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Ageing and Biomedicalisation, Temporalities of Care, Writing STS, Re-Engaging Technoscience, Internet Governance

Phenix by Dmitry Morozov (aka ::vtol::)

Consumer electronics thrown into the trash do not evaporate and do not disappear. In order to draw attention to this problem especially for Eldorado (consumer electronics retailer) I created an installation from old consumer electronics called *Phoenix. Kinetic bird* – metaphor for rebirth and transformation. Having risen from waste, it seeks to fly away and transform. I collected all the elements of the art object from microwave ovens, speakers, hair dryers, fans and other equipment.

- dc linear actuator
- fans
- lcd monitor
- 2 speakers
- led lamps

https://vtol.cc/

Photocredit: Anastasia Soboleva

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Cover *Phenix*, by Dmitry Morozov (aka ::vtol::)

BOOK REVIEWS

Editorial of the future

You cannot buy the revolution.
You cannot make the revolution.
You can only be the revolution.
It is in your spirit, or it is nowhere.
Ursula K. Le Guin, *The Dispossessed*, 1974

To mark fifteen years of *Tecnoscienza*, we open this anniversary issue with a resonant statement from Ursula K. Le Guin's *The Dispossessed*. We hope you will forgive this momentary bold departure, as her words speak deeply to the spirit of what we aim to celebrate with all of you – our readers, colleagues, peers, collaborators, and friends – who have all contributed, and continue to contribute significantly, to the successful development of the journal.

Therefore, it is not too early to express our heartfelt thanks to each and every one of you.

If not a revolution, *Tecnoscienza* was a theoretical, intellectual and organizational "short circuit" (The Editorial Board 2010) – an intense burst of energy channeled by a group of Italian scholars into the creation of an academic journal committed to contributing to the international debate on science and technology studies, "starting from a particular interest in the 'doing' of science and technology" (p. 8). Looking back, we gratefully acknowledge it as a brave collegial act of "bringing to Italy a debate as much established and acknowledged at the international level, as it is neglected and disregarded at the national one" (p. 8). Adopting a model of self-organised open access publishing, *Tecnoscienza* "represented the newest and in some sense the most radical alternative to traditional scientific publishing" (Bruni, Magaudda and Perrotta 2020, 7). Thanks to the foundational collaboration with the *Italian Society for the Study of Science and Technology* (STS Italia), *Tecnoscienza* no longer faces the challenges of the early days.

Remaining true to its Diamond Open Access model, the journal nowadays counts on the collaboration with AlmaDL – the Digital Library of the University of Bologna. The transition from a fully self-supported publishing scheme to an Open Journal Systems platform – hosted by AlmaDL – began in 2022, with a partnership between STS Italia, the founding body of the journal, and the Department of Philosophy and Communication Studies at the University of Bologna, which now jointly serve as not-for-profit publishers of *Tecnoscienza*. Alongside this structural change, it is worth acknowledging the collaboration with a newly appointed production editor, as well as the creation of an interdisciplinary Associate Board composed of twenty-nine international scholars who have brought fresh energy to the journal and helped foster its "culture of collaboration,

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transparency, and excellence within the STS academic community" (Coletta, Crabu and Perrotta 2023, 7). The support of an International Advisory Board, composed of esteemed STS colleagues, remains a pillar of *Tecnoscienza*, and this issue also proudly celebrates that long-standing collaboration.

Still, there is work ahead – and this anniversary offers an opportunity to look to the future with renewed enthusiasm and purpose. As we embark on this new chapter – and before sharing the future we envision for the journal – we wish to express our heartfelt thanks to Manuela Perrotta, who served as an invaluable Co-Editor-in-Chief through 2024. Her dedication and passion have shaped *Tecnoscienza* in countless ways. We are thrilled that she will continue to collaborate as a cherished member of our Editorial Board.

We – Co-Editors-in-Chief, together with the Editorial Board – remain fully committed to contributing to the STS debate by staying with the troubles that arise from the fact that STS is not an academic domain with well-defined boundaries, but one marked by fluid and fuzzy edges.

First, *Tecnoscienza* intends to continue navigating these uncertain waters by cultivating and expanding its international collaborations – paths we are currently exploring. From the beginning, one of the journal's defining features has been its international vocation: publishing in English, welcoming contributions from scholars across the globe, and, for example, including reviews of books published in languages beyond Italian and English. Strengthening *Tecnoscienza*'s international profile is one of the objectives of the recently renewed team of Editors-in-Chief, who strongly believe in the possibility of remaining true to the journal's situatedness while investing in broadening its positioning in the international and steadily growing STS landscape.

Second, *Tecnoscienza* seeks to strengthen its tentacular posture, welcoming contributions that embody diverse forms and ways of knowing – non-linear, non-hierarchical and non-human-centric. We extend our tentacles to all scholars who wish to explore, sense, connect and respond to today's heterogeneous and entangled connections between human, nonhuman and more-than-human actors. We hope that *Tecnoscienza* can amplify as many voices as possible, becoming a vibrant tapestry of epistemological and methodological sensibilities attuned to contemporary phenomena. A space where critical perspectives are welcomed, constructive dialogue unfolds, and mutual learning is nurtured through respectful academic exchange.

Third, *Tecnoscienza* seeks to consolidate its emancipatory political aims by nurturing connections beyond Academia – connections that may allow the journal to offer alternative interpretations and representations of the STS field, while remaining in conversation with it. This can be achieved by deepening existing collaborations with artists (some already involved in the production of *Tecnoscienza*'s covers) and other professionals who may meaningfully contribute to the STS debate about our messy world – unpredictable, relational, multiple and constantly becoming.

In *The Left Hand of Darkness*, Ursula K. Le Guin (1969[2017], 549) writes:

> It is good to have an end to journey towards;
> but it is the journey that matters, in the end.

We resonate with Ursula K. Le Guin's words, and instead of inviting you to consider the three points above as fixed markers on an inevitably unstable scholarly landscape, we view them as broad signposts along a journey. It is a journey we hope many of those reading our editorial will join in the future... because, *in the end, it is the journey that matters*.

The Co-Editors-in-Chief
Michela Cozza, Claudio Coletta, Stefano Crabu

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Framing Ageing as a Medical Problem: Public Discourses on Older Adults, Health Risks and Tecnoscientific Solutions in the UK and Italy

Francesco Miele
University of Trieste

Federico Neresini
University of Padova

Emanuele Di Buccio
University of Padova

Corresponding author
Francesco Miele
University of Trieste, Department of Political and Social Sciences (DISPES)
Piazzale Europa 1, 34127
Trieste (TS), Italy
francesco.miele@dispes.units.it

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Abstract

This work aims at contributing to the debate around the social representations of ageing, here by considering the theory of "biomedicalisation of ageing", for which getting older is transformed into a medical problem with specific health risks that can be treated thanks to the help of technoscientific innovations. A considerable body of literature has created and developed this theoretical perspective, mainly through conceptual contributions or with qualitative methods, but different from most research, our paper contains a comparative-quantitative analysis of two large datasets, consisting of all the articles regarding the older population published online on *the Guardian* (UK) and *la Repubblica* (Italy). These articles underwent a quantitative analysis based on topic modelling techniques to identify and analyse the relevant topics. In parallel, we developed some synthetic indices to support the analysis of how news about older people is "biomedicalised" in media coverage. First, our analyses show how, during the period under scrutiny (1985-2021), while older adults have been increasingly framed as subjects at risk, the technoscientific solutions typical of the biomedicalisation era (i.e., personalised medicine and devices for self-monitoring vital parameters as well as lifestyles) have become increasingly relevant in the media sphere. Second, the analysed data show how biomedicalisation processes are interwoven with the ongoing social, cultural and economic arrangements (e.g., reduction in welfare state spending and exacerbation of the ageing population). Finally, focusing on the 2020-2021 period, it is observable how during COVID-19 public attention to the health risks of older adults has further increased; at the same time, there has been a diminishing emphasis on technoscientific solutions within the public sphere.

Keywords

ageing; biomedicalisation; media narratives; comparative analysis.

1. Introduction

Modern societies are characterised by massive social representations that define the rights and duties of people in front of ageing and the effects of this process on bodies, social, physical

and cognitive abilities (Kholi and Meyer 1986). As is well known, these representations are socially constructed, changing both across space and time, and they specifically concern older people, that is, the population target that is generally judged as intensely affected by biological ageing. For a long time, older people have been represented as passive recipients of pensions and exposed to specific risks (e.g., poverty, social segregation, diseases) that have to be managed with the help of welfare services and family caregivers (Cumming and Henry 1961). Over the past four decades, social sciences have highlighted how, in parallel with the emergence of the so-called ageing society and crisis of the welfare state, the social expectations around older people have dramatically changed (Holstein and Minkler 2003; Bowen and Skirbekk 2017). Thanks to the circulation of concepts such as "active ageing", "third age" and "successful ageing" that began to emerge in the 1980s, older people have been increasingly portrayed as subjects who, in contrast with the typical stereotype of the passive and dependent older people, can stay healthy, independent and productive (Laslett 1989; Lassen and Moreira 2014). This change has often been investigated by taking into consideration new and old media (see newspapers, television and social media) as an important source of data (Holstein and Minkler 2003; Markson and Taylor 2000; Kessler et al. 2004; Asquith 2009; Rozanova 2010; Shimoni 2018).

In this frame, our work aims at contributing to the debate around the social representations of ageing, here considering the theory of the "biomedicalisation of ageing" (Estes and Binney 1989), for which biological ageing can be transformed into a medical problem that can be treated with the help of technoscientific solutions. The biomedicalisation of ageing can be easily framed in the above-mentioned wide trend that presents ageing as an irreversible process associated with decadence, passivity and inactivity. This theoretical construct emphasises the role of medical science in contrasting biological ageing, modifying the bodies and lifestyles of the senior population. To understand if biomedicalisation of ageing theory is a conceptual framework suitable for interpreting changes in the social representations of ageing over the last decades, we consider the public discourse developed in two broadsheet newspapers (*la Repubblica* and *The Guardian*) belonging to two different European contexts (Italy and the UK), particularly regarding these countries' healthcare systems, cultural arrangements and demographic trends. From our perspective newspapers, as well as other contemporary media, are generative elements engaged in the exchange, reproduction and transformation of the social meaning of health and medicine: they are at the same time agents contributing to the development of social processes and an arena in which these processes take place (Neresini et al. 2019, 2). This latter aspect is particularly emphasised from authors that chose to study press coverage because "newspapers cover topics when institutional actors [...] turn their attention to them, particularly when attention leads to extensive debate, legislative proposals, or executive action" (DiMaggio et al. 2013, 573). As pointed out by other studies (Fowler and Gollust 2015; De Dobbelaer et al. 2017; Stroobant et al. 2019; Hallin et al. 2021), this is particularly evident in health journalism that, more than other journalistic beats, tends to reflect the concerns and the priorities of institutions as well as other influential actors of healthcare sector (e.g., experts, pharmaceutical companies, authoritative research centres). Claiming that there is a deep connection between these actors and media does not mean to affirm that these latter are passive recipient of content decided somewhere else. Rather, we assume that in health and medicine sector, media are particularly aligned with institutions, experts and other actors, collectively contributing to the co-production of representations of health (Hallin et al. 2021, 701).

The current paper is structured as follows: after an in-depth presentation of the debate about the biomedicalisation era, we describe the contexts, the research questions and the methods that of our study. Then, we present and discuss the main findings of our study before making some final remarks concerning the extent to which biomedicalisation of ageing has taken place in the two considered national contexts.

2. Biomedicalisation and Ageing

One of the most successful attempts at conceptualising the changes that have taken place over the past few decades in the field of health and medicine has been conducted by Clarke and colleagues (Clarke et al. 2003; 2010a; 2010b; Clarke 2010) with their contributions concerning the *biomedicalisation era* (1985-ongoing). The "medicalisation" era (1940-1990), as deeply explored by Peter Conrad (1992; 2007), has been marked by processes through which aspects of life previously outside the jurisdiction of medicine (such as anxiety, transsexuality, infertility and impotence) come to be represented and treated as medical problems. As explained in the following excerpt, the concept of biomedicalisation has been created with the aim of underlining the continuities and discontinuities between the medicalisation era and a subsequent historical era:

> We signal with the "bio-" in biomedicalisation the transformations of both the human and nonhuman made possible by technoscientific innovations, such as molecular biology, biotechnologies, genomisation, transplant medicine, and new medical technologies. That is, medicalisation is intensifying but in new and complex, usually techno-scientifically enmeshed ways. (Clarke et al. 2010a, 47)

Biomedicalisation deploys a broad range of trends, that is, the emergence of an arena in which biomedical knowledges, technologies, services and capital are increasingly interconnected; a new and intense focus on health (in addition to illness and injury), on the detection of health risks and on interventions aimed at treating them; the transformation of biomedical practices where clinical interventions are increasingly reliant on technoscientific innovation; the progressive centrality of information infrastructures and technologies in the production of biomedical knowledge; and the transformation of bodies to include new proprieties and consequent emergence of new identities. As it can be easily inferred from its main features, biomedicalisation takes shape within an economic and political framework strongly influenced by neoliberal thinking, characterised by cuts in public spending, an emphasis on individual responsibility and the involvement of private corporations in key governmental functions such as the provision and the development of healthcare services (Dickenson 2013).

A wide range of studies has paid attention to the shapes of biomedicalisation that have taken place in the conceptualisation of ageing and practices enacted to ensure the health of the older population. The term "biomedicalisation of ageing" was coined several years before the attempts made by Clarke as a way to define in detail the complex trends that compose biomedicalisation processes. With this term, Estes and Binney (1989) defined the phenomenon whereby ageing comes to be framed as a matter of biomedical interest,

contributing to the wider reorganisation of healthcare around technoscientific interventions and modes of prevention and consumption.

In their seminal contribution, the two authors defined the biomedicalisation of ageing as a phenomenon composed of two dimensions: i) the social construction of ageing as a medical problem and ii) the praxis of ageing as a medical problem. These two aspects of biomedicalisation of ageing have attracted the interests of several contributions, mostly belonging to medical sociology and science and technology studies[1] (STS), hence stimulating a lively debate.

First, several authors have reflected on how, in the biomedicalisation era, biological ageing and its consequences have started to be conceived of as a medical problem that brings with it pervasive health risks. The growing connections between the market and biomedicine have favoured the creation of screening techniques and self-monitoring technologies aimed at detecting possible health threats connected with ageing for which there are specific care paths, here modelled on the economic interest of big corporations and private companies. In this frame, several conditions that were once considered a normal consequence of ageing have become pathologies that can be prevented or treated in their early stages. Some common examples of this transition that garnered the interests of STS scholars and medical sociologists are the shift from senile dementia to Alzheimer's disease (see Moser 2008; Moreira and Bond 2008), the transition from impotence to erectile dysfunction (Mamo and Fishman 2001; Loe 2004; Marshall 2010; Ferrero Camoletto 2020) and the pathologisation of menopause and widespread use of hormone replacement therapies (Murtagh and Hepworth 2003; Palmlund 2006; Singh and Sivakami 2020). A recent evolution of the pathologisation of ageing is the problematisation of the entire ageing process: a considerable number of contemporary biogerontologists, rather than pursuing disease-specific explanatory models, have been focusing on the common biological basis of all the diseases that would seem to characterise the lives of the older people (Moreira and Palladino 2009). Within this framework, the so-called "anti-ageing medicine" has arisen, not only aiming at alleviating the symptoms of ageing or curing the diseases associated with old age, but also making advancements in genetic manipulation or chemical interventions, here with the main aim of extending human lifespan or, even, abolishing ageing (Vincent 2006).

Second, the growing interest of biomedicine in ageing and age-related diseases has been intertwined with the spread of technoscientific innovations that are aimed at minimising health risks or treating them when they materialise into full-blown diseases (Crawford 2004). There are two specific kinds of interventions that are typical of the biomedicalisation era and that have been particularly adopted with the aim of intervening in the ageing process.

On the one hand, there is personalised medicine[2], which is intended as a clinical field in continuous advancement that aspires to provide diagnoses and treatments tailored to each patient based on all patient data, including genetic and genomic ones (Ginsburg and Willard 2009). At the turn of the twentieth and twenty-first centuries, personalised medicine has taken particular relevance on the global scale, both inside and outside clinical debate (Prainsack and Naue 2006), thanks to big transnational or international projects (such as the Human Genome Project or international HapMap project), which have aimed at developing new infrastructures for "genome mapping". Biological ageing has been among the fields of application of this kind of medicine, which has been widely applied in the treatment of various diseases typical of old age

(first cancer but also dementia and cardiovascular diseases; Henney 2012) and in the exploration of experimental interventions aimed at manipulating the roots of the mechanisms behind ageing (Fuellen et al. 2016). In parallel, personalised medicine has attracted both public and private capital, become increasingly interwoven with a market logic (in particular, the connections with pharmaceutical and information technology industries) also stimulating the public agenda to understand new ways to incorporate personalised services in national health systems.

At the same time, the relationship between biomedicalisation and ageing has been characterised by the transformation of good or bad health into a moral responsibility of the individual (Petersen and Lupton 1996; LeBesco 2011; Lupton 2013), here with a particular reference to older people. The emphasis on individual responsibility seems to have become particularly pervasive also in the field of prevention through lifestyles, pushing individuals to reorganise their daily lives around the moral obligation of "health maintenance", which is typical of the biomedicalisation era (Clarke et al. 2010a, 63). Concepts such as *third age* (a time period in one's life between the completion of primary family and career responsibilities; Laslett 1989) and *active ageing* (concerned with enabling people to remain independent and achieve their potential regardless the age; Lassen and Moreira 2014), despite their differences, share the aim of pushing older people to actively manage their own ageing processes in the "right way", that is, maximising their self-worth and staying safe as long as possible. In parallel with the massive circulation of these concepts in the public sphere (e.g., in media, in institutional and experts' discourses, in advertising messages, etc.), older people are increasingly pushed to adopt technoscientific practices that embed biomedical knowledge (e.g., advice for improving the adherence of individuals to clinical guidelines) and technological devices (e.g., self-tracking devices such as mobile phones, apps and wristbands), here with the aim of treating the health issues connected with ageing.

3. Methodological Framework and Empirical Contexts

Our main purpose is to understand if the representations of the health issues connected with old age are consistent with the theory of the biomedicalisation of ageing. A considerable body of literature has created and developed this theoretical perspective, mainly through conceptual contributions or with qualitative methods (Markson and Taylor 2000; Kessler et al. 2004; Asquith 2009; Rozanova 2010; Shimoni 2018), but our paper aims at measuring the onset and development of the two main aspects of the biomedicalisation of ageing (the social construction and praxis of ageing as a medical problem) through a quantitative study. As noted in the introduction, we will focus on the public discourse, mainly with reference to mainstream media.

To adopt quantitative methods for exploring public discourse about ageing is motivated, at first, by the opportunities offered by the digitalisation of huge quantities of text that, according to Krippendorf (2004, 43) shifts "the bottleneck of content analysis from the costs of access and tedious human coding to the need for good theory, sound methodology, and software". In our case, having at disposal huge archives of newspaper articles allowed a shift from qualitative content analysis to quantitative methods suitable for analysing a great number of texts and, at the same time, capturing in depth their meaning. As elucidated by DiMaggio and colleagues (2013), topic modeling, along with other methods aimed at identifying

co-occurrence patterns of specific terms, effectively addresses this challenge, since they enable inductive and automated text analysis that recognizes the relationality of meanings. This latter aspect is particularly important for sociologists interested in understanding how a certain phenomenon is portrayed in a certain text, without violating a fundamental principle of non-positivist sociology, i.e., that meaning emerges from relations among terms included in a discourse rather than inhering within them (*ivi*, 577). Indeed, by focusing on the recurrent and emergent associations of words, it becomes possible to treat terms as varying in meaning across different contexts. Drawing on these methodological insights, a certain number of scholars have recently used quantitative content analysis for exploring if and how processes associated with biomedicalisation are emerging in newspapers (see Hallin et al. 2013; 2021; De Dobbelaer et al. 2017; Neresini et al. 2019; Crabu et al. 2021).

These studies, in line with social constructivist approaches, have been marked by a shared effort to explore how news media, along with the voices of actors that find expression through them, influence, negotiate, and shape the representation of health (Hallin et al. 2021, 701).

3.1 Research Questions

Thus, we are first interested in understanding how biomedicalisation has changed the ways of representing ageing in contemporary society, transforming it into a medical problem. Within this frame, becoming older is a process that brings with it specific health risks that can be analysed and detected with the aim of reducing them or their impact in the case that they become real. Therefore, the first two research questions (RQ1, RQ2) have been formulated as follows:

- *RQ1: How and to what extent has media coverage over the past decades framed ageing as a medical problem associated with specific risks?*
- *RQ2: How and to what extent has media coverage over the past decades paid attention to solutions aimed at treating health risks connected with ageing?*

In addition, taking into account the scarcity of literature concerning biomedicalisation processes and ageing during the COVID-19 pandemic, we are interested in understanding how and if the COVID-19 outbreak has influenced media coverage concerning older adults' health, here with reference to their health risks and the treatment for these latter. Indeed, on the one hand, the recent literature on COVID-19 and media representations has remarked how this healthcare outbreak would have favoured a strong circulation of ageist stereotypes about older adults, who are intended as passive subjects that need to be protected (Ayalon et al. 2021; Zhang and Liu 2021) and/or as a burden for society (Fraser et al. 2020; Meisner 2021); on the other hand, it is not clear if the pandemic has obstructed the circulation of representations of ageing consistent with the biomedicalisation era, in which dependency and frailty are conceived of as preventable and treatable. Our third research question (RQ3), therefore, can be outlined as follows:

- *RQ3: How and to what extent has the COVID-19 pandemic affected the ways in which media represent health risks connected with ageing and its treatment?*

The combined exploration of these three substantive research questions can allow us to verify whether and to what extent biomedicalisation processes are pervading health and medicine narratives in the public sphere while also investigating the possible effects of COVID-19 on these processes.

3.2 The Considered National Contexts

We focus on medical and health accounts concerning ageing in *la Repubblica* (Italy-based newspaper) and *The Guardian* (UK-based newspaper), with particular attention to the extent to which media narratives have become "biomedicalised". Comparative analysis is an effective approach to test – across different national contexts – the existence of a phenomenon that has been theorised as typical of Western societies. Moreover, the differences existing among these contexts can give insights into general processes – namely healthcare system model, cultural arrangements and demographic trends – that influence the development and diffusion of the biomedicalisation of ageing.

While we recognize that the two selected newspapers do not fully represent the broader media ecology in the UK and Italy, we believe this limitation also offers certain opportunities for the aims of our study. Their status as elite newspapers makes them particularly attuned to scrutinizing medical and health issues. Moreover, their notable similarities – in terms of news framing, editorial policies, and audience demographics – enhance their suitability for conducting a consistent comparative analysis (see also Neresini et al. 2019, 2). Additionally, the extensive online archives of both newspapers allowed us to construct a dataset that aligns coherently with our chosen methodological framework. Thus, we could hardly have found better newspapers for exploring the topic of the biomedicalisation of ageing, while remaining aware that they provide access to only a portion of the possible representations of ageing within our society.

We have focused on these two newspapers because they paradigmatically exemplify diverse economic, social and political contexts in Europe that are exemplars of different healthcare system models. In the UK, the National Healthcare Service was born after World War II, inspiring several other governments – as in the cases of Italy, Spain, Sweden, Denmark, Norway, Finland and Canada – to build universal and public healthcare systems (Lameire et al. 1999); starting in the early 1990s, this model has been radically reformed following neoliberal economic theory. With the explicit aim of controlling escalating costs and increasing organisational efficiency, the British government has introduced a quasi-market framework in their National Healthcare Service. This shift favoured the widespread use of private health providers in competition with public ones and supported the adoption of business management models in the latter areas (Kitchener 1998). In the early 1990s, after its foundation in 1978, even the Italian National Healthcare System has been characterised by the above-mentioned trends but in a less systematic and uniform way (Giarelli 2017). If some regions seem to follow the British neoliberal model (e.g., Lombardia, Lazio, Campania), with a growing role of private organizations in the provision of healthcare services, in others (e.g., Emilia Romagna, Trentino Alto Adige, Piemonte), this phenomenon seems to be still limited (Pavolini 2011). In both countries, the introduction of neoliberal principles in healthcare systems has been accompanied by a modest growth of domestic general government health expenditure in the 2000-2010 period, especially taking into account the dramatic increase of care demand, and by a strong decrease since 2010, which is attributable to the global financial crisis. In Italy, public health expenditure decreased from the 78.45% level in 2010 to the 73.74% level in 2017. Meanwhile, in the UK, this decline was more modest, shifting from the 82.74% in 2010 to the 79.66% in 2017[3].

Even from a purely cultural perspective, the UK and Italy have different reference models. Assuming as a reference the well-known typology of national cultures provided by Geert Hofstede (2011), the UK has been traditionally characterised by "individualism", in which individuals are focused on achieving their own goals and taking care of themselves and their close relatives. In contrast, Italy has historically been characterised by a national culture that brings it closer to what Hofstede calls "collectivism", in which individuals are integrated into larger communities based on practices of mutual support and control, as well as collective identities and social norms that are historically consolidated. Consistent with this cultural model, in Italy, as in other Mediterranean countries, the family has historically played a pivotal role in providing daily care for relatives with significant health issues (e.g., people with disabilities or chronic conditions) and/or limited autonomy (e.g., children, older people without specific diseases), thereby ensuring their overall well-being and compensating the existing gaps in welfare provisions (Miele 2021).

However, it is necessary to underline that, over the past few decades, phenomena such as the demographic crisis, the increase of the presence of female workers in the labour market and growing emphasis on personal realisation have weakened the importance of informal ties and support in Mediterranean contexts (Miele 2021).

A final difference between the UK and Italy concerns the demographic composition of the population.

Looking at the old age dependency ratio[4], although at the beginning of the 1990s, the UK was slightly an "older" country than Italy (in 1993, the index value was 27% in the UK compared to 26% in Italy[5]), the situation has completely reversed in the following years. In 1995, both countries reached the same value (26.9%), while in 2000, Italy's old age dependency ratio rose to 29.2% (compared to 27% in the UK). By 2010, Italy's ratio had increased to 33.4% (versus 27.8% in the UK), and finally, in 2020, it reached 38.5% (compared to 32% in the UK). Thus, both countries are undoubtedly affected by an ageing population, but this process has been much more pronounced in Italy.

3.3 Data Analysis

Our analysis is based on two large datasets of all the health- or medicine-related articles found in the public archives of *la Repubblica* and *The Guardian*. Article selection was performed by searching the online public archives of *la Repubblica* (1,736,384) and *The Guardian* (2,315,794) from 1985 to 2021, using the keywords *anzian*/terza età* in the first archive and *elderly/senior*/older adult*/third age* in the second one. The open repository "The Guardian Open Platform" was used for *The Guardian*, while the open archive "la Repubblica dal 1984" was used for *la Repubblica*. After the research was conducted using the above-mentioned keywords, the dataset in *la Repubblica* comprised 46,336 articles, while there were 49,834 articles in *The Guardian*. These two datasets have been labelled as "general datasets" (Table 1).

Given the analysis that would be realized, the different type of articles – i.e., such as short news, comments, opinions, and so on – have been considered as similar, only excluding the articles with less than 300 characters because they are too short for automatic techniques like topic modelling, or they could be just advertisements.

	The Guardian	*la Repubblica*
Total articles published 1984-2021 (public archives)	2,315,974	1,736,384
Total articles related to elderly (general dataset)	49,550	46,336
% of articles relating to the elderly on the total number of articles published	1.62	2.67
Total articles related to elderly limited to those related to technoscience (technoscientific dataset)	3,918	3,103
% of technoscientific articles relating to the elderly on the total number of articles related to elderly	10.43	6.70

Table 1.

The composition of the considered datasets.

These articles were analysed through both a manual and iterative analysis of topics extracted by Latent Dirichlet Allocation (LDA)[6].

Although it is a quantitative methodology, the analysis using topic modelling requires continuous interaction between the researchers' interpretations and the algorithm, starting from decisions on the number of topics whose existence is hypothesised within the dataset up to the attribution of the topics' labels using both the words most associated with each of them. Moreover, we manually analysed the 30 articles whose text most closely reproduces the textual features of a given topic as a further source to better identify to which semantic domain each topic is referring to and thus as a tool to better define an appropriate label. In this way, it has been possible to explore the content of the topics with greater accuracy, especially when it came to capturing aspects relevant to our research questions. So, in line with a constructivist approach, we are fully aware that the conducted analysis was without doubts influenced by the theoretical backgrounds, interests and interpretations of the researchers that actively participated to the enactment of analytic categories (see Hardy et al. 2004, 21).

In the first LDA run, we worked with 40 topics for each general dataset, that is a topics quantity that after some explorative attempts resulted to be appropriated to obtain topics nor too generic, nor too specific. The resulting topics that were coherent with our research interests (i.e., regarding issues connected with health, medicine and clinical research issues) were only three for each newspaper. This first run thus provided the opportunity to contextualise the specific public discourse about ageing and health within the general media coverage about older people.

With the aim of deepening the analysis on ageing and biomedicalisation – and thus analysing data closer to our research questions – we conducted a second run of the LDA on a more focused dataset, here extracted by the initial one, containing only articles concerning technoscientific issues (technoscientific dataset). These articles were selected by applying machine learning techniques for automatically classifying texts with a specific focus on science and technology issues.

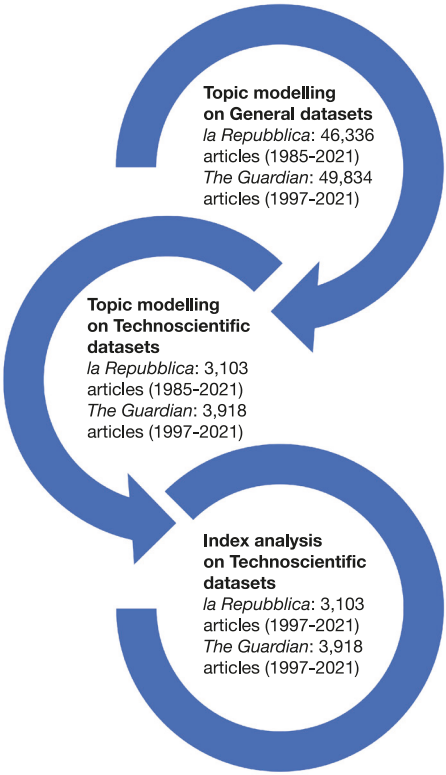

Figure 1.
The stages of the conducted comparative study.

To this aim, we used an automatic classifier that we have already applied and tested (Neresini et al. 2019; Crabu et al. 2021; Neresini et al. 2023). The classifier has been trained through a sample of articles in which there are both articles related to technoscience and not; this training set has been manually coded assuming that an article should be considered "related to technoscience" if it fulfils at least two among the following six criteria: a scientist is mentioned, a scientific journal is mentioned, a research organization is mentioned, a scientific discipline is mentioned, the text talk about a research process or an innovation one, scientific instruments and/or technological artefacts. This allowed us to select articles in which technoscience plays a relevant role outside those published in the newspapers' sections specifically dedicated to science, technology and/or medicine (Cammozzo et al. 2020; Di Buccio et al. 2022)[7]. Following this approach, we collected one technoscientific dataset for *la Repubblica* (3,103 articles) and one for *The Guardian* (3,918) (see Table 1). Given the reduced number of articles obtained in that way, we extracted 20 topics for each technoscientific dataset, again finding this number appropriate in order to have a balanced output between generality and specificity. Then we selected 15 topics consistent

Index	Associated keywords (ITA)	Associated keywords (ENG)
Risk category	Person* a rischio; categori* a rischio; grupp* a rischio; popolazion* a rischio; gente a rischio; soggett* a rischio; soggett* con un rischio; diagnosi precoce; epidemiolog*; screening; predisposizione; colpisce/colpiscono/colpit*	At risk; to a risk; people at risk; risk category; risk categories; risk group; risk groups; early diagnosis; early diagnoses; epidemiological; epidemiology; epidemiologist; epidemiological; screening; predisposition; affect/affects/affected
Risk factors	Fattor* di rischio; indicator* di rischio; indica un rischio; condizion* di rischio; esposizione a; diagnosi precoce; trattamento precoce; fas* inizial*; epidemiolog*; screening, probabilità	Risk factor; risk factors; risk-factor; risk-factors; risk condition; risk conditions; a higher risk; higher risks; exposed to; exposure to; early diagnosis; early diagnoses; early treatment; early treatments; early stage; early stages; epidemiological; epidemiology; epidemiologist; epidemiological; screening; screenings; likelihood; probability; probabilities
Personalised medicine	Personalizz*; individualizz*; terapia genetica, farmacogenomic*; terapia genica; medicina di precisione; medicina personalizzata/su misura	Personalis*; individualis*; gene therapy; genetic therapy; pharmacogenomics; precision medicine; personalised medicine; tailored medicine
Lifestyles	Fumator*/fumo/fumare/sigarett*/ tabacco/tabagismo; dieta/e; bere/alcool/ alcol/alcolici/superalcolici; vizio; sostanze stupefacenti; obesità/sovrappeso; abitudini/stile di vita/stili di vita; bmi/ indice di massa corporea; consum* di alcool/di alcolici/di superalcolici; attività fisica/praticare uno sport/praticare degli sport/praticare sport/fare sport seguire una dieta/osservare una dieta/regime alimentare/corretta alimentazione; proteggersi/volersi bene/coccolarsi; ipertensione; attenzion* verso se stessi/ cura se stessi/cura di sé/cura del corpo; consumo eccessivo; sana e corretta	Smoke/smokers/smoking/cigarett*/ tobacco/tobacco use/tobacco addiction; diet/diets; drink/alcohol/alcool/ alcoholic/liquors; vices; substance abuse; obesity/overweight; habits/ lifestyle/lifestyles; bmi/body mass index; alcohol consumption/consumption of alcohol; physical activity/to play sports/ playing sports/to play a sport/playing a sport; a diet/a balanced diet; to protect themselves/protecting themselves/to love themselves/loving themselves/pamper themselves; self-care/body care/attention to yourself/attention to themselves; over use; healthy and correct

Table 2.

List of the indices and the selected keywords developed to analyse the content of the articles.

with our research interests in the Italian newspaper and 16 in the British one. Hence, to analyse the topics treated by the public discourse concerning ageing and biomedicine, in the empirical section, we discuss the results of topic modelling conducted on the technoscientific datasets.

Finally, to gain more meaningful insights regarding our RQs, we developed some indices (Table 2) to exploit a manually selected list of keywords[8]. Each index provided a score to be assigned to each article. The index's score was calculated based on the frequency of occurrence of the keywords in the document and normalisation based on the length of the article. For example, the more an article contained words such as "at risk", "risk group", "early diagnosis" or "screening", the more it was supposedly related to a talk about "risk category" or relate its contents to that concept. The keywords have been selected following a mix of qualitative/quantitative steps: for each index, we have first selected a sample of 30 articles in which we can recognize a clear reference to the issue related to the index; this sample has been extracted manually. Then a list of candidates keywords has been extracted using TF_iDF, i.e., a measure that indicates which words are more specific for a given corpus in comparison to another one; hence an initial version of the index has been calculated on a sample composed by 1000 articles randomly extracted by the general dataset regarding elderly/senior people and by 1000 articles not regarding elderly/senior people randomly extracted by the newspaper repository; comparing the average values of the index applied to the two subsamples we have checked manually whether the index scores were consistent with the issue we expected their can detect actually; lastly, the list of candidates keywords has been refined both removing those words that resulted to be too generic or misleading.

Of course, this approach based on indices as "bag-of-words" (see on this Di Buccio et al. 2016) can offer some useful insights about how ageing is covered within a technoscientific frame; therefore, what is suggested by the indices had been deepened through a qualitative analysis of the articles more representative (i.e., the articles that received the highest index's scores) in order to check whether the indices actually measures what it was expected to measure.

Regarding the analysis of indices, to have a satisfying number of articles to be analysed and compare the two national trends during the same time frame, we applied the indices to the whole technoscientific dataset considering the 1997-2021 period. Indeed, in the 1985-1997 period, the articles stored in the dataset of *The Guardian*, obtained using the above-mentioned keywords, totalled only 33. This is because of the low total number of articles stored by the British newspaper in its online archive and not to a supposed irrelevance of the considered topic in the UK public debate.

4. Findings and Discussion

4.1 Overview of Italian and UK Press

The general picture we have about media attention to older population is described in Table 1. Even if it is just a first and very general glance, there are some interesting aspects to be outlined.

