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VIII STS Italia Conference
Dis/Entangling Technoscience

Probots (2015-) by Chris Csíkszentmihályi

Probots are teleoperated robots designed to replace or augment human protestors in demonstrations and manifestations. They are designed to disassemble into a suitcase, be reassembled in short order, and to picket for up to eight hours. They are controlled via smart phones, and each has a megaphone and can either produce synthesized speech or relay a human voice. They can protest in Santiago, controlled by a clicktivist in a café on the Left Bank.

Should protest be conducted by robots? What does it mean to have a vacant body in public space, that neither understands nor benefits from a direct action, but is only a proxy? Can movement solidarity be maintained through telepresence? Regardless of the answers to these questions, governments are funding research and development of next-generation autonomous weapon systems: UCAVs, USVs, UGVs, LAWs, ARSS, SUGVs, VIPeRs and Ripsaw MS1s, ULAQs and Krunks… Thousands of different models, increasingly used by police forces in addition to armies, all built atop decades of civilian research by computer scientists and electrical engineers. Should war be conducted by robots? Too late! Rhetorical question!

Probots were developed[1] on the island of Madeira with engineers Victor Hugo Aguilar and Victor Azevedo, based in part on an idea from Julio Fernandez Ostolaza. They are part of a series of politically engaged robots that Csíkszentmihályi has been developing since 1991, including hunter hunter, Species Substitute, Afghan eXplorer, and the DJ I, Robot Sound System. These projects and others may be found at https://www.edgyproduct.org/

Chris Csíkszentmihályi *is an artist and Associate Professor of Information Science at Cornell University, where he leads the Redistributive Computing Systems Group*[2]

Photocredit: Sara Tranquada

[1] https://github.com/VitorHugoAguiar/ProBot
[2] https://rc.infosci.cornell.edu/

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Cover *ProBots (2015-)*, by Chris Csíkszentmihályi

VIII STS Italia Conference, Dis/Entangling Technoscience

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STS Encounters in Pandemic Times

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Abstract: This short essay by the departing board of STS Italia (Italian Society of Science and Technology Studies) introduces a Special Section of the Journal collecting a set of writings that present and develop some of the key themes of the VIII STS Italia Conference, held in June 2021 as a virtual event. The Special Section features an invited essay by Dimitris Papadopulos and Andrea Ghelfi followed by a short commentary by Luigi Pellizzoni. In addition, the Section includes ten different "Conference Reflections" – as situated perspectives on the meeting – written by colleagues who had a major role in organizing the event, or who convened one of the conference thematic tracks. As a whole, the Conference Reflections help broaden and improve our understanding of the manner and extent in which contextualized meanings and local socio-material practices constitute the fabric of the socio-technical environments where we live, thus unveiling the inextricable entanglement of novel vulnerabilities and technoscience.

Keywords: Dis/Entangling Technoscience; Conference Reflections; Vulnerability; Responsibility; Justice.

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In memory of Trevor Pinch (1952 –2021)

Our colleague Trevor Pinch passed away during the preparation of this Special Section. We publish this collection of essays in remembrance of his passing. Trevor contributed greatly to the development of this journal and of the Italian STS scientific community. The next issue of Tecnoscienza (June 2022) will feature a collection of articles by STS Italia members to honour his memory.

The VIII STS Italia Conference is a tale of two meetings. Initially planned in the Italian town of Trieste in June 2020, the gathering was postponed as the Covid-19 pandemic struck in Spring 2020 and was held online one year later (June 17–19, 2021). Two utterly different events, but united by an understanding of the entanglement of science, technology and society, whose relevance Covid-19 unexpectedly and tragically reminded all of us of.

"Dis/entangling Technoscience": that was the title, and the ambition, of the conference. While we observed Sars-Cov-2 travelling across seas and lands and we anxiously waited for biomedical advances able to counter the infection, Covid-19 called our attention to the relevance and ambivalence of such entanglement: we were all prompted to acknowledge that science and technologies play a critical role in shaping our societies – making possibilities flourish, but also creating new vulnerabilities, hence solving and creating societal challenges in equal measure (Jasanoff 2020). The pandemic was, and still is, an extreme example of how, in societies largely shaped by technoscience, vulnerability can be understood as an emergent property of the relationships between human and non-human entities, such as biological materials, technical objects and infrastructures, knowledge-making practices and social processes. And yet, the effects of these socio-technical entanglements (in terms of levels, intensities and types of vulnerabilities) are unevenly distributed across space, time, and social worlds.

Dis/entangling technoscience proves to be quite a slippery task, one possibly overwhelming due to the multivocality that the notion of "entanglement" itself assumes in the STS community. Demanding as it may be, this task is nonetheless an urgent and necessary step in effectively exploring the socio-technical fabric of human existence, as well as in grasping the issues and problems at stake when science and technological developments are normatively defined, measured, legislated and assessed in search for a just and responsible technoscience.

As the debate over vaccine supply has forcefully demonstrated, unequal distribution of such a critical preventive biotechnology points to the underlying, fundamental question of justice in technologically dense societies. Understanding the nexus between technoscience and justice requires us to explore and critically assess topics such as the forms and sources of power and public participation, the limits of social control via technical dispositifs and epistemic uncertainties, the expectations, media representations, discourses and interests of the social actors and the assumed neutrality of scientific knowledge and infrastructures, as well as the pitfalls and failures of public decision making and health policies in ordering the relations between science, technology and society. Ultimately, issues of justice demand to examine how responsibilities for this state of affairs are defined and assigned to and by different stakeholders, public agencies, research organisations and concerned groups of people. They call for addressing topics such as models of governance and regulation, ethics and values, hegemony and contestation.

Vulnerability, responsibility and justice were thus the guiding concepts of the VIII STS Italia Conference, in an effort not only to explore important research subjects for STS and related fields but also to delineate potential trajectories of STS's public. Three plenary sessions, two roundtable discussions and 28 parallel tracks, encompassing over 200 paper presentations, sparked a lively debate on these three notions and their implications for a broad range of issues and fields, from genetics and biomedical innovation to disability, from platforms and infrastructures in media industries to surveillance technologies and inclusive communities.

A dedicated online conference platform (Fig. 1) was designed and set up to foster peer-to-peer interaction and engagement despite the online format of the event. Before the conference, each participant was encouraged to record a short video highlighting the key takeaways of their own presentations. Prior to the meeting, approximately 200 videos were made available online in a "Video Library" on the platform, so that track participants could spend more time in debates and discussions, thus making the conference more engaging and interactive.

Figure 1. The VIII STS Italia Conference platform

This is the backdrop of the present Special Section of Tecnoscienza. While this Special Section does not claim to cover all the topics discussed during the conference, the collection of articles highlights some of its most salient themes by hosting ten "Conference Reflections" – as situated perspectives on the meeting – written by colleagues who had a major role in organising the event, or who convened one of the 28 thematic tracks.

The conference thematic tracks largely benefitted from the three Conference Plenary Talks, which were invaluable in providing conceptual and methodological entry points to explore the mutual relationship between vulnerability, justice, responsibility and technoscience. In her opening lecture entitled "Postcolonial Flows and Forensics as an Art of Paying

Attention", Amade M'charek (Professor of Anthropology of Science at the Department of Anthropology of the University of Amsterdam) shed light on the material traces of today's migration tragedies in the Mediterranean. In her talk, she explored the current shift and extension of the notion of forensics – from a practice of conferring evidential relevance to facts and materials about a single event, to an art of paying attention that allow us to re-configure the realities of death and dying and helps to critically examine the current politics of colonial relations. The second Plenary Talk by Rene von Schomberg (Senior Research Fellow at Käte Hamburger Kolleg: Cultures of Research of RWTH Aachen University, and formerly Team Leader for Science Policy at the European Commission) called for an institutional transformation of science, technology and innovation systems to foster socially responsible research and innovation. His talk, which was entitled "Responsible Innovation: A Call for Institutional Change", questioned the current market-centred innovation paradigm and reclaimed a stronger role for public authorities in science regulation after decades of privatisation. In doing so, von Schomberg argued for institutional changes that encompass Open Science and Responsible Innovation and that can prove effective for addressing the frequent failure of market mechanisms in delivering socially desirable outcomes of innovation. Dimitris Papadopoulos (Professor of Science, Technology and Society at the University of Nottingham) delivered the Closing Plenary Talk of the conference, on "Elemental Justice: Necrochemicals, Ecological Reparation and Generative Chemical Practice". The talk unveiled a paradox permeating our life: if our socio-technical worlds are paradoxically unsustainable without anthropogenic chemical interventions, what does it mean to experience and live in such a toxic regime, where human made substances are deeply ingrained into ecosystems and society? What are the implications of this forced coexistence?

The great political relevance these questions have for STS is further discussed in the article "Ecological Transition: What It Is and How to Do It", which Papadopoulos and Andrea Ghelfi (Leverhulme Early Career Research Fellow at the University of Nottingham) co-authored and which is published in this Special Section. In a companion commentary, Luigi Pellizzoni (Full Professor of Sociology of the Environment and Territory at the University of Pisa) critically examines the current convergence between an unshakeable faith in technofixes and the hollowing out of both traditional representative and participatory democracy in the context of the current ecological crisis.

A broad set of "Conference Reflections" follows these two essays. Though differing in their subject matters, theoretical questions, and epistemological stances, these articles share a common interest in investigating how shifts in socio-material and knowledge-making practices (see Viteritti and Piromalli; Cozza), living bodies (see Moretti and Morsello; Miele and Nunes), socio-technical regimes and (digital) infrastructures (see Bonini & Magaudda; Olivieri and Pelizza; Sciannamblo and Zampino), instances of technological weaknesses (Bory and Di Salvo), power relations in

technologically dense environments (Bruni and Tirabeni) and public participation and jurisdictions (see Giardullo et al.) are predicated and performed, simultaneously creating novel and unexpected vulnerabilities and opening pathways for justice and responsibility. As a whole, these writings help improve our current understanding of how the local meanings of technoscience and their related practices emerge in different socio-technical environments where novel vulnerabilities and technoscience are entangled. The VIII STS Italia Conference and its legacy, coalesced in this Special Section, demonstrate that the STS community is unafraid to take up the challenges characterising our increasingly turbulent socio-technical worlds, and is experimenting with novel practices of academic knowledge-making and -sharing. However, as doing so is likely unable to demonstrate to society the promise of STS for shaping desirable, just and responsible socio-technical change, new types of affective engagement and public commitment are required in order to forge a shared responsibility to care for and nurture the human and more-than-human relations life on our planet is made of (Puig de la Bellacasa 2017).

Acknowledgements

Organising a large international conference is a demanding collective endeavour, and we would like to thank all those who made it possible. Firstly, we are very grateful to the community of STS Italia (The Italian Society for Social Studies of Science and Technology) and, especially, the VIII STS Italia Conference Scientific and Organising Committee, which offered invaluable support in realising the conference: we are very grateful to Attila Bruni, Paolo Giardullo, Paolo Magaudda, Veronica Moretti, Barbara Morsello, Federico Neresini, Giuseppina Pellegrino, Manuela Perrotta, Leonardo Piromalli, Mariacristina Sciannamblo and Paolo Volonté. A heartfelt thought is dedicated to Marina Maestrutti, the former vice-president of STS Italia and a force behind the organisation of the association's biennial meetings, who suddenly and prematurely passed away on January 22, 2021. Secondly, we would like to thank the keynote speakers (Amade M'charek, Dimitris Papadopoulos and Rene von Schomberg) and all the participants and convenors who joined the conference. More than 250 STS scholars participated to the conference, debating the complex ways in which technoscience and society are mutually entangled. These outstanding contributions were essential to making the conference a success. Last but not least, we thank all the authors participating in this Special Section thus helping establish a collective legacy of the conference.

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Ecological Transition: What It Is and How to Do It

Community Technoscience and Green Democracy

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Abstract: The paper examines different practices, imaginaries and programs of ecological transitions whose articulation points towards a more-than-local and less-than-global green eco-social transformation. Translocal ecological transitions bring together climate action politics, environmental justice, and the everyday ecologism of experimental community-led technoscience. Within transition projects we see the emergence of new more-than-human political constituencies, the making of broad eco-social coalitions, and the implementation of innovative forms of reparative governance. Ecological transitions foster a new political space, green democracy, as an alternative to both regressive nationalism and green globalism that dominate contemporary politics.

Keywords: Ecological transition; translocal infrastructure; more-than-human politics; green democracy; reparative justice.

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1. Transition and the Ecological Condition

The symptom Anthropocene testifies to the indelible traces of human presence on planet Earth and the dangerously unstable condition of the Earth-human relational systems (Bonneuil et al. 2016; Zalasiewicz et al. 2011). The sixth mass extinction, climate crisis, soil depletion, ocean acidification, human displacement, forest destruction–the traces of ecological conflict are everywhere. The unpredictable consequences of human impact on the chemical, biological and geophysical structure of the Earth are ungovernable. This is a new condition. What once was from the pespective of the colonisers a "terra nullius," land free for grabbing, "the

land of no one" (de la Cadena et al. 2018; Millner 2017; Svirsky 2010; Wynter 2003; Wolfe 2006) has now become an unknown and unrecognisable land, "terra incognita" (Crutzen 2002). But it was not only about land, it was not only about the proclaimed "land of no one," it was also about the "matter of no one": presumably inert, passive, unowned and unclaimed matter free to be appropriated; materials free to be excavated in the accelerated extraction of natural resources to satisfy a global demand for minerals and energy and to provide for economic growth. Now this supposedly inanimate and governable matter has become something unrecognisable whose destructive power puts us in the middle of a multitude of ecological troubles.

In this paper, we reflect upon different practices, imaginaries and programs of ecological transitions whose articulation can, perhaps, enable a proposal for a green democracy. The centre of gravity of transition politics is an understanding of the ecological that highlights the entanglement of ecosystems, technologies, institutions, and cultures through practice-based forms of activism and more-than-local and less-than-global accounts of material transformation. The emersion of climate protest movements, such as Fridays for Future, diverse climate strikes, indigenous mobilisations, and environmental protest movements such as Extinction Rebellion and a multiplicity of more localised environmental justice campaigns, espouse a new sense of being and relating to Earth, a new geo-internationalism that takes climate protest into a new direction towards a transition from below: everyday practices of ecological reparation with the support of different alternative forms of technoscience and multiple experimental processes of institutional reinvention.

Transition politics demands alliances and convergences amongst the everyday ecologism of community technoscience, protest politics and innovative forms of ecological governance. In this paper we develop the idea of green democracy, a third political space alternative to both regressive nationalism and green globalism as the political expression of ecological transitions. We glimpse the possibility for a green democracy inside the many entanglements and convergences amongst eco-social coalitions for a zero-carbon and ecologically sustainable society, the emersion of forms of reparative governance, and the accumulation of grassroots knowledge innovations. The constituent power[11] of green democracy, as we argue in this paper, is a composition of alternative forms of sociability and materiality, protest politics, and new institutional architectures.

Transition is a key word for contemporary eco-social movements. This term refers to the everyday collective capacity to take actions of ecological reparation by mobilising different actors and sets of practices starting from localised (not just local though, as we will discuss later) and specific issues. From community urbanism (Pickerill 2021; Bulkeley 2015; Calvário et al. 2016) to energy and food sovereignty (Shattuck et al. 2017; Angel 2017; Engel-Di Mauro 2022), from transformative environmental justice activism (Agyeman et al. 2016; Bullard et al. 2009) to indigenous

resurgence (Whyte 2018a; Mander and Tauli-Corpuz 2006), from alternative technological development and community led ecological change (Ottinger et al. 2011) to social economies, the environmental commons, and transition towns (Hopkins 2011; P2P Foundation 2015; Utting 2015), there is a plethora of movements and programmes that situate themselves within the larger field of discourses for civilizational and ecological transitions.

2. Experimental, Reparative, and Translocal Transitions

If we look at food sovereignty campaigns, for example, we see how alternative food production systems and agroecology are key elements of community transition within a multiplicity of movements and material regeneration practices. Food sovereignty campaigns entail the simultaneous responsibility of participants to be food growers and consumers, which means being involved in the processes of food production and distribution by inventing alternatives to the large supply chains that currently dominate the existing agrifood system. But food sovereignty is something more than the consumers and growers' right to choose what to consume and what to grow and how. Food communities are first of all about creating alternative ways for dealing with the ecological interactions and interdependencies involved in the processes of farming: the collective enterprise of creating an alternative lifeworld within the interactive dynamics that inhabit the soil and its inhabitants (Bertoni 2013; Krzywoszynska 2020; Puig de la Bellacasa 2014; 2019; 2015). Starting from the end of the 1960s the so-called green revolution significantly transformed the ways through which agriculture has been developed on a global scale (Rosset and Altieri 2017; Shiva 2008; Altieri 2018; Altieri and Toledo 2011). The central role of mechanisation, the adoption of new technoscientific innovations, the selection of high-yielding varieties of cereals, and the extensive use of chemical fertilisers and agrochemicals are the main features of current "industrial" agriculture. These technologies of food production have wide-ranging eco-social implications on biodiversity and climate change, and they entail a relationship of strong dependency between farmers and the world's largest chemical producers.

Agroecology (Rosset and Altieri 2017; Altieri 2018) appears as one of the main alternatives for overcoming the shortcomings and damage that the "green revolution" has caused. Agroecology is a response to the question of how to transform and repair our food system and the rural life starting from a transformation of the ecological practices of peasants and farmers, artisanal fishers, pastoralists, indigenous cultivation methods, urban food producers etc (for different approaches and cases see García López et al. 2019; Lanka et al. 2017; Rosset et al. 2019; Altieri et al. 2011). In this sense, food sovereignty movements and agroecological farming are creating an alternative politics of matter: by seeking different material cir-

culations and channels of involvement, they enact different ontologies by materialising alternative forms of human-soil-food relations. Permaculture, organic, biodynamic, regenerative agriculture, alternative food distribution[2]: these are some of the names given to practices by which movements of ecological agri-food transition are converging today in emphasizing a need to attend to the health of the soil and the broader ecologies in which we grow food (Altieri 2018).

The ecological dimension of transition highlights the interconnectedness of people, animals, plants and geophysical world, as well as the entanglement of ecosystems, histories, technologies, institutions, and cultures (Chakrabarty 2009; Kingsland 2005). While the environmental perspective focuses primarily on nonhuman nature, ecological thinking encompasses the complex web that binds together humans, nonhumans and planetary systems (Nash 2006; Puig de la Bellacasa 2017). Ecological thinking introduces the biggest paradigm shift in social science of the last 50 years, according to Latour (2017; 2018) – framing societies as embedded in interconnected multi-cultural and multi-natural worlds (Rozzi et al. 2015; Hamilton et al. 2015; Krebs 2016).

This ecological dimension differentiates ecological transitions from other forms of transition, in particular technological transitions such as for example the substitution of one type of fuel for another in energy transitions. The history of such technological transitions reveals that rather than reducing environmental impact they increase energy consumption and neglect their broader environmental and social implications (for different positions in energy history see Bonneuil and Fressoz 2016; Fouquet 2016; Fressoz 2014; Malm 2013; Podobnik 1999; Sovacool 2016)[3]. Ecological transitions reverse this reductionist social-environmental function of technological transitions and put transitions squarely back into the terrain of decentralised, bottom-up, and justice-driven practices that radically transform the socio-ecological organisation of the specific domains (such as energy, housing, food provision, farming, sustainable production, urban regeneration etc) in which they take place.

Transition is a multiscale process of ecological reparation that involves technological experimentation, institutional invention, and local spatial diffusion. Reparation here is about reclaiming places that have been appropriated or damaged, and then inventing alternative collectives, experimental practices and mundane interventions: transitions are reparative and practice based (Brown et al. 2012; Pickerill 2021; Papadopoulos et al. 2022). Transition is not a single process; different practices make different realities. With Escobar (2015) we can say that the aim of transition consists in changing existing socio-ecological configurations making alternative worlds as part of ontological struggles for reappropriating, reimagining, and re-inventing forms of living beyond existing socio-economic organisation in the specific domains they take place.

Research from within Science and Technology Studies and related fields reminds us that technological "reality is not destiny" (Law 2004)

and that there is always a multiplicity of alternative and diverging ontological configurations in the making (Braun et al. 2010; Papadopoulos 2018; Holbraad et al. 2014). Different realities are enacted through different practices: the practices of transition are making fragments of alternative worlds in the present. Through practices of material reparation, ecological transitions can be seen as ontological transitions, in which what is at stake is reappropriating and reinventing what living otherwise in a damaged planet (Tsing 2015) could mean. Ecological transitions drive social transformation through multilevel, practice-based experimentation with alternative ways of relating between humans, animals and plants, objects, and technologies (Papadopoulos 2012, 2014). There are good reasons for framing transition movements as local movements. Each transition enterprise defines its boundaries of immediate efficacy, local alliances, and the specific pragmatics of day-to-day transformation. Transition needs a concrete space to exist. Nevertheless, the local offers a very limited perspective for addressing the more-than-local circulation of materials, chemicals, living matter, symbols, imaginaries, and narratives; the proliferation of translocal infrastructures for knowledge and technological transfer; the transnational composition of experiences, tools and tacit knowledges that crisscross each and every local experiment.

At the same time, ecological transitions are less-than-global: practices are always situated, actions are always grounded, and trajectories never extend in the same way endlessly. If the global has been the universalist matrix through which the liberal governance evacuates ecology in the name of economic growth (Leonardi 2017; de la Cadena et al. 2018), nationalism – which (re)introduces an understanding of the local marked by reactionary belongings and identities – has been the illusory refuge in times of economic and geopolitical crises (Latour 2018). As we will see in the next section, both represent key obstacles for more-than-local and less-then-global processes of ecological transition. Rather than universalism and localism, the model of ecological transition relies on the abundance of many different contingent practices: ecological transitions imply that practices do different things in different local ecologies and yet they are intensive flows between them: translocalism (Ghelfi and Papadopoulos 2022).

3. Technofix and the Ecological Impasse: Regressive Nationalism and Green Globalism

Such more-than-local and less-than-global ecological transitions are contested on two fronts. On the one hand, current forms of nationalism that attempt to appropriate and redefine the local in exclusionary, primarily racial terms, and to assert ownership of a dominant "us" that is permitted free access to local resources and materials negating its ecologi-

cal embeddedness. On the other hand, we see attempts to unleash the green economy into a global scale and create a universalist approach to green economic growth that, again as with nationalism, negate the ecological embeddedness of its economic model and its limits.

Current expressions of nationalism condense common nationalist tropes – such as protectionist localism, corporate libertarianism, ultraconservatism, reactionary militarism, and the hate for the cultural left – with the violent disregard for antiracist, trans-feminist and ecological movements (Stanley 2018; Giroux 2018; Teo 2021). Regressive nationalism relies on widely common features of nationalism (Paxton 1998; Sternhell 2010) but does that in a moment of a widespread liberal hegemonic crisis and the ascent of postliberalism: the annulment of accepted liberal-democratic rights and liberal-democratic patterns of governance without the justification of entering into a distinct state of exception that would, even if only nominally, justify such illiberal policies (Tsianos et al. 2012; Papadopoulos et al. 2008; Hayden 2021; Plattner 2019). In the core of these postliberal moves and the renvigoration of nationalism resides the implicit, and sometimes explicit, possibility of regression to fascism. This threat of a "second coming of fascism" (Harootunian 2007) that propagates authoritarianism and the rise of racism came as a response to a wide range of antiracist, anti-austerity and radical democratic and environmental movements that crisscrossed the globe in the past decade. "Our way of life is not negotiable": this is the slogan that dominates much of the political expressions of regressive nationalism that refuses to recognise that we all share, live, and rely on the same planet (Collomb 2014; Malm et al. 2021).

Climate negationism is one of these dimensions of regressive nationalism cultivating pride in a form of secession from the Earth in which ecological claims are dismissed in the name of national economic interests, blunt anthropocentrism, and naïve humanism (Malm et al. 2021). This fictional secession from the Earth implies not only the refusal to take action in order to mitigate the climate and ecological crisis but also an acceleration of the practices of extractivism and environmental irresponsibility: from deforestation to deregulated fracking, unchecked agribusiness, mining, and fossil fuel reliance are seen as key vectors of economic development and geopolitical dominance. Regressive national-ism's authoritarian realignment of state institutions and the incitement of social polarisation along lines of race, gender, and migration (Negri 2010; Traverso 2017) erases the space for any ecological claims.

If regressive nationalism has declared a war on Earth through assuming the proud belonging and uncontrolled exploitation of a locality, the hesitant policies of green liberal governance constitute the other strategic obstacle for ecological transition. Green globalism is promoted by leading multilateral organisations and is assumed in national and interna-tional policy (Aykut and Dahan 2015). It rests on the assumption that a decoupling of GDP growth from resource use and carbon emissions at a rate

sufficient to prevent dangerous climate change and other dimensions of ecological breakdown is possible (Gupta 2014). Green globalism promotes an aggressive agenda for globalising the green economy which relies on a conception of technology and innovation completely disconnected from its socio-ecological premises and consequences (Pellizzoni 2015). The World Bank defines it as "economic growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters" (The World Bank 2012). Despite the wider circulation of the term green economy within significant global governance organisations, green economy initiatives made their presence in the world more as object of political discourses than in a substantial green conversion of production. Fossil fuel economies are still leading features of our societies, and a significant green transition is yet to be materialised. The underlying assumption of green economic globalism is that environmental limits and "planetary boundaries" (Rockström et al. 2009) should not be perceived as constraints to development but as unprecedent business opportunities towards green financialization and as engines of growth that lay the foundations for a new cycle of accumulation (Nelson 2015; Braun 2015)[4].

Despite their open antagonism, regressive nationalism and green globalism co-exist and both severely limit the possibility of ecological transition today. Market driven green economic globalism is failing to tackle emission reductions and has weakened many attempts to deploy widespread ecological transformation. This failure is reinforced by the real threat for relapsing into far-right authoritarian politics that regressive nationalism poses. The threat of a second coming of fascism has effectively blocked ecological change not only when regressive nationalism is in power[5] but also when regressive nationalism acts as an oppositional pressure group to the liberal or-der of power and the project of green globalism. Regressive nationalism blocks change when it is in power and it also blocks change when in op-position through the threat of a fascist turn.

Paradoxically, what unites these two political strategies is their humanist conviction that strong political will and the implementation of technological innovation can prevent climate and ecological danger (Boehnert 2018; Huesemann and Huesemann 2011; Hopwood et al. 2005; Castree 2008). The lure of the technofix is not only dominant in the eco-modernist discourse of green globalism but appears as a core political strategy for appeasing the political unrest that regressive nationalism spawns. Claims that the solutions to current environmental problems and to the lifestyle changes that many in the Global North need to undertake will be delivered through technological innovation and technoscientific progress serve as the liberal answer to the postliberal challenge that the second coming of fascism poses.

This threat of regressive nationalism and the fallacy of the technofix together with the failures of international governance (the fundamentally flawed Kyoto protocol, replaced by the non-binding commitments of Paris, and the very weak compromises of Glasgow[6]) have dwindled the hopes that the climate crisis could be tackled alone through top-down government-led initiatives. The eruption of new ecological mobilisations and climate disobedience actions seem to be an expression of a civil society no longer accepting the inactivity of governments. Greta Thunberg: "[…] people are dying. Entire ecosystems are collapsing. We are in the beginning of a mass extinction. And all you can talk about is money and fairy tales of eternal economic growth. How dare you!"[7].

On the 17th of November 2018 thousands of activists of Extinction Rebellion organised a civil disobedience action by blocking five bridges over the Thames in London. Similar actions have expanded with different intensity over the last two years across hundreds of cities globally. On the 20th of August 2018 Greta Thunberg decides to skip school in protest Swedish government's insufficient actions to reduce greenhouse gas emissions. Virally propagated in Europe, the United States and Australia, the Friday school strikes initiative, promoted by the Fridays for Future movement, continued into the following year and then diversified into a multiplicity of mobilisations and direct action campaigns. As the voices of the climate protest movements are intersecting with other campaigns for environmental and social justice, they reinforce a new sense of being and relating to Earth, a new geo-internationalism that promotes an ecological transition for below. In what follows we examine two evolving and interconnected dimensions of this geo-internationalism that might take the climate protest into the direction of ecological transitions: first, collective practices of ecological reinvention of everyday life through the mobilisation of communally accessible technoscientific knowledge and, second, the institutional reinvention of ecological governance.

4. Community Technoscience and the Making of Ecological Transitions

Collective practices of ecological reinvention turn everyday ecological existence to a terrain of material and political experimentation. Starting from situated practices, transition movements are constructing other ways of inhabiting our planet by practicing ecological transitions from below. The movements we refer to sit uneasily within the broader political category of social movements (see for example Tilly et al. 2009; Della Porta et al. 2006). Transition movements are more-than-social movements in the sense that their practices and aims are not primarily directed to challenge power relations or established institutions. To put it in a different way, they are doing more than that: by experimenting with other ways of en-

gaging with the materiality of life and making alternative socio-material interventions, more-than-social movements are constructing fragments of alternative common worlds beyond the dichotomy nature/society. Insisting on the more-than-social dimension of transition movements highlights their transformative power: their capacity to set up alternative material configurations and everyday practices that aim to materialise ecological transition in the human-nonhuman everyday continuum. From the perspective of more-than-social movements ecological transition is not only the field in which a multitude of revolts against institutional injustice are enacted, ecological transition is also the field for experimentation with everyday practices of socio-ecological regeneration and reparation. Transition movements always involve the entanglement between human and nonhuman others, between materiality and sociality, and, as we will see, between knowledge and practice.

Many of the ecological transitions and ecological initiatives described in this paper not only engage in the circulation of alternative knowledges but also in the production of knowledge itself through a multiplicity of activities and practices: citizen science, maker and hacker spaces, agroecology, co-production between instituted and amateur innovation, open science and technology. This is the distributed power of community technoscience to collaborate and invent technoscientific solutions necessary for materialising ecological transitions. The lure of the universal technofix that dominates green globalism and regressive nationalism as we de-scribed earlier is here reversed though situated practices of minor technoscientific inventions embedded within ecological transitions: kitchen science, DIY biology, the alternative experimentation with medical sub-stances, lay engineering projects, production of alternative forms of energy, community projects of environmental modernization, self-managed systems against environmental hazards, radical patient-based campaigns, permaculture regeneration, traditional systems of knowledge, craft, embodied technoscience, punk science, health movements, open source science, technology and agriculture, clandestine chemistry, the hackers culture, ecological justice initiatives, cross-species collaborations, bio-art, self-organised projects of scientific literacy, bio-dynamic principles of farming, inner city food gardens, cooperative production, organising against extractivism, creation of alternative seed banks, ecofeminist advocacy, production of alternative research, making of alternative knowledge collectives, setting up local systems of exchange – all examples of crafting alternative material-ecological transition projects through the creation of community technoscience.

Community technoscience is about the transition from a highly regulated relation to material and technological innovation that takes place within instituted technoscience, such as formal research labs and industrial R&D facilities, to a multiplicity of self-organised experimental spaces (Papadopoulos 2018). Community technoscience is not only about the generation of alternative scientific and technological innovation within di-

verse communities of practice and the wide distribution of this innovation across multiple places; it is also about the increase of traffic and exchange between instituted technoscience and community technoscience. This increase in the traffic of knowledge and the distributed invention power of community technoscience support the experimentalism of ecological transitions: reclaiming everyday materiality by actively recomposing and rearticulating it. Here, technoscience is done not only within its so-called core institutions but in multiple ways and in many different mundane environments: hackspaces, makerspaces, traditional and alternative knowledge systems, clandestine science, community labs, amateur science and technology, fab labs, indigenous knowledge, bio-art, activist knowledge, self-education projects, punk science, agroecology all gradually become a part of technoscience.

Following the example of agroecology mentioned earlier in this paper, we see how the multi-local experimentation with participatory programmes for genetic seed improvement has become a key dimension of how the agroecological mission for seed biodiversity[8] is redefining the relation between science and everyday farming practice. In order to develop on-farm seed conservation, genetic agrarian scientists, farming communities, ecological movements and consumer associations are co-creating inclusive spaces of technoscientific engagement: community biodiversity management practices involve a multitude of practitioners and a situated capacity of negotiating different needs and material engagements with seeds. The implementation of on-farm conservation projects, participatory research projects, seed banks, heritage seed libraries, open source seed catalogues, knowledge and material transfers are key ingredients for making participatory biodiversity management a significant technoscientific innovation in food transition practices and in agrobiodiversity farming. In this example we see how community technoscience can be continuous with parts of instituted technoscience and vice versa, a continuity that unfolds across disparate and fragmented research settings. This extended view on technoscience allows us to capture how every specific knowledge practice assembles around it a different social and material world, be it scientists, technologists, animals, materials, businesses, social policy makers, marketeers, tools, practitioners, consumers, enthusiasts, activists, community stakeholders. What we have here are large ecologies of multiple actors, landscapes, and information. An intense traffic of knowledges and relations crisscross instituted and community based technoscience, public policies and grassroots organising, everyday life ecologism and public protests. This mangle of interdependencies situates the constituent power of transition politics as discussed earlier in this paper within a wider field of alliances and ecological connections contributing to new forms of institutional imagination: green democracy.

5. The Demise of Progressive Democracy

Modern polity and especially political and social rights in our societies are closely linked to fossil fuels. Timothy Mitchell (2011) argues that since the nineteenth century workers in the Western world achieved political and social inclusion thanks to their crucial role as workers in the extraction, distribution and use of coal. ''Carbon democracy'' has been the terrain for the inclusion of working class struggles into modern polity (Mitchell 2009). But the miners' ability to stop production, to make alliances with railwaymen near their unloading grounds, to send their families demonstrating under their employers windows, to sabotage industrial production, all this disappeared with the global infrastructures of the oil economy starting from the late 1960s (Bonneuil et al. 2016; Latour 2018). The international energy transition from coal to oil constituted the material base of the demise of working-class organisation and the end of a cycle of social emancipatory struggles for more democratic rights (Mitchell 2011). As much carbon democracy was the terrain of a more inclusive polity in the Global North, with the oil turn of the economy it became eventually the terrain that constituted the defeat of progressive democracy and its vision that within capitalist development it is possible to strengthen social and political rights able to improve the economic conditions of an inclusive workforce. The turn to oil not only brought with it the marginalisation of the workers' movements within polity and the erosion of democratic rights but also amplified a collective form of life based on unlimited economic growth.

The new dependency on oil made progressive democracy vulnerable and the oil crises of 1973 and 1979 dismantled the fragile political knot that connected economic growth, working class struggles, and the widening of democratic institutions. Simultaneously, the political alternative offered by socialism was de facto limited to the redistribution of the economy's benefits eventually also relying on the same dominance of oil in the model of production (Charbonnier 2020). The collapse of socialism and the end of progressive democracy not only led to the dominance of financialised neoliberalism but also to the intensification of ecological breakdown. The term "Great Acceleration"[9] captures the other side of the ''Thirty Glorious Years'' – it is the dark side of the "Golden Age" of capitalism (Brenner 2006; Duménil and Lévy 2005a; Duménil and Lévy 2005b; Glyn 2006).

The term resonates with Karl Polanyi's ''Great Transformation'' (1944) that attempts to understand broader interconnected domains of social change and aims to grasp the comprehensive and interlinked nature of the post-1950s transformations sweeping across the socio-economic and biophysical spheres of the Earth: ecological breakdown is inseparable from economic growth. Despite the economic turbulences of the past two decades recent studies highlight that we are witnessing a second acceleration with even greater ecological and climate consequences (Steffen et al.

2015). This second acceleration, which started in the beginning of the 2000s, was not a short-term phenomenon and has continued for more than a decade. In the period 2002-2015 global material extraction increased by 53% in spite of the 2008 economic crisis (Krausmann et al. 2018). During this period alone over 1000 Gigatons of materials were extracted, that is, almost one third of the total extraction since 1900. Moreover, during the Covid-19 pandemic that started in 2020 the demand for raw materials continued despite the temporary decrease of the global GDP, the breakdown of supply chains and extensive labour shortages. We are witnessing a significant crisis of raw materials availability and this as a worldwide-spread phenomenon (Zanoletti et al. 2021).

