Shaping uncertain journeys into digital futures - perspectives on the digital and socio-ecological transformation

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Our earth has already passed six of nine planetary boundaries that are critical for maintaining the stability and resilience of it (Richardson et al., 2023). Threatening environmental developments, such as overconsumption of resources (Daly, 2005; Kirsch, 2020), increasing amounts of technological waste (Notley, 2019; Saha et al., 2021), and improper handling of used products and goods (Ali et al., 2021; Zhang et al., 2022), are frighteningly compromising the health of our planet. Along with the substantial energy consumption required to train artificial intelligence (AI) tools and models (Wu et al., 2022), a major concern is that digitalisation, and especially AI, may exacerbate rather than alleviate environmental issues (van Wynsberghe, 2021). In particular, there is a need for a critical-analytical view of ecological, social, and discursive issues of sustainable AI beyond the narrative of technological solutionism, which is based on an informed and empirical foundation (Ullrich et al., 2024).

Considering the societal cohabitation of humanity, we are experiencing an erosion of democracies (Laebens & Lührmann, 2023), a new era of migration towards Europe (Osler, 2023) and North America (Massey, 2020), and increasing inequalities in various aspects, including access to education (Easterbrook & Hadden, 2021), income, and healthcare (Wang & Xu, 2023). Such disparities are accelerated by and in the digital sphere. There have been significant debates around the potentially adverse effects of increased screen time on mental and physical health, such as the excessive use of digital devices being associated with poor sleeping behaviour (Martin et al., 2021) and obesity (Fang et al., 2019) or contributing to depression and anxiety (Meier & Reinecke, 2021). Furthermore, privacy violations and cybersecurity issues compromise digital sovereignty (Momen, 2023; Timmers, 2019), affecting both individual and societal maturity. All of these are frighteningly compromising the prosperity of our futures.

In particular, sustainability and AI are two critical areas that have been gaining increasing attention in recent years. The *twin transformation* – the intertwined digital and ecological transformation of societies (Barth et al.,

2023) – holds immense potential for addressing some of the most pressing environmental challenges facing our planet today. As the global population continues to grow and natural resources become scarcer, finding innovative ways to promote sustainable developments is essential. Digitalisation has the potential to optimise resource use, reduce waste, and uncover new solutions to complex environmental problems. For example, digital platforms can be used to foster circularity and close resource loops (Körppen et al., 2024), facilitate mobility and energy transitions (Canzler & Knie, 2016; Dekeyrel & Fessler, 2024), and reduce information asymmetries of company information (Salvi et al., 2021). Additionally, they can promote the involvement and participation of citizens to influence their local spheres through the use of publicly available data (Hamm, 2020), improve climate literacy through engagement in citizen science projects on digitality and sustainability (Kox et al., 2020), and enhance relations between citizens and public organisations (Santolamazza et al., 2024).

However, the promise of participating in shaping the future seems contingent upon designated invitation, leading to civics *washing* instead of civic *involvement* (Zehner & Ullrich, 2024). Technologies and social developments thus mutually condition each other in a *co-evolutionary* (Stewart & Williams, 1998) process that precludes the identification of simple cause-and-effect relationships (Gerhold & Brandes, 2021). That emphasises the complexity of so-called *wicked problems* (Rittel & Webber, 1973) and the fundamental indeterminacy of the future. The associated uncertainty about future developments and resulting phenomena, such as mental overload, anxiety, and a weakening of social norms, can make it more difficult to deal with potential crises and their dynamics. Scientifically sound strategic foresight can be used to determine which developments are conceivable and likely to actively shape the future (Gerhold & Kox, 2024).

The Sixth Weizenbaum Conference focused on the question of how we can shape a desirable future in the face of current and future challenges and crises. This anthology comprises diverse contributions that approach this question from different perspectives against an interdisciplinary background: 1) Smart cities and urban transformation, 2) digital technologies for sustainability, 3) social justices, governance, and citizen participation, and 4) imaginaries and visions of futures.

1. Smart cities and urban transformation

In her contribution, Francesca Bria develops the building blocks for a European strategy for a digital economy based on sustainability and human rights. In view of the current polycrisis, triggered by (trade) wars, migration, and climate crises, as well as dependencies on critical raw materials and geopolitical shifts, she poses the question of a desired society. She calls for a democratic agenda to protect data, interests, critical processes, and infrastructures and an anti-monopolistic economic policy committed to climate neutrality, open-source technologies, intra-European interoperability, and competition. Mennatullah Hendawy et al. analyse the promise of smart cities and their actual (non-)implementation, rejecting it as impractical and providing avenues for possible futures of digitally enhanced cities. Bonny Brandenburger et al. investigate challenges and enabling factors for digitalisation projects in the context of smart regions from the perspective of municipality staff. They emphasise that communication within and with citizens is key and that the problems at hand must be understood as social problems so that socio-technical support can help overcome them.