First, the percentage of articles mentioning older people out of the total articles published in the period under observation is considerably higher in the case of *la Repubblica* (2.67%) compared with *The Guardian* (1.62%); this seems to reflect the greater demographic weight of senior population in Italy, even if media coverage appears to be in a much higher proportion than the difference in the demographic data. In part, this may be because of the fact that, as noted, *The Guardian* database offers a rather small quantity of articles for the first few years; however, this does not seem sufficient to explain the fact that the articles concerning

older people are found to weigh twice as much in the case of *la Repubblica*. In Italy, hence, the elderly show higher attention in the public sphere than in the UK.

Second, we can see a significant difference in the proportion of articles with a technoscientific frame, but this time, the positions are reversed. Although the percentage of technoscientific articles relating to the elderly on the total number of articles related to the elderly generally is equal to 10.43% for *The Guardian*, the ratio is reduced to 6.7% for *la Repubblica*. In the Italian context, therefore, older people are discussed more, but this is done less so within a technoscientific framework, which is quite the opposite in the UK. These data can be interpreted as a preliminary indication of the greater complexity in the UK debate, which is focused on indicating a wide range of technological and clinical solutions to the ageing issues. Obviously, however, this is a very generic clue, which will eventually have to find other supporting elements to be seriously taken into consideration.

Remaining at an exploratory level, the first topic modelling run on the general datasets can offer further introductory indications. As anticipated, the longitudinal study of the topic trends in Italy and the UK has been realised for 40 topics, here focused on a broad range of content domains, which can be summarised as follows:

- **Culture and art** (8 topics both in Italy and 6 in the UK). Older adults are artists, writers and actors/actress, spectators of cultural events (e.g., audiences of TV programmes and movies) or characters that appear in artistic products (e.g., books, movies, paintings);
- **Politics and institutions** (10 topics in Italy and 12 in the UK). Older adults are the recipients of public policies and citizens involved in political life (as leaders, electors, part of trade unions or social movements);
- **Business and economics** (3 topics in Italy and 3 in the UK). Older adults are the targets of new products (e.g., digital technologies) and services (e.g., holiday packages) or managers of big companies;
- **Social and physical vulnerability** (5 topics in Italy and 6 in the UK). Older adults are the victims of crimes, sociopolitical conflicts and meteorological events (e.g., global warming, earthquakes);
- **Sports** (2 topics in Italy and 1 in the UK). In this case, the term "older" is often used as an adjective to describe experienced players or coaches in certain sports (e.g., football and tennis). Sometimes, older adults are spectators of sporting events;
- **Community and everyday life** (6 topics in Italy and 4 in the UK). Older adults are the members of territorial, religious, familiar and ethnical communities participating in their daily life (e.g., as observants of Catholic church or as family members with a certain role);
- **Healthcare** (3 topics in Italy and 3 in the UK). Older adults are "people at risk" of incurring health problems – with particular reference to COVID-19, to which a separate topic is dedicated – and are the recipients of clinical interventions and research, welfare reforms concerning national healthcare systems.

The last 3 topics for *la Repubblica* and 2 for *The Guardian* resulted in a low internal consistency, therefore making it hard to circumscribe clearly the issue of reference.

Hence, if, in general, the public discourse affects older people in many ways, the specific focus on health and medicine occupies a relevant but not overwhelming part of this. This can be considered a first hint about the biomedicalisation of older adults within Western societies.

However, to make the analysis more relevant to our research questions, it was necessary to focus our attention on a dataset composed of articles more directly related to technoscientific issues. For this reason, we applied LDA to a collection of articles that not only have something to do with older people in some way, but that also talk about them with greater reference to technoscience (the so-called "technoscientific dataset").

The longitudinal analysis on the topic trends in Italy and the UK (see Tables 3 and 4, *following pages*) shows that the public debate about ageing and health presents features that are reasonably coherent with the biomedicalisation perspective for which ageing has become a matter of biomedical interest to a great extent.

Emerging topics mainly regard issues that have to do with the health of the older people (15 out 19 in Italy and 16 out 19 in the UK; see Table 3 and Table 4, respectively), and the most of them belong to the domain of well-being and prevention (11 in Italy and 11 in the UK), showing a high public concern about the health conditions of the ageing population, even when full-blown diseases are not discussed.

In the well-being and prevention domain, attention is sometimes focalised on the prevention of certain specific diseases – deemed to be particularly dangerous for older people – through public health campaigns, with particular reference to the flu (topic 10 in Italy; topic 13 in the UK) and COVID-19 (topic 19 in Italy; topics 2, 14 and 15 in the UK). Here, we can observe that public health campaigns have attracted more attention in the UK than in Italy, considering both the number and relative weight of these topics[9]. Regarding this latter aspect, it is because of observations that, in both national contexts, topics dedicated to COVID-19 emerged and that in the UK these topics seem to have had even more relevance in the public sphere; in particular, in the UK, topic 14 concerning restriction measures appears as the sixth topic regarding relevance (see the column "relative weight" in the Table 4).

Other topics, coherently with the processes that characterise the biomedical era, signal that a media discourse "problematise the normal" (Armstrong 1995), supporting the surveillance of the population once judged as "normal" and pushing it to embrace clinical interventions. This can happen in many ways:

- Pathologizing the conditions once considered as nonpathological consequences of ageing processes, that is, memory loss (topic 8 in Italy) and infertility (topic 12 in Italy);
- Transforming individual routines as a matter of clinical concern, see, for example, sleep (topic 2 in Italy), nutrition (topic 3 in Italy; topic 3 in the UK), physical activities (topic 9 in Italy) and living during global warming (14 in Italy; 11 in the UK);
- Surrounding older people with technological infrastructures and interventions aimed at enhancing their capabilities. The UK press pays particular attention to the role of digital innovation and robotics in allowing senior citizens to improve their daily lives, supporting them in communication (topic 10) or mobility (topic 6). In Italy, only one topic (11) focuses on the role of territorial innovation in improving the quality of life of older people;
- Giving the floor to the ongoing research on ageing mechanisms (topic 4 in Italy; topic 12 and 17 in the UK) and the factors that can expand life expectancy (e.g., genetics, lifestyles, received clinical interventions). These topics, although of a limited number, are paramount in the public debate: in particular, in Italy topic 4 and in the UK topic 12 are, respectively, in second and the first position when it comes to relative weight.

la Repubblica

Topics' thematic domain (1)	Topic number and label (2)	Relative weight (3)	Top 5 words (4)	Topic trend from 1985 to 2021 (5)
Wellbeing and prevention	2, Medications, sleep and overall wellbeing	(0,122) 7th	medications, sleep, medication, doctor, effects	
	3, Diet, nutrition and health	(0,103) 9th	diet, vitamin, food, nutrition, fats	
	4, Research about health and wellbeing	(0,369) 2nd	study, researchers, research, results, studies	
	8, Brain, ageing and health	(0,085) 12th	brain, Alzheimer, memory, disease, dementia	
	9, Physical activity and ageing	(0,114) 8th	activity, physical, ageing, body, exercise	
	10, Flu and vaccines	(0,1) 10th	virus, flu, cases, children, disease	
	11, Innovation, territorial development and quality of life	(0,187) 4th	research, Italy, countries, development, Europe	
	12, Bio-technologies and reproduction	(0,051) 14th	animal, animals, dog, dogs, humans	
	14, Weather, warming and health	(0,126) 6th	air, water, temperature, sun, heat	
	16, Risk and prevention	(0,393) 1st	risk, age, women, population, Italy	
	19, Covid-19 and vaccination	(0,086) 11th	Covid, vaccine, vaccines, coronavirus, dose	

la Repubblica

Topics' thematic domain [1]	Topic number and label [2]	Relative weight [3]	Top 5 words [4]	Topic trend from 1985 to 2021 [5]
Treatment of disease	5, Cancer and treatments	(0,084) 13th	patients, tumor, cancer, tumors, disease	
	7, Mental health	(0,084) 13th	children, depression, anxiety, social, sexual	
	15, Clinical advices and diseases	(0,157) 5th	heart, disease, patients, patient, blood	
NHS	0, Epidemiological changes and innovation in NHS	(0,33) 3rd	patients, clinicians, Italy patient, elderly	

[1] General issues to which topics can be connected.
[2] Labels have been attributed manually by the authors on the basis of the most relevant words – see column 4th and of the articles that better represent the topic.
[3] Relevance of the topic and its ranking compared to other topics relevance.
[4] Representing the topic, i.e., probabilistically more related to the topic.
[5] By year.

Table 3.
Topics clustered per thematic domain in *la Repubblica* newspaper; topics relative weight and ranking, top 5 words representing the topic and trends across the 1985-2021 period.

The Guardian

Topics' thematic domain (1)	Topic number and label (2)	Relative weight (3)	Top 5 words (4)	Topic trend from 1998 to 2021 (5)
Wellbeing and prevention	2, Public health in USA	(0,077) 10th	health, public, states, Americans, California	
	3, Diet, nutrition and health	(0,06) 14th	food, water, vitamin, eat, milk	
	6, Digital technologies, robotics and society	(0,087) 8th	technologies, robots, robot, digital, internet	
	9, Pollution and air quality in the worldwide	(0,072) 11th	air, pollution, health, world, countries	
	10, Mobility, innovation and health	(0,072) 11th	city, car, cities, cars, transport	
	11, Climate crisis and health	(0,066) 12th	climate, change, heat, water, temperature	
	12, Research on health and life expectancy	(0,473) 1st	people, study, health, research, age	
	13, Infectious diseases: symptoms and management	(0,085) 9th	flu, virus, cases, disease, people	
	14, Covid-19 and restriction measures	(0,126) 6th	Covid, people, virus, pandemic, cases	
	15, Covid-19 and vaccines	(0,064) 13th	vaccine, vaccines, Covid, people, vaccination	
	17, Scientific research and anti-ageing medicine	(0,026) 15th	brain, cells, body, blood, research	

The Guardian

Topics' thematic domain [1]	Topic number and label [2]	Relative weight [3]	Top 5 words [4]	Topic trend from 1998 to 2021 [5]
Treatment of disease	1, Mental illness, neurological disorders and suicide	(0,139) 5th	people, older, dementia, mental, care	
	18, Contemporary diseases, diagnoses and treatement	(0,118) 7th	cancer, drugs, patients, drug, treatment	
	19, Social innovation and frail populations	(0,261) 4th	social, people, work, working, community	
NHS	3, NHS, care load and crisis	(0,33) 3rd	patients, hospital, NHS, care, hospitals	
	7, NHS and institutional reforms	(0,314) 2nd	care, health, NHS, services, governament	

[1] General issues to which topics can be connected.
[2] Labels have been attributed manually by the authors on the basis of the most relevant words – see column 4th and of the articles that better represent the topic.
[3] Relevance of the topic and its ranking compared to other topics relevance.
[4] Representing the topic, i.e., probabilistically more related to the topic.
[5] By year.

Table 4.
Topics clustered per thematic domain in *The Guardian* newspaper; topics relative weight and ranking, top 5 words representing the topic and trends across the 1998-2021 period.

Therefore, at first glance, the media discourses in UK and Italy seem to be characterised by a problematisation of ageing, here intended as a process that can be explored and manipulated in its entirety or, at least, that brings with itself pathological conditions that can be prevented. Both in Italy and in the UK, there is a high level of attention given to the role of individual routines in treating health risks related to ageing, also if the topics related to this issue seem to be more present in the Italian press both in terms of number and relative weight (see the second point in the above list). These outcomes are consistent with the emphasis on moral responsibility of the individual that characterises the biomedical era. However, at the same time, the UK debate is also characterised by a high attention to the role of public health campaigns in improving the overall health conditions of older people and on the ways through which the environment can be transformed to improve older people's well-being (see the focus on public health issues and campaigns).

Regarding the topics under the domain "treatment of disease", there are some relevant differences between the two national contexts. In Italy, the focus is mainly on the factors at the basis of some diseases common in senior population (topic 7) and on possible clinical treatments (topics 5 and 15). In the UK, only topic 18 focuses on the diagnosis and clinical treatment of diseases related to ageing, while topic 1 faces the issue of suicide (in terms of assisted suicide or suicide prevention), and topic 19 concerns the social policies aimed at supporting the frail population. Also in this case, in Italy there is a higher presence of topics clearly ascribable to the biomedicalisation of ageing, with regard to the ones that promote interventions that can cure diseases associated with old age. It is interesting to observe that, among the topics under the domain "treatment of disease" found in the Italian newspaper, the most relevant is topic 15 (placed at the fifth place for relative weight), in which healthcare professionals give clinical advice directly to the readers, which is again in line with the individual responsibilisation that characterises the biomedicalisation era.

The last domain, "NHS" confirms that, in the UK, there is more attention than in Italy to the role that public institutions can play in the management of older people's health: topic 7 (the second topic for relative weight) and the topic 3 (the third topic for relative weight), respectively, face the problems encountered by the healthcare system and possibility of reforming it. In Italy, only topic 0 faces this issue (score of 3.33; the third topic for relative weight).

To conclude, although with some variations between the two national contexts, topic modelling has highlighted how, in both countries, older adults' health issues are widely problematised, focusing on the role of lifestyle and technoscientific innovation in preventing or treating them.

In the following subsections, we can go deeper in our analysis of elder biomedicalisation, taking advantage of the indices expressly developed to address our RQs, hence tracing the trends followed by media coverage in representing health issues connected with ageing processes in terms of risk and individual duty.

4.2 Framing Older People as Subjects at Risk

The indices "risk category" and "risk factors" are strongly related to RQ1 because they offer the opportunity to observe whether and to what extent old age is framed as belonging to a

risky group of population and how some specific factors can determine these risks. The two indices present steady positive trends in both national contexts in the 1997-2021 period, even if, in Italian press, the regression lines indicate a more rapid growth of framing older people as a "risk category" exposed to more "risk factors", here with a particular acceleration over the past decade. Moreover, although "risk factors" have become more relevant in Italy than in the UK after 2010 (Figure 3), old people as a "risk category" (Figure 2) have appeared more frequently in *la Repubblica* since the end of 1990s.

Therefore, both in Italy and the UK, the growth of the "risk category" and "risk factors" indices appear reasonably coherent with the biomedicalisation perspective, in which ageing is constructed as a medical problem. The trends observed align with the general tendency of media coverage to incorporate changes in biomedical knowledge, illustrating how the analysis and the treatment of health risk is always necessary even in the absence of a full-blown disease (Hallin et al. 2021, 702). In this way, citizens are transformed into "ready subjects for health discourses, commodities, services, procedures and technologies" (Clarke et al. 2010b, 64).

Regarding the rapid growth of considered indices in Italy after 2010 (see both Figure 2 and 3), compared with the slow one happened in UK, this could be explained referring to the intersection between two processes: the stronger decrease of government health expenditure due to the crisis and the rapider ageing population process (see the section "Methodological Framework and Empirical Contexts"). As previously noted (Briggs and Hallin 2007), the introduction of issues aligned with the biomedicalisation era into the media sphere, including a clear emphasis on individual health risks and on their management, is closely linked to the rise of neoliberal arrangements in healthcare. We can reasonably assume that, within a context already characterized by a significantly heightened ageing population, the sudden rise of public attention to the health risks of older people is some way linked to the harsh impact of economic crisis on Italian National Healthcare System and associated acceleration in neoliberal politics (Giarelli and Neri 2020).

A last remark regards the influence of the COVID-19 pandemic on the considered indices, thus addressing RQ3. Both in Italy and the UK, the "risk category" (Figure 2) and "risk factors" (Figure 3) peaked during 2020, the year in which the COVID-19 virus was discovered. As predictable, the widespread discussion of a virus framed by experts (i.e., statisticians, epidemiologists) and politicians as a "disease of the elderly" (Zhang and Liu 2021) has favoured a clear increase in public attention to the risks that mark old age. As argued by Crabu and colleagues (2021), the COVID-19 pandemic has been characterised by the transformation of medical knowledge into a subsidiary body of knowledge to be mobilised in the public sphere for legitimising the expansion of a political centralised governance of the emergency. Consequently, COVID-19 has promptly attracted a great deal of media attention, ceasing to be a simple healthcare issue and becoming also a social, political and economic one. In 2021, this attention seems to partially decrease: the "risk category" values decrease in both national contexts while remaining higher than in the pre-pandemic period; on the contrary, "risk factors" values grow again (although slightly) in *la Repubblica* articles and slightly decrease in *The Guardian* ones. Compared with the previous years, it seems that COVID-19 strengthened the framing of older people as a risk category and increase the relationship between being old and being exposed to health risk factors because those related to COVID-19 are mainly relevant for aged people.

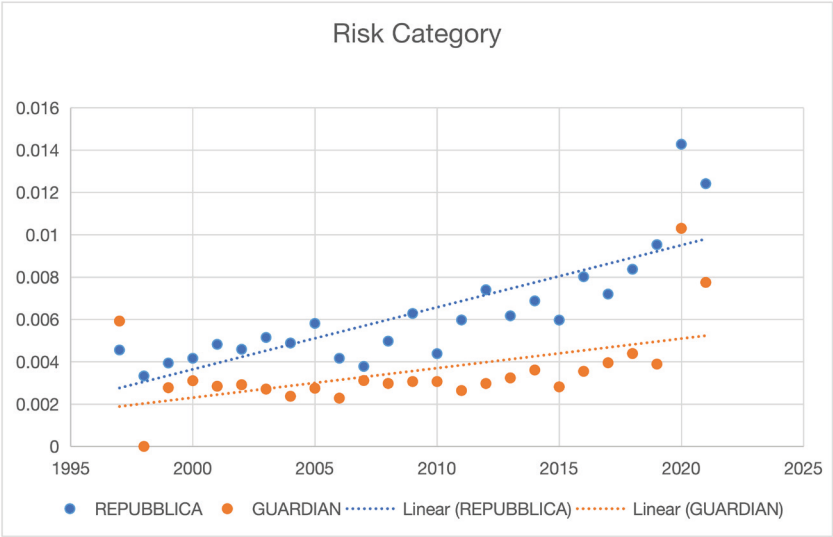

Figure 2.
"Risk Category" index trend (1997-2021) in *la Repubblica* and *The Guardian* (related to RQ1 and RQ3).

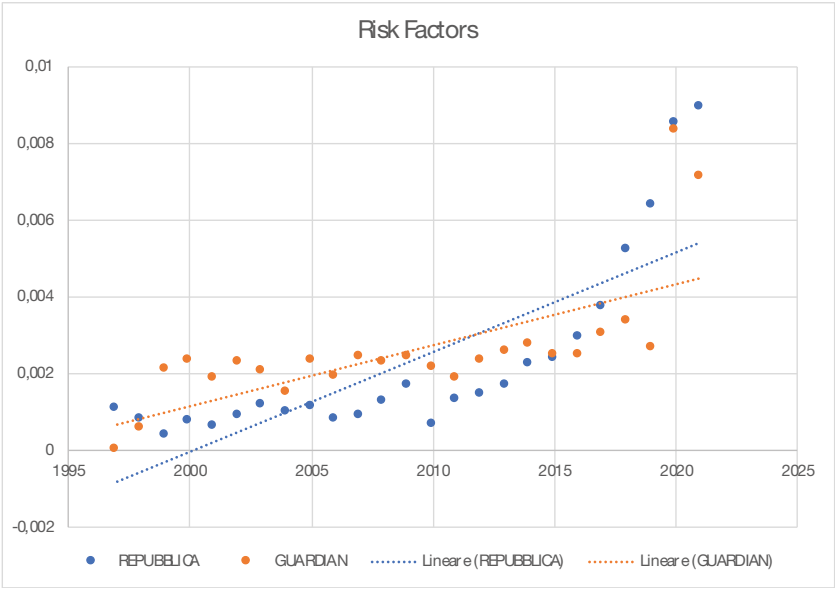

Figure 3.
"Risk Factors" index trend (1997-2021) in *la Repubblica* and *The Guardian* (related to RQ1 and RQ3).

4.3 Treating Ageing Through Technoscience: A Focus on Lifestyles Interventions and Personalised Medicine

The indices "lifestyles" and "personalised medicine" are related mainly to RQ2, given that they regard the ways through which people can adopt technoscientific interventions with the aim of improving their health. These indices, once applied to the articles concerning older people, show the high attention of the public sphere to the use of technoscience for treating those conditions associated with ageing. The "personalised medicine" index follows a positive trend in both newspapers over the years (Figure 4): at the beginning, the values were generally higher in *The Guardian* articles, showing a turnaround during the 2010s. In contrast, the index "lifestyles" shows a slightly decreasing trend in *The Guardian* articles and strong positive trend in *la Repubblica* ones (Figure 5): during the considered period, the two regression lines progressively tend one towards the other. In both cases, the indices in *la Repubblica* show rapid growth, and in this case, their values seem to have accelerated over the last decade.

Regarding the "personalised medicine" index, the positive trends found in both newspapers mirror the growth of in the popularity of these forms of intervention that took place since the late 1990s, as already mentioned (see Figure 4). Through this index, we have measured what Prainsack and Naue have suggested (2006) based on qualitative observations, that is, the growth of popularity of personalised medicine has manifested itself in (and has been shaped by) a considerably larger number of scientific and nonscientific publications regarding the breakthroughs and developments of this innovative strand of clinical interventions.

Concerning the differences between national trends, at first glance, we can observe that, since 2005, the values of this index in *la Repubblica* have started to overcome those of *The Guardian*. Since previous studies have shown how media coverage of health is particularly dependent on knowledge produced by expert sources in the field of medicine (see Hallin et al. 2021, 701), the earlier involvement of British scientific and clinical institutions into personalised medicine, which culminated in the development of public healthcare services based on the principle of personalisation (Cribb and Owens 2010), can explain the initial higher values shown by the considered index in *The Guardian*. In contrast, the rapid rise of public attention in Italy around this issue can be interpreted as connected with the greater space given by the Italian debate, compared with British one, to the individuation of the factors at the core of the diseases associated with old age and the formulation of treatments aimed at curing these latter ones. On the contrary, as shown by topic modelling results, UK public attention seems to be split between, on the one hand, the technoscientific solutions typical of the biomedicalisation era and, on the other hand, the focus on public health campaigns and the reorganisation of health and social care services.

Regarding the "lifestyles" index (see Figure 5), the initially higher values in *The Guardian* articles can be easily explained by the strong emphasis on individual responsibility that has characterised British public debate since the middle of the 1980s. As is well known, under the influence of neoliberal economists in the 1980s, the UK was affected by a reduction in welfare state spending and, during this same period, the emphasis on the responsibility of older people to stay fit, active and engaged rose in the public debate. With the progression of population ageing, over the past 30-40 years, policy makers and experts have publicly discussed the opportunity of supporting the involvement of seniors in volunteering activities

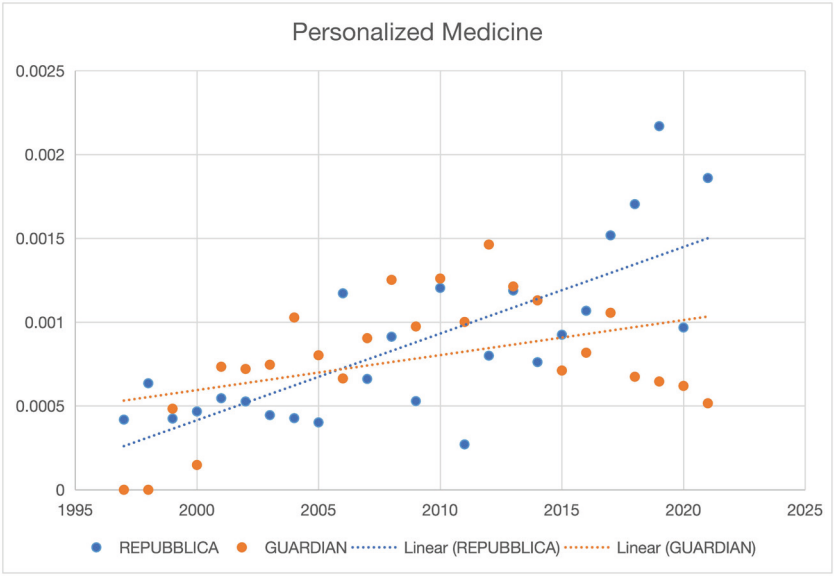

Figure 4.
"Personalized Medicine" index trend (1997-2021) in *la Repubblica* and *The Guardian* (related to RQ2 and RQ3).

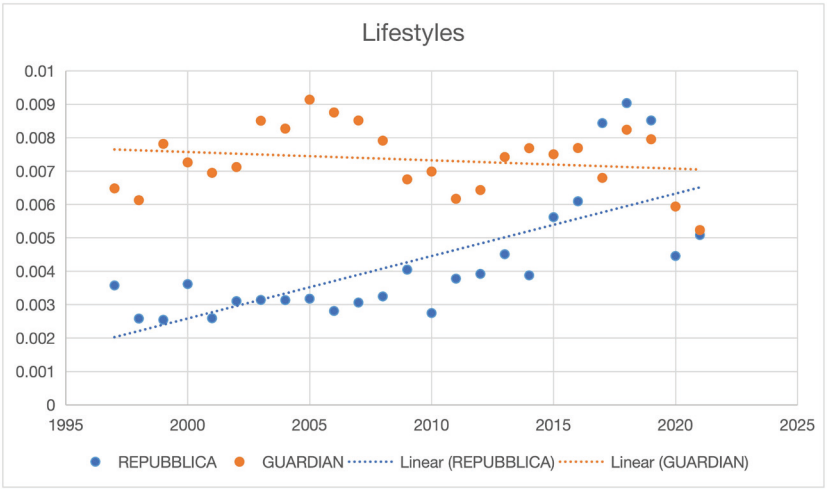

Figure 5.
"Lifestyle" index trend (1997-2021) in *la Repubblica* and *The Guardian* (related to RQ2 and RQ3).

(Lloyd et al. 2014) and providing services and programmes in which they are supported in making health lifestyle choices (see AgeUk 2019). In parallel, concepts such as "third age" (Shimoni 2018) or "active ageing" (Lloyd et al. 2014) have strongly permeated the public discourse. The index's values in *la Repubblica* seem to be much lower than in *The Guardian* for the first part of the considered period, dramatically increasing around the 2010s. This trend can be traced back to the late emphasis on lifestyles in ageing within the Italian public discourse. The concepts of the third age and active ageing in Italy were novel in the early 2000s, and the implementation of policies based on these ideas are quite recent (Palomba et al. 2001; Quattrociocchi et al. 2021). We can hypothesise that, over the last decade, in a national context marked by the pressure of welfare cuts on healthcare services and ageing population, institutions, policy makers and experts, along with newspapers, have increasingly put emphasis on lifestyle choices at the individual level.

Finally, in this section, we can go back to the consequences of the COVID-19 outbreak (RQ3). In 2020, both the "lifestyles" and "personalised medicine" indices underwent a sudden decrease, while the values of two risk-related indices peaked (see Figure 4 and Figure 5). This trend can be explained by the scarce clinical relevance of lifestyles and personalised medicine for the treatment of this virus. Using the distinction of Dickenson (2013), these kinds of interventions are ascribable to so-called ME[10] medicine, which is strongly interwoven with the neo-liberalisation of Western healthcare systems and is focused on the individual responsibility and/or on the role of private companies in the development of technoscientific innovation. In contrast, COVID-19 has given centrality to WE medicine, of which vaccination and, more generally, public health campaigns are typical expression (Crabu et al. 2021). In 2021, the values of the considered indices in the UK continued to decrease, while in Italy they slightly increased. This can be elucidated by the results emerging from topic modelling that indicate how, although in both national contexts topics dedicated to COVID-19 have emerged, in the UK the discussion about vaccination and restriction measures has taken more relevance in the public sphere. These data could suggest a stronger decrease in the attention paid to ME medicine in the UK, favouring the growing importance given to WE medicine that lasts throughout 2021.

5. Conclusions

The comparative analysis over the media coverage in UK and Italy shows that the phenomenon of biomedicalisation of ageing has been taking place over the past few decades, also taking into account that the two European national contexts here considered present some remarkable differences in healthcare system model, in the national cultural model and in the ways in which the ageing population has arisen.

We can now come back to the initial research questions, using both the results coming from topic modelling (period 1985-2021) and analysis of the indices (period 1997-2021).

Regarding *RQ1 – To what extent over the last years has media coverage conceived ageing as a medical problem that brings with it specific risks?* – both in Italy and the UK, a growing problematisation of the health conditions of older people seems to have taken place. The topic modelling analysis has underlined how, in the two national contexts, older people have been

interested in a problematisation of normality (Armstrong 1995), in which their bodies, daily routines and living spaces have become matters of clinical concern. From the analysis of "risk category" and "risk factors" indices, it has been possible to clearly outline how the attention around health risks connected with ageing has followed a positive trend in both countries, even if growing after 2010 more rapidly in Italy than in UK.

Regarding *RQ2 – To what extent over the past few years has media coverage paid attention to solutions aimed at treating health risks connected with ageing?* – the data underline how, in parallel with the growing problematisation of health risks associated with ageing, the public sphere pays an increasing amount of attention to technoscientific solutions for treating these risks. The topic modelling analysis has highlighted that, both in Italy and the UK, media coverage, here coherently with the expectations of scholars engaged in theorising the biomedicalisation of ageing, has focused on the treatment of diseases typical of old age (e.g., Vincent 2006) and on the role of individual responsibility (e.g., Lassen and Moreira 2014) in managing the health issues associated with ageing. The indices "lifestyle" and "personalised medicine" are initially marked by much higher values in the UK, given the early attention paid by British institutions to personalised clinical solutions and the role of individual responsibility in the maintenance of health status. However, in Italy, the public attention paid to lifestyles and personalised medicine during the past few years seems to reach and overcome the one found in the UK.

Finally, with respect to *RQ3 – To what extent has the COVID-19 pandemic affected the ways in which media represent health risks connected with ageing and its treatment?* – the analysis of indices' trends allowed us to explore the effects of COVID-19 on the public discourse around the older people. In both countries in 2020, the pandemic has caused a peak of attention on health risks of older adults and, at the same time, has negatively affected the importance of lifestyles and personalised medicine in the public sphere. In 2021, despite a partial setback, in both countries, the level of attention around health risks of the aged population remained higher than in the pre-pandemic period; in parallel, in Italy, there was a return of attention to lifestyles and personalised medicine, while, in the UK, the attention around these two technoscientific solutions continued to decrease. In the UK, here in a more permanent way than in Italy, the pandemic seems to have weakened the emphasis on so-called ME medicine, here in favour of the various forms of WE medicine (see Dickenson 2013).

Conducting a comparative analysis between contexts that present some remarkable differences has been useful not only for understanding if biomedicalisation of ageing has taking place in public discourse, but also for exploring its interconnections with broader processes. This interpretative effort has been necessary since, following Hardy et al. (2004, 20), "to understand the constructive effects of discourses, researchers must locate them historically and socially". Through our work, we have shed light on the intersections between, on the one hand, newspaper coverage on health issues related to ageing and, on the other hand, changes happened in attention paid by experts and institutional actors to this topic, ageing population and healthcare system arrangements. In the considered contexts, the two key dimensions that compose the "biomedicalisation of ageing" (i.e., social construction and the praxis of ageing as a medical problem; Estes and Binney 1989) have been emerged and evolved along with the just mentioned broader changes. In the period under scrutiny, these interconnections have been particularly appreciable in Italy, a context in which the cuts of public welfare

spending and the weight of older people in the demographic composition of the population, have rapidly and strongly taken place. Moreover, Italy has been characterized by a delayed yet apparently uncontested focus on technoscientific interventions associated with the biomedicalisation era in institutional documents and in the media sphere. In contrast, in the UK, public attention seems to be divided between the emphasis on new technoscientific solutions and the potential of public health campaigns in addressing health risks associated with ageing.

Therefore, it is reasonable to argue that diverse social, political, and cultural processes have contributed to co-producing the trends identified in our analysis. The considered newspapers are active part of this co-production process, influencing the dissemination of perspectives and priorities aligned with government policies and expert sources. Given the quantitative approach adopted in the paper, we cannot fully understand how the specific logics and norms of journalists and the news media shape the representation of health, filtering and reformulating those generated by other actors. We believe that future qualitative or mixed-methods studies could delve deeper into this aspect, taking inspiration from previous works on similar topics (e.g., Fowler and Gollust 2015; De Dobbelaer et al. 2017; Figenschou and Thorbjørnsrud 2018).

Notes

[1] This term is generally used to circumscribe an interdisciplinary field of studies with the common aim of probing how scientific discovery and its technological applications link up with other social developments in law, politics, public policy, ethics and culture.

[2] Currently, the term "personalised medicine" is often substituted with that of "precision medicine". Both are used to describe a clinical approach aimed at identifying the most effective treatments, taking into account the genetic and genomic information, environment, life context and lifestyle of each individual. Some authors prefer the use of the second term because it would allow for a focus on the most recent forms of tailored clinical interventions. In this case, we prefer the first term because it embraces the new and the old kinds of clinical intervention based on individual characteristics, being more suitable for a longitudinal study on the entrance of this field in the public sphere.

[3] The World Bank data: https://data.worldbank.org/indicator/SH.XPD.GHED.CH.ZS. Extraction date: May 25, 2022.

[4] The old-age dependency ratio is defined as the number of individuals aged 65 and over per 100 people of working age defined as those at ages 20 to 64.

[5] The old-age dependency ratio is defined as the number of individuals aged 65 and over per 100 people of working age defined as those at ages 20 to 64.

[6] LDA is a topic modelling algorithm, that is, a machine-learning technique that aims to discover patterns of words in very large document corpora. Given a corpus as the input, a topic modelling algorithm provides as output a set of "topics", each of which is a group of related words, for example, involving the same thematic issue. Probabilistic topic models assume that each document in a corpus is generated by a set of topics, each of which is a probability distribution over the entire vocabulary (the entire set of distinct words occurring in all the documents in the corpus). See Blei et al. (2003; 2009).

[7] The approach has been developed within the Technoscientific Issues in the Public Sphere (TIPS) project and implemented in a web-platform devoted to performing media analysis for social sciences.

The web platform is described in Cammozzo et al. (2020), and the details on the machine learning techniques have been adopted in this paper, for example, text classifiers and topic modelling algorithms, are reported in Di Buccio et al. (2022).

[8] The general formula for the index is:

$$\mathrm{I}(d) \;=\; \frac{1}{|W|}\; \Sigma_{w \text{ in } W} \frac{TF(w,d)/B}{TF(w,d)/B + K}$$

where *I(d)* denotes the index value for document *d*; *W* is the set of keywords; *TF(w,d)* is the frequency of the keyword *w* in document *d*; *K* is a parameter (in our analyses, it is set to 1.2); and *B* is a document normalisation factor that includes the document length. This formula is based on one of the components of the BM25 weighting scheme (Robertson and Zaragoza 2009) for ranking documents in IR. A detailed description on how to compute the index can be found in Di Buccio et al. (2016).

[9] The "relative weight" is a probabilistic measure that corresponds to the probability of each topic of reproducing the set of words making up the entire dataset.

[10] With the terms WE medicine, Dickenson (2013) wants to distinguish two counterposed forms of medicine. The first one is more recent, it is deeply interwoven with neoliberal ideology, it is tailored on individuals, and it is generally provided by private corporation directly to the consumer (e.g., personalised medicine). The second one invokes an ethos of public health and notions of mutuality and solidarity, finding, in recent times, a strong resistance also by Western populations (e.g., vaccines).

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The Ecological Rhythm of Mastery of Non-Mastery: Disaster, Ecological Reparation and Biodiversity from Southern Italy

Enrico Milazzo
University of Padova

Corresponding author
Enrico Milazzo
University of Padova, Department of Historical and Geographic Sciences and the Ancient World
Via del Vescovado 30, 35141, Padova, Italy
✉ enrico.milazzo@phd.unipd.it

Royal College of Art, School of Architecture
Kensington Gore, South Kensington, London SW7 2EU, United Kingdom
✉ enrico.milazzo@rca.ac.uk

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Abstract

In Salento, since the bacteria *Xylella fastidiosa* outbreak in 2013, the frictions between temporalities of care and technoscience exposed the issues of the governmental state of emergency imposed since 2013. The disaster – a hecatomb of millions of olive trees – set its own temporality, dictated by the rhythm of the bacteria spreading through the environment. Drawing from ecological reparations in Salento's aftermath, and from co-evolutionary practices in Sicilian biodiversity, I will outline the features of the temporal experience and rhythms of an ecosystem, particularly those that can no longer be governed. These ethnographic insights contextualize and inquire into Mastery of the non-Mastery, a political and ethical stance colliding nature and culture: for Michael Taussig, MNM is the way to tackle climate change (2020). Wild and feral biologies in the ecosystem oppose the rationality of modern agriculture, while marginalized human-beings, forgotten plants or animals, and discarded lands stand out as *assemblages*, despite the pervasivity of market-economy and extractivism. If care, ecological reparation and coevolution retrace, just like MNM does, methods of production and reproduction of human/nature relationship outside the extractivist perspective, I question the role of technoscience to help build temporalities of care and ecological repair rather than human frames of mastery over nature.