The current social and ecological conjuncture characterised by the end of progressive democracy, the demise of political alternatives, the threat of regressive nationalism and implicitly fascism, and the unstoppable presence of ecological breakdown means that a new democratic transformation will be inevitably confronted with the very conditions of production itself. An ecological turn in the economy means disarticulating the relation between production and fossil fuels and at the same time abandoning the idea that progressive democracy is possible within this material mode of production. Social justice cannot be achieved in the current historical conjuncture without ecological transition. And ecological transition cannot be achieved within the top-down political strategy of green globalism.

6. The New Institutionalism of Green Democracy

We already highlighted how community technoscience is a key actor in ecological transitions. Here we want to focus on the wider fields of political, economic, social reinvention that can sustain and implement the ac-cumulation of knowledge innovations coming from grassroots movements and at the same time experiment with the governance of complex and articulated networks of socio-ecological transitions. It is of course too early to describe the key tenets of such an institutional reinvention. But as the alternative to both regressive nationalism and green globalism a third space of green democracy[10] gravitates around three political tendencies that already exist within collective enunciations and practices of ecological transitions: (1) assembling a more-than-human political constituency; (2) the making of broad eco-social coalitions for a zero-carbon society; (3) the emergence of reparative governance.

1) From food sovereignty movements to practices of solidarity for the right to health, from permaculture to occupied factories, from feminist and queer movements to indigenous resistance, from environmental justice campaigns to alternative autonomous subsistence movements, from grassroots climate urbanism to alternative making, mending, hacking and design practices, a central point of contemporary ecological movements

lies in the experimentation other ways of relating between humans, animals and plants, objects and technologies. Following the case of the Italian network of peasants, called Genuino Clandestino (Genuine Clandestine), we can see agroecology as a set of practices that is transforming the everyday doing of farming and as a process of reinvention of rural forms of life (Ghelfi 2022). Reclaiming rural forms of life, though, is not about the restoration of some nostalgic premodern social conditions. In the politics of Genuino Clandestino the farmers and activists who define themselves as "contadini" (peasants) reactivate the capacity to invent other modes of material existence. Becoming a peasant, as they call themselves, is an existential transition to a "practicability of life" (Bertell 2016), to a form of living in which self-subsistence and ecological care are inextricably intertwined starting from the reinvention of daily practices of socio-ecological repair. The desire of an embodied, everyday, material relationship with the land: this is the peasant return. Permaculture, organic, biodynamic, regenerative agriculture, the peasant return brings with itself a multitude of practices of care (Puig de la Bellacasa 2017) in which material engagement meets an obligation to make an ecology a liveable place for all its participants.

Projects of ecological transition such as Genuino Clandestino place politics in a very different terrain than the traditional politics of progressive democracy: politics unfolds in the material experimentation with land, in the forest, in the scientific laboratory, in the clinic, in the commune, in the field and the farm, in the hackerspace and in the many other places where humans are learning how to decolonise their relationship with the governance of earth and nonhuman others. A green democratic political constituency addresses, involves, and implicates increasingly a very different set of actors, human as well as nonhuman, in its material workings. Such a reconfiguration of the political constitution is of course from the perspective of regressive nationalism or liberal green globalism impossible to be conceived let alone practised through existing political institutions. In the sense of Rancière (1998), we could say that green democracy emerges as those nonhumans and more-than-social actors enter the political scene only to reorder it so that it can allow for them to act politically.

2) La Via Campesina is a global network of peasant organisations that are aiming to transform agriculture and food systems (Giunta 2021; Ajl 2021). Embracing 148 organisations from 79 countries, and representing millions of rural peoples in Asia, Europe, the Americas, and Africa, La Via Campesina is the most politically significant transnational agrarian movement existing today. Since its foundation, in April 1993, La Via Campesina began forming cross-sectoral and cross-cultural alliances with key urban and rural social movements, unions, parties, civ-il society organisations, NGOs, indigenous resistances, environmental movements. The global resonance of claims such as food sovereignty and agroecology is not understandable without this culture of alliance that made possible

the significant presence of La Via Campesina within the alter-globalisation movement, the World Women's March or the COP26 Coalition for Climate Justice.

La Via Campesina is a good example for thinking the role of eco-social coalitions in transition politics. Green democracy as a political condition and a transformational movement cannot develop without reassembling diverse eco-social demands coming from heterogenous intellectual, social and political positions (e.g. movements, trade unions, parties, progressive business associations, NGOs, artists, scientists, ecological movements) around the idea that in the current historical conjuncture social transformation is driven by ecological transformation[11]. This is happening through a programmatic convergence around the necessity of decelerating carbon intensive activities in sectors that do not contribute to socio-ecological well-being and at the same time accelerating the forms of public investments, private enterprise action and collective agencies that can build the social, cultural, material and ecological infrastructures of a zero carbon society. This involves a re-composition of the most ecologically progressive sectors of a transformative economy: policy driven green new deal with strong incentives for sustainability and circularity; municipal and regional institutions capable of inventing localised innovative ecological policies; and grassroots movements' ability to form political alliances around diverse issues such as zero emissions by 2030, high energy efficiency, renewable materials, the downscaling of production, food sovereignty, carbon emissions and wealth tax, and climate and ecological reparations. Green democracy is mobilised as a vision and as a political framework through the creation of novel alliances and material coalitions between diverse actors and segments that participate in or at least enable ecological transitions.

3) The reliance on top-down solutions has been shown to have limited effects on mobilising ecological transformations and to be exclusionary towards diverse communities as well as transition projects that do not fit within the green globalist agenda of the Global North. Ecological transitions interrupt existing centralised liberal governance and valorise projects and experiments of ecological reparation with novel models of interactive governance across different scales and geographies: alternative forms of agriculture and soil renewal, revegetation of urban spaces, indigenous ontologies, reclaiming of dispossessed land, experimentation with bio-fuels and green chemistry, recuperation of traditional and indigenous systems of land use and land care, water and biodiversity conservation, production of alternative forms of energy, participatory practices of urban and regional ecological planning, to name just a few examples.

Reparative governance reinstates a postcolonial and decolonial perspective into the governance of ecological transitions. Unlike "romanticised reparations" (Cadieux et al. 2019, 649), contemporary

transition projects start from the assumption that there is no pure and original state to begin with: environmental destruction, colonial and racial injustices, and geopolitical inequalities are deeply intertwined with ecological degradation (Ferdinand 2019; Simpson 2021; Cairns 2003)[12]. Reparative governance relies on the framework of reparative justice that seeks to address the wrongs done to those who are suffering ecological damage rather than focusing solely on the punishment of the offenders (Walker 2010; Perez Murcia 2014; Macleod et al. 2017; White 2016; Almassi 2017). Du Bois (1964) provides the conceptual framework for reparative justice in the *Black Reconstruction in America* and Fanon (2004, 58-59) raises the question reparations as part of anticolonial action. Reparations have a long history in postcolonial thought and practice and are also a defining moment of indigenous politics for decolonising settler colonial lands (Clapperton et al. 2019; Bacon 2018; Whyte 2018b). Reparative governance involves reconsidering the geopolitical ambivalences of the green democratic project and its uneasy attachment to Global North politics. Green democracy cannot be a global project but only a transversal and translocal one that reinvents itself through the multiplicity of practices and demands of the diverse transitions and movements involved[13].

Include non-humans in your politics! Make broad social coalitions! Claim reparations and repair reclaimed lands! This is how current eco-social movements do ecological transitions. The constituent power of a myriad of ecological transitions that take place across so many different places and geographies right now is a process of political composition that entails alternative forms of sociability and materiality, transitional knowledge and community technoscience, more-than-social civil disobedience actions, new coalitions amongst a multiplicity of actors, and the call for the new institutionalism of green democracy.

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[1] The notion of constituent power introduces a processual idea of democracy as the "becoming of democracy" in the present, rather than normative promise of democracy that is eternally deferred to the future, see Negri (1999); Negri (1996); Hardt et al. (2000). Extending this view, a green democratic political constituency – see for example Doherty et al. (1996); Braun et al. (2010) – involves a very different set of actors, human as well as nonhuman, in its material workings in comparison to 20th century constituent politics discussed in Negri's work. This more-than-human approach resituates constituent power from humanist modernity to our new ecological more-than-human present.

[2] See, among others, Holmgren (2002); Mollisonand Holmgren (1978); Paull (2006); Pfeiffer (2004); Masters (2019); Chase (2014).

[3] For a broader discussion of the concept of transition see Feola and Jaworska (2019); Escobar (2015); Heffron and McCauley (2018).

[4] See for example different approaches to the valuation and financialization of ecosystems and natural environments in Beckert et al. (2011); Birch (2017); Huguenin et al. (2006); Lilley et al. (2014); MacKenzie (2011); Svampa (2015).

[5] For example, the Trump administration in the USA (2017-2021) not only opposed regulation for carbon emissions reductions but also rolled back over 100 environmental policies; recent developments in Russia, Brazil, and India show how the rise of regressive nationalism has supported aggressive climatic negationism, see Kohl et al. (2021); Fearnside (2018); Popovich et al. (2020).

[6] See Rosen (2015); Kutney (2014); Spash (2016); Arora and Mishra (2021).

[7] Greta Thunberg's speech at the U.N.'s Climate Action Summit in New York City, 23rd of September 2019.

[8] See Bioversity International (2017); Ceccarelli and Grando (2019); Ceccarelli et al. (2009).

[9] Invented by a working group at the 2005 Dahlem Conference (Berlin) on the history of the human–environment relationships (Hibbard et al. 2006).

[10] In recent years the democracy-environment nexus has been developed in the field of environmental politics under the label of ecological democracy. This notion crisscrossed various intellectual trajectories that are trying to stress the role of collective ecological actions in a politics of radical transformation: prefigurative, collective, and ecologically integrated practices give birth to new sustainable systems of production and circulation (Meyer 2015; Schlosberg and Coles 2016; D. White 2019; Pickering et al. 2020; Eckersley 2020; Doherty and De Gleus 1996). The ecological reorientation of the material practices of everyday life is at the centre of new materialist work that highlights the democratic role of local communities' action in shaping sustainable systems of food, water, and energy circulation. The notion of green democracy developed in this paper resonates strongly with ecological democracy that aims to create new alliances, convergencies and processes of political composition amongst everyday ecological transitions, the politics of environmental justice and environmental protest, and new forms of reparative governance.

[11] For example see D'Alessandro et al. (2020), O'Neill (2020), White (2019), Brand (2015), Adler (2019), Ocasio-Cortez et al. (2019).

[12] See also Rose (2004); Rivera Cusicanqui (2010); Simpson 2021; Kimmerer 2020.

[13] We are thinking, for example, of the world's indigenous movements which have put forth a multitude of proposals for reparative justice and ecological restoration, such as the Anchorage Declaration, the Karuk Climate Adaptation Plan, the Red Deal, Green New Deal for Appalachia (Nation 2021) or the agro-foresters of the Savanna Institute and of the African-inspired agro-ecologists of Soul Fire Farm proposals for experimenting with alternative food production in a decolonial perspective, (Ajl 2021).

Handle with Care

Transition, Translocalism and Experimentalism for a Green Democracy

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Abstract: Commentary to the Lecture "Ecological Transition: What It Is and How to Do It. Community Technoscience and Green Democracy", by Andrea Ghelfi and Dimitris Papadopoulos (this issue).

Keywords: technofix; prefiguration; neoliberal governmentality; Anthropocene; Gaia.

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The question of the ecological crisis is on the table for many years. It surfaced around 1970 as the "limits to growth" issue. The MIT report, together with other publications of major public resonance, such as Paul Ehrlich's *The Population Bomb* or Barry Commoner's *The Closing Circle*, stressed the material impossibility of proceeding forever, or for long, with what retrospectively would be called the Great Acceleration in industrialization and economic growth. Yet, the post-Fordist restructuring of capitalism, supporting and at once supported by the impetuous development of life and information sciences, dovetailed with the rise and worldwide diffusion of neoliberal rule – according to which the market is the only resource-efficient social institution – in opening a season of "ecological modernization", that is a technology-based and market-mediated reform of industrial economies aimed at transforming the limits to growth into the growth of limits.

This season, however, was showing signs of fatigue already at the beginning of the 2000s, due to two concomitant factors: on one side increasingly worrisome global threats (climate change, biodiversity loss, resurgent or insurgent epidemics…); on the other a new Great Acceleration, with a thrust – which continues to date – in extraction and dejection processes far outperforming any increase in resource-efficiency. Faced with that, calls to reform started to look incongruous. Not by chance ruling political, economic and intellectual elites' strategy for legitimizing the status quo began to change. Though climate denialism persisted, it was increasingly overtaken by a complex move. On one side an endorsement of the Anthropocene narrative, as calling for a "stewardship" of the planet allegedly based on the "decoupling" of society from its material underpinnings (Breakthrough Institute, 2015). On the other a backing of the Gaia argument, as originally developed by Lovelock (1979), whereby planetary forces are provided with self-reparatory or self-adjusting capacities, while constituting a "form of sovereignty, [...] a power that dominates the heads of state" (Latour 2018, 84), to which one cannot but bow. As a result, we are faced today with an awkward governmental arrangement, which combines a strongly technocratic approach – the one advocating fourth-generation nuclear power and geoengineering solutions like GHG capture and storage – with a gambling one, hedge fund managerial styles being increasingly extended to material assets (Cooper 2010) with the purpose of riding the unexpected and the unpredictable thanks to resilience, flexibility and "ongoing creative experimentation" (Clark and Yusoff 2017, 18). Where these apparently opposite governmental approaches – one hyper-agential and hence "responsible", the other hypo-agential and hence ultimately "irresponsible", in the sense of irrelevant to what happens – converge is in an unshakable faith in technofixes (though what is meant by "fix" diverges considerably) and in hollowing out democracy, both in its traditional representative forms and in the "enlarged", participatory modes that scholars in STS and environmental politics had been advocating as the only sensible reply to increasingly complex issues, often entailing "real life experiments" (Funtowicz and Ravetz, 1993; Krohn and Weyer, 1994).

Against this increasingly bleak backdrop, the proposal of Andrea Ghelfi and Dimitris Papadopoulos for a green democracy stands as a sort of anti-climax. Admittedly, the plea for a renewal of democracy is not new. Since the 1990s there have been plenty of attempts to devise institutional changes capable of addressing Ulrich Beck's diagnosis of the ecological problem as the result of the inability of modern political, economic and scientific arrangements to tackle the consequences of their own operation. The very term "green democracy" has contended the academic and public space with other expressions, like "environmental democracy", "ecological democracy", "green politics", "global environmental governance", "earth system governance", "environmental state" and others, each of which conveys partly different meanings, referring to dif-

ferent understanding of the type and scale of institutional change supposedly needed to address the ecological challenge, from the reformist to the radical, from the local to the state, to the planetary (Dryzek 2016; Eckersley 2020; Pellizzoni 2020; Pickering et al. 2020).

Ghelfi and Papadopoulos's argument builds on three basic features: 1) the authors make a case for a green democracy from below, the level of everyday practices and of a technoscience made by and for communities; 2) this is for them implied in the need for taking into account more than human constituencies; 3) yet they also contend that, for having any efficacy, these broadened constituencies need translocal coalitions, namely around the goals of decelerating carbon intensive activities and of engaging in reparative actions, away from mythologies of pristine nature. Let's have a look at each claim.

Democratization from below is the workhorse of supporters of prefigurative politics (Yates 2015), frugal and DIY innovation (Khan 2016), new materialist mobilizations (Schlosberg and Coles 2016) and new peasantry (van der Ploeg 2009). In different ways and from different perspectives, this scholarship argues that change is possible (and indeed is already taking place) only starting from the bottom, in a sort of revamp of the old anarchist claim that to change the world you have first to change yourself and your way of living, acting as if the new world was already there and avoiding to engage in an open conflict with institutionalised powers. This case seems no doubt fit for a situation where, as Ghelfi and Papadopoulos argue, democracy is caught between the Scylla of regressive, hyper-extractive nationalism and the Charybdis of green, hyper-regulative globalism.

Taking into account more than human entities as constitutive of an enlarged political community is a case made by philosophers and ethicists since at least Aldo Leopold's "land ethic". Recently, anthropologists have been especially prominent in conveying a sense of more than human communities, as their work on non-western cosmologies has shown how naturalism, with its sharp division between humans and the rest of the world, clashes with other ontologies for which there is continuity, kinship and mutual exchange between animal and vegetal species, and even with the inanimate world (Descola 2014; Viveiros de Castro 2014; Kohn 2013; Haraway 2016). Bruno Latour (2004) has made an elaborate attempt to translate such acknowledgment into the refashioning of democratic institutions.

Finally, the issue of scale has increasingly taken the forefront in reflections over the way global capitalism works to extract value and how human and more than human arrangements survive and develop in response to its devastations (Tsing 2015; Papadopoulos 2018). The issue of scale is moreover for long time at the centre of debates over the scalability of "real utopias" and new materialist arrangements up to challenging the ruling order (Wright 2010; Schlosberg and Coles 2016). Ghelfi and Papadopoulos's case for an intermediate level of coalitions of local expe-

riences, based on the recognition of affinities between differences, is relevant to escape the lure of localism or of a "climate Leviathan", that is an overarching technocratic governance necessarily authoritarian even if formally respecting democratic rules (Wainwright and Mann 2018).

Taken on their own, the pillars of Ghelfi and Papadopoulos's argument have thus been developed at length in recent years. What makes it promising, however, is the stress on their reciprocal implication. I say promising as it is obvious that the space of an article prevents from a thorough development. The paper, in my understanding, is a first outing in the troubled water of (re)thinking green democracy in the post-Liberal era. In this sense, the sketchy character of the new institutionalism the authors propose should not be regarded as a detractor. Indeed, even book-length elaborations, like Latour's (2004), remain at quite an abstract level of development. Of course, a more precise account would and will be welcome of how, say, prefigurative practices can translate into institutional set ups, or translocal initiatives like Via Campesina can come to really challenge the ruling order. But beside and before this, it is worth considering a few issues, paying attention to which I believe can be beneficial for the development of Ghelfi and Papadopoulos's argument.

One is the problem of voice. Who is going to speak for nonhumans? On the basis of what kind of entitlement? These are recurrent questions in environmental political theory (see e.g. Dobson 2010; Eckersley 2011; O'Neill 2001). Whatever the reply (scientific knowledge, moral intuition, empathy, indigenous culture and so on), "the authority of nature's representatives depends primarily on their claim to know something about nature", with ensuing temptations to "shut down democratic debate with claims to speak for nature's objective interests" (Brown 2017, 33). Even worse, one may add, if an understanding of representation as correspondence, whereby representatives directly talk for pre-existing constituencies, is replaced with a constructivist approach, whereby "the process of making representative claims shapes both the representatives and those they represent" (Brown 2017, 35), as the scope for dominative outcomes is likely to grow proportionately. In any case, connecting democracy – an eminently human notion and enterprise – with nonhumans is anything but simple. Whatever the solution one envisages, one should clarify beforehand the type of relationship between humans and nonhumans one has in mind. There is ostensibly a major difference between a commitment to caring and building kinship (Puig de la Bellacasa 2017; Haraway 2016), to which Ghelfi and Papadopoulos subscribe, and, say, Latour's most recent take on environmental politics, according to which, faced with terrestrial forces, "there is no other politics than that of humans and to their own benefit", and no possibility of living "in harmony with so called 'natural agents'"(2018, 86-87). The kind of "non-identity" relation between humans and nonhumans envisaged by Adorno possibly points to yet another direction. In other words, green democracy can be conceived, and institutionally developed, having in mind quite different

ontologies and related politics.

Another issue demanding attention is whether a green politics from below, even aimed at building translocal alliances, is capable of escaping the risk of ineffectiveness – or worse. Indeed, one of the major criticisms of prefigurative mobilizations is that, especially after an initial, more confrontational phase, they tend to boil down to lifestyle politics, that is personal choices concerning "dress, diet, housing, leisure activities, and more" (Portwood-Stacer 2013, 4). This is something that has long proven inoffensive and even welcome to capitalism, which reads it in terms of market differentiation and of diversion of energies from open contestation (Pellizzoni, 2021). Even intimately oppositional experiences like Genuino Clandestino, or comparable "alternative value practices" (Centemeri 2018) one encounters especially in the primary sector, from participatory plant breeding to flour compacts, are not immune to this risk. On this view, the locality of initiatives raises not only the question of their scaling up and coordination but also a question of how they can translate into something more straightforwardly political and antagonistic, and whether this translation is actually needed (Mouffe 2013).

A third point worth considering is solicited by the anti-climax character of Ghelfi and Papadopoulos's case for an encompassing, more than human democracy, when it is set against the *Zeitgeist*. Recent years have been characterised by a growing sense of urgency, insecurity and pending catastrophe. Many indicators tell this: post-9/11 "wars on terror"; the securitization of everyday life, with an unprecedented extension of surveillance; the worsening of climate change indicators, from GHG concentration to weather turbulences; the accelerated pace of new and resurgent epidemics; the very rise of climate movements like Fridays for Future and Extinction Rebellion, which build their case on the lack of time and impending disaster; the diffusion of dystopian narratives and of collapsology, a literature and public discussion over how capacities for survival after the fall of technologically organized society, deemed inevitable, can be developed (Allard et al. 2019; Centemeri and Tomassi 2022). Faced with all that, one is reminded that democracy is time and energy consuming. Growing voices claim in fact that it is a luxury increasingly hard to afford – most recently in relation with the Covid-19 pandemic. If one compares the Latour *of Politics of Nature* (2004, first published in 1999) with the Latour of *Down to Earth* (2018), the change in tone is striking, showing how, at least for a progressive *intelligentsia*, the situation has changed in twenty years from serious to dramatic. In the first book we find a case for diplomacy, a cautious, patient negotiation, an ongoing reassessment of which entities have to be admitted to the world in common. In the second book we meet a case for the need to act now, in haste, with very simple and clear objectives in mind: struggling for human survival in competition with all the organisms present in the "critical zone" a few kilometers thick between the atmosphere and the source rocks. In this framework the rise of a "climate Leviathan" or, at the opposite side

of the spectrum of reactions, the flourishing of groups self-organized around survival skills and emergency stockpiling may seem a more likely future than a further enlargement of democracy. Said differently, the time for a truly radical green politics might be already over.

Finally, one has to consider the very notion of transition. As a term, transition has been increasingly replacing others, like revolution or transformation, to convey a sense of change. Concerning climate, for example, claims from social movements and workers organizations (Schlosberg and Collins 2014; Smith 2017) talk of "just transition" (towards sustainability). Concerning socio-technical change, successful approaches like the "multilevel perspective" also talk of transition (Geels and Schot 2007). Yet, are revolution, transformation and transition just synonymous? The issue would obviously require an extensive treatment. At face value, however, one can say they are not, to the extent that they entail different ontologies. Revolution literally means "turnaround" – turning things upside-down. A certain stuff is reversed, usually abruptly. Yet, it is just *that* stuff, only organized differently. Transformation, instead, suggests a more substantial change: a variation in structure, texture, assemblage, look or form by which something becomes something else. This may happen quickly or slowly, even imperceptibly. However, the end result cannot be completely different from the point of departure, at least if it is to be successful. Transformations can be monstruous and monstruosity consists in an unmatching combination of parts: some of them have changed while others have not. This affects and, according to countless dystopias, ultimately undermines the functioning of the thing. Said otherwise, transformation has to keep an inner consistency; one cannot become *anything*. The ontology of transformation is thus more dynamic than the ontology of revolution, but it keeps a fundamental stability. Compared with both, then, transition conveys the idea of a subtler, smoother, yet at once more radical morphing. It implies an ontological fluidity unknown to the other types of change. Step by step the original assemblage is led to become something radically *else*.

This ontological "freedom", however, comes at the cost of opening avenues to unprecedented forms of domination. As I have argued elsewhere (Pellizzoni 2016), ontological fluidity is the cypher of both cutting-edge social theory, which sees in it an emancipatory claim and opportunity, and of neoliberal governmentality, which builds on it to expand and strengthen its appropriative, exploitative hold on humans and nonhumans. Just think of how corporate storytelling depicts biotech as the continuation of what humans did for thousands of years, or nature always did, "the 'technology' in these practices [being] nothing more than biology itself, or 'life itself'" (Thacker 2007, xix). In this account nature is technology and technology is nature, through and through. The result is that GMOs are claimed to be indistinguishable (no specific regulation needed) yet simultaneously different (more usable, valuable, hence patentable) from natural entities. Or just consider how experimental poli-

tics, as advocated by Ghelfi and Papadopoulos and a host of scholars in STS and political theory, is advocated as well since the 1980s by neoliberal managerial and policy literature, in terms of accepting and indeed riding and enjoying unpredictability, surprise, insecurity, volatility, disorder, as "at the heart of what is positive and constructive" (O'Malley 2010, 502; for an example of this literature see Taleb, 2012). In this framework the recipe for good politics is trial and error and non-predictive decision-making. The result is a de-responsibilization of policy-makers and, consequently, a depoliticization of issues, including those fraught with major social implications like climate change (Swyngedouw 2010). The result is also an "administrative" take on all sorts of crises, from financial to biological, no longer seen as amenable to solution but as a permanent condition with which to come to terms (Pellizzoni and Sena 2021).

In short, one may ask, is experimental politics compatible with democracy? In a broad historical sense certainly yes, as democracy builds on no pre-existing certainties but proceeds through collective reasoning and dialogue. The affinity between science and democracy has not by chance long been stressed, by the likes of Popper and Dewey, among the others. However, in another sense, closer to the present situation, the reply is uncertain. It much depends on how one conceives of experimentalism, who are those that apply it, and for what purposes.

To conclude. Notions like transition, experimentalism and translocalism are hardly innocent and self-evident in their meaning. A case for a green democracy like Ghelfi and Papadopoulos's needs a careful disentanglement of the different, even opposed implications these notions carry with them. Their article is an excellent starting point for such an endeavour.

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Managing Uncertainty in Biomedical Innovation from Below

Exploring Tensions and Contradictions in Oncology and Pregnancy Cases*

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Abstract: The contribution originates from Track 1, "Genetics and biomedical innovation: Between risky and promising scenarios", held within the VIII STS Italia conference. The session was intended to promote reflection on the implications of the latest innovations in genetic research and molecular biology for the formation of new care practices, as well as new surveillance and risk management. The objective of the paper is to highlights the contradictions and ambivalence that may rise from biomedical innovation through analysing two specific cases: 1) off-label practice in the context of rare disease in oncology and 2) pre-natal screening technology and surveillance practices. In both cases, these biomedical innovations, although very promising, produced high uncertainty, and the technologies and/or processes developed to cope with the 'unknown' were challenging. However, at the same time, tensions and contradictions were observed that originated unexpected practices 'from below'. In particular, the following section is focused on the ambivalence that has increasingly taken root in the management of risks related to health with respect to individual contributions and to research and scientific work practices.

Keywords: Biomedical research; genomics; digital pregnancy; self-surveillance; off-label.

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1. Introduction

The session "Genetics and biomedical innovation: Between risky and promising scenarios" was held in Trieste, Italy, at the VIII STS Italia Conference "Dis/entangling technoscience, vulnerability, responsibility and justice", and focused on the rise of new practices related to biomedical innovation. New screening techniques are profoundly related to emerging knowledge that shapes patients' experiences. Furthermore, reconfigurations of the infrastructures of biomedical innovation have also led to new practices. The common thread in this development is the management of some health-related risks, ranging from top-down forms of regulation and surveillance, traditionally realised under medical dominance, to the recent 'from below' forms of participation in clinical practices, usually expressed by the self-determination of and self-surveillance by patients. The following paragraphs aim to explore numerous different gazes (medical, patients and digital) in the identification and mitigation of some health-related risks, sharing the perspective that even healthy situations can be treated as pathological.

Highlighting the role of human and non-human actors in the reconfiguration of knowledge produced by innovation, the present contribution reflects on two specific cases in which the ambivalences of risk management by laypeople and clinicians were addressed.

Specifically, the first case study concerned how biomedical innovation is shaped by risk management in the clinical context and biomedical research. As emerged during the conference, the tension between 'adventurism' and 'securitism' is particularly visible in the case of oncogenetics and rare diseases, a highly experimental context, where protocols and off-label drugs play a specific role in fostering (or not) innovation. Protocols are conceived as infrastructures that – in certain contexts – must be reassessed, as in the case the prescription of off-label drugs that seems to favour a 'wild' de-regulation process.

The second case addressed new surveillance practices in the pregnancy arena, ranging from screening technologies to online foetus visualisation. This topic was examined to illustrate how pregnancy and birth have been included in the process of self-surveillance and data-sharing. Risk management in the everyday lives of pregnant women continues to use traditional screening practices, but also utilise the ability of subjects to negotiate this type of knowledge in public arenas such as social networks. The medicalisation of pregnancy and birth helps in understanding the surveillance of daily risks faced by pregnant women. Finally, as a consequence of extended medical surveillance, research dedicated to lay strategies towards risks suggests that the possibilities of sharing online ultra-

sound images of the baby-to-be should be critically analysed among scholars.

2. Dis/entangling Biomedical Innovation in Oncology: Between Boundary Infrastructure and Therapeutic Anarchism

This section focuses on the tension between protocols, understood as boundary infrastructures, and off-label clinical practices with the aim of reflecting on 'bioclinical adventurism' as a resource for biomedical innovation, as well as the deep limitations of this approach. Biomedical research is a prolific field of experimentation; thanks to the greater availability of information and new diagnostic biotechnology, a radical evolution in patient care is underway. Predictive medicine, neo-adjuvant therapies, which have recently become widespread in major health institutions, convert a patient's body into a theatre of medical-scientific experimentation, opening new possibilities of care.

The field of precision medicine seems to be a promising way for discovering correlations between DNA mutations and the risk of developing different diseases, helping patients to acquire new practice of self-care and illness-identity, perhaps simultaneously establishing a new regime of proto-illness (Gillespie 2015). Moreover, screening, self-diagnosis, and predictive tests are just some of the practices and tools now employed to gain greater control over disease (Timmermans and Buchbinder 2010). As in the case of genetics, the rise of knowledge acquired by biomedical research and translational medicine have modified and shaped both the experiences of patients and scientific and clinical practices. Genetic screening was envisioned to identify risk factors by creating new bio-clinical entities (Keating and Cambrosio 2003), and such diagnostic approaches are essentially focused on prevention and managing uncertainty. Oncology is a field of great experimentation with new techniques and care practices, involving knowledge from molecular biology, genomics, and informatics, as well as innovating diagnoses and stadiation processes (Huber et al. 2018). Thus, the production of biomedical knowledge concerning the cytogenetic characteristics of the disease and medical treatments is no longer confined to scientific laboratories (Martin et al. 2008; Cox and Webster 2013) but is strongly connected to clinical practice (Crabu 2014; Cambrosio et al. 2018). In line with this, oncology is an assemblage of practices and knowledge where specific 'oncopolicy' may rise to norm clinical and research activities that are also designated to reshape health policy.

Looking at pharma for cancer treatments, drugs have very long and complex trials where data are sources of legitimacy about off-label use, Pascale Bourret (Aix-Marseille University), Alberto Cambrosio (McGill University, Montreal), Jonah Campbell (McGill University, Montreal), Peter Keating (University of Quebec at Montreal) and Jessica Polk (McGill University, Montreal) underlined how physicians play a pivotal role in constructing the legitimacy of off-label uses instead of pharma companies or researchers. Overcoming data legitimacy by physicians imply to reconfigure authority of the data, by posing clinical experience with patient on a new light and this may lead to what the authors call 'therapeutic anarchy' or 'therapeutic adventurism.'

However, several studies have documented the proactive and critical engagement of patient associations in therapeutic and biomedical research in various contexts as a solution to patients' exclusion from health systems (Epstein, 1996; Rabeharisoa and Callon 1999; Panofsky 2011). Notably, patient associations are interlinking the rareness of diseases, the 'politics of numbers,' and patient's involvement in research (Rabeharisoa et al. 2014), playing leading roles in the legitimisation of new care practices.

A striking example of this is 'off-label' treatment. Off-label is defined as the use in clinical practice of drugs or treatments that have already been registered but are used in a way that does not comply with the requirements of the authorised product. The drugs used off-label often include already known molecules that are used in clinical situations for purposes not explicitly approved from a regulatory point of view. This practice is widespread in various areas of medicine where off-label prescriptions make up a conspicuous proportion of prescriptions. The off-label prescription of drugs is therefore allowed and regulated in some cases, even if not explicitly approved, representing an important opportunity that could lead to significant advances in the knowledge and treatment of certain diseases as cancer. On the other hand, the off-label use of drugs exposes patients to potential risks, given that the efficacy and safety of these drugs have been evaluated in populations other than those being prescribed. In contrast, patient organisations argue that such 'exceptional' programs should be thought of and eventually redesigned as appropriate insofar as they bring in 'real-life'-based evidence on the clinical efficacy of the orphan molecules and on their medical and social values. Indeed, the 'off-label law,' from the patient's perspective, take debates out of the strict realm of economic evaluation to issues of unmet medical needs, accessibility, and social justice.

In France, for example, rare disease patient organisations have pushed for RTU (temporary recommendation for use) as an appropriate option for orphan drugs. They argue that there are numerous molecules that have

already passed a series of toxicity tests that could thus be used for rare diseases if they have shown some 'real life' bio-clinical impact on certain aspects of the diseases (Rabeharisoa and Doganova 2016).

However, the wide diffusion of this practice has created new 'alliances' between clinic, laboratory, and pharma. The wide availability of personalised drugs from molecular profiling services – public and private – means that physicians can provide highly personalised off-label treatments. Nevertheless, many of these drugs are introduced with very little information about their effects. This is often the case for cancer treatments, which are becoming increasingly precise and targeted, but there is also poor bioclinical evidence of their efficacy. Finally, failures and successes are not routinely detected when off-label drugs are prescribed. In this regard, it can be problematised if off-label is the only suitable alternative to produce innovation within highly experimental settings and to overcome the stiffness of biomedical protocols.

On the one hand, off-label use can be interpreted as a break in the infrastructural assumptions enshrined in protocols that could be interpreted as boundary infrastructures (Mongili and Pellegrino 2014). Repositioning off-labels in the context of rare diseases transforms treatments and care practices, disentangling patients from protocols giving them more agency about their conditions and experimental treatments.

Rare diseases, in fact, are settings where knowledge is not sufficient to implement new treatment, and therefore protocols are rigid and there is difficulty in producing innovation. This situation takes on the features of a paradox. In keeping with this, off-labels can be perceived as a source of innovation and the way for patients with rare diseases to 'break' the infrastructure.

As remarked by Giuseppina Pellegrino (University of Calabria) in our track, protocols are more than boundary objects. As pointed out by Star and Ruhleder (1996), infrastructures are based on specific relational ecologies and are built around particular works and social practices. Assuming this perspective, protocols become a relational concept, the generator of a set of heterogeneous techno-scientific contexts where data can be produced by all actors involved in clinical settings. Indeed, today we are data citizens and our data are an integral part of our lives, especially related to health and wellbeing. In this vein, the need to explain natural phenomena in formal terms – to make knowledge available to the relevant scientific community and actionable to laypeople – reveals a strong tension between local knowledge, tacit knowledge (Collins 2010), and public knowledge (Knorr-Cetina 1981). This is also because knowledge and innovative practices in biomedicine are increasingly interconnected between clinical practice and scientific research following the model 'from bench to

bed' (Neresini and Viteritti 2014), where patients are simultaneously sources of knowledge and fields of experimentation. The tension between protocols and off-labels in producing biomedical innovation indicates a gap between aspiring to a highly desirable future, in which many serious illnesses will finally have a cure, and the daily organisation of clinical practice and laboratories. The collective dimension of biomedicine shows some limitations, while it also reveals hidden asymmetries and deep inequalities in the so-called post genomic and proto-illness era.

