices that prefigure futures. Social media not only represents, but also intervenes in the making of territorial orders. This becomes evident, for example, in TikTok videos that

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frame urban futures as either under threat or desirable, as the following empirical example illustrates.

The racist trope "Talahon" on TikTok

TikTok, operated since 2017 by the Chinese parent company ByteDance, is a short video platform with integrated social networking features (Otto 2023). Otto (2023, 40) describes it as "a network with tight meshes," where few escape the logic of reproduction. The platform is shaped by the entanglement of pop-cultural and political content, and a self-referential dynamic driven by algorithmic regulation, recommendations and data collection – a serial, meme-based logic beyond user control. Social media is increasingly recognized as a key factor in far-right mobilization (Fielitz and Marcks 2020; Strick 2021). Contrary to early visions of the internet, as a space of universal freedom and participation (Winter 2010), digital platforms have become fertile grounds for exclusionary and degrading far-right structures. TikTok, in particular, has emerged as a central arena for far-right agitation – its algorithmic curation and platform aesthetics amplifying such content (Verwiebe 2024). Far-right actors no longer operate in secret, but appear increasingly in public (Strick 2021).

It is not prominent actors alone that play a role here, though. On TikTok, seemingly insignificant videos can gain wide reach, given that the specific algorithmic logic promotes content based on engagement metrics rather than the prominence of its creators (Otto 2023). In summer 2024, a trend around the term "Talahon" gained traction. Coined by young users of color, the term was initially used in self-identifying and self-empowering videos set to the song "Ta3al Lahon" by rapper Hassan (e.g., Archive 2025: 4, 5, 6, and 11) – a practice Yildiz and Hill describe as migrant youth subverting dominant representations (Yildiz and Hill 2014). Over time, the meaning shifted, and comment sections show blue hearts or airplane emojis – symbols associated with the AfD and deportations – alongside remarks like "foreigners out" (Archive 2025, 6). Simultaneously, parody videos emerged that caricatured "Talahons" using racist stereotypes. So-called explanatory videos describe them through supposed features, such as Gucci caps, waist bags, large (male) groups, riding e-scooters, or "shadow boxing" (e.g., Archive 2025, 14, 32 and 33). This *Othering* process – constructing and marking the *Other* (El-Tayeb 2016) – reveals the racist devaluation of individuals based on ascribed behavior and appearance. Under the guise of humor, young, racialized men (and occasionally women, under the label "Talahina") are both homogenized and excluded. What began as a self-designated term became a racialized insult – a new synonym for old slurs like "foreigner." This culturalist form of racism (Balibar 1995) reinforces a stigmatizing social exclusion that is grounded in racist ideologies.

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I use digital ethnography to examine imaginaries of regressive urban futures linked to the trope of "Talahon" and their territorialization. This reflexive approach studies everyday environments and how they are shaped by digital technologies, treating platforms like TikTok as embedded in daily life (Pink et al. 2016). In an exploratory phase, I created a private TikTok account, followed relevant actors,[5] and observed routines and content flows (Bareither and Schramm 2023). TikTok's algorithmic infrastructure required constant reflection, given that content is filtered and personalized. Since control over what appears is limited, I followed Markham and Gammelby's (2018) flow-oriented approach, adapting to platform logics. After encountering the term "Talahon" in various videos, I shifted my focus to this narrative, documenting recurring visual patterns and anything related to the field. I then compiled an archive of video metadata (e.g., uploader, hashtags, music, and engagement)[6] to analyze how *ordinary* urban spaces are staged as desirable futures.[7]

Socio-technically designed futures

Regressive urban imaginaries become territorialized through TikTok in multiple ways. The trope of "Talahon" reveals two far-right imaginative territorializations that have become visible within the digital TikTok spheres that I have examined. I outline these in order to show how hybrid forms enable some future imaginaries while obscuring others.

Urban threats: racialized imaginaries of disorder

One dominant frame presents the urban as a threat or as an enemy space. While far-right mobilization is often linked to rural regions (Braun 2024), TikTok videos using the term "Talahon" show that urban spaces also play a key role in far-right imaginaries – especially in framing certain areas as illegitimate, migrant spaces. The original self-designating videos are usually filmed in urban settings such as train stations or shopping streets. The regressive appropriation of the term specifically targets these spaces and conveys its messages through them.

5 I followed public accounts exclusively. All of the videos used in the digital ethnography were publicly accessible at the time of data collection.

6 The archive lists entries for each video along with individual metadata. In this text, I refer to the archive and the corresponding entry number (e.g., Archive 2025, 1).

7 Note towards ethical consoderations: While my account was private, my research activity was not disclosed – contrary to standard ethnographic ethics. For security reasons, I refrained from making my presence as researcher visible; this is common in far-right research (Hedtke and Beurskens 2025).

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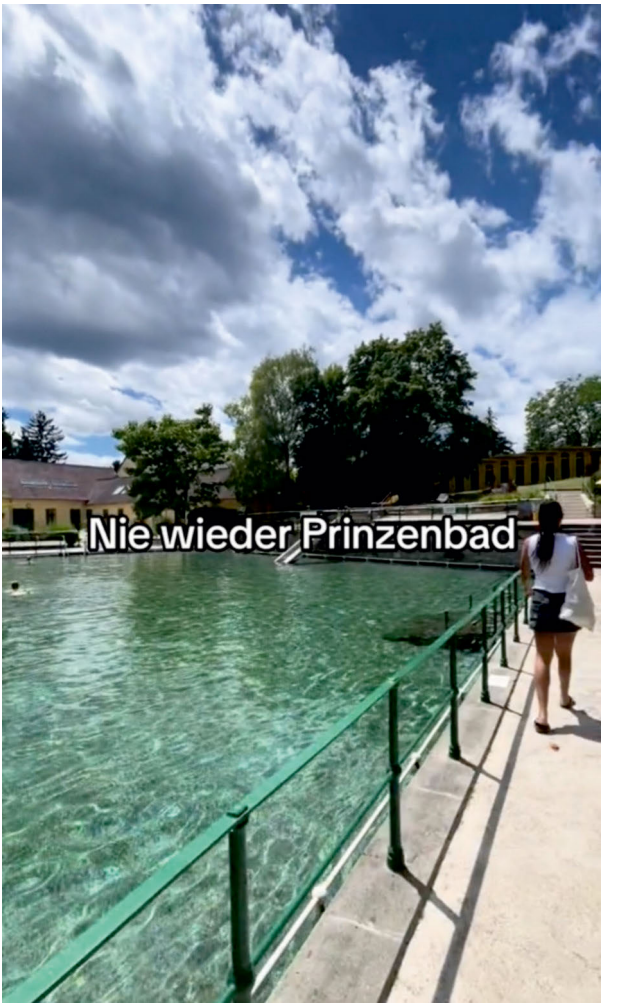
Figure 1: The TikTok video stating "Never again Prinzenbad" demarcates itself from the perceived urban threat of unordinary territorializations.



Screenshot from TikTok, July 8, 2024.

A video titled "Where do they spawn near you?"[8] (Archive 2025, 20) marks cities like Hamburg, Cologne, and Berlin as migration hotspots, with Berlin's supposed "spawn rate" of 20,000. The English term spawn originally refers to laying a large

8 The original version, for a better understanding, is: „Wo spawnen sie bei euch hin?"

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number of eggs (Cambridge Dictionary 2024) and in gaming describes "the act of making a character, object, monster, or entity appear in the game world" (Streamers Visuals 2023). Both meanings imply sudden appearance or rapid proliferation. Likely borrowed from this context, the term is used to metaphorically describe the perceived spread of certain groups, thereby revealing an underlying biologistic and social-Darwinist concept of race. Blurred satellite images reinforce associations of cities as chaotic, grey, and confusing. Even more explicitly dehumanizing is a video commenting: "metropolis: frequent occurrence (10/10)" (Archive 2025).

Specific sites are repeatedly mentioned within this trend. Train stations function as spatial anchors in the original, self-designated videos (e.g., Archive 2025, 6). A user comments on a clip of teenagers dancing in front of Bremen's central station: "Nice station—just not what's in front of it" (ibid., 6). Another writes: "Every central station within a two-kilometer radius in Germany" (ibid., 1). Explanatory clips attempt to map "spaces without Talahons." One user lists: "Places where Talahons are 100% guaranteed include: shisha bars, train stations, inner cities, funfairs, public pools, and REWE supermarkets after 10 PM" (ibid., 14). Comment sections amplify these imaginaries by using emojis that affirm the narrative. A post states: "Stuttgart city library—Talahon share 70%—that's a spawn point" (ibid., 21). Public swimming pools are also frequently mentioned (e.g., ibid., 21, 25 and 28), likely due to the racially charged debates around them during summer 2023 (Klinke 2023), as suggested by a video stating: "Places without Talahons […] never again Prinzenbad" (Archive 2025, 25, see figure 1). While the tone is often ironic or humorous, the implications are serious. The baseless and arbitrarily high percentages foster a racialized sense of disorder. Visibly migrant, especially young male, groups in public space are associated with chaos and with a lack of control, thereby projecting racist imaginaries onto specific urban sites.

These projections onto urban spaces share a common perspective: the city is imagined as chaotic, disorderly, and disproportionate – a condition often attributed to migration. The imaginaries are both collectively produced and reinforced by TikTok's algorithmic logic, which privilege simplified, affectively charged, and seemingly self-evident knowledge claims aligned with hegemonic worldviews, such as those concerning migration. Particularly relevant is the socio-technical co-production of space that operates through distortion, disinformation, and a one-sided narrative. Whether these spaces exist beyond TikTok or reflect real urban experiences remains unclear. However, through a form of communication shaped by disinformation and socially exclusive humor – an amusing experience for some, a racist one for others – they reference far-right ideologies. These include notions of overpopulation and "population replacement" that portrays certain groups as overrepresented and as threatening to the spatial and cultural order (Weyand 2023, 157). The videos, thus, construct a collectively produced image of regressive urban fu-

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tures as *unordinary* territorializations – anchored in far-right ideology, but without expressly spelling that out.

Urban desires: purist imaginaries of the *ordinary*

In contrast, the urban is simultaneously imagined as a space of possibility– a canvas for aspirational futures devoid of perceived disruptions. Alongside the imaginative territorialization of spaces associated with migration—often termed "Spaces with Talahons"—there is a recurring emphasis on places presumed to be free of this constructed, racialized group. One video presents a ranking titled "*Places with the fewest talahons,*" showing not only mountains, but also primarily urban-coded spaces such as the organic supermarket Alnatura, libraries, concert halls, and churches (Archive 2025, 32) – spaces evoking elite culture, education, the fine arts and (Christian) spirituality.

Other videos refer to similar spaces, with historic city centers playing a prominent role. Polish cities—like the old town of Wrocław— are highlighted and implicitly framed as role model for restrictive migration policies (e.g., Archive 2025, 26 and 36, see figure 2). Responding to a comment asking for the location, one reply simply states: "Breslau," followed by the remark "former German territory" (ibid., 26) – a historical-geopolitical reference subtly evoking nationalist or revisionist sentiments and inscribing them into imagined spatial futures**.** Another comment about a recent trip to Poland reads: "Spent two weeks in Poland and it's beautiful [praying hands emoji] such friendly people, everything clean, 10000% better!" (ibid., 36). In a different example, a user declares their store a "Talahon-free zone", stresses the need to act, and places a sign on their shop window (ibid., 39).

Places like libraries, historic town centers, and concert halls are idealized as coveted sites of high culture within German cities. This idealization goes beyond cultural capital or aesthetic taste – it constructs a powerful imaginary of the *ordinary*. What appears to be simply normal or even civilized urban space is visually coded through quietness, order, and light. These scenes present a spatial commonness valued precisely for appearing undisturbed and self-evident. The visual language evokes care and preservation. Public libraries, for example, appear as refuges of education and tranquility; historic city centers appear as heritage sites preserved for a white, autochthon population. Human presence is often minimal – well-dressed passersby reflect bourgeois respectability. These portrayals promote a notion of *ordinariness* in which urban space is framed as racially pure and culturally stable. This idea of the *ordinary* becomes hegemonized through repeated circulation and aesthetic framing. The trope of "Spaces without Talahons" operates here as a potent, digitally co-produced imaginative territorialization of desirable urban spaces, thereby naturalizing a hegemonic vision of the *ordinary*.

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Figure 2: The TikTok video stating "Poland – the country without Talahons" is imagining the old town of Wrocław as urban desire.

Screenshot from TikTok, July 18, 2024.

Territorializing futures

Together, these two narratives shape a powerful dichotomy in urban imaginaries: on the one hand are denied spaces – marked by migration and racial *Otherness*; on the other hand, there are desired spaces – clean, *white*, and implicitly exclusionary. Both define boundaries of belonging and exclusion, yet these territorial dis-

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tinctions are not fixed. Rather, they are continuously (re)produced through sociotechnical and collective practices that are enabled by the digital realm. Users do not passively consume these imaginaries – they actively shape them: uploading content articulates territorial visions; liking affirms and boosts visibility and commenting reinforces or reconfigures them through anecdotes, stereotypes, or emotions. Even watching constitutes a performative act of witnessing (Schankweiler, Straub, and Wendl 2019), thereby reinforcing visibility and normalizing content. These practices shape how space is imagined, influencing how urban futures are collectively envisioned. *Ordinary* and *unordinary* spaces emerge as dominant imaginative territorializations that are enabled through the digital realm. As hegemonic (yet partial) representational territories, they obscure territórios – such as the empowering use of *Talahon* – and silence marginalized voices, undermining their spatial claims in the process. These effects extend beyond the platform, producing exclusion and alienation in everyday urban life. In one video, a young man expresses his fear of deportation to Bulgaria after receiving hate comments on dance clips. Regardless of the actual threat, the affective impact is real and may resonate with other racialized youth, thereby reinforcing the sense of being policed both offline and through one's digital presence.

This illustrates how platform-based discourses intersect with everyday embodied and emotional experiences, thereby producing material and affective consequences. The binary of *ordinary/unordinary* leaves little room for understanding space as processual or for understanding identities as fluid. Instead, two fixed urban futures take center stage that normalize a racialized, exclusionary vision of urban life. At its core lies the persistent framing of migration as a threat – a logic drawn from far-right discourse. Yet migration is a structural condition of the present, shaped by global crises, war, exploitation, and climate change. Framing it as inherently harmful and responding by attempting to erase it from public space – physically and digitally – is analytically misleading and inadequate as a political response. This becomes evident in TikTok videos that seek to remove figures associated with migration from public life and urban space. Though often playful in tone, they reinforce exclusionary meanings and present a regressive (yet seemingly coherent) vision of urban futures. The resulting urban imaginaries – devoid of racialized *Others* – are portrayed as desirable, promising safety, order, and a better life. Following Jaeggi (2023), their regressive core lies in their inadequate and discriminatory response to given social challenges. Hence, instead of addressing structural issues, these narratives present an appealing and (seemingly convincing) alternative vision of urban life that gains traction with many.

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Hybrid territorialization of the *ordinary*

The racist narratives of *ordinary* and *unordinary* spaces – quiet libraries vs. chaotic train stations, peaceful old towns vs. overcrowded swimming pools – serve as core motifs in regressive urban futures. As shown, TikTok enables the continuous materialization of such imaginaries through socio-technical practices. Uploading, liking, commenting, and witnessing content makes territorial boundaries tangible. Algorithmic systems reinforce this by boosting content aligned with dominant ideals, thereby fostering belonging in perceived ordinary spaces, while excluding others. The *ordinary* refers to familiar urban spaces perceived as calm, intellectually oriented, undisturbed, and publicly accessible. A defining trait is their imagined stability: they appear fixed, best preserved in their current or in a previous state, in a fashion detached from historical complexity or plural notions of belonging. Thus, the *ordinary* functions as a space of continuity, evoking regressive urban futures not through overtly dystopian aesthetics, but instead through a seemingly positive one. This is central to their appeal: they promise safety, normalcy, and non-disruption. Yet they are sustained by racist disinformation, exclusionary humor, and logics of *Othering* – reproducing socio-political structures aligned with far-right ideologies. Although its counterpart, the *Unordinary*, has been framed in postcolonial and queer theory as a site of resistance – there being associated with fluidity, hybridity, and the subversion of dominant norms – it is here mobilized within a regressive logic. The very markers of disorder and disruption are used not to open up space, but to delimit it as signs of illegitimacy. This shows how territorialization is not inherently progressive or reactionary, but rather depends on the meaning-making practices through which space is performed.

TikTok videos can be interpreted as socio-technical coproduction of far-right narratives that frame migration as a problematic threat, using tropes such as overpopulation and demographic replacement. The portrayal of desirable spaces as escapes from these threats can, following Jaeggi (2023), be understood as regressive – that is, as inadequate modes of problem-solving. While certain spaces are singled out for their high "spawn rates," others are idealized as "Talahon-free." Both forms draw on and reproduce the same narrative, blocking critical engagement and the development of progressive alternatives. These imaginaries derive their plausibility not from nostalgic retreat, but rather from appearing to be coherent, identity-forming responses to the present – seemingly modern, dynamic, and detached from overt far-right symbolism. The regressive moment lies in how these imaginative territorializations simultaneously offer a promising alternative vision of urban life, while also obscuring underlying social issues and reinforcing racial exclusion, rendering their political effect both compelling and problematic. This challenges the notion that far-right urban imaginaries are necessarily spectacular or overtly representational (Bodenschatz, Sassi, and Welch-Guerra 2015). The examples here rely on

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everyday aesthetics. Freistein, Gadinger, and Unrau (2022) similarly show that far-right visuality may manifest through seemingly benign imagery. This subtlety is key to their effectiveness: the more they blend into the surface of progressive modernity, the more persuasive and normalized they become.

Digital platforms host the negotiation of conflicting territorial imaginaries that do not merely represent symbolic visions, but that actively co-construct broader social realities. These imaginaries are prefigured through embodied and algorithmically mediated practices, making them materially grounded. What appears as coherent and appealing visual narratives emerges from contested processes of imaginative territorialization. This perspective reveals a layered landscape: dominant spatial futures gain traction, while others are marginalized or silenced – shaped by the socio-technical dynamics of digital platforms.

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"It is, like any space, full of possibilities"

Interview on spatial contestations and far-right mobilizations in the digital age

Jason Luger, Zita Seichter, and Michael Krell

In February 2025, the president of the United States shared an AI-generated video depicting the territory of Gaza – devastated by Israeli bombardment – reimagined as the Riviera of the Middle East: streets appear lined with luxury boutiques, modern penthouses, and beach parties, featuring Elon Musk dancing beneath flying banknotes[1] (Trump 2025). This short clip, shared millions of times and viewed by a global audience, serves not only as a provocation, but also a digitally mediated fantasy of territorial transformation. This is not a technological sideshow – it is an expression of territorial desire, staging a spatial imaginary that both claims and reorders place.

This video is one among many expressions of territorial desire, formation, and contestation in the context of the global rise of authoritarian, far-right actors, movements, and parties. We have been engaging with the spatial dimension of far-right mobilization in times of intensified border regimes, exclusions grounded in powerful constructions of hierarchical difference and human devaluation, as well as shifting geographies of belonging around contested notions of identity, security, and place as part of the author collective Terra-R, of which two of us – Zita Seichter and Michael Krell – are members. We know that far-right mobilizations happen "not in a void but in concrete spaces and, as such, continue to produce far-right geographies" (Terra-R 2024, 1). Their actors appropriate spaces in a variety of ways, often employing violence, thereby shaping societies in a physically and materially tangible way. In so doing, the far-right challenges opposing hegemonies while manifesting their own. Terra-R approaches these spatial practices as territorializations, understanding them as multifaceted processes and practices that shape spatial differentiations (Terra-R 2025).

However, the introductory example of Trump's techno-authoritarian imaginary of Gaza showed that it is insufficient to understand the far-right as being merely

1 See: Donald Trump (2025), *Instagram*, 24 February. Available at: https://www.instagram.com/realdonaldtrump/reel/DGhfpgHsOg6/ (Accessed July 28, 2025).

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physically and materially grounded. The video and its global resonance would neither have been possible in this form nor would it have achieved such an impact and level of circulation without digital technologies – AI-generated video production enabling its creation, social media platforms (first published on Truth Social) serving as its channel of distribution, and not to mention the consumerized infrastructures of digital services and internet access that allow for the consumption and spread of such content in the first place. Rather than treating such technological dimensions as peripheral, they are instead integral to contemporary spatial practices. Consequently, an analysis of contemporary society that disregards the digital dimension or treats it as isolated will fall short. Instead, digitalization is deeply intertwined with material spatial practices, shaping territorial formations that produce socially differentiated forms of inclusion and exclusion. Equally, far-right mobilizations operate in hybrid modes (Krell, Zschocke, and Ludwig 2025; see also Seichter in this edited volume). Nevertheless, these spatial formations remain insufficiently explored – particularly in terms of how they entangle digital and material modes of territorialization, in terms of their technological affordances, and in terms of their embodied, spatial effects.