Keywords

ecological reparation; mastery of non-mastery; Xylella fastidiosa; ecologies of care; fieldwork; Sicily and Apulia.

1. Introduction

This paper represents an attempt to position technoscience and its relationship with ecological temporalities based on two ethnographic cases, focused on agricultural, agroecological and environmental contemporary matters in the south of Italy. I try to develop a critique of the radical human control of nature and its effects, as exemplified by the established methods of management of ecological "emergencies".

I argue that a whole set of bio-security measures and practices are disturbingly familiar with those of industrial agriculture. The underlaying concepts of this critique are what Michael Taussig calls "Mastery of the non-mastery" (MNM) and in minor part, following the argumentation as a red-tread, the "matters of care" for how especially Maria Puig Bellacasa depicts it.

The main case discussed is the institutional management of bacteria *Xylella fastidiosa* and its aftermath in Salento, south of Apulia. At first, I will consider how wildlife, like insects and plants, have been under the lenses of Regione Puglia, the Italian Minister of Agriculture and European Union, and how these institutions tried to control the bacteria, starting from its ecologically-intertwined temporality. Secondly, I trace back the language of rhythmanalisis of a few agroecological farmers of Salento, framing their attempts to rebuild a healthy relationship with the soil: this relation is depicted, by their words, as a temporary and rhythmic "attunement" between the human and non-human.

I outline a literary review of the critiques toward the policies and the practices recommended or imposed by a certain technoscientific discourse in Apulia, regarding the outbreak and the eradication of bacteria *Xylella fastidiosa* since 2012 (Saponari et al. 2013). Concomitantly, a whole ecological reparations movement took place in Salento, attentive and responsive not only to the needs and the belongings aroused by the victims of the bacteria, the olive trees, but also to all the other components of the ecosystem, expecially the soil (Ciervo 2016). On one hand, I will discuss the role of technoscience in the extractivist and productivist approach of an agro-industrial entrepreneur. On the other hand, I will demonstrate how essential technoscience is to the ecological reparation of many different agroecological initiatives in Salento.

The second ethnographic case will inquire into the relationship between technoscience and agroecology, following Paola Quatrini and her team's Project Life Desert-Adapt. In Caltagirone, in the lands of farmer Michele Russo, a whole part of the farm, planted only with Indian figs, went wild. The data gathered on the explosion of biodiversity in 10 years represent the reason to think that any strategy or plan to contrast climate change have to hand over a part of control to wild and non-mastered non-human relationships.

2. Debates and Research Questions

The paper examines the impact on technoscience and knowledge production when mastery of non-mastery (Taussig 2020) and care (Puig de la Bellacasa 2017) are taken into account. The ethnographic cases are discussed under the hat of relationship between technoscience and temporalities, arguing how technoscience can be modeled to be a significant element of that ethics that Taussig calls "non-mastery" and how technoscience can participate to matters of care. Technoscience represents the main epistemological and practical device that western culture and governments rely on for the management of environment and its troubles (Edwards 2013; Hirsbrunner 2021; Pellizzoni 2015).

With temporalities I refer to:

> the human experience of time and the perception of the unfolding of changes (Fabian 2014; Bodei 2006; Puig de la Bellacasa 2015; van Aken 2020), as well as to rhythms, understood

> as the synchrony or asynchrony of multiple temporalities (Lefebvre 2004; Bonifacio and Vianello 2020; Milazzo and Colella 2021). (Milazzo and Colella 2022)

My aim is to understand whether and how human and non-human temporalities vary according to matters of care and non-compliance with control, and to seek if technoscience might be involved in the a-synchronicity I might call ecological failure and global meltdown. There is a connection that in this paper might be deemed central between non-mastery and care: interspecies care is also defined by relationships that are not over-determined and hegemonized by one of the actors. That's the measure in which care and non-mastery, inside the ecological and feminist approach, I believe should be considered in framing community technoscience.

I take "governance" as that form of policy and decision-making that is based on rules made in agreement with international actors, making environmental governance a non-exclusive prerogative of the nation state. Moreover, it should be noted that governance also refers to those structures and processes permeated by global capitalism, effectively being its own structural principles. These define environmental problems, even the evident ones, on the basis of antagonistic interests and relations of power and domination that, if on the one hand do not define the limits of growth at all, on the other hand find in the management of environmental problems new fields and terrains for capitalist accumulation (Pellizzoni et al. 2022). To this historical-materialist reading of environmental governance, one can add the critique of the practices of biogovernance, a form of biosecuritarian norms deployed primarily to protect the markets of invasive agriculture (Barker and Francis 2021).

The debate I address, is not only related with the current literature on the Xylella management, but tries to contribute to the critique that testify the advancement of the ecological thought in social disciplines, especially thanks to the recent publications of co-edited works by Dimitri Papadopoulos, Maria Puig de la Bellacasa and Natasha Myers from one side (2021), and Luigi Pellizzoni and the political ecology network on the other (2022; 2023). These situated research and approaches are here confronted with more philosophical and anthropological issues like those of Tim Ingold (2022a) and Elisabeth Povinelli (2016), whose production on ecology and science are considered a milestone in contemporary anthropology, as well as Michael Taussig (2018; 2020), who connects historical-materialism perspective with the anthropology of the body and language.

So, my research question is: how relevant is non-control to make time for other temporalities? As Povinelli notes (2016), we need a multitude of temporalities to shake the imaginary. This question raises many doubts regarding the epistemological and practical approach of technoscience, for it is often considered the indispensable ally of every governmental policy regarding the management of ecological disruption, including climate change. But what would happen if we take into account what Michael Taussig calls Mastery of non-Mastery (Taussig 2020)? That is to say, how to do and stay with things without being in control. Would that change our perception of temporalities, even making a new era of constitutively different coevolutionary and creation ties begin, to say it with Tim Ingold (2022a)? In this paper I inquire into the relationship between technoscience and non-human temporalities, and if and how technoscience will be providing means to cope with the complex and non-productive temporalities required by ecological repair (Papadopoulos et al. 2022).

A culture-of-care and an approach as that of agroecology, I will argue in the end, might be able to connect the technoscientific resources with that of minor things (Ghelfi and Papadopoulos 2021), as to let arousing scientific disciplines like microbiology and ecology re-direct narratives of climate change, contrast to desertification and policies against biodiversity erosion.

These ecostories are embedded and linked, for better or worse, with technoscience, and I argue in conclusion how we need to sought community technoscience, to reclaim alternative technoscientific practices and the right to make diverse ways of cultivating a "practicality" of life within the cycles of the land possible and not persecuted by environmental or biosecurity governance (Papadopoulos et al. 2021).

3. Methodologic Approach

The ethnographic field has been conducted since 2018 in Salento, and in Sicily since 2020. Many of the concepts and the interviews that lead to this paper have been shared and made possible by the joint work of Collettivo Epidemia[1]. The possibility of sharing knowledge and explanations with fellow researchers and friends has been particularly relevant for the field research conducted in Salento, since the discussions were based on notions of phytopathology, entomology and other disciplines that neither of us would have dealt with alone successfully.

The interviews considered here were held between 2019 and 2021 and recorded with the verbal consent of the participants. The ethnography between Sicily and Apulia involved more than 50 people, among farmers, agronomists and counts an average of two interviews for interlocutor. Anthropology of proximity constitutes the research epistemological framework, for at least two reasons. The first questions the distance between researcher and interviewed/observed. A relevant issue of the anthropology of distance are the political aspects of co-constructing the fieldwork with the interlocutors (Breda 2017; Zanotelli 2017), as an outcome of the attempt to reduce hermeneutic distance (Fabian 2014) or epistemological distance (Affergan 1991).

The second reason is whether the anthropology of proximity considers legitimate the "ethnography of the neighbour" (Gupta and Ferguson 1997) as a necessary form for the discipline to be able to deal with contemporary issues, so it is also an opportunity to reflect on the history of anthropological knowledge, tracing its political transformation starting from the inadequacy of those theories which, at the origins of the discipline, considered ethnography to be meaningful only and exclusively because it was carried out in so-called "exotic" areas and inhabited by peoples other than and distant from western culture.

All of the texts cited, whose translation from Italian to English wasn't available, were translated by the author, as well as all of the interviews cited, originally recorded in Italian or local dialects.

4. Xylella and the Spittlebug: The Political and Scientific Temporalities

The Salento peninsula is an area at the southeastern tip of Italy, where millions of olive trees have been affected by the spread of a quarantine pathogen, *Xylella fastidiosa* subsp. *Pauca* (Saponari et al. 2013). The European Union and the Italian National Research Council

(CNR) in Bari deem *Xylella fastidiosa* accountable for the Olive Quick Decline Syndrome (OQDS). Almost a year after the bacterium's detection in Salento, the regional council requested a "state of emergency", so that "extraordinary powers" could be awarded to the government. The request was supported invoking the bacteria's "great *rapidity* and effectiveness in spreading" to the trees, "thanks to the vector species Philaenus spumarius L., commonly known as 'spittlebug', an indigenous, common, polyphagous and '*ubiquitous*' entity"[2].

At the beginning of February 2015 the state of emergency was made effective for three months and renewed from there until today. *Xylella fastidiosa* was, at that point, already present in a large part of the region, and the landscape was undergoing relentless transformation: historical olive trees orchards, in some cases, quickly depleted into dead trees.

The main concern of the institutions was the hazardous impact of the bacteria on the valuable crops in Apulia and the rest of Europe. The emergency paradigm was drawing a specific future by taking into account only a designated type of temporalities. As Colella wrote: "Each epistemic culture produces differently not only the horizon within which to place what is necessary to know (Knorr-Cetina 1999), but also what becomes necessary to ignore (Böshen et al. 2006)"[3].

It can be useful to summarize the article I previously published with Colella, where we inquire into the wrongdoings of the emergency governments and the mistakes of technoscientific experts (Ciervo 2016). Specifically, we address the temporal processes triggered in the scientific official institutes by the finding of Xylella. The identification by the governmental approach of a Xylella pathosystem was based only on three elements, "diseased plant, bacterium, vector insect"; it constructs and defines the sole the temporalities taken into account. Excluding and ignoring every other form of life from the "equation", the institutions also came to refuse their first definition of the crisis, considered a complex of concomitant cause.

On their side, the movements defending the olive trees from the eradications, were challenging the actions taken by the institutions in order to frame, manage and control the emergency. Their counter-narrative was focused on the "actual rhythms" of all the different species involved in the ecosystemic depletion that was having place. The alternative researchers and scientists from local competing universities and institutes brought a greater number of other species in their observation, studying their relationship with the olive trees decline. The activists could easily visualize that at stake there was the ecosystemic future of the whole Salento's environment.

With Colella, we also addressed "the emergency as a way of managing time (Pellizzoni 2020)"[4], identifying the normative reason for this temporal "dictate" in the Council Directive 2000/29/EC[5], whose aim is to regulate the presence of quarantine pathogens on European territory.

Violent and urgent timelines have been directing the actions towards a complex system like that of a collapsing environment, simplified and reduced to the pathosystem, made of the sole relations between the olive trees, the spittlebug and the bacteria (Bandiera 2020). As the activists pointed out for years, the action plan was not to be based on the eradication of Xylella, but rather on the timeframes necessary for all life forms in the ecosystem to find a new equilibrium[6]. The main field of confrontation between the institutions/the researchers and "Il Popolo degli Ulivi"[7], were the measures prescribed to contrast the diffusion of Xylella. Among the measures, olive tree eradications were seen as policies of land's death and genetic heritage's loss (Casid 2019).

Through extensive studies on the timelines of the spittlebug's reproductive cycles, the Italian Civil Protection Department published a "control" strategy, carried on mainly by chemical means, for the entire region (Milazzo and Bandiera 2021). The understanding of the *Philaenus*'s temporality was considered *urgent to know*[8]. What stood out to my eyes, as the research went forward, was the conviction and pretense of the institution to gain control on the forms of life in the landscape, like the "sputacchina", that at some point was expected to be completely under control and defied.

This unsustainable certainty on the part of the institutions, helped to create a perception in the social and environmental movements of the imposition of an ecologically devastated future (Davies 2018). The toxicity of which would be derived from the use of chemical drugs and herbicides, which refer to:

> a future of pollution, a temporality of devastation and death (Alliegro 2012, Papadopoulos 2021, Davies 2018, Hoover 2017). The synthetic products functioned as an organizing center of temporality: in addition to considering its consequences in the territorial future, retrospectively the movements integrated pesticides and chemical herbicides into the aetiology of olive disease (Collettivo Epidemia 2019; Colella 2019; Vacirca and Milazzo 2021). (Milazzo and Colella 2022, 106)

The depressing outcome is the contemporary landscape, that has been produced not only by Xylella, but also by the attempt to force its exclusion from the ecosystem: the olive trees plantations have been either cut up or eradicated, leaving dead lands beneath. Some abandoned fields show resurgence, whereas the wild sprouts of the olive trees risk every summer to burn for the lack of care of the dried grass.

5. Soil and Climate Change: Ecological Movements Temporalities

From what depicted above, it seems that technoscience did anything to make it worse. It's not exactly like that as I will explain in the last section. Rather, what could have been done differently?

The bacteria's temporality becomes more understandable if we consider it and the temporalities at large as the outcome of interspecies' co-construction and negotiation. The *Xylella*'s complexity is, for example, that its temporality can only be understood as intertwined ecosystemically with an entity like the "sputacchina". The failure of the institutions to get ahold of this aspect left the movements of farmers and activists alone in trying to repair and attune to the non-human rhythms of complex "soil temporalities".

Activists close to an environmental conception of health connect the toxic history of Salento to the present, something that has not been considered by the official institutes of research. As Antonio, a traditional olive oil miller, explained, the present crisis is rooted in Salento's "bad past", when in recent times huge amounts of pesticides were widely used to ease the agricultural work, at the expanse of biodiversity and interactions.

As written elsewhere, Antonio exacerbated "the radical simplification" that had largely taken hold in Salento, corresponding to the spread of pesticides as a common practice in agricultural

care (Tsing et al. 2019; Vacirca and Milazzo 2021). One of the main theories circulating among the activists was the idea that Xylella had been so deadly for the olive trees because the roots were actually grasped to an already dead and sterile soil. In this perspective, the institutional guideline that imposed the use of pesticide to control the bacteria, was jeopardizing the olive trees and the whole environment's capacities to survive the crisis.

Consciousness about soils recently erupted in Salento "thanks" to the disaster (Vacirca and Milazzo 2021). The tales from the past started to circulate, about 1960's kids running after cows and horses to collect their droppings, in order to receive praise by their farming parents, later merging the precious manure to the stony land, slowly becoming an arable land.

The soil temporality is not just found in the past. On one hand, the past and the soil-memories have an active role in transforming and re-shaping the present meaning of olive trees; on the other, soil temporality also bonds humans and microbiotical life in the future. Activists and microbes are allied in building up fertility and ecosystemic equilibria. This alliance has a specific role in depicting the future-scapes of Salento, like other elements that point to the fact that soils have been taking a symbolic role in the post-crisis efforts. One of these, is the experimental practices conducted by a farmer-activist of Presicce, Roberto Polo, and micro-biologist Giusto Giovannetti (CCR)[9], among others, since 2015. Their attempt to save the olive trees focused on their microbiome. For that, it was essential to recover and establish the soil's health as the source of the ecosystemic equilibrium, rather than focusing on a single aspect, like the killing of the spittlebug or of the bacteria. In their view, a healthy soil would have provided the tree with everything needed to resist. The whole status of the tree would have changed for the better. A-specific solutions, to be maintained with the hard and slow work on/of the soils, fed for many months with the missing fungi and micro-organisms: the biodiversity of soil's microbiome, they believed, erased by decades of chemical abuses, with time would regenerate.

A similar concept and practice were developed by Cooperativa Karadrà as explained by the president Roberta Bruno:

> The average amount of living matter, organic matter, in the soil in southern Salento is 1.3%. If there had been a long-term vision, (on the part of the ruling class) the organic system would be the current system, of all, for a long time. The criterion of productivity has been followed and not that of the yield of the land over time... that is why I say: what is the point of private property, of being able to decide on lands that should be able to produce for millennia? The question arises even more, if there is no long term in the projection, you find yourself having to work on an emergency basis... [...] If you decide that a hectare of land must produce 10 for you, while a hectare of land can produce 2 for you, you are doing damage to a collective... and here we come back to the discourse on private property, another cornerstone of capitalism and patriarchy. Freedom is conceived as that of owning... but freedom is to live free of disease, to think that in 20-50-100 years that same area that served me to survive may also serve those who follow me. We work in regenerative agriculture. We go out and do reclamation. [...] It is necessary to leave margins to the fields, wild plants grow... we are experimenting, we invest annually to improve techniques, to interact with the soil with macerates and materials to improve the crop and the yield. (Aradeo, LE, 10/03/2021)

Cooperativa Karadrà's experience pushes temporality of soils and of human-soil relations to re-establish their synchronicity, outside a paradigm of productivism and extractivism. Regenerative agriculture is now a need in Salento, and there is no other option for those who, farming without chemicals, have to enrich the soils that have given everything they had.

Soil-regeneration temporality is particularly relevant for my argument for different reasons: first of all, because soil-regenerative practices are the extreme opposite of agro-industry. Specifically, agroecological practices with soil are entrusting control to non-human entities, unlike agro-industry, whose main activity has been, for decades, to wipe out life from soils and put the minerals and molecules back in with a wholly human-led process.

An ethnographic example comes from Gioele, farmer and son-in-law of Roberto Polo, also based in Cape Leuca. His ultimate form of militancy for the soils responds to the urge to chip the trunks of dry olive trees and leaving it on the ground. This is the only way all of the secular energy embedded in the trunks might be given back to the soil, for they might be burnt or worst (Lyons 2020)[10]. Gioele's practice is another example of how to be in the network of the living, where "making time" for the soils means building relationships of care, activating multispecies reciprocities between humans, olive trees, insects, soil's microbes. The temporality that is built by all these interdependent forms of life, is one that is negotiated and composed by complex and always renewed relationships (Lefebvre 2004; Puig de la Bellacasa 2015). The meaning of Salento's ecological crisis is embedded in the reciprocity of practices of care, which nonetheless are not the outcome of human-led processes. Even if putting the olive trees organic matter back in the soils is a human choice made by Gioele, it operates in the absolute dependence of the work of an unknown number of microscopic entities, benefitting the biodiversity in its complexity.

I think it's particularly meaningful that care and attention to soil's temporality are not only able to address and even counter the effect of the Xylella pathogen, and the related eco-systemic disruption, but also the challenges imposed by global warming. It's not even essential to consider the proliferation of *Xylella fastidiosa* as an aspect of climate change – something I'd strongly suggest. What is going on in Salento indicates that Bellacasa's claim "the time to care for and better for soils is now" (Puig de la Bellacasa 2017), is valid to counteract the olive trees depletion and against climate change.

This statement by Maria Puig de la Bellacasa shows how important the *temporality* of the bacteria *Xylella fastidiosa* is: to disclose the role of soils and unveil the whole ecosystemic course whilst positioning in the present time of plural environmental crisis. Its solution could not be nothing else than more-than-human, which does not mean exclusively non-human, as humans are still one of the most important part of the "equation".

In order to be clear: what could have been done differently is on a completely different timescape. So, what is the point of criticizing technoscience? We should not be forced to take side between caring relationships and technoscience (Puig de la Bellacasa 2017; Ghelfi 2015; Papadopoulos 2018). We have to upstand outside temporal paradigms as the "emergency" when we are trying to cope with climate change and environmental problems, because we need epistemic strategies and experimental research trying to compose assemblages, both in knowledge production and ecosystemic production (Henning 2015; Randazzo and Richter 2021).

The importance of taking time for assemblage and research is a need very well reclaimed by organic farming, as Roberta Bruno says:

> You are investing today and in six months you may have the result. Even in experimentation and research you have the problem of time. We are in transition. We should have the honesty to say that we are not able to be productive today, we need to be approached by the world of scientific research in the broadest sense, which arrives at new equipment, at new patents, but which also arrives at agricultural preparations, at macerates, in order to be able to totally replace agro-industry. That is why the worry on our side has always been research. Where the fuck is it? I don't want to react badly when they come to me and propose the possible economic correspondence between investment in biodiversity and production. (Aradeo, LE, 24/02/2021)

Roberta Bruno is claiming the need and in some ways the right to access research and technoscientific counseling: "minor things", just like the microorganisms of the soils and marginalized biodiversity, would finally see their potential to outsmart agroindustry fulfilled from the additional knowledge provided by technoscientific expertise.

6. Coevolution and the Ecosystemic Rhythms: Temporalities of Minor Things

One of the most interesting aspects of the temporalities of the minor things, as soils, biodiversity, or the wild plants, is how unseen and unreplaceable is the work they do. We also should consider that they take not more or less time, but just time, like the search for the "salvation olive tree" shows.

When the local varieties of olive trees started to deplete, the Ministry and the local entrepreneurs, started to worry. G. M. is the most important oil-miller and olive oil producer of Capo Leuca, and president of the consortium Terra d'Otranto DOP, whose aim is to publicize the local olive oil production. G. M. considered the risk of losing the two historical *cultivars*, Cellina di Nardò and Ogliarola Salentina. Salento's olive trees plantations could not compete with other larger-scale economies, so the local entrepreneurs really had to rely on story-telling and distinctiveness through genetic historical heritage, in order to have a semblance of olive-economy.

Yet, because or with Xylella, even the "Giant of Alliste", an eight centuries old olive tree begins to die. The best solution, for G. M., was "to find another cultivar and autochthonous: imagine all the narrative you can build around this cultivar born in Salento!". The only and poor solution the Regione came up with was to re-plant varieties or hybrids with no historical nor narrative value, like Leccino or FS-17[11].

G. M. is a different entrepreneur than Bruno from Cooperativa Karadrà. He does not really believe in the urgence of organic farming or regenerative agriculture, as compared to conventional farming. He is the kind of agronomist that cut the ties with wild and spontaneous plants in the fields, in order to rationalize the farming techniques and maximize the production. Yet, when the Xylella crisis destroyed his fields, he had to turn his gaze to the wilderness: that's also where "mastery of non-mastery" gets into the story.

G. M. was looking, like many others, for the "green olive tree in the desert". This olive tree had to be the outcome of a spontaneous crossbreed, enabled by the wild relationship between

domesticated and wild olive trees, insects, birds. It also had to have certain characteristics to be interesting, like being very productive, not vulnerable by Xylella or other pathogens, possibly not requiring too much water and not taking too many years to start producing.

G. M. mobilized the technoscientific entourage of CNR and Regione Puglia with two projects: Xylor and ResiXo[12]. Both projects aimed to receive photographic reports from citizens of green and productive olive trees, and to collect genetic material of the plants, to be PCR-analyzed. The most important information for G. M. was the genomic code: to become the "olive tree of salvation", the plant had to be a completely new variety, registered by no other patent of no other territory in the world.

> So what is the idea? A scientific fact, for sure, because it would be the first time that without genetic improvement and with random recombination a plant resistant to the bacterium is born. That is, with natural genetic improvement, it is in itself the first time that a genotype resistant to the Xylella bacterium is found and productive, and it would be a unicum. A scientific fact is also the fact that if I have to make crosses as I am doing, and this independently [not with the CNR], between two cultivars for example Leccino and Favolosa, two resistant cultivars, the hope is to obtain a super resistant one with better characteristics as drupes and oil than the two parental ones. This path can take 20 years. Instead, you search for the seedling in the countryside, in the escarpments, in all the uncultivated or abandoned land, there are these shrubs that produce, but they are already 15 years old. So, at 15 years old... (Gagliano del Capo, LE, 02/03/2021)

So, there is an aspect of temporality and technoscience that the action of wild crossbreeding solved by ecosystemic spontaneous services:

> The wild olive is still born from seed, but it is the child of a pollination between wild and a cultivar, or between wild. So you have the possibility from a scientific point of view to shorten that time needed for genetic improvement by mass selection. Nature took care of that over the years when we weren't interested, so I'm going to see the fruit of that work of nature today. (Gagliano del Capo, LE, 02/03/2021)

G. M., thanks to something humans oversee, managed to cut the time to find the new autochthonous olive tree born in Salento: somebody found, in the only place where it could have been found, the olive tree of salvation. On the side of a road, between Presicce and the sea, *where it would not bother*, a wild olive tree has spontaneously grown, to become today the new autochthonous variety of Salento, to be reproduced and spread around.

Is it the kairological event that gives birth to a new co-evolutionary history between olive trees and Salento's people?

Tim Ingold refers in his last book to the Greek word "kairos: the moment that must be seized in any process of skilled work, when 'human action meets a natural process developing according to its own rhythm'" (Ingold 2022, 119). He dwells around the fact that any human, so to say our G. M., to acquire "fine judgement: of pitch, velocity and direction", has to make certain assumptions and calculations, "calculated as time to target" (*ibid.*, 282):

> [...] all business is conducted in the plane of the present. It is a world ruled by the computational logic of the algorithm, which sets out a step-by-step programme for problem solving. [...] Maker and materials, going along together, arrive at a solution that emerges only in and through their collaboration. Here, attention and response take precedence over computation and execution. (*ibid.*, 282-283)

Attention and response, conducted in the plane of the present, represent the capacity to grasp at once "pitch, velocity and direction". This mode of "attunement" resembles what Henry Lefebrve defines as eurythmia:

> He hears the wind, the rain, storms; but if he considers a stone, a wall, a trunk, he understands their slowness, their interminable rhythm. This object is not inert; time is not set aside for the subject. It is only slow in relation to our time, to our body, the measure of rhythms. An apparently immobile object, the forest, moves in multiple ways: the combined movements of the soil, the earth, the sun. Or the movements of the molecules and atoms that compose it (the object, the forest). (Lefebrve 2004, 20)

In my interpretation, when a human is capable of attuning with the surrounding entities and materials in this way, in such moments the foundation of a new coevolutionary tie can happen, like a new historical alliance between a variety of olive tree, a territory, and a people. Does this mean anything similar for G. M.? Did he experience rythmanalysis or a shared direction, according to the networked connection of the surrounding environment? Does he "question his very modern understanding of speed, and of complexity", in order to experience time as "perceived not chronologically but kairologically: it lies, that is, not in the succession of events but in the attunement of attention and response to rhythmic relations" (Ingold 2015, 89)? The fact that G. M. is buying a patent over this spontaneous olive tree raises many doubts.

Spontaneous biodiversity showed how rational temporality can be outsmarted by wild relations, and how they are unconceivably precious. Nonetheless now it risks being re-comprehended, following G. M.'s plans, to reconstruct a temporality of single-crop monoculture and productivist rhythms.Yet, one might ask why would any technoscience discourse have to deal with rhythms and the perception of the environment. Rythmanalysis is actually a "skilled revelation of skilled concealment" (Taussig 2020), capable of forecasting by means of preventing. It works on the long run, on different plans of temporalities, and we have yet to recall that events that destroy what we believe durable and given, just like millennial olive trees, actually happen. With the global meltdown we are called for re-negotiating coevolutionary ties with the etero-specific, as much as we are called to re-build new relations continuously.

Is rythmanalysis a practice capable of paying attention to those minor things that are so dear to the ethic stance Taussig called Mastery of non-Mastery? That is, what capital and modern agrarian culture have discarded and marginalized in order to dominate the relationship between humans and nature. The lesser things, such as those techniques and forms of life put aside by capitalist productivism, were not interesting because with the mastery of modern techniques and the aid of chemistry applied to agriculture, their observation had in fact lost its importance.

Rythmanalysis and MNM are both *crafts* of minor things. During my ethnography in Cape Leuca, I saw an intonation and an attunement happen between humans and the surrounding entities by means of photography and painting. An ecosystemic moment was captured similarly by Jànos Chialà[13] (Figure 1), at the end of August 2020. Yet, the flaming olive tree recalls the same anthropomorphized form of the olive tree that Marco "Terraiolo" used in his artistic composition five years earlier, when the epidemic was only at its begins (Figure 2).

Rythmanalysis here merges the perception of the disaster of the environment with its harsh materialization. The fire is the result of an inexorable and generalized desiccation, witness to the overwhelming impoverishment of ecosystem conditions (Collettivo Epidemia 2020) of ecology.

The painting and the picture both reveal a crucified olive tree, an Olive-Christ with red blood bleeding: the present and the future are united by the painter's gestures. It is a domain of language, MNM, that alone allowed Marco to foresee the image of the present time and to embody it, through the aesthetic and artistic perception of the present, past and future temporalities of ecology. Taussig would argue that the painter's gestures are somehow a kind of "skilled revelation of the skilled concealment". Is he, thanks to his hands and art as Lefevbre suggests, transforming beforehand "everything into presences, including the present, grasped and perceived as such; integrating these things – [...] these trees – in a dramatic becoming, in an ensemble full of meaning, transforming them no longer into diverse things, but into presences" (Lefebvre 2004, 23)?

We don't observe here a mere overlapping between the picture and the painting, but, instead, we recognize the movement gathered in a simultaneous perception of all the temporal difference that has occurred over these five years, and of the realization of a destiny that was already perceived and foreseeable as inexorable (Lefebvre 2004; Bonifacio and Vianello 2020).

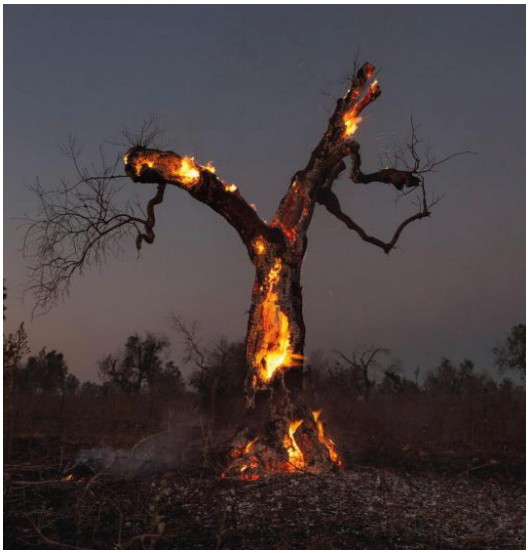

Figure 1.
Janòs Chialà ©, 2021.

Figure 2.
La crocifissione degli ulivi, Terraiolo, 2015.

Sometimes loose coevolutionary ties are still so meaningful that they leave traces on our culture. In Salento, agroecological farmers asked themselves at what stage our civilization is in its relationship with olive trees. The millenary relationship is knowing, especially in Salento, a deep transformation. Symbolically, the grafting of the olive tree with the branches of the "olivastro" (the wild olive tree found on the side of the road), recalls the kairological moment that Saint Paul, the most important Christian Saint in Salento, describes as the moment everything changes. In the letters to the Romans, Saint Paul attributes to the grafting of the wild olive tree the meaning of a new history for the people of God. Christ is, no less, embodied in the wild olive tree of salvation, grafted with a kairological gesture into the love of God (Lettieri, *forthcoming*). This grafting seizes the moment[14] and simultaneously attunes history on new temporalities, that of the catastrophic expectation of the apocalypse and the messianic return of Christ.

This gesture also severs the history and the time of Israel from that of Christianity. Yet, what is most meaningful of the Olive-Christ, is the election of the minor: the grafting of the wild olive tree is actually no more than the rejection of "the powerful, of the elected, of the noble, and as such the acceptance into the love of god of the ignorant, the marginalized, the pagans, the weak". Already once, a new salvation coming from the wild, as Saint Paul says, founded a new epoch.

7. Mastery of Non-Mastery and the Wilding

At the antipodes of G. M.'s actions and position, there are Cosimo Terlizzi's fields in the countryside of Carovigno, in northern Salento. There, inter-species care relationship and the decentralization of the human from the ecosystem become the driving force behind the criticism of the agricultural-social history Salento.

Filmmaker-artist Cosimo Terlizzi set up an atelier in the middle of an olive grove. Combining agronomic, artistic and relational practices, in the Lamia Santolina, the ecosystemic complexity is accompanied and increased. Cosimo, coherent with Roberto Polo's microorganic approach on soils, enhances the biodiversity under the olive trees to refrain the attacks from the spittlebug. He started to take care of the life forms in his olive grove, inviting more than 400 species to join and relocating to the centre of his field, including around 200 officinal Mediterranean shrubs that had been forced onto the roadside. "I got the plants either from the roadside or from markets. There is this gentleman who sells frayed, ugly plants, they are the best there is". He put what was marginalized back to the center.

Sympathy and compliance with the "wild" do not come with a drastic refusal of technoscience. Cosimo, as Roberto, decided to avoid the chemicals prescribed by ministerial regulations to destroy the vegetation on which the spittlebug reproduces. Yet, both of them entrusted and experimented the trials coming from microbiological research. They had to cope with microbiology's "inefficency", compared to the official science's mastery of nature.

Wilderness, micro-organisms and sensoriality seem to share the same marginalized position in the productivist system of value: they are *ignored things.* Puig de la Bellacasa argues that the *ignored things* are the most important and care-taking forces of reproduction of life[15] (Puig de

la Bellacasa 2017). Biodiversity and soils, are not "in the horizon within which to place what is necessary to know (Knorr-Cetina 1999), but also what becomes necessary to ignore (Böshen et al. 2006)" (Milazzo and Colella 2022).

One should certainly not make the mistake the spread of biodiversity and soil-fertility as simple natural processes, they are anything but easy. Probably that's why interspecies relations write their own philosophy of evolution outside extractivism and determine healthier environments as wholes. As neglected, they embody today the ethics of the Mastery of non-mastery. Just as industrialization and agro-industry, the plan of actions developed against Xylella by the University of Bari and other research institutes had the worst impact to the unseen plants and insect "outlaws".

Minor things are what constitute the base of the Mastery of non-mastery, and the unseen is often called upon by Michael Taussig to depict it, just like in Emily Dickinson's poem:

> It was a common night,
> Except the dying; this to us
> Made nature different
> We noticed smallest things,
> —Things overlooked before[16]

Moving to Sicily and to another case of technoscientific approach to agroecology, Paola Quatrini was thinking about "things overlooked before" when she proposed with other colleagues the Desert-Adapt project. I met Paola with Tommaso La Mantia and Raphael Bueno in the fields in Caltagirone[17]. They were monitoring an hectar that was let wild. As Paola herself describes the project:

> The Life Desert-Adapt has as main objective to experiment with land management that somehow reverse trends like desertification, especially in southern Europe. [...] The project is tested in ten farms partners. These are farms that tell us their problems, their limitations, their difficulties. This project brings farmers together, puts together technical researchers so this adaptation model is really a farm planning, shared between landowning farmers who experience on their own skin, on their land. The project includes 19 partners, part of which are technical research and development and parts are companies, farms and municipalities. (Building BRIDGES, *Suoli, clima, biodiversità: Come adattarsi alla complessità naturale, culturale, scientifica?*, 8/06/2022)

In this socio-technical environment, they decided substantially to experiment on Michele Russo's land. "Anything that diversifies a cultivated environment results in better ecosystem stability" says Tommaso La Mantia to deepen on the methods they embrace:

> Let's start at the end: all the different ways of declining agriculture as an alternative to industrial agriculture are nothing more than a way of trying to reduce as much as possible the distance between the natural and cultivated-man-made environment. [...] all things that are in antithesis with conventional agriculture, that what operates is basically a process of simplification

> of the ecosystem, to the point of reducing the relationship simply between soil and culture, where the soil is seen as a substrate, more or less inert, that you just have to provide it with resources that then have to be transferred to the plant. And everything is a simplification process. I always say when the farmer does careful farming, he must be an educated farmer who must necessarily interact a lot with the ecosystem, he must know the plants, the diseases, the balances, he must know when it is necessary to intervene, always aiming to intervene as little as possible. And when it is not necessary to intervene. On the other hand, the farmer who applies industrial agriculture is a farmer who often does things absolutely on a calendar, and this was a normal agricultural practice until my agronomic training, even. The practice of calendar treatments was the norm. But he is also a farmer who also has to contend with increasingly important technological facts. (Palermo, 14/03/2022)

In the experimental fields they measured the impact and the results of the "alternative" way of farming.