2. Digital technologies for sustainability

Various aspects of the twin transformation and instruments for shaping desirable futures are presented in a number of contributions. Ina Schieferdecker looks at the uncertainties regarding climate change and the development of technologies. She emphasises the potential of sustainable, green artificial intelligence for ecological transformation and discusses accompanying myths. Lubna Rashid et al. examine the drivers of pro-environmental attitudes and behaviours among workers in high-emitting industries in Germany and highlight purpose, leadership, emotional resilience, and inclusion as decisive factors for shifting towards environmentally conscious practices. Florian Butollo et al. analyse the influence of generative AI on knowledge work and call for new requirements regarding skills, creativity, and the ability to verify the authenticity and reliability of automatically generated content for workers when engaged with generative artificial intelligence tools. Paula Scharf et al. present a mobile, energy-efficient, and low-cost sensor-based system for optimising bicycle-oriented mobility planning and safety strategies. Verena Majuntke et al. discuss the possibilities of making software more efficient and sustainable. They argue that

the first step is to make these parameters measurable not just in terms of energy consumption but holistically, taking into account resource and water consumption. More collaboration between European countries is needed for international standards and effective regulation. They suggest that in addition to contributing to greater transparency, open source also enables greater choice.

3. Social justice, governance, and citizen participation

In a similar vein, several contributions elaborate on issues of social justice, governance, and citizen participation. Tina Comes et al. present a case study on the behaviour of refugees and the provision of vital infrastructure, from which concrete recommendations for improvement could be derived. Christian Herzog et al. analyse *digital sovereignty* as an *ill-structured problem* that can only be solved procedurally and call for resiliently pursuing and engaging in spaces of negotiations. Anne Mollen et al. argue along similar lines and demand a social science perspective to adequately address the question of how infrastructures of generative AI can be sustainably shaped. With this focus on sustainability, they develop a socio-technological concept of AI infrastructures that points to the socio-ecological effects of their production and discuss how AI infrastructures can be shaped sustainably. Florian Meissner et al. discuss how the Federal Office for Information Security informs the public about security problems via social media, with the sobering result that this is often inadequate, vague, and self-referential. Ame Elliott reports the results of a series of workshops and the challenges faced in cross-disciplinary research on the topic of data donation for clean energy. Most participants perceived this task as a classical engineering problem, which they felt they lacked the professional knowledge to address rather than embracing it as a wicked problem. Marc Steen's essay discusses alternative ways to design and use digital technologies to deal with societal and environmental issues by looking at non-Western indigenous cultures. Ines Weigand investigates Communities of Practice in the context of the Open Source movement regarding their specific knowledge practices and cultures. On this basis, she provides suggestions on how academia can participate in such knowledge ecosystems by focusing on the role of participatory and practice-based design research. Mennatullah Hendawy et al. identify key narratives and representations of citizens within the United Arab Emirates' national AI strategy. On this basis, they call for inclusive

governance models that actively involve citizens in shaping AI policies to ensure that AI development aligns with societal needs and democratic values. Yuya Shibuya et al. investigate the potentials and limitations of civic data by contrasting it with the concepts of counter-data and open data. They reveal that there exists a limited understanding of what constitutes 'civic' data and note that issues related to power structures, diversity and inclusion, and the infrastructuring of civic data have received little attention.

4. Imaginaries and visions of futures

Several papers discuss the ideas and imaginations of the future that motivate contemporary actions. Josephine Schmitt and Samuel T. Simon analyse drawings and sketches that people had made about their visions of the future, allowing for reflections on the importance of ethical considerations in the development and deployment of digital technologies. Annemarie Witschas criticises visions of the future as powerful constructions of industrial actors working against a socio-ecological future and proposes a democratic reconquest of the future. Lorenz Erdmann presents the approach of *horizon scanning* combined with *sensemaking activities*, which could enable organisations to minimise the uncertainties of the twin transformation, eliminate systematic biases in thinking about the future, and enable meaningful action.

This anthology is intended to inform researchers, practitioners, and policymakers, encouraging them to take responsibility for our behaviour and its impact on the environment and societal life, that is, the basis of living conditions of future generations. Thus, we wish to take a step further in the right direction and help minimise the knowledge gap. But, much more importantly, we aim to provide ideas and examples that help us assess the impact of and modify our actions, as we are convinced that we currently face an action gap rather than a knowledge gap. Therefore, we call on citizens, policymakers, practitioners, and scholars: It is time to act, to individually and collectively contribute to designing convivial futures.

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