In this chapter, we aim to extend the framework by engaging with digitalization as a crucial factor in contemporary territorial formations, especially among the far-right. We ask whether the digital realm reinforces far-right territorializations or whether it creates openings for counter-practices and for progressive practices of territorialization. To explore these questions, Zita Seichter and Michael Krell conducted an in-depth conversation with Jason Luger, Assistant Professor at Northumbria University in Newcastle, and a scholar with expertise in digital platforms, on-/offline spatialities, and territory (Luger 2024). His work critically engages with urban contestations, networked spaces, and authoritarian spatialities, making him an ideal interlocutor for a discussion about territorialization's materialization within digital transformation processes.

Zita Seichter & Michael Krell: You work extensively at the intersection of body, identity, and space. Why do you choose the digital as your entry point? One might assume that body and space are most distant – perhaps even disembodied – there. Or do you see new forms of materialization emerging precisely in this realm?

Jason Luger: I did not begin at the digital at all. In fact, my background was in urban planning and regeneration, where I dealt much more with the built environment in a literal sense – things like planning permission, retail high streets, and regional housing.

My early academic research took me to Singapore, around 13 years ago. I entered that project looking at the notion of 'creativity' and the arts in city-making and the paradoxes and contradictions of an authoritarian setting – like Singapore – increas-

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ingly funding and providing space for the arts and culture as part of its global city ambitions. I explored the role of criticality and radicality, in terms of state-society relations, in a context where arts are on the one hand encouraged, but on the other hand, censored and highly restricted.

This is what led me to the digital, where in my interviews, with artists, activists and cultural policymakers, I heard again and again how important online space was for edges and angles of criticality and radicality that were not possible in the built environment. Physical spaces like theatres, galleries, or university classrooms were vital for catalyzing an enriched and active civil society, but were also limiting and constricting. A theatre holding an activist meeting of 50 people behind closed doors can become larger, and more impactful, when it is also circulated as an online image to millions of people globally. This research was also coincided with the rise of "Web2.0," or the age of the smartphone – when more and more people were digitally connected and social media had gone mainstream.

Whilst digital platforms are not free of censorship and various forms of governance, they did, in the context of Singapore's territorial confinement, provide some breathing room for expression and connection. Digital space allowed those connections, for example, the wider Singaporean diaspora or global critical arts community, space for shared learning, exchange, and co-production. Of course, authoritarians often use the digital for other aims, from surveillance to bullying, and this is equally important. I don't argue that the digital is an open, equitable, or democratic space. It is, like any space, full of possibilities.

I came away from this work, with some help from theorists, like Henri Lefebvre (e.g., 1991) and his framings of space as conceived, perceived, and lived, with wider conclusions about how the digital relates to authoritarian environments, in a constantly shifting relation of 'open' and 'closed' space. I think it is essential to look at how these spaces of openings and closure extend into, and out of, the digital – especially when considering illiberal environments and various territorial and material fixities and realities.

From 2016 onwards – spurred into motion by events like 'Brexit' in the UK and the first Trump election – I shifted my focus from authoritarianism writ-large to the global far-right. One of the things that I noticed immediately was the strong entanglement of the far-right and bodies, embodiment, and physical cultures (like strength training and bodybuilding) which, if you look deeply into the far-right's ideology, have specific associations with white and male supremacism and certain hierarchies of power. In particular, I noticed the emergence of a new type of 'warrior' male body-type, ethos, and series of practices and codes: a modern version, circulated through today's digital networks, of the 1930s ideal 'fascist man' that was lionized by far-right movements including Nazism. Whereas then, these ideas and images were circulated on leaflets and posters, now, they circulate virally via social media, thereby infiltrating the mainstream and becoming consumed and embodied

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by digital users. These ideologies and digital bodies are pushed into view by far-right media influencers of the 'manosphere.'

This coincided with a shifting culture of young masculinity increasingly using the body as social capital, something that Jamie Hakim (2020) suggests is emblematic of late capitalism, where industrial labour and neoliberal competition increasingly utilize the body. And the entanglements of body, the far-right, and digital are not limited to men, as we've seen with how women and femininity are represented through online movements like 'Trad Wife'[2] and the way body and gender are expressed in neo-racial-pseudo-science movements like 'Neo-Natalism,'[3] which is largely expressed digitally.

In short, social media platforms offered a huge, global, mainstream, and accessible space for far-right ideas, images, discussions, and practices that would have previously been the domain of specific websites and chat rooms and, previously, magazines, posters, and flyers. Social media arenas can be mainstreaming windows for the far-right and are often entry points for more serious radicalization pathways. Users not even seeking far-right material can find themselves exposed to it via algorithmic pathways which become self-perpetuating.

You ask about whether new materializations are forming in this realm. We must remember that the digital does not exist on its own. It relies on real bodies, real people, and real infrastructures. What is visible in the digital – whether they be bodies, rooms, buildings, and landscapes are very much material. Connections rapidly made between digital users can result in bodies gathering in place, as we've seen time and again with how the far-right mobilizes and materializes. The kinds of organizing that used to rely on politically-extremist forums and chat-rooms could now be done with wider audiences, faster, via both open social media and 'darker' social media like Telegram. The body is a user of a phone, and the body is present at an urban riot or political rally. Or, sometimes, at the end of the radicalization process, the body commits acts of material violence. The body can also become an ideological expression, through the act of, for example, becoming muscular or inscribing certain tattoos that are etched into the skin as visual political symbols. The body is a political becoming and, these days, it is via the digital that bodily norms, expectations, and expressions are learned and emulated.

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2 The Trad Wife movement is explained in this piece by Carter Sherman (2024) Sundresses and rugged self-sufficiency: 'tradwives' tout a conservative American past … that didn't exist. *The Guardian*, 24 July. Available at: https://www.theguardian.com/lifeandstyle/ng-interactive/2024/jul/24/tradwives-tiktok-women-gender-roles (Accessed July 28, 2025).

3 A helpful primer on the 'Neo Natalist' movement by Seyward Darby (2025) The Dark History of the Far Right's Natalism. *Vogue*, 3 May. Available at: https://www.vogue.com/article/dark-history-of-the-far-rights-natalism (Accessed July 28, 2025).

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So, the digital helps to shape the material: they are never separate from each other. We (as humans) come to know the material world as it is represented online, and we create spaces (or bodies) that reflect this. Just look at how urban environments are transforming into spaces made for selfies, ready backdrops for that viral TikTok post. The far-right is keenly aware of this too, playing a part in how cities and places are represented online and offline. The circuitry of the digital shapes global ecologies too, of course – from the electric power needed for servers to the damage that Cryptocurrencies (popular with the far-right), to the ways that AI and bots still rely on exploited forms of labor (often in the Global South). Over time, the material world can start to mimic the online representations and imaginaries, and this is how ideology becomes brick and mortar.

What these new materializations look like is an interesting question. From an urban geographical perspective: I'd suggest that we are seeing the rise of clusters of buildings and infrastructures that serve the digital – think of warehouses by the side of highways – and these spaces are increasingly important to our world, in the way that city centers were in the past. The digital, and within that the digital far-right, does not only rely on a city's main square or central business district, but on the large, anonymous warehouse on the city's fringe, where men may be crafting their bodies into the 'superman' they wish to be or where computers are running autonomously to pump out bitcoins, AI images, or other cyber-systems. I think that the perfect material exemplification might be an Amazon warehouse by a highway, surrounded by low-slung warehouses full of logistics businesses, with maybe a gym nearby.

Zita & Michael: You addressed how the far-right constructs and utilizes ideas of masculinity through digital spaces. We would like to follow up on this: How do digital spaces function as arenas for the performance and reinforcement of masculinist spatial claims, and how does this translate into material spatial contestations?

Jason: I would go so far as to hypothesize that the digital manosphere was the birthing ground for the contemporary far-right. If you look at web archives you can see how prominent far-right content was from the late 1990s through the early 2000s in men's spaces like gaming, bodybuilding, or other 'miscellaneous' discussion forums (early Reddit, etc.). These, I'd argue, have translated over time into the 'dissident right' that we see today, led by certain male influencers. And then, we see this translating into material spatial contestations when these men get together, or act alone, for far-right expressions, from the proliferation of fight clubs or man camps, to marches on the street, to lone-wolf violence. We have these early digital spaces to blame for the birth of the 'Incel' movement: Bodybuilding forums, for example, as early as the early 2000s, regularly featured men putting other men down, critiquing their physiques or broader life choices, thereby insulting and denigrating

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other bodies. This was at the time very overlooked and easily dismissed, but I think the generational impacts have been huge, given how violent 'Incel' behavior can be, and the terror it has unleashed.

Of course, the birth of social media was also a masculinist project from the beginning: Zuckerberg, from his university dormitory room setting up 'Face Book' first as a site where Harvard students could rate each others' looks – mainly men rating the looks of women. There is an undercurrent of incel within that. This followed other early 2000s sites like 'HotorNot.com,' where users voted on the attractiveness of other users. We've seen how this has grown of course into the multi-platform monolith 'Meta' (with Facebook, Instagram, WhatsApp, and others), and the power and influence of techno-feudalists today. Digital space, from its outset, has been an arena for the performance and spatial claims of masculinity. We can also see this in Trumpism and in other current far-right movements, which discursively deploy 'hot' or 'not' statements, policies, and binaries. With, of course, more power and menace, when directed toward vulnerable and marginalized groups in society.

There are exceptions where the digital can be affirming, liberatory, and transformative towards justice. McKenzie Wark (2004) for example has written from a feminist and queer lens about the emancipatory potential of digital space as a way to 'hack' against the ruling class; there are also strong voices within critical feminist geography who note the possibilities for gendered resistance offered by/through the digital. The prolific geographer Gillian Rose likewise opens up the digital as a complex space for exploration. But I think the re-assertion of the 'bros' in Trumpism 2.0 (and its axis of allied global movements) indicates the hegemony of digital space as a man-topia, as has the rise of digital finance (cryptocurrencies) and related infrastructures and geopolitics (space rockets), which often occur in consort with (male) authoritarian leaders in countries which have been receptive to crypto-and-outer-space-infrastructures, like Moroccan-governed Western Sahara, Indonesia, or Saudi Arabia.

You use the words 'arena for performance,' and I think this is really poignant. The digital manosphere is a sort of arena for masculinist debate, expression, and supremacism and it is perhaps no accident that the manosphere is obsessed with references to the arenas of Rome or Athens, and with the motifs of 'Spartans' and 'Gladiators'. Digital representations of the 'warrior masculinity' seem to proliferate, also verbalized by influencers like Andrew Tate (and others) who advocate for a brutal, 'winner takes all' version of being a man. Through digital virality, this thinking, these aesthetics, and discursive politics have captivated male digital users, especially those under 30. These would-be Spartan warriors interact with the real world everyday of course, shaping communities, families, relationships, and workplaces. As I explained in my last answer, these warrior masculinities are underpinned by far-right ideologies around racial, ethnic, and gender superiority.

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In my 2022 and 2024 *Political Geography* papers (Luger 2022, 2024), I discuss how online 'Alpha-lands' translate to offline spatialities: I use the examples of fitness gyms fashioned as Roman Coliseums, or male-meccas like 'ALPHALAND,' a fitness and retail campus in Texas. But these examples are perhaps too literal. The digital manosphere, with its far-right entanglements, gives shape to the way men construct their social relationships, their families, and their daily life-worlds. And, as I mentioned, women are not absent from these worlds, of course, nor are they absent from the far-right – often envisioned as enablers and supporters, as in the 'TradWife' movement, where the woman takes the role of traditional homemaker and subservient cheerleader of the strong man. Women, too, can be far-right leaders and influencers: see for example Eviane Leidig's (2023) excellent book on women and the right.

Zita & Michael: In our own research, questions about territorialization, which we use as a way to conceptualize these specific spatial processes you described, play a crucial role. How do you conceptualize territory and processes of territorialization in your work? How does digitalization factor into it?

Jason: For me territory indicates a tangible relationship to the ground (i.e., an anchoring in place). That's not to say that territory exists independently of space, if we take from geographical theory the notion of 'relationality' (and also when thinking through the digital). So, we might think of territory as being, as Doreen Massey (2005) suggested, capable of being a static place and a dynamic place, in movement, connected, at the same time.

Going back to Singapore, I looked at the importance of the ground – literally – as an anchor for activism and civil society operating under authoritarianism. One example of this was an arts collective that I followed, which gathered thousands of people together across Singapore to make ceramic objects from Singaporean clay. The importance of this exercise was citizens collectively making art from the ground, the *terroir* – thereby making a subtle/soft political statement about the grassroots, in a state-context where most power relations are envisioned as top-down and centrally-planned.

Far-right territorialization matters, something I know the Terra-R collective has critically explored and argued for years. It is through territory that the far-right gains not only visibility, but also legitimacy. Of course, explorations of the relationship between the far-right and 'territory,' are not new, and we can look back to the 1930s phenomenology of Heidegger (making sense of the subjects relationship to the spaces around him) and Walter Benjamin (his affective wanderings through the Parisian arcades, at a time of rising fascism), or more recently, the explicit focus on architecture as a possible 'right wing space' (e.g., Oswalt, 2023).

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Building on this work, I have tried to make sense of how the far-right territorializes today, in the very rapid, connected, and pop-up nature of the digital paradigm we live in. I look at the digital discourse around places – for example, how a city, a neighborhood, or a building is discussed or debated online – to gain insight into how these places materialize in the urban environment in a very real, tangible texture. I also draw upon Marxian geographic notions of 'fixity' and 'motion,' (e.g., David Harvey's canon of work) insofar as social relations, and capital, rely on certain places, structures and spatial configurations and are constantly in the processes of making and re-making, often destroying themselves in order to create anew. The far-right can be inserted into these processes of spatial fixity and motion.

In my *Political Geography* paper in 2022, I developed the heuristic model of 'Celebrations,' 'Exaltations,' and 'Alpha-lands' as three ways this territorialization happens (Luger 2022). I framed 'Celebrations' as the daily social happenings of joy and conviviality where far-right worldviews may be encountered, but often in a sanitized and mainstreamed fashion. For example, the celebratory nature of a Trumpian social gathering in the form of a flotilla of boats on a lake, draped in flags, and drenched in alcoholic consumption. 'Exaltations' refer to territories of prayer and spirituality, which, as we've seen with movements from Christian Nationalism to Hindu Nationalism, are vital for far-right coherence. 'Alpha-lands' refers to the territories of masculinity and, more specifically, to a certain type of reactionary, hyper-masculinity that seems to undergird far-right movements around the world.

All of these sites rely on the digital for upscaling, broader representation, marketing and publicity, global connection, and for the developing of meaning and signification. But these territories cannot exist purely in the digital, either. So, land, wires, walls, water, plants, air and bugs, guns, germs, and steel – these things matter, too.

Zita & Michael: In the digital age, processes of territorialization are taking place on- and offline. Do you think territorialization has to be understood as hybrid – entangled across digital and material spatialities? And what would that mean? Or do you see digital spaces operating under fundamentally different spatial logics?

Jason: Firstly, yes, I think territorialization has to be understood as hybrid, 'entangled across digital and material spatialities,' as you phrased it in your question. The digital is inescapable today and no territory is free from it. You can argue this in terms of how our understanding and mapping of the world – the way we view it – is informed by satellites and GPS (though, of course, there are 'blank spots' and 'glitches'). You can argue this in terms of finances and the global economy, which operates through a digital circulatory logic; and some elements are completely digital (e.g., Cryptocurrencies, albeit, still needing material facilities and infrastructure, labor inputs, and electric power). And of course, the digitally-networked decisions of powerful global

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elites have very real impacts for the environment and climate: a digital 'click' can raise the global temperature and ocean levels, in the name of greater profits. A 'click' can release a drone or a bomb.

So, yes, territorialization is hybrid. That is not to say that everyone is actively digital: there are still ways of switching off, deactivating, or even returning to analog forms of communications and socializing, trends that seem to be growing among younger people. And of course, large segments of global population still do not have access to digital connectivity (or even basic utilities). But this does not mean that the digital is not present. The algorithmic logics of platformization continue to colonize.

I suppose practically – ontologically – this might call for the lasting utility of assemblage approaches, something that new materialists in Geography have prioritized for the past 30–40 years. I have found looking at territorial assemblages useful in my own work, given that it allows room for both the human and the non-human, the local and the global, and materials and affects (e.g., both touching and feeling). This was the approach I took in my paper in *Political Geography* (Luger 2024) where I explored how urban developments in Germany and the United States are being crafted in the image of the digital far-right, influenced by visual and discursive motifs of patriotism and hierarchies of race, or by reactionary notions of 'tradition' versus 'modernity.' I followed the idea of the 'strategic assemblage,' which the digital geographer Jason Dittmer utilizes in questions of geopolitics.

Assemblage ontologies work well, I think, amidst the 'more than human' turn – and this is also useful in thinking through how politics, too (and the far-right) often operate in a more-than-human set of processes. For example, bots and AI, which, as we've seen in recent elections, have very consequential impacts in spreading ideologies and disinformation.

Whether digital spaces operate under different spatial logics is something I'll have to consider and an answer I'm less clear on. I think that digital geographers – I could refer to authors such as Gillian Rose to James Ash, Louise Amoore or Sarah Elwood, Rob Kitchin or Agnieszka Leszczynski – would be better served for a more convincing conclusion. But – and perhaps I'm reading this wrong – the consensus seems to be that since the digital and the 'real' are inseparable (e.g., they are not 'separate places,' but are entangled and relational), then perhaps there is no easily delineated spatial logic between the two. I'm sure these musings will need an update in the near future.

Zita & Michael: In a time of re-bordering, nationalism, expanding defense budgets, and increasing restrictions on migration, we find it crucial to highlight how various actors continuously produce territories – both through external demarcation and internal homogenization, which our approach to territorialization seeks to illustrate. Far-right actors essentialize a supposedly homogeneous group as belonging to a specific space while excluding other bodies, identities, and perspectives. Here, we have elaborated on how far-right territorialization takes place

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by and of the far-right (Terra-R 2024). Based on your experience, could you help us further explore how these processes might unfold in entangled digital spaces?

Jason: I think in many ways the bordering, demarcation, and homogenization of digital space mirrors the trends that you have explored via far-right territorialization (Terra-R 2024), insofar as digital space is a web of enclosures and different processes of inclusions/exclusions. I think one aspect of this is generational. Younger users – e.g., 'digital natives' – are often very canny at re-creating territorial processes online. This is true with far-right processes as well as broader social relations/processes.

Venkatesh Rao (2019) coined the term 'the cosy web' to describe the intimate, private niches of the internet where authenticity, familiarity, and sincerity are fostered. This means things like private (rather than public) groups, forums, or chats, such as through encryption, or even using codes that only some users will recognize. We see this, as I mentioned previously, more broadly than just with far-right users – but the far-right has really been at the forefront of carving out these 'cosy' spaces on the web, as a means of being able to have discussions, share images, etc., that might be censored or flagged by other users or moderators as offensive or out of bounds. Think of the far-right as a series of digital rooms, some of which are kept locked 'by invitation only,' others which have doors flung open, and each room is deliberately curated in a certain-way to speak to, appeal to, wrap in, or to offend/repel certain users.

This is demonstrated by how far-right users have found each other in 'cosy' spaces to organize marches, rallies, and riots, but also how they trade conspiracies or specific racist and prejudicial agendas, from the 'neo-natal movement' (which re-asserts eugenics frameworks for contemporary society), to antisemitic or misogynistic agendas. Certainly, many of the most troubling and violent episodes in recent years, from Brenton Tarrant's horrific terroristic attack on the Mosque in New Zealand to the nasty ways Andrew Tate reaches young men – happen in these more private, enclosed digital spaces, away from public view. And often, in digital spaces that aren't explicitly far-right – from 'gaming' forums to bodybuilding/fitness digital niches, which might only be accessible through signing up and joining, as opposed to the more open landscape of Instagram. And we know how much the far-right relies on encrypted platforms like Signal, Telegram, etc. We might think of these 'cosy' spaces of the digital far-right as mirroring a secret meeting taking place in a private home, or a private club in a building on the urban fringe with no identifiable characteristics on the outside. You have to be invited; you have to either know someone or the password/code to be let in.

But – just as some far-right territories are more publicly accessible and visible and reach into the mainstream of public space and urban life – the same is true for digital far-right space. And I think the far-right relies on *both* for their online/offline

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territorialization and growth: the 'cosy'/private and the open/public/mainstream. Again, my metaphor of the hallways full of rooms.