> If we have to measure, we must necessarily refer to quantitative parameters. We must be able to measure these ecosystem services with certain parameters, and give rewards according to the achievement of certain ecosystem services. How many pairs of birds are there in a hectare of maize? Zero with chemistry. So, chemically cultivated apple trees zero birds. Now cultivated with an integrated fruit-growing system with nest boxes, there are 10 pairs of birds, it is an achieved value. Then there's the problem that the "torcicolli" go and block the irrigation pipes, and so what? We'll have to find a solution and live with it, because it's not really simple, we have now increased biodiversity in our countryside because there are pigeons... parrots, except that parrots are aliens, but then you have to cover everything because the pigeons eat the vegetables. So, this aspect here is also a "romantic" view, birds have increased, yes it is a parameter, I am happy, I am an ornithologist, but what is the reflection on agriculture, they often cause or are problems. So yes I have to increase, but then I have to find solutions to live with them, and in this sense alternative agriculture to conventional agriculture must continually come to terms with new problems and solve them, find ways to live with them. (Palermo, 14/03/2022)

The measuring of ecosystemic services happens in order to verify and certify who and where something is going toward a richer ecosystemic equilibrium, even in an economically productive environment. Because, concludes La Mantia: "Yes, we have to have methods, how to say objective, I use this term in inverted commas, scientifically, to be able to say that one agricultural system is better than another".

Yet, on the fields of Michele Russo, there was something else that got the attention of the scientific entourage. It is the abandonment of a 30 years old Indian Figs conventional crop, for a period of time that can't be earlier than 15 years, as memory and the spontaneous plants tell to Michele. The aim of the observation of the abandoned crop is briefly described by the farmer himself, Michele Russo, speaking in the forest fluorescent of incredible diversity of plants, smells and colors:

> It was a conventional Indian fig orchard, the plants are 32-years-old, the land was perpetually tilled.The abandonment allowed me to observe what the renaturalisation process of a Indian fig grove is. The Indian fig behave as a primary succession plant, I was able to observe the other plants what spaces they manage to find, so it was my main observation point. What was happening here, we replicated on the other side. Clearly, always bearing in mind production, because on this side it is almost zero, or at least the figs are complicated to pick. But there are other things, asparagus, mushrooms, here there was a sea of "gambesecche", meadows looked white. What I invite you to observe is the speed with which the maquis plants, trees and shrubs are growing in a Indian figs orchard. In an orange grove abandoned after 10 years does not give the same results. The Indian fig for a whole series of concauses, which we will summarise as the Indian-fig-effect, allows the plants to do well when they are small, and the birds come to sow and they are protected in a suitable microclimate and grow quickly. This oak tree that you are touching I don't think is more than 8 years old. Because when we abandoned it there was nothing. I should show you the pictures because you can't believe it. (Caltagirone, CA, 02/04/2022)

Wilderness showed a pattern to follow to contrast desertification with the most efficient natural method, "with the aim to increasingly reduce every kind of input". This means to let the forces of nature do what they do, with their time, which is the re-naturalization of an environment and the building of a more diversified ecosystemic equilibrium, observing from a lateral position. Also here, a new variety of peach is born thanks to wild crossbreeding, showing to be more resistant to many illnesses of this crop.

One of the most interesting aspects is that this wasn't even the specific aim of the project. Yet, being close to the wild processes showed a new way of proceeding against desertification, whereas until now thousands of trees have been planted without care just to die in desertifying land. Now to see that the naturalization coming after a fig orchard is abandoned is so rich and spontaneous, gives direction until now unexplored by technoscience or governments, something that they will not oversee from now on, since it's being measured and tested.

I introduced to professor La Mantia the concept of mastery of non-mastery by Michael Taussig: "You say we are the controllers, because otherwise it's a forest. But there's mastery and one side and on the other side there's non-mastery. Isn't there the capacity for mastery of non-mastery? Is there the capacity to be in a relationship of non-mastery with something and also be OK with it?"

> T.: "Yes, but that's what in this really organic or sustainable farming actually happens, we don't have total control of all the biological parameters, but it's not completely like that. When we talk about a cultivated field, we are talking about a field in which we decide everything that happens in there. We can be aware that we want what happens in that field to be as close as possible to what happens in a natural environment, but we are the controllers. Yet, I don't control the biological *tiny* parameters, insects, parasitoids, I don't control them I leave them that is to say to free evolution knowing that in the end *free evolution* is an advantage for me. (Palermo, 14/03/2022)

Technoscience and agroecology in this project merge together against desertification with the unexpected help of un-controlled wild relationships. Michele Russo intervened against the Ailanto, an alien-invasive species. But at some point, he didn't cut them anymore, because the invasiveness was self-controlled in favor of wider forms of life. Minor things, as La Mantia and Emily Dickinson put it, are for Taussig the place for Mastery of non-Mastery. Proximity, as well and a somatic attention to the ecosystem wellness and balance, have been fundamental in producing a new path in scientific research and farming practices against environmental depletion.

8. Conclusion

Temporality for agriculture is at the same time about "patience" and "hurry", when is time to harvest and the weather is uncertain (Teti 2018). The same has to be valid for technoscience in order to help in:

> our journey through the death-space of planetary demise. It makes not for an absence but for a new sense of connectedness, not just new connections but a new quality of connectedness [...]. Confronted by the specter of planetary meltdown, I am aware not just of a connection but of a sense of connection attentive to "things overlooked" as a step toward MNM (essential, I assume, to helping us out of the present pickle).

Do the "olive tree of salvation" born from misery and misjudgment, on the side of the road, or even the new variety of peaches and the wild oaks, mushrooms, olives and blackberry that now inhabit a previously abandoned land, account for:

> the making of mythologies or rather meta-mythologies or post-mythologies bound to Walter Benjamin's idea of "reactivation of mythic force," as when he writes, "Capitalism was a natural phenomenon with which a new dream-filled sleep came over Europe, and through it a reactivation of mythic force." (Taussig 2020, 56-57)?

More than human temporalities call for different co-evolutionary ties: time and new sense of connectedness, for Michael Taussig, resonate with mythic force, that of "Benjamin's idea of 'the dialectical image' charged with 'the time of the now', where past and present coalesce with the rise and the fall of the sun" (Taussig 2020, 57).

Is this ethnographic parade anything more than my endorsement to what Maria Puig de la Bellacasa unravels for technoscience and care? Relationships of mutual care between soil, humans and any living species, might become a viable alternative of reformulation of technoscience. We need to be capable to move away from a productivist perspective, "from tensions in soil science around the imperative of progress to conceptions of soil as living, and to related practices of engagement with soil as a food web of which humans are part" (Puig de la Bellacasa 2017, 205).

To live with the body in climate change, to live the proximity with non-human forms of life, to look and even search for ignored things is to enhance connectedness that produce more-than-human temporalities and more-than-human knowledge.

Notes

[1] Collettivo Epidemia was founded in 2018 precisely with the people sharing an ethnographic field or journalist investigation in Salento in that period. After that spontaneous experience of research together, we became a larger group with diversified interests, but a common editorial project and research approach.

[2] Regione Puglia, deliberazione della Giunta Regionale n. 1842 del 5 settembre 2014, "Richiesta dichiarazione stato di emergenza fitosanitaria e conseguente emanazione di specifiche norme per la eradicazione e il contenimento delle infezioni di *Xylella fastidiosa* e adempimenti conseguenti".

[3] Cfr.: Milazzo and Colella (2022).

[4] *ibid*.

[5] 2000/29/EC is available at this link: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32002L0089.

[6] Cfr.: Milazzo and Colella (2022):

> With the subsequent declaration of a state of emergency in 2015, a rearticulation of temporalities between technoscience and decision-making of crucial importance takes place. The time of political decision-making runs much faster than the time required to reach a techno-scientific consensus (Collins and Evans 2002; 2010). The "pragmatics" of political action strategically decides to ignore some aspects to the detriment of others (Mcgoey 2012). In this case, it decides to focus on the triad consisting of pathogen, vector and host, leaving out the other multi-species relationships, secondary to what was urgent to know at the time. Research on the *Xylella fastidiosa* bacterium in Europe is placed within such emergency frames.

[7] The authors refer to an organisation of activists called "Il Popolo degli Ulivi". It is a movement that has brought together different associative realities from civic and political activism and environmentalism. A galaxy of movements that with some of the exponents of research discussed their vision of the pathology (Colella et al. 2019). The Olive Tree People was officially born on 29 April 2015. They don't exhaust the scenario of protesters against the phytosanitary measures, but represent a significative case.

[8] The knowledge around the reproductive cycles of the spittlebug was also necessary in order to "optimise" the use of pesticides.

[9] Centro Culture Sperimentali di Aosta.

[10] Unscrupulous and concealed companies grab thousands of olive trees, take them to burn in biomass power plants, leaving nothing but empty holes on the lands. Gioele travels all along south Salento to chip the olive trees and regenerate the land, hoping to arrive before fire or power plants' emissaries.

[11] "We will lose that added value as a cultivar because prices will drop. If I don't have the narrative, I won't be able to get that price, that price differential compared to a Spanish production – because I don't have the territory to compete!". (Gagliano del Capo, LE, 02/03/2021)

[12] http://www.infoxylella.it/xylor/.

[13] The full reportage, "The Ghosts of the Landscape", is available here: http://www.postphotography.eu/portfolio/photos/the-ghosts-of-the-landscape/.

[14] Exactly in the bodily sense Ingold means it: *kairos*, referring not only to the moment that must be seized but also to the attention and responsiveness necessary to be able to do so. It is a gesture that is foundational of genetic inheritance, and yet it is nothing less than a technique of the body (Mauss).

[15] Aesthetically, also the rythmanalytic present body of the Olive-Christ recalls the figure of the outlaw, the marginalized who has nothing to give.

[16] Dickinson, Emily (1996) *The Last Night That She Lived*, in "The Selected Poems of Emily Dickinson", New York, Modern Library, p. 207.

[17] They are professors and researchers in microbiology and agroecology at University of Palermo. The fields were Michele Russo's, one of the farmers participating to the Desert-Adapt project.

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Writing Choreographies: (STS) Knowledge Production in Post-digital Academia

Andrea Schikowitz
University of Vienna

Esther Dessewffy
University of Vienna

Sarah R. Davies
University of Vienna

Bao-Chau Pham
University of Vienna

Kathleen Gregory
Leiden University

Elaine Goldberg
University of Vienna

Ariadne Avkıran
University of Vienna

Fredy Mora Gámez
University of Vienna

Corresponding author
Andrea Schikowitz
University of Vienna, Department of Science and Technology Studies
Universitätsstraße 7/Stiege II/6.
Stock (NIG) 1010 Wien, Austria
✉ andrea.schikowitz@univie.ac.at

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Abstract

In this paper we develop the notion of "writing choreographies" and explore the epistemic practices and politics of STS writing by drawing on a collective autoethnography of academic work. In particular, we analyse post-digital writing practices, where these are understood as distributed across different devices, tools, bodies, and spaces under conditions in which distinctions between "digital" and "non-digital" formats, practices, and objects are no longer clear. As in the choreography of a dance, writing choreographies emerge from dynamic movements across space and time, follow rhythms and patterns, and are shaped by aesthetic considerations. We argue that writing is choreographed through the artful arrangement and navigation of "seams" between different materialities of writing, and through configuring and "atmosphering" writing spaces. We explore how agency within writing emerges from aesthetic choices and practices, and how STS researchers are "made and done" within their research. As such, writing choreographies speak to the ways in which writers encounter and negotiate current academic structures and dynamics, such as acceleration and increasing pressure to produce concrete "outputs" such as articles.

Keywords

writing; choreography; epistemic practices; post-digital; aesthetics; materialities.

1. Introduction

STS has, from its earliest years, emphasised the crucial role of writing "as a process and a product" (Michael 2021, 139) of scientific knowledge production (Shapin 2010; Latour and Woolgar 1986; Callon et al. 1986). Interest has also extended beyond the scientific laboratory to attend to social science writing (Garforth 2012; Hoffmann and Wittman 2013; Jensen

2021), and to our own writing practices in STS (Lippert and Mewes 2021; Michael 2021; Downey and Zuiderent-Jerak 2017). Departing from the insight that writing is performative of the realities it describes (Latour and Woolgar 1986; Law 2004), as well as of the research cultures in which it is embedded (Knorr-Cetina 1999; Michael 2021), in this paper we develop the concept of "writing choreographies" and explore the epistemic practices and politics of STS writing by drawing on a collective autoethnography of academic work.

Two central questions animate our discussion. First, we are interested in how writing as a material-semiotic practice is distributed across different devices, (digital) tools, bodies, and spaces. Second, we are concerned with the epistemic, ontological, and political dimensions of such distributed practices. Our interest is thus in how heterogeneous elements are managed and coordinated to produce knowledge in its written form – the "writing" that academics speak about, agonise over, make jokes about, and feel that they should be doing more of (Davies 2021). In analysing distributed writing practices, we develop the notion of "writing choreographies" (building on Cussins/Thompson 1998; 2005). As in the choreography of a dance, writing choreographies consist of movements across space and time following rhythms and patterns that are shaped by aesthetic considerations, and that are planned in advance *and* emerge in the situation. In this sense, our central argument is that writing as an epistemic and ontological practice is carried out by aligning heterogeneous elements in dynamic ways.

One crucial dynamic that shapes contemporary academic writing and agency is that any writing will now be carried out under "post-digital" conditions, by which we mean that distinctions between "digital" and "non-digital" formats, practices, and objects are no longer clear (Jandrić et al. 2018; Taffel 2016). Digital tools and practices cannot be separated from other elements of writing, such as the material devices or particular forms of embodiment needed to use digital tools (Albero-Posac and José Luzón 2021; Tusting et al. 2019). We therefore view scholarly writing as necessarily carried out across diverse devices and equipment, technical infrastructures and their maintenance, forms of embodiment and movement, power and internet supplies, specific arrangements of sites and places, institutional and social conventions, and many other such elements (Waight 2022; Sciannamblo 2019). Relatedly, the boundaries between individual and collaborative writing are increasingly blurred, as commenting and editing text can be done by multiple users simultaneously. Recent technological developments – and in particular generative AI – are also constituting writing in new ways, though these developments are beyond the scope of this article.

Our analysis is sensitised by STS discussions of current academic structures and dynamics, including acceleration and increasing pressure to produce concrete "outputs" such as articles (Ylijoki and Mäntylä 2003; Fochler and De Rijcke 2017; Sigl et al. 2020). With such debates in mind, we trace how agency is constituted and distributed in and through STS writing.

The article thus makes a number of contributions to STS thinking. As well as adding to literature that has examined writing as an epistemic and ontological practice, we build on and develop the notion of choreography (Cussins/Thompson 1998; 2005; Law 2003), using it as a key conceptual device to make sense of how diverse elements are coordinated in writing practices, and highlighting its aesthetic dimensions. We also respond to recent calls to apply the analytical sensibilities of STS to its own epistemic practices (Kuznetsov 2019; Lippert and Mewes 2021), using a group autoethnography to explore writing as a practice that is central to STS knowledge production.

In what follows we discuss literature on scholarly writing from STS and beyond, before describing the study on which we are drawing and our central arguments: that writing is choreographed through the artful arrangement and navigation of "seams" between different material forms of writing and through configuring and "atmosphering" writing spaces, and that writing choreographies as aesthetic ordering constitute agency. In closing we reflect the significance of these findings.

Before we start this more substantive discussion, however, it is worth noting the ironies and tensions of writing about writing. Like the writing that we report and reflect on in our autoethnographic material, this text has gone through multiple iterations and forms. The knowledge claims within it have been transformed over time and as different members of the authorship team have worked on it in its different materialisations (as notes on a flipchart in a meeting, as Word documents stored on individual computers, as Google Docs worked on collaboratively, as paper printouts with handwritten notes on, or as Powerpoint presentations for conference talks). Similarly, the text has taken shape according to (implicit) disciplinary conventions around story, significance, and clarity. While such conventions are not the focus of our analysis – as we discuss below, our attention is primarily on writing as an embodied, material practice – in this regard we want to flag, and acknowledge, our participation in reproducing a particular set of genre norms that themselves co-constitute how and what we can know (Kaltenbrunner et al. 2022).

2. Writing and Knowing in STS and Writing Studies

Writing has always been of interest to STS and its predecessors. While pre-Kuhnian sociology of science focused on the structural conditions of publication processes and the role of publications in the distribution of merit (Merton 1968), historical accounts detailed the development of genres of academic writing and the "literary technologies" (Hoffmann 2013; Shapin and Schaffer 1985) that constitute researcher subjectivities, peer communities, and knowledge claims (Bazerman 1988). Later work explored the material-semiotic practices of producing and distributing text, and how this is involved in the construction of facts: Latour and Woolgar (1986), for instance, framed "literary inscription" as a chain of translations that led from a substance and its manipulation in the laboratory to written texts that circulate in and beyond it, and that constitute the primary outcome of knowledge production (see also Latour 1999). Latour and Woolgar observed how scientists – portrayed as "compulsive and almost manic writers" (1986, 48) – juxtapose, converge, and transform different kinds of text, which then become the actual subject of their efforts. Laboratory studies thus framed writing as implicated in heterogeneous material practices within the lab and writing as performative of the realities it describes (Callon et al. 1986). In the laboratory, "[r]ealities are produced along with the statements that report them" (Law 2004, 38).

More recent research has left the laboratory to, for example, examine the writing of grant proposals (Philipps and Weißenborn 2019) or patents (Myers 1995), the role of text as device in economic experiments (Asdal and Cointe 2022), writing practices in social science methods such as ethnography (Greiffenhagen et al. 2011; Garforth 2012; Jensen 2021; Kilby and

Gilloch 2022; Schindler and Schäfer 2021), and our own writing practices in STS (Michael 2021; Downey and Zuiderent-Jerak 2017; Lippert and Mewes 2021). There is also increasing interest in how writing relates to the politics of the academy, for instance by exploring publication dynamics and how these affect knowledge practices and epistemic cultures (Kaltenbrunner at al. 2022), writing in the context of changing time regimes (Ylijoki and Mäntylä 2003), the role of indicators (Fochler and De Rijcke 2017; Sigl et al. 2020), misconduct (Andersen and Wray 2019), citation practice (Sokolov 2022; Rekdal 2014; Erikson and Erlandson 2014), or peer review (Myers 1985). One striking feature of this body of work is that, while it addresses the effects of changing conditions and dynamics of writing, it engages much less with writing as material practice.

In contrast, the nascent field of writing studies has put the materialities of writing centre stage (Guillén-Galve and Bocanegra-Valle 2021; Prior and Shipka 2003; Johannessen and Van Leuween 2018). Such research addresses the material techniques and digital tools involved in writing (Hynninen 2018; Kuteeva and Mauranen 2018; Tusting et al. 2019; Haas 1996), as well as writing spaces (Dobele and Veer 2019; Prior and Shipka 2003; Tusting et al. 2019; Waight 2022; Powell 2014). Studies mostly focus on students' writing practices, with the aim of finding ways to enable them to write "better", in the sense of efficiency or of following disciplinary norms (Carter 2007). This work has begun to highlight the importance of embodiment and materiality within writing practices (Allen 2019; Muhr and Rehn 2015; Waight 2022) but has been much less concerned with the nature of writing as a form of epistemic practice. While writing is often framed as "a tool for thinking" (Menary 2007), epistemic aspects of writing are rarely present in this literature beyond questions of motivation or being "productive" (cf. Dobele and Veer 2019).

In addressing the epistemic and ontological effects of material practices of writing one key lineage for our research is scholarship on (social science) method. Such work emerges from feminist and decolonial thinking (Haraway 1988; 1997; Bhambra et al. 2018; Muhr and Rehn 2015) and has sought to deconstruct the taken-for-granted authority of "method" (Law 2004; Savage 2013). Accounts have focused on the performativity of writing as one aspect of method, and the ways in which academics should, as writers, consider how to write in ways that are sensitive to the worlds they want to bring into being (Jensen 2021; Lippert and Mewes 2021; Sciannamblo 2019). Importantly, this does not only concern the subjects of research, but researcher subjectivities and how these contribute to academic cultures and practices. STS researchers should attend "not only to what the scholar makes and does but how the scholar and the scholarship get made and done in the process" (Downey and Zuiderent-Jerak 2017, 225). In contrast to early laboratory studies, here the scholar does not appear as a Machiavellian entrepreneur who mobilises text to stabilise facts (Callon et al. 1986; Latour and Woolgar 1986), but as co-becoming with the research and writing process. In this sense attention to method emerges as an ethical and a political question of which worlds (including ourselves and the academic cultures we contribute to) we help to constitute through our research and writing.

For Michael (2021), questions of how research becomes entangled with ontological politics, the subjectivities of researchers, and the wellbeing of different kinds of actors are one aspect of "the research event", a notion which links epistemic, ontological, and political dimensions of

method and writing. Discussing "writing as analysis" (*ibid.*, 139), he explores the epistemic potentialities of writing not only as "concretiz[ing] thoughts that are as yet unformed or immanent" (*ibid.*, 139), but also as "prompting the emergence of a not-as-yet thought, of pushing the analysis in unexpected directions" (*ibid.*, 139). Studies of knowledge production in both experimental set-ups (Knorr-Cetina 1995; Rheinberger 1997) and in the design studio, as a site of aesthetic and material production (Farías and Wilkie 2016), similarly reference the role of surprise and the emergence of new insights in knowledge production. Rheinberger (1997) characterises experimental systems as including both reproduction and difference as a "driving force" for surprising and new observations and questions. Indeed, Rheinberger (2010) argues that for humanities scholars such as himself, writing is an experimental system that at once reproduces thoughts and introduces difference, and thus generates new ideas and insights.

In this paper we build on such discussions of the emergence of epistemic novelty along with writing studies' interest in the material practices and tools of writing and STS concern for the performativity of material-semiotic practices. We start to reflect (and hopefully spark further debate) on elements which have thus far been implicit in STS research on writing, and in particular on the intersection of (digital) writing tools and practices, embodied and encultured academic values and identities, individual agency and affects, and broader structures and expectations of contemporary academia. As described below, we do this by drawing on a collective autoethnographic study of our own academic practices, and by mobilising the notion of choreography to understand these.

3. Studying Scholarly Writing

Writing is widely understood as closely entangled with thinking and feeling. As Garforth (2012) writes in her discussion of "private" or "invisible" knowledge-producing practices, being observed during "solitary thinking work" (*ibid.*, 266) such as reading and writing often makes researchers uncomfortable. Such activities are perceived as intimate and being observed as "intrusive and disruptive" (*ibid.*, 274). As one response to this, in our analysis we draw on an ongoing autoethnographic study that we (that is seven researchers covering different career stages, employment forms, national and disciplinary backgrounds and life situations) have collectively been conducting since February 2021. Within this we write field notes and take photographs, reflect on these in group discussions, comment on each other's reflections using collaborative software, and experiment with creative methods of analysis and reflection, such as drawing our individual writing processes. We trace our practices within and beyond digital platforms and online spaces, and therefore mobilise sensibilities from digital ethnography (Albero-Posac and José Luzón 2021; Beaulieu 2010). Following Pink et al. (2016) we pay attention to a multiplicity of digital and other material practices. While the current corpus consists of some 85 pages of field notes, images, written reflections about these from workshop notes, and Slack messages, the material we draw on in our discussion here has largely emerged from a prompt we used in early 2022 to structure our observations and reflections. This prompted us to collect images and field notes that "reflect how you produce knowledge – how you think, write, and know within your academic work"[1].

Autoethnography can be minimally understood as "biographically opportunistic research" (Anderson 2006, 375). In this case we are certainly able to access experiences and practices around writing that would be inaccessible to external observers, but we also view our individual autoethnographic notes and collective reflections as lively and performative: our accounts "perform themselves into the material world" (Law 2000, 2) and have shaped and re-shaped both our practices and our (collective) reflections on them. The arguments we make in this paper emerged from cycles of coding, discussion, writing, and re-writing and should be understood as being located between us, as authors, and our materials. We draw on the notion of "duoethnography" (Norris and Sawyer 2012) to understand the ways in which our analysis has oscillated between personal and group reflections, and the ways that the boundaries between these are blurred, as "life itself is multi-authored, [...] voices overlap, tangle and become a kind of chorus of experience, sometimes harmonised, sometimes discordant" (Balmer 2021, 1156). Similarly, in this case we can make no clear distinction between "field notes", "analysis" and "writing". Phillips et al. (2022) describe the way in which they combine "thinking with" and "thinking about" their autoethnographic stories, using these simultaneously as analytical approaches and research objects. Our empirical material similarly consists of layers of descriptions, pictures, field notes, interpretations, conversations about field notes, (article) manuscripts, and further field notes.

This is a situated analysis (as all are), and a product of a particular time, place, and collective. In our writing we use the first-person plural to designate a heterogeneous group (in terms of career stage, gender, nationality, disciplinary background, family situation, etc.) with a range of practices and experiences who have, however, chosen to tell a collective story of this research. In doing so, we are not only describing and analysing our writing choreographies but writing our choreographies (into being) and constituting ourselves as researchers alongside our analysis in a particular "research event" (Michael 2021). Our aim is therefore not to give a definitive account of the nature of writing choreographies – and certainly not a universal one; our experiences emerge from a very specific time, place, and set of identities – but to introduce the notion as one means of studying how knowledge claims and researcher identities are made through writing practices.

4. Writing Choreographies as Aesthetic Ordering

An initial observation from engaging with our autoethnographic material was that many of our notes and reflections were concerned with practices that managed particular flows, rhythms, transitions, and spaces. Writing was, as we have already suggested, realised across different material, temporal, and spatial elements. The notion of choreography therefore became a central means for understanding these transitions and how they were managed and mobilised.

In developing this concept, we build on Cussins'/Thompson's (1998; 2005) notion of "ontological choreography", by which she means processes of ordering that relate different enactments of reality through coordinated spatiotemporal movements. She analyses how, in an assisted reproductive technology clinic, a wide variety of entities – body parts that are objectified and treated separately, different technical procedures, legal and bureaucratic

procedures, emotional moments – retain their affiliation to a whole through a choreography of movements which might be distributed in time and space, but which form dynamic patterns. She writes:

> What might appear to be an undifferentiated hybrid mess is actually a deftly balanced coming together of things that are generally considered parts of different ontological orders (part of nature, part of the self, part of society). These elements have to be coordinated in highly staged ways so as to get on with the task at hand: producing parents, children, and everything that is needed for their recognition as such. (Cussins/Thompson 2005, 8)

Exploring choreographies – of writing or anything else – thus affords examination of how the movement and ordering of diverse entities and ontological orders hang together. In the context of our material we are concerned with how the materialities and spaces that form part of our experiences of writing (and enact it in different ways) are coordinated, and how this relates to epistemic and ontological achievements of writing. The achievements we are interested in here are in particular creating new meanings that are accepted as novel contributions to scholarly literature, as well as enacting the scholar who makes such contributions and the research cultures in which the scholar is embedded.

There are two aspects of the notion of choreography that are of special value to our analysis. The first is the way that the notion foregrounds temporality in its focus on dynamic ordering, highlighting, in the context of academic spaces, how different temporal orders and rhythms can shape how specific academic spaces are perceived (for instance as dispersed, interrupted, or continuous) and individual and collective possibilities to act and to produce knowledge (Felt 2016; Hautala and Jauhiainen 2014; Vostal 2013; Ylijoki and Mäntylä 2003). To examine choreographies is thus to explore the temporalities of writing, and to attend to the interplay of speeds that form rhythms through which writing practices are ordered and propelled. The second aspect is the emphasis on spatial movements and their patterns and scopes. Choreographies can be understood as combinations of movement through both symbolic and material spaces: the notion has been used, for instance, to analyse the formation of disciplinary and trans-disciplinary fields and research communities (Moreira 2018; Schikowitz 2017; 2021) or the ways in which seemingly contradictory and dispersed movements constitute new research fields (Molyneux-Hodgson and Meyer 2009; Vermeulen 2018). It therefore calls our attention to the specific spaces (material, digital, or symbolic) that are implicated in writing, and to movements and flows between these.

These dimensions are, of course, not distinct: movement passes through both time and space and consists of (and creates) rhythms and patterns. In investigating writing choreographies, we therefore seek to explore the ways in which temporal and spatial moves blend within particular practices. In addition, we find it important to extend the notion of choreography further, to take into account its aesthetic dimensions. We make use of the affordances of the notion of choreography – a term that in part comes from dance and that refers to the way that an artistic experience emerges from movements through space according to specific rhythms – to consider how (writing) choreographies may be shaped through aesthetic considerations. Aesthetics allows for the creation of coherence in an intuitive and

affective way; "ingredients" are allowed to fit without the need to explicitly spell out the criteria for that fit beforehand (Dewey 2005; Michael 2021). Aesthetic dimensions figured prominently in our autoethnographic materials, which often mention creative and aesthetic practices – such as using colour codes, drawing, or sketching – for handling and ordering written material, and which include reflections on how these were used to create meaning and new knowledge (cf. Hoffmann and Wittmann 2013). Such aesthetic concerns were also extended to workplaces and to the atmospheres we try to create to facilitate writing (cf. Schindler and Schäfer 2021; Prior and Shipka 2003).

According to Dewey (2005), aesthetic experience "fixes attention upon the way things bear upon one another, their clashes and unitings, the way they fulfil and frustrate, promote and retard, excite and inhibit one another" (*ibid.*, 134). Aesthetics thus brings about new configurations that are more meaningful than the sum of their components. In the case of writing practices, this implies bringing about new meanings and knowledges. Similarly, Michael (2021) discusses aesthetics as one aspect of the "research event", something both to be analysed and that is an integral part of analytical practices and methods. Aesthetics, he suggests, is one way of understanding the analytical process, in which we come to "see" or create patterns and achieve a sense of "an aesthetic fit between two classes of ingredient, broadly speaking the perceiver and the perceived (or the researcher and the data)" (*ibid.*, 128).

In addition, while aesthetics is deeply personal and embodied it can also point to broader power relations and cultural norms. Aesthetics as "taste" or cultural habitus (Bourdieu 1987) can be disciplining and exclusive: anything that does not fit into the standards of a certain aesthetic may be deemed ugly or inappropriate. In this sense, reference to aesthetics as a crucial part of choreographies sheds light on how particular forms of exclusion may be realised. Coordinating and balancing various elements in a way that makes them "fit" and become productive is a delicate achievement that depends on the specific conditions, abilities and power relations involved. As Law (2003) states:

> [D]ance *isn't* easy. Rather, it is an accomplishment, a form of work, of effort, of great effort, in a place, with materials that are obdurate. With materials that may resist. With materials that may impose their costs, their own forms of pain. (*ibid.*, 6)

To be attentive to aesthetics within (writing) choreographies is thus to explore both normative judgements and the ways in which aesthetic choices or concerns are involved in situated, embodied, and affective enactments of particular practices. Aesthetics provides a link between pre-scribed (Akrich 1992) movements and rhythms and individual and collective sense-making and affect within a specific situation, operating as a particular mode of ordering (Law 1994). Choreography is thus not only the prior planning of a particular performance, but the emerging performance itself, and the choices made by the performer(s). By paying attention to aesthetics in choreographies as ordering without the need for coherence, we are able to grasp how tensions, dissonance, and surprise (Rheinberger 2010; Farías 2015) emerge within writing practices, how this is performative of new knowledges and identities, and how agency is distributed.

5. Writing as Epistemic and Ontological Practice

In engaging with our empirical materials through the notion of writing choreographies we are concerned with the rhythms of academic writing, the ways in which these are entangled with movements and patterns across diverse spaces, and the role of aesthetics and aestheticising in them. We trace how these configurations and rhythms are coordinated and made sense of through writing choreographies, first by discussing the different materialities of writing and how the interstices and transitions – the "seams" between them – are managed and navigated. Second, we lay out how we compose and "atmosphere" writing spaces and how we move between them. And finally, we attend to the specific relation of aesthetics and agency, and how writing choreographies are entangled with researcher identities and research cultures. For each section, we start with an indicative vignette from our field notes.

5.1 Navigating Seams between Materialities of Writing

> **Vignette 1:** *I am working on a co-authored paper. Sitting at my desk I flick rapidly between different windows: the Slack channel where some of our notes are sitting; the Google Doc this version of the paper is in, with its plethora of notes and edits; screenshots and images on my desktop; and Word, the programme I usually write in. "Have you finished editing for now?", I ask (via Slack) the colleague who, as I can see in the Google Doc (and who I know is sitting two offices down the hall; we just had lunch together), has most recently been adding comments and text. At the same time, I copy and paste one Slack thread into Word, then print it out – emojis and all – so that I can read it through in hard copy and take handwritten notes. Then I download the Google Doc as a Word file, putting a stop to this form of collaborative writing for the moment. I need to read the notes on paper, then think about how to integrate them by editing in Word. Only then will I again upload the text to Google Docs where the others can comment. In practice, this is what my work looks like much of the time: I am emailing and working on Word documents and checking my calendar and scanning pdf papers and much else besides, all fairly seamlessly or without noticing the gaps between these different tools. They all afford different ways of thinking or working (why, for example, does it feel different to write in a Google Doc than in Word?).*

Similar to other aspects of our material, this vignette highlights how writing is enabled by the dynamic coordination of different materialities (cf. Ince et al. 2022; Schindler and Schäfer 2021; Haas 1996) which afford different ways of thinking and working. We understand materialities of writing as a specific constellation of writing that includes tools, the researcher body, affects and identity, and specific knowledge. What emerges from the vignette above, and from our autoethnographic material more generally, is a concern for careful selection of the right materialities for different tasks and purposes, at specific moments and places, and for the skilful composition and coordination of these to yield epistemic gains. This, of course, presupposes access to and the ability of using all kinds of tools and infrastructures, which is not self-evident for all researchers and often requires personal effort (see Davies et al. 2022). The diverse materialities of writing are therefore not static but must be constantly coordinated and arranged. Different materialities of writing need to be made compatible,

and, importantly, the gaps and seams between them need to be managed and navigated. For instance, elsewhere one of us describes the routinised bodily movements necessary for creating the experience of "seamlessness": fingers flicking over the touchpad and typing shortcuts on the keyboard, moving between different tabs and windows on the screen, and transferring information between different devices by using online clouds and platforms. It is only when their routines are disrupted – for instance by a plaster on a finger that slows their typing, or by a new laptop where buttons and apps on the desktop are ordered differently – that the different materialities and affordances of these digital modes, and the routinised bodily and mental movements that are necessary to bridge them, are made recognisable.

While the vignette and description above involve rapid and straightforward transitions between different platforms and aspects of the writing process, we also find that the mobilisation of "seams" – points at which different infrastructures "collide" and where actors must therefore "make connections and bring disparate elements together" (Vertesi 2014, 268) – may be used to aid epistemic production. Other accounts indicate that we (purposefully) exploit seams between different materialities of writing for epistemic gains. One indicative example is the paper notebook and the role of handwriting. These play a crucial role in our writing practices but are used in very different ways (cf. Waight 2022; Hoffmann 2013): they can be places for collecting messy ideas and notes, for organising tasks and writing lists, for remembering well-elaborated arguments, or for externalising messages to ourselves. In whatever ways we use our notebooks, however, they feel close to our bodies and thinking. Handwriting cannot be easily altered, and writing in them therefore gains a certain authenticity and intimacy – also indicated by our reluctance to let others see our notes. The aesthetic and tactile appearance of the notebooks and the pens we use to write in them also play a role, giving rise to different moods, subjectivities and ways of writing and thinking.

Transferring handwritten text into digital writing notably takes more effort than copy-pasting text or transferring it from one digital platform to another. One set of field notes describes in detail how the author regularly goes through their paper notebooks and transfers "all important thoughts and ideas" into digital formats, in a way that aids their reflection on those ideas. It is the re-ordering of text as it travels between different materialities, and the slowing down of the workflow that this implies, that is productive for re-arranging thoughts and ideas and thus for creating knowledge. In this sense, navigating different materialities of writing involves translations between them, each of which causes small shifts in meaning, or "betrayals" (Law 2003), and creates something new. Each platform, device, or writing mode affords different ways of thinking, and alternating between them can contribute to the emergence of new knowledge. Farías (2015), in the context of architectural design, refers to this as "epistemic dissonance" between different "material mediators" of an outline, which is key to the emergence of new ideas and alternative designs.

In this way the skilful navigation of the diverse materialities through which writing is realised might not (always) strive for seamlessness but does seem to mobilise the affordances of diverse formats and the seams and dissonances between them in order to find rhythms and patterns that result in new knowledge. Writing choreographies are also distributed between humans and non-humans, and between the material affordances of certain tools and devices and our ways of using them. It is, in part, the artful management of this distribution that allows for epistemic novelty to arise.