3. From Pre-natal Screening to Digital Foetus: The Surveillance Course Perspective

The main objective of this section is framing modern surveillance practices as they apply to risk management in the pregnancy arena. More broadly, considering the genomic turn of biomedicine addressed in the previous section, being 'at risk', as a new social condition, presupposes the control of individuals through screening practices that can estimate, in numerical terms and through statistical modelling, the chances of getting sick or, in the case of pregnancy, to prevent diseases for foetuses. Over time, as claimed by Foucault (1963), the evolution of clinical practice, as well as the growing development of new technologies, have brought about a change in what is observed, what is found under the microscope of medicine, shifting from a surveillance of symptoms to a surveillance of illness and to the lifestyles of the subjects. Unable to trace a radical clinical distinction between healthy and sick, everyone, according to Armstrong (1995), must be placed in a surveillance network. This Shakespearean limbo produced by the medical surveillance of risks generates a subject suspended between 'to be ill or not to be ill' that has redesigned the boundaries and interests of medicine and, above all, of surveillance. This extension to medical surveillance has been applied to gestation over the years.

Nowadays, in what has been defined as a post-genomic society, risk anticipation surrounding pregnancy has become increasingly pervasive, including not only recommendations on appropriate lifestyles regarding smoking, alcohol intake, and food, but also medical technologies, invasive screening, and numerous genetic tests, thus shaping motherhood. This is interrelated to the concept of intensive mothering (Reich 2018), namely the idea of mothers as able to prevent risks, pursue success, and manage their (future) children's health.

Following Armstrong's (1995) assumption, pregnancy is situated today in an intermediate space between health (normal pregnancy) and disease (pathological pregnancy) (Burton-Jeangros 2004), meaning that mothers-to-

be must control and regulate every single aspect of their pregnancy pathways. If being at risk is often interpreted as a predictor of future disease (Gillespie 2015), we should mitigate the uncertainty (Giddens 1991) through risk anticipation. On the basis of Crawford's definition (1980), healthism is defined as 'the preoccupation with personal health as a primary – often the primary – focus for the definition and achievement of well-being; a goal which is to be attained primarily through the modification of lifestyles' (p. 368). In the pregnancy arena, a dominant view considers the foetus's health of higher importance than the pregnant woman's health and well-being, and this hierarchy makes 'maternal sacrifice' legitimate (Bessett 2010).

The development of new technologies in reproductive health has opened new opportunities for prenatal diagnosis and, at the same time, have contributed to the medicalisation of the prenatal period with the 'normalisation' of prenatal foetal screening (Ettorre 2007). This is in line with the prolific experimentation in biomedical research, as highlighted in the first section. Various studies on the technical surveillance of pregnancy and birth have described future 'mothers' contrasting experiences and expectations regarding risk management surrounding prenatal screening and delivery' (Burton-Jeangros 2004 p. 420). As highlighted by Alice Scavarda (University of Turin) prenatal screening is often intended to function to facilitate selective abortion in case the foetus presents some abnormalities. Therefore, parents who refuse prenatal testing or choose to carry the pregnancy even in presence of a defect or a genetic disorder are deemed responsible for the birth of their disabled child. Motherhood thus becomes a perfect target for medical surveillance and actions taken to define legitimate and illegitimate maternal practices (Ehrenreich and English 1978; Murphy 2003).

On another level, recent developments in mobile technologies are making this practice more user-oriented, as different channels (apps, sensors, and social media) offer new ways of monitoring and measuring the human body and the maternal experience (Lupton 2012). As reported by Adams and Niezen (2015), identifying risk fits the paradigms of individualised and personalised health, where health risks are considered to be manageable and controllable via self-monitoring and self-care.

Surveillance practices and the management of new biomedical risks can be considered an integral part of our ordinary pregnancy routines. They are becoming an everyday activity, routinely performed. In addition, the rapid growth of self-surveillance pregnancy apps raises critical questions about the commodification and surveillance of personal data (Barassi 2015). Based on these premises, it can be argued that the use of the Internet and social networking to present the prenatal experience acts on two different fronts. On the one hand, it encourages what has been defined by Andrejevic (2005) as 'lateral surveillance,' which concerns peer-to-peer monitoring and the use of

surveillance tools by individuals rather than public or private institutions. This form of horizontal control, exercised among peers, is particularly widespread in the pregnancy experience. It involves subjects' (mostly voluntary) self-exposure on the internet and concerns three forms of routinised social monitoring and self-expression, which are integrated into the technological architecture of many contemporary social media platforms: (1) watching and judging (morally, aesthetically, etc.) networked Others; (2) watching Others watching oneself – that is, sensing and anticipating the gaze of strangers as well as of fellow group members; and (3) watching one's own data double – that is, the hypermediated Self in the form of (for instance) geographical positioning or personalised publicity offers (Christensen and Jansson 2015, p. 1480).

However, the representation of pregnancy in the online sphere also acts on a second level. Following Oviatt and Reich's (2019) work, posting status updates, pictures, and events of the prenatal experience could help one to make decisions regarding pregnancy and/or parenting. Already in 2010, Rideout, Foehr, and Roberts presented how groups and channels for prenatal and postnatal periods that appeared to provide visual and textual information about pregnancy, parenting, social support, and humour were popular among future parents, considering the different levels of expertise, community networks, and of course cultural understandings. This constant sharing of the future parenthood experience can impact the practices and representations associated with pregnancy.

Additionally, as Ilenia Picardi (Federico II University of Naples), Sole Alba Zollo (Federico II University of Naples) highlighted during the conference, the dissemination of foetal images on the web through the analysis of a corpus of pregnancy websites/blogs/social media range from weekly development guides to personal birth stories. As a result of the short circuit of the use of the new diagnostic technologies and new communication practices on the Web, pregnant bodies, conceived in the field of biomedical diagnostics as the site of control of pregnancy, become the site for the social construction of the digital foetus.

The extensive sharing of foetal images by parents has enabled a situation whereby corporations have access to important data regarding the unborn. The datafication of the body and this new form of 'foetus-veillance' blurs the boundary between private and public control. Some research (Barassi 2015; Lupton and Pedersen 2016; Ley 2016) has shown that some mothers not only endorse medical definitions of health risks but are also particularly eager to share images and data of the unborn. This creates a digital environment in which participation is often incentivised, and a variety of information is increasingly commercialised.

We do not know whether such data will be lost in the digital ecosystem or whether it will be integrated with other data, effectively impacting children's digital profiles and fuelling other surveillance practices. However, we know that 'data policies do not address this problem and collect children's data by relying on an ambiguous discourse that directs the responsibility, once again, to users' (Barassi 2017, p. 6). Quoting a famous song by the Rolling Stones, "Fingerprint File": 'Keep on the lookout / Electric eyes / Rats on the sell out / Who gonna testify / You know my habits, way ahead of time / Listening to me, on your satellite.'

4. Conclusion

Population screening, self-diagnosis, and predictive tests are just some of the practices and tools now employed to gain greater control over the development of disease, reinforcing the intersection between health, risk, and technology. As Jasanoff (2003) pointed out, risk is part of the modern human condition, woven into the very fabric of progress.

The present contribution proposes a reflection on the tension between new forms of negotiation and participation in biomedical research. Patients' participation in the processes of biomedical innovation is multifaceted; they are both the subjects of clinical experimentation and the sources of genomic data in diverse fields, from oncology to neurodegenerative, metabolic, and cardiovascular diseases. But individual forms of participation as biomedical innovation are also located in other fields, such as pregnancy. Risk management is particularly encouraged in pregnant women, where their everyday lives represent a central feature of the experience of pregnancy.

Through self-surveillance, pregnant peoples' bodies cease to be objects of medical knowledge and become a mode of knowing (Mol and Law 2004). Collecting data about different conditions could increase the set of knowledge and know-how showed by mothers-to-be. Conversely, in highly experimental settings, technological innovation produces new forms of knowledge, as in the case of oncogenetics; however, at the same time, it can become challenging to translate innovation into stable clinical practices. While protocols act as patient safety devices, in the case of rare diseases, they become highly constraining infrastructures for innovation. This tension can lead to the emergence of borderline practices, such as off-label treatment prescription, presenting scenarios that are potentially harbingers of innovation but where the risks of therapeutic adventurism are still poorly under-stood.

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[*] While this article is the result of several discussions between the authors, Barbara Morsello has written sections 1. "Introduction" and 2. "Dis/entangling biomedical innovation in oncology, between boundary infrastructure and therapeutic anarchism" and Veronica Moretti has written sections 3. "From prenatal screening to digital foetus: The surveillance course perspective" and 4. "Conclusion".

Has COVID-19 Changed Everything?

Exploring Turns in Technology Discourses and Practices Related to Ageing

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Abstract: This article presents reflections resulting from the conference session "Dis-entangling Later Life: Ageing Processes, Innovative Practices and Critical Reflections", organized in the context of the VIII STS Italia Conference. The paper expands the discussions from the session and touches on three topics regarding the multiple relationships between COVID-19, ageing and health, namely: (1) the decline of a hyper-responsibilizing rhetoric in the public sphere over the last decades, along with concepts of active ageing and successful ageing; (2) the reinforcement of the representation of ageing as a process with homogenous effects on population, transforming older adults into a social group characterized by shared frailties and needs; and (3) the growing role of public and third sector institutions in supporting older adults in the use of technology during the COVID-19 outbreak, expanding the network of involved actors. Proposals for future research paths are addressed in the conclusions, encouraging the further analysis of the topics discussed in the conference session.

Keywords: Ageing; COVID-19; discourses; practices; technology.

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1. Introduction

This article presents reflections from the organizers of the session "Disentangling Later Life: Ageing Processes, Innovative Practices and Critical Reflections" (chaired by the authors and Silvia Fornasini), which took place during the VIII STS Italia. Planned for the summer of 2020, the event was postponed to 2021 as a result of the COVID-19 Health Pandemic. The

disruptive outcomes of the pandemic encouraged organizers and authors to reorient their reflections and to integrate pandemic constraints and challenges into their work. The session generated an enriched and in-depth discussion of age definitions or standard measurements, social-media use – before and during the COVID-19 pandemic – along with the adoption of personal or healthcare technologies in rural environments. This paper expands on the session's outcomes, namely on three emerging topics arising from the multiple relationships between COVID-19, ageing and health, reframed in the light of current work in the fields of Science and Technology Studies (STS), ageing studies, and media studies.

2. Older Adults and Public Discourse During the Pandemic: A Turning Point for Self-responsibility?

The consequences of the COVID-19 pandemic on public discourse about ageing is one of the emerging topics in the debate within the field of ageing. During the pandemic, the public discourse has vehiculated the perspectives of various stakeholders (e.g., scientists, politicians, political opinion leaders, patients' families, and organizations) and simultaneously, has oriented public opinion and political agendas.

In this context, it is relevant to start by clarifying how the pandemic has (re)shaped representations about the role of older adults in self-managing their health conditions. Since the beginning of the 1990s, public discourse has promoted a vision in which older adults are expected to practice self-care, or, in other words, to take care of themselves by embracing a 'healthy lifestyle' and enhancing their bodies (Joyce et al. 2007; Lassen and Moreira 2014). As stressed by William Jones (University of Washington, USA), concepts such as active ageing and successful ageing have dominated public discourse, leading to the perception of older adults as independent subjects, in this way turning good and poor health into a matter of pure individual responsibility.

In contrast with this trend, the pandemic strengthened rhetorics that objectified older individuals, regarded as fragile and passive, in need of protection from the community (Miele 2021). Beginning with the correlation between chronological age and COVID-19 disease severity, presented by statisticians and epidemiologists, public narratives framed COVID-19 as a "disease of the elderly". Throughout the pandemic, this conceptualization has taken on different shapes: during the initial phase of the pandemic, particularly on social media, the health of older adults was represented as an unproductive social burden, dispensable in the name of economics (Fraser et al. 2020; Jimenez-Sotomayor 2020). With the spreading of the virus, older adults were increasingly represented as passive recipients

of interventions carried out by governments, scientists, and public institutions (Ayalon et al. 2020; Zhang, Liu 2021; Caliandro et al. 2021). Research is required to determine if the COVID-19 outbreak has indeed weakened the previous emphasis on older adults' individual responsibility or if the latter will resurface as pandemic conditions pass.

3. The Meaning of Ageing: From Homogenization to De-standardization and Vice Versa

A second relevant topic concerns the role of the pandemic in ascribing meaning to ageing processes. The last decades have been characterized by attempts from biogerontology and social sciences to produce new knowledge about the biological processes that modulate ageing. In particular, as underlined by Bronzini (2021), the connection between chronological age and ageing has been growingly contested over recent years. New criteria for measurement have been created, providing personalized age measures (Moreira 2016) and reconceptualizing ageing as a process that is not completely aligned with chronological age (Pickard 2016). De-standardization of ageing challenges the assumption that there is a certain homogeneity in the ageing process and that individuals with very different physiological, psychological, clinical, and social characteristics can be considered similar merely because they share the same number of life years (Katz 2006; Moreira 2016).

As a result of the COVID-19 pandemic, national and supranational institutions have powerfully re-affirmed their need to treat older adults as a homogeneous social group characterized by shared necessities and fragilities. Since the beginning of the pandemic, public discourse has played a key role in 'othering' older adults, i.e., treating them as a homogeneous group, distinct from the "normal" (meaning typical or mainstream) population, and characterized by frailty, dependency, and vulnerability (Allen and Aylon 2021). As demonstrated by the qualitative study conducted by Melis and colleagues (2021) focused on daily life during the COVID-19 lockdown in Italy, the containment measures recommended by the institutions through public speeches, guidelines, and government regulations, contributed to isolate older adults, forcing them to re-define their daily life and to dramatically restrict their social contacts. The reinforcement of the 'othering' processes, already normalized before the pandemic in discourses regarding older adults (Fealy et al. 2012), appeared to have a twofold effect which requires further investigation. On the one hand, 'othering' processes have allowed a wide campaign of vaccination to be organized, a typical expression of the so-called 'WE medicine' (Dickenson 2013), a kind of

medicine aimed at protecting entire sectors of the society and characterized by universal access to healthcare services (in opposition with the personalized and privatized 'ME medicine', strongly interwoven with the neo-liberalization of western healthcare systems). On the other hand, 'othering' has favoured the isolation of a large percentage of older adults, supporting the reduction of their social life (e.g., abandoning informal care and volunteering activities) and exacerbating pre-existing inequalities (e.g., affecting individuals with weak family ties and with very low digital literacy).

4. The COVID-19 Pandemic and the Networks Supporting Older Adults' Technology Use: The Increasing Role of Formal Ties

The last topic discussed in this paper concerns the similarities and differences between the practices of technology use, before and during the pandemic by older adults.

One difference that COVID-19 pandemic seems to have introduced is the increase in the diversity and number of actors involved in the technology use by older people. Traditionally, technology use by older adults has been characterized as an individual or a small group activity supported by close family and friends (Nunes et al. 2010; Vines et al. 2015; Riche and Mackay 2010). The study by Simone Carlo (Cattolica University, Milan) and Francesco Bonifacio (Cattolica University, Milan), conducted in a pre-covid context and presented at the conference, aligns with this depiction. The study provides examples of both individual and collaborative use of technology, supported by close family and friends in the rural Italian town of Castel del Monte. Fuelled by the need to use technologies to access essential services, such as healthcare, older adults would engage with these tools by themselves through trial-and-error, or resort to the support of close family or friends to learn to use different technologies, or, also, to help them overcome accessibility barriers (Greengard 2009).

However, the COVID-19 pandemic seems to have motivated other actors to become involved in the usage of technology by older adults. Government restrictions and public representations about the effects of COVID-19 on older adults' health have limited their agency, bringing new actors into their networks. For example, with the presentation by Monica Murero (Federico II University of Naples) we learned about the role of local volunteers in supporting older adults in "using" electronic prescription. While intended to work as a facilitator during the pandemic, electronic prescription made it harder for older adults to get medication prescriptions because these were only accessible through a mobile app on a smartphone. Volunteers supported older adults in accessing such prescriptions, going to the pharmacy to purchase the medication, whenever older people were requested to stay home. The role of volunteers was, however,

not only applied to enabling electronic prescription. Multiple studies demonstrate volunteers' role in teaching the use of certain technologies over the phone (Haase et al. 2021; Gresh et al. 2021). Municipalities were also a new actor supporting technology use. Evidence is provided by Giulia Melis (Bicocca University, Milan), Emanuela Sala (Bicocca University, Milan) and Daniele Zaccaria (SUPSI, Switzerland) on the important role municipalities played in training older adults to use information and communication technologies, in assisting older citizens in gaining access to essential services, but also social media which became key to maintaining rich contacts with family, friends, or their local community (von Humboldt et al. 2020).

The examples of collective engagement presented in the session motivated us to consider whether such initiatives were isolated instances, or if society has globally gained a new understanding that the use of technology by older adults is a shared responsibility. In a moment of adversity, new actors appeared to support older adults in learning to use or directly access services perceived as critical to their wellbeing. However, issues of accessibility undoubtedly continue to exist when solidarity and the voluntary nature of the community have weakened. As researchers working in this area, it is our hope that the same willingness to support older adults remains after the pandemic and, also, that such initiatives counteract other accessibility issues in the community, such as those faced by people with disabilities.

5. Concluding Remarks

Starting from the reflections gathered during the session "Dis-entangling Later Life: Ageing Processes, Innovative Practices and Critical Reflections" and from the literature produced over the past year and a half, we have shown how the pandemic has weakened the pre-existing emphasis on individual responsibility and on the individualization of the life course. These trends, typical of the biomedicalization era (Clarke et al. 2003, 2010), shared a specific focus on individuals, perceived as key actors that can positively and successfully shape the ageing process. From this viewpoint, personalized and customized biomedical interventions can help individuals to maintain a good health status, balancing the progressive weakening of public welfare systems and the increasing involvement of private entities in the provision of health services. In contrast, during the pandemic, medical knowledge has turned into a subsidiary body of knowledge to be mobilized in the public sphere for legitimizing the expansion of a political centralized governance of the emergency (Crabu et al. 2021). In parallel, older adults have been put at the centre of discourses, representations, and policies that treat these adults as recipients of public health interventions that target a homogeneous group of frail individuals, in need of protection from the community. Moreover, the networks of older adults have been changed by

the pandemic, welcoming several new actors from public and third sector institutions, to support the adoption of technology directly associated to these adults' wellbeing.

We believe more research is required. Firstly, it is important to verify if the trends identified are temporary or fated to persist beyond the pandemic phase of COVID-19. Second, it is important to understand if the pandemic has inspired possible alternatives to hyper-responsibilization and objectification of older adults, namely through fostering community solidarity and the strengthening of public welfare policies directed at older adults, without reducing agency and overlooking individual characteristics. The attempt to view older adults as an active part of the planning and development of techno-scientific processes is not new in STS (see: Peine and Neven 2019; Cozza et al. 2020). However, now it is vital to investigate the ways through which the pandemic conditions have favoured or obstructed the active involvement of older adults in the co-construction of interventions aimed at improving their health and wellbeing.

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Disentangling Digital Technologies and Power Relations in Work and Organization*

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Abstract: This contribution stems from the thematic track "Digital technologies and power relations in work and organizations. Theoretical and empirical perspectives", held during the VIII STS Italia conference. Referring to the contributions and the discussions we had during the track sessions, we present two main themes that emerged as crucial issues: 1) the hidden dynamics of digitalized interactions in workplaces and organizations; 2) the role of algorithms and digital platforms in organizational and work practices. Not with the aim of summarizing the variety and richness of the discussions we had, with this text we want to raise the curiosity and the attention of the readers toward some of the conversations emerging from the encounters between "the digital" and "the organizational".

Keywords: Digital technologies; work practices; organization; power; algorithms.

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1. Introduction

This contribution stems from the thematic track "Digital technologies and power relations in work and organizations. Theoretical and empirical perspectives", held during the VIII STS Italia conference. In fact, the way technologies may affect work and organizational dynamics represents a longstanding debate in and out STS (i.e., Thompson 1967; Orlikowski 1992; Grint and Woolgar 1997; Karakilic 2020; De Vaujany et al. 2021). This debate is particularly vivid nowadays, as digital technologies are

widespread and ubiquitous in the workplace and give opportunity to new forms of organizational coordination and management-at-distance of different and dispersed organizational actors (De Vaujany et al. 2021). The diffusion of digital systems allowing the creation of complex datasets on employees' performance (Trittin-Ulbrich et al. 2020), together with the spread of digital platforms enabling a "tap" model of work and workforce – a sort of stand-by workforce which can be 'tapped' anytime in order to gain work as a commodity (Stampfl 2021) – are just two of the many examples of the new forms of articulation of organizational processes.

The encounter of "the digital" and "the organizational" leads nowadays to reconsider the articulation of some of the very basic concepts traditionally implied to frame organizations (Plesner and Husted 2020): organizational structures turn to digital infrastructures; production implies "produsage" (a neologism for the combination of production and usage – Bruns, 2008); knowledge management translates into processes of datafication and data management; managerial power and control can be exerted "remotely", but digital technologies may also offer the opportunity to workers for collectively organizing and renegotiating power.

In particular, during our sessions the discussion focused around two major themes:

1) the hidden dynamics of digitalized interactions in workplaces and organizations;

2) the role of algorithms and digital platforms in organizational and work practices.

Thanking all the participants for their engagement and contribution, we will now briefly present the principal insights we retain from the discussions we had.

2. Hidden Dynamics of Digitalized Interactions in Workplaces and Organizations

We are in a factory warehouse, in 2019: the employee's workstation displays staff progress in a "funny" game on a small screen. Lights indicate which item the worker/player needs to put into a given bin and scanning devices track task completion. All the items are tracked so that movements can be followed by the system and shared on the workers' workstation screen in a Tetris-like game. In the warehouse, workers and teams are engaged into these race-like competitions to pick or stow different items, like toys, cellphone cases, coffee machines, and so on.

This is the main idea behind gamification: having fun while working. But be careful, "fun" is mandatory (Mollick and Rothbard 2014). Gamification implies the introduction of game design elements in non-gaming contexts (e.g., the workplace) with the aim of improving work organization, efficiency, and productivity. Nowadays, in many organizations, gamification tools are employed as technologies for modifying workers'

motivation and pushing them to better perform their tasks and correcting their work habits "spontaneously" according to a supposed "good" rhythm of work, without (at least apparently) any constriction, mechanism of sanction, disciplinary or corrective action. But as the Amazon case presented by Daniele Ruggiu (University of Padua,) in our session shows, behind such a funny and apparently "harmless" practice there are not so harmless consequences. This case is a clear example of how technology may hiddenly work for serving capitalistic interests (Coombs et al. 1992), rather than for supporting workers and their legitimate interests in the daily work. It seems rather that, through gamification, the worker becomes a kind of funny hamster running on a wheel, a consideration that highlights how gamification can be problematic from the point of view of workers' rights (e.g., the right to health), their self-determination and self-exploitation, and not lastly privacy.

In the same vein, the case presented by Klara-Aylin Wenten (Technical University of Munich, Germany) shows how technology may induce behaviors and interactions. In the presented case, teamwork (apparently flat) and coordination (apparently horizontal) are mobilized thanks to management tools with a strong, albeit hidden, disciplinary power. Drawing on the concept of "script" as "program of action" (Akrich 1992; Latour 1992), Wenten examines how post-its and whiteboards may act as core objects for performing idea generation and for managing designers, developers, and engineers. The result is that diverse interests and ideas, instead of being exalted by post-its and whiteboards (apparently designed for this purpose), appear unified and standardized, while other issues get lost in the process of translation through keywords on the post-its. The material characteristics of post-its (e.g., they are made to stick on the wall) discipline employees to stay permanently activated: a post-it may fall, thus "interpellating" (Law 2000) the participants to the session in order to be reattached to the whiteboard. Again, in a hidden manner, post-its and whiteboards manage workers to constantly stay committed to their daily work. In other words, on one side these artefacts may discipline, coordinate, and control people's work, while on the other they may standardize and delete otherness and difference.

In short, the discussion articulated around the ways in which organizational power and control may be incorporated in analogic and digital artifacts adds further evidence to the need for STS not to dismiss the dominating side of (digital) technologies simply because this could sound "deterministic" but, on the contrary, to elaborate non-deterministic interpretations of the hidden power of technologies. In other words, there is a growing need for non-binary and fine-grained interpretations able to give account of the intricacies of power, digital technologies, and organizational processes (Bruni et al. 2020; 2021).

Since labor process theory, in fact, critical theorists focus their attention on the more or less hidden power of technology, usually seen as a driver for instilling managerial strategies and organizational ideologies. We may

add that, when it comes to technology and work, a common assumption is that technology impacts work and organizing, leaving people helpless in the face of it. An argument that reinforces the general concern regarding workplace surveillance and technologically raised power imbalances between employers and employees (Tække 2011; Zuboff 2019). Going back in time, already Marx himself suggested that workers are not powerless, rather, they have a compensatory workforce because capitalists depend on them to do the work that provides a return on the invested capital. Also, the very "malleability" of digital technologies may either "empower" or "disempower" workers allowing them to act in unexpected ways: in short, technology shapes our behaviors but, in turn, is shaped by our behaviors.

A telling although somehow paradoxical example of this dynamic is the case of the FairLabor app presented by Francesco Saverio Ranieri (Sapienza University of Rome), which shows how a technology designed to act as an "emancipator" tool may fail to help workers to free themselves from their condition of exploitation. FairLabor has been developed by the Lazio region for opposing the illegal hiring in agricultural work. It was designed to work as a virtual placement office that allows users to register on the booking lists for agricultural work for bypassing corporals in the practices of labor intermediations. However, there are difficulties in enrolling users, as they are already accustomed to the use of much more informal and widely used app (namely, Whatsapp), which better supplies the needs of on-time coordination and permits to maintain the illegal structure of work intermediation. We may add that a "failure" in configuring the users (Woolgar 1991) eventually results in a failure in enrolling them in the program.

The point, thus, is that humans may play an active role in the development of a (digital) technology simply by not using it (Kline and Pinch 1996; Kline 2003). This same point underpins the work presented by Robin Renwick (Trilateral Research, UK). Here, mapping and understanding human factors for an effective cybersecurity is the core of a project that tries to consider the fact that management, cybersecurity departments, and general employees can have conflicting priorities towards cybersecurity. Workers may activate tactics that defuse technology. As we will shortly see considering the case of digital platforms, such a consideration can be applied also to study contexts other than cybersecurity for showing how workers can react, resist, and even "appropriate" technology (Eglash 2004) in many different and unexpected ways (Miele and Tirabeni 2020; Andrei et al., 2022).

3. The Role of Algorithms and Digital Platforms in Organizational and Work Practices

Digital platforms, it could be argued, are one of the major outcomes of the encounter between "the digital" and "the organization". The debate on digital platforms, even if recent and still ongoing, has already witnessed two

different interpretative waves (Bruni and Esposito 2019a). In a first wave, digital platforms are put in connection with concepts such as "peer-to-peer", "digital commons", "online cooperation", "liberation of work", "horizontality", "innovation from below", and, foremost, "sharing economy" (Benkler 2006; Botsman and Rogers 2010; Gillespie 2010; Sundararajan 2016). In other words, platforms are seen as helpful tools that contribute to the pursuit of ideas of freedom and free circulation of knowledge. This first wave dates to the early days of Web 2.0, when the possibility of users interacting with the World Wide Web and going beyond the original designers' project (by customizing online spaces, uploading content, and sharing them in a network of peers) seemed to give concrete support to facilitating commons and commoning (Plantin et al. 2016). As Van Dijck, Poell and de Waal (2018, p. 11) put it, it was as if "connectivity automatically leads to collectivity".

More recently, a second wave has stressed how "many forms of digital commoning are not purely informational but are entangled within an organizational network of concrete (non-digitalized) economic practices" (Ossewarde and Reijers 2017, p. 612). The sharing of a car or an apartment (such as BlaBlaCar or Airbnb), as well as the delivery of food (such as Foodora, Just Eat, or Glovo) and/or a taxi service (such as Uber), are evidently linked to a set of heterogeneous practices, often "material" (such as driving or riding) more than "digital". This second wave thus concentrates on the conditions of those working behind the platform and the ways in which platforms profit from users' labor (Irani 2015; Jin 2015; van Doorn 2016). Platforms are now associated with words such as "precariousness", "fragmentation", "individualization", "erosion of workers' rights" and, most of all, "outsourcing". In fact, even if many differences occur between them, Airbnb, Uber, Amazon Mechanical Turk, BlaBlaCar, Foodora, or Taskrabbit all share a form of operating "through a hyper-outsourced model, whereby workers are outsourced, fixed capital is outsourced, maintenance costs are outsourced, and training is outsourced" (Srnicek 2016, p. 95). Through this outsourcing-based model, platform-organizations optimize labor's flexibility and scalability, articulating a "workforce-as-a-service" model (Starner 2015) and creating *ad hoc* (labor) marketplaces, apart from institutional rules and rights (van Doorn 2016).

In the vein of this second wave, various contributions focused on the role of algorithms and digital platforms in organizational and work practices. In particular, Gianmarco Peterlongo (University of Turin) and Francesco Bonifacio (Cattolica University, Milan) concentrate respectively on Uber and Glovo riders to problematize the power exerted by platforms over the workforce. In the ethnography conducted by Peterlongo in Buenos Aires, the peculiar illegality of Uber's ride-hailing service has allowed unprecedented forms of counter-use of the digital platform: subverting some of the app's tools, Uber drivers adopt and share tactics to circumvent the rules of the platform, re-appropriate its digital infrastructure, and turn the conditions of work for their own advantage. Similarly, the four-months

enactive ethnography (Wacquant 2015) conducted in Milan by Bonifacio focuses on the relation between Glovo riders and on-screen interfaces, epitomized by moments when algorithms come to matter, as for the notification of deliveries' acceptance/refusal. Showing the heterogeneity of riders' workforce, the research accounts for the "fabrication" (Wacquant 2005) of different types of food-delivery workers, which also lies in the construction of a different "algorithmic imaginary" (Bucher 2018). In fact, "thinking about what algorithms are [...] and how they function" (ibid. p.113) affects riders' work, embedding different meanings (precariousness, risk, professionalism, competence, etc.) and organizational and work practices. In fact, a conspicuous part of riders' training and skills lies in the interpretation of algorithms computational functioning, so that the interaction with the algorithms becomes a site of learning and differentiation between various ways of unfolding the job. Some of these skills are directly referred to the algorithmic organization of work (e.g., learning how to manage work differently during the weekend or the week-days), while a good portion of the required knowledge is not algorithmic based, even if fundamentally entangled with it (e.g., achieving a good knowledge of the city, its traffic and its rhythms is fundamental for a rider in order to decide what gigs to accept or the area where to work more proficiently). As showed by Bonifacio, if part of this learning is the result of an ongoing individual process of learning-by-doing, a specific algorithmic-related knowledge is also collectively produced and shared in different spontaneous micro-communities of workers originated in informal moments and places (as for the times/places when/where riders wait for gigs).

This same relational and non-deterministic account of the role of algorithms and platforms permits Fabio Esposito (Federico II University of Naples) to question the kind of organizational model emerging from the platform-user relationship. Focusing on Airbnb, Esposito shows how coordination between its "core" (namely, the digital infrastructure) and single operating units (i.e., the Hosts) is achieved through reciprocal adaptations. Thanks to its templates and managing tools, the platform is able to collect information about its members and impose a few standards, while adapting to Hosts' different local needs and arrangements. On the other hand, Hosts adapt their spaces, habits, and time-schedules to meet the platform's standards and requests; and given the freedom they have, they find *ad hoc* arrangements to perform the service required by the platform. Referring to Mintzberg (1980), the organizational model emerging from Airbnb could thus be framed as an "adhocratic infrastructure". In adhocracies reciprocal adaptations take place through informal relations which seems to have no need to be standardized, and power exists only as "virtual loci" of control. This happens also in the case of Airbnb, which positions itself as some kind of authority that simply regulates interactions between its central core and single operating units, organizing, monitoring and eventually sanctioning or rewarding them. In this way, the platform draws

and maintains the sociomaterial infrastructure in which organizational norms and standards are inscribed (Bruni and Esposito 2019b).

As the inspiring concept of "adhocratic infrastructure" suggests, together with all the other contributions and discussions we had in our track, further inquiring is needed in order to grasp the specific ways in which organizing processes and power relations are performed and stabilized in and through digital technologies.

4. Concluding Remarks

Pointing to some of the themes around which our debate articulated, the purpose of this text was to stimulate the curiosity and the attention of the readers toward some of the conversations emerging from the encounters between "the digital" and "the organizational". Focusing on the hidden dynamics of digitalized interactions in workplaces and organizations and on the role of algorithms and digital platforms in organizational and work practices, we have highlighted a number of related issues, such as the organizational adoption of gamification processes for motivating workers; the disciplinary power of material artifacts and digital technologies; the failures and paradoxical effects digital technologies may have once final users (that is, workers) enter the stage; the forms of appropriation, adaptation, counter-use and even non-use workers may display in relation to the algorithmic management of digital platforms; how digital platforms may be framed as "adhocratic infrastructures", where coordination is exerted through informal relations and power exists only as "virtual loci" of control.

Some of these issues are already at the core of the STS debate, others are *in fieri*, but all together they signal the heterogeneities and complexities of disentangling digital technologies and power relations in work and organization and deserve to be further explored.

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Weak Systems
Unveiling the Vulnerabilities of Digitization

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Abstract: This article discusses digitization weaknesses, biases, and malfunctions to challenge popular, almost hegemonic visions of contemporary technologies. By focusing on examples provided by recent mediated cases, controversies, and critical research about biases, we aim to propose an analysis of anything digital starting from its vulnerabilities, to look beyond polarized deterministic views, both optimistic and pessimistic. The article generates from the thematic track: "Weak Systems. Exploring bias, bugs and the vulnerability of digitization" that took place at the VIII STS Italia Conference. The panel brought together scholars from different backgrounds, including STS, history of technology, sociology of communication and critical data and media studies to discuss instances of technological weaknesses in various contexts. The article sums up some of the panel takeaways and pleas for a cooperative and interdisciplinary effort focusing on "weak systems".

Keywords: Digital vulnerabilities; infrastructures; artificial intelligence; cybersecurity; critical data studies.

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1. Introduction: From Powerful Systems to Weak Systems

This article considers popular narratives of digital technologies, their origins and rationales aiming to advance a critical take on how these narratives come to become hegemonic. In particular, the article will challenge popular narratives of anything digital based on quasi-sublime and deterministic visions and cultures, advancing a focus on technologies' inner vulnerabilities, biases and material and design limitations. We will argue that

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a stronger focus on technologies' weaknesses and vulnerabilities would bring beneficial insights to the current debates around digitization and its social and political impacts by bypassing polarized takes.