I've explored how mainstream gyms and fitness spaces (not just 'fascist fight clubs') can be spatial portals for slow/passive radicalization. So, the same can be said of mainstream digital spaces like Instagram, Tik Tok, etc. – and through the guise of health/wellness/lifestyle, faith and spirituality, or even professional/career-related content. Those who are not aware of far-right signposts and codes may not even be aware that they are consuming far-right content or interacting with far-right users. I think the average digital user will not be aware of the ideological underpinnings of the 'trad' movements, for example; they may see only representations of users in traditional gender roles, like women in the kitchen preparing a meal for their husbands, or men getting strong for an unpredictable and often dangerous world. At first glance, these things seem banal, lovely and estimable even.

I think these open/public expressions are often deliberate: the 'minds' of the far-right know what they are doing. Far-right influencers know how to recruit and are often well-versed in psychology and even in some of the same tactics and tools used by the marketing industry. They also know how to stay hidden/invisible, when necessary. By the time a user stumbles into one of the more private or, as I described, 'cosy' far-right digital spaces, they are moving ahead on the radicalization pathway. Unless, of course, that user is a critical researcher of the far-right, who infiltrates these spaces to learn about them and to expose them – as some members of the Terra-R research network do (and thanks for that important work!).

Zita & Michael: You have effectively described how the far-right becomes publicly accessible to a mainstream audience through digital territorializations, thereby reaching public spaces and urban life. Mullis (2024) argues that the far-right does not simply impose its positions on the rest of society, but rather mobilizes the broader societal mainstream. In relation to this, we would like to ask: What societal connections and points of engagement for the radical right do you see specifically emerging through the digital realm? To what extent are radical right mobilizations empowered by their connections to fundamental societal mechanisms of exclusion and belonging that are inherently facilitated by the digital?

Jason: Absolutely, I agree with Daniel Mullis (2024) on this, which ties into the larger consensus that far-right identity emerges from wider societal conditions (in a rhizomatic way, as Deleuze and Guattari (2000) have proposed in their musings on micro-fascism). And, earlier, of course, we have authors from Hannah Arendt to Theodor W. Adorno, to more recent voices like Jack Bratich (2022) (on 'everyday fascism') to Michael Billig (1995) (on 'Banal nationalism') who all point to the conditions of everyday life that give rise to fascism and far-right genesis.

What are these wider, underlying conditions? As all of these authors have proposed, extremist politics arise out of social anxieties, fear, and perceptions of insta-

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bility and change; inequality and resulting polarization and mistrust, fragmentation of community and breakdowns of social cohesion, consumer culture, and capitalist spectacle; from all of these things.

Walter Benjamin (1982), of course, noted the atmospheres and affects of these conditions amongst the Parisian Arcades of the 1930s, and if he were still with us, perhaps he'd see these conditions in Amazon.com fulfilment centers, space rockets with celebrities, Tik Tok reels, a screaming match at a store in a mall, or the obsession with airline 'status' to get three inches of extra legroom. I wrote recently with my colleague Jacob Miller (2025) on the capacity for fascism to emerge from these banal things, small things, that surround us. Credit cards. Designer watches. Food blogs. CrossFit. Golf.

The virality of the digital, as I've discussed in my previous answers, helps to give 'shape' and 'texture' to the far-right amongst these wider conditions. It allows a rapid, visual, and narcissistic medium for expression and introspection, and as you allude to in your question, new forms and feelings of belonging and exclusion. Because the algorithm always listens to us and tracks our movements, it acts like a far-right entity in giving us options that we do not actually need, and that aren't necessarily good for us, but that we feel compelled or even pressured to take. *Upgrade to Premium, for £4.99 a month! Just one click, and you can have a six-pack. Install a front-door camera – you'll be safe from crime!* This is not just a capitalist accident. Safiya Noble (2018) powerfully explores how algorithms are often programmed with certain biases and ideologies that trend toward racism and hetero-patriarchism. This is both a feature of the white-maleness of the software coding space and tech industry more broadly, but also of the propensity for far-right viewpoints to circulate among that same cohort (as we now see unleashed in the form of Elon Musk, Peter Thiel, and others).

Among all these frenetic and fragmented conditions of modern life, digital space allows users to see the ideal body; to see themselves (or a version of themselves to which they aspire) reflected back at them as a series of visual/textual promissory notes. This sense of belonging – if only to a digital community or affinity – is powerful. The digital offers rapid connections with other users (or avatars, bots, and algorithms) that tell them exactly what they want to hear, show them what they want to see, and reinforce their truths or lies. It can give affirmation where it is lacking. It can 'find friends' when real friends are absent. It justifies, it clarifies, and it simplifies.

So it is natural, in my opinion, that the far-right appropriates and utilizes this space to sink their teeth into vulnerable identities and would-be adherents. The far-right has long played the role of a mechanism for projecting illusory spectacles, lies, and conspiracies, and notions of stability, grandeur, and gain, amidst a world where all of these things seem out of reach. Meanwhile, the deportations of students and citizens, the torture of migrants, the disciplining of body types, the regulation of

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intimacies, and fomenting the ongoing death cult of late capitalism – these things can happen while we are distracted, entertained, *click, click, click*.

In the digital, you can also exclude. You can end a conversation so easily. You can 'block' a user, delete a post, censor yourself or others, you can alter an image, and you can curate your life in a way that shows all the treasures and hides all of the grit and grime. Live in augmented realities. Never wake up! Doesn't this mirror what the far-right offers in its politics and aesthetics? A politics of curated lies and illusions, a politics of filters, and mirages. A politics of deletions and insertions. A digital user can 'report' or 'block' another user or post that they find offensive or ugly. The far-right can deport, detain, torture, can disregard the law, democracy, and human decency in callous and catastrophic ways. It is no surprise, then, that the digital has been so vital in far-right growth and in its resulting territorialization, and that far-right territorialization comes to mirror the architectures of digital space.

Zita & Michael: Finally, the examination of the territorialization of far-right movements, and the associated violence, requires careful consideration to avoid reducing it to the sites of the perpetrators. In our book, we argue that it is crucial to acknowledge the perspectives of those affected by far-right territorialization in order to understand how their communities and experiences shape their own spatial understandings and territorializations that contravene the increasingly hegemonic narratives of the far-right (Terra-R, 2025, 120f.). You touched on the emancipatory potential of digital spaces in one of your previous answers. Could you elaborate on this? What opportunities do digital territorializations provide for emancipatory endeavors? Or do you believe that the digital space fosters genuinely regressive forms of social and political practice?

Jason: When Manuel Castells (1996) outlined his vision for the then-emerging digital 'network society,' he noted a few possible trajectories. He predicted that the network society would likely result in new forms of exclusion, authoritarianism, and exploitation (and look how it has!), but also, new forms of democracy, organizing, resistance, and liberation. Perhaps we are less convinced by this latter potential, but I do believe it exists.

I do believe that there are 'spaces of hope' in all spaces of daily life. In my own research on authoritarianism, I have argued that digital space – in some contexts – offers vital pathways for resistance and democracy that are not possible in the built environment or within the bounds of the nation state. For example, I've explored how Singaporean civil society groups and activists/dissidents have utilized digital space to connect with the diaspora and to gain representation and influence through social media (Luger 2016, 2020, for example).

In my paper with Martin Zebracki (Zebracki and Luger 2019), we argued that digital space – for some groups – offers new forms of intimacy not possible elsewhere (e.g., LGBTQ+ individuals who aren't able to meet in 'real life' or who can 'try out'

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identities online in an anonymous or safe way). We also argue that far-right digital expression can be taken by progressives and remixed into humorous or satirical forms that can neutralize far-right hate or extremist ideology – for example, the way that far-right images or Memes can be altered to be just silly and cartoonish, the digital equivalent of the old 'Look, the emperor has no clothes!' story. Take the power of online humor into account to both platform the far-right and – importantly – to unmask and ridicule it.

The revolution will not be digital. I do not believe it will be. And I do not believe that digital resistance or digital antifascism alone are powerful enough to disarm the far-right and the authoritarian contagion that we now face. But I do believe that the digital will and must be utilized and re-appropriated away from the far-right ideologies of 'neo-reactionary movement' ('NRX') and the Techno-feudalists and that it will be vital in building consensus for the progressive and just revolution that is emerging (and it is emerging!). Making this work it will necessitate a program of de-coding and re-coding the algorithms – and artificial intelligence – to work for, and not against us. But as radical Anthropocene scholars like Wark (2019) suggest, along with the critical queer and feminist digital geographers claim, digital space can be reset and 'glitched' to offer hopeful alternatives and trajectories.

But this will also mean unplugging from the capitalist power of the platforms and returning digital space to the progressive grassroots through community-based networks and intranets (the equivalent of using a local monetary currency to 'shop local'). If Elon Musk, Peter Thiel, Rupert Murdoch, Fox News, et al., no longer have the power to monopolize our digital world, then they will also lose the power to invite regressive actors to crowd 'the cloud'.

Generation Z makes me hopeful here, because of their digital literacy and also their keen ability to 'read' different kinds of online code and discourse. They don't tolerate bullshit. And they are getting tired of empty digital influencers and endless, brain-rotting content. They are creating new spaces for emancipation that we may not yet have the language for or understanding of – but watch this space. The far-right will also be led by a younger generation, and one that is increasingly digitally-savvy. So, the future is uncertain. I hope the critical work of many scholars, like you, can continue to raise awareness and hopefully, engage non-academic solidarities in antifascist ways forward. This is what we need, online and offline.

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Work and Repair

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"Is something broken?"

Producing and moderating Do-It-Yourself repair advice online

Ronja Trischler

Introduction

"*Is something broken, damaged etc.? It doesn't have to go straight in the bin! Children's toys, electronic devices, furniture, cars, and clothes; everything can be repaired up to a certain point, usually even with the simplest means! Sometimes you pay a fortune to a specialist, but that doesn't always have to be the case!*" When everyday objects break, their owners can access support online through tutorials, forums, manuals, as well as in online groups – such as the one that the above description was taken from.[1] It demonstrates a wide understanding of Do-It-Yourself (DIY) repair of all kinds of everyday objects, both concerning what can be repaired and who can repair it. DIY repair relates to manual tasks to either care for or fix belongings or household matters (i.e., using one's own free time, materials and tools, instead of hiring professional crafts persons or buying something new (Hitzler and Honer 2014, 430)). While it does not take place through gainful employment, as a form of care and reproductive labor it is work, as studies on repair have pointed out (Graziano and Trogal 2021; Jackson 2014). DIY repair advice online makes this work both visible and also debatable. This chapter examines the interactional accomplishment of producing DIY repair advice online: it requires not only time and effort by those engaging in asking for and giving advice, but also relies on the platform infrastructure, including a common form of digital volunteer work: the moderation of online interactions.

1 The German-speaking online repair advice group will be introduced and discussed in greater detail throughout the course of this chapter. All quotes from data – such as the one right at the beginning of this chapter –, including platform vocabulary, have been translated into English by the author and written in double quotations and italics. Excluding the original German wording is part of an effort of anonymization. There are grammatical or synthetical errors in the quotes, something typical for online communications, but these are limited to writing in upper or lower case, which will only be indicated and discussed if they are analytically relevant.

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Although online DIY repair advice promises 'easy' access to help with making repairs, examining its practical accomplishment reveals the specific challenges posed to those involved. This chapter examines the interaction in the online group from which the description was taken, a group specialized in the repair of everyday objects. It is based on an ongoing study that consists of focused ethnographic episodes conducted since autumn 2023. For this chapter, fieldnotes, and particularly screenshots of posts and comments, were analyzed using "trans-sequential coding" (Scheffer and Trischler 2023) in order to trace the *temporal* unfolding of the production of advice.[2]

The following analysis illustrates the work of members of a large online group to communicate their local repair problems and potential solutions – as well as how they organize their interactions with each other. Here, manual tinkering with the objects – described in Science and Technology Studies (STS) as an essential part of repair as practice (Dant 2010) –[3] is communicated and 'translated' into providing repair advice. In the case of the online group, this takes place within the digital infrastructure of a platform through posts and comments. As will be explained, this sociotechnical interaction is subject to both "content moderation" and "volunteer moderators," who take care of the group in their free time. In practice, this "civic labor" (Matias 2019) often remains "invisible work" (Star and Strauss 1999) that facilitates the collaborative production of repair advice, but can also sometimes become the subject of group discussions itself. Examining the sociotechnical accomplishment of producing and moderating DIY repair advice in interaction emphasizes the practical efforts required to create a 'participatory culture.'

"*Join group*": participating in an online repair group

The description of the group anticipates specific reasons to participate in online discussions *of DIY repair* in contemporary society. For instance, it refers to social issues relating to the motivations for DIY repair, such as limited financial resources or limited access to expert repair knowledge. Thereby, DIY repair work is positioned as against social issues. With it, the group becomes a means to both handle and process their effects in the everyday: here, people can seek and find trans-local help. This relates to other popular collaborative civic repair practices offline, such as repair

2 While ethnographies are helpful for understanding repair, given the instructive materiality of repair practices (Strebel; Bovet and Sormani 2019), research methods need to be adapted for an adequate study of repair advice as *online* interaction (Hine 2015).

3 According to STS, repair sustains all kinds of social practices: the world is constantly in need of repair and maintenance (Graham and Thrift 2007; Jackson 2014; Denis, Mongili and Pontille 2015).

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cafés or markets (Baier, Hansing, and Werner 2016; Kannengießer 2020; Bradley and Persson 2022). These local initiatives often "politicise repairing as an act against the throwaway society" (Kannengießer 2018a, 76; author's translation R.T.) – a phrasing that is indeed mirrored in the continued group description by its admin who wants to work "*against the throwaway society!*" DIY repair is both a matter of social inequality, with regards to unevenly distributed resources to buy and/or repair everyday objects, and of addressing other "existential problems" (Scheffer 2021), including the climate crisis and related issues, such as global production and finite raw materials.[4] Conserving resources, cost savings, and reducing waste, as well as other motives, such as self-empowerment, joy in the activity of repairing, or passing repair knowledge on, all motivate participation in repair cafés (Kannengießer, 2018b, 213–214).

Online communication can broaden who can participate in repair works. This is certainly a main feature of the group's mission, given that its description ends with: "*Just get in touch with us if you have something, nothing is impossible!*" This echoes the promise of inclusivity and participation, common for online communities more generally (Stalder 2018, 58ff.). This promise has been criticized – and proven wrong empirically on many levels, such as concerning inequal access (Dijk 2020) and hate speech (Kalsnes and Ihlebæk 2021; Eickelmann 2017). However, this group's inclusive approach seems to be fruitful overall: it was founded over ten years ago and during the course of this study, it has gained over ten thousand members over two years since 2023, rising to over 50,000. There are also a lot of "*activities*" in the group that drew my attention to it initially – and continued to capture it; new repair enquiries are posted daily, asking for repair advice about a very wide array of everyday objects – like washing machines, television sets, lawnmowers, hairdryers, speakers, toilet flushes, faucets, furniture, clothing, etc. – that commonly receive up to 100 replies over the course of a day or two. This shows a vivid online community; its members are eager to help each other with their repair work.

However, while the online group is "*visible*" to anyone on the platform, it is a "*closed group*," requiring admission by clicking the "*join group*" icon. In the subsequent process of becoming a member of the group, its "*rules*" have to be affirmed; these rules focus on etiquette, trying to prevent judgmental comments about *who* wants to repair *what* and *how* – as well as on their capabilities to *communicate* (see below). The membership admission also includes a small, but easy, test that seems to be an attempt to make sure new members actually read the rules. This is part of the work by its three "*admins*" and four "*moderators*" who grant admission to the group. While the

4 This is of course not only addressed through civic initiatives, given that reparability of products is also a legislative question: In June 2024, an EU Directive came into force that aims to make it easier for consumers to either repair products themselves or to have them repaired. These regulations must be transposed into national law by the end of July 2026.

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former were part of the group's founding, the latter were recruited from the members a couple of years ago as a response to the increased number of members. In a post directed particularly at "*old hands*," (i.e., those members who have been involved in the group for "*a couple of years*") the group's admins asked for volunteers to support them. In a comment they specified that the group had gained 10,000 members in two months and also – humorously – highlighted the *unpaid* labor involved in moderating, thereby arguing not only for the necessity of the additional support, but also advertising themselves as "*quite nice colleagues*" and as an overall friendly group that "*adheres to the rules*." Several members replied, some explicitly applying and indicating their previous experience in the group and as moderators of other online groups. Others expressed their interest, admitting that they had only recently joined and some had no time for volunteer work. Five days later, the three admins announced their selection of three new moderators, who accepted this "*vote*" by the admins (according to their status as "*moderators*" in the group).

These voluntary roles, as well as the formal enrolment in the "*closed group*," are part of how platforms are organized as digital infrastructures and this is usually described using the term "content moderation." In practice, this takes place *sociotechnically*: While platform companies rely heavily on algorithms and increasingly on 'artificial intelligence' for the organization of their online services, these technologies are integrated in the organization in their development, execution, *and* when making potential changes (Gillespie 2019). This means, in practice, that they are intertwined with human work: this includes the platform company's small internal teams and programmers, a larger number of badly paid "crowd workers" (i.e., contractors primarily from the Global South who are exposed to harmful content (Roberts 2019; Gillespie 2019, 120)), both the unpaid volunteer moderators in different groups, and users who post and report posts for review.[5] In the repair advice group, posts can be reported to the group admins and/or to the platform. There are different reasons that can be selected, such as "*breaking the rules*," "*spam*," or "*irrelevant content*," but also "*harassment*" or "*member conflict*." The report form also states that the posting person will not be informed about who reported them, thereby making not only the work of moderators, but also that of users, invisible to other members.

Platform companies provide volunteer moderators with (oftentimes extensive) guidelines for moderation online. However, these remain "discursive practices" (Gillespie 2019): Empirically, moderation can vary both on and between platforms and depends both on the kind of "content" that is being moderated and the participants involved. As has been stated in the (ethnographic) study of other infrastructures, platforms are embedded, built on an installed base and embody

5 From the perspective of the sociology of organization, these connections between core and periphery are typical for digital platform as a form of organization (Ametowobla and Kirchner 2023).

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standards; they are transparent to use and link to conventions of practice, yet these are learned as part of membership (Star and Ruhleder 1996, 113; Star 1999). Thus, we will now look at the *practices* of producing and moderating repair advice online. How is DIY repair advice produced, participatorily *among* the group members and the moderators and admins, *with* this digital infrastructure?

"*Is there a trick?*": asking for repair advice online

"*Is there a trick to rethreading the zip so that it closes properly?* 😕 *I got a knot in my head. I opened the zip and now I've rethreaded it the wrong way round.* 😤" (14–06-2023) This is a typical enquiry in the group, in which most of the posts consist of requests for repair advice on current repair issues relating to everyday objects. Solved or potential issues are addressed in such posts, albeit less often. Although they differ in length, detail and style, these enquiries usually identify a specific object (here *the zip*), indicate an existing problem (*unthreaded zipper*), express a wish for repair ("*so that it closes properly?*"), address both the recipients of their enquiry (here implicitly the whole group: "*is there a trick?*") as well as a recipient for the advice ("*I*," also supported by the infrastructural reference to the user as "*author*" in the post). As with this example, they might also report the cause of the repair problem ("*I opened the zip and now I've rethreaded it the wrong way round*"), explain previous attempts to either repair or describe the objects to be repaired in greater detail (e.g., naming the manufacturer, the name or number of the model, its age, etc.). The posts often include images or videos: likewise, this post was accompanied with a close-up photo of the end of a closed zip (for some sort of bag) and two fingers holding the detached zipper in front of it.

First, to ask for advice, the repair issues relating to the object need to be communicated. While media such as manuals (Schröter 2018) are commonly consulted during DIY repair, members of the group can and need to articulate their problems *themselves* in order to receive advice. They use images, videos, and descriptions to make both the objects that are to be repaired and practices understandable and discussable for other participants of the online interaction who are addressed as peers with repair expertise. Advice, as a conversational form of help, is a common genre online which developed early (Briggs and Burford 2002; Suzuki and Calzo 2004), particularly through peers (i.e., giving advice is not limited to professional experts). Depending on the object and the issue with it, this takes more or less effort – whether it is successful can only be judged through the subsequent comments (see below).

Second, *a new conversation was started* with this post. This is typical of the organization of the group. Although it might seem like 'digital common sense,' this allowed for a sociotechnical organization of repair advice interaction that focused on one specific broken object. This practical use of the digital infrastructure is key to the success of creating advice online (Vayreda and Antaki 2009; Stommel and Lamerichs

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2014; Locher 2013):[6] it creates a shared 'here and now' for members that are concerned with *this problem* – generally allowing its members to participate with different requirements, not only relatively and regardless of their specific repair expertise, but also on the basis of their prior involvement in the group. In ethnomethodological terms (Garfinkel 1967), it is an accomplishment to ask for advice online.