5.2 Atmosphering Writing Spaces between Mess and Order

Vignette 2: *In pandemic times in [country], I write best from my home office, a.k.a my dining room table, where everything is arranged just so, protected from the disorder of the rest of the apartment and family life. The floor is protected by an old bath towel so that the chair – which I have stolen from my son's desk, as he left it unguarded – will not scratch the floor of our rental apartment. The table is protected by an orange napkin from potential water rings and discoloration which might be caused by the running supply of tea and water which I drink while I write. My tablet and notebook are neatly organised, ready to help me sketch ideas which are just better as pictures or diagrams, and my noise-cancelling headphones are fully charged to muffle the noise from my partner's calls in their home office, a.k.a our bedroom. My writing practice is also protected. I close all messaging apps – WhatsApp, Slack, mail, Twitter, anything which might "ding" and distract me from my flow. I close the doors to the dining room, sometimes putting a hand-drawn picture of an animal on the door with a speech bubble saying "Shh...I am on a call." (I have learned that saying "Shh...I am writing" is not as effective at keeping my children out of the room.)*

Vignette 3: *In my office, piles of paper (articles, printed versions of manuscripts, notes etc.) are "growing" over my shelves and my desk. The piles are marked and separated through post-its and sort pockets in somewhat unsystematic and chaotic ways. On my desk, some books I recently used, my notebooks, and teaching materials, as well as boxes with pens and office supplies, occupy the sparse free space, which leaves barely space for my laptop. In my laptop, the mess continues, with several tabs open in my browser which contain papers I want to look at or ideas I still need to follow up on. But actually the messiness of that can be productive, too. For instance, when I am looking for a specific article for teaching and need to go through a whole pile (or more) for finding it, I might accidentally stumble over other texts which spark new ideas for one of the writing projects I am working on. Thus, the inefficiency of the system facilitates contingent and serendipitous encounters. It contributes to my thinking and writing – new connections are made, new ideas come up and some observations suddenly make sense.*

These two vignettes – representative of several accounts from our field notes describing different writing spaces – show how, by choosing and composing different materialities of writing by in- and excluding a range of things and persons, we configure our writing spaces and their specific atmospheres. This involves adjusting and (re-)arranging a whole range of things: furniture, drinks, devices and tools, noise, family members, software, printed articles and books, and notepaper. This arrangement is maintained through technical as well as social and organisational means: turning off notifications and wearing noise-cancelling headphones, closing doors, and drawing signs that keep others out, using sticky notes or tabs in a browser to allow for a loose coexistence of materials.

The vignettes show how mundane practices participate in aestheticising our writing, and thus in the process of knowledge production. Our argument here is that arranging writing spaces does not only give rise to a motivational or productive atmosphere in which we write well (cf. Waight 2022; Schindler and Schäfer 2021; Prior and Shipka 2003), but that constituting a writing space at the same time enacts writing practices, knowledge production, and researcher subjectivities. In this regard we find the term *atmosphering* (Göbel 2016) useful to

address the fragility and ambivalence of atmospheres, and the necessity of constantly maintaining or reinvigorating them. Atmosphering creates "situated capacities of mediating the desired atmosphere, which maintains a certain potential to crowd out others and develop an agency of its own kind" (Göbel 2016, 172). As such, materiality and bodily experiences are a crucial part of creating writing spaces, and something that is repeatedly referenced in our field notes.

Vignette 2 presents an orderly and protected space, indicated by terms like "neat" or "clean", where the furniture is protected from damage, the workplace is protected from disorder, and writing practices and the writer are protected from disturbances. Creating a protected writing space means gathering everything which is needed for the writing situation (tea, notepaper, laptop, the writer), and excluding everything else (family members, noise, emails). In this case, a protected writing space co-becomes with the solitary, focused writer as a thinker and the systematic knowledge that draws together elements to compose a well-founded knowledge claim. In contrast, vignette 3 describes a messy writing space that includes and maximises contact with all kinds of external impressions. Here the writing space appears as crowded with elements that do not belong to a specific writing project. It is a repository, an archive layered with the remains of past and current projects, which spills over to the writing task at hand. Here, the messiness and the coincidental juxtaposition of texts sparks a creative atmosphere that redirects intended connections and allows new relations to emerge, shaping thinking and writing and leading to new ideas. The writer that co-becomes with the messy writing space is a creative scholar, who gets easily distracted by accidental observations, which however spark ideas and ingenious insights (cf. Michael 2021). The knowledge which is thereby created is innovative yet raw and in need of systematisation and streamlining.

Our materials show that particular individuals do not stick to one such writing space (although they may have preferences), but that in our writing choreographies we strategically create and alternate between different (protected or messy) spaces for different writing purposes (cf. Tusting et al. 2019). As one of us describes:

> If I were working on a reference list, I would be drinking a double espresso at Cafe X and watching the daily market out the window. If I were intently writing, I would be at the library cafe, where I could be surrounded by mostly hard-working students and be kept awake by my uncomfortable wooden chair.

By conducting different kinds of writing in different surroundings, the writer actively seeks different sensory experiences that might provoke specific moods, bodily affects, subjectivities, and ways of thinking. Importantly, the degree of freedom to choose and equip appropriate writing spaces for "managing the body to allow it to do this thinking work" (as one of us phrases it in their field notes) is often related to privilege and to the availability of financial resources to choose appropriate furniture and to write in commercial spaces, or to independence from care or occupational obligations. When choices to shape our writing spaces according to our needs are very limited, this might obviously hinder the emergence of dynamic writing choreographies, and thus knowledge production. It speaks to the idea that experiencing and pursuing our writing spaces always happens against the backdrop of the positions we occupy within different orders and power relations (cf. Tusting at al. 2019). It is therefore important to consider how our "aesthetic experience" (Dewey 2005) is situated and relational.

Atmosphering is a crucial element of our writing choreographies: it does not create a single, fixed writing space, but is ongoing and malleable. Different writing spaces not only motivate us to carry out different tasks; more than this, navigating and balancing protected and messy spaces in specific ways is co-constituted with researcher subjectivities as systematic *and* creative, and our knowledge claims as novel *and* well-founded (cf. Rheinberger 1997). Navigating these spaces in specific choreographies is therefore performative of how we write, who we are as researchers, and what knowledge we produce. This onto-political dimension of aesthetics, and how aesthetic ordering is both an expression of individual idiosyncrasies, collective becoming, and current academic norms and cultures, is further addressed in the following section.

5.3 Aesthetics and Agency between Efficiency and Intimacy

> **Vignette 4:** *In writing together, the two of us met once, in person, to discuss our plan and then just ping-ponged our draft via Google Docs. I was pleasantly surprised how efficiently this worked; in terms of synchronicity, it felt as though I was in direct dialogue with them via the platform. At some point, our rhythms seemed to converge and we worked on the document at the same time. Sometimes, we would even tweak and fiddle around with the same sentence, still it felt really easy going and effective, as though we were thinking together. Either we were really perfectly synced, or Google had made some improvements to the platform, but not even the problem of "slippery text" (where one writing partner deletes or adds a section and the text below suddenly bounces up or down while the other writer works on it) occured. Without explicitly coordinating we seemed to perfectly harmonise during the editing process. Even though we were physically distanced, I felt close to them during the whole process. So, relating my engagements with co-writing in Google Docs to verbal discussion, I find that Google Docs alleviates some of the time(-ing) pressure that comes with conversation. I noticed that I find the possibility to revisit and edit my own comments and suggestions very calming. In this way, I can find my own flow, making my own rhythm.*

Collaborative writing figures prominently in our material. Writers create co-presence (Beaulieu 2010; Ince et al. 2022) in digital spaces through writing-oriented Zoom calls (where writers sit with their cameras off, working on the same writing project together), working on Google Docs at the same time, as described in the vignette above, or using messaging services such as Slack. The technical affordances of particular platforms for collaborative writing are key to this (cf. Hynninen 2018) – and it might seriously hinder collaborative writing if they don't work as expected. Platforms such as Google Docs are another space to be atmosphered as writers work together on texts and find "synchronicity" in how they collaborate. The vignette above addresses one such instance in which co-writers succeed in creating an atmosphere that allows for both "making my own rhythm" and "perfectly harmonis[ing]". Here the two co-writers and the relations between them, their working customs and affects, and the technicalities of a platform that allows for simultaneous writing in the same document all contribute to a common rhythm and atmosphere that allows for "thinking together". That such a delicate coordination between people and platforms works well is not obvious, and involves skill, luck, and the production and management of particular affects.

The vignette particularly points to the ways in which seeing the other write and think, and the conversations into which interlocutors enter through editing and commenting, creates a shared space with a specific atmosphere, one that allows for intimacy and trust. The proximity kindled by this atmosphere might be enjoyable in a trusting relationship, while in a different context such exposure might induce vulnerability (something we also find in our material). Including others in our writing spaces, letting them see our unfinished, raw, and messy writing, and exposing ourselves to their reactions implies showing them our fragile researcher identities. For instance, if collaborative writing tools are not available or do not work as intended, or if colleagues disagree about the rhythms and aesthetics of the common workflow, the choreography can fall apart. In that sense, choreography includes not only the mastery and coordination of tools and spaces, but emotional work and the need to balance frustration and anxieties emerging from collaborations. Attending to the intimacy of writing thus shows how closely writing choreographies are entangled not only with epistemic processes but with researcher subjectivities, agency, and identity formation – both relating to individual researchers who develop a sense of who they are as researchers through writing, and to collaborators and research groups who develop togetherness as they write together.

The momentum, the common thinking which emerges from co-writing, can be regarded as another way to introduce variation and surprise into the writing process (cf. Rheinberger 1997) and thus to create epistemic gains. As collaborative writing is becoming more common some of the techniques and technical means that support it – such as having conversations within the text via comments and tracked changes, and the atmospheres that these help produce – also inspire new, individual writing practices that allow new ideas to emerge from (auto-)conversations within the text. The increasing co-presence of others in our writing spaces and the common rhythms which emerge shape the atmospheres not only of these spaces, but also of individual writing, as the boundaries between individual and collaborative writing become blurred through new technical means.

Vignette 4 highlights not only the intimacy of the co-writing process, but notions relating to its efficiency and effectiveness. Here and throughout our material "efficiency" – in the sense of a smooth process without unnecessary delays or conflicts – is often framed as a goal. Such references hint at the moral connotations of certain aesthetics in contemporary academic norms, and expectations regarding how to be a good researcher. In the field notes we all invest time and effort into "organising my time and thoughts" (for example by creating lists and tables), describing these as crucial for being able to write and produce knowledge in the first place. At the same time, we also find the sense that messiness and "ineffective" processes that include detours and delays are valuable for writing, and that messy processes give rise to contingent and surprising ideas and allow us to make new connections between elements (as mentioned in vignette 3).

While we acknowledge the epistemic necessity for mess and inefficiency, our field notes include feelings of embarrassment, guilt, and concern at being haphazard, messy, or impulsive (cf. Muhr and Rehn 2015). This might be further exacerbated when occupying specific positionalities, like not being an English native speaker, having been socialised in a non-STS discipline, neurodiversity, or other sources of stress. The current academic regime, with its moral and aesthetic "script" (Akrich 1992) towards efficiency, acceleration, and "productivity", is thus understood as being in tension with writing as a creative and intimate practice.

In practice, however, we found that order and mess, efficiency and delay, mostly blend into each other. Playing around with messy text elements can lead to new orders, and sometimes ordering practices lead to mess. To exemplify the first, our field notes include various descriptions of writing as assembling text elements from notes, literature, feedback, and empirical materials and fiddling around with these elements – "like children in a sandbox" as one of us describes it – until a serendipitous pattern, a new order emerges. Vice versa, one of us describes how joy about the "neatly ordered categories" of a literature management program can lead to "fiddling around with it for so long that I completely forget what I was looking for in the first place", or how repeated attempts to develop a perfect file system end up in "pure chaos" because it does not fit the messy working modes in practice.

These examples demonstrate how despite the moral urge towards efficiency and order, mess and contingency slip in. Ruptures, seams, and dissonances which slow down efficient workflows, and which urge us to re-order and think things anew, making new connections, might be less efficient, but are epistemically generative (cf. Rheinberger 1997). The back and forth between mess and order, delay and efficiency, and the writing choreographies this gives rise to make writing an epistemic practice and enact writer subjectivities that may be more or less in tension with those that emerge from current regimes of academic governance (Sigl et al. 2020). Agency is thus not merely determined by the "script" (Akrich 1992) of single tools but emerges from atmosphering and the use of different tools in specific ways in individual and collaborative writing. These individual combinations of tools, writing practices, and aesthetics intermingle with those of current academic regimes within writing choreographies.

6. Conclusion

Deploying the notion of writing choreographies on material from an autoethnographic project, we have discussed the ways in which academic writing in STS unfolds as a distributed practice, coordinated through dynamic patterns that emerge from the alignment of different materialities of writing, writing spaces, and aesthetics. Writing, we have shown, is choreographed through the artful arrangement and navigation of "seams" between different material forms of writing, and through configuring and "atmosphering" writing spaces. We further argued that agency within writing is related to aesthetics and to interplays between intimacy and efficiency. Ultimately, we have suggested that writing choreographies enact new knowledge as well as individual and collective researcher subjectivities and research cultures.

In this way, the concept of "writing choreographies" does not only allow us to understand knowledge production, but also offers a lens to analyse researcher identity and positionality, and in particular how exclusion of certain forms of writing or individuals from post-digital writing may take place. As we have seen, it is necessary to master and align different materialities, tools, and spaces in complex and delicate ways to successfully perform writing choreographies, as well as to balance current norms of efficiency with creative leeway and personal needs. This might not be possible for those who lack access to certain tools, do not possess the privilege to aesthetisize their writing spaces in ways that meet their demands, or whose positionalities do not allow them to introduce creative rhythms and orders. While our materials emphasise

the epistemically generative, satisfying, and community-building aspects of writing choreographies, it is not self-evident that such distributed post-digital writing results in improving knowledge and togetherness. Furthermore, choreographing divergent elements is not always a joyful experience. It can also be extremely frustrating, annoying, and accompanied by anxieties.

While these observations are based on situated empirical experiences and emerge from a very specific time and location, we suggest that the concept of writing choreographies could have more general applicability, and that it would be valuable to explore these alignments of different materialities and spaces in post-digital writing in other contexts, for example in different disciplines or research traditions. Paying attention to aesthetics as a crucial aspect of academic practices and writing choreographies allows us to understand knowledge production and epistemic cultures as emergent, and to see agency as both determined and as changeable.

In this regard one central implication of our argument relates to current debates around academic publishing dynamics concerned with increasing output pressures (Ylijoki and Mäntylä 2003; Fochler and De Rijcke 2017; Sigl et al. 2020). Our analysis suggests that writing choreographies are both structured by (and reproduce) larger developments, such as demands for efficiency or productivity, and by researchers' own agency and identity work. They are infused with moral expectations concerning how one should work – efficiently, productively, in an organised manner – and thus enact neoliberal selves. However, simultaneously they enable the formation of new, caring relations between co-writers, or allow for positive valuations of mess and disorder. The notion of writing choreographies thus emphasises not only the ways in which agency emerges through the back and forth between different materialities and spaces, each with their different affordances, but the entanglements between epistemic novelty, researcher identity, and the material practices of research. As such it provides one frame for examining how we, as STS researchers, are "made and done" in our research (Downey and Zuiderent-Jerak 2017).

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Authors Contribution Statement

Andrea Schikowitz is the corresponding lead author of this paper. Esther Dessewffy and Sarah R. Davies contributed equally and share the second author position. Bao-Chau Pham and Kathleen Gregory contributed equally and share the third author position. Elaine Goldberg is listed as the fourth author. Ariadne Avkıran and Fredy Mora Gámez contributed equally and share the fifth author position.

Notes

[1] The full prompt was:

« Over the next weeks:

- Take 3 (+/–) photos that reflect how you produce knowledge – how you think, write, and know within your academic work.
- Write fieldnotes or text fragments (1000 words, +/–) that respond to these images. Consider (for instance):
  - What digital tools, platforms and technologies are implicated in your academic work?
  - How do you use these, and how do they relate to "offline" practices?
  - Where are these (digital) practices respectively located physically? Are there certain places where you conduct certain kinds of work or certain knowledge practices?
  - What rhythms, temporalities, and flows are involved?
  - What other activities or practices are involved in academic work, aside from "knowledge production"? What does this even look like in STS? »

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Re-Engaging Technoscience in and beyond Science and Technology Studies

Barbara Allen
Virginia Polytechnic Institute and State University

Barbara Prainsack
University of Vienna

Lucy Suchman
Lancaster University

Corresponding author
Barbara Allen
Virginia Polytechnic Institute and State University, Department of Science, Technology, and Society
Virginia Tech Research Center
900 N Glebe Road, Arlington, VA 22203
ballen@vt.edu

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Abstract

This *Crossing Boundaries* celebrates 20 years since the foundation of STS Italia, the Italian Society for the Study of Science and Technology, reflecting its ongoing commitment to disseminating STS and critical perspectives on the relationship between science, technology, innovation, and society, both in academic contexts and among the general public. Promoted by the Editorial Board of Tecnoscienza, this contribution brings together three authoritative voices exploring new frontiers in Science and Technology Studies. Barbara Allen examines the role of participatory science in environmental justice, highlighting the importance of involving local communities in scientific knowledge production. Barbara Prainsack proposes the use of systematic utopian imagination as a method to critically rethink technological futures, emphasizing the role of solidarity. Lucy Suchman offers an incisive critique of military datafication, questioning the epistemological premises of data collection and use in security contexts. Together, these contributions challenge traditional STS boundaries, proposing innovative approaches to re-engage with technoscience in ways that promote justice, equity, and critical reflection.

Keywords

participatory science; utopian imagination; data critique; environmental justice; solidarity; military datafication.

Environmental Justice, Participatory Science, and Policy Change

Barbara Allen

In reflecting on the potential value of Science and Technology Studies (STS) ideas to shape public discourse and policy change within environmental justice spaces, the primacy of participatory science as a mechanism for change, looms large. From issues of trust to deciphering opaque code and large data sets, including the public in a substantive way is key. To understand the rise of participatory science in addressing hazard problems in vulnerable communities, it's

important to understand the complicated interrelationship between institutionally produced science and less formal ways of understanding the environment and human health. Public participation as a mode of shaping science aligns with the growth and popularity of engaged scholarship in the STS community as evidenced, in part, by the robust display of work in *Society for Social Studies of Science* (4S) "Making and Doing" program which is in its 10th year.

1. The Problem of Science in Environmental Justice Debates

Science has played an important role in environmental concerns and controversies over the past few decades, often as a pivotal element in regulatory decision-making. For this reason, unpacking the construction and use of science in environmental disputes provides a powerful lens for making knowledge inequities visible, particularly in polluted and vulnerable communities. The struggle for scientific knowledge has been well documented in the Environmental Justice (EJ) movement, predominantly in case studies where residents have formed alliances with scientists and experts to speak out against their exposure to toxic substances such as industrial and agricultural pollution (Allen 2003; Liévanos et al. 2011; Ottinger 2013; Harrison 2011; Brown 2007).

For residents of polluted places, science is often a barrier to having their voices heard – that is, the science produced by government agencies or corporations is a hurdle that citizens must confront to overcome. This idea of science as a barrier leads to three main issues of public disconnect in contested environments. First, the science that becomes regulatory science has little or no input from the people that live there. Residents typically have neither formal training nor a transparent mechanism to enter the regulatory science world. Furthermore, what knowledge they do have does not easily conform to the frame of decision-making science (Kimura and Kinchy 2016; Suryanarayanan and Kleinman 2013). Whatever policy input mechanism that might be provided for them as "participants" is often perfunctory and of little consequence in the final decision – they are only there to ratify what regulators have already decided, lending the facade of public acceptance (Irwin 2005). Second, excluding the empirical insights of residents from regulatory science creates a credibility gap, engendering further distrust on the part of the public (Wynne 1996). The science that is acceptable for official purposes is often socially remote and contextually segregated (Harding 2015; Nowotny et al. 2001), having little relationship to the lived experiences of citizens in contested environments. Third, the science that the residents desire – science that answers their questions about *their* health and environment and frames *their* empirical "lived" evidence in regulatory-relevant terms – often does not exist: it remains "undone science" (Hess 2016; Allen et al. 2017).

2. The Participatory Science and Policy Change Conundrum

Counter to the science disconnects mentioned above is the increased interest in participatory science among government agencies, NGOs, environmental groups, and the public. Participatory science functions as an umbrella concept for a wide range of activities and modes of engagement, including "citizen science" (Irwin 1995; 2015), "street science" (Corburn

2005), "popular epidemiology" (Brown 2007; Allen 2003), "consensus conferences" (Guston 1999), and "crowdsourcing" (Haklay 2013), to name a few. These cover an array of different practices and understandings about what lay people's contribution to science is or could be, ranging from citizens functioning as a collection apparatus for carefully circumscribed projects to the collaborative shaping of research questions, methods, and even data analysis. What "demarcates citizen science activities (of whatever sort) from more conventional science is that they build not only on the active participation of citizens but, also, and explicitly, *on their expertise*" (Irwin 2015, 35, *emphasis in original*).

Epistemic modernization (Hess 2007; Moore et al. 2011) has emerged as a counter to the closed practices producing state and corporate science, whereby lay-people and social movement groups participate in shaping science and the scientific agendas that impact them (Hess 2016). When people for whom science matters most can participate in shaping or making science, this leads to greater social and place-based contextualization of knowledge. Some science studies scholars argue that deeply situated science that includes the social distribution of expertise is often more empirically reliable, yielding higher quality, socially relevant results (Harding 2015; Nowotny et al. 2001).

For participatory science to simply advance an ongoing project is one thing – but "generating whole new knowledge structures and cognitive frameworks is quite another" (Irwin 2005, 3). In many communities facing environmental injustices, local residents have expressed their concerns about water and air quality, often related to concerns about health, but little changes. Giving voice to their concerns does not necessarily lead to structural and/or policy changes. The regulatory and political system is unjust, in part, because it does not "recognize" (Fraser 2009; Young 1990) their observations as sufficient justification for action to address pollution. Instead, their concerns are often refuted by regulators using quantified state science deemed valid by government agents. Even in cases where locals employ citizen science, like collecting air samples as evidence of poor air quality claims, their efforts or "voices" are diminished by regulators as "non-standard" or not "scientific" (Ottinger 2010). Given the uphill battle communities have "confronting" science that does not match their observations, what kind of work is needed? How can engaged scholars working on the ground with communities do to change the structural dynamics of knowledge – and better yet the environmental outcome?

3. Strategies for Effective Participatory Science

Engaged research around environmental justice issues, particularly environmental health, has had a mixed record of success. Davis and Ramírez-Andreotta (2021) address the question of effective strategies of participation for environmental justice by systematically analyzing over 150 case studies. To assess effective engagement, they examined both the dynamics of academics working with communities as well as the types of participation involved with communities. They were particularly interested in projects that led to structural change such as policy enforcement or revision, public service provisions, or increases in political power. From the case studies they theorized over 20 participatory catalysts for structural change in EJ engaged research including: i) study design and research questions informed by members

of the community; ii) inclusion of a community advisory/review board; iii) data collected from more than one source, such as including both quantitative and qualitative data; iv) data "translated" and made more accessible for the community, the press and decision-makers; and v) decision-makers involved at some point in the process.

Translation of data and participatory science output is important for both local communities and state agents. For example, facilitating data interoperability (Göbel et al. 2017) is a way to "further leverage the power of scientific data for structural change" such that it can be translated for regulators and policy makers (Davis and Ramírez-Andreotta 2021). Additionally, collecting and analyzing the same kind of data that regulators use to inform policy decisions is also key in effective participatory science (Allen 2018). As an example, in my participatory research, we "workshop" epidemiology-based health data, inviting local focus group input and reflection from the people whose health is represented by the data. The participatory process of workshopping aligns with science communication research on attention and motivation (Lupia 2013). People have greater capacity (and working memory) for the understanding and personal processing of science if it connects to both: i) people's preexisting beliefs or empirical observations and ii) concrete events or outcomes that impact their lives or those that they care about (Lupia 2013). Strong participatory science, is both science that is trusted and used by regulators for policy purposes *and* science that is trusted, informed by, and used by residents to successfully pressure policy change (Allen 2020; Allen et al. 2019).

4. Scientific Citizenship

In concert with engaged scholars and participating communities, science allied agencies and institutions must realize their own cultural limits, and that they need to be structurally and cognitively open to new forms of knowledge and participation (Leach et al. 2005). The scholarship on participatory science for policy relevance in the environmental justice arena can be seen as a repositioning of "citizen science" to include official government science made more relevant through the deliberative processes of citizens. Participatory science in this instance is an "engagement object" to alter "the dynamics of trust and authority" (Kleinman and Suryanarayanan 2020, 687) in the coproduction of knowledge between state scientists and the lay public.

In the environmental justice arena, participation furthers the scholarship on scientific citizenship through which institutional approaches are made more inclusive, even transformed, via new kinds of "questioning communities" (Irwin 2015). This justice-oriented approach to scientific knowledge is part of emerging scholarship in STS calling for "generative justice" (Eglash 2019) and "generative projects" such that "scholars are learning and creating for and with non-academics in ways that highlight the many kinds of epistemologies, technologies, and labor that make up technoscience, and contribute to its reorganization" (Moore 2021) and to larger structural change.

Working towards epistemic justice through participatory science is supportive of an emerging "scientific citizenship", part of the process of reframing civic institutions and institutional approaches to doing science toward not only being more inclusive, but to also be open to new kinds of "questioning communities", a move that can strengthen both science and democracy (Irwin 2015).

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Systematic Utopian Imagination: A Case for Building Futures

Barbara Prainsack

Looking through the "most read" and "most cited" sections of leading STS journals, it is apparent that STS scholarship has its finger on the pulse of many societal developments. There is a lot of work on data practices and ethics, on robotics and artificial intelligence, as well as on

public participation and engagement. At the same time, some of the keywords that I normally encounter, many times a day, in newspapers, magazines, and podcasts, are almost entirely absent. In a total of 200 STS journals' top-ranking papers in several journals, the term *climate* appears twice; *democracy*, or *democratic* comes up three times, and *autocracy* not at all. The reason for the latter could be that the term is mostly used in political science, but still: considering that the climate crisis, along with the decline of democratic values and respect for human rights[1], are among the most pressing challenges for societies across the globe – and given that science and technology play a role in both – the absence of an explicit engagement with these concepts is puzzling. How does this reflect on STS' engagement with current political and economic challenges? What, if anything, could STS scholarship do better?

STS is deeply political, in the broad and the narrow sense of the word. As Charles Thorpe noted, at the very minimum, STS is political in that it addresses ideologies and practices that "technologize the political order" (Thorpe 2008, 65)[2]. And STS is political also in other ways (see also Brown 2015; Simmet 2025). It often gives a voice to groups and perspectives that would otherwise remain unheard. Moreover, while many other disciplines treat technologies mostly as vehicles of progress, STS scholarship is attentive to the nuanced and at times contradictory effects that technological practices have on the distribution of power and agency. Digital innovations, for example, besides having brought tangible benefits, also entrench inequalities. Digital payment systems for the "unbanked", or educational apps for girls in gender-segregated societies, increase the agency of people, but they often also stabilise the oppressive systems that have limited their agency in the first place. STS scholarship has made great contributions to our understanding of the specific dynamics that lead to the inequalities that are coproduced with technological practices – and that are implicated in almost all societal crises. STS work has troubled assumptions in mainstream political discourse about "good" v. "bad" technologies, and challenged the idea that "innovation" is necessarily a solution for societal problems (e.g., Pfotenhauer and Jasanoff 2017; Jasanoff and Kim 2019; Birch and Muniesa 2020). It has also added nuance to hegemonic narratives about the contributions that technological innovation is making to our economies. For example, STS scholars have argued that a major part of innovation in recent decades has increased capital gains more than it has contributed to the rest of the economy[3], and drawn attention to "the dark side of innovation" (Coad et al. 2022; see also Vinsel and Russell 2020; de Saille and Medvecky 2020). While innovation that creates public value is as important as ever, there is a large part of innovation that does not do that – and that exacerbates societal problems and inequalities rather than mitigating them. By drawing attention to these nuances and tensions, STS scholarship invites us to imagine technology use that promotes justice, inclusion, and solidarity, rather than economic profit and growth (e.g., Benjamin 2019; 2024).

At the same time, many STS scholars have been hesitant to spell out these imaginations. Analyses within the sociology of expectations, for example (Brown and Michael 2023; Van Lente 2012; Borup et al. 2006; see also Tutton 2017) have shown how techno-solutionist expectations can cause tangible harm (see also Paskins 2020). These and similar insights have made many STS scholars wary of utopian thinking. Utopian thinking, so the argument goes, obscures the complex, contingent, and deeply political nature of sociotechnical systems, or oversimplifies societal challenges (e.g., Benjamin 2019; Sovacool and Hess 2017; Winner 2020[1988]).

By prioritising idealised futures over the messy realities of the present, utopian thinking risks perpetuating harm and sidestepping necessary debates about justice and inclusion (see also Sand 2019).

There is much to be said for skepticism of a kind of utopian thinking that lets corporate or academic elites choose the futures that are worth creating on behalf of everyone else. I also echo the call of STS scholars for grounded, context-sensitive approaches that prioritise the lived experiences of diverse communities over abstract, one-size-fits-all solutions. But I still believe that these concerns should not stop STS scholars from formulating alternative visions. Because of the way in which STS is intrinsically political, because of the attention to the subtle mechanisms of empowerment and disempowerment that are arguably at the core of STS, STS scholarship is uniquely placed to engage in systematic utopian imagination.

1. Utopia as a Method

Something important gets lost if we stop creating alternative visions altogether. The work of Ruth Levitas (2013) is instructive for how this can be done without stepping into the traps that STS scholars rightly warn of. Rather than as the drafting of uniform visions of ideal societies, Levitas sees utopian thinking as a tool for reflecting on possibilities for change. For Levitas, utopia is not an end point, but a method of creative reimagination. Using utopia as a method can help to find solutions that do not merely replicate the assumptions of the existing system, which often caused the very problems that are now to be solved (see also Liboiron 2021; Thaler 2022). Utopia as a method is like cutting loose a balloon that is tethered to the ground. While the view from the balloon is initially limited to the immediate environment, once the string is cut, the horizon widens.

There are ways to prevent the balloon from drifting away. Building upon Levitas' approach, Hendrik Wagenaar and I suggest systematic utopian imagination (SUI) as a method comprising three steps (Wagenaar and Prainsack, *under review*): the first step involves describing the existing reality and identifying what holds it in place. It is an empirical endavour during which we ask: what assumptions stabilise the *status quo*? Which of these assumptions have become so ingrained in our thinking that we no longer question, or no longer even see them?

The second step is the development of alternatives. For example, once we have established that what holds the current data economy in place, next to the overarching political and economic power of technology companies, are the assumptions engrained in Western categories and instruments of data governance, we ask (Prainsack, *in press*): what would happen if we had a different notion of personal data that did not consider people only as atomistic individuals, but as relational beings (see also TallBear 2011)? What if we regulated data use that benefits people dependent on income from work differently from data use that benefits only capital owners? As noted, this exercise is not about professional experts deciding on everyone else's behalf which alternative is the right one. It is about opening a process of – ideally collaborative – reflection on what better ways exist to solve a specific problem or organise our societies. Who would benefit from these alternatives, and at whose cost?

The third step – and one which is specifically aimed to prevent the balloon from drifting away – is the development of concrete policy instruments to implement these better

alternatives, and to "test" them with people who have practical experience. If we decided, for example, that a more relational understanding of personal data would be desirable, what legal and policy changes would it need to realise this?

Step 1	Deconstruction	What holds the status quo in place?
Step 2	World Making	What alternative futures would be better, and why? Who would benefit, who would be disempowered?
Step 3	Institutional Design	What instruments and measures would it take to realise these alternative futures?

Table 1.
Three steps of systematic utopian imagination (source: author, inspired by Levitas 2013. See also Wagenaar and Prainsack, *under review*).

2. The Role of Solidarity in Systematic Utopian Imagination

Some STS scholars may be put off by the explicit normative thrust of this endavour. Even those who do not shy away from being normative may worry about "locking in" specific futures by formulating explicit visions of how things could be different. For many, an important concern will be the tacit ways in which futures that seem desirable to many will still disempower some. When SUI is used in policy making, the process of developing possible alternative futures should be deliberative, meaning that it should include a broad range of voices speaking from different places in society (Wagenaar and Prainsack, *under review*; see also Parthasarathy 2025). When the creative imagination of alternative futures is used by academics, this is typically not feasible. In this situation, taking a solidarity-based perspective can help. Solidarity, understood as practices by which people support others who they take to be like themselves in a relevant respect (Prainsack and Buyx 2011; 2017)[4], can be a helpful starting point for visions of a better future.

Solidarity is different from other prosocial practices in that it builds on what people have in common instead of what sets them apart. While this does not mean that solidarity neglects or denies difference, it means that among all the things that separate people, the things that bind them together become the "design principles" for practices, policies, or institutions. An example are universal healthcare systems that provide services to people based on need, despite the fact that everyone – due to different life circumstances and biological factors – has different risks to fall ill. Here, the "design principle" – the thing that binds people together – is a shared human vulnerability to disease or injury. Another example are farming communities that share harvesting work. The shared feature that gives rise to solidarity here is that everyone needs help getting their harvest in on time, a task that often exceeds the capacity of individual farmers.

The result is a system of mutual support, of indirect reciprocity, that builds on this shared characteristic, despite all the differences that exist between farmers in terms of their economic and political power, their social standing, or other factors that matter in other domains of life.

How can solidarity help with SUI? By focusing on things that people have in common, rather than on what sets them apart, solidarity can help to realise future-building "at eye level". Solidarity builds on the needs that everyone has in common, rather than being dominated by the preferences of those in the most powerful positions. While it is not an absolute safeguard, and while exposing suggested alternatives to public deliberation and scrutiny is still necessary before visions of alternative futures are implemented at the level of policy, taking a solidarity-based perspective can help to reduce the risk that utopian thinking excludes marginalised or dissenting voices in pursuit of a vision shaped by the loudest voices. Including a solidarity-based perspective into exercising utopia as a method can be a corrective to our unconscious acceptance of the divisions that ruling elites are imposing on people[5].

3. Countering Elon's future

I had worked on the notion of solidarity for over two decades without making the connection to utopian thinking. Like so many STS scholars, the concerns about the pitfalls of utopian thinking prevented me from embracing it. It was while working on an article for this journal (Prainsack 2023) that I understood what we are losing if we give up on utopias. I was inspired by Daniel Susser (2022, 297-298), for example, who warned that, if we do not create alternative visions of a good technological future, all we can do is mitigate the harm of the vision of tech corporations. From Linsey McGoey's work on strategic ignorance I learned about the political dangers of silence (McGoey 2012; 2019). I also heeded Jana Bacevic's words (2021), who said that, to muster the strength to act upon the present, we need a vision of a future that is worth acting on (see also Bell and Mau 1971; Tutton 2023). I have also been inspired by Ruha Benjamin's work on imagination (Benjamin 2024), which treats imagination as a collective political resource to shape socio-technical futures. Like Levitas, rather than offering a fixed blueprint for an ideal society, Benjamin calls for a continual contestation and creative engagement that empowers communities to envision alternative futures centered on equity, accountability, and justice. In this way, imagination transcends mere escapism to become a transformative ethical imperative that challenges the status quo and amplifies marginalised voices in particular.

By explicitly formulating alternative visions, we open them up for scrutiny by others. We also make ourselves vulnerable. It may seem safer to remain in the realm of the empirical or stick with abstract conceptualisations. But if we do not actively spell out desirable futures, others will do it for us. These others are likely much more powerful and have vested interests in practices that maintain the status quo – or even change it in such a way that it exacerbates current problems. The visions of tech entrepreneurs that are currently shaping policies are exacerbating the climate crisis and catalysing the transformation of the remaining liberal democracies into electoral autocracies. The United States are but only one example of a country that demonstrates the effects of placing tech entrepreneurs in charge of world-making.

Building alternative futures could, I believe, be seen as an activity at the core of STS. As John Law put it, "[t]hings never have to be the way they are. That is the point of this STS of method" (Law 2017, 49).

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Notes

[1] Globally, the proportion of the population living in democracies is steadily declining. At the same time, the quality of democracy in many countries is also deteriorating. According to the V-Dem study, which measures democratic development using over 600 indicators, countries such as Hungary, Türkiye, and India are no longer democracies but electoral autocracies – countries that still formally hold free elections but lack other essential characteristics of democracies, such as academic and press freedom or an independent judiciary (Nord et al. 2024). Globally, 40 countries are currently transitioning from democracy to autocracy.