Since their birth, in fact, the rhetoric surrounding digital media and digital infrastructures has been constantly characterized by two main ideas. On the one hand, a long series of neologisms and metaphors have conveyed the idea of contemporary and future digital infrastructures as immaterial if not transcending worlds. Think for example at the early visions of the Internet as an "Intergalactic network" (Licklider 1963) or at the promises of the "cyberspace" (Mosco 2004). Or think of the recurring metaphor – harshly criticized, though still persistent - of "the cloud" (Peters 2015), up to the most recent techno-utopian dream of the "Metaverse" promoted by Mark Zuckerberg. Beside the political, ideological, or even metaphysical implications of this rhetoric (Natale and Pasulka 2019; Bory 2020), the social imaginary has been fiercely driven to think of infrastructures as distant, self-sufficient, and intangible means. On the other hand, companies, governments, and stakeholders have long characterized digital technologies through a series of adjectives and nouns evoking a sense of power, magnificence and reliability. Think at the unstoppable shift from mainframes to supercomputers or at the spread of the so-called information superhighways in the 1990s, the never-ending idea of a digital revolution, or the always imminent arrival of strong AIs (or again super-intelligence). Through these concepts, alterity and powerfulness, the term "digital" goes hand in hand with the idea of a distant and uncontrollable, but stable, efficient, and reliable system. As the sociologist Pierre Musso (2003) argues in his historical analysis of networking, this kind of rhetoric has both a fictional and functional implication. A system must be both narrated and perceived as strong and reliable. In other words, in our contemporary society, companies and providers need to instill trust in users and users need to blindly trust providers, otherwise any essential service would collapse or be replaced. Notably, infrastructures must be "off the radar, below notice, or off stage" (Peters 2015, 36); they must be strong, stable and reliable, allowing us to live our everyday lives with no concerns about the streets we walk on, the quality of the water we drink, and the data we access and share.

2. The Internet of Our Discontent and the Raise of Critical Takes

Today, after decades in which enthusiastic (if not ecstatic) visions of digitization have prevailed in the public sphere, critical scholars have challenged the propensity of digital technologies to strengthen individuals' protection and the democratic organization of societies. The Snowden case and the turmoil following the Cambridge Analytica (CA) controversy, for example, have inspired debates and discussions about Internet surveillance, the perils of the data economy and the potential "weaponization" of

social media platforms for political influence and propaganda goals. At the same time, the once supposed "horizontal" architecture of the Web has been clearly subverted by centralizing actors such as digital media corporations and national governments who exercise an immense power on our choices (Morozov 2011; Zuboff 2019). Moreover, the frequency in the use of the "black box" metaphor (Pasquale 2015) to define anything data or digital has increased significantly. Corporate algorithms are now defined as such, together with other controversial areas of datafication, such as surveillance, algorithmic manipulation, or machine learning. *Per se*, black boxes are socio-technical *apparata* capable of seeing and sensing all around them, without revealing enough information about their inner mechanisms. Not surprisingly, the metaphor works nicely when it comes to define how digital power is exercised by technological companies and other powerful actors, which are usually extremely successful in masking their actions, policies and dynamics behind veils of technical opaqueness and legal protections. As Ronald J. Deibert argues (2013, 5-9), never before have we known so little about how technology works, as we are actively discouraged from "developing a curiosity about and knowledge of the inner workings of cyberspace." Thus, it comes with little surprise that whistleblowers and leaks have taken a crucial public role in opening and exposing some of these black boxes, starting from Facebook (Olesen 2020). Overall, notwithstanding enthusiastic visions of the digital have been – at least in academia and in the media – completely overturned, the idea of digital media and infrastructures as strong and powerful has been rarely put into question[1].

Our aim here, as for the track we organized at the VIII STS Italia conference, is to look at digital media and infrastructures rather than through their strengths and power, through their vulnerabilities. From their side, STS have long been interested in the relationship between materiality and vulnerability, for example when addressing the relevance of repair and maintenance for the very existence of technical artifacts and infrastructures (Denis, Mongili and Pontille 2015; Russell and Vinsel 2018). More than a decade ago, in an article titled "The vulnerability of digital culture", Weibe Bijker already argued that "vulnerability is an inevitable characteristic of technological culture" but also that any vulnerability "is socially constructed as much as facts and artifacts are" (2006, 55-56). In line with Bijker's stance, we argue that understanding digital media and infrastructures as "weak" may help scholars to overcome the polarization of the goodness or evilness of technology. In our opinion, this peculiar perspective should start from analysing biases, bugs, and errors as essential elements of the systems we live by. Although some of these vulnerabilities appear in public discourse following incidents such as data breaches, outages, leaks, hacks, and other disruptive occurrences, sometimes they can also be the symptoms of more rooted phenomena and problems. For instance, the kind of problematic third-party data sharing that was at the core of the CA case was not an isolated incident, while actually a legitimate part of the Facebook business model at the time of the events. As many observers have

noted, the CA case was caused by a feature rather than a bug (AccessNow 2018). This point opens up interesting theoretical questions about almost two decades of hegemonic positivistic and deterministic takes on digitalization: have they been so "pervasive" to transform any discourse around digital things going wrong into an accident disrupting otherwise efficient and safe technologies and infrastructures?

3. Bubblegum and String: Infrastructural Spectacular Failures, Weaponization and Inherent Vice

Recent international media events have brought more attention on the vulnerabilities, bugs and errors of digitalization, shedding light on how these powerful systems can be weak and prone to malfunction. The global Facebook outage that occurred in October 2021 has definitely been one of the most interesting cases of this kind. As the web infrastructure and website security company Cloudflare wrote commenting the events (Martinho and Strickx 2021), seeing Facebook "disappearing from the Internet" has been probably the most explicit of these cases showing the existential weaknesses of today's digital infrastructures. As cybersecurity expert Eva Galperin noted, the accident also shown how "the internet is held together with bubblegum and string"[2], echoing recurring concerns about the stability and strengths of the Internet infrastructure. It is interesting to stress how the Facebook outage was caused completely by an internal mistake that occurred during a routine maintenance operation that disconnected Facebook data centers globally. In all its spectacularity, the biggest and richest global social network went completely offline by a rare but banal configuration mistake, underlining the hollowness of any "sublime" or "magical" view of digital infrastructures, the cloud or social networking at large. Other incidents had different origins. In 2016, for instance, the Mirai botnet brought interesting insights for a meta-analysis of the weaknesses of digitalization. Infrastructure company Dyn, offering DNS services to a set of major US clients, including Netflix, Amazon and PayPal among others, was targeted with a massive, distributed denial-of-service (DDoS) cyberattack, aimed at disrupting online services managed by Dyn. The result was a global outage that made enormous parts of the Internet unavailable for hours. While DDoS attacks are all but rare, this one was a peculiar one, as it was caused by a remotely controlled botnet of infected hijacked Internet of things (IoT) devices, such as printers, home appliances and security cameras (DeNardis 2020, 5-8). The malware Mirai was behind the infection of the devices involved in the botnet and it was created with the explicit aim of exploiting vulnerabilities in the devices' security, which is a topic of huge discussion in the field of IoT, given its usual low security standards (Bunz and Meikle 2018, 122). The Mirai botnet of *zombie* infected devices is so peculiar because it shows how inner digital vulnerabilities (i.e., weak

security standards) can be exploited remotely to launch attacks to the vulnerable Internet infrastructure.

4. "Mind" Vulnerabilities: Inside AI and Facial Recognition Shortsightedness

Vulnerabilities are not only a distinctive feature of digital infrastructures. If we adopt a simple and outdated analogy, the infrastructural "body" of digital systems is as weak as their "mind". For example, beyond the recurring myth of an upcoming superintelligence, humans' everyday life is constantly confronted with the biases and shortcomings of contemporary artificial intelligence such as voice assistants, facial recognition, social bots and companion robots. As scholars from different fields like anthropology, sociology, media and communication studies and STS have aptly shown, contemporary AIs often embeds the very same cultural biases and weaknesses of contemporary societies. Recent studies and critical enquiries have stressed how racism, deception, and western-centered behaviors and beliefs are among the many deficiencies of artificial intelligence, just like in our unequal and biased social world (Barassi 2020; Crawford, 2021; Crawford and Paglen 2021). This is clearly visible with facial recognition, one of the current most controversial applications of AIs, whose usage in various contexts has shown the existence of racial and gender biases in how the technology operates (Castelvecchi 2020). An influential study by Joy Buolamwini and Timnit Gebru (2018), for instance, underlined the presence of skin-type and gender biases in at least three commercial facial recognition systems. Similar results have emerged from further research and the available literature in this area is now extensive, as suggested by a comprehensive literature review by Khalil et al. (2020). Reasons for the presence of these persistent biases in facial recognition have to be found predominantly in the training materials that these systems are built upon and, in particular, in "internet-scraping at scale", the most frequently used approach to build large datasets for training facial recognition systems. These datasets, according to an Alan Turing Institute report, "have largely reflected the power relations, social hierarchies and differential structures of privilege that have together constituted the sociocultural reality from which those data were extracted in the first place" (Leslie 2020, 17-18). The profound ethical implications of biases in facial recognition, though, can also have severe civil rights consequences, especially when facial recognition is deployed as a law enforcement and security strategy in public spaces. In 2020, Robert Julian-Borchak Williams, a black man from the Detroit area, was wrongfully arrested after being falsely "recognized" by a facial recognition system in a CCTV footage (Hill 2020). The repressive and social sorting-oriented repercussions of facial recognition are even more explicit in China, where the technology has been used to target the oppressed Uighur minority. For instance, a 2020 *Washington Post*

investigation (Harwell and Dou 2020), based on internal documents, showed that a facial recognition software capable of sending automated "Uighur alarms" to the authorities had allegedly been tested in China. Yet, racial biases have emerged also in the application of other machine learning / AI applications, such as search algorithms: Safiya Umoja Noble's research work, among others, has demonstrated the existence of clear racist biases reinforcement and replicas in how commercial search engines like Google work, whose outcomes end up discriminating against minorities and black women in particular (Noble 2018, 64-110).

5. Conclusion: Joining Critical Voices to Unveil Digital Vulnerabilities

Especially in light of these profound ethical and societal concerns, deepening our understanding of the weaknesses and vulnerabilities of the "body" and the "mind" of contemporary digital systems means to reverse both the enthusiastic and the critical perspectives which indiscriminately accept the power of technology and its capacity of transcending human agency and social responsibility. Notably, by looking at weak systems scholars and policy makers can interrelate technological advancements and data infrastructures with human features and values to detect, acknowledge and even contain the very human errors embedded in contemporary socio-technical systems. To think about the weakness and vulnerability of digital systems such as the Internet and AI is essential to understand how such systems, just like human societies, are quite far from reaching perfection, but they are, and they must, be mutually perfectible. On a broader societal level, though, a question about how technologies reach the public and how they get transformed into "narratives" remains unanswered. In particular, the role of media in perpetuating discourses and how they are created requires further scrutiny. For example, so far research conducted in the UK has shown how the public narrative of AI systems is predominantly driven by corporate and industrial interests and voices (Brennen, Howard and Nielsen 2018). Scholars and critical voices, by stressing and unveiling the vulnerabilities of weak systems, have the opportunity – and the duty – to influence and change these narratives. However, in order to counterbalance the overreaching voice of corporate actors, the inner weakness lying in academic fragmentation and disciplinary boundaries should be (respectfully) assessed and overcome. This article, which is a first result of the fruitful interdisciplinary panel we organized during the VIII STS Italia conference, is a first, short, step in such direction.

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[1] Scholars from STS and media history have partially filled this gap by looking symmetrically at the relevance of failures and forgotten projects to the development of the contemporary socio-technical environment (see Magaudda and Balbi 2018).

[2] Eva Galperin's tweet is available at: https://twitter.com/evacide/status/1445177126139809796 (retrieved December 30, 2021).

Infrastructures and Platforms in Media and Cultural Industries

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Abstract: This article offers an overview of the topics explored during a conference track, titled Platforms and Infrastructures in Media and Cultural Industries, organised by the authors within the VIII STS Italia Conference held virtually in June 2021. The text starts outlining how infrastructural research, which emerged in science and technology studies (STS) and has been then adopted in different branches of media studies, evolved. To this end, it reviews some of the major works that embraced the so-called 'infrastructural turn' in media studies. The emergence of platform studies is then outlined, a field that stemmed from game studies and, largely owing to the social relevance of social network platforms, subsequently became a major intersectional space between STS and media studies.

Keywords: Infrastructures; platforms; digital media; cultural industries; STS.

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1. Introduction

On the occasion of the VIII STS Italia conference, we decided to organise a track devoted to exploring the current research on platforms and infrastructures in media and cultural industries. In recent years, it is quite evident that the major changes in cultural industries and content distribution have been shaped according to the affordances and constrains offered by media platforms and digital infrastructures. Media and cultural industry studies, by borrowing a sensitivity from STS, addressed platforms and infrastructures by highlighting that they are not only neutral carriers or facilitators but also distinctive sociotechnical entities able to, among other

things, create new relationships, produce inequalities, modify professional jobs and consumer practices and even reshape the aesthetics of cultural content.

The reasons for organising such a track were therefore quite clear: on the one hand, in the last couple of years, an STS-rooted perspective on infrastructures has filtered in media studies to address the growing relevance of the technical dimension in shaping media practices and ecologies (i.e. Parks and Starosielski 2015; Peters 2015); on the other hand, the rising relevance of those entities defined as platforms in different societal realms, including the distribution of media content, witnessed a renewed interaction between STS and media and cultural industry studies (van Dick et al. 2018; Gillespie 2018). We thus arrived at the idea of using the conference track to map the emerging research focused on this intersection.

In this emerging literature at the crossroad between STS and media studies, a specific emphasis has been placed on the mutual interactions between platforms and their infrastructural qualities, especially by considering the convergence between internet-based infrastructural services and the emerging role of different platforms in media and communication. The ongoing process of 'platformisation' is thus outlined as a crucial structural shift in how value, meanings and practices are created in cultural industries today (Plantin et al. 2018; Nieborg and Poell 2018; Plantin and Punathambekar, 2019).

The next two sections summarise how "infrastructures" and "platforms" have recently emerged as the two ground-breaking keywords in both STS and media and communication studies.

2. Infrastructures from STS to Media and Cultural Industries

Since the middle of the last decade, media studies have been developing a new perspective centred on media's infrastructural dimension, an approach rooted mostly, even if not exclusively, in the research on information infrastructures that emerged in the '90s in STS. Since several scholars have highlighted media's infrastructural dimension, this conceptual shift that occurred at large in media and internet studies has been described as an 'infrastructural turn' (see Balbi et al. 2016; Musiani et al. 2016; Hesmondhalgh 2021).

Adopting the notion of infrastructure has been important in media studies to bring to the foreground several relevant characteristics of digital communication: from the growing relevance of networks in content distribution (Lobato 2019) to the shift from the focus on individual devices such as television to interconnected technologies such as digital standards (Sterne 2012) and smartphones (Magaudda and Piccioni 2019); from the relevance of invisible and taken-for-granted structures that make communication possible such as undersee cables (Starosielski 2015) to the growing

relevance of being constantly connected to our increasingly mediatised social organisation (Couldry and Hepp 2017).

The roots of the notion of infrastructure, as is well-known among STS scholars, lies solidly in STS and, more specifically, in the work of Susan Leigh Star and Geffrey Bowker (Star and Ruhleder 1996; Bowker and Star 1999). According to a seminal article by Susan Leigh Star and Karen Ruhleder (1996), infrastructures are important because they emerge at the intersection between technical elements and social phenomena. Their social relevance derives from the fact that they need to be adopted and made their own by users so that their role can be easily taken for granted in social routines. In short, from an STS perspective, focusing on infrastructures does not mean only considering the technical dimension – it also means considering how the technical details of technologies intersect with and are mutually influenced by individuals' technological uses and practices.

In recent years, the focus on infrastructures opened in STS has directly influenced various scholars in media and communication studies, where an infrastructural perspective has been adopted as a useful point of departure to make sense of the complex interaction between media's material nature, dematerialised digital contents and collective media practices. For example, media theorist John Durham Peters proposed an infrastructuralist approach as a way of understanding the work of media as fundamentally logistical in the sense that "the job of logistical media is to organise and orient, to arrange people and property, often into grids" (Peters 2015, 37). Indeed, as Lisa Parks also noted, "since infrastructures cannot be captured in a single frame, we must read media with an infrastructural disposition — that is, when viewing/consuming media we must think not only about what they represent and how they relate to a history of style, genre, or meanings, but also think more elementally about what they are made of and how they arrived" (Parks 2015, 357).

Joshua Braun outlined the intersection between distribution processes and media infrastructures in relation to the television sector. In his research on the MSNBC TV channel, he argued that an infrastructural approach to media research involves "a sort of archaeological interest in the various kinks, epicycles, and roundabouts found in a distribution route" that can expose the "sociotechnical systems at work and lay bare the influence of infrastructure" (Braun 2015, 9). Similarly, in his research on Netflix, one of the most relevant contemporary audio-visual platforms, Ramon Lobato foregrounded the relevance of the infrastructural turn in media studies by outlining that "what is exciting about this turn to infrastructure in critical humanities and social science is that it invites engagement with topics that were previously out of bounds, or at least inaccessible, for many humanists — issues related to electrical engineering or information systems design" (Lobato 2019, 78).

A different level of analysis is represented by the material implications of media technologies and the way digital media are used concretely in situated contexts is considered, especially in relation with space and the city.

An early example of this perspective is offered by the pioneering work of anthropologist Brian Larkin (2008) in his ethnographic study on the mutual interactions between communication infrastructures and the culture of North Nigerian urban contexts. Looking more closely to the relationship between media infrastructures and the city, media anthropologist Shannon Mattern (2017, XXV) outlined that the notion of infrastructure "enables us to appreciate media as potentially embodied on an urban or even global scale, as a force whose modes, ideologies, and aesthetics of operation can be spatialized, and materialized, in the landscape". Maren Hartmann (2017) adopted the notion of infrastructure by considering the role of electricity in relation to smartphone use: electricity, undoubtedly, is a fundamental infrastructural dimension that shapes smartphone practices, even though the infrastructural qualities of these devices go well beyond this dimension and include a wider set of stratified infrastructural levels overlapping each other. Along the same line of enquiry, Magaudda and Piccioni (2019) outlined the multiple infrastructural levels that characterise smartphone-based situated practices in everyday life and empirically showed how intimate relationships with smartphones are nested into a stratified arrangement of overlapping and intersecting infrastructures.

The study of media infrastructures thus did bring several productive inputs to media studies; however, the quick and rapid embracing of an infrastructural turn has also produced several critical issues. Media scholar David Hesmondhalgh (2021) summarised these issues, noting that the notion of infrastructure has rapidly become a fashionable buzzword, often losing its analytical power, especially in interpretations characterised by an ambiguous understanding of the role of materiality in studying infrastructures and by a tendency towards banality and vagueness. Moreover, Hesmondhalgh added, emphasising STS's roots in studying infrastructures is also the basis for a lack of recognition of an original intellectual trajectory already present in media history and media's political economy, a trajectory related to the long-term developments and political implication of communication infrastructures, a space of research pioneered, among others, by Armand Mattelart (2000).

3. Platform Studies at the Intersection between STS and Media Studies

In the last fifteen years, STS and media studies scholars have also met each other on another emerging field of research with a new research object: digital platforms. The field, according to Bogost and Montfort (2007), is called *platform studies*, where we find not only STS and media studies scholars but also anthropologists, cultural studies scholars, critical political economists of media and communication, and software scholars. Media studies primarily borrowed the concept of 'platform' from game design

(Bogost and Montfort 2009) and extended it to content-sharing websites (Gillespie 2010; Helmond 2015) and social media applications (Langlois and Elmer 2013). The key features platform studies discuss include programmability, affordances, networks of heterogeneous actors, platforms as socio-technical assemblages, platform power and user agency.

Among the earliest media and communication scholars who addressed the material aspects of digital platforms from a social constructivist perspective is Tarleton Gillespie: after deconstructing the 'discursive positioning' of platforms as neutral intermediaries, Gillespie showed in his foundational article on the politics of platforms that it is, in fact, the activity of content moderation that defines digital platforms (Gillespie 2010). Gillespie et al. (2014) are also among the first to identify the cross-pollination process between media scholars and STS scholars in platform studies. Gillespie's research on platforms stands precisely at the intersection of STS and media studies and has opened the dialogue to scholars from these two disciplines. In the meantime, the increasing prevalence of digital platforms in all spheres of society (van Dijck et al. 2018) has also drawn the attention of other disciplines, such as the critical political economy of communication. These strands of research are important because they help foreground the social and political consequences of the rapid 'platformisation' of social life (Van Dijck et al. 2018). Langlois and Elmer (2013), for example, critically assessed "some of the new forms of power produced by corporate social media platforms" such as Facebook (p. 14). Economic interests, they argued, influence the design of social media interfaces.

In addition to political economy, cultural studies also intervened in the conversation, bringing attention back to the agency of the users of these platforms. But it was with the work of Jean Christophe Plantin that these debates converged towards a single centre: Plantin et al. (2018) are among the first to connect the growing strands of research on infrastructures and platforms, arguing that digital technologies have made possible a *platformization of infrastructures* and an *infrastructuralization of platforms*, highlighting the tensions that arise when the infrastructures most essential to our daily lives are dominated by the private technological entities represented by platforms.

The conceptualisation of these two processes – *platformisation* of infrastructures and *infrastructurisation* of platforms – represents the ripe fruit of several years of mutual breeding between STS, media studies, anthropology, cultural studies and critical political economy of media. It is important to clarify what Plantin et al. (2018) mean by these two processes. The platformisation of infrastructures refers to a process whereby the traditional infrastructures tend to be privatised and fragmented: a typical example being the World Wide Web, which started as an open infrastructure, conceived as a public good created by public investment, which then gradually became more and more fragmented into closed ecosystems where the users are 'locked-in': a few global apps such as Twitter, Instagram, Tik Tok, Spotify or Netflix capture the majority of internet consumption. Users

of these platforms no longer surf the web, but jump from one private platform to another, while their online actions are subject to the dynamics typical of web platformisation (datafication, commodification and selection, according to van Dijck et al. 2018). On the contrary, the infrastructuralisation of platforms indicates the endemic growth of the power of some platforms that start functioning as infrastructures. Other authors, such as van Dijck et al. (2018), have also highlighted this process, noting that Facebook and Google have acquired the scale of real infrastructures ("platform-infrastructures") and become semi-monopolistic actors, like what happened with the infrastructures of the past, such as railway networks, electricity grids and so on.

Like the global and transnational companies that monopolize the oil and pipeline markets, big tech is monopolizing the process of extracting data from users (see Zuboff 2019; Couldry and Mejias 2019). Although there are many similarities with the past, we must also emphasize the differences in terms of "range" between media platforms and transportation and electric networks of the past: the former monopolies act today at global level, the latter are often limited to national contexts.

Facebook, according to Plantin and Punathambekar (2019), is a striking example. Though it began its evolution as a platform (Helmond 2015), the now massive scale of Facebook usage and its semi-monopolistic position in social networking services have led the company to enter more deeply into a variety of infrastructural domains. In 2016, as highlighted by critical political economy scholar Dwine Winseck (2017), Facebook built a massive undersea cable in partnership with Microsoft, connecting the United States to Spain, in line with the current trend of internet companies entering the cable industry.

4. Conclusion

As we have seen along this article, the infrastructural dimension of web platforms has become a crucial focus for today's social sciences, which have been increasingly borrowing the concepts and perspectives formed at the intersection between STS and media studies. What we hope is that this overview on the converging trajectories that have characterised, on the one hand, the STS-rooted study of infrastructure and, on the other hand, the analysis of digital platforms, represents a common ground on which developing new research on multiple domains and topics: from the evolution of online communication to economic processes, from cultural production and consumption to raising political concerns related to the increasing role of platforms in our contemporary society.

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The Ambivalence of Platforms

Between Surveillance and Resistance in the Management of Vulnerable Populations

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Abstract: This contribution aims to summarize and highlight the main themes emerged during the panel "Surveillance infrastructures or open platforms? Aid and control of vulnerable populations through digital data" that took place at the VIII STS Italia Conference. The panel invited to reflect upon the ambivalence and ambiguity of digital platforms and data infrastructures for population management as well as on the highly diversified functions and users they support and attract. More precisely, presenters were encouraged to enquire how platforms and data infrastructures affect vulnerable populations and reconfigure the boundaries between the private and public domains: how do they allow empowering and innovative communication and resistance strategies? How, on the contrary, do they produce novel or exacerbate already existing vulnerabilities? How is the modern distinction between government, business, and civil society de facto reshuffled as a consequence? Although panel's presentations discussed remarkably different types of platforms – from online maps and social networks to public health databases and migration technologies – they overall emphasized that only a careful, situated analysis of the multiple socio-technical factors shaping users' engagement might help to understand how – and why – those technologies become tools for control and surveillance or empowerment resources.

Keywords: platforms; surveillance; resistance; vulnerable populations; data infrastructures.

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1. Introduction

In his seminal article, Gillespie (2010) stressed how the semantic richness and ambiguity of the term "platform" allowed firms to attract users, clients and advertisers by promising an open, neutral and egalitarian space. The term, he suggested, could be connected to four semantic territories – computational, architecture, figurative and political – which overall "point to a common set of connotations: a 'raised level surface' designed to facilitate some activity that will subsequently take place" (Gillespie 2010, 350). Through this semantic and discursive escamotage, firms attempt to obscure and alleviate the tensions between "user-generated and commercially-produced content, between cultivating community and serving up advertising, between intervening in the delivery of content and remaining neutral" (Gillespie 2010, 348).

One decade later, digital platforms have become even more ubiquitous and increasingly able to attract multiple, heterogenous types of users, who gather around their services in order to accomplish a continuously expanding set of actions. In this respect, our panel "Surveillance infrastructures or open platforms? Aid and control of vulnerable populations through digital data" aimed to shed light on some of the tensions which were not addressed by Gillespie's analysis. First, we decided to focus on a specific typology of users – vulnerable people and vulnerable populations – and on a specific type of data – sensitive and personal data. Second, but strongly connected to the previous point, we asked to reflect upon the dialectic between power and resistance, between aid and surveillance, which shapes the use of online platforms.

In proposing a discussion about this two-fold tension crossing the multiple uses and appropriations of platforms, we suggested to broaden the scope of the analysis in order to include data infrastructures which are not usually considered in the ranks of platforms, such as those for migration management. This move, we think, is needed in order to question and problematize what is usually perceived as a 'division of labor' between the biopolitical traits and purposes associated to institutional data infrastructures and the emancipatory, self-empowering features usually connected to digital platforms. This rigid distinction does not seem satisfactory: on the one hand, data infrastructures for population management provide access to healthcare and shelter; on the other hand, digital platforms and their data have increasingly become new sources of surveillance and control (Manokha 2018; Wood and Monahan 2019).

2. The Role of Digital Infrastructures in the Control and Empowerment of Vulnerable Subjects

The contributions to our panel addressed these issues along three main topics. First, the hybrid and open nature of online maps and social media

was analyzed in terms of resistance and surveillance in the contributions by Federico Montanari (University of Modena-Reggio Emilia) and Lorenzo Olivieri (University of Bologna). Second, Roxana Varvara Boboc (University of Amsterdam, The Netherlands) and Laetitia Della Torre (University of Technology of Compi gne) highlighted the blurred boundaries between digital, private platforms and public services during the Covid pandemic and between health data stored in medical platforms and the possible risk of co-optation of those data for control and surveillance purposes. In a third set of presentations, Annalisa Pelizza (University of Bologna), Alice Fill (Scuola Superiore Sant'Anna, Italy) and Wouter Van Rossem (University of Twente, The Netherlands) explicitly addressed data infrastructures for migration management by analyzing the 'scripts of alterity' through which migrants are enacted by the European information systems, by showing how the principle of non-refoulment is jeopardized by the datafication and digitalization of European borders, and by focusing on the issues of data quality and data frictions between migrants' identities and the standards and interfaces available in information systems.

Montanari's talk addressed the ambivalent nature of online platforms by focusing on maps and mapping. As a matter of fact, maps, and especially online maps, add a further level of complexity, as they are simultaneously interfaces, representations, and tools. As pointed out by authors like Mitchell (2002), Latour (1990) and Farinelli (2009), maps have historically been vectors of cognitive, perceptive and social transformation. It is thus their highly hybrid nature that makes maps powerful tools allowing for both surveillance and control, and for solidarity, aid and cooperation. Today, maps and mapping constitute the basic elements of infrastructures and social media, and, as a consequence, they have also emerged as pillars of contemporary surveillance capitalism. Drawing on these insights, Montanari's contribution enquired how the polymorphous nature of maps allowed to provide and support aid, solidarity and resistance. More specifically, his work has investigated how maps allow the representation of the so-called 'Balkan route' as a site in which multiple types of solidarity and struggle have stratified over the years.

Olivieri's presentation discussed how border-crossers' smartphones, and the data stored in them, have become new means of surveillance. His work drew upon interviews collected at Greek Hotpsots as well as on a recent body of literature (Latonero and Kift 2018; Bolhuis and van Wijk 2020) which have shown how the vetting of smartphones and social media is an increasingly common practice during both registration and identification procedures conducted at the Hotspots, and the asylum process. These security checks allow extracting different types of data from smartphones and laptops in order to assess migrants' stories and identities through

content that is generated in non-securitarian and non-institutional contexts. The novelty represented by this modality of surveillance is that it seems to contrast with 'the epistemic suspicion towards the story' which characterizes biometric technology (Ajana 2013). By taking into account content produced by migrants in non-institutional contexts, smartphone and social media surveillance seem, at first glance, to be able to recover and foreground their stories and narrations. Yet, the vetting of smartphone and social media ends up reproducing and enhancing power relations: the content extracted and analyzed is always partial, deleted content can be retrieved without consent, the interpretation of data is done by officers. As a consequence, rather than filling the gap between identity and identification, social media surveillance and digital forensic technologies ultimately produce a proliferation of spokespersons (Pelizza 2021) which enact border-crossers in different, contrasting and unjust ways.

In Varvara Boboc's contribution, the implementation of apps and services for digital contact tracing during the COVID-19 pandemic represented a precious opportunity to explore the relational frictions and the co-productive processes at stake in the collaboration of private and public services. In April 2020, Google and Apple joined their forces to develop an Exposure Notification System (GAEN) which replaced the EU's previously developed options and enabled interoperability between Android and iOS devices using apps from public health authorities. These circumstances made particularly visible the co-production of power-relations. On the one hand, private platforms are considered reliable and invisible, provide public services on their own and, unlike public institutions, have the ability to transform a risk or crisis situation in a commercial opportunity. On the other hand, public institutions are both regulators and users of those platforms, while simultaneously being concerned with the organization of trust. The reciprocal dependency of public and private sectors became even more relevant during the COVID-19 pandemic, when digital, private platforms emerged as the main resilient actors, to the extent that essential public services became dependent on them. Yet, private companies still need to operate within a set of rules stipulated by institutional actors: privacy, interoperability, data management and lawful implementation then become the core issues to be clarified and implemented within a coherent regulatory structure. In this regard, one of the main obstacles highlighted by the contact-tracing case was policy-makers' struggle to produce consistent guidelines and propose feasible alternatives to private companies. However, Boboc argues, public and private bodies' need to access a large volume of high-quality data, as well as the urgency to determine the governance of data collection, make difficult to achieve a balance between individual rights and public health. Overall, the experience with apps for

digital contact-tracing leaves with more questions than answers: how can public and private actors earn citizens' trust? Is the private going public or, vice versa, is the public going private? Can secondary usage such as surveillance be prevented?

The problems of health data – or, more precisely, of the access to such data – was also addressed by Della Torre's contribution. Her presentation focused on refugees' medical records and on the risks of instrumentalization and misuse of such data. It relied on interviews conducted with doctors and social workers working in French health structures, such as the "Permanances d'access aux Soins de Santè" (PASS), providing access to care and medication to people living in the streets, people without social security and migrants. The research revealed, first of all, that the digitalization, data collection and exchange of patient medical records is significantly underdeveloped and poorly harmonized, leading to inefficient situations. However, most of the interviewees did not express any specific concerns about the possible misuse of medical records and felt to be in control over the data collected. This perception, according to Della Torre, might be due to the major role played by secrecy and confidentiality for professionals like doctors and social workers. A second element which might explain the perception of low risk is the logic of care associated to the PASS, which, despite not being an autonomous structure, is thought to work regardless any possible issues linked to migratory flows. However, these elements are not, per se, sufficient to exclude the possible, future misuse of medical data for purposes of migration management and control, especially in the light of the relationship between the Ministry of Interior and the Ministry of Health. To mitigate these risks, Della Torre suggested a few strategies, such as the minimization of data collection and the use of paper medical records, as they are generally perceived as more secure.

Pelizza's presentation discussed how the categories and modalities of classification utilized in European data systems for information management enact different typologies of people on the move. Crucial in her argument is the shift from a representational understanding of identity to one based on the performativity of practices, doings and actions. This shift suggests paying particular attention to the mediums, or chain of translations, through which identities are built, which are especially important when it comes to the technologically mediated management of populations. Drawing on empirical analysis of the data models implemented in information systems used at the European borders, Pelizza identified four typologies of intended border-crossers, four 'scripts of alterity' which show how intended people, with their own skills, goals, limitations and capabilities, are inscribed into databases for migration management. First, the several functions (administration, security, health care, family reunification, etc.)

allowed by the data collected in the Greek register of foreigners are seeing and enacting people on the move as long term foreigners, eligible for integration. On the other hand, Eurodac – the European database storing asylum seekers' fingerprints – contains significantly fewer data. The scarcity of data collected suggests that Eurodac tends to enact people on the move as irregular migrants who are expected to cheat and to remain in Europe for a short period. Along similar lines, by collecting only information about possible aliases, physical features and episodes of violent conduct, SIS II (the European Schengen Information System) enacts people as potential criminals. Lastly, the categories contained in the European Visa Information System (VIS), the database used to process third-country nationals' Visa applications, enact people simultaneously as travellers and settled individuals. Yet, this paradox is only apparent: the type of intended individual inscribed in the VIS is in fact the settled non-Western traveller.

Fill's contribution addressed the tensions and contradictions of the European system of international protection by focusing on the principle of non-refoulment. According to it, Member States are forbidden from returning asylum seekers to countries in which they might be in danger or subjected to persecution. Yet, as Fill showed, this principle is systematically violated by European countries through three different modalities of rejections: pushback, pullback and back-scattering. Pushbacks occur at the external borders of Europe and they are the most documented and violent violation of the principle of non-refoulment. Pullbacks depend on the increasing involvement of third-countries authorities which allow externalizing border control through strategies of non-arrival, remote control and deterrence. Lastly, the implementation of smart borders made possible what Fill defined as 'back-scatterings', a term used, in physics, to describe the reflection of waves, particles, or signals back to the direction from which they came. Through a network of interconnected biometric databases and through the aggregation of data which allows identifying who is suspect and to develop risk analysis, smart borders in fact operate a distinction between trusted and untrusted travellers, configuring a regime of 'border apartheid' which digitally exclude people from accessing the European territory. Smart borders then reproduce a systematic and discriminatory bias towards migrants, creating a 'data banned population' (Bigo 2014) based on categories and identification processes implemented in bureaucratic and algorithmic systems. Particularly interesting, in this regard, is the Eurosur project, a system of systems which supports European member States in the monitoring of the Mediterranean Sea and of the European external borders. By visualizing maps as operational areas and by expanding the capabilities to operate in those pre-frontier areas, Eurosur justifies preventive actions based on the analysis of potential migratory flows.

Whereas Fill's presentation foregrounded the functions of surveillance characterizing migration technologies, Van Rossem's contribution focused on issues of data quality in the infrastructures for migration management. Crucially, problems with data quality and data frictions might significantly hamper the respect of people's fundamental rights. As highlighted by the Fundamental Right Agency (FRA 2018), European Information Systems often contain inaccurate alphanumeric, biographic and biometric data. This situation negatively affects people's possibilities to exert their rights and might eventually lead to accuse them of something they never did. This might occur, for instance, when an issue of low data quality is misrepresented, by authorities, as one of identity fraud. One of the major reasons for which the information might be incorrect or incomplete is that migrants' identities data do not always fit neatly in information systems' categories. Personal data, in fact, might be inputted in two different systems with slight but relevant differences, leading to what policy-makers define as 'blind-spots'. Such blind-spots could be solved through interoperability, which would allow to detect inconsistencies in the records. Van Rossem's presentation discussed the 'smart search and match' technology used in migration and border control in order to overcome data frictions and to match biographical data.