"*Just open the zip again*": giving repair advice online

How to start asking for advice is important, as advice interaction, because it is organized through sequential turn-taking (Sacks, Schegloff, and Jefferson 1974). But how (and if) repair advice is accomplished in the group can only be answered in the subsequent comments: most responses offer advice – of some form, including hints, suggestions, tips, and assessments, but also encouragement, jokes, and disapproval – or ask questions to obtain additional information in order to give advice. Similarly, Morrow (2006) classifies three types of posts in an advice forum: problem messages, advice messages, and thanks messages that differed in features and in terms of discursive function. While new enquiries receive "*replies*" and "*reactions*" in the repair group, their sequential unfolding as interaction is more complicated.

Comments responding to requests usually appear in a matter of hours of the repair advice enquiry, sometimes within either minutes or a few days. In our case, the first comment appeared within a minute after the post, suggesting opening the zip again to thread the zipper. Three minutes later, the author followed up, pressing the idea that there could be a "*trick to spare them this work*," thus, repairing the zip without having to open it. The first commentator answered right away, detailing how to press open the zip with "*something sharp*" (suggesting a way to make "*this work*" easier, rather than to "*spare*" it,), which got backed up (after 25 minutes) by a second commentator suggesting that a pen would work. One hour later, a third commentator replied to the first comment, arguing that opening the zip was not enough, the thread also had to be opened in order to include the zipper. In the meantime, a small number of other replies had been posted with no direct reference to the initial comments, stating similar problems with their own zips or one suggesting to "*just pop it back in*."

This shows the practical, and asynchronous unfolding of generating advice in the group; a piece of advice might be confirmed or criticized with reactions or replies. This includes what can be described as interactional "repairs" (Schegloff, Jefferson, and Sacks 1977) through a mutual evaluation of advice or by referring each other to

6 As argued in the previous part, technologies do not determine these practices, but rather participate in their organization (i.e., online interaction should be viewed as an interaction in its "own right" [Meredith 2019: 128, see also Meredith, Giles, and Stommel 2021]).

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existing comments. Commentators reply to each other (e.g., semantically), by linking each other, or by creating "*threads*"; they might also delete their own comments retroactively, thereby using the infrastructure as a resource for repair advice interaction. In this example, the third commentator referred to her previous comment in her reply to the first commentator's reply: "*Separating the other side is what I suggested and did myself yesterday (it was a small bag for organizing luggage, nothing valuable)*." While sequential reference can be identified as a principle of order in the online interaction, in ethnomethodological terms, there is also a multitude of second "turns" (i.e., answers to an original post) that do not refer to each other.

Relevant information might also be missing, thereby prompting questions from other members, sometimes forming a lengthy back and forth. This often means both longer involvement and the necessity for patience from those asking for and giving advice who possibly need to wait for responses (as is typical with cooperation, see Trischler 2023). The author's involvement in the comments of their own posts is also remarkable: a lot of them answered questions, gave thanks for advice, or closed the comments underneath their post. For instance, the zip post was edited once (on the same day that it was posted): it initially only comprised of the first question, with the second part being added thereafter. The platform marks their actions with "*author*" next to the name, thereby highlighting their special accountability for their post.[7] The work of asking for advice does not commonly stop after the initial request.

While replies differ in length, detail, and style (and, of course, usefulness), repair advice posts determine the *part* of the object to be repaired, suggest a *solution, qualify it* – and even define the *recipient* of the repair advice with reference to the repair enquiries. Discussions about suitable repair advice appear alongside these aspects: Which parts can/need to be repaired? How can they be repaired? How do we know this? (And: do we know enough about this?) These questions also relate to the question of specialization and expertise in DIY repair that is often discussed in the group (concerning specific objects, such as electronics). Importantly, they also relate to the recipients: repair advice also includes *who* could repair *this object*. As in the context of this group, skills vary a lot and members categorize differences in repair skills necessary for the solutions posed. Most commonly, this refers to practical knowledge, hinting at their own repair activities, like one commentator: "*I couldn't do it. I unraveled the other side, threaded it from there and then sewed both sides back together again*." In other posts, members present themselves as professional craftsmen who participate

7 As this platform attribution is directed at the user that is *requesting* advice, it is a marginal form of authorship that is limited to producing a comprehensible problem description. However, as the focus of the advice interaction is on creating solutions to repair problems in the form of advice, it could be argued – contrarily to the platform attribution – that those *suggesting* repair solutions have a more plausible claim to their advice's authorship. For more on the concept of authorship in cultural production, see Göbel in this volume.

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in the group in their free time – this relates to how the repair advice unfolds and also relates to the specific repair object. This also refers to the ways in which DIY repair workers encounter each other online and their roles, a topic that will be discussed in the following section.

In general, comments and reactions *affirm the new conversation* that the post opened with their suggestions as well as their critique. Most enquiries are concluded (or abandoned) after a few days. In this example, the author closed the comments without further explanation. Although this might indicate that she received sufficient advice, it is primarily a way to definitively end *this conversation*, thereby producing a closed repair advice interaction. Hence, the group displays a particular sociotechnical organization of online interaction through singular enquiries for advice about singular things. This organization represents a practical answer to the challenge of the 'many-to-many interactions' in the group, ordering the interactions in a comprehensible way. It allows group members to participate in these interactions without preconditions, more or less. While the group members, therefore, *use* the digital infrastructure (posts, comments, likes as well as reports, see below), the latter does not determine the practice. Similarly, taking the "*group rules*" into account, it is the admins' and moderators' wishes that replies should indeed *not* refer to previous posts. However, it is through their members' skillful use of the forum that they – routinely – accomplish the production of advice together.

"Top comments," "rising contributors," "moderators," & "group rules": producing 'good' repair advice online

A varied practical etiquette seems common to the group in online repair advice interactions. There is a general etiquette in replying to the original post, whose base line can be characterized as 'staying vaguely on topic' in the reply. This etiquette intensifies if contributors discuss a specific suggestion with each other and they reply to each other's comments, thereby creating a conversational thread and accountability for their contributions. In the example of the zipper, they disagree politely ("*I don't think so*") or agree with each other ("*you're right*") or "*like*" the other's reply. Yet, there are also cases in which members show their disagreement concerning repair advice more strongly, disqualifying each other's expertise in some cases. As a form of *help*, advice interaction constitutes a mutual, albeit asymmetrical, form of relationship (Wagner 2019). Whether online or offline, advice is an interactionally delicate undertaking because it raises questions about competence and can, thus, be face-threatening for both those seeking and those giving advice. Thus, peer-advice and expert-advice online both showcase "relational work" (i.e. work on the relationship as part of the discursive mitigation strategies (Locher; Bolander and Höhn 2015)). These are "interaction rituals"; i.e., 'little' acts of (im-)politeness in the ways members

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address each other and interactively and construct each other as members of the group (Goffman 1967). The ways in which members participate and encounter each other is facilitated infrastructurally, not only by becoming members of the closed group, but also through different statuses awarded to them by the platform *for their participation*. Members can become a "*rising*" or "*top*" or "*major contributor*" in the group by posting; this status is then listed next to their name with every post or comment that they make (this is also effective retroactively for the posts that have been made by the user prior to receiving the award). For instance, one of the third commentator's replies was marked "*most relevant*;" it only had two likes, but one of them was by a "*top contributor*" to the group and its author marked as a "*rising contributor*."

The group's "*rules*" display a strong emphasis on etiquette, too, and attempt to facilitate repair advice *without judging* the repairer, their work, or the way in which they communicate it in the group. In practice, these rules are sometimes mentioned – or even enforced: occasionally, there are 'calls for' and complaints about moderation. From an ethnomethodological point of view, moderated conversations (not just online) are specialized or "institutional interaction" (Heritage 1998): they have particular speakers and contributions. Moderation facilitates this through an asymmetrical interaction between moderators and other contributors (Rebstein, Rabl, and Schnettler 2011) who adopt different roles in interaction. In the case of the online group, moderators are granted other sociotechnical resources by the platform in order to moderate groups: they decide upon the group's rules and who can join, posts can be reported to them (using a drop-down menu that can be opened in each post), they can delete posts and comments, and even close the comments section – and they are listed (and marked) as moderators and admins when they post, thereby making them accountable for the group. *Calling for* moderation, then, is one way of addressing a general problem for members of the group: the gradual invisibility of group moderation. First, the digital infrastructure allows for different ways to make moderation visible (Kalsnes and Ihlebæk 2021): in the group, deletion is indicated only if somebody had already replied to a post; thus, sometimes when returning to a post, I could only tell a difference through screenshots taken previously. Thus, users often perceive these socio-technical selections and closures, if at all, as opaque and as a cause for speculation (Myers West 2018), asking: *was* this moderated? Second, it is also not visible how much time volunteer moderators spent reading comments: the "civic labor" (Matias 2019) of volunteer moderators requires time-costly monitoring, as well as care and emotional labor, which is made difficult through the platform logics (Ruckenstein and Turunen 2020). In replying to these questions, in the group, the moderators repeatedly pointed out that they actually did not delete the comments or would explain their ways of moderating. They were walking the tightrope between creating trust (Squirrell 2019) and facilitating the common goal of generating peer advice by evaluating and (potentially) deleting posts. In so doing, group moderation was primarily concerned with specific contributions to these online in-

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teractions: moderators would delete *specific* comments or close the comment section of specific posts; they also granted entrance and (potentially) banned members from the group. Yet, the calls for and complaints about moderation show that this can be perceived differently by the members and by the moderators in the context of the group more generally (beyond the individual post), sometimes asking explicitly about the 'state of the group.'

Other complaints concerned the (admittedly rare) closing of specific comment sections by moderators, which users perceived as premature, indicating a problem specific to the moderation of this group: the question of expertise. For example, one member pointed out that suggestions for repairs concerning electricity were left undisputed, which they understood to be dangerous. They justified their complaint by means of expertise, through a reference to the regulations of a trade association. Thus, questions of moderation show a tension between the group's claim of enabling *everyone* to participate in repair advice interaction with the specialized knowledge that also exists in this area. The question of who engages in DIY repair is also gendered: while members of the repair group present in different genders and gender is not often discussed *explicitly*, there is a remarkable volume of members read as male involved in the group (which gets acknowledged in the group conversations at times). Explicit gender constructions can sometimes be found in the address in the posts (such as "*good evening, men!*"). In an archival effort (using the search word "*men*"), I found some posts addressing gender: they sparked engaged (sometimes heated) conversations about the relevance of gender to repair, while also acknowledging problems in communication by some of the male group members.[8]

Conclusion

This chapter has analyzed the sociotechnical production of repair advice in a large online group. In cases like this, conversations between a large number of participants can be accomplished, specifically *because* they are organized as requests for

8 Both the historically gendered character of home improvement as well as the topicality of gender online is relevant here. While white middle-class women were commonly responsible for all household matters in the US in the 19th century (including hiring professional craftsmen), the emergence of "Mr. Fixit" marked a change in American family roles in the 1950s: "By taking over chores previously done by professionals, the do-it-yourselfer created a new place for himself inside the house." (Gelber 1997, 67). As has been pointed out, current studies of repair oftentimes ignore the heterogenous histories of repair (Krebs, Schabacher, Weber 2018, 11). While (also more implicit forms of) doing gender is certainly worth discussing to a greater extent, it is not the focus of this chapter. For a discussion of gender online, particularly in the case of "the manosphere," see Luger's contribution in this volume.

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advice. Yet, this labor is intensive, both due to the necessity to communicate manual repair problems comprehensively and due to the necessity to interact with each other in posts, comments, and reactions. This is facilitated through content moderation and volunteer moderators: The sociotechnical practices of moderation dot not exhibit a sheer 'platform effect,' but instead depend on the specific topic of the conversation at hand.

On the one hand, the digital infrastructure of posts, replies, and reaction supports the organization of repair advice interaction. Although they are often rightfully described as problematic spaces for discourse, in the case of the DIY repair advice group, the platform is used in a way that makes it helpful to allow members to participate in advice interaction without previous participation or without a familiarity with the group. The group's interactions are organized by creating *closed conversations* on repair problems and by requesting and providing help for *particular* objects. Within the platform infrastructure, repair suggestions can be formulated without interruption as comments and "*likes*," thereby making it easy to reinforce a suggestion. The order provided by "*relevant*" and "*current*" posts, as well as by the different members' statuses (both important parts of content moderation) also helps to organize successful advice. Members can use these infrastructural forms of evaluation as orientation for their own judgment about the quality of the advice given. The actual implementation of the repair advice given routinely remains absent, though.

On the other hand, the organization of DIY repair advice is also made more difficult by the potentially high number of posts and replies, the lack of referencing between replies, and the fact that they can be posted simultaneously. Volunteer moderators may need to intervene where the production of advice is becoming hindered. The fact that they only rarely delete comments or close posts in this group, along with the occasional complaint about it, affirm that moderation is interactionally delicate. There is a particular tension between the group's claim to enable *everyone* to participate in advice interaction for DIY repair with the specialized knowledge that exists in this area. In this context, how repair advice is generated also depends upon the kinds of objects that need to be fixed, concerning commonality and expertise that needs to be explored further.

Online repair advice has become commonplace in DIY repairs, adding interactional and communicative labor to the situated practical tinkering with repair objects. Therefore, producing online advice for DIY repairs can be considered to be a form of volunteer or civic labor, supporting the (often individualized) reproductive labor of repairing everyday objects. Producing advice together makes the work of DIY repairs more visible, but it also makes them debatable: Producing good advice requires care from both users *and* volunteer moderators; the latter particularly so in the instances in which posts become careless, thereby hindering the interactional organization of producing advice. Moderation, however, is not only about monitoring specific or singular post, so as to enable a good conversation or to provide 'good'

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advice; it is also, more generally, about continuous (even constant) care expressed for the current and future conditions of the conversations that take place within the group.

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Working (on) Spaces

Repairing rural infrastructures through collaborative working spaces?

Inga Reimers

Introduction

How does the digitally grounded, collaborative working practice of rural coworking spaces[1] materialize in their local and wider environments? To what extent can rural coworking be described as a care and repair practice in this context? Which specific practices do coworkers use to counter the declining infrastructures that are commonly discussed in peripheral and suburban areas?

In this contribution, I will examine rural coworking spaces (CWS) as sociomaterial entanglements of individual working practices and care/repair practices for rural spaces that are oriented towards common goods. As the slash between "care" and "repair" suggests, these practices and concepts are not clearly separable; rather, they intersect in that they are both aimed at the functioning of the relationships and spaces described here. A more precise differentiation is provided in the section on infrastructures of care and repair in rural coworking.

The analytical perspective on infrastructure work is intended to foreground the visibility and invisibility of the transformation processes addressed here, in both the field of work and in the development of rural spaces. Additionally, looking at rural CWS through the lens of infrastructuring (as a verb) enables an analytical sensitivity to be developed concerning the practices and agency that are distributed in alternative, decentralizing spatial design processes. For this purpose, I draw upon two studies about coworking in rural areas (Bertelsmann Stiftung 2020; Marmo and

1 I use the term coworking spaces in a broad definition in this article and that includes all formats and concepts in which spaces and infrastructures are (also) used jointly for gainful employment in order to take account of the heterogeneity of rural coworking spaces in all of their spatial forms and different practices (Marmo and Avdikos 2024; Bertelsmann Stiftung 2020).

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Avdikos 2024) and on seven interviews that were conducted with CWS hosts as part of a project seminar at the HCU on practices and spaces of digital work.[2]

Rural areas are often discussed as problematic and deficient, with a dysfunctional infrastructure in academic and public discourse (e.g., in terms of public transportation or medical supplies) and are often considered as backward and conservative (Steinführer 2015; Naumann and Reichert-Schick 2013). In fact, many rural regions in Germany struggle with out-migration, an aging population, and insufficient funds to operate and maintain schools, kindergartens, and swimming pools (Steinführer 2020; Fischer-Tahir and Naumann 2013). Nevertheless, a wide range of civil society, voluntary initiatives, and associations continue to both shape and organize social life in rural areas. However, the actors often reach their capacity's limits when trying to balance gainful employment, care work, and other activities, due to the withdrawal of both state funding and state involvement (Rüger, Greinke, and Skora 2022).

However, non-urban areas came into focus as positively connoted spaces of longing and counter-designs to life in urban areas during the COVID-19 pandemic. Life in the countryside seemed desirable during this exceptional crisis situation, when the positive aspects of urban life, such as a diverse cultural, economic, and social infrastructure, were unavailable or even dangerous. In fact, younger, well-educated middle-class couples, in particular, who had already planned to move out of the city anyway, stated that the pandemic had supported or drove their decision (Dolls and Mehles 2021, 31–32). Nevertheless, immigration mainly favors suburban and small-town locations with good transportation connections to the larger cities, so people can pursue well-paid jobs there and can easily take advantage of the cultural offerings.

The opportunity for gainful employment, which is both financially rewarding and can be found within a reasonable commuting distance, is a significant factor in the decision-making process regarding place of residence. The aforementioned well-educated young couples and families require reliable digital infrastructure in order to maintain their lifestyle and employment when either relocating to or remaining in rural areas. This demand has resulted in mounting pressure on local municipalities to either upgrade or to maintain their infrastructure. The capacity to secure gainful employment in close proximity to one's place of residence, with adequate transportation options, exerts a substantial influence on residential decisions. Childcare is also crucial, particularly for families and for prospective parents. Dolls

2 The interviews were conducted by students, Arina Panchulova and Isabella Gmehling, as part of the project seminar and I would like to thank them for their work and for making the interviews available for further research. I would also like to thank the CoworkLand cooperative and Hans-Peter Sander in particular, who provided support in making contact with suitable coworking operators.

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and Mehles (2021, 31) find that the influx of young professionals raises expectations for local planning, particularly in areas of education and mobility. Digital connectivity is essential for both social and professional communication; remote work has emerged as a viable alternative to commuting, influencing relocation decisions – though it is feasible only where high-speed internet is already available. As of July 2024, gigabit (74%) or broadband (30%) coverage remains incomplete throughout Germany (Bundesregierung Deutschland 2024). In the section that follows, I will introduce the group of actors, outlined here in the context of rural CWS, and will conduct an in-depth examination of this phenomenon's characteristics.

Rural coworking

In what follows, I will explore rural coworking as a heterogeneous, spatialized, and digitally based practice. In considering this framework, I will firstly delve more deeply into concepts of rurality. This reveals that rural areas are characterized by heterogeneity in terms of conditions, appearance, and functionality. Settlements close to urban centers are subject to different conditions than settlements in peripheral, sparsely populated areas (Küpper 2016). Therefore, it is necessary to establish a clear distinction between the terms "rural" and "peripheral."

This concerns quantitative distinctions less, such as population size, and more concerns suburban and peripheral areas, whose living conditions differ from cities due to size, location, and specific infrastructure (ibid.). Rurality refers to measurable factors that include density, settlement structures, or land use and is linked to specific images and narratives. Periphery, always defined in relation to a center, is understood here as a peripheralization process formed by social relations and developments (Beetz 2008, 574). Consequently, there are actors in this process who shape it more or less actively. Coworking actors can, thus, be identified as agents who co-shape this center-periphery relationship because they address peripheralization as a development of inequality and attempt to counteract it. This happens, for example, through the decentralization of work locations through digital communication and data transmission in the home office, as well as in CWS. In this regard, the expansion of the digital infrastructure functions as a catalyst for progress, particularly in specific domains. This assertion is exemplified by the expansion of superior transportation networks (Melgaço 2022). It can be argued that enhancing the region's digital infrastructure may contribute to a region's de-peripheralization. I prefer the term periphery in the definition above, rather than the term rural; however, I will use it to describe these sites in this text because the term "rural coworking" has become established in practice and academic discourse.

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Rural coworking as part of a rurban lifestyle

The EU-funded international junior research group CORAL ITN, which studies collaborative workspaces in rural areas, states that these workspaces are roughly equally spread throughout Europe's urban and rural locations in one of its surveys (Marmo and Avdikos 2024). In their study on "Digitization as a Driver for Rural Development", Hölzel and de Vries speak of roughly 20% of German CWS that are now located in rural or suburban areas (Hölzel and de Vries 2023).

While there are many similarities in coworkers' working methods and motivations in urban and peripheral areas, a study by the Bertelsmann Foundation (2020) describes rural CWS as more heterogeneous in terms of user structure, among other things. For example, coworking is operated in parallel with work in an employment relationship for additional project work. Both studies highlight the importance of social exchange, networking opportunities, and other events, such as training courses and cultural events, particularly for users of rural CWS. However, in both forms of CWS, the majority of coworkers are self-employed, creative, and knowledge workers, all of whom can work remotely due to the digitalization of their work products and tools; however, they are also dependent upon a stable internet connection to use communication and collaboration tools. The basic technical and cultural prerequisites for the operation of coworking on a permanent basis are summarized within the term coworkability. These prerequisites include technical skills and tools for organizing work digitally, autonomy over spatial and temporal work organization, and both a suitable team and trust culture within professional networks (ibid.).