[2] In Thorpe's words:

> The political concerns of STS have pivoted around the formulation and criticism of liberalism. Liberal values of individualism, instrumentalism, meliorism, universalism, and conceptions of accountability and legitimacy have been closely related to understandings of scientific rationality, empiricism, and scientific and technological progress. (Thorpe 2008, 63)

[3] For example, if a car company, whose main business model was the sale of cars, begins to generate a significant portion of its profits through mortgages or leasing contracts, this is an instance of financialisation. Companies are transformed from entities that produce goods or services into vehicles for maximising financial profits (see also Lawrence and Laybourn-Langton 2021). The logic of finance is penetrating into more and more areas of society and even into the personal lives of many individuals. Social and economic justice and public interests are subordinated to financial goals. Financialisation has increased the indebtedness of private households and forced public institutions such as housing companies, care facilities, or universities to change their business models to borrow money from global investment banks (Smyth et al. 2020, 8; see also Wagenaar and Prainsack 2021).

[4] The commonalities that are recognised by people as a basis for solidaristic action are not necessarily "objectively" existing characteristics. Instead, they are features that we have learned to attribute to ourselves and to others. They are lenses through which people have come to see reality and that make it more or less likely that they recognise similarities with others. A person who grew up in a society that taught them to think of a person with different religion as their enemy, for example, will find it much harder to see commonalities between them and these others than someone who grew up in a context where similarities between all humans, or even all living entities, were emphasised.

[5] I am grateful to Carrie Friese for helpful discussions on this point.

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◆

Injurious Orders and the Question of Data

Lucy Suchman

This contribution to *Crossing Borders* is a call to question the figure of "data" in the armamentarium of in/securitization. It builds on scholarship at the intersections of STS and critical security studies, in the context of military operations characterized by expanding infrastructures of datafication and the automation of targeting. Located within a history of discriminatory ordering, the systems of categorization that enable data-driven targeting are deeply implicated in the regeneration of configurations of enmity that justify further warfighting. Critical destabilization of those systems and practices is a necessary element in interrupting the perpetuation of militarism and the political and economic investments in its expansion.

1. Before Data

Published just over twenty-five years ago, the book *Sorting Things Out: Classification and its Consequences* (Bowker and Star 1999) examines the primacy of regimes of categorisation in practices of social ordering, enabled by the building out of data-driven information infrastructures. Bowker and Star demonstrate the non-innocence of classificatory practices in cases ranging from the determination of causes of death, to valuations of labour in the medical workplace, to systems of racialized discrimination in apartheid South Africa. Each of these, they argue, operates to reproduce systems of hierarchical difference. Long an apparatus of imperial and colonial domination, the differential valuation of life and labour has been further amplified and accelerated through computationally based techniques and technologies of discriminatory social sorting[1].

The premise that data exist prior to their "collection" and that everything can be rendered as a data source aligns with a wider colonial imaginary of data naturalisation (Ricaurte 2019). But as famously observed by Bowker (2005, 184), "raw data is both an oxymoron and a bad idea". The proposition that data were ever "raw" is one way in which data are framed as independent of context (Gitelman and Jackson 2013, 8). Figured as already delineated into units of information, "raw data" suggests a form of naturally occurring resource awaiting extraction and refinement (Monteiro 2020). Data refinement includes the statistical transformation of traces of past events into predictions of probable futures. The word "traces" here, frequently passed over in the rush to address the proliferating consequences of datafication, is key. Even more than previous documentary media – the written account, the photographic image or recorded video – data in the form of the marks left by digitisation beg enormous questions of interpretive translation. To become the input to analysis through computational statistics, earlier forms of documentation in written accounts or cinematic media require rendering into machine readable form. This process exemplifies what Foucault names "the sign system that linked all knowledge to a language and sought to replace all languages with a system of artificial symbols and operations of a logical nature" (1994, 63). Requisite practices of "data reduction" are fraught with judgements that determine what is made to count. The work of

data's "cooking" begins, moreover, before these processes of translation, in the design of devices for the generation of relevant signals and protocols, and the interests that inform them.

It follows that in analysing knowledge practices we need to start, as Gitelman and Jackson suggest (2013, 3), before rather than with data. In pursuing historical epistemologies of datafication the question is how situated, material conditions of knowledge production constitute their subjects and objects in ways that haunt the technologies through which those subjects/objects are translated as data. Pushing further on the observation that "the logical and ontological boundary of machine learning is the unruly subject or anomalous event that escapes classification and control" (Pasquinelli and Joler 2020), we could say more fundamentally that the limit or boundary of technologies of data generation and analysis is the necessary translation of any specific subject or event into a member of a standardised and normalised class, against which the unruly subject and anomalous event become legible. The aggregated discreteness and abstracted homogeneity of each "datum" is what makes data calculable. Taken together, data erase the multiplicities and noncoherence of the worlds that they claim to represent (Law 2004).

2. Data Weaponization

Nowhere is the apparatus of standardisation and normalisation more lethal than in the operations of warfighting. Based on the reproduction of longstanding architectures of enmity, variously figured and enacted, militarism justifies its existence with a promise of security that is endlessly deferred. In the current moment of frenzied investments in algorithmic intensification (AI), a growing number of commercial providers promise to "optimize the kill chain" through expanding infrastructures of surveillance and the machinery of computational statistics required to render data as "actionable intelligence"[2]. To question the premises of these initiatives in AI-enabled warfighting, we need to start with the "input" to the military machine. This includes a challenge to the objectivist onto-epistemology that obscures the messy and unaccountable operations through which persons, relations, and lives are translated as data.

With the rise of "sensor to shooter" imaginaries there is ever greater need to expand the figure of "the weapon" to include datafication[3]. In the martial epistemologies of data-driven warfighting, data are "captured" from the figurative wilds of a world outside the military machine. The primary organs for data capture are sensors. As Reichborn-Kjennerud (2025, 35) explains:

> In the martial world, sensors can be anything from human interrogators, observers, or spies to satellites, cameras, radars and lidars, acoustic buoys, microphones, wiretaps, or pieces of software that "scrape" the digital ecosystem.

A composite of input devices, the sensory apparatus is figured as prior to and independent of the machine that it serves. In contrast, Reichborn-Kjennerud highlights the entanglement of the means of sensing with "specific historical, political, and technological contexts and imaginaries… undergirded by particular epistemological assumptions" (*ibid.*, 34). These assumptions range from the fit between signals and devices designed for their detection, to the relation between machine-readable traces and their assignment of significance through the categorization of persons, things, and events.

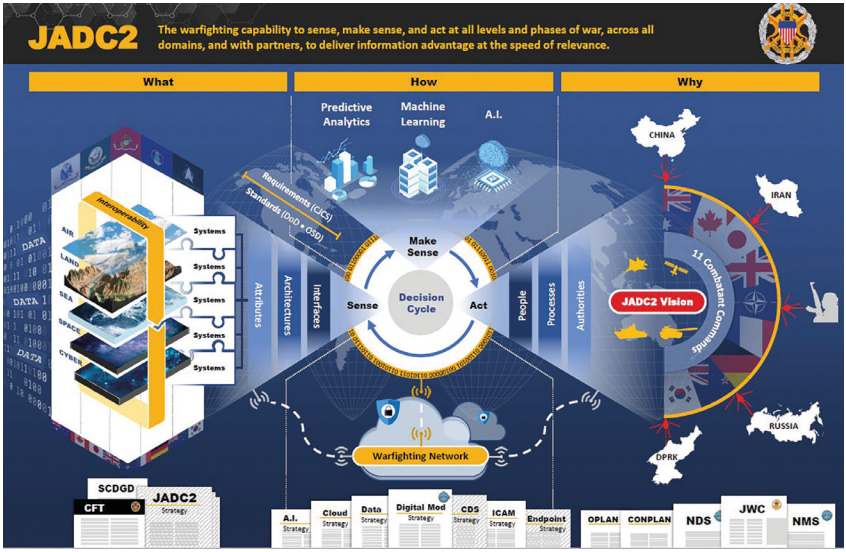

Figure 1.
JADC2 Placemat.

The premise that, rather than being given *a priori*, data are produced through procedures of encoding deeply informed by the purposes that they are intended to serve suggests that we need to look at what happens to the left of data's common diagramming as the input to a machinery of knowledge production. An indicative example might help.

A reading of Figure 1 from the US Department of Defense's summary of the Joint All Domain Command and Control (JADC2) initiative (DoD 2022), titled in a homely spirit the "JADC2 Placemat", is illuminating. We should begin with the leftmost margin of the figure, showing "data" streaming in from the world beyond the frame, channelled into a set of stacks, the general architecture of computing. In this case the stacks correspond to the current sorting of domains of warfighting into territories (air, land, sea, space, and cyber), which together comprise a set of interlocking and interoperable "systems". These input sources are funnelled through the structuring filters of "attributes", "architectures", and "interfaces" to make the results of the data gathering apparatus accessible to decision, an update of the canonical Observe-Orient-Decide-Act or OODA loop. Or more specifically, to the further machinery designed to "Make Sense" of the data through the intercessions of Predictive Analytics, Machine Learning, and the residually floating signifier A.I. The aim of this data processing is the generation of output to be implemented by "People, Processes, and Authorities", comprising the enactment of the "JADC2 Vision" that joins together the 11 Combat Commands to manage the state actors whose positioning as threats provides the justifying grounds for the whole machinery. Floating somewhat ambiguously below and between all of this is the "Warfighting Network", figured as a cross between the iconic tank and the aspirational cloud, all joined together by the dotted lines of electronic transmission. Finally, hovering along the

bottom of the frame is the repository of doctrine and at the top the program's aim, that is "The warfighting capability to sense, make sense, and act at all levels and phases of war, across all domains, and with partners, to deliver information advantage at the speed of relevance".

Realisation of the JADC2 vision has been hampered by the relative ease of building out technologies of surveillance compared to the labour-intensive demands of classifying data so that they can be translated into intelligible information. Military analysts bemoan, moreover, the non-coherence of sources, practices, and infrastructures across the U.S. DoD and eighteen independent intelligence agencies. Into this space, defense technology providers offer further technologies for the "fusion" of data sources into a coherent picture of what is euphemistically named the "operational environment" of warfighting. The leading provider of "battlefield AI" is Palantir, founded in 2003 by Alex Karp and Peter Thiel and named after the "seeing stone" in J.R.R. Tolkien's legendarium. In 2024 Palantir secured a $480 million dollar contract with the US Army for its AIPlatform (AIP), a system for command and control aided by so-called generative AI. More specifically, the AIP offers access to an LLM-based back end through a "dashboard" that includes a ChatGPT style conversational interface[4]. Palantir assures its military customers that the platform has been designed to activate data and models "from classified systems to devices on the tactical edge" to maintain a real time representation of the battlespace.

Consistent with prevailing martial epistemology, the "real time representation of the battlespace" promised by Palantir takes relevant phenomena to be prior to and independent of the military apparatus. On this understanding, Large Language Models are "world models"[5]. However, critical analysts and practitioners do not agree with the premise that the computational statistics used to find correlations over tokens in datasets comprise an understanding of the worlds from which those tokens are derived. An alternative analysis is that "As a technique of information compression, machine learning automates the dictatorship of the past, of past taxonomies and behavioural patterns, over the present" (Pasquinelli and Joler 2020). Rather than disinterested prediction, on this view, data-driven securitisation relies upon and reproduces histories of discriminatory ordering.

3. The Limits of Datafication

In 2008 *Wired* editor Chris Anderson infamously declared the "end of theory" based on the proposition that "the data deluge makes the scientific method obsolete". We might rewrite Anderson's dictum as "the data deluge makes the knowledge that is the prerequisite for its generation and interpretation obsolete", clearly a nonsensical statement. Commonly articulated as "bias", troubled relations between computational models and the worlds that they purport to capture are treated as a failed approximation to an ideal of faithful data. In contrast, the critique offered here begins with an acknowledgement of the ways in which all data involve betrayals of the worlds they render[6]. The acts of standardisation and normalisation that are prerequisites to classification and prediction comprise a limit that extends beyond bias (unless the latter is taken as a general term for all forms of ordering). Such an acknowledgement is not a categorical condemnation of datafication, but a statement of its limits and the criteria for its responsible application.

While the intersections between technoscience (a neologism already marking the entanglement of technology and science) and managerialist militarism are longstanding, the present moment is marked by a fever of new investment in the reanimated promise of optimisation through automation. Pasquinelli (2024, 101) proposes that political economic theories provide crucial foundations for tracing the sociotechnical genealogy of current forms of AI and the specific logics of automation that they follow. In political economic theory, Pasquinelli reminds us, it is a commonplace that technology development proceeds in the service of greater speed, more efficient organization, and lower costs (including crucially for labour). Measurement is an essential component across the board, as is the valuation of labour per unit of time. As Pasquinelli observes: "Metrology has always been a political affair" (*ibid.*, 105).

In the face of the premise that "if it's not in principle measurable, or it's not being measured, it doesn't exist" (Bowker 2013), how might we resist? What might be the virtues and strengths of remaining invisible to the machinery of datafication? One path is traced by Natasha Myers (2020), in her tour through Toronto, Canada's High Park. In Myers onto-epistemology "sentience" (rather than sensors), and *not* knowing, are an ethic and a practice. She explains:

> Not knowing is not about cultivating ignorance or indifference. Rather it is a capacious and humbling space that offers some refuge from the hubris of knowledge systems... that are bound so tightly to colonial conquests, discursive regimes, cultural norms, and moral economies that have too long dictated what is good, valuable, and true. (Myers 2020, 75)

This insight is based on Myers' intimate engagement with the life sciences and the more than human world, but most importantly with knowledge practices committed to sustained engagement with their subjects/objects, aimed at coming to know their worlds from within rather than from a distanced vantage point. This is what Myers terms a process of "becoming sensor" (*ibid.*, 76). Myers encourages us to think about the ways in which the sensoria that we inherit from settler colonialism and capitalist extractivism, rather than revealing the world, render worlds illegible. Following Myers' anthropological STS, might it be possible to disrupt the militarist sensorium "in order to cultivate new modes of embodiment, attention, and imagination, and new ways of telling stories about lands and bodies" (*ibid.*, 78)?

As a technoscience of death, military doctrine is replete with calls for "peace through strength" (the latter read as martial not diplomatic), imagined in the current moment as "real-time, decision-quality information advantage in all warfighting domains" and materialized as "a kill web linking any sensor to any shooter" (Berrier 2025). In a model of circular reasoning, warfighting that is faster, more lethal, and more autonomous is taken as an inevitability, a consequence of the very arms race to which it is posited to be the necessary response. This martial epistemology is materialized in the Israeli Defense Force's imposition of a grid over the territory of Gaza, as a device to monitor, measure, and control the spaces, relations, and movements of people (Figure 2).

We need to ask what kinds of il/legibility these methods of quantification produce. Notably, the Israeli assault on Gaza has shifted the argument for AI-enabled targeting from claims of greater precision and accuracy, to the objective of accelerating the rate of destruction. IDF spokesperson Rear Admiral Daniel Hagari has confirmed that in the bombing of Gaza "the emphasis is on damage and not on accuracy" (Abraham 2023). For those who have been advancing

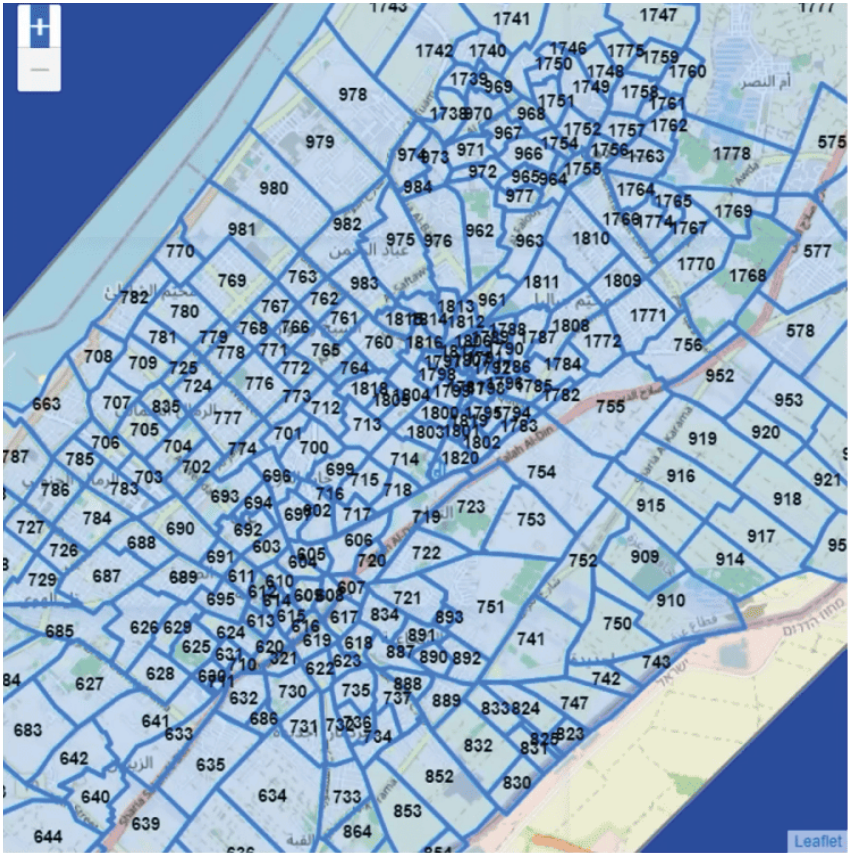

Figure 2.
Grid map of Gaza (see: https://forensic-architecture.org/investigation/assessment-israeli-material-icj-jan-2024).

precision and accuracy as the high moral ground of data-driven targeting, this admission must surely be disruptive. It shifts the narrative from a technology in service of adherence to International Humanitarian Law (IHL) and the Geneva Conventions, to automation in the name of industrial scale productivity in target generation, enabling greater speed and efficiency in killing.

Recognizing the limits of its knowledge practices is anathema to the military project, but those limits exist, nonetheless. In *Cloud Ethics*, Louise Amoore writes:

> When machine learning algorithms segment a social scene, generating clusters of data with similar propensities, everything must be attributed. Yet, that which is unattributable does remain within the scene, exceeding the algorithm's ability to show and tell, as well as

> opening onto a different kind of community and a different mode of being together, of being ethicopolitical. (2020, 25)

While we need to pay attention in the current moment to the enormous expansion of signal generating infrastructures we also, I am arguing, need to attend to that which escapes capture by datafication, for better and worse, from complex social relations to the lived experience of those who find themselves at the center of targeted discrimination and the exercise of violent power. The point of this shift in focus is to destabilise the premises through which technomilitarism perpetuates its logics of rational and controllable state violence, while obscuring its senseless and unaccountable injuries. Rather than further accelerate the speed of warfighting, we need to challenge the premise of an inevitable AI arms race and redirect our resources to innovations in diplomacy and social justice that might truly de-escalate the current threats to our collective and planetary security. Scholarship at the intersections of STS and critical security studies provide invaluable resources for that ongoing project.

Notes

[1] For a recent historically informed analysis of these issues in the time of so-called Big Data, as well as movements of resistance and alternative future making, see Chan 2025.

[2] For media coverage of a relevant warfighting exercise see Henley 2025.

[3] On the "sensor to shooter" concept see Wilkins 2024; on the weapon see Bousquet et al. 2017.

[4] See demo at https://www.youtube.com/watch?v=XEM5qz__HOU.

[5] On standard definitions of "world model" in the AI literature see Mitchell 2025.

[6] See Pasquinelli and Joler 2020. For a lucid unpacking of the multiple senses and sources of bias and why problems of discriminatory profiling cannot be "solved" technically, see Crawford 2017.

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Governing (Socio)Materialities at the Intersection of STS and Internet Governance: Hybridization as a Product of Necessity

Samuele Fratini
University of Padova

Corresponding author
Samuele Fratini
University of Padova, Department of Philosophy, Sociology, Education and Applied Psychology
Piazza Capitaniato 3, 35139, Padova, Italy
✉ samuele.fratini@phd.unipd.it

Università della Svizzera Italiana, Institute of Media and Journalism (IMeG)
Via Buffi 13, 6900, Lugano, Switzerland

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Abstract

In the last years, a rich literature has emerged at the intersection of Internet Governance as a field of study and Science and Technologies Studies. This *Scenario* retraces the complex social and technical historical developments that favored the integration of these two fields. This hybridization process can be described as a "product of necessity" – a descriptive label highlighting how the integration of STS concepts responded to evolving analytical challenges. It is delineated through a reconstruction in three phases, whose aim is to describe key intersections and to capture the ongoing trends within the Internet Governance community. The analysis shows that the first "turn to infrastructure" (Bowker et al. 2010) in the 2010s oriented scholarly interest towards materialities and protocols of the Internet as information infrastructure, thus favoring the study of its "control points" (Musiani et al. 2016). On the other hand, today's focus on geopolitical competition and informal governance practices provokes renewed interest in the social and situated components of the Internet infrastructure, such as imaginaries, contestations, and reappropriations. The *Scenario* finally discusses possible future approaches and research interests.

Keywords

internet governance; science & technology studies; digital geopolitics; information infrastructure; digital sovereignty.

1. Introduction

At first glance, the Internet is the perfect object of analysis for the toolbox offered by Science & Technology Studies (STS). It is a distributed system that has come to be imbricated with almost every human activity, and whose social integration makes it often disappear in the background, within the invisibility of taken-for-grantedness. In a word, the Internet is an infrastructure (Mongili and Bowker 2014). It would be fair to assume that Internet Governance (IG) – the research field that is specifically concerned with analyzing the Internet from any angle – configured itself as a branch of the larger Infrastructure Studies tradition.

Nevertheless, despite the convergence between IG and STS being extremely productive, it is a relatively recent phenomenon, being no more than 15 years old. What are the reasons for this lateness in the appropriation of STS by Internet governance studies?

This *Scenario* retraces the complex developments that have increasingly put STS and IG on the same track. It does so by entangling the changes of paradigm in the IG academic community within a broader scenario that accounts for the most significant technological innovations and sociopolitical events. The result is a reconstruction in three phases (Table 1), whose aim is to describe key developments and to capture the ongoing trends within the IG community to indicate possible future research directions and approaches. It is worth mentioning the difficulty – and sometimes the impossibility – of separating IG as a field of practice and IG as a field of study. While the former gathers those who are directly involved in the governance processes, the latter indicates the scholarly community concerned with analyzing the Internet and its governance. Such academic family took institutional shape during the 2006 GigaNet (Global Internet Governance Academic Network) and became increasingly wide and organized. While the present *Scenario* always refers to the community of study, it also seizes the opportunity to highlight how the IG research toolbox has been constantly reshaped by key events that affected the community of practice. A prominent example emerging in the analysis is the growing privatization of governance functions (community of practice) which set the stage for the infrastructural turn in IG-related research (community of study).

We show how the IG scholar community in its seminal stage was characterized by an institutional understanding of governance, focusing on the formal actions and processes undertaken within specific international venues, with the ICANN (Internet Corporation for Assigned Names and Numbers) playing a central role. The hybridization with STS came up in the early 2010s and can be described as a product of necessity. We use this term as a descriptive device underscoring the scholarly need to develop new analytical tools to decipher both the increasing privatization of the governance of the Internet (infrastructural turn) and the effect of the latest sociopolitical processes (social turn). Rather than a fully-fledged theoretical construct, the "product of necessity" helps capture how shifts in the Internet governance landscape prompted methodological adaptations among scholars. This concept also shows how changes and challenges affecting the community of practices rearranged the research toolbox of the community of study.

The infrastructural turn in IG was the recognition that a complex sociotechnical system such as the Internet is not only governed by institutional authorities, but by every actor that participates in its modular, distributed, and hybrid shaping. In a historical moment where the Internet is contested by a large variety of social formations (Badouard 2017), this recognition means opening Pandora's box, as it presumes the identification of each of these sociotechnical communities as performative – thus governing.

On this basis, we envisage a new theoretical and conceptual arrangement in today's IG that complements the infrastructural approach with renewed attention to informal acts of governance, enhanced geopolitical competition, and new public-private relationships. We argue that this approach represents the natural evolution of continued integration of STS and IG because it allows for accounting for the value of lay users, social movements, and invisible workers as governing subjects. This trend is well epitomized by the choice made by Uhlig

and colleagues (2021) to depart from the traditional OSI (Open Systems Interconnection)[1] layered representation of the Internet to propose a different model with a top "social" layer, thus accounting for the role played by states, companies, and lay users. It also constitutes a valuable analytical key to analyzing how existing power relationships unfold and materialize in a fragmented scenario of intense and continuous contestation over values and sovereignty.

The *Scenario* concludes by asking whether the conceptual enlargement of the governing subjects brought about by the STS scholarships, as well as the inclusion of other social sectors in the field of IG are provoking further boundary shifts in the discipline.

2. The Institutional Approach: The Birth of Internet Governance Among International Bodies

IG as a field of research saw the light during a process of conflict and stabilization over the transformation of the Internet into a mass public medium (Mueller and Badiei 2020). Its massification concerned the structuration of new governance solutions and ended up generating a class of international bodies responsible for regulating the Internet as a public medium. Before the '90s, the Internet was mainly a tool in the hands of the US military and a small, but growing, group of academic institutions[2]. As repeatedly narrated, it was the product of the American acceleration of scientific innovation undertaken under the Eisenhower Administration in the context of the Cold War (Abbate 2000). The Internet's development was funded by the Pentagon and coordinated by the ARPA (Advanced Research Projects Agency, now DARPA).

In that context, the Internet was expected to provide a distributed system of data storage and communication capable of outliving a Soviet nuclear assault. The achievement of this goal experienced a significant leap forward thanks to the creation of the TCP (Transmission Control Protocol) by Vinton Cerf and Robert Kahn in 1974, which became an official standard in 1980. While the protocol handled the segmentation of information into packets, the management of delivery functions was complemented by the Internet Protocol (IP), which assigns a unique numerical code to each network node. These codes are turned into human-readable names within the Domain Name System (DNS).

The process of massification of the Internet occurred in the '90s and was the result of a multiplicity of factors, such as the development of the World Wide Web in 1989-1993 and the publication of a freely available web browser software in 1991 (Schafer and Thierry 2018). However, the decisive process was the privatization of the Internet backbone undertaken by the Clinton Administration, officially culminating with the assignment of the administration of the DNS to a newly created nonprofit corporation based in California in 1998: the Internet Corporation for Assigned Names and Numbers (ICANN). The Internet stopped being a tool of the US military-industrial complex, as ICANN was incorporated under California law (Balbi and Magaudda 2018). Nevertheless, it kept decisive relations with the US government, which continued to exercise formal oversight. This outcome was subject to vocal contestation since the beginning (Froomkin 2000).

The American decision generated different responses from all over the world, and the resulting institutional debate represented the embryonic stage where IG as a field of study was

generated. In particular, countries of the BRICS (Brazil, Russia, India, China, South Africa), already existing international organizations such as the International Telecommunication Union (ITU), and, in the first stage, the European Union opposed the self-regulation principle as the rationale behind the incorporation of the ICANN. As outlined by Pohle and Santaniello, the US administration, corporations, and technical community were components of a "self-regulation" coalition, while the others were an "internationalist" one (2024). This controversy mainly occurred during the UN-hosted World Summit on the Information Society in Geneva (2003) and Tunis (2005) and mainly addressed the Internet's resources that ensure its technical functioning and who should have been entitled to their administration. Prominent resources were domain names, the root server system, and IP addresses. The result of this debate was the institutionalization of multistakeholderism as governing principle and hegemonic discourse (Santaniello 2021) and a standardized definition of IG as:

> the development and application by governments, the private sector, and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programs that shape the evolution and use of the Internet. (WGIG 2005)

Both the multistakeholder model and the definition of IG can be seen as a compromise of the two conflicting positions (Malcolm 2008).

What resulted from this decade-long process was also the emergence of some non-national and non-binding institutional venues as the main *loci* where IG was to be practiced and the continuous, open, and neutral functioning of the Internet as the main goal. This played a major role in defining the field's objects of analysis, its conceptual toolbox, and the academic background of the first scholars who tackled it. The first relevant objects of analysis for those pioneer IG scholars were those very same international institutions and forums, often with a focus on the formation and stabilization of their internal structures (Kleinwächter 2004; 2006). Particularly significant works have analyzed their crystallization into institutionalized hegemonic discourses (Chenou 2014) and ideologies (Simpson 2004). The most analyzed institutional venues are the United Nations Internet Governance Forum (IGF), the ICANN, regional Internet registries (RIRs), and the organizations in charge of setting the logical and hardware standards of the Internet, e.g., the Internet Engineering Task Force (IETF) or the Institute of Electrical and Electronics Engineers (IEEE).

A second analytical dimension relates to the definition of the principles that drive these institutions' activities, such as openness and network neutrality. A special mention is to be made for the guiding principle of multistakeholderism, which has remained a relevant object of debate until today. Officially included in the IG language with the establishment of the Working Group on Internet Governance (WGIG) in 2003, it initially acquired a dogmatic status, as it prescribed the inclusion of governments, the private sector, and civil society in the governance processes. It was for this reason welcomed as the decentralized and bottom-up mode of governance that the Internet deserved (Doria 2014). Today, several contributions gained a more critical approach to multistakeholderism, often presented as fiction (Hofmann 2016), as a discursive tool to reproduce dominant power relationships (Palladino and Santaniello 2021), as an inconsistent institution (Raymond and DeNardis 2015), or as characterized by economic entry barriers (Cogburn 2006).

A third academic debate was preoccupied with the legal and jurisdictional consequences of the standardization of the Internet's protocols. Topics such as intellectual property, the circulation of illegal material (McIntyre 2010), and user surveillance (Mueller 2004) triggered a prolific debate over the relations between laws and digital technologies (Lessig 2000) and how states and governments could exert their legal authority (Goldsmith and Wu 2008).

It is worth noticing that, although the centrality of said international institutions is evident, it was already challenged by the need to include other objects and actors. Brousseau and colleagues, e.g., pointed out the difficulty of defining IG, and the need to address the strict relationship between technical and political communities, analyzing narratives and practices of developer and user communities (2012). In this context of the negotiation of the disciplinary boundaries and tools, the definition provided by Jeanette Hofmann of IG as a "regulative idea in flux" (2007) attracted particular interest. Hofmann assumes the institutional process of formation of a governance structure leaves a "regulatory void" that intertwines with the desire for more actors to be involved in the governance processes. For this reason, IG emerged as a field in continuous mutation.

3. The Infrastructural Turn in IG: A Product of Necessity

The opportunity to expand the boundaries of IG studies through the hybridization with much STS scholarship came with the increasing importance of the phenomena of privatization of the governance of the Internet (DeNardis 2012). In a way, private actors have always been central in the proper functioning of the Internet: they operate the wired and wireless technologies underlying the Internet, participate in standard-setting organizations, and develop the main applications that channel information across users. Nevertheless, as observed by DeNardis, their role in "determining freedom of expression and carrying out law enforcement functions" has heightened at the end of the 2000s. They have been increasingly coopted by nation-states to influence financial flows, carry out technical outages, and domain name seizures.

Those years were also characterized by the rise of an unprecedented kind of private actor: platforms. While traditional telecommunication companies played key roles, such as that of Internet Service Providers (ISPs), platforms such as Google and Amazon profited from their network power to grow as actual infrastructures (Plantin et al. 2018). Instead of developing as bare marketplaces or content operators, they created their own infrastructural capitals, e.g., data centers with storage space and computational power to sell, and submarine and terrestrial fiber optic cables developed in public-private consortiums (Starosielski 2015; Zájacz 2019). Private platforms became thus indispensable for the Internet to work – and in fact, they changed the way it works (Terranova 2022) – for other platforms to operate, and for national governments to enforce their laws.

On the academic side, these changes in the modes of governance required an analytical adjustment to be grasped. This is the context where the so-called "turn to infrastructure" took place as a product of necessity. This characterization should be understood descriptively, pointing to a pattern of adaptive integration rather than proposing a generalizable theoretical model: the political cooptation of private infrastructures provided a theoretical rearrangement

of the field based on the assumption that "material arrangements are power arrangements" (Musiani et al. 2016). Understanding these power arrangements implied reinforced attention to infrastructures as large collections of material necessary for human organization and activity. While this may be of little novelty for STS specialists, it led several IG scholars to reconsider the conceptual foundations of the field. While several works crossing STS tools and IG objects of research had already seen the light (e.g., Manovich 2001; Star and Bowker 2002), they received little attention because of dominant approaches in the field that were rooted in political and legal sciences. In the studies on the Internet, the infrastructures became particularly useful as "information infrastructures" (Bowker et al. 2010), implying enhanced attention not only on materialities, but also on the way information is constructed, treated, and conveyed. In the context of the Internet, this allowed us to conceptualize the protocols, repositories, and languages through which data are treated.

As infrastructures became the central object of concern for IG scholars, they also became the foundation for a new perspective, commonly referred to as the "infrastructural approach" (Starosielski and Parks 2015). In this first theoretical hybridization, the academic focus was mainly captured by the material components of infrastructures, regarded as the *locus* where politics unfolds. They were conceptualized as "control points" (DeNardis 2009) – technical components to harness to carry out political decisions. Of course, the reflection behind this concept was heavily influenced by the traditional STS literature on Actor-Network Theory and the agency of non-human actors as "mediators" (Latour 1992). Furthermore, since the focus on materiality was largely functional to understand the ways political entities were coopting it to pursue their ends, scholars were forced to cope with the complex intermingling of state and designers' agency. The analysis of how human actions unfold at a material level revealed the usefulness of the concept of "inscription" to highlight the situatedness of the human shaping of technology (Akrich 1992).

Another significant contribution of the STS scholarship is the attention developed by IG scholars for controversies (e.g., Haraway 2016). Although it was already present in many works adopting the institutional approach (e.g., Deibert and Crete-Nishihata 2012), the concept of controversy was deeply reconsidered and accepted as an analytically productive moment that allows for invisible infrastructural components to be noted, power relations to emerge, and the meaning-making systems of relevant social groups to be studied (van Eeten and Mueller 2013).

The centrality of controversies is also linked with the reconsideration of what governance is. In many STS-informed contributions, the salience of distributed and hybrid agency meant the necessity to ponder which acts are acts of governance. At this point, the governing institutions that were reified by political and legal scholarships started being imagined as "seemingly stable arrangements of IG arise from the chaos of taken for granted, mundane, and often apparently unrelated activities of Internet design, regulation, and use" (Epstein et al. 2016), just as "scientific order is constructed out of chaos" in scientific labs (Latour et al. 1979). Re-considering the situated construction of technology and assuming governance as coordination constituted a driver for deeper reflections on the notion of normativity. According to Musiani, IG is to be understood as a "normative system of systems", made up of discrete and hybrid agencies that intersect according to different value systems (2024). In her argument, the author draws on the concept of "ordering" proposed by John Law (1992) in the realm of the sociology of translation

(Latour 2005) to account for the unstable and ever-changing product of hybrid networks of actors, shifting narrative, and contrasting value systems. This concept has been also adopted in other similar works (Brousseau et al. 2012; Flyverbom 2010; Ziewitz and Pentzold 2014).

Such deep reassessments of normativity have been particularly useful in the study of standard-making and standard-setting. As the interest of IG studies in standardization processes was already strong with official standard-setting organizations (e.g., IETF, IEEE), the ground was breeding to include other actors and situated aims in the definition of standards. Insightful works have debated, e.g., the power dynamics underpinning standard-making processes (ten Oever and Milan 2022) the geopolitical use of standard-setting organizations (Nanni 2021), or the making of informal standards outside institutional venues (Ermoshina and Musiani 2019). Furthermore, other scholars tried to retrace the dynamics of these complex ordering processes through the STS concept of *black box*, i.e., intricate combinations of technical and non-technical changes, political discourses, sociotechnical imaginaries, and norms. This is the case in Pohle (2013; 2016), who used the concept to analyze institutional coordination issues from a discursive perspective, and in Fratini and Musiani, whose work highlights the performative nature of the imaginaries, discourses, and practices (de)legitimizing data localization measures (2024).

4. The Social Turn: Digital Sovereignty, Geopolitics, and Informal Governance

Today, the role of private actors in IG has become a given. However new global conditions have made new sociopolitical processes central among IG scholars. In particular, the multiplication of military conflicts, the regulatory activism of many governments (Flew 2024), and the unfolding of digital-related contestations around privacy, surveillance, and disinformation (Gros et al. 2017) have raised new academic questions, together with a renewed re-articulation of the hybridization of STS and IG and open debated about the boundaries of the field. We call this latest hybridization step a *social turn*, as it is characterized by the need to understand the effects that said social and political changes have on digital technologies and their governance. This phase is also shaped by the growing interest in and use of concepts related to imaginaries, discourse, and the performativity of informal governance practices.