3. Conclusions

As this short summary demonstrates, despite the heterogeneity of platforms taken into considerations, the seven contributions to the panel have engaged with the ambiguity of platforms. An ambiguity that suggests the need to look for the sociotechnical conditions under which a platform can be used either for control purposes, or for empowering goals. When do mobile social networks stop supporting self-empowerment and become surveillance tools? What uses can turn institutional data infrastructures for population management into resources of care? As the STS tradition reminds us, only situated, performative and inclusive research can help to answer these questions.

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Dis/Entangling the Worlds of Education through a STS Perspective

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Abstract: All fields of education are affected by technological and digital processes. Blackboards (physical and digital), information infrastructures, chairs (mobile and immobile), online platforms, educational data, they are all weaving together with humans the very fabric of educational and research processes and practice in school, university, and training settings. These entangled processes are shaping educational scenarios through heterogeneous practices. In this short contribution, we shall unpack such processes and explore the emergence of relational textures across educational scenarios.

Keywords: sociomateriality; digitalisation; education; learning; knowledge.

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Introduction

When we received the announcement of the upcoming VIII STS Conference, we decided to convene a panel session on how to perform STS-oriented research in the field of education ("Education and/as its making: Vulnerabilities in the sociomaterial worlds of learning"). The educational field is in fact dense now with relational processes that entangle humans and non-humans and produce significant effects that deserve scholarly investigation.

In this contribution, we shall offer an overview of the contributions brought by the participants to the panel session and provide a summary of the emerging STS perspective in education and its contribution to educational studies. Two issues will be investigated: how sociomaterial processes are (re)shaping education, and how digitalisation and platformisation processes are reassembling educational policy and practice.

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1. Sociomateriality, Technological Frames, and the (Re)Shaping of Education

The STS approach was translated in the field of education in the first decade of the 21st century with the introduction of the concept of sociomateriality. This notion was originally put forward by Wanda Orlikowski (2007) for describing the constitutive entanglement of social and material processes in everyday organisational life. Soon after, the German sociologist Estrid Sørensen brought about this concept in educational studies for exploring how both humans and non-humans are implicated in relational arrangements in educational scenarios, and what are the effects of this enmeshment (Sørensen 2007; Sørensen 2009; Fenwick et al. 2012; Fenwick 2015). As Mathias Decuypere recently argued (2019), the STS approach in education enables to observe simultaneously the 'doing', the 'un-doing', the 're-doing', and the 'non-doing' of educational actors within and across their intimate relationships. Artefacts and materiality – such as technology, space, body, policy, practice – have thus taken centre stage in scholarly investigation into the (re)shaping of local and global educational processes (Sørensen 2009; Fenwick and Landri 2012; Landri 2018). The sociomaterial sensitivity in education is often adopted for exploring the emergent effects of the assemblage of human and non-human actors in educational scenarios, and the design and translation of educational policy (Fenwick and Landri 2012). A wide range of research opportunities thus unfolds for investigating educational processes through a sociomaterial approach.

For instance, the everyday professional and epistemic practices (Knorr-Cetina, 1999) of university professors are nowadays attached to (Latour 1990; 2011) and entangled with (Barad 2007) complex and non-neutral sociomaterial networks. The life of university professors has become a daily Odyssey, as they are constantly caught in the multiple effects of new organisational and administrative practices that extend beyond the consolidated teaching and research activities. In order to comply with the 'moral frame' imposed by new public management logics, university professors must continuously account for their work and attend to many administrative requests that emerge from the marketisation of academic institutions: they must produce efficient performance in the professional academic market; they must update their personal performance indicators on their institution's digital platforms; they must self-monitor their rankings, positioning and citational indexes; they must meet specific performance standards if they wish to qualify for funding opportunities. The agency of university professors thus allies with new ecologies of elements, and produces unexpected attachments to these sociomaterial networks. New sociomaterial textures emerge thereby (Orlikowski 2007; Fenwick 2015) which diverge from conventional university practice.

A sociomaterial perspective is also adopted for exploring technological

artefacts as relational arrangements that are inscribed with specific – and sometimes conflicting – moral values (Bowker and Star 1999) and programmes of action (Akrich and Latour 1992). As argued by STS scholars, educational artefacts are better understood as 'matters of concern' rather than 'matters of fact' (Latour 2004). Michael Schlauch (Free University of Bozen-Bolzano, Italy) drew on these insights to discuss the effects of sociomaterial entanglement between human actors and texts in educational scenarios. In particular, he combined the sociomaterial sensitivity and the 'interpretive flexibility' approach (Bijker 1997) for discussing how educational texts have configured processes and practice in education through history. By following a methodological path "that leads from text to things and from things to texts" (Latour 1992), Michael Schlauch distinguished three competing technological frames ('teacher-centred', 'technology-centred', and 'distributed') that afford different kinds of spatial arrangements and interactions. While providing the technological frame for most educational texts, the 'teacher-centred' and 'technology-centred models' contribute in (re)producing vulnerable interactions in classrooms. Instead, the 'distributed instruction' frame involves instances of 'repurposing', 'reinscripting' and 'repairing' (Jarzabkowski and Pinch 2013) that expand the affordances of the artefacts beyond the prescribed programme. Sociomaterial flexibility in educational technology should therefore be further explored and fostered.

2. Platforms, Digital Technologies, and New Assemblages Across Educational Policy and Practice

The concept of 'assemblage' is also very significant today in STS studies on education. The strength of this notion resides in the fact that it enables to describe both the emergence of events and objects in social and material spaces, and their entanglement in heterogeneous relational networks.

This concept is often mobilised to inspect educational policies as ever-changing entanglements that are seldom coherent and complete (technology and software companies, educational practices, subjects, texts, programmes, tasks, exercises, teachers, students, etc.). 'Assemblage thinking' is also useful for unravelling the 'power networks' (Williamson 2019) that tie together edtech market actors (such as Google, Apple, Microsoft, etc.) and institutional actors (schools, universities, etc.). Moreover, this concept is deployed to analyse digitalisation processes in education (Gorur 2011; Landri 2018), as it allows to untangle the hybrid relational networks that bring together configurations of actors and technical processes striving for the digitalisation of educational spaces and practices. This has been discussed in educational studies on computer-mediated instruction (CMI) in university settings (Nespor 2012), and on digital applications and technological ecologies of learning (Decuypere 2019). Digitalisation processes have also been addressed in scholarly research on the design and use of

learning platforms, which might emerge as invisible architectures that build networks of action and reassemble educational processes (Williamson 2018). More broadly, digitalisation processes in education have been often addressed in recent literature as the effect of complex sociomaterial relational assemblages (Landri 2018; Decuypere et al. 2021).

An interest to assemblages, platforms, and digital technologies has indeed emerged in our session. Some contributions have embraced this sensitivity in order to explore the making and the effects of infrastructuring and platformisation processes on academic professionals, IT specialists, and students in order to highlight sociotechnical features of interoperability and inspected standardisation and marketisation processes. Mariacristina Sciannamblo (Sapienza University of Rome) discussed how digitalisation processes in academic life and other knowledge production processes might contribute both in creating new spaces for action, and in (re)producing older vulnerabilities and new fractures.

Research on digitalisation processes in education have singled out a particular tension in empirical settings (van Dijck et al. 2019): on the one hand, edtech actors might attempt at imposing top-down digitalisation and platformisation policy and practice; on the other hand, interdisciplinary professional communities can build from-below digitalisation and platformisation processes.

Final remarks

The notions of sociomateriality and assemblages in education have become significant lens for examining phenomena and processes – artefacts, technical devices, platforms, spaces, policy, practice, etc. – that emerge today in the educational field. This sensitivity allows for 'thicker' explorations on the active role played by all forms of materiality – both digital and analogue – in the making of contemporary education. In particular, a posthumanist and sociomaterial perspective can be fruitfully adopted to investigate the heterogeneous entanglement processes across which education is negotiated and fabricated (Latour 1992; Braidotti 2019).

The scenario of contemporary global education is marked by tensions, complexities, and fractures. Technology in education can indeed foster the (re)production of existing vulnerabilities and inequities, since it might inscribe new normativities (through discourses, policies, regulations, behaviours, algorithms, etc.) and foster marketisation processes in education (Williamson 2019). However, technology can also mend troubled social worlds that are challenged by educational crises at both at the local and global scales. Alternative cultures, spaces, and connections can thus be envisioned and enacted.

As argued by scholars, the COVID-19 pandemic has prompted a significant 'acceleration' in educational processes worldwide (Cone et al. 2021; Grek and Landri 2021). It becomes paramount now to inspect all processes

that might be (re)shaping the educational field, dis/entangle all social and technical processes, and invent new postures and lexicons that can help dispel technological determinisms. A STS sensitivity to educational processes is a valuable tool in this endeavour. The challenge for STS scholars in education is indeed to unravel the hidden cultures inscribed in technologies, co-produce reflexivity and expertise through engagement with research partners, and interfere in the empirical field itself.

The issue at stake is to start examining educational practice and policy as a heterogeneous set of relational processes. A renewed recognition of the inherent sociomateriality, uncertainty, and nonlinearity of educational processes might then help to imagine and perform alternative worlds.

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Affective Engagement in Knowledge-making

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Abstract: This article provides an overview of the discussion animating the track "Doing research in technoscience as affective engagement" organised at the VIII STS Italia Conference. By acknowledging the inheritance of feminist STS scholars in expanding the theoretical scope of care beyond its traditional sites, this session was devoted to exploring knowledge production as a matter of care as well as a form of affective engagement and entanglement with multiple Others while doing research. Two contributions were presented. The first ethnographically investigates Canadian blood donation practices by drawing on Haraway's SF figure to develop what the speaker calls 'Sanguine Figuration'. The second presentation relies on research of women's animist practices amongst horses in Swiss Alps through a filmmaking practice influenced by Haraway's work on the *natureculture* continuum and situated knowledge. Both studies embody efforts to develop non-representational research practices and experimental approaches showing the affective entanglement between researchers and researched, subject and object. Further, these contributions have highlighted the importance of conceptual creativity and imagination in building an apparatus that enables accounting for affective engagements in doing research in STS.

Keywords: Affect; body; entanglement; posthuman feminism; post-qualitative.

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1. Introduction

Affect can be described as a moment of intensity, a reaction in/of the body at the level of matter, and affectivity can be formulated in terms of 'to affect/being affected', with modes of intensification, movement, and capacities (Gherardi et al. forthcoming).

The 'affective turn' in Science and Technology Studies (STS) is experiencing renewed interest, manifested in research works exploring affective entanglements and embodied ways of knowing in science. Feminist thinkers, in particular posthuman feminist scholars (e.g., Alaimo 2010; Braidotti 2013; Niccolini and Ringrose, 2019) have contributed extensively to studying the transformative potential of affect in research and knowledge creation. Within STS, we could mention Donna Haraway's (1991; 1997) foundational work on the situatedness of knowledge, which points at knowing and thinking as inconceivable without a multitude of relations that also make possible the worlds we *think with*. Building on Haraway, Maria Puig de la Bellacasa (2012; 2017) emphasises, in a non-idealized way, how relations of thinking and knowing require care, and how such relationality is not without conflict or dissension. Therefore, we – as researchers – should be aware that our knowledge practices always entail important consequences (see the concept of 'cut' in Karen Barad's agential realism theory (2007)), which are not always positive for every-body and every-thing (Cozza et al. 2021). Echoing Puig de la Bellacasa, and focusing greater attention on affect and care in sociology, and particularly in STS, Latimer and López (2019) propose the concept of 'intimate entanglements' as a material-semiotic device to think not beyond, or together with, but alongside multiple and troubling countless Others, humans and more-than-humans that are deeply implicated in and contribute to practices of knowledge-making.

In STS, laboratory studies (Knorr Cetina 1981; Latour 1979; 1988; Lynch 1991; Traweek 1988) have widely articulated the role of technoscientific assemblages in generating knowledge: scientists, practitioners, particles, cells, fluids, matter, animals, plants, objects and technologies contribute altogether to doing and redoing science and the world. As for the affective turn in laboratory studies, Myers (2006) makes visible the roles of embodiment, affect and performance in scientific knowledge production, with ethnographic attention to the expressive body-work of molecular modelling. Aiming at innovating STS analyses of the performativity of scientific knowledge, she usefully reminds of Erving Goffman's suggestion that ethnographers – and researchers more generally – "must 'tune' their bodies 'in' to the daily activities and practices of those they study. This would require subjecting one's own body to the rhythms of another's

practices in order to gain a richer interpretation of the plays of affect, gesture and language among members in particular group" (p. 8).

More recently, Smolka et al. (2021) have proposed the concepts of 'disconcertment', 'affective labor', and 'responsivity' to analyse the role of the body in interdisciplinary collaborations. That is, they develop a heuristic meant as "a provisional tool that helps us think of disconcertment as a form of responsivity. Responsivity emerges among interdisciplinary collaborators who became increasingly sensitive to how researchers from other disciplines think, talk, and behave. Sensing and responding to differences may be disconcerting, but engaging with disconcertment becomes easier with practice, what we refer to as 'affective labor'" (p. 4).

Similarly, Hillersdal et al. (2020) contribute to the ongoing discussion within STS, inspired by the strand of research that has centred on emotions and affects in the practices of science (on the role of emotions, see, e.g., Barbalet 2002; Kerr and Garforth 2016; Parker and Hackett 2012). In particular, by drawing on Haraway's (1997) notion of 'response-ability' (i.e., the capability to work with sensitivity to difference) and Verran's (2001) concept of 'generative critique' (i.e., the ability to develop other ways of seeing and doing problems), Hillersdal and colleagues point out how affective tensions can be generative of effects not only on modes of collaboration, but also on the knowledge we – as researchers – contribute, and the ways we engage the world in our scientific practices. They have the merit of clarifying the important distinction between affect and emotion. Affect is "relational and not belonging to particular individuals or representing private emotions. Instead, affect is understood as the effects of situated practices of social bodies" (p. 70). Such a remark warns off defining 'what affect is' but rather invites to focus on 'what affect does' in knowledge-making practices (Gherardi et al. forthcoming).

The track "Doing research in technoscience as affective engagement", which I organised together with Silvia Bruzzone and Lucia Crevani (Mälardalen University, Sweden) for the VIII STS Italia Conference, was grounded on such an understanding of affect as doing, caring and becoming-with multiple Others. In the following, I summarise the purpose of the track and the main contributions of the two presentations that animated the discussion.

2. A Conversation Around 'Bloody-fleshy' and 'Wild' Affective Engagement

The track originated from our (convenors') urgency to understand care as a commitment with the worlds that we, and our fellow researchers, are

part of and study. We developed our proposition by acknowledging the inheritance of feminist STS scholars in expanding the theoretical scope of care beyond its traditional sites, of health care and domestic labour, to include knowledge production (Martin at al. 2015). We positioned our invitation into the transdisciplinary post-qualitative debate on affect as "the capacity to affect and being affected" (Massumi 2002, p. 5) through encounters while doing research. From this perspective, the researcher is not conceived as an external, neutral, detached observer, but rather as an actor engaged in becoming-with-data (Bispo and Gherardi 2019). This view urges "finding ways to re-affect an objectified world" (Puig de la Bellacasa 2011, p. 99). Hence, for this track, we invited contributions exploring the idea of doing research as a form of affective engagement and entanglement with the humans and more-than-humans to whom we – as researchers – relate while doing research.

Six abstracts were accepted for presentation, but only two were finally presented. In particular, the discussion revolved around Tyler Anderson's (Queen's University, Kingston, Canada) research, titled "Blood lines: Notes toward investigating affective-discursive entanglements of knowing and being through Canadian blood donation practices", and Anna Joos Lindberg's (independent videographer and visual anthropologist) study "*Wild Woman*: Disrupting the disembodied researcher. The personal essay-film as feminist research methodology". Without any pretension of being exhaustive of the theoretically rich, (post)methodologically exciting, and affectively engaging work of Anderson and Joos Lindberg, I summarise their main contributions, as well as what caught my attention and interest as an STS posthuman feminist scholar.

As the title of his presentation discloses, Anderson is investigating Canadian blood donation practices. As defined in his conference abstract, blood is a natural technology of the body and a meaning-making referent, something that speaks loudly about the entangled natures of knowing and being. In Anderson's words, "blood is affective: the intense wave of 'giving life'. Blood is discursive; blood quantum that decide racial 'purity'". He continues: "[a]s an object of study in a Feminist STS tradition, blood is a fierce material and abstract signifier that demonstrates importantly how the Actual is always more than itself and how complex processes of understanding tend to become flattened into discrete Things to be acted upon, and how these objects of knowledge are made to speak some sort of Truth to being". In his presentation, Anderson "put forward how these epistemological tensions can be meaningfully addressed by tending to affect". To this end, he turns to Haraway's canonical body of work and the figure of 'SF' that she introduces in *Staying with the Trouble* (2016). SF stands for "science fiction, speculative fabulation, string figures, speculative

feminism, science fact (…) SF is a method of tracing, of following a thread in the dark (…) SF is a practice and process; it is becoming-with each other in surprisingly relays" (pp. 2–3).

Anderson interprets and transforms SF into his research. Indeed, he has developed an extremely fascinating sign, called 'Sanguine Figuration' to stay with the troubles that come with 'blood' as a complex and multiple object of inquiry. In an unpublished chapter of his doctoral dissertation, generously shared with me – upon my request to know more about such a fascinating figure – Anderson says that he coined this term "in a Harawayian sense to capture the current moment and what it means to be a fleshy, bloody body in an age of extinction. It refers to an analytic – modes of thought and thinking that figure the body as discursive, affective, *and* material; as naturecultural; as biosocial; all the while refusing essentialisms; refusing naturalizations and concretized markings that condemn the body-as-fixed-object. *Sanguine figures* understand the body as dynamic and generative. As the place where it all happens. And as a lively place to induce change" (forthcoming, p. 2). He clearly develops a feminist STS approach to blood through a no-representational material-semiotic technology which, in Harawayian terminology, corresponds to a practice and art of fabricating meaning with signs, words, ideas, descriptions and theories to link meaning and bodies. But he is also developing his own affective methodology to account for how multiple subjectivities – including himself – are entangled in blood donation practices, as well as their agentic capacities to affect.

Joos Lindberg's study shared with Anderson's an intention to stay with the troubles. She rejects any toxic 'objectivity' by learning, in her own body, how to generate situated knowledge in encounters between people and communities (Haraway 1988). In her research on women's animist practices among horses in a remote corner of the Swiss Alps, Joos Lindberg – building on Haraway's work – disrupts traditional distances between researchers and informants, subject and object, by employing the sensory faculties (mainly sight) of filmmaking as opposed to a textual and representational methodology. *Wild woman* is a feminist essay-film (2020, 19 mins) that Joos Lindberg shared at the conference track and which she produced as part of her MA dissertation, completed in October 2019 at the Granada Centre for Visual Anthropology. It is a provocative film where the represented natureculture continuum may, at times, be disturbing or appear to embody an overflowing bond between humans and more-than-humans (i.e., horses) to which, especially in a Western anthropocentric culture, people are unaccustomed. Joos Lindberg acknowledges that the fieldwork also involved interrogating herself as a woman (immersed in a contest of

'wild women'), even before her role as a researcher (initially tolerated but not welcomed).

In this regard, discussion was led by the fact that – in appropriating Haraway's dilemma regarding the importance of how scholars can get into, rather than out of, the field– Joos Lindberg did not try to buff out of her research project the discrepancy between her own anthropological perspective and Caroline's (an informant) pagan perspective. Rather, Joos Lindberg embraced the affective labor (Smolka et al. 2021) performed in the encounter with forces in a world unknown by secular science (see also annajoos.com). Joos Lindberg allowed her authorial control to be challenged by, for example, including scenes showing her incomplete control of such a multispecies ethnography (for example, when Caroline refused Anna's technologically mediated presence). However, as Joos Lindberg disclosed, precisely this conscious vulnerability eventually enabled a conversation between her informant and herself. Joos Lindberg's stance for an affective engagement in research embodies the feminist practice of rejecting the mythical "god trick of seeing everything from nowhere [because] this eye fucks the world to make techno-monsters" (Haraway 1988, p. 581). She was not afraid of letting the ethnographic field *leak* into her epistemological possibilities as researcher. On the contrary, she was and is interested in experimenting with such a 'leak' between informant, researcher, personal life and the ethnographic field, and what it *does* or, rather, how this 'leak' affects the overall research assemblage.

Both presentations generously fostered discussion and, afterwards, populated my thoughts on affective engagement in technoscientific knowledge-making practices.

3. Conclusion

Tyler Anderson's sanguine figuring and Anna Joos Lindberg's feminist filmmaking embody efforts to develop non-representational research practices and experimental approaches in studying affective entanglements in technoscience. Their fieldwork speaks about fleshy and bodily multiplicity and multispecies entanglements that interrogate them on different levels, leaving traces of affective encounters on their research practices as well as their being and doing. Their bodies of work not only reminded me of the scholarly importance of interrogating the adequacy of the onto-epistemological apparatus which I mobilize when approaching my subject-object of inquiry, but also invited me to ponder whether I, in my knowledge-making practice, produce adequate interpretations of real-life conditions in fast-changing times. To account for such affective material-semiotic

complexity, posthuman scholars (Braidotti and Hlavajova 2018) remind us of the importance of conceptual creativity, which means trusting in the powers of the imagination. Haraway's figurations are excellent examples. This is not only for the sake of inventing new terms or concepts, but for a research apparatus that accounts for the relationships between critique, creativity, and ethical accountability, rather than applying the form of intellectual laziness which still confines many (STS) researchers to a practice of 'following the actors', as per the mandate of the pragmatist research program of the 1920s. What I deem important is questioning the great divide between subject and object by more 'objectively' – in a Harawayian sense – acknowledging the affective engagements with the sociomaterial assemblage that we, as researchers, *become with* in our fieldwork. In this, I stay with Susan Leigh Star who, already in 1995, pointed out that "we must vastly complexify the way we think and talk about matter" (p. 20). This track was an attempt to further work in that direction.

Post-scriptum

The two presentations – focused on blood transfusion and entanglement between humans and animals (namely horses) – evoked in me Marion Laval-Jeantet's (2011) (artist, transcultural psychiatrist, and Associate Professor, University Paris 1, Panthéon-Sorbonne) performance *May the Horse Live in Me*, a project questioning scientific methods and tools and exploring trans-species relationship, in which the artist injected herself with horse blood plasma.

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What if Siri and Alexa Unionize?

Disentangling Digital Feminist Technoscience, between Gender Bias and Self-determination

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Abstract: This contribution takes shape from the conference track titled "Disentangling Digital Feminist Technoscience", held in occasion of the VIII STS Italia Conference. The article discusses the main insights emerged from the research works presented in the track, identifying digital technologies as assemblages made up of relationships, cultural and social values, as well as imaginaries that can disambiguate, but also overturn, gender bias. The contributions presented reflect, and thus are summarized around, two central issues developed in the literature about feminist technoscience in digital domains, focusing on how digital technologies reproduce gender bias and power asymmetries, but can also generate responsible and conflictual interventions. Ultimately, the article reflects on the potential of technologies and design as important tools to develop a gender-sensitive reflexive stance towards cultures of technology, as well as to subvert gender clichés and create possibilities of transformations.

Keywords: Feminist technoscience; digital STS; gender; digital technologies; transformations.

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Feminism does not have to have gender as its ground zero. I kind of want more.
(Susan Leigh Star, 2008)

1. Introduction

In a recent interview with Ana Gross, Lucy Suchman found herself tracing her encounter with feminism, claiming that one of the greatest resonances between her work as STS scholar and feminist theory and politics was the acknowledgement that social structures have to be reproduced, "but that there are also slippages in that cycle of reproduction and that those slippages are points of potential intervention for transformation" (Gross and Suchman 2021, p. 183). Once again Suchman, in a recent contribution to "Tecnoscienza", returned to the question of the performativity of knowledge, arguing that STS is fully implicated (as any body of scholarship and research practice) in world-making practices through its own peculiar figures (Suchman 2020). According to Suchman, the attention towards boundary making practices that mark out differences and the transformative reconceptualizations of the relations between research methods and their objects are becoming, however contentiously, the linchpins of the connections between STS and feminist theories.

These reflections inspired the will and desire to develop a space dedicated to feminist technoscience within the scope of the VIII STS Italia Conference, whose title reads "Dis/Entangling Technoscience: Vulnerability, Responsibility and Justice". The focus on the complex and ambivalent role of technoscience in constituting societies, between the emergence of new opportunities and the creation of new vulnerabilities, has indeed naturally evoked questions that have always characterized the core of feminist technoscience, that is how to enact silence, give voice to the traditionally invisible, interrogate boundaries, uncover local and marginal positions enacted by technoscientific practices. In other words, the call of the last STS Italia Conference has directly pointed to the inseparability of knowledge practices (entailed in the word "Dis/Entangling") as well as to the commitment to uncovering the unintended consequences of technoscientific enterprises and to fostering interventions for transformations emerged from the slippages of cycles of reproduction as underlined by Suchman (2020).

Against this backdrop, the focus of the track titled "Disentangling Digital Feminist Technoscience" has been devoted to unpacking the relations between humans and computational machines through feminist sensibilities in the light of the growing body of literature exploring the intersection of STS and digital technologies (Vertesi and Ribes 2019). The development of the track grounded in those analyses concerning sites and practices

shaped by digital technologies, which uncover the ways through which they are biased in terms of gender, sex, labor, class, ethnicity, (dis)ability. This body of research addresses various issues, from the underrecognized or neglected contribution of female work to the development of computing (Hicks 2017) to the role of gender practices in shaping computing cultures (Dunbar-Hester 2019); from the negative biases against women of color embedded in search engine results and algorithms (Noble 2018) to the ways through which digital platforms engage and exploit user labor (Jarrett 2015).

Six research works have been presented in the track by scholars located in different parts of the world, such as Canada, Austria, Japan, Israel, UK, and Germany. The contributions presented reflect and thus are summarized around two central issues developed in the literature about feminist technoscience in digital domains, focusing on how digital technologies reproduce gender bias and power asymmetries, but can also generate responsible and conflictual interventions.

2. Digital Technologies, from Gender Discrimination and Inclusion towards Reflexive Interventions

Feminist Technoscience Studies (FTS) have been defined as a "trandisciplinary field" (Åsberg and Lykke 2010) as it merges social studies of science and technology and the multiple critical intellectual legacies of feminist critique. As such, this field of study emerged as a "nodal point" (Lykke 2010), namely a discursive site that has historically gathered a plurality of epistemological and political traditions. These are concerned with various issues such as the analysis of disparities between men and women in science and technology, the inequities of technoscientific systems as for the discriminations of women, queer persons, people with disability and illness, elders, people of color. On the other hand, FTS examines how science and technology, in their plural forms (artifacts, places, infrastructures, standards, protocols, policies, etc.), are constructed through and entangled with sexist, gendered, racialized, and political scripts. Far from any deterministic assumption, research and reflections in this space have argued that science and technology can produce and exacerbate forms of discriminations, but also forms of critical deconstruction and reflexivity around gender bias in technoscientific practices. These insights emerged from Yoshimi Kakimoto (Nara Women's University) contribution, which addressed the issue of gender-equality, claiming that technologies should help to disrupt gender stereotypes. The gendering of technological objects, among which we find social networks that make us interconnected in any time and in any

space could become a way to enact practices of self-awareness. Against this background, Kakimoto argues that this interconnection of digital technologies shapes cyberspaces, which can be interpreted as spaces of self-determination aimed at disentangling gender bias with the aim of reconfiguring a world based on gender equality.

On the other hand, IT-related domains are marked by persistent gender gaps and asymmetries. Therefore, women find themselves elaborating different strategies to cope with male-dominated environments. The contribution by Annika Richterich (University of Sussex, UK) focused on these aspects by investigating networks that support women's access to STEM disciplines. According to Richterich's study, women respond to the discomfort of living in highly masculine professional worlds by adopting individualistic and pragmatic solutions, rather than allying and enacting collective strategies to bring about structural changes. These findings resonate with those research endeavors that shed light on the controversial implications of "diversity in tech" advocacy, which seem to align with industry goals and market values rather than being attached to structural issues connected to power and inequality (Dunbar-Hester 2019).

Nevertheless, initiatives aimed at bridging the gender gap in tech environments are proliferating, including those devoted to shaping the gendered character of widespread digital platforms, such as Wikipedia. This is the case presented by Shlomit Lir (Ben-Gurion University of the Negev) in her contribution focused on gender bias in the most popular "free encyclopedia", by examining how different barriers are interlinked in a manner that deters women and prevents them from editing in the website. Lir's research followed the steps of 27 Israeli women activists who participated in editing workshops. According to the author, having the will to edit and the knowledge of how to edit are necessary but insufficient conditions for women to participate in Wikipedia. The research suggests, indeed, the presence of a "vicious circle" mechanism (characterized by negative reputation, anonymity, fear, alienation, and rejection) that discourages women from contributing to the website. In order for more women to join Wikipedia, the research suggests the model of a "virtuous circle", which consists of nonymity, connection to social media, inclusive policy, soft deletion, and red-flagging harassment.

Besides being places that can reproduce or tackle gender and power asymmetries, digital technologies can play the role of interesting methodological tools to favor processes of reflexivity within practices of technology development. With their contribution, Anna Gerhardus (Institute for Advanced Studies, Austria) and Julia Schmid (Institute for Advanced Studies Austria) have indeed shown the potential of virtual reality (VR) as a learning tool for gender inclusiveness. In the project presented, an

interdisciplinary research group made up of potential users, employees, manufacturing companies, sociologists and informatics adopted VR tools to develop scenarios configuring potential cases of gender discriminations. By developing and examining together the set of possible events and actions, the group was able to question and learn about power differentials, intersectional positions and gendered practices that characterize workplaces and other daily environments.

3. Experimenting with Gender and Technological Design

Adopting a feminist approach allows us to look at the heterogeneous processes that shape materiality as effects of practices that oscillate between overturning the gender order and reinforcing discrimination practices. In this section we look at how researching with and about technology can help to experiment with the design through which gender is constructed.

Early work on the initial deployment of video games revealed how self-representation and online identity were constrained by graphical interfaces towards a binary choice of male/female gender (Reid 1996). Analyzing the gender script is a way to understand how design adapts to specific user groups due to the incorporation of specific images of future users (Oudshoorn et al. 2004). Gradually STS and feminism studies developed theoretical concepts and conducted empirical research with the aim of deconstructing gender as a category, helping developers to produce more gender equality-oriented technologies (see Rommes 2000). In digital spaces, bodies can become symbolic artefacts through the concretization of heteronormative models that reinforce gender inequalities, but also the outcome of performative assemblages of gendered/gendering practices. This is the direction in which the study by Ona Bantjes-Rafols (Carleton University, Canada) and Chiara Del Gaudio (Carleton University, Canada) moves. In their contribution, they developed an analysis of the video game "The Sims'' to question the patriarchal culture embedded in gaming design practices. The authors reflect on the role of designers in the construction of an inclusive and plural script, aimed at challenging the heteronormativity often embedded in gaming design. They offered an analysis of The Sims game and the changes it has undergone through updates and releases. The Sims is a particularly suitable game for this analysis because it is a sandbox game, i.e. it offers the player the possibility to customize characters by personalizing the clothes, the hair, the physical appearance of the characters and to build family, relational and work stories. Because of these features, The Sims became an interesting game for the Queer community,

whose members feel free to play with their appearances, building digitized bodies capable of representing fluid gender identities. The conclusions underline the potential of video games to perform bodies by enacting visions that can reconfigure the way we think about gender and make gaming culture sensitive to the challenges posed by feminist struggles against gender binarism and patriarchal power structures. The user becomes an integral part of the process of constructing a virtual reality in which gender identities are performed by game practices as a result of a process of negotiation between the actual users and the users imagined by the developers in a mutual adjustment (Akrich 1992).

In ICT studies, challenging the gender dichotomies embedded in technological artifacts calls into question the gender of design. In this respect, Natalie Sontopski (Komplexlabor Digitale Kultur, Germany) presented an experiment showing how structures of inequality can be co-shaped with technologies. The scholar returned to the transformative power of speculation and creativity to overthrow gender roles and stereotypes like those embedded in intelligent personal assistant (IPA) technologies (e.g. Siri, Alexa). As Sontopski noted, most users choose to let IPAs speak with a female voice and conceive their digital assistant as "she". This perception is emphasized by speech patterns as IPAs stereotypically speak very politely, give affirmations, signs of listening and suggest instead of dictate, thus playing a passive character that obediently takes orders and seeks pleasure in care work. In order to change this narrative and start breaking away from the gender clichés embedded in IPAs, Sontopski and colleagues developed an experimental installation using speculative design methods and a sociological theoretical approach. The experiment involved an actress who "played" the part of an IPA called "MiauMiau", which interacted with users, showing character traits not available for conventional IPAs, like declining to answer questions, demanding fair pay for her work and defending herself in cases of abuse. In doing so, "MiauMiau" showed to act according to alternative embedded conversational patterns, aspiring to be a kind of "Anti Alexa". Users who had the chance to interact with "MiauMiau" for a few minutes were invited to participate in a survey, which (surprisingly) showed that over 60% of respondents liked the interaction, while (not surprisingly) most of them found the interaction not helpful.

This study has succeeded in creating a space for theoretical and political discussion, in which STS feminists can connect with 'the sciences of the artificial' (Suchman 2008). Within this feminist framework, AI can be questioned in its gendered configurations in order to bring out multiple positioning and emancipatory practices.

4. Conclusions

The contributions briefly outlined above have allowed us to discuss digital technologies as assemblages made up of relationships, cultural and social values, as well as imaginaries that can disambiguate but also overturn gender bias. Technology can be conceived as a political intervention to transform social relations and the knowledge inscribed in technological artifacts. The research works presented have shown the potential of digital technologies to disrupt gender stereotypes and patriarchal power structures, the different tactics undertaken by women to adapt male dominated tech environments, but also to identify and implement virtuous cycles to achieve gender balance in these domains. Moreover, we have acknowledged the potential of technologies and design as important tools to develop a gender-sensitive reflexive stance towards cultures of technology, as well as to subvert gender clichés and create possibilities of transformations. In these terms, digital technologies become an agonistic space to overturn traditional and stereotypical gender imaginaries such as those embedded in the design of personal assistants as an impersonation of typically feminine caring roles. What if Siri and Alexa decided to join forces and claim the rights of personal assistants?

The discussion that followed individual presentations emphasized precisely the twofold character of feminist technoscience: the sharp critique of patriarchal structures and practices as well as the seed of transformation conveyed by such a critical stance. This generative tension between knowing and doing is by all means the central hallmark of feminism(s) and feminist studies, being these transformative politics engaged with the question of how to intervene on traditional ways of knowing (Ahmed et al. 2000). In asking how we can reflect on changes in the current moment, Sara Ahmed and colleagues argue that wondering about transformation is a task of "thinking through feminism". In this respect, Susan Leigh Star argued that feminist theory needs to go beyond the "good reparative work" in expounding the invisibility of women and other marginal groups, in order to look more ecologically at the implications and possibilities of technoscientific pratices (Zachry 2008). This resonates with Suchman's words that open our reflections, underlining the possibilities to intervene in the slippages that characterize any cycle of reproduction through transformative reconceptualizations of the relations between research methods and their objects. As the contributions presented are also demonstrating, this can represent a fruitful path for the relationships between digital STS and feminist theories to be cultivated.

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Responsible and Inclusive Citizen Science

Comparing Initiatives and Assessing Impacts

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Abstract: This contribution develops from the panel titled "Responsible and inclusive citizen science: comparing initiatives and assessing impacts" organized for the VIII STS Italia Conference. We conceived our panel as a place to gather experiences and perspectives about the study and assessment of inclusiveness, effectiveness, and impact of Citizen science (CS) initiatives. A better understanding about CS, even taking into a perspective for policy-oriented interventions, may intercept crucial issues about participation and engagement into science and technology. These issues are getting increasingly explored but research about how and, moreover, what to assess as the positive outcome of CS is still in its infancy. The original idea was to build upon experience and methods to develop a common reasoning, but the discussion went beyond our expectation, elaborating the value of participation beyond the pure enlargement of the number of participants into CS activities. Accordingly, this paper explores the variety of notions of participation, citizenship, and democratization of science entailed in the idea of assessing participation and inclusion as addressed during the track.