This categorization also demonstrates that coworking in peripheral areas is subject to specific conditions that distinguish it from coworking in urban areas (Knapp and Sawy 2021). However, there is a large degree of overlap with the practices, lifestyles, and values of urban coworkers. This is not surprising, given the origin of this phenomenon in urban areas. The fact that coworking is a mostly value-based and value-oriented practice is shown, not least, by the Coworking Manifesto, which is frequently referred to in texts and conversations.[3]

Furthermore, as demonstrated previously, the majority of rural coworkers are individuals who have formerly spent at least part of their working and educational life in larger cities. In this regard, these practices must always be seen as the result of different influences. Consequently, a classification that is based exclusively on spatial location appears to be inadequate. The Bertelsmann study also concludes that rural coworkers are not compelled to choose between living and working styles, but rather observe a trend towards hybrid rural living and a rurban lifestyle (Bertelsmann Stiftung 2020).

3 https://www.coworking-germany.org/coworking-manifest/ (Accessed July 30, 2025).

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At the same time, the urban influence should not be disregarded in the discourse on peripheral areas and concerning the concrete implementation of CWS on site. The impression that local problems can be 'repaired' one-to-one with concepts that have been tried-and-tested in urban areas has emerged. This has led to discussions about gentrification being transferable to peripheral areas (Lange and Üblacker 2023; Mießner and Naumann 2021). In addressing the issue of rural gentrification, I am less concerned with the common questions of displacement, price increases, and revaluation processes, but rather with the acceptance of lifestyles and working practices by the local population. This entails the examination of social perceptions, the identification of the beneficiaries of these changes, and the analysis of the processes that facilitate collaborative actions and, consequently, the development of a sense of community. A more thorough examination of this phenomenon is warranted, but will have to be conducted elsewhere.

Rural coworking always (at least implicitly) addresses and discusses the spatiality of (gainful) work, given that it is a response to spatial problems. These problems are related to both urban and rural spatial problems and largely address the scarcity of space, resources, and infrastructures. On the one hand, there is a scarcity of affordable living and office space; on the other hand, there is a scarcity of sufficient public mobility and networking in everyday working life. These processes and discussions are embedded in post-growth narratives and logics that involve planning and implementing new solutions and answers according to criteria such as sustainability and ethical principles (Thornton et al. 2023).

Heterogenous formats and combinations of coworking

The majority of the studies mentioned previously indicate that the success of rural CWS is contingent upon the extent to which they address local needs. Furthermore, the motivations of CWS founders are diverse and this situation has given rise to the development of various CWS formats that are described in greater detail in the Bertelsmann Foundation study (2020). At this point, I would like to highlight the CWS form of the "New Village Center" (Neue Dorfmitte): This concept describes spaces that integrate the concept of coworking with other services, thereby offering novel opportunities for social interaction and for the initiation of cultural and spatial development. The study also emphasizes that the combination of coworking with other functions, such as post offices or corner stores, can increase the economic resilience of these locations.

The aforementioned interviews (see fn 2), which form the basis of this contribution, address the specific combination of coworking and childcare. The interviewees explain their goals, challenges, and individual solutions for combining childcare with CWS. I will not discuss the interviews in detail, due to this chapter's lim-

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ited scope, but will instead present preliminary interpretations that are based on the interviews. The combination of coworking and childcare was also investigated and monitored as part of the EU-funded CoworCare project in the Alpine region.[4] The initiative's objective was to enable care providers to enhance their participation in the labor market through a combination of workplaces close to home and adequate childcare services. In addition, an online platform was developed that makes CWS in the Alpine region, offering care services for children or older people, more visible.

Rural CWS as subject of rural development policies

Merkel and Avdikos argue that it is not just economic values, but also social values that should be acknowledged and supported in policy principles for peripheral areas in their paper on supporting collaborative workspaces as tools for regional development. Within this scope, they describe collaborative working spaces as shared social infrastructures that can play "a distinct social role in cities and peripheral areas in offering wider social services and in maintaining but also creating the social fabric within rural areas" (Merkel and Avdikos 2020, 354).

This infrastructure work is carried out by motivated individuals in order to repair, adapt, or to create lacking and non-functioning infrastructures in the areas of work, mobility, and community in peripheral areas (Hölzel and de Vries 2023). Despite the actors' usage of state aid in the form of subsidies, they do not transfer the responsibility and implementation of their societal and infrastructural concepts to the political level; rather, they implement these concepts autonomously. Consequently, they can be situated within the broader context of (social) repair and DIY movements (Schabacher 2022, 205ff).

While many CWS launched in peripheral areas are largely based on the (financial) efforts of individuals, there are also municipalities in which coworking is or was specifically targeted and promoted as a development tool. For example, in the federal state of Schleswig-Holstein, CWS have been and are being actively promoted as a tool to retain the younger, well-educated population in rural and suburban areas or to become more attractive for new residents. Additionally, CWS offer alternatives to commuting to larger cities for gainful employment. This is also interesting in contexts in which local culinary offerings and retail establishments have become financially unfeasible. In this context, actors in the fields of digitalization and urban development regard the promotion of coworking by municipalities and re-

4 https://www.coworkation-alps.eu/aktuelles-events/projekte/coworcare.html (Accessed July 30, 2025).

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gions as a form of infrastructure, rather than project support.[5] In this regard, Merkel and Avdikos (2020) emphasize the significance of CWS as community goods that should be perceived even more strongly by regional political bodies. Furthermore, CWS should be considered with an expanded concept of innovation and might

> "become shared social infrastructures and community platforms, playing a distinct social role in cities and peripheral areas in offering wider social services and in maintaining but also creating the social fabric within peripheral areas. Their role as community hubs can be the base for a more integrated approach to rural development potentials that combines social, cultural and economic development" (ibid., 354).

As examined previously, local authorities should view CWS as part of the basic infrastructure. This would also imply financial support, especially since coworking is not usually economically viable in peripheral areas by itself.

The commitment to the development of CWS in peripheral areas, including the provision of financial and non-material support from political actors, can be summarized, borrowing the perspective of Alexa Färber, as a promise of progress and social cohesion (Färber 2023). In this context, she identifies infrastructure projects in particular as the subject of political promises that are often not kept. While the broken promises of large urban infrastructure projects are typically viewed negatively, the vagueness of promises in rural CWS is ambivalent. There is an openness to experimentation, though, which is politically supported. However, the failure to deliver on the promise of innovation and interaction in rural CWS can lead to increased skepticism toward politics and progress. The concept of infrastructural promises clarifies temporalities, by describing processes of care and repair in the establishment and operation of CWS, for example. I will discuss this specific issue further in the following section.

Infrastructures of care and repair in rural coworking

The present contribution utilizes three concepts – namely, infrastructure work, care and repair – that all play crucial roles in the context of cultural studies research into practices of social maintenance and reproduction. However, these concepts function on different levels. For this reason, I would like to briefly differentiate the terms at this point and describe the extent to which they are fruitful for the research discussed in this chapter. A comprehensive understanding of work is imperative for

5 https://cityandbits.de/2022/08/25/handreichung-fuer-kommunen-zum-aufbau-von-coworking-spaces-im-laendlichen-raum/ (Accessed July 30, 2025).

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this foundation and extend beyond the conventional feminist conception of work (Koch, 2013). This expanded concept encompasses all of those activities deemed essential for the sustained viability of both communities and society, including gainful employment, care, and nursing work. While feminist scholars have historically focused on issues of remuneration and (in)visibility in the context of work since the 1970s, the concept of infrastructure work offers a more nuanced lens for understanding complex, sociomaterial systems that involve multiple actors.

Infrastructure work

Infrastructures are defined less as static technical entities in this work and more as dynamic and relational socio-technical structures that are subject to continuous coordination and networking, "which seeks to establish and maintain the manifold links between social organization, moral order and technical integration" (Niewöhner 2014, 3; author's translation). Therefore, the focus of analysis shifts from infrastructure as an object to infrastructurization as a process (ibid.). Gabriele Schabacher describes this fluidity and the paradox that stability can only be achieved through constant improvement with the term "infra-agency." She includes processes unrelated to human agency in her conception of infrastructure work (Schabacher 2022,19ff). Thus, in this context, the focus is not only on work on infrastructures, but also on the work of infrastructures themselves. This occurs, for example, by enabling and shaping communication and change through their nature as media (ibid.).

Infrastructure work follows different temporalities in the context of rural coworking: First, it involves short-term experimentation, adaptation, and tinkering (ibid.) to try out working practices and certain technical and spatial innovations; these can be adapted directly where necessary. For example, the early phases of CWS should be mentioned here, when the needs and possibilities on site are first explored in so-called "pop ups."[6] Second, many coworking actors in peripheral areas aim to permanently establish locations for communication, encounters, and innovation. They seek the medium- and long-term development for the spaces themselves and the environments in which they are embedded. This stabilization can be achieved through ongoing care and repair work, as well as through infrastructural elements such as buildings and furnishings (see the section on empirical perspectives). Additionally, many rural CWS in particular are integrated into networks, such as the CoworkLand cooperative. It provides learning and exchange spaces (web-meetings,

6 The CoworkLand cooperative offers interested parties the opportunity to evaluate their needs in a time-limited testing phase with pop-up coworking, https://coworkland.de/de/popup-coworking (Accessed July 30, 2025).

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conferences, personal support, etc.), but also concrete infrastructures, such as booking tools and a mapping of CWS in peripheral areas on its own website.

Care

As outlined in the definition of infrastructure work, infrastructures rely on continuous stabilization through care and maintenance. María Piug de la Bellacasa conceptualizes care as a threefold entanglement of labor, affect, and ethics/politics that structure the relationships in care processes (Piug de la Bellacasa 2017, 28). She distinguishes her notion from conventional ethical models by describing care as situational, relational, and speculative. Other scholars emphasize the relationality between care providers and recipients (Mol, Moser, and Pols 2010). From this follows the basic epistemological attitude of thinking/researching with care in order to make invisibilities both tangible and discussable.

This invisibility resonates with a statement from a CWS community manager, in the aforementioned seminar, who noted that she had no official job description, but simply ensured in her daily work routine that coworkers were "doing well" – something at which she had always been good. This reflects how care work is often framed as innate traits, rather than as recognized labor, and this leads to its under-evaluation and invisibility in terms of tasks worthy of remuneration in everyday working life, thereby often remaining invisible. In contrast, IT staff visibly engage in technical care, such as through proactive updates. While both activities are usually equally invisible in terms of infrastructure maintenance, there are differences, especially with regard to the describability of the precise tasks: emotional work (mostly female) is less tangible than technical support (mostly male).

Coworkers also engage in everyday care by maintaining shared spaces – cleaning the kitchenette or refilling coffee beans – contributing to the socio-technical stability of CWS environments in the process (Puig de la Bellacasa 2017; Mol, Moser, and Pols 2010). Such practices render infrastructures invisible by maintaining their functionality. However, when infrastructures – like childcare – fail to meet needs, then they become visible again, triggering the necessity for negotiation. The offensive thematization of care work in the context of digital gainful employment also expresses a fundamental topic in (feminist) labor research: that of the impossibilities and simultaneities of different forms of work.

Michael Liegl's concept of "care of space" (Liegl 2014) helps to frame these observations. While his focus lies on caring for the self, the focus is also on caring for the shared space and municipalities in the case of rural coworkers. Liegl identifies the (in principle) free choice of location by knowledge workers as a resource for creativity and productivity (ibid., 167–168). At the same time, the workers shape the respective places through their discursive and practical work, thereby establishing a reciprocity of place and practice. Care, thus, manifests on several levels:

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Firstly, towards organizing everyday life and implementing personal life plans. Secondly, in taking care for community things and spaces. Thirdly, the involvement can extend beyond the CWS by jointly planning and implementing initiatives that affect living and working conditions in general and are based on a common lifestyle and on shared values.

Repair

When repair activities are identified as necessary, it is often due to either changing conditions or due to a lack of care and maintenance that can stem from various causes. In the case of rural coworking, these causes may include major social transformations in the area of labor or inadequate infrastructure in areas such as housing, childcare, and mobility. Although repair practices are often included in care practices, care tends to be preventive, aiming to avoid situations that require repair.

In the context of this contribution, care is understood as a more continuous and invisible process that can include minor repairs. Consequently, repair is a more conceptual process due to the origin of the rupture. As Elke Krasny describes in a field note on repair (2024), spatial repair work means (re)establishing a relationship with spaces and the people involved, as well as with the meaning of spaces:

> "[R]epair […] is a way of relating to broken relations themselves—relations with all the things on the planet that are not working, all its environments that are depleted, all its lives that have been ruined. Such repair insists that these breakages can be addressed. Repair therefore is a process, not an end" (ibid.).

In recent debates on repair practices different approaches are discussed: First, there is the development of emergency remedies or workarounds that are aimed at short-term, individual solutions to problems. Second, there are more fundamental repairs that are aimed at larger transformations. The concept of workarounds also seems to be particularly fruitful for the relatively new and constantly developing practice of rural CWS. Schabacher (2022) uses this IT-term, to describe a general practice of inauthentic solutions that do not correct the problem, but that nevertheless enable work to continue. People, such as facility managers or secretaries, often operate in a workaround mode in work and organizational processes. The function of the community manager described above also ties in here with her situational, intuitive problem-solving practice. Even at the broader level of coworking as a laboratory for rural development, workarounds are likely to be a productive lens that needs to be investigated further empirically. "As an 'improper' circumvention or temporary solution, the workaround calls into question what can be considered the 'right' solution to a problem" (Schabacher 2022, 229; author's translation). Rather than hoping for

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perfect, trouble-free infrastructures, the focus here is on the ability to address ruptures, defects, and uncertainties creatively.

In short, infrastructuring as a process and practice requires that coworking actors be aware of different formats of needs, gaps, problems, technical systems, and tasks and helping to shape them care-fully (Niewöhner 2014) in iterative feedback and learning processes. In the following section, I will share some insights from the interviews undertaken about these attempts.

Prospects: empirical perspectives on care and repair in rural coworking

I would like to present three perspectives that emerged from the underlying interviews by building on the previous discussion of rural coworking as a practice of care and repair within infrastructure work. These perspectives could inform further discussions about collaborative spaces in peripheral areas through the lens of repair and care. I am presenting these perspectives in the form of preliminary analytical considerations that should be discussed further.

Pooling of resources

When examining current strategies to revitalize urban and rural centers, one usually comes across the principle of multifunctionality, in which different functions are spatially bundled (BMEL 2022). This principle is also applied in the development of rural working spaces; these can be found, for example, in the aforementioned coworking format 'Neue Dorfmitte' (Bertelsmann Stiftung 2020) or with a focus on the topic of local supply in Schleswig-Holstein in so-called Markttreffs.[7] According to Hölzel and de Vries, the spatial bundling of points of interest (POIs, Hölzel and de Vries 2023), such as doctors' surgeries, cafés, or bakeries, improves the on-site infrastructure's vitality: "The more gatherings and interactions are possible, the denser the network of relationships and exchanges becomes, with this process resembling the workings of a vital organism" (ibid., 5). This allegory relates to the idea of infrastructure as a sociomaterial structure, which in this context is constantly maintained, both by the work of the individual POIs and by those interacting socially. In an interview, one coworking operator described how such a combination of several places for daily needs motivates many coworkers to use 'their' CWS. She has integrated her own kindergarten into her CWS, which also has a canteen for both the children and the coworkers. There is also a fitness studio on site (Interview V.L.)

Additionally, restricting expansion to a few multifunctional centers of collaborative work is a move that is aware of peripheral areas' lower population density.

7 https://markttreff-sh.de/ (Accessed July 30, 2025).

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On the one hand, this happens because people who are interested in corresponding with professional or cultural networks can find fixed places for (random, unplanned) encounters and exchanges; on the other hand, financial aspects are at the forefront when pooling resources. Due to the lower population density, there are fewer (potential) users per CWS and for the other services offered in multifunctional village centers. Sustainability is also cited as an aspect for those multifunctional centers: Shorter distances between shopping, medical care, childcare, and places of work save time and CO2 emissions. In addition, the care for personal resources is important because people often continue to ensure the operation and maintenance of these places on a voluntary basis alongside other employment and caregiving responsibilities.

Preservation through transformation

One interview was conducted with the chairman of a sports club that aims to make sports clubs more future-proof through digitalization and comprehensive health education (Interview D.B.). The club implemented a coworking space as part of this initiative. This offer also represents a bundling of functions, where parents are provided with a workplace while their children train or allow them to train near their workplace. This example addresses how to both maintain and make viable structures that are worth preserving in peripheral areas through sustainable transformation. Identifying needs and both negotiating and implementing these transformations requires the "with care attitude" (Piug de la Bellacasa 2017) mentioned above, combined with the ability to try out new offerings, to wait for developments, and ultimately to either adapt or discard them.

Gabriele Schabacher derives from the Latin origin of the word re-parare that a form of repe-tition is always inscribed in the practice of repair, to the extent that a previous condition is restored through repair. This implies the possibility of transformation on the one hand, but also a return to what was previously given and is now no longer functional on the other (Schabacher 2020, 222). Following this logic of restoration and repetition of repair in rural coworking reveals a juxtaposition of new, forward-looking practices, technologies, and (infra-)structures. However, there is also a desire to both restore and prove the validity of practices, infrastructures, and ideas of living and working together as well as notions of rurality. An important task for recent rural development would be to both ask for and to include knowledge from previous repair and transformation processes undertaken in the respective villages.

This is particularly evident in the conversion and renovation of buildings. Many coworkers describe the planning of rebuilding and conversion processes (often involving a high proportion of their own work) as a kind of dialogical process between buildings and users. They also highly value the preservation of old building's

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elements, such as facades, doors, and appearance. Inside, however, the focus is on the most recent technological and sustainability requirements. Even after that, as cowork operator B.M. puts it, "the house is seeking its people." This also often applies to places used by the public previously, such as post offices or corner stores and that had been used as meeting places.

Another coworking operator emphasized the relevance of demand-driven developments, explaining that CWS are subject to different developments that coincide with larger structural or demographical changes. In practice, this manifested in part of the CWS he co-operates having to shut down, due to reasons relating to building law. This meant that adjustments had to be made to the overall utilization concept (Interview F.M.). Here, the agency of building infrastructures can also be seen and it sometimes hinders usage, in combination with other factors.

The repurposing of these buildings and the revitalization of their locations and infrastructures are also of political interest in economic and spatial planning (Thornton et al. 2023). Networks in coworking and rural development can create recommendations and policy papers for policymakers, partly based on their experiences of living and working in rural areas. For example, they illustrate the added value that municipalities gain by not selling vacant properties to the highest bidder, but rather by focusing on the best concept for the common good (Nickisch et al. 2023).

Bridging infrastructural gaps as/with care

Locally available, situated knowledge about dealing with change is an important aspect of transgenerational collaboration that can be taken into account. This is often overlooked when newcomers establish new forms of living and working, such as CWS. The design of such places should prioritize the development of spaces, practices, and technologies that respond to the needs of all those involved, including the local environment and infrastructure.

As described above, a large proportion of coworkers are either self-employed or have flexible employment relationships. Therefore, it is reasonable to test solutions based on flexibility and location to address the compatibility of gainful employment and care activities. In interviews with coworkers who provide care, inflexible pickup and drop-off times at kindergarten and a lack of emergency childcare options were mentioned as problems, especially for the self-employed. Other childcare infrastructure gaps that were mentioned included homework tutoring and school transportation, which worsen conditions for care providers who are pursuing gainful employment.

These gaps are filled by workarounds in individual cooperation in rural CWSs. Parents take on tasks and, in turn, CWSs offer short-term childcare. Additionally, a few CWSs create tailor-made childcare structures with their own kindergartens. Cowork operators carry out long-term repairs by intervening in the existing infras-

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tructure. For example, they renegotiate childcare regulations with both providers and politicians (interview with V.L.).

The care and repair activities related to negotiating work and rural infrastructures, at different levels, are sometimes associated with exhaustion and limited solutions. Exhaustion occurs when the amount of work, whether visible or not, becomes too heavy to integrate with personal goals and activities. If important services cannot be provided as a result, then it is often problematic, partly because it weakens trust in the promises made and negotiated (Färber 2023). However, the limited duration of collaborative workspaces is also an intrinsic characteristic of experimental, speculative care ethics. "Such, then, is what failure calls for in an ethics—or, should we say, ethos—of care: try again, try something a bit different, be attentive" (Mol, Moser, and Pols 2010, 14).

Remaining visible?

In conclusion, the question arises as to whether the invisibility of infrastructural work in CWS should be reevaluated. On the one hand, repair work is carried out relatively publicly and communicated intentionally and addresses coworking spaces as laboratories of the future, by both politicians and coworking actors themselves. This approach is necessary to secure funding and to foster participation. However, many forms of care and maintenance performed in the ongoing operation of these spaces remain invisible; familiar or social care work is often overlooked, for example.