The study of how states (or the EU) try to assert their control over digital infrastructures, the reasons for doing it, and the hybrid actors involved is usually categorized under the label of digital sovereignty (Couture and Toupin 2019; Fratini et al. 2024; Pohle and Thiel 2020) and involves deep attention for those regulatory and bureaucratic mechanisms that shape technology. A brilliant example among STS scholars is represented by the work of Brice Laurent on the EU infrastructural regulations (Laurent 2022). Among IG scholars, digital sovereignty has become a first-relevance topic just as multistakeholderism was. Pohle and Santaniello, e.g., talk about a new discursive order (2024), while Thumfart defines digital sovereignty as a new normative paradigm (2021). A relevant STS concept that started being adopted in this research strand is that of *sociotechnical imaginary* (Jasanoff and Kim 2015). Since governmental agencies and regulators around the world became proactive in reshaping technology, several authors investigated their expectations connected to the Internet and the digital (e.g., Monsees and Lambach 2022).

This concept has been also subject to re-elaboration and criticism. A remarkable example is the concept of *infrastructural ideology* proposed by Maxigas and ten Oever (2023) by expanding the work on *network ideologies* carried out by Bory (2020). The objective was to better highlight the power relationships that are produced and reproduced in the process of materialization of the discursive elements captured by the concept of sociotechnical imaginary.

The work on digital sovereignty is intimately connected with the rising geopolitical approaches to IG. Just as in the case of the turn to infrastructure, the geopoliticization of IG can be understood as a product of necessity related to the uses (and abuses) of the Internet infrastructure in times of war and enhanced interstate competition. A set of works in this regard is preoccupied with the analysis of the geographical dimension of the Internet from an infrastructural perspective in times of conflict. Some examples are provided by Fontugne and colleagues, who adopted an original approach combining network measurement and qualitative interviews to assess the degree of interdependence between Autonomous Systems (ASes) in Crimea after the Russian occupation (2020). Similarly, Salamatian and colleagues analyzed how Iran has been able to selectively cut off Internet traffic for geopolitical purposes by leveraging the Border Gateway Protocol (BGP), i.e., the protocol responsible for traffic routing between regional ASs (2021). Finally, ten Oever and colleagues used the same approach to assess the effect of European sanctions against Russia (ten Oever et al. 2024). This debate links with the longstanding argument around the possible fragmentation of the Internet (Drake et al. 2016; Mueller 2017), which some authors managed to handle through a more infrastructural perspective that accounted not only for materialities and state policy, but also for the agency of corporations, users, and civil society (Rossi et al. 2024).

A third prolific dimension relates to the effects of the scandals and contestations that burst in the 2010s around digital technologies and their use or misuse, e.g., in the case of the Snowden revelations or the Cambridge Analytica scandal. In the field of Critical Security Studies, Monsees delivers an important contribution to the contestation of surveillance

	Institutional Approach	***Infrastructural Approach***	***Social Approach***
Object	How IG is politically and legally understood and enacted	How IG is materially achieved through design choices and material leverages	How non-institutional actors negotiate and (de)legitimize IG
Actors	International and national public institutions and governments	Corporations, designers, technological artifacts	Users, social movements, collective actions, invisible workers
Theory	IG as a set of policies and strategies	IG as a material arrangement and design choices	IG as a hybrid black box

Table 1.
The three phases of Internet Governance.

technologies whose core thesis postulates the connection between modes of surveillance and modes of contestation (2020). According to the author, diffuse surveillance generates diffuse forms of contestation, with key technologies such as encryption becoming arenas of political struggle. The rising interest in cryptography can be observed in a variety of other works (e.g., Ermoshina and Musiani 2022; West 2022). The analysis of user agency also stimulates STS' proclivities for considering the situatedness of values that were initially analyzed only in institutional sites, e.g., privacy and openness. In this regard, Mager conducted an in-depth analysis of how search engine developers counter-imagine hegemonic search (Mager 2023) and Friedewald and colleagues observed the perception of surveillance, privacy, and security among different social groups in Europe (2017). This links with a flourishing interest in alternative and contestational technological production (e.g., Fratini 2024; Spencer and Pizio 2023).

In this phase, IG emerges as a hybrid black box itself, because the new historical conditions call for renewed academic interest in distributed practices of reappropriation, contestation, and informal governance in contexts of (geo)political conflicts.

5. The Debate on the Disciplinary Boundaries: A Further Enlargement?

This last phase shows an unprecedented interest in other components of the infrastructural perspective that received less attention in the previous phases. If the first "turn to infrastructure" was mainly animated by the interest in the material components and "control points" of the Internet infrastructure, the present moment is characterized by a beefed-up consideration for the discursive, imaginative, and practical dimension of Internet Governance. Multilayered contestations, regulatory domestications, and geopolitical frictions stimulate the reflection on the social construction and steering of technology. These processes investing the community of practice opens many debates in the IG as a field of study, e.g., over which actors are governing actors, with evident consequences on the disciplinary boundaries of IG.

An ongoing debate (even among STS-informed scholars) is related to the consideration of users – with their appropriations, subversions, or re-imagination – as governing actors, participating in distributed innovation and infrastructural maintenance. On the one hand, DeNardis contests this perspective, affirming that IG should be distinguished from user practices (2014). On the other hand, other authors argue for their inclusion (Musiani 2015), and the very Internet architecture is being rethought considering these new actors' relevance. Uhlig and colleagues, in a well-written explanation of how the Internet works, depart from the traditional OSI layered model used to illustrate the Internet infrastructure by connecting an additional top layer labeled as the "social layer", that also includes citizens and lay users (Uhlig et al. 2021). This conceptualization of user agency can open up new ways of assessing their governing capabilities (e.g., Fratini and Musiani 2024). This ongoing debate certainly highlights the extent to which multistakeholderism was influential in shaping the boundaries of IG through its tripartite inclusion of governments, the private sector, and civil society.

Finally, the inclusion of new governing actors, the attention to informal practices of governance, and the geopolitical-related salience of other sectors, such as the industrial one (e.g., chips' production), in the governance of the Internet stimulate the reconsideration of the

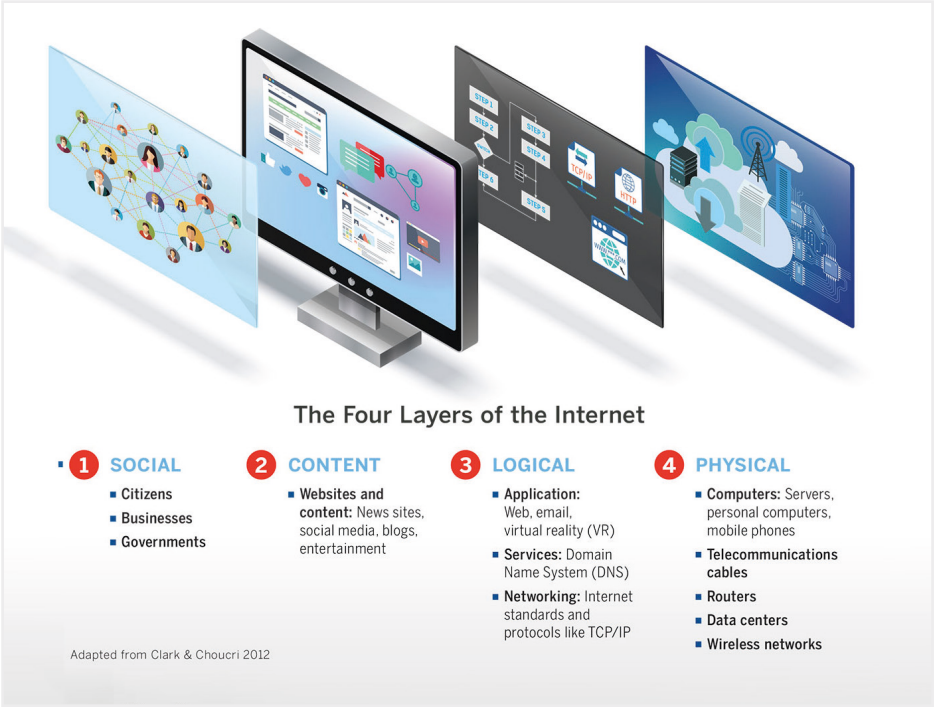

Figure 1.
Internet layered model that includes a social layer.

field boundaries. According to Mueller and Badiei, IG should be kept separate from other forms of governance, as it indicates an interest in the protocols and the principles governing the Internet's functioning (2020). Nevertheless, as DeNardis aptly notices, "there is no longer a logical demarcation between native digital companies and non-tech companies" (2020), which emphasizes the question of the convenience of distinguishing between digital and non-digital. Finally, the attention that several IG scholars have been increasingly devoting to other actors and fields is hard to deny, and the distinction between strict and broader Internet Governance is blurrier than ever. Due to the growing IG interest in the sum of societal fields gravitating around and shaping the Internet infrastructure, it is reasonable to expect further enlargements of the field's boundaries.

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Notes

[1] The open systems interconnection (OSI) model is a layered representation of the Internet whose clarity made it become a traditional means to explain how the Internet works. Available here: https://www.cloudflare.com/en-gb/learning/ddos/glossary/open-systems-interconnection-model-osi/.

[2] Even if there is an increasing amount of STS scholars producing thorough analyses of local, alternative, or failed versions of the Internet with an historical perspective (e.g., Schafer and Thierry 2017).

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Crisis Vision: Race and the Cultural Production of Surveillance

by Torin Monahan (2022) Durham, Duke University Press, 228 pp.

Andrea Mubi Brighenti
University of Trento

The pervasiveness of surveillance in contemporary society is attested by not only its technological deployment but perhaps even, more poignantly, its infiltration of the contemporary imagination. The imaginary is, indeed, a constitutive terrain for science and technology, towards which scholars and researchers are increasingly turning their attention – and, by doing so, they can meet those professionals of the imaginary who are the artists.

In *Crisis Vision*, Torin Monahan contributes to this discussion by critically examining the rise of surveillance-themed artworks, or what might be called "artveillance", over the last couple of decades. The many "trappings of visibility" – to speak Foucault-like – are discussed specifically vis-à-vis the concerns – shared by both the author and many of the artists discussed – that surveillance may increase social inequalities and systemic racism.

The book opens with two artworks taken as prototypical of two extreme positions: Banksy's *One Nation Under CCTV* (2008), on the one hand, and Ai Weiwei, Herzog and de Meuron's *Hansel & Gretel* (2017), on the other. Whereas Banksy's piece embodies an Orwellian denunciation of the totalitarian danger inherent in surveillance society as a whole, Ai's installation offers a playful approach that caters to contemporary narcissism while at the same time evoking a "new-prudentialist" stance that emphasizes personal responsibility in protecting one's own personal data.

Both approaches, the universalist and the personalist, argues Monahan, are insufficient to grasp the whole scope of critical surveillance art. Although it's perhaps not entirely fair towards Banksy to charge him for failing to address issues of social inequality, racialization and violence – as these indeed represent major topical interests of the British artist – the author has a point in highlighting the existence of many different artistic takes on surveillance.

Critical surveillance art can be defined as a thread in contemporary art revolving around the exploration and the criticism of the politics of visibility sustained by surveillance, exposing the visibility regimes in place, and agitating the public debate around them. This form of art inherently entails politicization. Monahan argues that critical artwork produces assessments of what he calls "crisis vision", defined as "a destructive way of seeing that amplifies differences among individuals and inspires the scapegoating of those marked as Other" (p. 12).

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Against crisis vision, critical surveillance artworks seem to gesture towards resistance through the creation of spaces of opacity, although the author also warns that many artworks themselves possess their own blind spots, often oblivious as they are of the larger historical and societal dimensions of racial domination and oppression that predate current technologies, and yet crucially prolong into them. A similarly restricted framework is at play in the type of artveillance that can be placed under the rubric of "avoidance". Given that surveillance technologies are most often oriented towards identifying subjects, various artistic operations seek to disrupt the process of identification, including hiding (becoming transparent of invisible to the system) and masking (passing for someone else by camouflaging). These solutions Monahan judges to be hyper-individualized and consumer-oriented adaptations to surveillance, rather than an actual challenge to it.

A second approach addresses transparency and its pitfalls. Surveillance, the author reminds us, is technically grounded in data collection and archiving, which digital technologies have exponentially multiplied. The systemic requirement of "transparency" effectively rhymes with such such enhanced scrutiny over people through data archiving and retrieval. In this respect, artists such as Trevor Paglen, Josh Begley, Paolo Cirio, Kai Wiedenhöfer, Andrew Hammerand and Hasan Elahi, have all variously worked towards creating counter-archives that trouble archival certainty, rejecting the narrative of rationality projected by surveilling agencies, and eroding – or, at the very least, instilling the seed of doubt in – the everyman's faith in them.

The third framework the author labels "complicity": it gathers artworks that focus on the "ways of being seen" (to paraphrase John Berger) enabled by surveillance. Artists such as the *#NotABugSplat* collective, Jakub Geltner and Dries Depoorter, question the nature and the outcomes of drone vision, satellite imagery and CCTV footage through either sarcastic or surreal commentary. Often, they deploy, re-deploy or recycle surveillance systems and their data to provoke the audience as regards the lay person's systemic complicity with the logic of surveillance.

Throughout the book, Monahan advances the argument that the surveillance society is intertwined with structural violence; and violence is actually a fourth interpretive framework, picked up by artists such as Marco Poloni, Hanne Nielsen and Birgit Johnsen, Santiago Sierra, Phil Collins, James Coupe, Paolo Cirio and Charlotte Haslund-Christensen. However, the author appears somewhat more critical of this framework, highlighting several gaps and inconsistencies in artworks deploying such a lens, which – he writes – "leans upon the promise of liberal systems of governance to live up to their mythology of equality, fairness, and justice" (p. 113).

"Rupture" represents a final framework, where crisis vision is finally targeted more directly: artists working in this direction deliberately bring to the foreground the enduring legacy of racial terror and trauma. In the works and performances by Hank Willis Thomas, Dread Scott, The Mirror Casket Project collective, JR, and the choreographer Will Rawls, the author sees a way to address more directly the racist underpinnings of the surveillance apparatus, effectively disrupting the dominant narrative. The most promising direction that emerges in this respect seems to be the one that goes towards creating new spaces of "opacity", a category the author draws from the Martinican poet Édouard Glissant.

Overall, *Crisis Vision* offers an informed and sustained discussion of contemporary artworks dealing with topics of surveillance, inequality, racism and violence. Although there is certainly a degree of idiosyncrasy in the way Monahan groups the artists and the artworks reviewed in his text, and although sometimes his criticisms might not be entirely fair towards the artists themselves, *Crisis Vision* is a brilliant book that powerfully demonstrates how surveillance can be satisfactorily analyzed only through a culturalist lens capable of re-embedding the technologies within the ideological hotbed out of which they have sprung. In conclusion, this book might prove relevant to STS, albeit in the very indirect manner of indicating the cultural coordinates within which a range of new technologies are deployed and can accordingly be questioned.

Quotidien politique. Féminisme, écologie, subsistance

by Geneviève Pruvost (2021) Paris, La Découverte, 392 pp.

Silvia Bruzzone
Mälardalen University

The book is the result of 10 years of research conducted by Geneviève Pruvost, sociologist of work and CNRS (Centre National de la Recherche Scientifique) research director. *Quotidien politique. Féminisme, écologie, subsistance* focuses on the subsistence perspective and, in particular, on ecofeminism as a way to think about political engagement and societal change. As mentioned in the introduction, the term subsistence refers to ordinary practices connected to the conduct, development and maintenance of our existence, such as producing food, fabricating clothes, ways of living, taking care of one's own health, loving, working, giving birth and raising kids, learning, and so on. This concept brings the focus of attention on the relations of interdependence between the human and material worlds which shape our everyday life (*le quotidien*) and become the object of political mattering. The study is an exploration of "rural alternatives" in the search of autonomy, drawing on ethnographic material collected in various (anonymized) regions of France.

The book unfolds in nine chapters, each divided into short subchapters. In the first two chapters – "Critical daily life" (*Quotidienneté critique*) and "Facilitated daily life and counter-system of professions" (*Quotidienneté facilitée et contre-système des professions*) – the focus is on different perspectives on subsistence intersecting marxism, feminism and ecology. The author draws on scholars – such as Henry Lefebvre, Henri Mendras and Ivan Illich – who have shown that the gradual passage from peasant societies to the capitalist ones brought about a radical change in the way basic needs are met. These transformations led to the loss of vernacular knowledges related to subsistence, the scientification and specialization of work and of knowledge, the segmentation and outsourcing of tasks within the capitalist system. As a result, the relationships of interdependence typical of rural communities were disrupted in favor of deterritorialized forms of production aimed at boosting consumption.

The following three chapters – "Feminism of subsistence: the matricial base of primitive societies" (*Féminisme de la subsistance: la base matricielle des sociétés premières*), "From subsistence work to domestic work" (*Du travail de subsistances au travail domestique*) and "'Housewifization' and capitalism" (*«Housewifization» et capitalisme*) – explore the core of the feminist subsistence perspective. The author focuses in particular on ecofeminism developed, between the 1970s and 1990s, by Francoise d'Eaubonne (1974/2020) – who introduced the

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term – as well as by the scholars from the Bielefeld School – Maria Mies, Claudia von Werlhof, Veronica Bennholdt-Thomsen – and by Vandava Shiva, Maria Dalla Costa and Silvia Federici. Even though not all of the above-mentioned scholars would recognize themselves under the label of "feminism of subsistence", they share the claim that the rise of capitalist industrial societies had a specific gendered dimension, grounding in exploitative relations of women, as well as of other beings and natural resources. Ecofeminism scholars' accurate historical reconstruction of those transformations – starting from pre-historical matriarchical societies and accelerating from the peasant to the industrial societies – highlight the devaluation of women's work within the capitalist system, their progressive confinement and domestication, the loss of knowledge and skills connected to women's tasks (for example in agriculture, water management, healing practices, birth control, food conservation). As the author claims:

> subsistence feminists have shown that the reduction of the household to the heterosexual couple has disrupted the logic of mutual aid that prevailed in extended local communities, which has allowed the rise of equipped domestic work – the keystone of capitalist development. (p. 281, *my translation*)

For ecofeminists, understanding the role of subsistence relations and transformations from peasant to capitalist societies is a focal point of political mattering and for building possible alternatives. In this regard, the difference between subsistence and domestic work is highlighted by ecofeminists. The domestic work is primarily linked to reproduction and to supporting consumption. In contrast, subsistence tasks, which have not disappeared in capitalist societies, are now outsourced to others (machines, experts and other humans working on our behalf) and purchased as services – typically for producing food, cloths, taking care of our beloved ones – on a global scale. The outsourcing of subsistence tasks leads to new forms of exploitation – of environmental resources, women and other marginals (animals, workers) – as well as to the creation of invisible and overexploited jobs worldwide.

Pruvost highlights how feminism of subsistence distinguishes itself from the broader feminist movement of the 1970s, which brought an anti-essentialist perspective on women. Compared to gender theories, ecofeminist researchers are less focused on the fluidity of gender and more concerned with the specific conditions and exploitative relations faced by women in the global South. These factors, together with the dominance of feminist scholars primarily raised in cities – in contrast to ecofeminist scholars who often have a rural background or have a specific focus on the rural experiences – help to explain the diminished academic focus on subsistence issues. A distinction can also be made between ecofeminism and queer and STS feminist theories (such as Donna Haraway's): while these latter share a critique of the nature-culture divide, ecofeminism is particularly critical of the lack of attention given to the conditions of comfort associated to the development and role of technology in modern societies.

Local and regional experiences are then explored – in the chapter "Local communities and inter-subsistence" (*Communautés vicinales et entre-subsistance*) – as a potential alternative to break the production-consumption divide typical of capitalist industrial relations. The subsistence question has been in fact addressed by movements such as bioregionalism, municipal libertarian and ecopolis, which – while focusing on different forms of decision-making, level

of autonomy and of technicity – view local initiatives and democracy as a means of social change. However, as Pruvost claims, none of these political theories and perspectives focus on gender relations and forms of exclusion. In this sense, ecofeminist theories offer a real alternative centered on the role of women, as an oppressed category and susceptible to be awakened. In d'Eaubonne's radical view, it is not possible to reform the capitalist wage-earning society, while the priority is on the overcoming of the separation of production-consumption relations, the re-appropriation of the knowledge needed for self-production and the creation of autonomous living communities. The critique of heterosexuality as societal norm as well as the power of motherhood is also constitutive of her thought. In this regard, as Pruvost claims, the feminists of the Bielefeld School have a less-utopian program and draw inspiration from the observed experiences brought in particular by peasants and indigenous women from the global South. Common traits among ecofeminist scholars are the restauration of vernacular knowledge and subsistence practices, the cessation of exploitative and pollutant industrial activities, the reconnection to a *milieu de vie* and to active engagement, the urgency of the ecological cause, the complementarity of tasks between men and women and the role of women as driving force of collective action and social transformations.

But how can subsistence relations and knowledge be reconstituted? In the chapter "Transitioning towards subsistence" (*Basculer vers l'entre-subsistance*), Pruvost explores transitional places (*lieux de bascule*) from which it is possible to experiment a new relationship to the living world and to initiate new ways of inhabiting. Through a multisite ethnographic study, the author documents a range of experiences – primarily chosen through snow bowl sampling – from collective actions aimed at reclaiming land in opposition to large projects, such as the Notre-Dame-des-Landes airport project, to the renaissance of rural communities through the municipalization of activities – such as a bakery and a grocery shop – and the practices of autogestion by local inhabitants. Concerning feminist experiences, as Pruvost notes, in France there is no large ecofeminist project or movement comparable to the women's lands in the US. Despite that, the author shares Gibson-Grahm's (1996/2004) view of the ubiquity of the feminist experiences as:

> a vast set of disjointed places – households, neighborhoods, localities, workplaces, civic organizations, public arenas [...] – related analogically rather than organizationally. (p. 266, *my translation*)

Feminist experiences are rooted in specific places to be created, defended or transformed. The empirical work carried out by Pruvost gives visibility to a plurality of stories, practices and experiences – combining ecology and feminism – and which address the subsistence option as transitional places (*lieux de bascule*): eco-construction, self-healing and auto-gynecology, bakery, self-education, knowledge transmission within informal communities. In the same chapter, she identifies different patterns of inhabiting, characterized by different degree of militantism, collective or individual action, with a focus on either feminism or ecological sensitivity, within rural or peri-urban contexts, and involving either only women or a broader group. The first pattern (*modalité*) gathers single women with a strong political commitment, without kids engaging in collective experiences, often within ecoqueer, vegan feminist

groups, bio-farming activities. They are committed to LGBTQIA+ or non-mixed groups and living mostly in the countryside to re-establish a subsistence economy. The second pattern is more fragmented and gathers mothers and other women who are not necessarily opposed to capitalism or heterosexuality and do not have feminist or radical claims. They focus on reconnecting and practicing of feminine know-hows within practical workshops (well-being and reparation), which are mainly attended by women. They practice ecology by minor gestures and everyday actions alongside work and family responsibilities. The third one involves highly engaged environmental, feminist, anticapitalism activists – often women students living in cities who are in a transitional phase of their life and yet to settle in a specific region and profession. They opt for short term practices and internships in permaculture, auto-gynecology, participation in ecofeminist events and festivals. The fourth pattern describes women who do not attend any activist groups, do not participate to national manifestations, preferring to focus on local action. These women – often living with few means, living in rural and peri-urban areas – are more engaged with ecological concerns than with feminist ones. They reject salary work in favor of manual skills and subsistence practices. Inspired by peasant women and women hunter-gatherers, they advocate for autonomy and emancipation from the system. A fifth pattern is the nomad version of the previous one. Their practice of subsistence includes gleaning, plants picking, the mastery of manual skills, while they choose to live within alternative networks. They engage in activities like woofing and use alternative modes of transports such as caravans or hitchhiking. As Pruvost notes, the evoked experiences do not necessarily refer to ecofeminism as the term is rather recent and unstructured. Moreover, the recent mediatization of the concept often prevents an open affiliation.

In the last chapters – "Vertigo of the materiality" (*Vertige de la matière*) and in the conclusion – ecofeminism and the subsistence perspective are thought as a way to develop new relations and modes of attention to the living world (*le vivant*) as well as a renewed distribution of tasks and solidarities connected to a *milieu de vie*. It is an invitation to experiment with new forms of attachment, starting from the place where one lives in and from awaking (*éveil*) to the local knowledge, the revaluation of craftmanship and alternative forms of transmission, for example through manual work and self-learning. Re-localizing means expanding the range of interlocutors, their diversity, which as Latour (2018) suggests, requires to put in place a parliament of things. The attention to materiality – the history of its fabrication and how it circulates – is central to these experiences in search of autonomy and of more responsible modes of subsistence. Finally, the subsistence option, understood as a right to occupy the world, implies as a form of militantism of everyday life and daily gestures, ultimately a form of love.

The book offers the theoretical grounding of the feminist subsistence perspective and makes the hard work of detecting and acknowledging the heterogenous, shattered and often invisible experiences which today address and share, in various ways, that sensibility. What strikes the STS reader is the resonance with – and yet the silence on (despite a few exceptions such as Tsing, Despret, Stengers and Latour) – feminist STS scholars and new feminist materialism regarding the urgency of the ecological question and of building new interspecies relations. This includes the overcoming of human-nonhuman divide, the critique of capitalist relations and new forms of neocolonialism and of exclusion, the ethics of reparation, the experimentation of alternative – bodily, sensorial – modes of education and of transmission

beyond the rational-scientific paradigm, the search for emancipatory gestures. The central role of "women", of the "feminine" within ecofeminism, the delicate relations with technology – as well as the focal attention to the South of world, and the exploitative relations with the industrial societies, remain however important elements of distinction with STS scholars. The book gives visibility to the heterogeneity of stories and minor gestures in search for autonomy and emancipation, very often at the margin of capitalist relations and of the urban gaze. It is about the practice of ordinary feminism.

Even without using the term, the "subsistence question" becomes increasingly relevant in STS studies where the metabolic engagements to the world become the core of social theorizing (Mol 2021) or where following the complex and global entanglements around a fungal delicacy is a way of examining capitalist destruction and new multispecies survival arrangements in the ruin of capitalism (Tsing 2015). More generally, after being marginalized in feminist theory, the renewed attention to ecofeminism (Hache 2016) – and its inherent heterogeneity – within feminist thought is linked to a new interest in materiality, beyond language and discourse. This shift also reflects the need for renewed relationships to "nature" and matter in feminist thought, particularly emphasized by feminist new materialisms (Alaimo and Hekman 2008; Barad 2003).

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Feminist AI: Critical Perspectives on Algorithms, Data, and Intelligent Machines

by Jude Browne, Stephen Cave, Eleanor Drage and Kerry McInerney (eds.) (2023) New York, Oxford University Press, 432 pp.

Ericka Johnson
Linköping University

feminist AI joins the growing number of books that examine the complexities and intricacies of AI's socio-technical entanglements, though with an avowedly feminist approach. Many of the volume's contributors have recently published their own, book length, manuscripts (D'Ignazio and Klein 2019; Costanza-Chock 2020), but the strength of *feminist AI* is in the bouquet of voices, theoretical perspectives, disciplinary approaches and methods that it brings together between two covers. It is a true *tour de force* demonstrating the analytical usefulness of feminist theory.

The chapters in *feminist AI* address a wide range of concerns – everything from asking if AI *can* be feminist to intersectional analyses of how the gendered effects of AI engage with other forms of power and control (such as ethnicity, race, class, disability, sexuality, and age). There is work on AI and labor (Chapter 11 *Of Techno-Ethics and Techno-Affects* by Sareeta Amrute), imaginaries of AI's potentially queer technological future (Chapter 9 *Feminist Technofutures: Contesting the Ethics and Politics of Sex Robots and AI* by Neda Atanasoski), examples of how alternative epistemologies can be engaged (Chapter 17 *Automating Autism* by Os Keyes) and what we mean by human (Chapter 6 *No Humans in the Loop: Killer Robots, Race and AI* by Lauren Wilcox).

The book presents intersectional feminism as a political project challenging social injustices, with example after example of how feminism is particularly well positioned to approach the risks and benefits of AI. But the collection of chapters in this anthology also displays the usefulness of a multidisciplinary approach to AI. The many authors include academics working in the humanities, social sciences and the computer sciences, but also contributors who are primarily working within community activism, the tech industry and the arts. In contrast to common authorship practices within the humanities and social sciences, a good number of the chapters are co-authored, reflecting interdisciplinary research constellations. Yet, all of the work in this volume employs lessons from critical theory, in particular a sensitivity to the power dynamics AI is entangled within, which creates a clear sense of cohesion for the reader.

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While AI is often framed as very new and cutting edge, this book refuses to fall into a discourse wrapped in an ahistorical present. Rather, there are contributions from foundational thinkers within the field of gender & technology (for example, Chapter 1 *Technosymbiosis: Figuring (Out) Our Relations to AI* by N. Katherine Hayles and Chapter 4 *Feminism Confronts AI: The Gender Relations of Digitalisation* by Judy Wajcman and Erin Young) that build on early lessons about the technology & gender relation and apply them *con gusto* to AI (see also Chapter 3 *AI in a Different Voice: Rethinking Computers, Learning, and Gender Difference at MIT in the 1980s* by Apolline Taillandier which explores an early attempt to create feminist coding and Chapter 15 *The Cruel Optimism of Technological Dreams: Thinking AI through Lauren Berlant* by Caroline Bassett that engages Berlant's concept of Cruel Optimism). These chapters, which use traditional theoretical approaches are joined by other chapters from scholars working in and with decolonial contexts and epistemologies (see for example Chapter 2 *Making Kin with the Machines* by Jason Edward Lewis, Noelani Arista, Archer Pechawis, and Suzanne Kite and Chapter 20 *Afrofeminist Data Futures* by Neema Iyer, Garnett Achieng and Chenai Chair).

Feminist technoscience has a long history of engaging with cutting edge technology through a feminist lens sensitive to power, and many of the early lessons we learned in the field are relevant today, too. For example, early conversations about the posthuman and our relations with technology that N. Katherine Hayles developed are also returned to and engaged in the first chapter, *Technosymbiosis: Figuring (Out) Our Relations to AI*. Hayles engages very high-volume questions, reminding the reader about the value of early feminist technoscience staples like the concept of the "informatics of domination" in Haraway's Cyborg Manifesto (1985/1991). Hayles also challenges the reader to think about the unique and evolving capacities of AI and theorize about power in ways that capture the technological specificities of algorithmic processes in AI while still "sticking with the trouble" of situatedness and power. Calling this an ontological approach, Hayles urges us to use feminist strategies like attending to metaphors and considering "othered" beings, but also to do the political work of building alliances, collaborations and affinities with people (often men) already working with AI so that we can make positive interventions to address the goals and assumptions of, for example, predictive algorithms (p. 12). Judy Wajcman and Erin Young also bring some of the early lessons from feminist work with technology to AI (Chapter 4, *Feminism Confronts AI: The Gender Relations of Digitalisation*). We are reminded of the importance of thinking about who (and whose bodies, subjectivities, situated knowledges) is engaged in making the technology and how that impacts the supposedly "neutral" technologies they make (p. 58). Here Wajcman and Young also push back at the attempts from within computer science to mitigate bias, problematizing the idea that there could be an "objective" measure of fairness or even of data, and again referencing early work critiquing the "view from nowhere" that these approaches embrace.

Finally, feminist critiques of well-known AI problems abound in the book – rightly so but with often quite nuanced analyses. The reader is treated to in-depth discussions about predictive policing and gender-based violence (Chapter 7, *Coding "Carnal Knowledge" into Carceral Systems: A Feminist Abolitionist Approach to Predictive Policing* by Kerry Mackereth), categorization practices, race and capitalism (Chapter 8, *Techno Racial Capitalism: A Decolonial Black Feminist Marxist Perspective* by Lelia Marie Hampton), digital assistants,

reproductive labor and care (Chapter 10, *From ELIZA to Alexa: Automated Care Labour and the Otherwise of Radical Care* by Jennifer Rhee), and the reappearance of physiognomy – defining types of humans from appearance – in AI technologies (Chapter 13 *Physiognomy's New Clothes* by Blaise Aguera y Arcas, Margaret Mitchell and Alexander Todorov). Chapters 13 and 14 (*Signs Taken for Wonders: AI, Art and the Matter of Race* by Michele Elam), in particular, provide a very good bridge between historical practices of categorization and racialization, academic work that has problematized these practices outside the field of AI, and the sudden impetus to embrace obviously problematic categorization practices again within AI because of the affordances of image recognition and ML.

A particular strength of the book is that the various chapters engage analyses of power in the multiple ways that feminism does, while not shying away from using the word feminism. *feminist AI* is a collection which shows how critical feminist theory can be productive for empirical studies of STS that could be considered distinctly feminist in that they are concerned with power and othering, but which are not necessarily labeled "feminist". The chapters in *feminist AI* bring feminism into conversation with relevant STS literatures and debates about how a critique of power is necessary to examine the social entanglements of AI. One hopes that the use of the word feminist in the title will not scare off colleagues in STS who should read these studies but don't consider feminist theory and intersectionality relevant to their work. Kudos to Tecnoscienza for reviewing this book, because there are many contributions in it which will be useful for STS studies, especially those working in areas that overlap with critical data studies, the medical humanities, and design.

The book's primary weakness was that only Chapters 5 (*Shuri in the Sea of Dudes: The Cultural Construction of the AI Engineer* by Stephen Cave, Kanta Dihal, Eleanor Drage and Kerry Mackereth), 12 (*The False Binary of Reason and Emotion in Data Visualisation* by Catherine D'Ignazio and Lauren Klein), and 18 (*Digital Ageism, Algorithmic Bias and Feminist Critical Theory* by Rune Nyrup, Charlene Chu and Elena Falco) were initially open access. Luckily, this has changed and now it appears as if all chapters are available on the Oxford University Press site[1]. This is great because especially Chapters 10, 13, 14 and 19 (*AI & Structural Injustice: A Feminist Perspective* by Jude Browne) – will be useful in the classroom, and open access literature is often a necessity for many less privileged institutions and students. This availability will also make the exciting conversations in the book much more accessible, especially to a global audience.

Throughout *feminist AI*, we as readers are reminded of the relevance of much work within feminist theory which – broadly – points to how we and the world are created and performed through the very processes of "collecting" and "categorizing" data. The details of how that collecting and categorizing our ways of being in the world happen, and how they become the material used for learning and training AI, matter. They matter because those practices of seeing us and our lives in very particular ways create very particular data representations. Many of the chapters in the book discuss the insight that, through methods of collecting and categorizing, we become legible to the technological structures and artifacts that afford, disafford and dys-afford ways of being (see in particular Chapter 21 *Design Practices: Nothing About Us Without Us* by Sasha Costanza-Chock; see also Costanza-Chock 2020).

This insight is also extremely relevant when thinking about how AI systems use data to learn the world in iterative processes. It inspires one to revisit work on legibility and intelligibility

(Chapter 16, *AI that Matters: A Feminist Approach to the Study of Intelligent Machines* by Eleanor Drage and Federica Frabetti in particular). The large discussions about AI in the book are all nuanced with a feminist approach that sensitizes the analysis to embedded structures of power. This is an approach which reminds us that it is both important to analyze the technology, but equally important to pay attention to the details of its entanglements and the situated material and social structures that mediate or obfuscate AI's impacts (c.f. Chapters 18 and 19). Reading the book is both aggravating and inspiring – one is reminded of the current and potentially looming issues AI will bring to our practices – in the workplace, the market, education, our interactions with technological tools we use daily, etc., but also inspired to, like the many authors of this book, continue balancing on the narrow edge of analytical activism and engaging, collaborating and building alliances. One can see this collection as an intervention, an intervention I hope will be part of an ongoing conversation about how AI can be implicated in working for social justice within STS.

Notes

[1] https://academic.oup.com/book/55103.

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The Black Technical Object: On Machine Learning and The Aspiration of Black Being

by Ramon Amaro (2022) London, Sternberg Press, 230 pp.