Keywords: Citizen science; public engagement; impact assessment; inclusivity.

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1. Introduction

Talking about Citizen Science (CS) often refers to non-experts that volunteer into data collection. Supporters of CS are largely confronted with the issues of reliability of CS-generated data produced with techniques and methodologies that encourage and sustain ongoing participation necessary for a project's realization.

Current debate about CS is increasingly engaging with the issue of the assessment integrating it to the array of challenges that are already on the table (e.g. quality of scientific activities – Vohland et al. 2021). Since assessment is the issue of defining tools for measuring and giving account of the impact of a certain activity, its presence is the signal of a mature contribution into the debate (Wehn et al. 2021). Indeed, assessment for CS aims to go beyond pure speculation about the claims for effective public engagement. Already in 2016, the Crowdsourcing and Citizen Science Act (CCSA) intended to "encourage and increase the use of crowdsourcing and citizen science methods within the Federal Government to advance and accelerate scientific research (…)" (US House of Representatives 2016).

Moving from such praise for offering valuable contributions to knowledge creation, focusing on the assessment is about to become a specific and urgent necessity, not only in the US but to the whole CS community. Indeed, the Ninth European Framework Programme, labelled Horizon Europe, clearly indicates for applicants to address societal needs and suggests considering different approaches to public engagement; plus, there is an explicit mention to Citizen Science. In doing so, the European Commission embraces the current success of such a catchy label; indeed, the participation into scientific activities by non-experts is one of the main features of CS. Being considered as a brand-new opportunity for public engagement, supported by the diffusion of Information Communication Technologies (Wynn 2017; Haklay 2015), as well as an established tradition in environmental monitoring (Bonney et al. 2016), the general tone of the debate around CS agrees in its great potential. As such, the growing community of scholars, practitioners and theorists that supports CS actively started interrogating themselves about the tools and strategy to effectively assess it.

The thematic session we proposed to the VIII STS Italia conference titled "Responsible and inclusive citizen science: comparing initiatives and assessing impacts", addressed exactly those issues in order to bring forward the discussion and complementing it with an alternative perspective, which can enrich the debate about the relationship between science and society. With this short resume the aim is to explore the variety of notions of participation, citizenship, and democratization of science entailed in the idea of assessing participation and inclusion: this is the challenge we addressed as convenors for our track. The present paper gives account of the main topics emerged during the session that further complexified the topic of assessment, reconfiguring the issues of inclusiveness, engagement and the

political value of CS. Before going through them, we will first summarize the main promises of CS for engagement, by accounting for the themes emerged during the debate and listing the main issues connected to the urgency of assessment.

2. Setting up the Scene: Citizen Science and its Promises for Public Engagement

There is not a unique CS definition (Haklay et al. 2021). There is a wide array of practices that can be listed as CS and at the same time, CS as a topic is open to a heterogeneity of practices characterised by several levels of engagement aligned with participatory research. To give some general coordinates, many agrees on the idea that Citizen Science consists in some kind of activity oriented to data collection supporting professional scientists in their research (Bonney et al. 2009); other scholars look at Citizen Science as an attempt to enter the agenda of science policy typically retained as dominated by a logic other than one of citizenry (Irwin 1995). These two sides of CS are particularly famous (Kulleberg and Kasperowski 2016) and co-exist in the debate; they are rarely considered as opposed perspectives, rather they are literally interpreted as two sides of the same coin (Cooper and Lewenstein 2016). Indeed, as recently reported (Strasser et al. 2019), CS has the potential to fruitfully address the rhetoric of openness and democratization of science in a threefold way: first, CS is presented as a trigger to foster public engagement in order to make knowledge creation process more open towards societal needs, in coherence with a dialogical approach between scientific institutions and society at large; second, even though not all CS activities have primarily an educational goal, many theorists and practitioners promote it as a way to foster scientific literacy for those who have been engaged in activities within a specific CS project; third, by being engaged into some kind of scientific activity, a volunteer would also learn about the scientific method as well as critical thinking and should be consequently more positively oriented towards science as an institution. The second and the third promises derive from the democratization thesis, which should be "more politically palatable than the previous autocratic or dictatorial regime of science" (Mirowski 2018, p. 177). The potential gains of CS for knowledge production and scientific literacy have been positively assessed when directly analysed in specific contexts (Bonney et al. 2016). However, knowledge improvements about certain topics do not necessarily demonstrate a more democratic turn; Martin (2017), in her analysis about the composition of volunteers in a CS project in Australia, for instance, questioned the presumption of CS as a tool to enrol people that are not already "engaged" with science; indeed, in that case volunteers' average profile tends to be a highly educated one and thus easily stands out in some scientific subjects. For this reason, the opportunity to provide insights for marginalised or normally excluded groups is

not guaranteed. CS per se does not avoid typical barriers in engagement and this should not be overlooked. The same applies to increasing scientific literacy: not all the projects include it as an aim (Bonney et al. 2016) and are mainly concentrating efforts in coordinating volunteers for data collection (Hecker et al.2018); furthermore, even though the increase in scientific literacy can be declared as a main objective, CS projects are not equipped for assessing its long-term effects. Finally, the fact that we can apply technologies and methods to support participation (Newman et al 2012; Wynn 2017), it does not automatically imply a contribution into the democratization of science (Felt and Fochler 2010).

Here we convey that it clearly emerges the need to address the different facets of assessing CS projects.

3. Elaborating Issues of Impact Assessment

Research about how to effectively assess CS is still in its infancy. As reported by Wehn et al. (2021), even though there are some reflections linked to single projects' perspectives, the literature is quite sparse and vast. Indeed, it should be acknowledged that talking about impact assessment may embrace several areas of interest that require methods for a comprehensive oriented data collection approach (Giardullo et al 2021).

Being this said, there is wide room for reflection about CS features especially concerning inclusiveness, effectiveness and impact of CS initiatives. Our track aimed exactly at taking stock of experiences about the subthemes related to CS impact assessment, such as: measuring and comparing inclusiveness across initiatives; defining useful criteria for the selection of both qualitative and quantitative indicators; tracking specific connections with the Responsible Research and Innovation (RRI) pillars and, relatedly, how to address gender balance within these initiatives. The discussion involved experiences or research about CS activities, and an audience that actively participated in the conversation further expanding the scope as convenors we originally imagined. A key element that emerged almost immediately is the repurposing of the two coexisting sides of CS: fully funded top-down projects and the grassroots ones. These two perspectives did not come out of the blue but rather represented the research topics provided by the session participants: a combination of research experiences about engagement into the analysis of CS, both from the perspective of institutional projects and from self-organized communities that promote local and sometimes trans-local mobilization, especially in the case of environmental conflicts. Such a state of affairs echoes issues related to the engagement of indigenous into data collection campaigns in those areas so important for biodiversity and climate change in Global South areas. Often promoted by researchers from universities coming from Global North these research programme may encourage participation of communities

traditionally excluded from scientific research, nonetheless it is uncertain if it can actually drive to a more open way of producing scientific knowledge and empower people. The risk of reproducing bias and power asymmetries is likely if researchers do not deal with them directly (Young and Gilmore 2017).

The conversation during the session allowed us to consider exactly the ambivalent role of inclusivity of CS in a complementary way.

On the one hand, both research experiences by CS projects and analysis provided by scholars from a top-down perspective approached the assessment of tools for engagement: how they work and how they do so, for instance checking the profile and composition of volunteers. Therefore, the efforts aim at understanding whether strategies to create opportunities for enlarging the array of people involved into the creation of scientific knowledge are working. Indeed, many of the issues that emerged reflected gender segregation, education and social class inequalities that are well-known for science. The suggestion to concentrate on the outcomes, meaning on the gains obtained or missed, compared to the aims of the project, rather than on outputs, is shared by most participants as a necessity in order to synthesize what a CS project can obtain.

On the other hand, analysis of grassroots projects, made visible to participants how inclusion is a debatable issue. Indeed, for example, grassroots projects that react by collecting data as evidence of an environmental emergency affecting their lives, may do so in contrast or as an addition to official environmental monitoring agencies. In this sense, these self-organized groups for data collection cannot be inclusive: first, because they typically start activities in response to a fallacy in the official data, which they either do not longer trust or do not consider reliable; second, because, especially in local environmental conflicts, being inclusive may enlarge too much the spectrum of their protest, exposing them to the risk of not being able to manage proficiently their efforts.

Therefore, inclusiveness turned to be a matter of concern in an unexpected way for a European/Global North context. It further reflects the two coexisting sides of CS but, in a sense, it complexifies the whole concept of inclusiveness itself. The narrative of being quantitatively inclusive and diverse in the context of top-down CS projects shows only a facet of the story. Indeed, as we learned through the confrontation and the debate with the participants of our session, inclusiveness cannot be taken for granted as a topic with an univocal value. Different experiences that may fall under the label of Citizen Science may interpret differently the issue of inclusive participation into their activities.

4. Conclusion

As the reader should have noticed by going through our contents' resume for the "Responsible and inclusive citizen science: comparing initiatives and assessing impacts" session, organized for the last STS Italia Conference, we went well beyond our expectations. Indeed, the debate triggered by the contributions of the participants and audience overcame the more technical and methodological issues. The many facets of impact assessment for Citizen Science once put on the table promoted a valuable discussion that provided an alternative perspective on inclusiveness and participation: the two dimensions typically assumed as desirable outcomes for a CS project. However, the discussion provided a twist to the concept driving to a more thorough analysis. Certainly, by deconstructing those concepts, the discussion provided interesting theoretical elements based on the collective re-elaboration of the empirical experiences brought by the participants.

Therefore, if CS cannot be taken for granted as a coherent phenomenon for the engagement of non-experts that take part into some kind of scientific research activities, the same applies to inclusiveness and participation. Potentially, an access into the governance of environmental issues (the main domain amongst the many presentations) as well as into policy for research can be obtained by CS projects that are not inclusive. Rather than being exactly the opposite, grassroots projects may be able to gain visibility into a political debate much more than welcoming forces from the institutions or from other groups. Such a perspective on inclusiveness is intriguing. While promoters of the mainstream narrative of CS as a method insist on the opportunities to enlarge participation and to promote engagement of non-experts, grassroots experiences, even though not always successful at this, configure the notion of inclusiveness in a more blurred way. Almost paradoxically, the highest aspiration of CS labelled as the "democratization thesis'', supports a more political value of inclusion fulfilling the principle of participatory turn into science policy (Strasser and Haklay 2018). However, quoting again Mirowski (2018), such a democratization may be obtained precisely without following the idea of inclusiveness in a blind fold way. The inclusion of a wider and wider array of social actors into such processes is at the core of many funding schemes. Indeed, most publicly funded projects for technoscientific innovation expressly require strategies of public engagement. However, our panel deconstructed such an idea, pushing on the table of impact assessment of CS projects an interesting research question: in order to be politically sounding do we need to be necessarily inclusive?

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Rethinking the Nexus between Science, Politics and Society in the Age of the SARS-CoV-2 Pandemic

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Abstract: This crossing boundaries section addresses the substantial aspects at stake in reshaping the nexus between science, politics and society triggered by the Covid-19 pandemic. In this regard, three main dimensions are explored: first, the emerging forms of science-related populism and how political narratives challenge and dispute prevailing scientific knowledge; second, the platformization of science communication and the active role of users and communities in consuming and spreading online misinformation; third, the role of lay expertise in contesting the epistemic authority of science during the health emergency. The authors explore the related topics by mobilizing different theoretical frameworks from STS studies, media studies and legal science, also moving from empirical to theoretical level in order to challenge the "surface" of a multilayered phenomenon.

Keywords: science-related populism; lay expertise; online communities; pandemic; public controversies.

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On Populism, Infodemic and Lay Expertise. Linking the Surface, the Layer and the Substrate in Mistrusting Scientific Practice

Paolo Bory and Stefano Crabu

One of the most pervasive claims circulating in the public sphere following the spread of the SARS-CoV-2 virus is that the uncertainty arising from pandemic governance and related science-based decision-making dramatically enhanced mistrust and public suspicion towards scientific communities, experts and public institutions. Despite this claim seeming to be an indisputable feature of these (post) pandemic times, an historical perspective allows to easily recognise its conceptual and analytical fallacy. In this respect, the contestations of the monopoly of science and scientific institutions, especially those mobilised by the so-called "non-scientific" or "pseudoscientific" movements and communities, are not a direct or contingent effect boosted by the troubles and anxieties enacted by the SARS-CoV-2. Rather, these forms of mistrust of science can be located within a longstanding process involving different agents and technological entities, such as political and scientific institutions, media and digital platforms, science policies and citizenship-making practices collectively engaged in co-producing the mutual configuration between (scientific) expertise, democracy and society at large.

A second relevant claim, enacted both in the public and academic debates, is that the pandemic should not be framed just as a "tragic" event, but also as an opportunity to better understand and "fix" the problems and shortcomings concerning public health policies, the structure of science journalism and science communication and, more in general, the delicate relationship between science, innovation and society. Notably, such an opportunity may request novel public responsibilities for social scientists, and especially STS scholars; but it can also drive them towards renewed forms of disciplinary fragmentation and solipsism. The main risk, in fact, is to polarise and oversimplify – for example, by adopting a monodisciplinary or autoreferential perspective – such a complex and multi-layered field of enquiry. In this regard, umbrella terms such as "populism", "infodemic", "post-factual society", "fake news" or "conspiracy theory" may represent a double-edged sword; they can be adopted to weave a critical debate, but also to (re)produce and reinforce a deterministic narrative portraying a mono-casual, unidirectional relationship between those who detain the political and communicative power and a passive societal landscape which is supposed to be prone and fully committed to faith in scientific rationalism (on this point see Pellizzoni 2019; Lynch 2020).

This Crossing Boundaries section (CB) aims to weave a dialogue between three scholars from different disciplinary backgrounds – legal science (Marta Tomasi), media studies (Simone Tosoni) and STS (Barbara

Morsello), respectively – with the aim to address three key issues characterising the reshuffling of the nexus between science, innovation and society during the pandemic crisis. In order to provide an introductory compass for diving into the magma of this CB without the risk of being liquefied, we mobilise three analogies borrowed from geology: the surface, the layer and the substrate. In geology, a comprehensive understanding of the surface (e.g., the growth and the flourishing of a specific plant) cannot be separated from what is happening in the layers and the substrates beneath it. At the same time, the surface (e.g., a natural phenomenon or an artificial intervention on the terrain) can penetrate deeply into the substrate, contributing to the creation of a specific, yet hidden, underground eco-system. Similarly, the three contributions in this section relate to three interconnected phenomena that influence each other: i) the spread of science-related populism; ii) the circulation on social media platforms of counter-knowledge and facts rooted outside the prevailing scientific paradigms, and; iii) the emergence of new forms of lay expertise.

The first contribution, authored by Marta Tomasi, deals with a quite visible and debated phenomenon – the surface – influencing public discourse on science: the emergence of the so-called *science-related populism* (see Crabu and Magaudda 2020; Mede and Schäfer 2020). By putting political populism and science-related populism side by side, Tomasi shows how the mutual relationship of these two phenomena impact the public's trust in scientific institutions. At the same time, Tomasi argues, the spread of populism and mistrust in science during the pandemic is also due to the false steps of public and political actors: hesitancies and frictions between governments, political leaders and regulatory agencies on how – and by which means – to stop the virus have also fuelled generalised scepticism and mistrust in science. Furthermore, one of the most interesting insights provided by Tomasi lies in the underestimated relationship between technocratic and populist solutions. As Tomasi puts it, populism and technocracy share an anti-democratic strain, since they both promote a form of unilateral solutionism: the will of the people, on the one hand, and the "one correct one-size-fits-all policy" solution on the other.

The second article by Simone Tosoni focuses on the key role that digital media, the layer, play in the practices contesting the monopoly of science. As is well known, social media can be used to spread "misinformation", also profiting from the cracks dug by populist leaders in the castle walls of science. According to Tosoni, this media layer – which clearly connects the surface (populist narratives) with the substrate (the publics) – is currently explored from a deterministic angle, bringing back an outdated paradigm in media and communication research. In this regard, Tosoni argues, the current return of a "strong media effect paradigm" goes hand in hand with a sort of emulation by media studies scholarships of the very same methods, research objects and theoretical stances coming from quantitative epidemiological studies: in particular, the theoretical overlap of the pandemic with the infodemic risks to homogenise and banalise the "audience". Such

oversimplification disregards the ways in which different communities and individuals can appropriate, deploy and integrate social media sources and content related to the allegedly biased institutional science during the pandemic crisis. Tosoni's research on the No-5G Italian scene is a clear example of how mistrust in science can be reliant on different sources, narratives, and, last but not least, practices.

The last phenomenon under scrutiny brings us to the final contribution of this section by Barbara Morsello, who addresses a less visible and hard to grasp phenomenon which underpins the legitimacy crisis of science: i.e., the way in which the "substrate", the lay people, may contextualise and activate different knowledge, objects, repertoires and practices juxtaposing the validity of personal experience with stabilised scientific research and methods. In addressing the creation and sharing of knowledge and experimental practices by lay people to contrast vaccination, Morsello sheds light on a missing link for a comprehensive understanding of the current mistrust in science: the way in which mistrust can grow from below, especially in combination with social media platforms. In this context, the complexity lying behind the forms of resistance to scientific "regime of truth" – like in the vaccine case portrayed by Morsello – can only be disentangled through a deeper analysis of the symbolic, relational and technological means adopted to build up and legitimise the so-called "lay expertise".

Although exploring only a small part of a vast area, this CB is a promising venue for opening and soliciting an inter-disciplinary approach to studying the science-society nexus, and to reconsider the very *socio*-technical process and arrangement through which science produces knowledge and can shape institutions, cultural beliefs and collective imaginaries on which its epistemic, cultural and moral authority, also in relation to the politics, is grounded. This analytical sensitivity is urgent for capturing the current cultural and socio-technical processes at stake in redefining the meaning and practices of scientific and technical expertise and authority, with particular attention on how the pluralisation and democratisation of digital communication tools enable people to shape, share and trust alternative forms of knowledge and expertise for organising everyday life. Thus, this CB solicits the opening of analytical strategies that avoid the application of the same demarcation criteria of institutional scientific rationality to distinguish different forms of knowledge and expertise. Indeed, such a position may reproduce mainstream accusations of irrationality without elucidating the existing social links between science and other competing forms of knowledge and expertise, also neglecting the cultural and material (i.e., technological) conditions behind the emergence of an antagonistic relationship between science and other concerned groups of people questioning its legitimacy.

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Populism, Politics, and Science in the Midst of the Pandemic

Marta Tomasi

Introduction: Trust and the Pandemic

The CoViD-19 pandemic played a central role in bringing forgotten issues to light and raising the collective awareness of others. First, the spread of the virus has brought back into the spotlight public health issues that, at least in a certain part of the world, have been only marginally addressed by the political agendas. Consequently, the attention that has been paid in the last decades to affirming the value of individual self-determination in health has been supplemented with the awareness of the extent to which personal choices made in this area can affect common living. Second, the containment strategies implemented have highlighted how policy decisions increasingly need to be based on a sound scientific foundation. The events of the last months (since January 2020) – which are now turning into years – have demonstrated the importance of both society and regulatory institutions being in tune with science. As both these relationships are based on trust, it is interesting to reflect on how the rhetoric of populism – which makes the very idea of 'trust' one if its favourite targets – impacts on them.

Moving from a legal perspective, thus, this paper investigates the concept of science-related populism, relating it to political populism. The two phenomena not only share some basic foundations, such as distrust and conflict around sovereignty, but are dynamics that thrive on mutual connections. The recent pandemic, which called for a rediscovery of the value

of relationships in the field of health, the centrality of public policies, and the importance of their close connection with scientific reality, serves as a case study to explore the dynamics of this relationship. The overall aim is to affirm the profoundly democratic root that must govern the 'political power-science-citizenship' circuits.

Trust and Sovereignty as Constitutive Elements of Populism

It can be said that the ability to control epidemics strongly relies on public compliance with government decisions and scientific advice and that the chance to modify citizens' behaviours, even before coercion, depends upon trust. The clearest and most up-to-date example of this order of precedence is to be found in policies that – before imposing an obligation to vaccinate – proceed with information, education and persuasion of the population, only to move on to more coercive strategies when immunization rates are low.[1] The willingness of individuals to act to promote outcomes that benefit the greater societal good is intuitively strongly determined by their attitude towards (and level of confidence in) institutions and the *res publica*.

From this perspective, the populist discourse – which describes society as a fundamental struggle between an allegedly virtuous people (a popular majority having a common will)[2] and elites (conceived as a social minority having decisional power),[3] who are portrayed negatively (Rooduijn 2019) – can clearly play a crucial role in the current situation. This statement requires some clarification.

Populism is difficult to capture in a single, uniform definition. Nonetheless, trust is commonly considered one of the critical targets of this phenomenon, and its opposite, distrust, is surely one of the elements common to all tendencies that can be framed under a general notion of populism.[4] More precisely, a focus on the social practices to weaken and dismantle trust, as well as the notion of distrust, certainly characterise the best-known conception of populism – that of political populism – but also some of its more specific and less conceptualised declinations, such as science-related populism (often referred to also as scientific populism). While the former is a tendence that has spread widely, especially in the last decades, so much so that some authors have conceptualised an 'age of populism' (Smith 2018), the latter is a trend that has emerged more recently and consolidated its features during the pandemic.

Looking at these phenomena from the point of view of trust, it can be observed that political populism often aims at weakening trust in political institutions and tends to undermine citizens' confidence that their governments are competent and reliable. Generally indispensable to state legitimacy, trust is critical in promoting respect for the rule of law.

Likewise, the erosion of trust also belongs to scientific or science-related populism, which often opposes the people and scientific experts, seen as representative of the societal establishment (Mede and Schäfer 2020), and addresses people's confidence in science and in scientific research processes, findings and evaluation mechanisms. Science, based on a method aimed at departing from the common sense, is the perfect target for all the theories that mythicise precisely the value of common experience.

The symmetries between the two phenomena are not limited to trust and the clash between the people and the elite. They also encompass the closely related notion of sovereignty,[5] generally conceived as supreme authority in politics and collective decision-making (Philpott 2003).

According to political populism, politics should be an unmediated expression of the popular will, as the mechanism of democratic representation is an illegitimate claim to sovereignty (Mede and Schäfer 2020, 477).

Science-related populism sees scientific elites as illegitimately detaining sovereignty with regard to 'decisions about what is being, or should be, researched when, how, and by whom'[6] and the definition of 'what constitutes "true" knowledge'.[7] The criticism takes different forms: in some cases, it does not address science itself, but the dominant scientific authority, which is seen as corrupt, working 'behind closed doors' and therefore deserving of replacement with alternative authorities and counter-knowledge. In other cases, condemnation is directed at the scientific method, which is contrary to the 'participatory turn', defined as 'a general shift of preference from representative democracy to more direct forms of participation' in the context of science (Blühdorn 2014, 407). In more radical scenarios, critics strike at scientific epistemology as such, asserting that it should be replaced with people's common sense, personal experiences and emotional sentiments. The difference between sovereignty claims in political and scientific populism is that the former are related to making political decisions, while the latter deal with the epistemic authority of knowledge generation. In light of recent events, the pressing question becomes: What happens when the two realms merge and scientific considerations come to represent the primary basis for political decision-making and regulations? An intersection between the two phenomena looms on the horizon.

Scientific and Political Populism Interrelated

Scientific populism and political populism not only share some basic foundations (such as distrust and conflict around sovereignty) but are dynamics that thrive on mutual relations.

Some earlier findings have already indicated that positions against institutional science can be associated with political populism. For example, in one study, a strong relationship was discovered between populist

sentiment and mistrust towards intellectuals and experts, a tendency of populist party supporters to have lower trust in universities was observed, and the fact that many voters of populist US candidates would rather 'trust in the wisdom of ordinary people than the opinions of experts and intellectuals' was highlighted (Mede and Schäfer 2020, 474).

One of the fields in which this interrelationship has become particularly evident is vaccinations, which are often at the crossroads of science, individual choice, and political decisions. The phenomenon of vaccination opposition or hesitancy is as old as vaccines themselves and has manifested itself throughout history, with greater or lesser evidence depending on the time and circumstances.[8] More recent analyses, however, show that it is possible to identify a link between this manifestation of distrust toward science and political preferences. In particular, according to a study published in the *European Journal of Public Health* (Kennedy 2019), there is a substantial correlation between the increase in European populism and levels of mistrust in science and vaccine resistance. A highly significant positive association was found between the percentage of people who voted for a populist party and the percentage who believed that vaccines were not important or effective. Although the author of the study argues that further empirical investigations are needed, 'it seems likely that scientific populism is driven by similar feelings to political populism, for example, a profound distrust of elites and experts by disenfranchised and marginalised parts of the population' (see Kennedy 2019, 513).

Under this perspective, the current pandemic may serve as a case study for exploring the dynamics of this relationship. Since the protection of public health in a pandemic relies on citizens' trust in government decisions and on political leaders' trust in the findings of the scientific community, the consolidation of the logic of populism can produce significant consequences. This point is all the more salient because, at the juncture we are experiencing, this erosion of trust – and where and when it occurs – can immediately put many lives at risk.

The Pandemic Between Political and Scientific Populism

The CoViD-19 health emergency and the need to develop effective strategies to contain it have consolidated a very close link between science and politics. Scientific data and the consideration of the epidemiological situation, which changes every day, have been positioned as the basis for the limitation of people's rights (Crabu et al. 2021). Similarly, scientific evaluations represented the guiding light in the development and distribution of vaccines against CoViD-19.

In reality, the regulatory approaches varied substantially, and while some countries strongly relied on science and scientific expertise as integral components of their decision-making processes, others leant towards more politicized models (Heims and Slobodan 2021). In this regard, some

crucial questions read: What was the impact of the health emergency on populist trends? Did it reinforce trust in the scientific realm, or did distrust take over? What was the role of politics?

The pandemic, in its first phase (since its onset and until the approval of the first vaccines in December 2020), dealt some significant blows to populist logics and some of their underlying principles. First, discourses and approaches aimed at disparaging scientific recommendations and supporting forms of pseudoscience have proved to be unsuccessful. Recent memory recalls Donald Trump's propaganda regarding controversial treatments against CoViD-19, such as hydroxychloroquine; Boris Johnson's initial recourse to herd immunity mechanisms in March 2020; Andrés Manuel López Obrador's refusal to wear a mask in the name of freedom; and Jair Bolsonaro's scepticism in calling CoViD-19 a 'small flu' and his dismissal of the whole pandemic as 'hysteria' (Eisenhammer and Spring 2020). The virus often served as a reality check; in fact, according to a report by the Associated Press, the countries that top the rankings of CoViD-19 deaths globally are not necessarily the poorest, the richest or even the most densely populated, but those lead by populist leaders (Daniszewski 2020).

Second, the need for shared public emergency management has also challenged nationalist approaches – typical of populism – and rehabilitated multilateralism and global cooperation (Apuzzo and Kirkpatrick 2020), reinforcing a vision of health as a global public good.

On both fronts, however, the months following the first approval of Covid vaccines showed a significant change of course. After joint efforts to develop the first doses, the saga of their procurement and distribution saw, on the one hand, the re-emergence of nationalist-oriented visions and, on the other hand, the surfacing of a science with little cohesion or consensus.

The initial shortage of vaccines led to the resurgence of vaccine nationalism,[9] aimed at capturing the largest number of doses available through the instruments of advance negotiation and purchase agreements and the blocking of exports to favour domestic demand, in the view that each country should be solely responsible for its own population (Katz et al. 2021). Examples include the deals struck by wealthy countries to buy more than two billion doses of coronavirus vaccines as early as the summer of 2020[10] or the numerous attempts – successful or failed – at bilateral negotiations between member states and non-European pharmaceutical companies or exporters[11] outside the common EU negotiation and purchasing mechanism. Nationalist attitudes were fuelled by the fact that the European Union's effort at joint procurement and distribution of the vaccines proved to be, particularly in its first months, 'a very European disaster' (Krugman 2021) or 'a breathtakingly reckless gamble that didn't come off' (Bickerton 2021) – an excessively slow action, tainted by technocracy. The EU's mishandling of vaccine procurement and rollouts risked undermining the appetite for further political integration, opening the way for new pockets of populism.[12]

These developments have affected not only national states but also the

European Union institutions, which, while committed to solidarity in the COVAX project, have intervened with significant restrictions on vaccine exports[13], somehow manifesting the kind of economic nationalism that the European project is meant to curb.

In the vaccine distribution phase, an uncertain and incohesive approach – also due to the urgency of the situation – affected the image of science (fuelling doubts over the incidence of the market logics that permeate the field of health) and, consequently, the level of trust placed in it.

In this sense, there has been little mutual recognition of and support for vaccine approvals by regulators. For instance, EU lawmakers warned against the 'hasty' approval of the Covid vaccines after the UK authorised the Pfizer vaccine for general use; yet, after only 3 weeks, the European Medicines Agency (EMA) came to the exact same conclusion. The events surrounding the AstraZeneca vaccine, however, are even more significant. The vaccine, which was approved for use in adults by the EMA in January 2021, subsequently became subject to a number of restrictions in member states, which varied significantly over time.[14] These variations symbolize the possible short-circuits between politics and science, being only partly explainable on the basis of two arguments: first, in the moment of constructing scientific certainty, recourse to a precautionary principle plays a crucial role; second, it is necessary to recognise how the risk-benefit assessment of a single vaccine can vary as certain external factors change, such as the availability of other vaccines and the concrete current epidemiological situation.

Beyond this, in the present case, decisions seem to have been sometimes made on the basis of weak and unverified elements (which were quickly refuted) or relying on mainly 'political' motives. In this sense, it is significant to consider the position of the director general of the Italian Medicine Agency (AIFA) who explicitly declared that the vaccine was deemed 'safe', but in need of further data collection, and that the suspension implemented in March had a 'political' nature and was determined by the attitude of other states (Germany and France *in primis*). In this case, with the aim of maintaining a 'common European front' (even at the cost of misalignment with the indications provided by the EU central regulatory authority as well as the WHO), national regulatory authorities took responsibility for seeking further advice from the scientific community, thus reserving for themselves - in the final instance - the decision-making agency in the field of public health. Although it is clear that every decision, even in these areas, has an intrinsic political dimension, in a time of vaccine scepticism, frictions and hesitancies in the relationship between political leaders and supranational and international regulatory agencies inevitably risk undermining trust in science.

The complex and sometimes controversial intertwining of science and politics, at times spectacularised in the public media arena, has generated a climate of general mistrust, fuelled populist impulses and anti-vaccination positions. The agency YouGov said it had already found in late February

that Europeans were more hesitant about the AstraZeneca vaccine than they were about the Pfizer and Moderna vaccines and that the clot concerns had further damaged public perceptions.[15] More in general, according to a report released by Eurofound on 13 May 2021, over a quarter (27%) of adults in the European Union were unlikely to get vaccinated against CoViD-19.[16]

The literature has demonstrated that trust in science serves as a key psychological factor underpinning vaccine acceptance (Larson et al. 2018), but less attention has been paid to societal-level scientific trust, which, in turn, can be positively associated with vaccination uptake. Moving from the assumption that trust is facilitated in trusting environments, some studies have demonstrated how individuals acquire informal impressions of how science is valued or contested through cultural and political debate and media representation (Sturgis et al. 2021). Institutional behaviour is therefore a crucial element in shaping individual assessments of the trustworthiness of science.

These last examples may in part be caused by mixed messages from scientists, which are more frequent in crisis periods when the pressure to produce results quickly is particularly intense; they do not concern governments that can be directly qualified as populist (at least for the most part). At the same time, public scientific controversies over vaccines can solicit mechanisms of distrust towards science that risk producing fertile ground for the affirmation of logics that can be traced back to the rhetoric typical of the populist phenomenon.

This can happen because, above all, populism is built as much on impatience with the rules and norms of common life – and similarly, with the rigorous times and methods of science[17] – as on the need for authoritarian approaches supposed to dominate chaos and overcome moments of uncertainty.[18]

Conclusions: A Democratic Toolkit to Counter Populist Drifts

By bringing science and politics closer together, the pandemic has shown some of the distortions that emerge from the spread of distrust promoted by populist rhetoric.

On the one hand, populist-oriented governments can disparage scientific recommendations, and on the other hand, segments of the public may believe that the advice of scientific experts is being manipulated to advance political gains. Perhaps more surprisingly, there is also a third response that is relevant in this context. It can be observed that, far from being at odds with one another, populism and technocracy may be considered two sides of the same coin. The two phenomena, in fact, share a deeply anti-democratic strain. As political scientist Jan-Werner Müller has pointed out,

'populism holds that there is only one authentic will of the people', whereas 'technocracy holds that there is only one correct policy solution' (Müller 2016); both represent a form of critique of party democracy itself (Bickerton and Invernizzi-Accetti 2015). Brought to its logical conclusion, technocracy breeds with populist logics, giving birth to what has been referred to as techno-populism (Bickerton and Invernizzi-Accetti 2021). Some of the shortcomings that occurred during the pandemic and that have been described above exemplify a crisis in decision-making that is both technocratic and populist.

Thus, looking closer, populism – both in its political and scientific forms – does not necessarily disregard science itself, but populist discourses often end up eroding the methods of its production and the roots of its legitimation and authority. Bridging the gap between governments, scientists and citizens and rebuilding trust – one of the hardest values to be generated – require a method that not only ensures and relies on independency and accuracy, but also promotes transparency, open communication and debate. Politicians and experts should work together to identify sources of bias and set them to rest, stimulate trustworthy information flows and establish effective accountability mechanisms. Needless to say, the fulfilment of these objectives is highly dependent on responsible support and cooperation by the media and journalism (not only scientific). Furthermore, not all critiques of science can be qualified as scientific populism, and some degree of scepticism is healthy because it encourages debate and contributes to change and improvements. Science – which is depicted as monistic, unitary and absolute in the populist narrative more than anywhere else – does not equal scientism or the idolatry of science, and its methods are actually diverse and multiple. As Naomi Oreskes puts it, 'in diversity there is epistemic strength', and 'objectivity is likely to be maximized when there are recognized and robust avenues for criticism, such as peer review, when the community is open, non-defensive, and responsive to criticism, and when the community is sufficiently diverse that a broad range of views can be developed, heard, appropriately considered' (Oreskes 2019, 53).

To act as an antidote to the ever-present risk of radicalization of the contrasts and oppositions promoted by the populist rhetoric (Collins and Evans 2019), politics and science, rather than providing superior truths, should both draw on the toolbox of democratic values, preserving and celebrating freedom, equality, pluralism and solidarity – all of which entail respect for the other (Collins 2019).

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Misinformation, Social Media and the Pandemic Crisis: Challenging the Return to a Powerful Media Effects Paradigm

Simone Tosoni

Introduction

In 2018, The *American Journal of Bioethics* published a comment by Emilio Mordini (2018) from the Haifa University Health and Risk Communication Center, discussing the proposal of Dr Edwards et al. that was advanced in that same issue (Edwards et al. 2018) to deal with the Ebola virus, aiming at reaching 'interspecies herd immunity' through animal and human vaccination. Pondering the practical and ethical implications of this strategy, one of Mordini's main concerns was the risk that 'testing a new vaccine on apes in the wild' could generate 'an epidemic even worse than Ebola: an epidemic of mistrust and fake news' (Mordini 2018, p. 56). The medical communities dealing with the virus were, in fact, seriously worried by the possible interferences with their work caused by the irrational behaviour promoted by a 'myriad of conspiracy theories about Western governments, "Big Pharma" secret plans, mysterious and clandestine experiments on apes, top-secret labs in Africa, escaped engineered viruses, bioweapons, and so on' (Mordini 2018, 56). Since the very beginning of the Ebola outbreak, medical and public health journals devoted systematic attention to the role of social media platforms in spreading misinformation (Pathak et al. 2015; Fung et al. 2016) – in the present paper used 'as an umbrella term to include all forms of false information related to health' (Wang et al. 2019) – as a precondition for mitigating its undesirable effects.