What are the implications of this, especially for peripheral areas? Could recognizing and highlighting the necessity of infrastructure repairs help to establish them as a collective process and shared responsibility? Should infrastructure become invisible again after repairs have been made, or does the visible patch hold its own value? To this end, we must relate the idea that infrastructures are never fully functional, thereby requiring constant repair and maintenance, to the problematization of care and repair practices as a means of stabilizing unequal social conditions. For example, this can be seen when state responsibilities are turned into private duties (Sadler et al. 2024; Tronto 2020). Could it highlight broader structural deficiencies that have only been addressed through social repair temporarily (Schabacher 2020, 211 ff.)? If multifunctional local spaces and CWS increasingly take on public service roles formerly held by state or municipal institutions, we risk reinforcing the invisibility of labor that such initiatives aim to challenge – this time under the guise of civic engagement.

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Hands for AI

Programming in Machine Learning as labor, work, and action

Johanna Fischer

> "These algorithmic systems are not standalone little boxes, but massive, networked ones with hundreds of hands reaching into them, tweaking and tuning, swapping parts and experimenting with new arrangements." (Seaver 2019, 419)

Introduction

This chapter sheds light on software programming in Machine Learning (ML). ML, evolved as a subfield of artificial intelligence (AI) and concentrates on the development of self-learning algorithms. These algorithms extract insights from data in order to make statistical predictions (Raschka and Mirjalili 2017, 25). Algorithms are a key technology in digitalization, a process of constant translation, combination, and use of societies' representations in digital technologies (Häußling 2020, 1,358). The translation process from data into algorithms is rooted in data scientists' everyday routines. I delineate the practices involved in producing ML algorithms and describe their cultural and material aspects through ethnography in the field of data science.

My perspective to study programming integrates data science, sociology, and design, and stems from years of experience in applied research projects in which I worked across disciplinary boundaries. Positioned at the interfaces of these fields, my ethnographic approach captures the moments at which translations occur: between domains, between technical and social phenomena, and between different stages of development. This vantage point has allowed me to trace how knowledge, tools, and responsibilities shift across domains, thereby making the otherwise implicit negotiations that shape programming practices visible. This contribution is the result of my ethnographic observations in the field of ML.

The chapter is built on the concepts of *labor*, *work*, and *action* as Hannah Arendt has described them in *The Human Condition* (1958). The use of labor, work, and action are fruitful because they conceptualize the practices of data scientists in distinct categories, thereby organizing observed phenomena in clear concepts. While Arendt's framework, dating back to 1958, does not address digitality, it nev-

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ertheless provides a valuable perspective on technologies through which to examine the relationship between human agencies and automated systems. Others have discussed Arendt's concept for new work forms, such as contingent work (Fayard 2021). Arendt's thought helps to articulate the stakes of human involvement beyond mere functionality or efficiency in programming environments in which the boundary between tool use and world-making is often blurred. Her framework, thus, speaks to our present by making visible how digital infrastructures participate in reshaping the conditions of human action, responsibility, and judgment in the public realm. This chapter focuses on highly skilled workers whose objectives lie in building automated systems.

Furthermore, I draw from current perspectives in Science and Technology Studies (STS). STS scholars aim to document science, technology, and societies as co-constituted, given that it is an intersectional studies program with a strong influence from humanities, social sciences, and information sciences. The parenthesis connecting these distinct fields is the conviction that knowledge does not preexist, and thus cannot be determined by, logical empiricism, only by collective arrangements (Jasanoff 2004, 261; Hilgartner, Miller, and Hagendijk 2015; Law 2017, 33). There is an entire research array dedicated to algorithms in STS from which I will draw in order to highlight the sociotechnical aspects of programming in ML. In the context of programming for machine learning, I engage with studies that ethnographically trace how algorithms are developed, stabilized, and interpreted. (e.g., Amoore and Piotukh 2016; Neyland 2019; Seaver 2019; Vertesi et al. 2019; Jaton 2020). Recent scholarship on algorithms emphasizes their cultural and processual dimensions, challenging perceptions of them as autonomous or disruptive forces. Nick Seaver (2022) highlights how algorithmic systems reflect the cultural practices and interpretations of their creators, framing them as human-made cultural phenomena, rather than external intruders. Similarly, Florian Jaton (2021) demonstrates the contingent, labor-intensive nature of algorithmic constitution, revealing how the illusion of seamless automation arises from concealed human effort. These insights align with Arendt's distinctions between labor, work, and action and offer a framework to further theorize algorithms as both technical artifacts and as expressions of human culture. This chapter extends the understanding of algorithms as embedded in human practice by integrating Arendt's concepts.

Programming is defined broadly as "[…] the situated activity of inscribing numbered lists of instructions that can be executed by computer processors to organize the movement of bits and to modify given data in desired ways" (Jaton 2020, 93). Regarding ML, the act of inscribing these numbered lists is partly automated by learning algorithms. In addition, inscribing code is only a small part of data scientists' practices. Surprisingly, it is only this small productive part that receives attention as *the* practice of programming in the general sense. I argue that there is more to programming than the inscription of numbered lists of instructions. Following Alex

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Preda's discussion on coding and expertise (2024), this chapter takes a wide perception on what belongs to the making of ML algorithms. Thus, the argumentation is built upon descriptions of the situatedness of labor, work, and action, the relationship of these concepts, and their role in the production of ML algorithms.

The text is structured into four parts: The first part is a short excursion into computing infrastructures, programming cultures, and ML algorithms.

In the following I expand on the concepts of labor, work, and action for practices in ML programming. In the second part, I focus on Labor (Arbeit). Despite automation being a focus of data scientists, human labor is also very important. Labor can be seen in initializing, maintaining, and repairing the material infrastructures for ML algorithms to run; it involves the repetitious and tedious practice of programmer's routines. The third part focuses on code and curated datasets as the result of work (Herstellen). The code will eventually – executed by a computer – produce an ML algorithm in combination with data. Work can be observed in writing, reading, testing, structuring, combining, and repairing software. By doing work, the programmer orchestrates and instructs automated labor-doing machines – she[1] is setting the structure by which a machine is *learning* rules and patterns from data. The fourth part describes the practices necessary to establishing epistemic infrastructures through action (Handeln). The programmer in ML is engaging in creative, informal, and communicative ways to produce, access, and distribute knowledge both before and after labor and work. These ways can be distinguished into two directions: Firstly, in the interaction with data as playful explorations[2] to gain insights and form new knowledge about the data's characteristics. Secondly, in interaction with and in exchanges with other programmers.

Programmers collaborate in vast networks to exchange ideas and to learn new methods; to draw concepts and models for the work ahead with colleagues; and to both communicate and narrate results to the public, thereby embedding them in the epistemic infrastructure. In each part, I draw from my ethnographic experiences in the field of Data Science and will bring my observations into dialogue with Arendt's framework, culminating in a reflection of the results in the final part.

1 To counteract the common notion of developers as male, but defining myself as female, I will refer to programmers with the pronouns "she/her." For the Interviewees and my observations, I will use the preferred genders of my colleagues and interview partners.

2 The professional term for this is Exploratory Data Analysis (EDA). This practice lies between action and work, given that EDA is often accompanied by cleaning and structuring the data. I decided to focus on this practice's exploratory aspect here and to focus on its role in knowledge creation.

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Excurse: infrastructures, machines and programmers' self-perception

Material and epistemic infrastructures

Susan Leigh Star suggests that we think of computers not as "information highways," but more modestly as "symbolic sewers" (Star 1999, 379). This notion helps to overcome the perception of computer infrastructures as impeccable systems. Instead, it opens observations up to a messy structure that is established by entangling partly compatible material from computers, cables, and plugs. This structure is characterized by ill-fitted interfaces and routinely small disruptions. Repair becomes a constant task to keep the system running (Graham and Thrift 2007, 19). "The organization of this work[3] of maintenance and reproduction is central to developments in ML as well as in its application" (Pardo-Guerra 2024, 380).

Two forms of infrastructures are relevant for ML: material and epistemic. Infrastructures are not static, but are instead processual structures (Schabacher 2022, 323). Infrastructures get highlighted through the labor practices of maintenance, reproduction, and repair as well as the action of both speaking and interacting. Both infrastructural forms have the objective of distribution: resources for the material or knowledge for the epistemic infrastructure.

Technological functionality depends on material infrastructures. Sara Hooker (2021) described it as a hardware lottery. This means successful technologies just happen to be "compatible with available software and hardware" (Hooker 2020, 1).

ML and its material contents are organized and embedded in hardware, such as server space and computing powers. Prerequisites for ML's operation are – simply put – electronic computer circuits for massive calculations, organized in cultural and material structures.

The epistemic infrastructure enables collaboration that is a prerequisite for programming. Collaboration is something that is deeply embedded in software's multiple aspects. Comments are inscribed residues for collective creation. However, exchange about the product goes far beyond comment lines in the code. As explicit documentation of a globally connected software manufacturing world, there are libraries to exchange tools and either chat rooms or small-scale manuals for almost every question about production.

"[L]ike other textual practices of knowledge creation, coding and creation of new ML applications are forms of bricolage that use existing resources in order to produce novel combinations." (Bergström and Blackwell 2016 in Pardo-Guerra 2024).

3 While Pardo-Guerra calls it work, I would suggest considering the practice of maintenance and reproduction as labor, in Arendt's sense, because it helps to take care of a system in which producing work can enfold.

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To conclude, infrastructures – material or knowledge – are evolving constructions that need constant maintenance.

Cultures of anthropomorphism

I showed my colleague from an ML project a revised dataset that had been meticulously prepared to be filtered by topics in a collection of 70,000 speeches. Each speech had been labeled with one of 24 possible themes. We aimed to train a model to predict the most prominent topics for a given composition of speakers in the German Federal Parliament. My colleague, sounding surprised, exclaims, "Oh my God! You didn't do that yourself, did you?" His tone was one of shock. "Did you build a tool for this?" (fieldnote from a data science workshop in 2025, J.F.).

His reaction clearly highlighted the view that, for him, repetitive and tedious tasks are something that the computer should take over. In addition, I observed that tutorials often emphasized how cleanly the machine works, never tiring and executing the code script identically over hundreds of iterations. However, the limitations of a code script and the lack of interpretative ability of a machine solution, as well as the hidden labor that either fades into the background or is outsourced, are frequently overlooked.

The history of computers is marked by the fact that intensive repetitive work was outsourced and hidden. For instance, one of the early computer experts, John von Neumann, did not acknowledge the work of women referred to as *operators*[4] on the ENIAC computing machine in his often-cited *First Draft* from 1945, which laid the foundation for the development of subsequent computer models (von Neumann 1993). The female operators' work was seen as involving merely the mechanical implementation of previously conceived concepts for the functioning of the computing machine. However, recent reviews of historical records show how important these operators' contributions were. They not only translated and corrected the blueprints of complex hardware architecture, but they also assembled and monitored the machines in collaboration with colleagues, created the punch card systems, and fed the machine with new inputs (Chun 2013, 29–34; Haigh, Priestley, and Rope 2016, 132–140). In other words, the operators became an invisible part of the system in this process.

The code script, as the ingenious product from the programmer, has received the great deal of attention since von Neumann's *First Draft*. Von Neumann's perception of the computer persists: "Whereas computing systems were, in practice, sociotechnical *processes* that could ultimately—perhaps—produce meaningful results, the formalism of the *First Draft* surreptitiously presented them as brain-like *objects*

4 Von Neumann did not credit many people involved in ENIAC's construction in his swiftly drafted paper. This led to several patent problems and lawsuits.

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that could automatically transform inputs into outputs [emphasis in original]" (Jaton 2020, 102). The assumption that the computer is a tool, comparable to a human mind, persists. A wide spread concept enfolds from this angle: with the right software, electronic minds might perform any task a human brain does and would, thus, be able to automate any human labor sooner or later.

This perception still shapes programmers' self-perception and the culture of how they think about automation; however, the code as the product of their work is just the technical artefact that transfers rules for labor from humans to machines. There are more practices that belong to programming with regard to knowledge and hardware. Defining, structuring, and translating rules needs much more than the transcriptions of a single individual. This can also be found in coding expertise. Alex Preda describes "coding expertise as bundles of skilled, both discursive and nondiscursive activities" (Preda 2024, 718).

We can take from the historical example the legacy of the cultural background that is part of programmers' practices in labor: The programmer's self-perception is influenced by the misconception of the computer as an electronical brain that is run by the programmers' law of code. The comparison of human cognition and computerized models is leading to the conclusion that almost all human cognitive activities can be automated. This results in ongoing attempts to automate increasing numbers of tasks through computed instruments. The analogy of the computer as an electronical brain is seductive, but it is also dangerous; it forms part of a larger ideological project that anthropomorphizes computation, blurring the distinction between automation and cognition in the process. This conflation matters: Wendy Chun even sees in this approach a sign of neo-liberal governmentality by building a stronger trust in technically computed outcomes than those achieved by human cognition and debate (Chun 2013, 10).

A machine learning model does not infer, unlike a human brain. It optimizes a loss function over data representations that are encoded in ways it does not *understand*. It also produces a statistically likely mapping. To illustrate this: an algorithm for movie recommendations will simply classify by meta data. It does not even need to understand the concept of a movie. It outputs recommendations based on the data that it has learned from and follows the goal to continue human-machine interactions. This exemplifies that machines' results are not directed toward the liberation of living organisms from labor, but instead to the monotonous processing of data according to pre-learned rules. In a certain sense, the machine performs labor (the movie recommendation), but the machine is no longer oriented towards humans' reproduction, but rather to the reproduction of the human-machine interaction. Their objectives are derived from the production process and according to the logic of the companies: Cost and time efficiency, creating awareness for advertising or reproducing and expanding the ML environment.

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Interestingly, programmers aim to transfer such tasks to others without recognizing the newly emerging precariat among so-called *click-workers* like Amazon's *mechanical turks* not only through software, but also through outsourcing (Jaton 2020, 66; Fayard 2021, 207). This is a sign that for programmers the emancipation from labor means handing over tedious and repetitive tasks and making the arduous labor behind the tasks disappear from their own perception: This happens both through outsourcing and automation. Fayard describes and explains this as the unequal distribution of power in an economic system: "Similarly, one can view on-demand mobile workers as standing in for the human infrastructure that supports the creative or leisure activities of a segment of the population. Work (as defined by Arendt) is not for all; it can exist only because of the labor of others" (Fayard 2021, 215).

The computer, as a machine that is capable of taking over mathematical and rule-based tasks, leads to a strong separation into a) labor that can be automated, and b) labor performed by humans. This creates a field of tension for programming in ML: tension between the urge to free oneself of labor, so as to enable (creative) work, while managing the labor necessary to reproducing their own field. Part of the work is, thus, directed at itself: By using automated technologies, programmers free themselves from the burden of repetitive tasks, or at least that is a prominent narrative in the programmer's domain (Ramirez 2020, 99; Munn 2022, 17).

In summary, the reproductive parts (initializing, maintaining, and repairing the material infrastructures) of programming are often overlooked, made invisible, outsourced, and automated whenever possible. Programmers' perception of their own work lies in the architecture and rules written in code that are handed over to machines. Thus, cultural and material components are constantly overlooked and underestimated. These aspects have only regained entry into the theoretical consideration of programming practices with the practical turn in Human Computer Interaction Studies (HCI) and an increasing number of studies on programming in STS (Bergström and Blackwell 2016; Seaver 2019; Jaton 2020). This shift has not only reframed algorithms as sociotechnical processes, but have also fostered greater self-awareness among programmers, who begin by recognizing their own role in shaping algorithmic systems as cultural artifacts.

Labor: maintaining ML environments

Arendt defines labor (Arbeit) as follows: "Labor is the activity which corresponds to the biological process of the human body, whose spontaneous growth, metabolism, and eventually decay are bound to the vital necessities produced and fed into the life process by labor. The human condition of labor is life itself" (Arendt 1958, 7). Labor is the basis of life and ensures the individual's survival and, thus, the preservation of the species (ibid., 15). Labor points towards the fragility of the material world (Scha-

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bacher 2022, 286), where "decay and the vitality of matter" are the most prevalent subject for humans and things (Denis and Pontille 2015, 355). The repair and maintenance of things as labor practices are open and have no assigned ending. They are undertaken by constant "acts of perceptual and affective attention" towards the objects being maintained (Jackson 2016, 183).

Arendt had already recognized that technological progress is being used to advance the automation of labor and to fulfill humanity's dream of an effortless life. According to her, the individual is striving to be freed from the perceived burden of necessary labor. However, there is a danger in this for modern working society, where the activity of the working individual has been glorified, as Max Weber's notion of a mechanical base in form of a professional duty (Berufspflicht) illustrates in the Protestant Ethic (Weber 2010, 179). Capitalistic societies know no other form of occupation, and only a few super-rich or artistically engaged people would understand themselves as being outside of labor (Arendt 1994, 11).

Today's societies are highly differentiated through the increase of work, due to the division of labor, its distribution, and also the transfer of these activities, namely as jobs, in the public sphere (ibid., 48). As a result, tasks can no longer be directly related to the survival of the individual carrying them out. Monotonous routines and one-dimensional activities arise because there is a division of labor. The tasks get distributed in the public, as the practices being carried out are fragmented. This isolates practitioners from their context of effects. The fragmentation of practices, thus, is the background for societies with a high automation of labor. It establishes the environment for automation that was to be expanded.

Labor's characteristic is that it does not produce a durable product; what it achieves is immediately consumed and utilized, thereby freeing up capacities for other activities (ibid., 81). "[…] *[L]aboring* always moves in the same circle, which is prescribed by the biological process of the living organism and the end of its *toil* and *trouble* comes only with the death of this organism. [emphasis in original]" (Arendt 1958, 90).

In highly technological societies, labor produces consumable goods that are abstracted from the biological needs of the individual. Labor in ML is the maintenance for the technological environment in which ML algorithms can be produced.

Work: producing code, structuring datasets

The objects that result from work (Herstellen) are not consumed or used up; they have durability and, as such, they are used in a world of things. Usage wears material things out in such a world. For digital objects, though, there is no sign of use because they perfectly reproduce themselves. A song will not lose quality when copied and a text does not wrinkle when read multiple times. Here, manufactured

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objects, namely data and code are, in a sense, absolute; only their interweaving with other objects, such as hardware and the constant progress and change in development, formats, storage, and processing power conditions their continual decay. Therefore, regardless of its reproducibility, software has a very short half-life as a tool because its functionality is highly dependent upon the environment in which it operates (Hooker 2020, 3).

Arendt's view on tools for manufacturing was that "[t]he process of making a thing is limited and the function of the instruments comes to an predictable, controllable end with the finished product" (Arendt 1958, 122). With continual change on the sides of the instruments and the constant decay of software, though, the manufacturing work is bound to constant labor, shaping the environment in which this object performs.

In Arendt's consideration, production is preceded by a mental model. The concept of the product and the manufacturing concepts are prerequisites for their production (Arendt 1994, 129). In STS, it is agreed that these are not just mental ideas generated by the programmers, but rather include shared knowledge between the manufacturers and explicit ideas that circulate through inscriptions. With ML models, they are sometimes so abstract that an explicable idea of the final product is missing. For example, the modeling of image recognition: One needed several steps to understand how to let the computer deconstruct the picture into machine readable lists of numbers when it first arrived on the scene.[5] Programmers first needed to abstract the recognition of images from their own perception and think in pixel-shaped 2D signals on a grid (Jaton 2020, 37–38). What becomes more important than the imagined model is a clear conception of the outcome. The results, in the form of desired outcomes, enable the programmer to evaluate the machines performance and can be presented publicly.

The software script: code

The software script, known as code, is a technical artifact that is also referred to as a rhetorical device (Preda 2024, 718) that delegates the tasks defined by a programmer to the machine. A perfect guide, instruction, and executive framework in one – a law that enforces itself. "It is better than law; it is what lawyers have always dreamed the law to be: an inhumanly perfect *performative* uttered by no one. Unlike any other law or performative utterance, code almost always does what it says because it needs no human acknowledgment. [emphasis in original]" (Chun 2013, 1) However, these are not simply or exclusively messages for the machine in code. By taking a closer look,

5 See this website for a useful demonstration of how a model "looks at" handwritten numbers: https://adamharley.com/nn_vis/cnn/2d.html (Accessed June 1, 2025).