Thomas P. Keating
Linköping University

In European philosophy, the concepts of technology and of the technical object are perhaps most often associated with relatively few names – Heidegger, Simondon, Stiegler – as well as a tendency in late 20th century philosophy to utilise the relationship between the thinking computer and thinking organism to reconceptualise the bounds of "thought" itself. For Heidegger, technologies and technical objects become significant in defining the human's reductionist mode of being-in-the-world through the way external tools reveal or conceal material things as an outcome of enframing (Heidegger 1977). Simondon (2017), meanwhile, goes to great lengths to distinguish technologies and technical objects, with the latter referring to specific concretised technological devices that are so sufficiently adapted (individuated) that they come to organise wider techno-geographical *milieux* often vastly in excess of the anticipations of human design. Extending the thought of both Simondon and Heidegger, Stiegler (1998) emphasises how the evolution of technical objects not only exceeds human thought but also *constitutes* it by serving as mnemonic devices that extend human memory and acts of thinking beyond what is already deemed "thinkable". One of the traits of this recent genealogy of technical objects is the argument that research on technology carried out within the philosophical field – and in particular theoretical research seeking to reconceptualise "technology" and the "technical object" – needs to do much more to understand how technologies specifically shape the production of thought and subjectivity through abstract processes often bypassing the perceptive frames of the individuated human subject (Lazzarato 2014). The implication here being that European philosophy has become hamstrung by a failure to understand the creative capacities of technology in the constitution of acts of thinking and processes of ontogenesis (being as becoming).

Despite this commitment to approaching technologies and technical objects to push the boundaries of what philosophy can possibly contemplate, this recent genealogy largely ignores notions of race, Black existence, and alterity. Ramon Amaro's *The Black Technical Object* challenges this erasure by attempting to understand how race and Black being demands a rethinking of social science and philosophy understandings of technology and technical objects. In doing so, Amaro analyses how machine learning and its cultures can be understood besides the logics of a White experience that continues to dominate anglophone scholarly reflection. As with critical

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reconceptualizations of technology and race advanced within and beyond science and technology studies (STS) by scholars such as Ruha Benjamin (2019), Safiya Umoja Noble (2018), and Simone Browne (2015) – to name just a few – the book addresses the racial limits of philosophical and technological thinking. Yet, uniquely it does so by bringing together Simondon's ontogenetic approach to thinking technologies in combination with Frantz Fanon's theorisation of "Black being" – two philosophers whose connections, such as their respective interests in the concepts of ontogenesis and ontogeny, remain an exciting and underexplored area of research.

However, it is worth emphasising that *The Black Technical Object* is not restricted to a philosophical meditation on how race and Black existence intervene in conceptualisations of technical objects. Rather, and perhaps principally, it is an ambitious political re-examination of how machine learning and algorithmic technologies are today variously alienating, dissociating, and dispossessing Black bodies from forms of agency and capacities for determination. The book develops these political lines of thought across seven chapters split into three distinct acts. These acts traverse many intellectual areas, including mathematics, computational theory, the history of science, media theory, continental philosophy, theories of race, as well as developing in detail how programming and algorithmic concepts might be better apprehended within STS.

Working at the limits of philosophical thinking on technology and race (see also Benjamin 2019), one of the major interventions made by *The Black Technical Object* is in its retelling the history of "machine learning". "Machine learning" is developed here "as an assemblage of human, technical, social, economic, and political processes" (p. 101). Different to computer science definitions that describe machine learning as a set of seemingly inert data-driven methods encompassing artificial intelligence (AI) and algorithmic computation, Amaro insists on apprehending the symbolic and representational functions of machine learning – especially as these processes encounter various limits in the way they make sweeping inferences about the future (pp. 108-109). Reminiscent of recent advancements in critical data studies (Chun 2021), Chapter 3 weaves in a history of machine learning by turning to the way computational thinking, especially deriving from the 1970s and 1980s, drew on statistical methods like inference classification trees to develop not just new mathematical equations, but also *non*-mathematical statements. As the book argues, the legitimacy of these non-mathematical statements rarely was put in question, and yet these non-data driven logics – that is, the symbolic functions and common-sense truths that become inferred from mathematic statements and systems – were foundational to early forms of algorithmic science (p. 103). One of the endgames of the book's critical rethinking of machine learning is the idea that an apprehension of specific symbolic, non-mathematical functions can draw attention to the racism and inequalities hardwired into machine learning systems. As Amaro notes, such a task is about pursuing:

> alternative articulations of racial perception mediated by machine learning algorithms. The necessary shift is one bound by the ontological, and it promotes an alternative algorithmic praxis. To unearth this relation is to also recognize a pre-individuated capacity for praxis that might disrupt, dismantle, and rebuild the primal components of both racial and machine perception. (p. 104)

Perhaps the most direct way the book tries to unearth some of these alternative articulations is through the concept of the "Black technical object", understood broadly as "an unwitting

link between black pathology and the technical object" (p. 46). Drawing on Fanon, here black pathology refers in part to various alienating psycho-social "imaginary systems" wherein "self-doubt becomes the guiding principle by which the racialised person views themselves as well as the world around them" (p. 47). Rather than position the Black technical object as a superficial disruption to the prototypical place of the "White object" (that is, the dominant abstractions that conventionally define technical objects), there is an attempt to think an aspirational concept of the Black technical object capable of breaking out of the "recurrent dialectic" (p. 53) that traps Black being as an alienated Other within White supremacist technical culture. As an aspirational term, the Black technical object can thus be understood as a concept that tries to expose thought to entrenched "techno-racial" (p. 92) logics and forms "algorithmic prejudice" that materialise correlations "under the illusion of objectivity" (p. 61). These prejudices include, for example, the way that the "algorithm" is today positioned as an unaccountable actant that explains the existence of racist decision-making and rationales within contemporary governance systems (p. 20). Intersecting research into the relationship between racism and algorithmic computation (Magnet 2011; Celis Bueno 2020), in developing the concept of the Black technical object the book highlights significant problems with the way machine learning infrastructures – such as facial recognition technologies – are premised on factors like the "white phenotype" as a "prototypical assemblage from which all future human characteristics are measured" (p. 46). Especially problematic here is the way that these technologies alienate certain bodies *prefiguratively* prior to any contemplative individuated subject.

In developing a novel understanding of the relationship between racism, race, and the technical object, the book draws on Fanon and to a lesser extent Sylvia Wynter (Chapter 6). These philosophers are pivotal for developing a key strand of the book's argumentation: that the Black technical object helps foreground the way machine learning and algorithmic cultures are "always already preconditioned by an affective logic of race" (p. 47). The promise in thinking the Black technical object, in this context, is in the way that it opens up forms of reason capable of building new relationships to machine learning whose purpose is to enact processes of "effective disalienation" (pp. 14-15; also Fanon 2008, 4). If, following Fanon (2008), race must not be understood as a necessary metaphysical state, but an outcome of sociogenetic processes that are socially and individually constituted, then the question of how philosophy begins to think with the Black technical object is not without certain challenges. The alienating and racist outcomes of a dominant White supremacist technical culture are clearly documented in the book – from the discriminatory vision of facial recognition technologies (pp. 42-46), to the racial profiling used to calculate and model student retention rates (p. 116), to the 17th century European colonial history of statistical analyses of racial characteristics (Chapter 5). However, less clear is how to resolve some of the conceptual tensions produced when combining, on the one hand, Fanon's theory of the sociogeny of racialised *individuals* with, on the other hand, Simondon's *non-individuated* theory of technology's ontogenesis in order to produce a singular theory of the Black technical object.

Considering something of the friction between Fanon and Simondon, the final part of the book develops precisely how the Black technical object might come to operate affirmatively and aspirationally by arguing that "Black being" itself can be understood "as an ontogenetic phase of existence prior to the racialized body" (p. 222). Part of the implication here is that

attending to an ontogenetic phase of Black being may help direct thought to the *emergence* of individuated forms of racialised existence, and thus offers potentials for alternative racialised existences. In staging the ontogenetic transformation of Black being and its relation to technics, the book traces how it is precisely the incompatibility of Black and racialised being that, following Simondon, potentialises it with the capacity to engage in transindividual networks of collective subjectivation (p. 224). Here the book departs briefly from Fanon in arguing not for a non-Black Other of technical culture, but for "a return to [Blackness's] nonessentialist origins" (pp. 225-226). Approaching the nonessentialist origins of Blackness means paying closer attention to the "substance of race" that forms the basis of an incompatibility that provides the potential for thinking and individuating Black existence differently. To do so might mean, in part, better understanding how technologies can be made to think with the "incalculability of Black life" (p. 219). It also opens up thought about how the Black technical object might speak to emerging debates around "digital spatial justice" that is attentive to how certain "micro-events" are pivotal for shaping how bodies encounter machine learning infrastructures (Tedeschi 2024, 8). In setting up this wide ranging political project, the book is a formidable contribution to theorisations of race and technical objects, which will appeal strongly to researchers across the social sciences interested in how machine learning, algorithmic logics, and AI are variously shaped, and are shaping, racial existence.

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Habiter la pollution industrielle. Expériences et métrologies citoyennes de la contamination

by Christelle Gramaglia (2023) Paris, Presses des Mines, 274 pp.

Chiara Loschi
University of Bologna

Christelle Gramaglia, a sociologist of science and the environment, studies polluted areas, focusing on the multiple attitudes to pollution. Her book *Habiter la pollution industrielle. Expériences et métrologies citoyennes de la contamination* investigates the everyday experiences of residents who must cope with industrial pollution. Analyzing why most of them prefer to endure the difficult living conditions of a polluted territory rather than relocate to an unfamiliar city, the author reveals the emergence of multiple modes of cohabitation, the reinterpretation of contamination, and the reshaping of pollution detection, potentially influencing its scientific recognition and governance.

Gramaglia carried out her ethnographic research in Viviez (Aveyron), Salindres (Gard), Fos-sur-Mer, Port-Saint-Louis-du-Rhône (Bouches-du-Rhône), Estarreja (Portugal), and Sierra Minera (Spain). Four excerpts from the field diary accompany four empirical chapters to answer some questions: how do residents protect themselves from pollution? Why do they accept the risks? How does pollution become part of their daily lives? The analysis focuses on the dietary, social and hygienic behaviors implemented to limit costs. Christelle Gramaglia proposes to study the *ethnomethods*, i.e., people's social practices aimed at determining the impact of pollution on their daily lives, as well as their perceptions of these practices, and their governance implication.

Pollution dirties and damages the environment. Contamination affects the air, soil, water, human and non-human bodies, weaving into a network of relations that erases any distinction between industrial and uncontaminated areas, between zones degraded by productivism and those seemingly untouched.

The author foregrounds the analysis of complexity and paradoxes within a network of social relations encompassing humans and non-humans, pollutants, and technological remnants that are simultaneously intrusive and viscous ("*intrusifs et visqueux*"). Her analysis focuses on everyday micro-interactions to open a space for a critical examination of knowledges and resignification practices, as well as the epistemic frameworks that citizens enact within their interactions with an environment that is, by definition, contaminated. In doing so, the study enables a nuanced exploration of resistance to prohibition and

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sanction-based norms as a methodological avenue for understanding the emergent dynamics of the social in its situated, material, and relational dimensions.

The volume is based on exploring the role of *résidus technologiques*, understood as proliferating and intrusive materialities (Boudia et al. 2018) and *viscous* entities (Morton 2013). This definition serves as the foundation for analyzing the relationships between humans and *résidus technologiques* as sources of pollution. The value of this work is significant in multiple respects, particularly in its ability to draw from a broad spectrum of academic debates to identify epistemological resources that restore meaning to the complex reality of everyday cohabitation between humans and non-humans and dangers and sources of pollution. Moreover, it highlights the often overlooked yet politically meaningful array of everyday practices in highly polluted areas.

Local populations blame industries for the deterioration of their living environment. Cohabitation with factories is experienced as a constant nuisance by the residents (dust emissions, odours, smoke, noise, etc.), and doctors warn about the abnormal development of diseases, respiratory disorders, and the poor quality of water and air. In the author's view, environmental mobilizations and health risk mitigation are part of the picture but only tell one side of the story. The book critiques the mobilization scholarship that overlooks the epistemological value of everyday, less overtly confrontational practices in understanding citizen science based on attachment and daily routines in polluted sites. Indeed, pivotal, in Gramaglia's investigation, is the reliance on the historian of science Michelle Murphy's (2008; 2017) works *Chemical Regimes of Living and Alterlife and Decolonial Chemical Relations*. Murphy emphasizes the deep interconnectedness between society and its relationship with pollutants, arguing that there is no ontological basis for assuming a strict separation between contaminated and uncontaminated sites or categorizing certain bodies as anomalies while attributing healthier conditions to others. In every chapter, Gramaglia investigates the intricacies of such contaminations.

Chapter 1 focuses on the implications of various forms of pollution on the social and ecological relationships leading to the deterioration of networks of solidarity and cohesion. The grounding is on pragmatism, which intends to reconfigure the spectrum of analysis on the role of various groups of organized citizens, scientific researchers, and local administrators. Such an approach, in the author's intentions, allows the identification of types of pollution both from industrial production activities and from the narratives, constructions, and definitions that the various social groups give of them. In this sense, the chapter stresses the relevance of citizens' perceptions by virtue of their living on the contaminated territory, even if they do not participate to specific political mobilizations.

In Chapter 2, Gramaglia delves deeper into citizens' lives and their caring dimensions in polluted areas. Drawing insights from feminist scholarship, she focuses on citizens' profound, experiential insights into the alterations of their surroundings, shaped by daily practices such as gardening, fishing, or hunting. Borrowing the concept of *altervies* ("alterlife") from Murphy (2017), the author investigates how citizens' daily life is shaped, altered, and entangled with persistent chemical exposures and toxic legacies, by means of adaptation, resistance, and everyday negotiation with pollution. Despite lack of any political mobilization, people don't passively accept contamination but develop personal ways of everyday coexistence. Borrowing

also methodological support from Actor-Network Theory (ANT), the author bypasses any epistemological dualism to define "attachment" as the imbrication between dimensions of pollution and domination while configuring new forms of knowledges on their environment.

In Chapter 3, Gramaglia relies on the *ethnomethods* (*ethnométhodes* in French) to study the minor mode ways of cohabiting with contamination and pollution when the public sphere or authorities cannot provide a frame of interpretation, let alone a solution. Drawing from Garfinkels' ethnomethodology, *ethnomethods* refer to the informal, everyday strategies developed by people in polluted environments to understand, navigate, and make sense of contamination. Here, we meet with Gramaglia's approach recognizing the political dimensions inherent in diverse forms of citizen engagement with polluted site. By refusing any reductive understanding, she deliberately extends full political citizenship to more nuanced practices of reconfiguring attachment, acknowledging how everyday adaptations, knowledge-building activities, and relational adjustments to contaminated environments constitute legitimate forms of political engagement that transform both individual subjectivities and collective understandings of place. Conscious residents' choices are to be found in accepting pollution as a necessary trade-off for jobs in industrial zones or the proactiveness in elaborating makeshift air filtration methods at home, such as placing wet cloths over windows. Gramaglia situates these participatory practices within an *intra-political* framework, drawing on the arguments of Michel De Certeau and James Scott. While these practices do not necessarily bear immediate social or political transformations, she argues that they nonetheless embody a transgressive and challenging stance toward norms, public policy, and authorities. The ethnomethods shed light on the multiple adjustments and reconfigurations of daily routines (whether collecting mushrooms and fruits or fishing), also reshaping the networks from which local and embodied knowledge emerges. These modifications offer the opportunity to build better informed analyses of citizen science. Indeed, the analysis in the following chapter serves not only to deepen the debate on *technical democracy* but, more importantly, to contribute to a radical rethinking of risk perception and governance.

In Chapter 4, Gramaglia examines a characteristic dynamic of citizen organizations in contaminated areas: the intertwining between citizens knowledges with scientific knowledge, mostly in the efforts to demonstrate causal links between pollution and disease, and the progressive search for not only pecuniary but existential compensation to the damage to health and social life. Two participatory biomonitoring experiments in the Fos area showed that including the perspectives of various sentinel organisms greatly enhanced the accuracy of environmental measurements. This approach generated new, locally relevant knowledge, representing what she defines as a "bottom-up" science that addressed affected populations' needs. Beyond more precise pollution data, the experiments also fostered new social and ecological connections. The collaboration between volunteers and lichens led to altered perceptions and practices, making pollution more tangible and highlighting how to live in environments impacted by excessive productivism, reshaping people's understanding of contamination. The occasional meetings, particularly among fishermen, revealed the links between industrial practices, technological residues, and contamination, showing that all organisms, from the smallest to the largest, including humans, are exposed to the same environmental threats (p. 238). In this context, the experience of the *Institut Ecocitoyen* (Ecocitizen Institute), a research and activist organization

dedicated to enhancing scientific understanding of pollution and its impacts by incorporating the perspectives of local populations, environmental protection groups, and other stakeholders, emerges as a particularly successful example, one which the author claims to be a part of. As she describes, the Ecocitizen Institute, on one hand, conducts its own research and shares the results through scientific conferences modelled after popular universities, to stimulate public debates. On the other hand, it engages with industrialists who occasionally seek assistance in measuring unregulated emissions, for which no standard methods exist. While some criticism may arise regarding the Institute's reluctance to challenge the power imbalances that drive pollution, the emergence of a transmission network, linking pollution sources, knowledge, and measurement, can pave the way for the development of new standardized methods for pollution detection, where affected communities have a more prominent voice.

The book is a rich source of information regarding some very well-known polluted areas in France, as well as Spain and Portugal. Still, a few additional observations merit discussion before concluding.

At times, the focus shifts ambiguously between *résidus technologiques* and industrial production, the latter receiving less attention, to the detriment of a deeper understanding of the ontological link between the capitalistic logic of production and the redefinition of the roles of citizens, workers, fishermen, researchers and experts. While it is of utmost importance to challenge narratives of citizen passivity in the absence of overt mobilization, the analysis proves defective as it fails to propose a coherent alternative framework for understanding the dynamics and mediating actors that have compelled communities to cohabitate with polluted sites. Chapter 2 appears to be the most problematic. It raises questions about the necessity of employing the ANT methods, if it merely serves to overcome an epistemological dichotomy that favours mobilization over everyday human-contamination cohabitation. It remains unclear whether the ANT framework meaningfully advances the analysis of human-non-human relationships, and, if so, in what form and through which actants reality is ultimately reconfigured. As a matter of fact, it is unclear where the "actants" are, in Latourian terms, within the scene. It falls short in accounting for the heterogeneous networks of human and non-human actors – regulatory bodies, industries, technological infrastructures, scientific discourses – whose associations in the history of sites generate the socio-material assemblages compelling communities to cohabitate with *résidus technologiques*. At the same time, by reaching the fourth chapter, it becomes clear how the quality of the ethnographic descriptions allows for a refined analysis of living in polluted areas in the present. Everyday practices of adaptation and attachment to the contaminated lands, the reconfiguration of neighbourhood, social, and political ties, confirm the epistemological need to analyze what mobilization literature often overlooks: citizen science, though not new, deserves more informed assessment through institutions that actively bridge citizen knowledge and scientific expertise. The relevance of the study lies precisely in the correlation between the rich ethnographic material and the mediating role played by the Ecocitizen Institute, with strong relevance on new socio-material assemblages and reconfiguration of knowledge production towards a co-production focus on governance dynamics. While the ANT framework appears fragile or not fully operationalized, the last chapter and the conclusions allow for better informed investigations and actual engagement on cohabitation between humans and contaminated territories.

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La musica nell'era digitale

by Tiziano Bonini and Paolo Magaudda (2023) Bologna, Il Mulino, 216 pp.

Micol Pizzolati
University of Bergamo

La musica nell'era digitale is a comprehensive and insightful text that may be read and appreciated by both scholars and amateurs, who, for different but intertwined reasons, seek both an informed and non-simplistic perspective on the fruition of platformed music. For instance, some passages in Bonini and Magaudda's book made me think about the relationship I have with music platforms. Sometimes, for example, I can only write if I have Spotify's "Rainforest Sounds" playlist playing in the background. While reading this book, I also found myself reflecting on the constant intertwining of music and my life. I remembered how, as a small-town girl, I used to call the local radio station Studio 93 in Alfonsine, a small rural municipality north of Ravenna, to ask for dedications read by Andrea Pezzi, then a teenage deejay and my music gatekeeper. Or how I traded Barbie's lift house for Madonna's *True Blue* compact disc (which cost at least ten times less!) and then listened to "Open Your Heart" on loop for days on end. Fast-forwarding to today, my Spotify Wrapped 2024 confirms that I have not lost the tendency to repeated (compulsive) listening. At the same time, *La musica nell'era digitale* triggered also less pleasant memories, like when I brought Luca Carboni's third album to school at the request of the music teacher. In less than two days, the compact disc disappeared from the classroom, and the teacher did not offer to buy it back. A bad, almost traumatic experience, which I would have spared myself in the digital age.

The two authors have written a fluent and enticing text, unearthing how the platforms behind music production, distribution and listening work, how this intertwines with the cultural value of music today and how everyone can play a part in creating a music ecosystem that benefits everyone. It is based on a reasoned and solid discussion bringing together perspectives from science and technology studies and media studies. It is also accompanied by examples that will stick in the mind of the reader. For these reasons, it is that kind of book that will be appreciated both by students who are eager to discover how music consumption is studied and by those readers that are more familiar with the topic of agency in the fruition choices of cultural products, complementary to other analyses, such as that offered for example by Nowak and Bennett (2022).

Bonini and Magaudda make various connections with those cultural studies that shed light on the complex links between the functioning and development of platforms and the circulation of culture. For example, in the Introduction they question the dualism between attentive (foreground) and inattentive (background) listening, and thus the opposition between

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authentic and functional musical experience. The development of analysis and argument throughout the book reveals the peculiar ways in which cultural aspects have been and are intertwined with economic and social elements. This reconstruction leads the authors to suggest that the future of music is not written in the functions of future technologies, but it will depend on how society will shape its progression in different directions.

Chapter 1 is an informed and detailed reconstruction of the innovation of digital music. This exploration is linked in a timely manner to reflections from the Sociology of Technology, for example, those on flexibility developed by Christina Dunbar-Hester (2014). The authors' aim is unravelling the intricate interconnections that seem to reproduce themselves in a similar way in different periods, from the nineteenth century onwards, when innovations that determined the evolution of music took hold. Among them are the advent of the phonograph, as media historian Lisa Gitelman (1999) has emphasized, and the introduction of the mp3 format, a topic of culture and technology scholar Jonathan Sterne's (2012) analysis. Other turning points have been the birth of peer-to-peer networks, the commercialisation of the iPod player, the creation of the iTunes platform, up to the emergence of Web 2.0, which gave rise to unprecedented forms of sharing. The chapter concludes by explaining the origins and early development of streaming in its various technical and practical meanings – that can be further explored in the research work of Eriksson et al. (2019), leading the reader to Chapter 2, which is devoted to the evolution of platforms and the interdependencies that music has with them. Through a clear and intertwined exploration of data and literature, the authors argue how the notion of digital platform has social implications. These can be observed at the micro level – characterised by the mechanisms of datafication, commodification and selection – at the meso level – defined by the platform ecosystems – and at the macro level – which leads to the question of the impact of this unprecedented form of social organisation on the cultural content sector in general and on music in particular. In relation to the latter, as Bonini and Magaudda point out, the monitoring of user behaviour is a peculiar aspect. This theme opens Chapter 3's in-depth discussion of how platforms select the music that reaches our ears. The authors offer a reconstruction of the mechanisms that characterize music platforms and an analysis that focuses on the transformations of gatekeepers – from peer-to-peer to platform – through a process of disintermediation of consumption and audiences. The authors detail research and data on algorithmic recommendations, playlists and music curators, and conclude that platforms are creating new inequalities between artists. In Chapter 4, different perspectives on the practice of listening to music are presented, enriched with references and empirical material from a previous study by the authors on digital practices. Overall, their analyses illustrate that the experience of listening to music is an ambivalent process. On the one hand, it consists of deliberate acts of domestication of algorithmic recommendations in order to link them to one's own rhythms and tastes. On the other hand, it also consists of forms of resistance to the invasiveness of data collection and the power to direct musical consumption choices.

In the fifth and final chapter, Bonini and Magaudda propose some scenarios about the role that artificial intelligence could play in the creation and dissemination of music. They do frame this exercise as an STS one, as they invite us to think about the relation between human activities and technological tools, particularly in music composition, as an intricate entanglement rather than a confrontation between two separate worlds. The authors focus on some of the

recent innovations brought about by artificial intelligence in the three main stages of the life of music: composition, production and distribution. They accompany their analysis with an accurate and detailed reconstruction that is accessible even to those readers that are less familiar with some emerging digital practices in the domain of music creation. For instance, they discuss the Landr platform, that offers an audio mastering service without human intervention at a very modest cost. Another example they unpack is the use of non-fungible tokens as certificates of ownership of a digital asset that makes it possible to create unique, rare or limited-edition musical objects that can become collectors' items, as the first editions of vinyl records were in the past. The authors leave their readers with a useful Epilogue, posing two interesting questions about the economic, relational and symbolic value of music and its potential to offer and create identification. Reflecting on these aspects, Bonini and Magaudda conclude their socio-historical reconstruction of the intersections between music production and fruition and developments in related technology and scholarly analysis by stating that the major changes in the circulation of music in society are not due to digital platforms and their technical characteristics *per se*. Rather, they are to be retraced in the reciprocal modelling between the nodes of the musical landscape network. These nodes are made up of actors, processes, ideas and objects.

In ideal dialogue with other rich reflections on the study – and rethinking – of music through Science and Technology Studies, as for example Hennion and Levaux (2019) and Tofalvy and Barna (2020), the text makes a solid contribution to the strand of analysis of the relationship between musical cultures, taste, constructions of authenticity, and technology – while drawing attention to the limits within which this lens helps to deepen knowledge. I believe that this work is also a starting point for new scenarios of future research into how we, as listeners, consumers and citizens, will be able to creatively appropriate the tools – in the broadest sense – that will be available to us, defining a destiny for music that is by no means yet written. As already mentioned, the book could be a useful tool for students, although the inclusion of boxes with illustrative cases, examples, or reflective prompts might have provided additional support for reading and comprehension.

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On the Interplay of Images: Imaginaries and Imagination in Science Communication

by Andreas Metzner-Szigeth (ed.) (2022) Firenze, Leo S. Olschki, 440 pp.

Patrizia Sergio
University of Tartu

A growing number of sociological and critical theoretical studies are arguing for new frameworks to theorize and grapple with contemporary social change resulting from information and communication technologies (ICTs) and computer-mediated communication (CMC). From smart and biometrics border controls to body scanners, from drones to passenger and financial surveillance systems, the study of the "visual politics of technologically mediated practices of seeing" (Bellanova et al. 2021, 128) has gained attention in recent STS scholarship, particularly where key tenets of Actor-Network Theory concerning the role of technologies (and other non-humans) in societal formations, intersect with Foucauldian theorizing on practices and techniques of neoliberal governance (i.e., governmentality). In the context of these diagnoses, data-driven technologies have been examined not merely as instruments but rather as mediators and co-producers of broader socio-political mechanisms that reorganize international relations, the public-private sphere, and population management (Bigo 2017). In turn, this epistemic view – where "Data has the performative power that is resignifying political life" (Ruppert et al. 2017, 2) – has significantly influenced the study of sociotechnical imaginaries that are shaped by the continuous interactions between knowledge production and digital data, as well as the collective meaning-making produced by these imaginaries (Csernatoni 2022).

"Imagination in Science Communication" engages with ongoing discussions by emphasizing the significance of visual communication in the de- and re-construction of the digital engineering of the social world, viewed through the lens of Science & Technology Studies (STS) and Science Communication. In light of the increasing focus on the digitalization and datafication of human activities in the social sciences, this timely book, edited by Andreas Metzner-Szigeth – who holds a full professorship in the Sociology of Culture and Communication at the Free University of Bozen – explores how visual communication, encompassing various topics (e.g., health, risk narratives, conspiracy theories, digitally mediated environments, and techno-aesthetics) might practically influence social processes of meaning-making. This volume adopts a practice-oriented approach, using generative dynamics to explore the intricate interactions among images (cognitive processes), imaginaries (communicative processes), and imagination (consciousness). In the first three theoretically oriented chapters, along with Chapter 28, the

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editor Andreas Metzner-Szigeth engages with the complexity of technologically advanced societies, paying particular attention to the changing connection between scientific knowledge production and socio-technical practices (Introduction; Chapter 28). According to him, if we are to understand how social actors make sense of reality, then it is imperative that "communication in scientific practices" (Chapter 2, p. 28) is taken as a point of departure, beginning with acknowledging how inferential data processing (Chapter 3, p. 37, p. 44) redraw the epistemic, cognitive, and perceptual categories of contemporary algorithmic life.

The following five chapters implement the chosen generative approach by linking scientific knowledge with creativity. In Chapter 4, Gerald Hünter exemplifies this by showing how a generative analysis of the "image-generating apparatus" (p. 54) can capture the influence of neurobiology on the social imagination. Both Chapter 5 and Chapter 6 employ a generative approach to explore the epistemic dimensions of imagination. Xabier Insausti (Chapter 5) combines the philosophical approach to imagination originating from Plato, Cassirer, or Adorno and Horkheimer to develop a critical understanding of scientific discourse in neurobiology. Massimo Bartolini (Chapter 6) reflects on fake news, exploring communicative elements, by analyzing the relationship between fantastic imagination (myths) and true imagination (science) in producing material effects on social values, lives, and beliefs (p. 80). From a sociological perspective on cultural and communicative processes, Luca Toschi, in Chapter 7, uses the concept of autopoiesis proposed by the second order of cybernetics to reveal how the epistemic dynamic between expectation/imagination and results/products is intricately connected to complexity at the level of social systems. In the field of Comparative Literature, Andreas Böhn (Chapter 8) focuses on three German novels on Artificial Intelligence, automation, and digitalization, addressing one of the most fundamental questions: how affective-computational architectures shape the digital imaginary by altering the conditions of human cognition. The next three chapters stand out in their theoretical and methodological innovations. Selena Savić develops in Chapter 9 a notion of visual imaginary from the perspective of Design and Media Cultures, which allows an incredibly complex picture of how data production and the computational processing logic crosses into a creative act brought by aesthetic, semantic, and epistemic elements based on decoding incomplete messages. Tzung-Wen Chen (Chapter 10) introduces the concept of Techno-Aesthetic to understand the "performativity, materialization, and propensity" (p. 135) of digital images when integrated into the social imaginary. In Chapter 11, Thomas Hundt develops a notion of virtual reality, which allows an understanding of the concealment of the cognitive boundary between experience and existence as an instrument of power and cultural technique. Interestingly, the nexus of data production to digital practices is described as a quantum logic showing how science and technology reinvent the social world at the level of different cognitive and perceptual systems of meaning.

The following eight chapters provide a practice-grounded approach to the generative analysis of the *visual imaginary*, promoting the integration of Science & Technology Studies with Science Communication, as suggested by the editor, Andreas Metzner-Szigeth, to a more rigorous and empirical research. In Chapter 12, Letizia Bollini focuses on celestial sphere models, moon observations, mind mapping, and DNA representations to give an example of the cognitive/visual changes between material models of knowledge and interpretative models of phenomena. Within this frame, Emiliano Guaraldo (Chapter 13) debunks the myth of abstraction

surrounding the optical techniques visualization by exploring the epistemic functions at play in Dataverse, where "types of data visualization, [...] detached from the object of visualization itself" (p. 172) offer insights about the post-critical politics in the Anthropocene. To complement this inquiry, Valentina Marcheselli (Chapter 14) pinpoints the transformative process by which digital images of Earth mold the boundary between understanding and representing. This generative analysis of the visual imaginary triggered by technoscientific representations is further deepened by Charudatta Navare. In Chapter 15, she delves into the ideological function exerted by specific color choices using Ernst Haeckel's *Tree of Life* (1897) to show how conservative imaginaries linked to progress and evolution are implicitly reiterated within contemporary popular culture. In Chapter 16, Emanuel Mathias adds one more piece to the understanding of epistemic functions operating within visual representations by focusing on the digitalization of fieldwork. Chapter 17 discusses the results of the research "ScientificVisualization: Impact on Practice [SVIP]" conducted by Stephan Schmith-Wulfen and Elisabetta Rattalino about the interplay between mental images and scientific imagination. As part of this area of study, Chapter 18 provides an example of practice-based research on cultural heritage and place memories in the context of the Sesto Dolomiti landscape. Focusing on the possibilities offered by digital apps, Waltraud Kofler Engl, Alexandra Budabin, and Gaia Piccarolo demonstrate how generative communication can be helpful by actively transforming learning processes. Investigating the socio-cultural and symbolic dimensions directing the word Heimat in South Tirol, Ingrid Kofler (Chapter 19) offers a place at the *visual imaginary* table to the most inspiring analysis of normative values prevailing in the neoliberal model of society.

In the following four chapters of the volume, the task of incorporating *visual imaginary* both in STS and Science Communication scholarship is grounded on the social construction of reality. Ilaria Riccioni (Chapter 20) combines the cognitive-enactive approach to mind and perception with the ecological approach to new media originating from Baudrillard and McLuhan to discuss the epistemic-shaping dimensions between experience and interaction that go deeper than the constructs of simulacrum, hallucination, and hypnosis. According to Roland Benedikter (Chapter 21), this ambivalent dimension has a direct relationship to the "meta-material" (p. 276) reorganization of capitalism, which is believed to place at the core of the value chain production, creativity processes, and imagination. Developing a typology called "visual imagineering", Joe Ravetes, in Chapter 22, connects contemporary socio-political dynamics to the epistemic dimensions of visual thinking. These theoretical contributions pave the way for a new critique of communication power in contemporary societies. Nevertheless, a well-established interdisciplinary tradition between STS and Science Communication enables a reevaluation of the role of *visual imaginary* and its generative components within broader societal dynamics, as majestically illustrated by Cristina Orsatti in Chapter 23. Significantly, the focus on the *visual imaginary* in Science Communication can give a breadth of understanding of socio-technical modes that (de)construct social reality as we know it – for instance, both Chapter 24 and Chapter 25 set out health communication and literacy frameworks. Berenice Golding, Elizabeth F. Caldwell, and Sarah Falcus (Chapter 24) analyze children's picture books addressing dementia through empirical research conducted with two focus groups of five adult carers and four nurses to intercept biased collective representations. Eugenio Pandolfi, Lisa Capitini, Ilaria Marchionne, Marco Sbardella, and Viola Davini (Chapter 25) deconstruct health literacy on

childbirth by a comparative analysis between infosphere and embodied knowledge to define the communicative components that should be explicitly redefined to provide correct information to patients. By prioritizing risk communication, Joost van Loon (Chapter 26) explores the aesthetic logic enhancing Capitalist Realism through the prism of Bifo, Derrida, and Beck. These aesthetic normative constraints are attested by Brian Rappert (Chapter 27) through the generative dynamics between images and imaginary, including conspiracy theories. Employing the documentary *Conspiracy Theory: Did We Land on the Moon?* – this case study shows how asymmetrical truth-making appears to be the precondition for the rise of the new myths of our times.

Overall, the volume presents a broad repertoire of theoretical approaches to *visual imaginary-building processes* in Science Communication and makes the visual operationalization transparent. This is extremely helpful to both seasoned researchers and newcomers to the field. Despite the programmatic label "On the Interplay of Images" suggesting a focus on the interplay, the chapters partly analyze what constitutes images, including technoscientific representations, digital data, virtual reality, visual tools, and scientific visualizations. This broader analysis stems from a non-representational, non-functionalist, and non-constructivist approach to redefining digital practices and data production within the generative paradigm of communication employed by this research program. In doing so, the book strengthens STS through the application of socio-cybernetics methods developed by Science Communication researchers. A key aspect that seems to be lacking is a clear formalization of the specific epistemic, cognitive, and perceptual components that influence socio-technical practices, particularly in the transition from generative dynamics to visual imaginary, and from visual imaginary to social change.

The ground-breaking proposal presented in this volume has the merit of shedding light on the problematic tensions between scientific communication, technoscientific representations, and knowledge production. To enhance the volume's findings and make it a more solid, consistent, and powerful analytic resource, I believe it would be pertinent to complement its results with analytical models. This strategy could help establish a clear distinction between visualizing practices and visualizing processes, allowing researchers to identify more robust patterns for analyzing how visual imaginary operates at the intersection of various social, political, and ecological crises that challenge digital societies. Given the pervasive influence of opaque algorithms, cloud infrastructures, digital search, and mobile operations in socio-technical practices, these new conditions of knowledge production open new opportunities for innovative synergies between STS and Science Communication. This integration could be effective in addressing issues such as fake news, strategic narratives, democratic erosion, and social distrust. Therefore, this volume represents one of the most significant contributions to this field of research and should play a central role in the future development of studies focusing on the interplay of images, imaginaries, and imagination in Science Communication.

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