This 'epidemic' approach to social media communication is typical of the way in which the relationship between social media platforms, scientific (mis-)information and consequences of people's behaviour for public health policies has been framed in medical and public health journals, especially regarding epidemic outbreaks (Wang et al. 2019) and resistance to vaccination (Evrony and Caplan 2017; Ortiz et al. 2019). Actually, it participates in a broader revival of the behaviouralist 'powerful media effects' paradigm (Anderson 2021), adapted for a networked environment that has gained momentum in the wider field of media studies with the debate on post-truth (Waisbord 2018) and fake news (Tandoc 2019) – especially after the moral panic following the Cambridge Analytica scandal (Carlson 2020; Bratich 2020). Chris Anderson (2021) observes how this now dominant paradigm adopts elements derived from two incompatible approaches in the tradition of the studies of 'media effects' (for an overview, see Nabi and Oliver 2009). From the so-called 'strong effects' theory,[19] it derives a conceptualisation of media effects that disregards 'what stands between media

and the individual decision act' (51) and conceives messages as unidirectional vectors of persuasion that transform people's behaviour in a direct and somehow mechanistic way, creating 'widespread, irrational social effects' (52). At the same time, it derives from Katz and Lazarsfeld's 'limited effects' theory attention to the mediating role of social relationships, understanding social media 'as a web of nodal social linkages whose media messages effect individual behaviour through a cascade of networked ties' (52). For Anderson, this hybridisation between incompatible paradigms has been fostered by its close resonance with the algorithmic epistemology underlying current data science, informing the logics of functioning of social media platforms, the data sets that can be derived from them, the methodologies to analyse them and ultimately (and un-self-reflexively), media studies theory, itself. Meanwhile, it would be promoted to a dominant role by the structural determinants represented by the strategies of key funding agencies (like the European Research Council), aiming at funding research efforts immediately spendable to contain the unwanted effects of fake news and misinformation.

As expected by Anderson, the current COVID-19 pandemic crisis and the warnings by the World Health Organization about the risks of an ongoing *infodemic* (an information overload making medical information and misinformation hard to distinguish) have promoted a further upsurge of research conducted within this paradigm, making it the dominant one in the field of science communication studies. It is, therefore, urgent to explore its internal articulations to investigate its eventual blind spots in addressing the topic of misinformation in the current phase of platformisation of science communication. In what follows, I will proceed in two steps: I will first draw on systematic and scoping reviews of pre- and post-COVID-19 medical, public health and science communication empirical research or on exemplary studies published in leading journals of the same fields to sketch a map of the paradigm and of its continuities before and after the present pandemic crisis. I will then draw on different approaches within the media studies tradition – mainly, audience studies – to highlight what seem to be the main limitations of the currently dominant epidemic paradigm.

The 'Epidemic' Paradigm: Virology, Immunology, Epidemiology of Social Media Misinformation (and its Remedies)

Significantly, Anderson titles his insightful discussion of the current trends in media studies 'Fake News Is Not a Virus' and mentions the 'epidemiological notions of media transmission' that inform Facebook's logics. Actually, the epidemic metaphor can be pushed further. In the current literature feeding into the powerful media effects paradigm, in fact, it is possible to recognise three main branches of research – virologic, immunologic

and epidemiologic – that approach social media misinformation, all of them ultimately aiming at the containment of its circulation and the mitigation of its effects.

Virology of Social Media Misinformation

Virology as a scientific discipline focuses on the structure of viruses, their classification, and the mechanisms they employ to infect host cells. A first branch of studies on social media misinformation assumes a virological perspective and draws on (mainly quantitative) textual analysis to classify the textual units circulating in social media spreading misinformation and to identify their recurring structural features: their contents, the rhetorical strategies adopted, the language used, their formats and visual formatting, and the use of images and other multimedia resources. This branch of research also aims to shed light on the capacity of these structural features to generate the effects of persuasion. Kapantai and colleagues (2021) have, for example, recently drawn on a systematic review to propose a complete (while potentially open) taxonomy of online misinformation, including 11 typologies (from hoaxes to clickbait): Medical and public health misinformation could possibly fall under several categories, but it would be mainly ascribable to *pseudoscience* ('information that misrepresents real scientific studies with dubious or false claims') (Kapantai et al. 2021). In this way, the authors intend to support multidisciplinary research, tackling the specificities of each category to design 'actions and tools to fight disinformation' (1326). Other approaches focus deeper on messages delivering misinformation on a specific topic. Wawrzuta et al. (2021), for example, address antivaccine messages, warning that 'reading antivaccination webpages for even approximately 5–10 minutes negatively affects the perception of the risk related to vaccination' (2), which emerged from a large-scale experimental study by Betsch et al. (2010). To 'help suppress vaccine hesitancy' (10), they propose a systematic review of empirical studies published between 2015 and 2019: In line with 'previous research examining antivaccine website content' (9), they ascertain that antivaccine social media messages not only 'contain false information about vaccines' (8), but they also feature images, celebrities and a plain and emotional style that makes them more popular than pro-vaccine messages. In light of these recurring characteristics, the authors recommend further research to create 'effective tools to automatically detect fake news' (10). Specific aspects of the textual units have also been scrutinised to ascertain their effects on perceptions of the message, users' engagement, or the message's efficacy to correct misinformation. It is the case, for example, of the use of humour (Vraga et al. 2019; Yeo et al. 2020), aggression (Chu et al. 2021) or fear-arousing sensationalism (Ali et al. 2019).

Finally, other authors have moved their attention from messages to users' comments to experimentally test their effects on the perceived credibility of the commented-upon scientific claim (Flemming et al. 2017; Petit

et al. 2021; Gierth and Bromme 2021). Gierth and Bromme (2021) have, for example demonstrated relevant effects on the perceived credibility of scientific claims and users' agreement, in particular of comments 'using thematic complexity as an anti-science argument' (242) or – for topics like vaccines and homeopathy – moving accusations of partisanship.

The main purpose of a virology of social media communication of this sort is to develop automatic detection systems of misinformation to monitor the ongoing communicative trends on platforms (see Lugea 2021; on vaccines, see Karafillakis et al. 2021), to flag – or delete – suspicious content, as in the containment strategies adopted by Facebook (Iosifidis and Nicoli 2020) or to prepare ad hoc strategies of debunking.

Immunology of Social Media Misinformation

In biology, immunology studies organisms' immune systems and the factors that make them vulnerable or resistant to pathogens. A second branch of studies of social media misinformation assumes an immunological perspective and draws mainly on psychology and social psychology to identify the individual factors that make people more vulnerable – or more resistant – to believing and to reposting unreliable pieces of information.

At the beginning of the pandemic outbreak, for example the *Royal Society Open Science* published a multi-country comparative survey (Roozenbeek et al. 2020) investigating the main factors fostering a belief in misinformation about COVID-19: making 'getting information from social media' resulted one of the key predictors. Drawing on previous literature, they also aimed at probing the role of age, gender, education, numeracy skills, political orientation, self-identification as a member of a minority and trust in scientists and the government. A systematic review by Pian, Chi and Ma (2021) added to these individual factors the lack of health and eHealth literacy and psychological states (like anxiety, fear and depression). In a sort of vicious circle, these last factors are affected by misinformation consumption, and at the same time, they affect the intensity of reposting 'rumours'. Other studies (Wang et al. 2019) investigate the role of information processing skills and information verification strategies, cognitive processes (including the lack of reasoning: See Bronstein 2019; Pennycook and Rand 2019), epistemic beliefs, previous beliefs, information literacy, critical thinking and reliance on emotions, finding for each of them positive or negative correlations with misinformation acceptance and reposting.

Motivations for sharing misinformation are investigated in a similar way. Apuke and Bahiyah (2021), for example adopt a uses and gratification approach[20] to demonstrate through a survey that altruistic motivation is the main predictor for sharing fake news related to COVID-19, together with information sharing, information seeking, socialisation and passing time (some of the main motivations investigated in the tradition of the

approach). Experimental approaches are also commonly adopted: Williams Kirkpatrick (2021), for example demonstrates the role played by psychological proximity and perceived threat on sharing misinformation, as well as the mitigating role of personal knowledge about the specific scientific issue at stake.

The main purpose of this immunologic branch of research on social media misinformation is to strengthen the factors of people's resistance to the effects of exposure, in particular through ad-hoc literacy programmes that could fill their 'deficit' (Sturgis and Allum 2004; Bucchi 2008) in scientific knowledge, media literacy and epistemic competences, to help them to better benefit from scientific or medical information in social media, without the risk of engaging in irrational and harmful behaviour due to exposure to misinformation.

Epidemiology of Social Media Misinformation

Epidemiology studies the patterns of the distribution and circulation of a disease in a population and the factors determining them. The third branch of studies of social media misinformation moves its focus from individual factors and behaviours to the network effects emerging from the interplay between users' behaviour, social network structures and platforms' algorithms. Basically, it draws on social network analysis and data science to identify the logics and patterns of the diffusion of misinformation among interconnected users. At its simplest level, this implies the quantitative assessment of the typologies of misinformation circulating on social media platforms. A recent systematic review by Suarez-Lledo and Alvarez-Galvez (2021) of articles published in English before the COVID-19 pandemic outbreak has, for example classified the main health-related topics affected by misinformation for different typologies of social media platforms (social networking, microblogging and media sharing platforms), finding out that 'health misinformation on social media is generally linked to the following six topical domains: vaccines, diets and eating disorders, drugs and new tobacco products, pandemics and communicable diseases, noncommunicable diseases and medical treatments and health interventions' (10). The authors highlight how 'health misinformation prevalence for each topic [varies] depending on platform characteristics' (10), with 'the prevalence of health misinformation (…) on Twitter and on issues related to smoking products and drugs' (11).

Several studies aim at mapping the infodemic in a more fine-grained way, for example though sentiment analysis (as systematically reviewed in Alamoodi 2021) or by addressing its spatio–temporal dynamics using stigmatised and official terms in search engines (in particular, using Google Trends). Hu et al. (2020), for example monitored the use of stigmatised monikers against China in 60 'countries and territories' from December 30, 2019, until July 15, 2020. Rovetta and Bhagavathula (2020) applied a similar 'Infodemiological' study to Italy, finding out that 'misinformation was

widely circulated in the Campania region and racism-related information in Umbria and Basilicata' (6). Cinelli et al. (2020) adopted a properly epidemiological approach to calculate the R_0 for 'mainstream social media' (Twitter, Instagram, YouTube) and less regulated platforms (Reddit and Gab), with $R_0 > 1$ revealing the risk of an infodemic. They find out that 'despite the differences among platforms, (…) they all display a rather similar distribution of the users' activity characterised by a long tail' (2) and that 'information deriving from sources marked either as reliable or questionable do not present significant differences in their spreading patterns [that would rather depend] by the interaction paradigm imposed by the specific social media or/and by the specific interaction patterns of groups of users engaged with the topic' (6). Finally, the authors admit some relevant differences between the analysed data and the progress of real-world epidemics (like, for example R_0 values out of scale and abrupt jumps in the number of 'infected' subjects) that would suggest caution in the application of epidemic models to 'social contagion phenomena'.

These results are in contrast with other studies reporting differences in spreading patterns between information and misinformation: For Pulido et al. (2020), for example during the pandemic crisis, 'false information' on Twitter would have been tweeted more but re-retweeted less than science-based information. Similarly, Vicario et al. (2016) have compared the 'anatomy of cascade' (number of reposts during the overall lifetime of propagation) for 'scientific' and 'cospirationist' content on Facebook, finding that 'viral patterns related to contents belonging to different narratives differ' (558). In fact, both types of content have 'a first peak at ∼1–2 h and a second at ∼20 h, indicating that the temporal sharing patterns are similar' (556). Conversely, they present specific cascade signatures, suggesting that "science news (…) reach[es] a higher level of diffusion quickly, and a longer lifetime does not correspond to a higher level of interest. Conversely, conspiracy rumours are assimilated more slowly and show a positive relation between lifetime and size' (p. 558).

In any case, the authors demonstrate that the 'homogeneity [of networks of friends] is the primary driver of content diffusion' (558), with both kinds of content spreading within homogenous, secluded and polarised clusters of users: It is the phenomenon of so-called 'echo chambers', the object of another large – and still not completely conclusive – number of studies (systematically reviewed in Terren et al. 2021). This last line of enquiry, which investigates the networks of misinformation propagation at a structural level, is complemented by studies on 'vital nodes' (Zhao 2020) and 'superspreaders' (Yang 2021). Regarding this last topic, a growing number of studies are focusing on the role played by non-human agents, like bots and scripts, in the propagation of misinformation (Broniatowski et al. 2018), and on automatic procedures for their individuation and containment (systematically reviewed in Orabi 2020). The declared main purpose of this epidemiological approach to misinformation in social media communication is once again practical, consisting of the attempt to better

monitor the progress of misinformation spreading and to better focus on intervention (and moderation) strategies.

To conclude this overview, the practical aims of all three lines of research just reviewed are supported and sustained by other lines of research that intend to ascertain the real-world effects of exposure to misinformation – for COVID-19-related misinformation, public psychological issues, trust loss, inappropriate protective measures and panic buying behaviour – as emerging from the systematic review by Pian et al. (2020). Research also seeks to measure the actual effectiveness of different remedies, like for example, social rating (Kim et al. 2019), social media interventions for the ex-post correction of misinformation (Walther et al. 2020), 'psychological inoculation (or *prebunking*) as an efficient vehicle for conferring large-scale psychological resistance against fake news' (van der Linden et al. 2020, 1) or the use of deep learning and machine learning tools for the automatic detection of misinformation (Varma et al. 2021).

Beyond the Strong Effect Paradigm, Once Again

The key methodological choices of research within the epidemic paradigm have not gone without criticism. The most relevant ones regard the construction of the research object, the delimitation of the research field and the individuation of causal links. Regarding the construction of the research object, several authors have indicated how the fundamental distinction between 'true' and 'fake' news – or 'information' and 'misinformation' – that represents the methodological linchpin of each of the three strands of research just reviewed is hardly tenable (Venturini 2019; Krämer 2021). The problem here is clarifying on what kind of epistemic authority the researchers ground this preliminary operation and pondering in a self-reflexive way its political implications: questions rarely addressed in actual empirical studies. Clearly, the problem of 'telling the true from false' is particularly evident in the case of public scientific controversies (Friedman et al. 1999) and with infodemic outbursts, when conflicting opinions from the scientific community are overexposed, when the statute of truth for a claim can change over time and when, by definition, information and misinformation are hard to distinguish even for experts.

Regarding the delimitation of the research field, most of these studies focus on a single platform, or at best assume a comparative perspective. Some attempts at trans-media epidemiologies of misinformation have been undertaken (see, for example Gunaratne et al. 2019, and Kearney et al. 2020, on the relationship between social media disinformation and the release of controversial documentaries like *Vaxxed* and *Plandemic,* respectively). Nonetheless, research on the epidemic paradigm seems quite far from addressing the present interconnected information ecosystem.

Finally, regarding the third criticality – the individuation of causal links – the authors of the already-mentioned multi-country survey on COVID

misinformation published by *Royal Society Open Science* (Roozenbeek et al. 2020) admit in a footnote how they could not disentangle the causal direction of effects in this study. Both options are plausible, i.e., belief in COVID-19 misinformation could reduce willingness to get vaccinated, and prior vaccine hesitancy could increase belief in misinformation. (…) A supplementary linear regression with misinformation as the dependent variable and with the question "Would you get vaccinated against COVID-19" as an independent variable (…) shows that being willing to get vaccinated against the virus is a significant predictor of lower susceptibility to misinformation in three out of four countries (Spain being the exception)" (Roozenbeek et al. 2020, 12).

Actually, this does not seem to be the case of this study only, even if the directionality of the identified casual links is very rarely questioned.

Yet, the problem with the epidemic paradigm is not as much about its internal flaws and therefore its ability to provide *answers*. Indeed, with any paradigm, it is more about the formulation of the *questions* it allows – or does not allow. In these final remarks, then, it is not my intention to retrace the critics moved since the early seventies to the behavioural/epidemic paradigm in a debate that is now part of media studies canon. Rather, I will point out what I believe are key overlooked *questions* to interrogate the topic of 'misinformation' in the current platformisation phase of the media system (Van Dick et al. 2018). In particular, I will discuss those inspired by another paradigm: the one represented by the long thread of research originating from Stuart Hall's encoding/decoding model of communication (1973), proceeding with reception studies and then with the ethnographic tradition of audience research (see Moores 1993), with Roger Silverstone's domestication theory (Silverstone et al. 1992) and its adaptations to the new media system (Bakardjieva 2005), up to the 'practice turn' in media studies (Couldry 2004) and the related invitation to decentre media studies (Morley 2009). This different paradigm, in fact, elects as its main research interest exactly what stands between 'media and the individual decision act' (Anderson 2021, 51) and it is therefore neglected by the epidemic paradigm: Basically, social actors' interpretation of media messages as a situated practice of meaning making (Anderson 2020) and the broader social practices in which media-related activities participate (Tosoni and Turrini 2018). This does not mean that, in this paradigm, possible 'effects' deriving from 'exposure' to misinformation are denied entirely. Rather, it means acknowledging an active role for social actors in their relationship with media and media content. This active role must be properly investigated to understand the phenomenon of production, circulation and acceptance of misinformation (like any other kind of media content). To keep the discussion less abstract, I will draw on an ongoing research on the circulation of knowledge refused by the scientific community regarding the harmful effects of 5G technology to propose illustrative examples of the main research questions originating from this approach.

Questioning Engagement with 5G Refused Knowledge on Social Media from an Interpretive and Practice-centred Perspective

The object of the research from which we are deriving our example is people's engagement with *knowledge refused by the scientific community* (from now on, RK: refused knowledge) regarding 5G technology. Actually, RK and *misinformation* – the umbrella term we adopted in this paper to refer to all forms of false information – cannot be regarded as synonyms. On the one hand, in fact, the second term is somewhat narrower than the first, referring specifically to claims that fall under the epistemic authority of one (or more than one) specialised scientific community and that have been discarded or disregarded by that same community: for example, claims about the existence of the non-thermal harmful effects of 5G electromagnetic waves. On the other hand, as anticipated, the term *misinformation* implies an attribution of truth from the researcher that the term RK does not require. In a way that is more compatible with the principle of symmetry of the sociology of scientific knowledge (Bloor 1976), the researcher simply highlights the refusal of the scientific community to accept a claim as true – or even as worth falsification. While this distinction is methodologically very relevant for research on 5G, it is hardly pertinent in the discussion that follows. This discussion, in fact, intends simply to highlight the different sets of questions that arise when people's engagement with controversial information on social media is interrogated from an interpretive and practice-centred perspective. These questions can be grouped into at least five distinct yet interrelated areas of investigation.

First, people engaged with 5G-related content do not access it by just logging into their favourite social network account and finding it in their feeds, as selected by algorithms. They may actively look for it, subscribe to the pages and channels of the influencers they acknowledge as alternative knowledge authorities, join groups discussing the specific topics of their interest or focus on a plurality of controversial issues. Similarly, they can regularly access 'hostile' spaces to protest, defend their opinions or simply be informed of 'mainstream' positions. Moreover, they do not necessarily access RK on a single social media platform. When engaging with RK, they can also be pointed to a network of debating spaces on other platforms and instant chat applications, like groups on WhatsApp and – especially after the recent intensification of content moderation activities by the mainstream platforms – Telegram. In these spaces, they can receive hints about resources outside the web, like in the case of documentaries or TV programmes, or in real life, such as meetings, conferences and other pubic encounters. In summary, people engaged with RK carve out and assemble from the mediascape a 'media territory' (Tosoni and Tarantino 2013; Tosoni and Ciancia 2017) and eventually integrate it with offline participation to remain engaged with the RK topic(s) of their interest. Such a space is by far more complex and dynamic than the one defined by the circulation of a single piece of misinformation, as traced by the epidemiology of

misinformation. This suggests questions about how media territories are articulated, how they are actively and collectively assembled by social actors, how and why they evolve in time and how people individually navigate within them. Defining the borders of the observation field, questions about RK-related media territories are of pivotal relevance for any other enquiry about social media engagement with RK.

Second, media territories are of key relevance to tackle the actual interpretation of specific RK-related pieces of information (Scheufele and Krause 2019), which is by far more elaborate than their mere 'acceptance' or 'refusal'. Online spaces, in fact, participate in a relevant way in the sociocultural context of the situated practice of meaning making. Within media territories, these messages are selected, circulated and discussed collectively in a confrontational or collaborative way. The most active and persistent groups may work for all intents as gatekeepers and 'interpretative communities' (Fish 1980), not only accepting and refusing single pieces of information, but also negotiating their meaning and assembling them into broader narratives, adopting specific epistemologies. For example, in line with what has been observed by Gagliardone et al. (2021), for conspiracy theories, the narratives regarding the harmful effects of 5G morphed in time depending on sociopolitical contingencies in broader context. Before the pandemic crisis, groups discussing 5G-related RK strictly focused on 5G technology (thanks also to moderators of WhatsApp chats and Facebook groups) and grounded their claims on studies published in regular scientific journals (and yet received with scepticism by the larger part of the scientific community). After the pandemic crisis, these same groups adopted a scientific–populist rhetoric (Mede and Schafer 2020) and a populist epistemology (Saurette and Gunster 2011) to collectively produce more syncretic – and sometimes conspirationist – narratives, holding together 5G technology, vaccines and the pandemic crisis as parts of a global transhumanist plan. Similarly relevant are the actual production and assemblage of these narratives and broader worldviews. In other research on techno-paganism online (Tosoni 2011), I observed how some online subcultures assemble their belief system through cooperative practices lacking any form of central authority and closely mirroring the typical production procedures of Linux and other open-source software, including calls for comments and episodes of forking. This invites researchers to formulate questions on the interpretation and negotiation of meaning of RK-related media messages, their encapsulation in broader narratives and their relationship with the socio-political context, their underlying epistemology and actual practices of production.

Third, people's engagement with 5G–RK-related media content is not limited to their interpretation or to their use as resources to produce broader narratives and worldviews. Actually, it may also include a wide range of media-related activities that cannot be simply reduced to reposting or commenting. They may, for example include translating content from other languages, digitally subbing videos, resuming information from many

sources in a new text, printing and distributing it offline or rewriting text using periphrasis and typographical camouflage (i.e. typing 'c0v1D' instead of 'COVID') to elude systems of automatic content recognition commonly used by social media platforms for content moderation (and by researchers adopting the epidemic paradigm for data mining). These practices of circumvention of gatekeeping by social media platforms includes, among other things, archiving contents that risk being deleted by platforms in online repositories and cloud accounts. Notably, these archives helped form a sort of 'canon' of 5G–related RK- resources crucial to producing broader narratives. Some groups have also used these archives to quickly socialise new members or as resources to quote in case of conflictual debates (online or offline) with 5G enthusiasts. Moreover, for many users, and activists in particular, these activities are seen as part of broader practices of engagement that cross the boundaries between online and offline. These may include leafleting, collecting signatures, public speeches, legal assistance and other activities of lobbying and pressure on local administrations or central governments. This invites researchers to formulate questions about the plurality of users' activities related to RK contents and messages, as well as about the inclusion of these activities into broader social practices, online or offline.

Fourth, the reference to activists draws our attention to the limitation of conceiving users simply as differently interconnected nodes in a network. Within 5G–RK-related media territories, it is possible to recognise a constellation of social groups interacting only online – using one or more platforms – or both online and offline. These groups have their specific social structures, which include formally defined social roles – like the ones of admins and moderators – and less formalised status systems.

A high status can be, for example achieved through knowledge and titles, organisational skills, commitment or simply showing charisma in discussions. Other users may, in turn, simply 'lurk' in the conversations in a group, or the posts of a Facebook page, remaining nearly anonymous to other users. These systems of statuses and roles define an uneven distribution of power that is relevant to the already-discussed practices of meaning making and other ongoing activities. For example, after some attempts at resisting it, admins played a key role in opening their 5G-related RK groups and pages to the syncretic and populist turn, radicalising it with their own posts and comments. This implies that it is not fully possible to comprehend the practices of interpretation and meaning making of RK without conceiving users properly as social actors and questioning the role of the social structures in which they participate and of their forms of unequal distribution of power in shaping meaning-making practices and other RK-related activities.

Finally, the relationship between beliefs and behaviour also needs to be investigated beyond the individuation of causal links. Rather than being simply an 'effect' directly stemming from a belief in RK, behaviour depends on decisions taken by active social actors within specific contexts in which,

as already clarified, media territories participate. Like interpretations, in fact, behaviours can be apprehended, discussed and negotiated online. For the 5G–RK case, they can, for example consist of attempts to reduce the level of electromagnetic pollution, switching to cable connections, turning off cell phones during the night or installing electromagnetic shielding. More notably, online resources are also of key relevance to learn how to evaluate the efficacy of the adopted conduct: This can happen, for example by following the advice of other users and purchasing specific technological devices to measure the intensity of the electromagnetic field in one's own environment or learning how to read in one's own's body the worsening or the amelioration of the symptoms of the effects of those same fields (like headaches, deficits in attention or sleep disorders).

Conclusion

In this paper, I have shown how research on the circulation of health-related misinformation (see Anderson 2021, on misinformation in general) responds to a behaviouralist epidemic paradigm that in recent years has become dominant and that has gained further momentum with the ongoing pandemic crisis. The main purpose of this dominant paradigm consists of delivering information to better tune up the (algorithmic) strategies of online misinformation containment currently adopted by social media platforms (Colombo et al. 2017).

From this point of view, controversial media content is conceived as a sort of viral pathogen affecting people's behaviour, to be contained through (algorithmic) eradication and through strengthening people's resistance to the risk of contagion related to exposition. Furthermore, the epidemiological study of the diffusion patterns of this information through reposts should contribute not only to the automatic detection of 'contagion' phenomena, but also to the optimisation of intervention strategies, for example identifying super spreaders to be targeted with ad-hoc measures. In this sense, the epidemic metaphor informs both the understanding of online 'misinformation' and the actual strategies to contain it. The recourse to mainly quantitative methodologies, based on data mining and automatic and semi-automatic procedures of content analysis, contributes to further simplifying the modelling of the ongoing processes in favour of the individuation of macro phenomena and tendencies.

Consequently, the dominant paradigm ends up deploying, often in a non-self-reflexive way, an impoverished theoretical framework that hardly contributes to shedding light on people's engagement with controversial resources on social media. For this undertaking, instead, it is of pivotal relevance to adopt an active model of social actors.

As suggested by the interpretative and practice-centred paradigm within audience studies, this means conceiving social actors as negotiating their beliefs and behaviours inside specific sociocultural contexts,

including online ones. As I have tried to show, adopting this perspective brings the researcher to focus on research questions that are neglected in the dominant paradigm and that are, however, unavoidable for a better understanding of the ongoing processes of platformisation of science communication.

Admittedly, the knowledge generated by this different set of questions cannot be immediately employed to develop practical strategies for 'misinformation' containment; yet it is of pivotal relevance to improve our understanding of all the key issues of the current debate on the relationship between science and society.

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"Stop Saying you Did your Research: You are the Research!". Rethinking Lay Expertise in Online Communities

Barbara Morsello

Introduction

During my ethnographic fieldwork about vaccine (vax for short) freedom online communities, I came across the statement "You are the research!" several times. In contexts where lay expertise and knowledge-making processes are mobilized to discredit prevailing scientific regimes of truth, as in the case of vax-free communities, users show a growing need to perform their agency over health issues, overcoming institutional mediation or delegation to experts. Drawing on ethnographic research in vaccine freedom online communities, this contribution aims to offer reflections regarding the role played by lay expertise in online communities during the COVID-19 pandemic. This work is conceptually framed within the fields of science and technology studies (STS) and media studies. It aims to shape a dialogue among three research streams about 1) the emergence of alternative forms of epistemologies and experience-based knowledge-making processes, 2) online platforms and the "platformization" of health literacy and 3) the current conspiracy theories. These three research streams are considered to gain a better understanding of some aspects related to the emergence of alternative truth regimes during the SARS-CoV-2 health emergency.

Lay expertise and alternative knowledge have long been studied in STS. The role of lay expertise in knowledge-production processes is now well known, particularly in studies involving biomedicine, patienthood and health-related activism. The many ways in which lay knowledge is produced, co-constructed and disseminated, including genetic condition

(Conrad and Gabe 1999; Kerr et al. 1998, 2007; Panofsky 2011; Tutton 2007), self-tracking or Quantified Self (Heyen 2020) and daily learning about one's illness or condition (Pickersgill et al., 2015; Pols 2014), produce new forms of experiential knowledge that can become moments of claiming one's role in knowledge-production processes or recognizing individual rights (Rabeharisoa et al. 2014).

Trust in technoscience has gradually declined in most Western countries (Beck 1992; Inglehart 1997). The epistemic authority that science holds today is often contested. Other forms of knowledge and expertise are on the rise, such as alternative and complementary medicine, alternative nutritional regimes and New Age philosophies of life (Campbell 2007; Hammer 2001; Heelas 1996). However, the question is not so simple because the decline in trust does not concern technoscience as a whole but its specific areas. In addition, trust in science is a multidimensional concept because: people evaluate scientific institutions differently than they evaluate scientific principles and methods (Huber et al. 2019). Some people trust the principles and methods but not the institutions.

Although these signs of public disbelief occur with some regularity and intensity (Van Zoonen 2012), plenty of statistics about trust in science are relatively stable and high across time (Critchley 2008).

The Eurobarometer 468 survey (2017) shows that despite a significant decline in trust in public institutions, particularly governments and justice, trust in democracy and the European Union remains constant. In this regard, Coleman (2012) clarifies the distinction between primary and secondary trust by revealing the paradox of trust in the main institutions of knowledge but distrust in what they claim as true. A particularly relevant aspect for this present paper's topic concerns the complicated connection between the concepts of trust and political efficacy. Coleman (2012, 40) argues that "to experience a sense of political efficacy is to believe that a communicative relationship exists between oneself and the institutions that govern society". When low levels of trust are combined with high levels of perceived efficacy, the potential for unconventional action is a probable outcome (Gamson 1968).

People who do not trust institutions but trust themselves adopt forms of action that circumvent official pathways. Coleman et al. (2011) points out that some Internet users experience high internal effectiveness (individuals' belief in their own ability to influence the political world) using online communication as a means of influencing public opinion, but at the same time, users experience low external effectiveness (individuals' belief in political institutions' responsiveness to public pressures) in influencing their elected representatives. Under these circumstances, citizens feel that they can influence the world around them but at the same time, experience a deep sense of frustration in their inadequate ability to make a difference within the political system. Therefore, if in online spaces, users can experience their ability to make a difference by influencing public opinion, it becomes crucial to observe the online communities where users can activate

forms of citizenship and knowledge construction "from below".

Social media is a particular kind of platform, where users can meet a plurality of voices, often expressions of personal knowledge based on user experiences and opinions, which Van Zoonen (2012) calls "*I*-pistemology". However, online platforms expand the role and form of lay expertise, which interconnect with others, giving rise to forms of syncretism, new theories and communities that are increasingly capable of challenging the epistemic authority of science by proposing new regimes of truth.

Since the 2020 health emergency, this process has become increasingly evident, with a proliferation of online communities advocating alternative truths about the pandemic.

SARS-CoV-2 as a biological entity, not fully stabilized in scientific knowledge, has activated multiple narratives, forms of activism and resistance, and strong hostilities towards institutions that have tried to manage uncertainty.

Experience-based Knowledge

The SARS-CoV-2 virus has struck globally, forcing a structural revision of societies, as well as economic, health and political priorities, and introducing new practices to cope with the spread of the virus. Therefore, scientific knowledge has become part of everyday life. Today, everyone speaks easily and without claiming specific expertise about viruses, RNA, molecular swabs, epidemiological data and constitutional laws and freedoms. The use of scientific knowledge to give meaning to everyday life is translated in various practices – with the use of the mask and molecular and antigenic swabs as appropriate, the control of temperature and symptoms, and the assessment of risks related to exposure to viruses in everyday contexts. In fact, being informed daily about epidemiological trends has transformed people's routine in terms of its limits and possibilities, returning to the subject of an unprecedented responsibility, both for individuals and public health. The integration of these new practices and knowledge has required considerable effort, even on the part of laypeople, to understand what is happening from health and social perspectives and what has actually produced such a huge fracture in the structures of meaning that characterize the infrastructure of people's daily lives. At the same time, scientific disagreement and the proliferation of conflicting information have required people to become more involved in matters of public interest, where institutions are not always able to provide clear answers in a short time, since the timing of science almost never coincides with society's need for answers (Funtowicz and Ravetz 1993).

In this context of high epistemological uncertainty, of not knowing what is true or who can be trusted, people have found someone or something to blame and then have turned to themselves as alternative sources of knowing and understanding (Van Zoonen 2012). In this situation of

unstable trust in knowledge institutions, personal experience has become a resource of meaning in order to face the present. Experience-based knowledge again brings the subject to the centre, with the belief that intersubjective experiences are adequate substitutes for technical knowledge (Grundmann 2017). Observing the communities that arise around specific forms of refused knowledge,[21] as in the case of the vaccine, a technology well established in mainstream biomedicine but strongly opposed by specific communities, it might be said that from their perspective, personal experiences of the subjects can be perceived as affordable substitutes for technical knowledge (Harambam 2020). Societies are increasingly knowledge dependent, and people are increasingly accustomed to the idea of having to manage knowledge, with the aim of making decisions in a landscape of individualized risk. In online groups, one of the prevailing discursive strategies for the free choice of vaccine is the use of the experience of vaccine damage, whether personal or that of friends and/or acquaintances, which assumes greater legitimacy than the epidemiological data. The experience of pain exceeds the aseptic nature of cold scientific data.

Anti-COVID vaccines fuel a lot of counter-narratives based on the authority of personal experience. An example is the proliferation of videos where users demonstrate, by letting a coin adhere to the point of inoculation, that vaccines contain dangerous metals and that through them, a microchip is installed in the human body, with the aim of controlling citizens. The videos are available everywhere on the web and aspire to be considered evidence by most of those who support the thesis that vaccines are harmful to the population. The so-called "vaccine magnet challenge" has become viral and has travelled via transmedia, ranging from TikTok to Facebook, to end up in private user groups on telegram and WhatsApp. As of May 14, 2021, a video of the magnet challenge (Fig. 1) had been shared over 22,800 times on Facebook and had more than 20,000 views after only 25 seconds from its publication on Instagram (Reuters 2021).

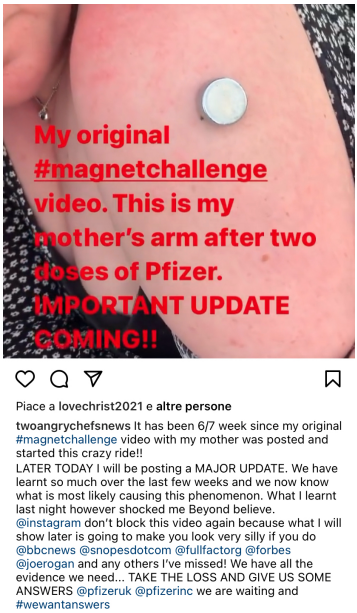

Fig. 1. 20/05/21 Instagram video on magnet challenge posted by Twoangrychefsnews and reported by Reuters Fact-Check (2021)

It is becoming increasingly difficult to follow the trajectory of such kinds of media objects, such as videos, posts, photos and so on, especially in light of the multiplication of their configurations. The first video that launched the challenge was actually born on the Instagram profile of "Keep_canada_free", where a woman first showed the strange phenomenon that would prove the theory behind post-vaccination magnetism. Several authoritative press channels, such as BBC, Forbes (2021), and so on, have committed to "disassembling" this theory. Several scientists have also committed to disseminating information materials online, through press releases, as well as videos on YouTube, with the aim of stopping the proliferation of the magnet challenge. Most of them have been deleted and are now impossible to find. However, the phenomenon whereby users provide "proof" of the microchip by chasing vaccinated people while holding a coin does not seem to have ceased.