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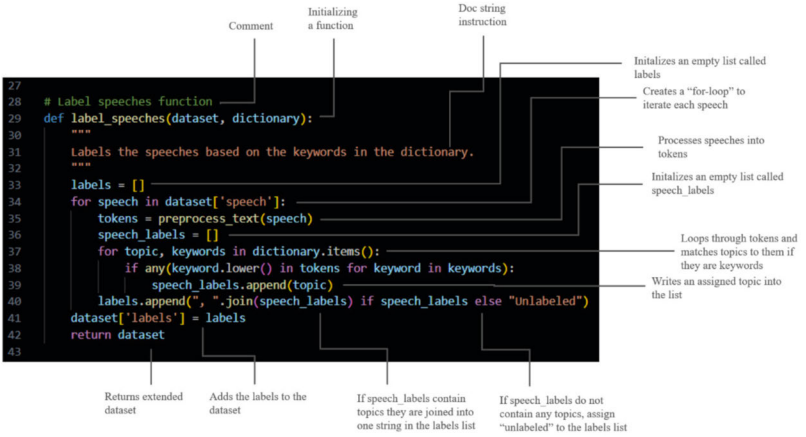
there are patterns with no value for the machine, but that are made for human readers: comments, common structures, naming conventions and, lastly, the software languages that make code readable to humans.

There are two ways to write rules into a software script, without ML and with ML: Without ML, the machine needs its tasks in a strictly structured form – this is achieved through the programming language. The tasks must be specified in clear logic. Machine-readable syntax helps with this: dictionaries, lists, classes for processing data, functions, if-statements, for-loops, etc. Let me illustrate this using the example of 70,000 speeches in a dataset. This is an example of software code that was created without machine learning, thereby being structured through human work.

Figure 1: Screenshot of a code script explained line by line. Fieldnotes J.F.



Credits: Johanna Fischer.

In this example, a dictionary was created in which topics were stored with keywords from German political parties' programs. This input must be stored in a special format and is integrated into the repository's structure (i.e., the code directory). The code shown here gives the computer a series of numbered commands: 1. load dataset with speeches, 2. call dictionary, 3. convert speeches into machine-readable sequences of numbers (tokenization), it follows a function that iterates a task until all parliamentary speeches are labeled, 4. go through each speech and look for the keywords in the dictionary; if the keyword is contained, then enter the appropriate topic label until the dataset has been run through once. This illustrates that writing

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software-scripts is the process by which to define a step-by-step instruction for the computer.

It is more abstract to achieve such a task with machine learning. Here, a pre-trained ML algorithm, which acts like a teacher, is provided with a dataset to learn about topics. The algorithm creates new models by 'showing' them the dataset. The models learn patterns and structures from the dataset and write these back into their code. The ML algorithm trains until one of the new models meets the predefined requirements. The models' quality will be measured against various test values on a test dataset. Most of the models will be discarded. The models' code scripts are no longer readable for humans. Programmers can influence this process by adjusting and fine-tuning hyperparameters, assembling the training algorithms, and through careful preparation of the dataset. Once trained, the new model can be shared and provided with new data to process.

Programmers freed themselves of defining rules for models into code by handing tasks over to an ML algorithm. As a result, their work shifted from defining rules to shaping infrastructures for rule-deriving machines. In contrast to writing software-scripts, the training of machines is a process of data preparation, building data *pipelines*, tuning hyperparameters, evaluating output results, and managing hardware to run the training.

Action: exploring and distributing knowledge

Action (Handeln), according to Arendt, is a political practice and an endless form of human process. In interaction with other people, action unfolds as an exchange of objects, knowledge, and stories that form isolated individuals into groups with common goals within a public space (Arendt 1994, 191). Social action also has high significance in sociology; for example, Max Weber described action in contrast to mere reactions to impulses. He defines it as the act, tolerance, or omission, in front of a socially subjective intention (Weber 1976, 13). In this sense, the communicative exchange, the collective planning of machines, and the action according to one's own inclinations and interests between the production processes are social actions.

Arendt's 'action' underscores that programming is not merely technical labor, but is instead a public, world-shaping practice. It is a point acutely relevant today as algorithmic systems mediate politics, culture, and sociality. Programmers often unconsciously become actors in contested social arenas whose actions shape visibility, agency and power by encoding cultural assumptions into infrastructures.

Actions can be understood in the production of MLs in two ways: Firstly, in the interaction with data to gain insights. The exploration of data and the playful engagement with data often comprises bricolage or tinkering (Turkle and Papert 1990, 128). This is considered to be a dialogue between the programmer and the data. Sec-

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ond, Human interaction plays a significant role in interaction and exchange with other programmers. It transfers knowledge and exchanges tools to overcome problems. In summary, action encompasses the crucial political, cultural, and subjective aspects of programming.

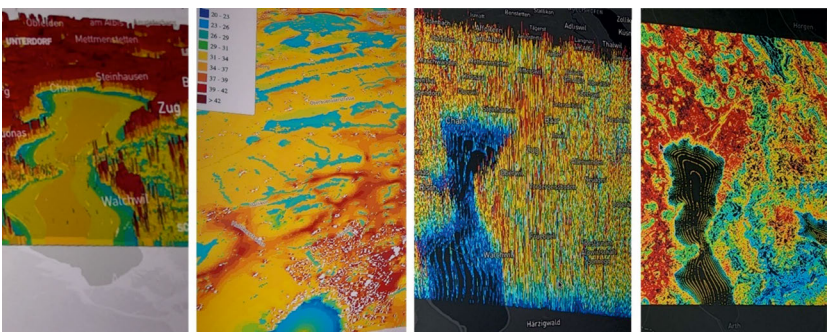
Programming emerges through three modes of action: *experimentation* (playful, iterative engagement with data), *inscription* (codifying and transferring knowledge through texts and tools), and *public dialogue* (negotiating meaning in collaborative spaces). These practices sustain programming as a cultural and epistemic endeavor. By centering action, we expose programming's irreducible sociality: its reliance on human interpretation, its entanglement with public norms, and its capacity to shape the world that it mediates.

Exploratory data analysis – a playful start

Rather than beginning with a fully clear mental model and executing it through code, developers often arrive at understanding through iterative, hands-on experimentation. This can even be experienced as fun and is described as a form of play. One of my colleagues once put it this way:

> "Playing with data meant for me: I was experimenting how to visualize it. […] So, I use these polygons and depict the temperature inside the polygon. The playing was in the visualization itself" (Interview with a data scientist, transcript J.F.).

Figure 2: Visual experiments with sensor data from fieldnotes, J.F.



Credits: Johanna Fischer.

This kind of play is a crucial part of knowledge production. My colleague is describing the trying out of different visualizations. Her goal was to decide on the best form of data representation for insights. Practitioners explore possibilities, test in-

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tuitions, and surface insights that may not emerge through formalized, procedural approaches through visual experimentation and through the practice of tinkering.

She reflects further: "I do think that 'tinkering' is an important aspect, but I can get lost in it, enter a flow state, and spend endless amounts of time on it. There's no clear endpoint. You can always go deeper […]. That's why it's important to focus on deliverables, on products that you can hand over and show to clients. Because that's when ideas come back. […] if you present a prototype, you enter an iterative loop." (Interview with a data scientist, transcript J.F.).

As this programmer highlights, tinkering serves as a pivotal mode of engagement, what Bergström and Blackwell (2016, 4) have described as a casual, yet intentional, form of exploration that cuts across distinctions between amateur and expert. It is through such playful and experimental interactions with materials and representations that ideas for production begin to take shape. However, and interestingly, prototypes emerge only in interaction with others in a public sphere. Only through communicating the idea, do programmers find an end to play. The collaborative and iterative shaping of ideas through discourse starts after the exploratory dialogue with the data.

Collaboration and knowledge transfer through inscriptions and public dialogue

Speech is a social act of expressing one's thoughts to another person. Thoughts about programming can be expressed through boundary objects like inscriptions in comments, graphs and notes (Star and Griesemer 1989) in a scientific discourse, as documents, in chatrooms, blogposts, papers, and recordings (Callon 1997, 250), through dialogue on conferences, weekly meetings, or even in coffee breaks (Jaton 2020, 42–45). The impact of these collaboration forms is difficult to measure and is, therefore, overlooked as a part of programming.

Collaboration is institutionalized through information infrastructures that are embedded in code itself: code scripts, documentation, online notebooks, and other sharing devices. They are not meant to be readable by machines, but should instead facilitate communication and knowledge distribution between programmers. Comments describe the function of the following code lines, or 'docstrings,' which are used to insert longer instructions for the use of functions. This standardized form of exchange that is embedded in the code is supported by a broader culture of collaborative software development, which relies on specific tools and organizational practices.

Version control systems provide storage and sharing infrastructure to track changes, thereby facilitating shared authorship and enabling the systematic factoring of code. Shared repositories make codebases accessible to distributed teams, allowing for collective maintenance and the transparent documentation of development histories. Task management systems like ticket systems structure

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coordination by segmenting complex projects into tasks, which are often linked to issues of code quality, errors, or refactoring needs. Together, they transform isolated writing into a durable, socially embedded process.

The practices of sharing and distributing textual elements are embedded in organizational frameworks, such as Kanban or Agile; these not only regulate workflows, but also cultivate norms of continuous improvement and code stewardship. Together, the sociotechnical arrangements of programming infrastructures make collaborative coding, refactoring, and long-term maintenance possible across teams and time.

Clicking through the contents on Stack Overflow,[6] a platform for programmers to discuss problems, makes it clear how important exchange between people, problem presentation, and discourse with experts for software production is. This is also reflected in numerous general meetings in which little programming is actually done, but in which much is discussed. Here, problems get described and possible solutions are explained, production concepts are developed, and common knowledge bases are created. The relevance of meetings can be underscored by the observation of translation during such meetings, by translating vague ideas into exact expressions that are ready to be coded (Pütz 2021). In other cases, the definition of a ground truth[7] may limit the ambiguity of human expression (Jaton 2020).

This shows that programming is not just an individual activity, but is instead a social process that involves communication through various means and grades of publicity. These exchanges are supported by institutionalized infrastructures, such as version control systems, shared repositories, and task management tools, all of which enable collaboration and long-term maintenance. Organizational frameworks further structure workflows, thereby fostering continuous progress through feedback. Meetings play a crucial role in translating ideas into executable code, clarifying problems, and establishing shared knowledge, thereby highlighting the importance of discourse in software development, despite difficulty relating to its quantification.

Invisible maintenance, technical production, and public discourse

Programming in ML encompasses diverse sociotechnical practices that can be examined in a structured way through the concepts of labor, work, and action by Han-

6 https://stackoverflow.com/questions (Accessed June 1, 2025).

7 Ground truth refers to the accurate, real-world data or measurements used to train, validate, or test a model; it serves as a reliable reference point, like an answer key in a test, to check whether a machine learning system's predictions are correct.

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nah Arendt. The concepts provide a comprehensive understanding of how data scientists engage with and shape material and epistemic infrastructures to produce ML models. I have shown that practices of creating ML algorithms can be described and viewed as cultural and material practice directed to material infrastructures, to the production of artefacts, and to epistemic infrastructures.

Labor practices set the stage for productional work. Labor reproduces, maintains, repairs, and transforms the material infrastructure in which models can be trained and run. These activities are time-intensive and are perceived by programmers as boring prerequisites. Programmers create the environment for ML to be done by infrastructuring the hardware into connected layers. Thus, labor in ML is the reproductive and maintaining force that sets the ground for automation.

Work contains practices, such as writing code to structure, guide, and to evaluate the training of MLs. Code can be seen as exemplified signals that contain rules that interface with automated actants and that can be shared, changed, and implemented by other humans or technological actants. The results of training with data are applicable to ML algorithms.

The relevance of Arendt's action to ML lies in its capacity to frame programming not merely as technical labor, but as a public, collaborative practice that shapes epistemic infrastructures. Exploration and iterative model refinement are not neutral technical steps, but are instead acts of disclosure. Programmers test hypotheses, challenge assumptions, and reveal new possibilities for data's meaning. This experimentation is inherently uncertain and generative, thereby opening up spaces for reinterpretation. The exchange of ideas via inscriptions among programmers, through meetings and chats, constitutes a public dialogue that sustains practices in ML as a collective endeavor. This notion grounds programming not as isolated work, but as a cultural practice.

In summary, there is a shift from inscribing computational rules to inscribing structures for a machine that learns rules from data with ML. This ethnography is contrasted with the traditional image of the developer as a brain-heavy genius who can architect complex systems entirely in her head before ever touching a keyboard. Instead, what emerges is the collective labor of maintaining the material environment, the producing work, and the public action of hundreds of hands. Their doing is grounded in the messiness of materials, play, aesthetics, collaboration, and in situated responsiveness. Algorithms get tweaked and tuned in endless loops of updates to keep pace with material boundaries. Working with data becomes a form of craft, one in which insights are shaped through manipulation, feedback, and sensory engagement.

By examining ML programming through the concepts of labor, work, and action, we gain a clearer understanding of the multifaceted nature of this practice. Programmers in ML not only strive to automate tasks and to create durable code, but also to engage in dynamic, playful, and collaborative processes that perpetu-

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ate the circular nature of programming in the field of ML. Their labor will shape, maintain, and repair material infrastructures. Their work creates executable code and shapes datasets. Their action will transform epistemic infrastructures by both exploring and distributing knowledge.

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Access Work in Disability Communities

A pre-enactment of repairing data intensive environments

Hanna Göbel

What if participants with bodily dispositions, such as deafness or blindness, took part in video conference sessions? In deaf and/or blind disability communities, data intensive digital environments are experienced as vulnerable and it has been argued, since the late 1990s onwards, that they cannot be treated as given, culturally inclusive spatial surroundings (Kitchin 2000; Goggin and Newell 2000). Spatial environments can be identified as a "dis/ability complex" (Goodley 2014) based upon experiences of power and violence in various disability communities and as situated social constellations under which both inclusive bodily abilities are negotiated and in which exclusionary mechanisms of disabling become reproduced. Research on disability communities and digital spaces during the Covid-19 pandemic (Yong et al. 2025) in particular has shown that digital solutions can be seen as a non-adequate factor to coping with isolation and loneliness. Digital participation by sensory and bodily means is limited because of the dominance of visuality and aurality that are encoded into technological devices, and because of the required touch-, movement-, and gesture-based competences in handling them. Even though universal design is an established field concerned with disability communities, these are not envisioned for plural sensory and bodily dispositions when it comes to digital devices and software environments (Hamraie 2017). To feel oneself as a "participant" (Kelty 2019) in a video conferencing environment, thus, always requires complex and resource-intensive media translations, infrastructural reconfigurations, and not mere promises of inclusivity. These circumstances become particularly pressing in disability communities because sensory and bodily participation is organized based upon a lack of resources and negotiations for corporeal standards in digital infrastructures that have not taken place in the context of diversifying access to society.

This chapter argues for the consideration of access work in digital disability communities; I wish to call for a cultural repair of the promises of inclusivity in digital spaces in order to argue for greater acknowledgment and visibility of this mandatory work and to inquire into *modi* of participation for a future common ground of action. In order to realize this speculative approach, I wish to utilize the method of pre-enactment, as an ethnographic way of knowledge production, in order to trace

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a complex assemblage of the sensory and bodily participatory status of deaf and/or blind disability communities in digital spatial environments of video conferences in specific. In the first part of this chapter, I will engage with recent arguments stemming from crip technoscience about the urgencies to consider and make visible assemblages of access work in digital spaces. In the second part, I will revisit recent debates about the cultural repair of societies, based upon advocating for the loss of progressive forms of technological innovations and of privileges in knowledge making. I argue that reparative ways of learning from each other's sensory capacities can be established only where these losses are legitimatized. Deaf and/or blind communities' access to spatial environments always requires care-intensive, low- or unpaid access work and engenders a mode of interacting by other sensory means than visuality and aurality alone. Considering access work as a cultural repair of the promises of inclusivity, inscribed into digital environments, envisions the potential to engage with different *modi* of digital participation. In the third part of this chapter, I will introduce the ethnographic method of pre-enactment and will outline empirical examples for more-inclusive ways of participation that were realized in the form of an online-research series entitled "Disability and the Digital." This event was organized by an international group of researchers, including myself, as well as scholars and activists from disability studies. This series was set up during lockdown during the Covid-19 pandemic and used the digital infrastructure of rapidly normalized video-conferencing tools and software; this created new spatialities for research and teaching ordinarily dominated by visuality and aurality. I will highlight how this series was analyzed ethnographically as a pre-enactment of accessing digital environments in a more-inclusive-way and through the exploration of a wider sensory understanding of modes of listening. Through this, I inquire into the sensory dimensions that are necessary in order to argue for a culture of repairing promises of inclusivity by reframing the normative inscriptions of listening into practices of cultural translation and synchronization, thereby undermining the time-efficient logics of digital spatial environments. I argue for the utilization of time, as a culturally rich resource of (non-)participation, and for the potentialities to consider "disability as a method" (Mills and Sanchez 2023) in order to ethnographically explore and sustain existing digital environments and to account for the reparative dimensions in digital environments.

"Crip times" and access work in digital spatial environments

Originally, "crip" refers to the disability rights movement and is used in these contexts as a self-empowering and queering vocabulary, rather than a discriminatory one (McRuer 2006). This interpretation dates back to the crip movement as it was founded in the aftermath of World War I in the 1920s. The term has since been used

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and has been adapted during the last two decades by referring to current "crip times" (McRuer 2018). Crip times was formulated as a diagnosis of present times, which Robert McRuer argues is a current, transformative struggle with the heterogenization of societies. This struggle is centered around both the liberalizing, empowering effects of inclusionary visions, as they have been formulated and implemented since the UN-disability rights convention in 2009, and neoliberalist-motivated ableist cultures of hateful and discriminatory positionings of disability communities at the margins of societies. Social media in specific can be seen as both an emancipatory and a discriminatory and ableist realm for disability communities. Ableism is defined, as Fiona Campell has argued, as a "network of beliefs, processes and practices that produces a particular kind of self and body (the corporeal standard) that is projected as the perfect, species-typical and therefore essential […] human. Disability then, is cast as a diminished state of being human" (Campbell 2009, 44). An actualization of the crip movement is currently taking place within disability studies under these given circumstances. In 2019, Aimi Hamraie and Kelly Fritsch published the "Crip TechnoScience Manifesto" (Hamraie and Fritsch 2019), a work that made the programmatic case for emancipatory practices in disability communities, especially concerning the daily use of technologies. They convert the discriminatory status of bodily impairments into its empowering opposite, especially when it comes to the interactions with technologies, technological infrastructures, and techno-scientific ways of knowledge production:

> "'crip,' [is] the non-compliant, anti-assimilationist position that disability is a desirable part of the world, and […] the co-production of science, technology, and political life […]. Crip theory centers disability as a locus of resistance […] agitating against liberal assimilation and inclusion practices by marking disability as a desirably generative and creative relational practice" (Hamraie and Fritsch 2019, 2).

Resistance refers to the various promises of inclusion, especially in relation to digital infrastructures of spatial environments, and to technical solutions to inclusivity in the form of designed products, or ableist *modi* of verbalizing technical possibilities, which then call for affirmative realizations in disability communities. Liberal promises of these kinds have a powerful performative capacity, as Alexa Färber argues (2019), since they assemble various resources for commoning certain visions. The manifest character of the "CripTechnoScience Manifest" references Donna Haraway's (1985) metaphorical and analytical figure of the "Cyborg" in order to highlight the self-empowering entanglement and emancipatory ways of knowledge productions between science, technology, and everyday cultures. The figure of the Crip resists ableist forms of knowledge production and refers to the emancipatory underminings of ableist standards in design through the refusal

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of heteronormous ways of designing technologies for everyday uses. Ashley Shew speaks of "technoableism" (2020) which is inscribed into the affordances of a lot of technologies of daily uses, and within the programmed infrastructures and constellations in which digital technologies become relevant in daily routines in particular.

These ableist cultures in digital technology-related contexts refer to what Orit Halpern and Robert Mitchell define as the "smartness mandate" (2023). Halpern and Mitchell conceive of smartness as a collectively agreed upon and ideologically framed mandate in societies that allow the inscription of visions of time-based efficiency, functionalism, and self-optimizing logics into the development of high technologies and spatial infrastructures. Conceiving of smartness as a cultural inscription of mere functional optimization, into technological surroundings of any kind, clearly echoes ableist conceptions of both potential, sensory and bodily engagements and designed tech environments; they remain exclusively accessible for optimized bodies and, therefore, re-inscribe ableist visions, rather than inclusive ones. The call for "undoing optimization" (2021), as Alison Powell has argued, also refers to the consideration of lived experiences with technologies, such as smartness-related devices.

In the context of these developments, disability scholar Louise Hickman and Cynthia Bennett have highlighted how low-paid or often unpaid "access work" (Hickman and Bennett 2023) takes place as a routinized form of laboring abled-bodies modes of automatization. It is also apparent in caring about the needs and necessary capacities in disability communities that are required to take part in spatial environments, especially those referring to smart city related solutions. They refer to the complex forms of knowledge productions and time-specific resources necessary for creating access to built environments, data intensive environments, and even lived experiences based on their work with access data walks through urbanized environments. This can include, for instance, the documentation of the access work necessary for navigating the city with app-related devices or the mappings of how digital sensor devices or Artificial Intelligence/(AI-)related activities are experienced within disability communities in certain places. They make visible both how the undermining of so-called smart solutions take place and how the entanglement of specific sensory dispositions and technological devices in various disability communities put the lived experiences of certain spatial environments front and center.

Assemblages of repairing access in digital spatial environments

The need to collectively repair the promises of inclusivity in existing spatial environments has been discussed as an inquiry of healing cultural discriminations and

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legitimate care-intensive work environments (Puig de la Bellacasa 2017). Healing, in the sense of cultural repairing, does not refer to a holistic approach, but to a relational inquiry of existing cultural programmings of spatialities. The urgency for the cultural repair work of spatial environments refers both to the acknowledgment of limited resources in democratic societies and to the acknowledgement of the heterogenization of society, which accompanies the loss of existing privileges over knowledge production and, for instance, the loss of progress-related technological forms of demanding 'innovation only.' The necessity to legitimate loss as a cultural category of repairing existing environments was also argued in terms of a resource-oriented approach necessary to inhabiting planetary futures (Elliot 2018). Loss has become a major cultural category for negotiations about cultural belongings under conditions of current ecological, economic, and cultural crises, given that the collective experience of loss provides the potential to form a common ground for more-inclusive action (Reckwitz 2024).

Thus, the cultural acknowledgment of losses is seen as an enabler of cultural reparations and a requirement for cultural repair work to take place. Cultural repair work is distinguished from a mere solutionist and problem fixing activity and has been described as a techno-solutionist fixing, and technical engineering, of current crises (Schubert 2024). A cultural perspective on repair pays particular attention to the loss of existing, accessible environments and accounts for the ways in which access to spatial environments needs to be organized for future modes of participation.

Repair is described here as a transformative practice in which *modi* of participation are being negotiated. This means that the production of knowledge that aims towards the heterogenization of society's access is legitimated as a basis, and the care necessary for the repairing of various lacks of resources is appreciated. In the context of disability, the "cultural model" (Waldschmidt 2017) departs from the assumption that liberal forms of inclusivity are negotiated at the center of societies, not at their margins, and that these negotiations refer to historically specific norms and values. Thus, promises of inclusivity need to constantly face repair work because societal conditions are shaped and become transformed with time.

Wendy Brown has argued for "reparative democracy" (2024) and she positions listening as the major reparative practice, in the sense of finding emancipatory forms of learning from each other. In the context of deaf communities in particular, Brown's idea of listening invites us to engage with widened forms of sensory interactions, and perceptual registers; it is, therefore, distinguished from a discriminatory and ableist meaning that refers to acoustic dimensions and hearing capacities exclusively. For Brown, listening in an overarching sense refers to empathic positionalities in given crises experienced by democratic societies. Listening encourages the consideration of cultural forms of knowledge productions that have been either marginalized or silenced. In the context of the climate crisis specifically,

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listening is actively required for critical engagement with short-term ecological reparations in the Global South (Tironi 2023) and as a "reconsideration of history" (Táíwò 2022) that necessitates the inclusion of Indigenous and heterogenous forms of knowledge productions. Brown also positions listening as a major device for reparations of media democracies that accounts for the ways in which participation in digital environments in specific must be repaired in order to sustain democratic value makings.

Restorative practices or maintenance work usually engenders reproductive and reconditioning effects within existing environments and infrastructures (Denis, Pontille, and Brown 2025). Maintenance work is conceived of as routinized care-work that requires repair as a mode of reinstating things, infrastructures, or other breakdowns within spatial environments (Henke and Sims 2020; Strebel, Bovet, and Sormani 2022). However, cultural repair work, in this widened sense, is also productive for existing environments in terms of the negotiating factors about modes of participation. The ways in which cultural belongings are being negotiated performatively changes the *modi operandi* and the conditions under which these environments become repaired. Cultural repair work references the inquiry of certain imaginaries, envisionings, or promises attached to spatial environments. In the context of disability communities and the accessibility of digital environments, such as video conference settings, argument about learning from each other makes visible both complex access work and the liberal assimilations that are based upon promises of inclusivity.

This debate, thus, resonates with the existing ethnographic research into the assemblages of access urbanism and the ways in which the variety of sensory dispositions and bodily belongings in disability communities feed back into the necessary cultural repair of existing spatial environments that are entangled with digital spaces. Thomas Críado (2019) has argued for "technologies of friendship" and the ways in which various forms of mobility infrastructures in disability communities unpack the entangled ways of moving through urbanized environments that involve bodily and sensory forms of perception, smart technologies, and the city's built hardware. The ethnographic details give insights into the sensory inquiries of existing built environments; they also give credit to the ways in which, for instance, breakdowns of the hardware infrastructures of the city, such as broken elevators, missing signs and signals, or unavailable assistive devices, lead to situated knowledge productions. This also applies to software-related aspects of what has been described by Sarah Pink et al. (2018) as "broken data," when, for instance, broken technological infrastructures enable space for negotiations by both making visible and by undermining the existing ableist scripts provided by technological devices. At the same time, as Robert Stock (2022) has outlined, the precarious status of navigating the smart city in disability communities is evidence that the entangled assemblages of access usually lack economic and political resources. The digital sphere, and the

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open-source-related devices and activisms to live-monitor in particular, such as the functionalities of certain hardware of the city (such as elevators in train stations, for instance) becomes an important emancipatory spatial surrounding for community building. In terms of cultural repair work, engagements such as open-source live-monitors or other community-based digital practices outline the potentialities to provide spatial surroundings, which culturally value access work and aim to normalize complex, sensory knowledge about access. These examples ethnographically generate knowledge that further aims to speculate about the future of inclusive environments by cultural means of differentiation and logics that are quite remote from mere technocratic ones.

Real fictions of access: a pre-enactment

Scenario productions for these kinds of speculative experiments about future environments happen in economic (and often in start-up) contexts and are normalized as a routine of presenting technological innovations to publics, especially in smart city-related contexts. As Halpern and Mitchell have argued, they can be defined as performative "demo-ings" (Halpern and Mitchell 2023, 122) when referring to the marketing of prototypes, test-beds, and territorial zones of experimentation. This technological idea of demo-ing, the authors argue, is a regressive performative principle that often clearly undermined the theatrical framework of the Aristotelian *demos* by challenging the theatrical conditions of democratic value-making in public spaces. Prototypes, test-beds, and territorial zones of experiments have been criticized for their project-related factors and the strong technology-related force of "futuring by speed" (Urry 2016) and technology-driven interests in smart city contexts that exclude a lot of expertise and participants by process. These kinds of spatial pre-enactments about futures, through digital innovations, are mostly related to epistemic closures in terms of knowledge production because their interest lies in technology-related factors of innovation-making.

A field of speculative knowledge production and "experimental zones" (Marguin, Rabe, and Schmidgall 2020) refers to epistemic openness and cultural innovation making, based upon "experimental collaboration" (Criado and Estalella 2018) with various actors from different sectors and fields in cultural studies and, specifically, at the intersection of ethnography, science, and technology studies and/or arts related contexts. The aim is to speculate about futures by formatting ethnographic objects through experimentation (Ballestero 2021) in order to explore cultural values that refer to the democratic principles of future makings. This mode of speculation is directed at the "invention of the social" (Marres, Guggenheim, and Wilkie 2018) at the intersection of ethnography and science and technology studies and seeks ways

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of cultural differentiations and the explorations of much-needed cultural belongings.

The major inspiration for these kinds of pre-enactments comes from performance theory and from theatre studies and it follows the principle of prefiguring collective experiences and encounterings in public spaces (Oberkrome and Straub 2019). The aim is to strengthen the demonstrative capacities of presenting technology-related innovations in public space with democratic means of knowledge production. In Vienna, the project "Real Fiktion Klimarechnungshof" was realized in order to pre-enact the foundation of a democratic institution; while this was promised, it has remained unrealized by Austrian politics (Färber 2022). The source of inspiration came from Hamburg-based performance artist and scholar Sibylle Peters, who developed the concept of "real fictions" in order to "call" for assemblages to come and which the performance collective *geheimagentur* has utilized in their performative practice since the 2000s. In Peters' account:

> "a real fiction is not about the few performing the many. It is about a few people who start to act *as if they were many*, to act *as if* the entities and practices, the wishes and necessities in question already existed, and thereby they might turn out to *be* many later on. […] The performative 'as if' generates a space for playful experimentation, […] even if a real fiction remains fiction and does not become very real" (Peters 2016, 37).

I connect this idea of bodily gathering in public space with the assemblage urbanism of access and with the bodily and sensory dispositions found in digital environments. Pre-enactment, in the ethnographic sense at least, also means staging and observing created scenarios as though they were real and as if they are in contact with the future. The ethnographic inquiry follows this scenario creation and deals with the enactment of anticipatory designs of what is to come (Pink et al. 2022; Cantanella, Hegel, and Marcus 2019). Through this inquiry, the approach mobilizes prefiguration's performative capacities that allow us to both interrogate and to move back and forth between the endurance and cultural histories of the phenomenon, the present negotiations, and related future experiences of accessing specific spatialities.

Platform software, such as video conferencing tools, both regulate and control participants' specific practices and online-interactions. Face-work and the ability to listen to spoken words and to read written chat communication is a normalized mandatory sensory requirement for video-conferencing tools. Anne Waldschmidt (2022) has argued that the face-work and the gestural coordination with the transmitted acoustic effects of spoken words and written chat-communication is related to the ways in which the normalization of bodily stigma takes place and does so by adopting a role theoretical approach to the theatral qualities of bodily interaction in

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public life, in a manner inspired by Erving Goffman. The participants assembled in video conferences present themselves on displays, in quadratic window frames in either a sitting or standing position, where only half of the body is visible in both instances (which resembles the disciplinary mechanisms of professionals presenting themselves in media publics, for instance, such as sitting or standing moderators do on TV news). In the context of disability communities in video conference settings, sitting or standing over a certain amount of time depends upon the mobility of participants and, thus, the window frame often exceeds these disciplinary mechanisms. Moreover, the theatrical qualities of gestural work, in combination with listening and reading, occupy the center of an analysis that requires a multi-modal sensory engagement and a level of coordination that quickly exhausts participants, especially those on neuro-divergent spectrums. Deafness or blindness, for instance, also requires access work, which is based upon language-based, translational capacities in an audiovisual context. Thus, the focus lies on the dynamics of interactions in the scenarios created and it interrogates the cultural histories of programmed spatial environments, often taken for granted and as given, and how institutionalized sensory capacities and bodily affects change under conditions as the theatrical framings of the environment do.

The following ethnographic case study exemplifies approaches to diversifying ways of both listening and learning from each other in a video conference setting by testing the newly normalized digital environments established by COVID-19 lockdowns in an academic context. In 2022–2023, the Online-Lecture Series "Disability and the Digital" took place as a collaboration of international research partners Mara Mills, Robert Stock, Mona Sloane, and Melike Şahinol who all stem from Disability Studies, Media Studies, and Cultural Studies. It offered a series of six sessions about topics such as Co-Opting AI and Queer Studies, Questioning Smart Urban Mobilities, Refusal and Resistance, Access Aesthetics in Dance and Performance, Arts & Design, Open Source and DIY Perspectives on Dis/ability, and Crip Authorship: Disability as Method.

The methodical inquiry in the context of the accompanying seminar at HafenCity University was to engage with the *modi* of repair in a video conference setting ethnographically. This kind of scenario creation was part of the Bachelor study program "Culture – Digitalization – Metropolis," with students engaged in urban research from a cultural studies point of view, who also supported the establishment of the sessions and who assisted with providing the digital infrastructure. The collaborators' roles in this scenario setting were double-coded: we all acted as moderators and hosts for each of the sessions, both on a rotating basis and as participants. The role of hosting the session included the establishment of the digital infrastructure, including the financial support. Whereas institutionalized, standardized access work to the software was provided by the US American universities and partners, we had difficulties to find financial support in the German context, much like our partners

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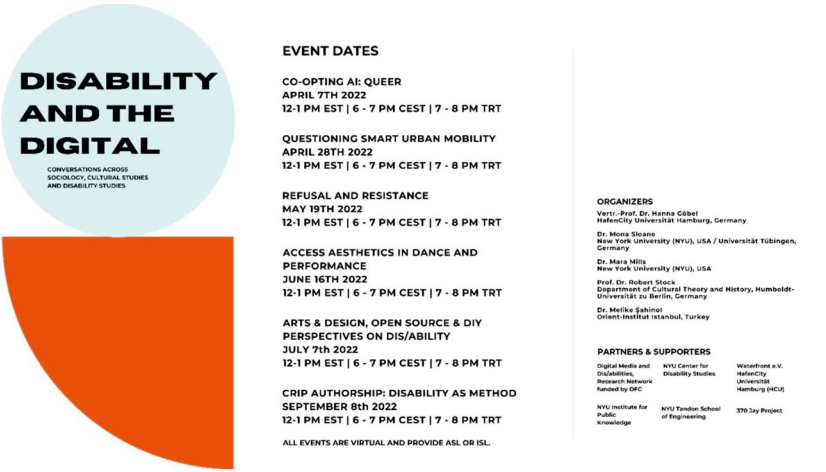
and participants from Turkish and Iranian educational institutions who also had very limited resources and support. Some of the participants in the audience also added major contributions to the debate about digital access to invited scholars and activists. In other words: we made the topic of inquiry itself a site of investigation.

Figure 1: Online-Lecture Series "Disability and the Digital" 2022–2023.



Credits: Mona Sloane.

Repairing data intensive environments through synchronization and time-based resources

In this seminar, the students and I autoethnographically explored digital privileges, positionalities, and traced the complex entanglements between digital environment, medial translations, the participants' sensory dispositions, and the access work happening; this was realized at HafenCity University and the focus was on design ethnography relating to scenario creation. Through this, it became clear that listening to each other in this context needed to be situated in a technical environment of collectively organized cultural translations: among them were digital shorthand translation tools that turned the spoken word into written form in real time, automated live transcription tools, chat assistants (they would probably be AI-based today), and the support of two sign language translators who joined in two image tiles at a time and who translated speech into visual language, either in American Sign Language (ASL) or in International Sign Language (ISL). We recorded all sensory-based impulses of the participants, worked with the dis-

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ability communities' autoethnographic protocols, and created situational mental mappings of technically-generated data streams and data flows.

I will summarize the major findings and experiences of the collective seminar work in what follows, since most of the empirical materials were students' learning outcomes and these were more related to collective reasoning and experimentation in the group.

In the context of real time translations from spoken word into written form, which is a common practice for streaming lectures in a lot of digital platforms, we noticed manifold misunderstandings and the need for interpretation and translation, especially in the English-speaking context (a language not native to everyone), and particularly relating to other translational processes, such as the sign language translators; if the transcript of the real time translation encountered grammatical mistakes, then the translational effects in the chains of communication were enormous for other participants. The automated live transcription tools installed in video conferencing environments usually complicate (potentially conflictual) dimensions, but can also make them the subject of ongoing negotiation. As Louise Hickman (2023) has shown, CART-related communication interferes in this manner by producing incomprehensible content in its automated forms. This also applies to the case of chat assistants, whether in-person individuals invited to the households and office spaces of the participants or in the form of chat technological assistances.

Two sign language translators, who joined in two image tiles at a time and who translated speech into visual language (one in ASL and one in ISL) supported our format, as mentioned previously. The integration of sign language translation was the most decisive part for the educational institutions involved from different nations and continents. Whereas this *modus* of inclusion was obligatory for US American partners and educational institutions, the financial situation was quite the opposite for the German partners and collaborators, including my own institutional environment. Funding institutions in the academic context only became aware of accessibility issues concerning the digital realm during the pandemic, especially for deaf and blind communities. For participants from Iran and Turkey, censor-based topics were also relevant for gaining access, and for inviting sign language translators.

In sum, language-based translations were experienced as a sensually excessive overload and involved a collective overburdening of content and information on various scales. In one observational protocol passage from a female, non-blind and non-deaf BA student, the student reflects on her own experiences of participating in the audience of one of the sessions. She writes:

> "This time, the atmosphere was again very respectful, even though in many places I just didn't understand what was going on and simply lost track. There were often these long pauses after someone had either said something or written something in the chat. All the participants and the moderators then waited for the sign lan-

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> guage interpreters to translate. I found these pauses very long, but I didn't find them annoying. It was just so intense, all the communication was coordinated very slowly, but carefully. Sometimes things from the live transcript were translated incorrectly, which made some participants smile in the tile windows. It was exhausting for me at some point because this room was so different" (Student's Observational Protocol 15, 3).

It can be argued that the scenario analyzed pre-enacted that access work is obligatory in care-intensive work in order to envision inclusivity in a video conference environment. An experience like this involves critical engagements with the automatization of abled-bodies and the inscripted ableist practices of a video conference setting. Disrupting this programmed software's cultural norms and values, through the pauses and through the practices described by the student above, was often perceived as technical noising and as giving rise to social unproductivity. Here, referring to the undermining and questioning of ableistic-dominating dimensions of visuality and aurality also involves analyzing overburdening and exhaustion, based upon the inscripted norms and values of seeing, speaking, and reading, all of which become contested in the scenario enacted. Scaling up the programmed software's disciplinary mechanisms means assembling various sensory needs and exceeds the disciplinary mechanisms of controlling language-based data flows and communications. To envision inclusivity here involves repairing the translational capacities of turning language-based communications and practices, such as listening and reading, into gestural ones and *vice versa*. Literate readers of this scenario can then become participants who are able to cope with sensual overload and exhaustion. It requires cultural repair work to make this visible and negotiable. Moreover, reflecting on the privileges and positionalities of abled-bodies is mandatory to engage with these more-inclusive ways of listening to each other.

The synchronization of heterogenous forms of knowledge production also refer to specific "digital timescapes" (Kitchin 2023) that are at stake in this scenario. Access work is a time-consuming process, especially when it comes to matters of translational processes of language and gesture-based forms of communication that involve a large number of assisting knowledge and technological tools that create access points. This results in an interlocking synchronization of very different temporal processes. If we include the complex access work here, then a series of online conversations is structured differently than it would be in a time-optimizing logic, as we know it from video conferencing tools, and as this is a premise for smart-related technology providers, even in educational contexts. With this finding, I wish to connect to recent debates about "time as infrastructure" (Besedovsky et al. 2023), in which time itself becomes a cultural resource of spatial negotiation and for the creation of spatial environments. This applies here through the simultaneity of various overlapping and (potentially conflicting) temporal processes in order to make

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a conversation happen; this can involve the blurry moments when waiting for comprehensions by face work or in translation-based responses, or even the time necessary for translational work to navigate misunderstandings and related situations or in terms of the assisted interference of ongoing translational work between participants, automated tools, and across the visual displays. We can both discover and describe these as moments of stand-by, as incomprehensible noise that belongs to digital environments like video-conference-settings. They are very time-consuming undertakings, but are necessary in order to establish a common understanding and to foster what it means to participate.

The collective findings also tell us something, both about the persistence of time and the continuities of speed and time-efficient modes of communication that our participants also faced. Our series was set up in capitalizing-time-formats for coordinating participants from different time-zones in a brown-bag lunch format or after-work format (depending on the time zone of participants) and that ran over one hour. In order to make that happen, the navigation of the sensual and comprehensive overload became a crucial factor for all involved. This insight was central for the result of this pre-enactment: this simultaneity of different accesses to the resource of time and the time-intensive synchronization work is necessary to repair this digital infrastructure. It is a collective experience, and is a common ground which needs to be enacted in order to repair this video conference and its liberal promises of inclusivity. Time becomes visible as an important cultural resource of synchronization and various temporal layers need to be coordinated, collectively practiced, and experienced by all members and by all moderators.

Care-intensive work, in relation to the timely synchronization of participants' ways of listening to each other, is part of what Powell's call for the undoings of optimization implies. In order to engage with modes of participation that aim at the reparation of the promises of inclusivity in digital environments, a break from time-efficient logics and mechanisms needs to be considered. Considering time as a culturally rich resource and as a requirement for negotiations allows for the creation of spatial environments in which a more-inclusive way of learning from each other finds common ground for action.

Concluding remarks: crip authorship in data intensive environments

I have argued for the critical consideration of sensory-based access work as an important experiential realm that contributes to the repair of the promises of inclusivity in digital environments, such as video conference settings, by departing from the Crip TechnoScience Manifesto and by considering recent debates about the urgencies relating to cultural repair and reparative potentialities. If participants allow themselves to delve into these time-intensive activities and negotiating processes,

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then it will become apparent that time-intensive human work and a lot of translational resources are necessary to provide access to various sensory attachments in digital environments. The acknowledgement of this work and these resources is needed in order to repair promises of inclusivity in ableist automated environments for abled-bodies. Bodily dispositions provide the capacities to crip existing time-efficient logics in digital environments and to allow for plural forms of authorship in digital spaces. These plural forms allow us to discover time as a cultural resource of learning, in which it is possible to listen to each other; this is a cultural form of repair that emerges at the center of society, not at its margins.

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Appendix

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