In the realm of contested knowledge, the knowledge of laypeople competes with that of scientists for epistemic authority. They resist regimes of truth through which science has legitimate power to define, describe, explain and delimit domains of reality (Harambam et al. 2014). As Collins et al. (2020) argue, the laity possess "ubiquitous meta-expertise" that enables them to choose domains when seeking expert opinions, such as whether a vaccine is safe. However, this process of selecting domains of expertise is

not as linear as it may seem, which the COVID-19 pandemic has demonstrated.

On one hand, citizens claim greater unity of experts and sources who are considered reliable in order to delegate vaccine choice; on the other hand, they mobilize heterogeneous expertise to address the problem of choice. The vaccine is a peculiar example of biopolitics because it embodies political visions, ideas of society, the body and health and could be related to what Rose (2007, p. 3) calls the politics of "life itself"; "it is concerned with our growing capacities to control, manage, engineer, reshape, and modulate the very vital capacities of human beings as living creatures".

Online Communities and Social Media Platforms as Multipliers of Truths

During the most intense phases of the SARS-CoV-2 spread, citizens have been susceptible to contracting the disease and have had to adopt strategies to cope with the risk in everyday life. Sanitizing hands and environments, maintaining social distancing, wearing a mask and learning to recognize symptoms are just some of the practices adopted as part of a generalized risk category. Undoubtedly, in the generalized risk situation, as in the case of the pandemic, citizens have experienced different levels of perceived risk and have therefore individually employed knowledge, behaviours and practices that they considered useful for their condition and coherent with their values. An online survey conducted in Finland (Soveri et al. 2021) has shown that although individuals with less trust in official information sources have a tendency to ignore official recommendations during the COVID-19 pandemic, these same individuals use complementary and alternative medicine (CAM) to manage their level of perceived risk. Those who do not adhere to the official recommendations spread by the media, as in the case of the vax-free community, often mobilize other information resources, including alternative experts, online information, blogs and personal experiences. At the same time, users who refuse to wear a mask and be vaccinated are very careful about their health by taking massive doses of vitamin C and supplements to boost their immune system, drinking alkaline water and following specific dietary regimens

In the case of the pandemic online platforms, social media has been a resource for providing information and sometimes challenging the authority of experts by reaching a vast number of hesitant people who have turned to the web. During the COVID-19 pandemic, online users have practised bio-digital citizenship (Petryna 2002, 2004; Rose and Novas 2004) where collectivities, such as the case of vax free communities, organized against specific biomedical classifications, mobilized themselves to build citizenship through communities linked electronically by email lists and websites (Petersen et al. 2019). Many of these activists fiercely oppose the power

and claims of medical expertise that classify them as at risk of contracting the SARS-CoV-2 virus, as well as civically irresponsible for refusing vaccination. The Internet and the information society are characterized by their extensive distribution of knowledge (Jensen et al. 2012, 2), and social media platforms are privileged venues for the circulation of experience-based knowledge assembled by laypeople. People in online communities can virtually face one another, share knowledge and information, as well as create alternative truths and fight for them.

For example, the theories on the vaccine issue that circulate online arise from a more complex set of alternative forms of knowledge, which are constituted as sociotechnical assemblages in which worldviews and technical aspects related to the contested objects are connected. The anti-COVID vaccine stance has been embraced by communities contesting this type of assemblage as a metaphor for "health dictatorship" or an emblem of a health system corrupted by pharmaceutical lobbies. At the same time, immunity is an ambivalent concept for anti-vaccinists. On one hand, it evokes the natural functioning of the biological organism; on the other hand, it is associated with the biomedical manipulation of the body enabled by vaccines. These communities are engaged online to produce and disseminate as much information as possible to support their thesis that immunity is a natural process that cannot be reproduced technically, if not with negative consequences for their physiological body. Currently, the issue that should be analyzed in the production of knowledge from below is that social media platforms are never neutral spaces; they are spaces of permanent relationships over time and repositories of ready-made knowledge. Moreover, researchers cannot ignore the fact that online spaces belong to specific platforms that arbitrarily decide the ways of value production in them.

In fact, platforms comprise different actors, human and non-human, who condition, foster and influence, more or less consciously, the flow of information. As Van Dijck et al. (2018) suggest, platforms are programmable architectures designed to organize relationships between and among users. Platforms are composed of algorithms and interfaces, which are formalized by ownership relationships driven by specific business models and governed through user agreements.

The ways in which value is created in society have always been a subject of interest in order to understand how society shapes individual behaviour and vice versa. Regarding online platforms, their business models refer to the ways in which economic value is created and captured (Van Dijck et al. 2018, 10). In online platforms, value is measured in various types of currency: money, attention, data and user valuation. These economic elements, together with the technological ones, steer users' interactions and shape social norms.

This ecosystem of heterogeneous elements either encourages or discourages certain types of connections and behaviours within the platform. Perverse effects, such as echo chambers, filter bubbles or the polarization of certain content, help resonate with certain content by consolidating

worldviews among members of different communities. It is also true that during the pandemic, YouTube (among others) has altered its content moderation policies to bring to the surface more "authoritative information" while removing videos that contain "medically unsubstantiated claims" (Humbrecht 2020).

Sociotechnical mediation of information by platforms is a key element. During the pandemic, a content analysis of videos posted on YouTube, which is a major source of information about science, technology and health, especially for young people (Anderson and Jiang 2018), shows that although the most viewed videos related to COVID-19 use mostly verified sources, only a fraction of users turns to institutional channels to find useful information. In fact, the majority are videos produced by different users. In some cases, they try to advance counter-narratives of the pandemic phenomenon; in others, they disseminate truthful and verifiable information without the mediation of experts or specific expertise. However, in the cases of videos where highly politicized health news and information are minimal, their contents receive far more engagement in the form of comments than any other type of video (Marchal and Au 2020).

Conspiracy Theories as Radical Modernity

Conspiracy theories are not new phenomena, but society is in a particular moment where they manage to penetrate more environments and social circles. Postmodernity (Lyotard 1979) is characterized by particular emotions, feelings, intuitions, personal experiences, customs, metaphysics, traditions, myths, religious sentiments and trustworthy knowledge. Finding alternative explanations of reality is a quite common phenomenon in postmodern society and is part of the broader field of contested knowledge. This knowledge primarily challenges the dominant truth regime (Foucault 1977), introducing another version of reality that often criticizes hidden economic interests and programmed global inequalities. In the public sphere, particularly online and social media platforms, conspiracy theorists strive for public recognition of their ideas by sharing information widely and contesting the information provided by those who have power, such as journalists, scientists and politicians (Harambam 2020). The dissemination of conspiracy theories and the growing online communities that support an alternative regime of truth show how the construction and management of truth is not a linear process and has become problematic at some point. The epistemological solution for studying this phenomenon without adopting the dominant perspective and judging such communities as just irrational, lies in "dividing the 'truthers' and the 'post-truthers' (…) in terms of whether one plays by the rules of the current knowledge game, or one tries to change the rules of the game to one's advantage" (Fuller 2018, 53). In a sense, conspiracy represents radicalized modernity, where individuals, through their experiences and expertise, can

compete in the construction of the prevailing regimes of truth against institutions. The monopoly of truth – scientific, political, economic and educational – is no longer the prerogative of institutions but of individuals who can compete and spread or share their messages and build new interpretations.

In an age of epistemic instability, a historical context where the truth can no longer be fully guaranteed by one epistemic authority, institution or tradition, the spread of relativism and ambiguity of knowledge and trust is quite an expectable consequence.

The epistemic authority of experience and the conspiracy milieu have a shared imperative to actively "connect the dots" (Aupers and Houtman 2006; Heelas 1996; Van Zoonen 2012) that through online platforms becomes a collective process. The growing number of Internet platforms, where citizens offer advice (based on their own knowledge and experiences) on matters ranging from finance to cultural entertainment, is not quantifiable. They are asked to share their knowledge and perspectives on social reality and advise others on what to do. "In this way knowledge becomes a capacity to act" (Grundmann 2017, 27) and to manage uncertainty. The COVID-19 pandemic has made communities of actors challenge current regimes of truth more prominently in the public sphere as the vast space of institutional, political and especially scientific uncertainty has somehow made more attractive a perspective based on a "theory of everything", where it is possible for anyone to make sense of what is really happening, independently of one's expertise.

Conclusion

Citizenship in the contemporary era of biomedicine manifests itself in a series of struggles over individual identities, forms of collectivization, demands for recognition, access to knowledge and claims to expertise.

Users do so by creating new spaces of public dispute over bodily experiences and their ethical implications and generating new objects of contestation and new forums for political debate, novel questions for democracy, and original styles of activism. The growing consumption of health news online shows that (1) users are able to choose when and where to consume news, (2) news offers are increasingly personalized, and (3) the consumption mode switches from a passive to an active one (Purcell et al., 2010). The users who support alternative knowledge on vaccines belong to a particular category because they fight for a common goal, that is, the free choice of vaccines. Therefore, they try to build online spaces to carry out their claims, weld alliances and claim expertise, activating a progressive disintermediation of the official expert in knowledge management. The expert is not necessary to access knowledge, so it is possible to examine these phenomena as forms of digital biological citizenship "from below", outside the prevailing biomedical paradigm.

Social media has changed not only individuals' access to health information but also their ability to create, adapt and use information. Digital media technologies, especially social networking sites (SNSs), have greatly accelerated the proliferation of different types of knowledge by encouraging laypeople to share their personal and experiential knowledge that complements and sometimes challenges the knowledge of accredited experts (Epstein 1996; Hardey 2002; Koay and Sharp 2013; Labonté 2013).

Undoubtedly, from Web 2.0 onwards, users are more active and participatory in the creation of content. It is no coincidence that researcher speak of "user-generated content" (UGC; see Han et al., 2018) and prosumers (Ritzer and Jurgenson 2010) to refer to the new digital users who are simultaneously producers and consumers. The UGC of social media allows citizens to produce knowledge, including knowledge about their own experiences, and to advocate changes in health-related policies and practices, particularly those affecting treatment (Lupton 2013, 2014).

Despite the fact that platforms, such as Facebook, WhatsApp and WeChat, claim to have millions of active users, recent research has confirmed a paradox of participation, given that although the Web is free to use, it generates economic or social value for platform owners. Although there are positive examples, today private companies, such as Facebook, Twitter and other SNSs, actually make profits from user-generated content (written posts, videos, photos, etc.) without any expense on their part (Balbi and Magaudda 2018). Contemporary society can be interpreted as a pluralistic knowledge society where competing types of knowledge coexist. To make a brief classification, four types could be recognized, namely everyday knowledge, special knowledge based on practical experience, traditional knowledge and scientific knowledge (Harambam and Auspers 2014). Different types of knowledge compete with one another to achieve epistemic authority (from time to time) for solving specific and especially situated problems. The situational approach (Haraway 1988, 1989; Suchman 2002) can help researchers to understand the interchangeability of different types of knowledge. In everyday life, which is the primary locus where the subject employs one's knowledge to solve practical problems, scientific knowledge is configured as a resource that is sometimes difficult to use. At the same time, in an individualized society characterized by generalized uncertainty and the multiplication of forms of public participation through online platforms, it is easy to witness an election of knowledge based on personal experience as evidence to describe reality and establish new regimes of truth. Laypeople play a fundamental role in producing and disseminating knowledge in society, capable of challenging the epistemic authority of science through experiential, situated and shared knowledge. This is not yet a generalized phenomenon, but it is evident enough to require careful reflection, especially in places where it is more difficult to follow knowledge production. Today, in fact, the methodological tools used to follow online controversies are still limited, also because of the objective limits set by the platforms (Veltri 2020).

The uncertainty caused by the health emergency has put a strain on the production of ready-made knowledge, being a phase of science in action (Latour 1988). However, it has long been the case that laypeople have relied on their ability to construct ready-made knowledge under conditions of uncertainty. This is particularly evident in managing the relationship with one's body and health, where a layperson manages information through the use of online platforms as support for experiential expertise. Google and other online search engines and social media platforms have flexible authority in common (among other things), precisely because they leave more space for personal experiences. Much remains to be done to understand the role of platforms in building the expertise of laypeople, which is becoming more urgent than ever in the face of a radicalization of uncertainty related to adverse events. After all, in the face of the enormous climate, health, political and social crises, the SARS-CoV-2 outbreak will not be the last stressful event in which laypeople and society itself will be called on to mobilize reliable knowledge in order to overcome the challenges ahead.

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[1] For a summary of positions on possible alternatives, with specific reference to the pandemic context: Pennings and Symons (2021) in response to Savulescu (2020).
[2] The term 'the people' does not usually denote a concrete physical group of individuals, but rather functions as an 'empty signifier' to refer to a group having a purported moral superiority, depicted as homogeneous and thus able to express the *volonté générale*. This will is considered to be the legitimate foundation for political and societal decisions (Mudde 2004).
[3] 'The elite' is seen as the villainous antagonist of 'the people'and includes political, economic, legal, cultural and intellectual groups (Mudde 2017).
[4] According to Jan-Werner Müller, these tendencies have a 'set of distinct claims and (…) an inner logic' (Müller 2016, 10).
[5] Described as one of populism's 'core principles' (Mede and Schäfer 2020, 476).
[6] Defined as '*decision-making sovereignty',* 'the right to formulate science-related *power claims*.' (Mede and Schäfer 2020, 482).
[7] Defined as '*Truth-speaking sovereignty',* 'the right to determine valid information about the world' (Mede and Schäfer 2020, 483).
[8] Europe, for instance – even before the pandemic crisis – was affected by a relatively widespread anti-vaccine sentiment. According to a 2018 study, 59% of Western Europeans – and just 40% of Eastern Europeans – thought vaccines were safe, compared with the global average of 79% (Bickerton 2021).
[9] Similar attitudes already created problems during the H1N1 pandemic (Fidler 2010).
[10] Callaway, E. (2020), T*he unequal scramble for coronavirus vaccines — by the numbers*, in "Nature", 24 August 2020.
[11] For example, Hungary licensed Russia's Sputnik-V coronavirus vaccine, ignoring calls to stick to a common European vaccine policy. About the risks of developing a "gray market" see Stevis-Gridneff (2021).
[12] Le Pen took the chance to say that 'The European Union has failed totally', and that 'They still tell us that as 27 countries we are stronger, but that is false — the solution must come at the national level, for this issue as in many others'. Meanwhile Orban, Salvini and Morawiecki discussed the possibility of creating a new populist alliance for the EU Parliament based on the values of 'Atlanticism, freedom, family, Christianity, sovereignty and opposing anti-Semitism' (Hopkins et al 2021).
[13] See the Commission Implementing Regulation (EU) 2021/442 and 521, both of 11, March 2021, making the exportation of certain products subject to the production of an export authorisation, introducing the criteria of proportionality and reciprocity.
[14] The AstraZeneca (lately named Vaxzevria) vaccine's efficacy was questioned by some countries in people over 65, on the basis of unclear and unofficial information; its administration was later suspended (temporarily or definitively) over fears that it could cause blood-clotting problems in isolated cases and was finally recommended in some countries (Italy is an example) only for people over the age of 60.
[15] See the report at: https://yougov.co.uk/topics/international/articles-reports/2021/03/07/extent-damage-astrazeneca-vaccines-perceived-safet.
[16] Eurofound, *Living, working and COVID-19 (Update April 2021): Mental health and trust decline across EU as pandemic enters another year*, see the report at: https://www.eurofound.europa.eu/publications/report/2021/living-working-and-covid-19-update-april-2021-mental-health-and-trust-decline-across-eu-as-pandemic.
[17] In this respect, a relevant example is Florida Governor Ron DeSantis' call to not trust the elites (DeSantis 2021).

[18] Here, the most suitable example is Viktor Orban's use of the virus to increase his political manoeuvring room (Rohac 2020). On the different faces of populism during the pandemic, see: Ganesh (2021), and, on the different responses to the COVID-19 crisis given by different populist parties, see Bobba and Hubé (2021).

[19] This label was attributed by Katz and Lazarsfeld (1955) to a plurality of actually diverse (and often non-academic) hypotheses on the capacity of media to generate strong effects 'to overturn [them]' (Anderson 2021, 45).

[20] Launched by scholars like Jay G. Blumler, Michael Gurevitch, Elihu Katz and others, the uses and gratification approach is a long-lasting tradition of research within media studies: It draws on social psychology to shed light on the motivations bringing people to engage with media or to performs specific tasks with media (see, for example Blumler and Katz 1974; Katz et al. 1973). In recent years, the approach has been adapted to social media, instant messaging services and other new communication platforms (see, for example Wang et al. 2012).

[21] The term "refused knowledge" refers to knowledge that is supported by a community or a group but rejected by prevailing scientific institutions.

Thinking with Maintenance and Repair to Account for Obduracy of Macro Orders

The Case of Informational Migration Management in Europe

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Abstract: Ongoing work and theorizing in the field of STS has made important progress in conceptualizing agency, and stressing contingency and dynamic processes in science, technology and society. However, this focus on case studies and micro dynamics has left the field ill equipped to account for obduracy and stability. We suggest a framework for understanding obduracy in STS can be found by reassessing various insights from the social sciences and STS on the processes of maintenance and repair (M&R). To illustrate our framework, we offer a concrete example in one of Europe's crises: alterity processing or the collection of practices and infrastructures to manage Europe's 'migration crisis' (Pelizza 2019). We make explicit how maintenance and repair can be used to consider the obduracy of large scale orders without losing the empirical edge that the STS offers.

Keywords: maintenance; repair; migration management; alterity processing; Europe; obduracy.

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1. Introduction

In 2015 the increased collective mobility of third country nationals travelling to Europe, often without the required visa, was dubbed "Europe's migration crisis" (Evans 2015; Park 2015). This labelling has since persisted (Islam 2020). The conceptualization of crisis was not only

adopted in media accounts on migration. Formal governing bodies of the European Union (EU)[1] embraced it, as well. The European Commission (EC), for example, adopted a new Agenda for Migration (European Commission 2015b), which maintained the crisis frame and introduced the so called "Hotspot approach" to streamline methods of migration management through "informational and bureaucratic standardization" (Pelizza 2020, 269). The Hotspot approach is illustrative of existing tensions between member states (MSs) and the EC triggered by the informational management of the outer edges of Europe. Infringement decisions, for example, have revealed tensions which were originated by the pressures set on frontline European countries who received the most people (Geddes 2019; European Council 2015a; 2015b). All in all, the onset of the "migration crisis" has laid bare the fragility of the EU project in a key area of integration such us internal affairs and security.

Scholars have questioned the nature of what is allegedly in crisis (Tazzioli and De Genova 2016). What does it mean that Europe is facing a crisis? This expression assumes the EU as a solid, obdurate construction that is being put under threat by people on the move. Scholars have conceived of the mobility of non-Europeans to Europe as a challenge to European stability (Mayblin and Turner 2021). They follow public and policy debates on migration and highlight the ways migration is problematized, and how certain citizenship laws and integration policies are set up to face this issue. The stability of the EU, or of MSs, is here conceived as something that needs to be reproduced through social processes (De Koning et al. 2018; Bracke and Hernandez Aguillar 2020). Differently, with this paper we aim to outline a framework which posits fragility to be a key characteristic of the European socio-material construct, highlighting the material and epistemic dynamics by which the EU is kept stable, to account for the obduracy of Europe. Obduracy is here taken as its hardened quality to persist and remain stable. We aim to investigate the constant work of maintenance that allows a complex set of organizations and scales like the EU to hold together amidst migration-related tensions. In particular, in this paper we wish to explore the extent to which the social sciences and in particular the Science and Technology Studies (STS) literature on maintenance and repair (M&R) can contribute insights to the effort of framing the current European condition. We hypothesize that if the ongoing migration "crisis" has up to now avoided the breaking point, this might be due to a work of M&R.

We suggest that a novel, potentially ground-breaking field of research opens when looking at European institutional relationships (e.g., between EC and MSs, as well as among MSs and International Organizations) from the perspective of M&R. Assuming fragility and precariousness instead of stability allows focusing on the mediating agencies, tentative at-

tempts and unexpected developments that not only keep the EU going, but every time enact it as a diverse outcome amidst crises. This is clearly revealed when it comes to migration management, where migration is accounted for as an issue that can be efficiently managed through sociotechnical solutions and informational controls. Data infrastructures for migration management are indeed conceived of as efficient solutions promising to smoothen the process of asylum application and relocation across Europe (European Commission 2015a). While various systems of registration and data collection are deployed, integrated and standardized to the end of upkeeping the EU, what is maintained and repaired every time is a different outcome.

We thus wonder how data infrastructures and practices of migration management operate to maintain and repair institutional relationships. In Europe, the data-based management of migration goes back to the early Union's Treaties (Balch and Geddes 2011) and further intensified with the Hotspot approach (European Commission 2015a). As the rationale goes, digital data infrastructures are expected to make the process of asylum application, deportation or relocation across Europe more efficient and effective (Amoore and Raley 2017; Dijstelbloem and Meyer 2011). By so doing, we suggest that they also contribute to address the tensions between MSs and European agencies, data infrastructures being a crucial element in the work of maintenance and repair of the European order.

In what follows we first provide an "archeology" of the objects of inquiry of M&R in literature. Then, we discuss insights on M&R from sociology and STS, and the works on (data) infrastructures specifically. The potential of these conceptualizations to understand the M&R of Europe is then discussed against the field of migration management. Finally, we conclude by outlining the potential consequences of a M&R framework for the maintenance of macro orders.

2. Maintenance and Repair between Engineering and Social Sciences

Through a systematic analysis for M&R in scientific databases like Scopus, it clearly emerges that until the 1990s most works were published in engineering disciplines, where the analyses were focused on the material infrastructures of mobility. They mainly dealt with the practical cases of repair or maintenance of roads, highways or bus systems (Dutta and Maze 1989). Their driving interest mainly concerned the financial or economic aspects of M&R. From the 1990s on, maintenance of mobility and transport systems was discussed in combination with computer models. The introduction of computers in the literature on M&R did not only

take computers as objects to be maintained (Ganderton 1990); they were also conceived of as maintenance warning systems (Hudson et al. 1993;). Computers therefore emerged since the 1990s as tools supporting M&R. Still in the 1990s, journals in aviation business and commerce published the first articles on aircrafts M&R (Parke 1995). It is in this field that M&R are for the first time discussed in relation to some other values than economics. Tripp (1995), for example, discussed the cosmetic side of repairing an aircraft as a matter of aesthetics, whereas previous civil/transport engineering journals mostly discussed M&R as a necessary aspect to be modelled into optimization or financial models (Luxhoj and Jones 1986). Furthermore, aviation studies for the first time discussed the enacting potentialities of M&R. Bradley (1995), for example, discussed M&R as key sites where business relations can be established or strengthened.

M&R have remained important concepts in civil and transport engineering well into the present. However, from 2000 onward we see M&R being taken up by more heterogeneous disciplines. In environmental science and policy, for example, maintenance is conceptualized as important in reducing CO emissions produced by personal automobile vehicles (Wenzel 2001, 2003). Interest in maintenance as an environmental matter was often mentioned in engineering journals – or interdisciplinary journals in engineering and environment (Kazopoulo, Kaysi and El Fadel 2007). This entangling of engineering and environmental concerns was also evidenced in the notions of "forest maintenance", wherein "maintenance" is taken up as an important factor in relation to climate change (Rummer 2008; Platt, Veblen and Sherriff 2008). Around the same time, the notion of "boundary maintenance" arose even in journalism and communication journals (Bicket and Wall 2007, Wall and Bicket 2008), used to discuss the process by which journalists maintain or protect an authoritative position in the face of challenges to this authority, either through online challengers or globalization processes.

As such, around the early 2000s the notion of maintenance started to trickle to the social sciences and be referred to sociotechnical topics. We saw the emergence of studies which did not consider M&R to be purely material or physical activities, but guided and laden with moral and social norms and ideologies (Graham and Thrift 2007; Gregson, Metcalfe and Crewe 2009). M&R started to appear in relation to safety science, risk analysis and accident prevention (Lombardi et al. 2009; Hon, Chan & Wong 2010) – mirroring Beck's (1992) insights on risk management and the risk society – as well as in urban studies and geography (Jacobs & Cairns 2012; Chelcea and Pulay 2015). The use of M&R in these latter was often done in response or relation to Nigel Thrift's (2005; 2007) work which convincingly called for an analysis of the politics of M&R. It was

also often explicitly related to the work of Latour and STS more broadly: it emphasized the role of non-human actors and stressed emergence, contingency and unpredictability (Edensor 2011).

However, it is against the micro-sociology of everyday life that M&R dynamics have been predominantly framed. Studies in M&R in the social sciences, and STS in particular, adopted Garfinkel's (1967) conceptualization of social order as produced through and in everyday interactions. Ethnomethodology – seen as a microsociology focused on people's response to the breach of interactional order – was a resource to investigate the breakdowns of social order to which M&R are expected to react. As such, social studies in M&R became interested in conversation analysis (Schegloff, Jefferson and Sacks 1977), and – especially relevant for this overview – focused on "repair" as a category of analysis (Henke 1999). As in conversations, when breakdowns halt smooth interaction, thus requiring clarification or repair, so in sociotechnical M&R breakdowns are revealing of taken for granted assumptions.

This understanding of repair as indebted to ethnomethodology was especially adopted by Henke (1999), among others. He described the work of repairmen at his university and discussed how they engage in a situated activity of repair through tacit knowledge and networked practices. He points to the ways in which repair is not always material, or not only material, but can concern users' expectations towards an artifact. What Henke (1999, 65) describes as "repairing the costumer" or "people repair" points to the gap between actual workings and expectations, for example in the case of establishing whether it is the air conditioner that needs to be repaired, or the user that needs to be convinced that the air conditioner is not broken. Henke (1999:64) points to the ways technological equipment is used as an extension of a worker's body, describing the body and the used equipment as a network, which is set to work to repair technological infrastructures, but also expectations and demands from office workers – wherein the body is the link between the social and the material. Henke's work points to the myriad of ways in which "order" is (re-)enacted in workplace settings through the constant work of repairmen.

While Henke draws on these early STS insights and on analytically neglected forms of work (Hochschild 1983; Orr 1996), ethnomethodology is foundational to his attention to and conceptualization of M&R. This is particularly evident in his analytical effort to frontstage those activities which are usually kept in the backstage in everyday life. Henke transposed the theorizing on M&R in conversation and the situated organizing of order through conversations to account for the material, situated, networked and embodied practices of maintenance and repair. Given Henke's influence on more recent STS theorizing about M&R, it is not by chance that many contemporary studies are underpinned by an ethno-

methodological approach based on micro situations, everyday interactions and contingency (Sormani, Strebel and Bovet 2015; Denis, Mongili and Pontille 2015).

3. Strands of M&R in Social Sciences and STS

We suggest that thinking with sociotechnical M&R opens up possibilities for theorizing about fragility and precariousness of institutional enactment from an STS perspective. As Denis, Mongili and Pontille (2015) point out, analyzing M&R can expand our understandings of sociotechnical work and object agency, and can help us rethinking the dynamics of innovation (Russell and Vinsel 2016), institutions (Sims and Henke 2012), power (Graham and Thrift 2007; Barnes 2017; Ureta 2014), the narratives and imaginaries of technology (Jackson 2014), as well as the careful, but potentially exploitative relations people have with their (built) environment (Mattern 2018; Puig de la Bellacasa 2011) and the ontology (Denis and Pontille 2015) and epistemology of order(ing) (Denis and Pontille 2020).

Given the burgeoning field of M&R in social sciences at large and STS specifically, we can identify four strands of research that are pertinent to our goal of exploring the extent to which the literature on M&R can contribute insights to the understanding of the work of maintenance and repair of the European order in the field of migration management. These strands should not be interpreted as straitjackets, but as identifications of common themes and tropes. Aspects of some strands can be found in articles that are here named under other strands, and authors named as emblematic of one strand can be found citing or relying on authors in other strands.

The first strand we identify is not so much interested in M&R activities framed as such, but it is rather concerned with the implications of the fact that relations, objects, organizations or structures require constant work in order to persist. Highlighting this is one way to challenge societal imaginaries of innovation, or a productivist bias in STS (Jackson 2014). Jackson (2014) formulates this as the general theory of 'Broken World Thinking' (BWT). BWT takes erosion, decay and breakdown as everyday phenomena. Its two main components are the appreciation of the fragility of the world we inhabit, and the recognition that many of the stories and orders of modernity are in process of coming apart, perhaps to be replaced by better stories and orders (Jackson 2014, 221). As such, Jackson (2014, 222) states:

> Here, then, are two radically different forces and realities. On one

> hand, a fractal world, a centrifugal world, an always-almost-falling-apart world. On the other, a world in constant process of fixing and reinvention, reconfiguring and reassembling into new combinations and new possibilities—a topic of both hope and concern. It is a world of pain and possibility, creativity and destruction, innovation, and the worst excesses of leftover habit and power. The fulcrum of these two worlds is repair: the subtle acts of care by which order and meaning in complex sociotechnical systems are maintained and transformed, human value is preserved and extended.

For Jackson, repair serves to hold pieces together, in this dual process of centrifuging-reconfiguring, so that other pieces can be added and discarded. Work in this strand focusses mostly on technological imaginaries and stories, and complicates these imaginaries by describing the use of technology in practice or in disrepair (Wakefield 2018; Donovan 2015).

A second strand is concerned with M&R as specific knowledge practices, and their production. This strand explicitly names the study of M&R as one that "helps reconsider an old legacy of ANT: The opposition between breakdown (crisis, controversy) and routine (taken-for-grantedness)" (Denis 2019, 284). While drawing from, or dialoguing with, the other strands here identified, this strand has an explicit focus on ontology and epistemology. It conceives of M&R as knowledge practices that help shape an order, but also "cultivate a particular epistemology of public order" (Denis and Pontille 2020, 21). In this analysis the authors attempt to grasp the ecology of maintenance interventions in order to discuss the dynamics of order and disorder, stability and fragility. As Denis and Pontille (2015, 353) state:

> Social scientists have known for a long time that order and disorder go hand in hand. Order does not get rid of disorder, just as bringing disorder to light does not remove order. […] In the case of maintenance activities, producing order is less costly, but necessitates operations that have a short reach, […] the emergence of order from disorder in maintenance work is always ephemeral. It draws on situated reordering micro-processes that have to be continually repeated. The very stability of the wayfinding system relies on each of the maintenance workers' interventions.

The production of order is thus a process that draws not only on norms and standards, which define stabilized states for objects and their environments, but also on the practices accomplished in the name of taking care of things. Order is thus not the negation of vulnerabilities, but it emerges by taking vulnerabilities into account. With this, Denis and Pon-

tille (2015) mean that the nature of "order" is constructed, something that requires constant re-enactment. Even if there is a materially standardized system in place, this standardized system requires maintenance.

The third strand highlights M&R as political practices in which relations are formed or abandoned. Work done in this strand emphasizes M&R's specific type of politics. Graham and Thrift (2007) discuss these politics as twofold: in the case of defining what is broken and how it should be repaired; and in the practice of M&R which displace some relations in favor of others. In the former, the politics is about definitions and discourses and how this influences other politics. In the latter, Graham and Thrift (2007, 17) call for an analysis of M&R as a mode of doing politics:

> Maintenance and repair is an ongoing process, but it can be designed in many different ways in order to produce many different outcomes and these outcomes can be more or less efficacious: there is, in other words, a politics of repair and maintenance.

Always in this strand, Barnes (2017) discusses how the everyday maintenance of irrigation canals in Egypt, done by local farmers, helps to build community relations and therefore empowerment. In contrast, the Egyptian state operates large scale repair on this irrigation system once per year, in which they undo many of the community-made adjustments. Barnes (2017) here highlights how the acts of M&R enact power relations, and can be used to (re)enact the state, or to enact counter power. Here, the specific practices of M&R matter, as well as who does them.

Concerning the issue of M&R having a discursive dynamic as well as a material one, Ureta (2014) describes how the Transantiago bus system in Santiago de Chile was repaired through a dual process of repair by numbers and by buffering. Herein the 'by numbers' mode refers to a discursive process of normalization that strategically refers to numbers and narratives. Repair by numbers points to quantitative metrics to shape a narrative of control. The first stage in implementing such a repair was to define what is "normal". Statistics were then used to identify those areas where the current system lagged behind the envisioned normal state. Second, the goal was redefined as bringing those specific areas that did not meet the standards up to the "normal" level. The failures of the Transantiago were framed by the project's management as a failure to reach the so defined standards of normality. As a result of these adjustments, the Transantiago was "normalized", repaired by bringing its quantitative metrics in line with its predefined standards. All in all, Ureta recalls, the aim of repair by numbers is affirming the government's power and capacity to plan and manage, by normalizing the situation. It works for "the maintenance of power, not the improvement of societies and/or individu-

als" (Ureta 2014, 372). While this mode of M&R raises also technical aspects, "repair by numbers" is mostly done through public discourse.

"Repair by buffering" instead refers to the practice of introducing mediators to relegate an issue in the background. One issue that haunted the Transantiago was the boarding speed of passengers. During the afternoon rush-hour, users who prioritized the possibility to sit in the bus and were thus willing to wait for the next bus used to slow down the boarding process. However, the Transantiago was designed around a different type of users: users who would board a bus in a minute's time. The design of the Transantiago's platform foresaw travelers as fare-and-time-optimizers; rational individuals who used the Transantiago in the most time-efficient manner and would thus board a bus rapidly. It quickly turned out that those intended users were quite different from actual travelers, who often preferred the convenience of achieving a sitting place, rather that boarding the first available bus. This unforeseen behavior was the cause of frequent disruptions.

While ostensibly a minor problem, these small disruptions had cascading effects on the full system, as every delayed bus delayed the next one. The project managers first attempted to educate those users that slowed down the system by hiring staff to stand at the platform and instruct users on proper usage. However, these attempts had no positive effects and only heightened tensions at the platform. After having found that it was impossible "to reduce traveling time because people don't want to change their behavior" (Ureta 2014, 381), the project managers begrudgingly accepted to redesign the bus stations to allow for two types of users: those who prioritized seating, and those who wanted to board the first possible bus. "Buffering" took place by redesigning the Transantiago system so that it allowed for two types of users in addition to the initially inscribed one. Buffering did not materially fix the problem but mediated it: "the new design is a buffering device mediating between, on the one hand, people with multiple motivations to use public transport and, on the other, a system that mostly enacts them as fare-and-time-optimizers" (Ureta 2014, 385). Buffering, in other words, can be understood as a process of placing (material) mediators as devices to separate conflicting entities.

The three strands so far identified were underpinned by univocal theoretical references: respectively BWT, ANT and a political-sociological call to relocate the site of politics. These strands are grouped based on the focus of analysis, and their theoretical underpinnings. A fourth strand that focuses more on methods than on theoretical underpinnings of M&R research was proposed by Colmellere (2015). The author discusses the production of workplace order through the organized repair of an IT system (named the 'K' system in the article), and outlines a method for stud-

ying the co-production of order and maintenance. Such method is located at the meso level of analysis. Colmellere indeed points to the need to investigate "an intermediate level, halfway between studies in ethnomethodology and analyses of macro scale structures" (2015, 106-107), which she locates in the workplace, as she calls to study the "links between repairs practices and maintenance issues in the workplace" (ibid.). Colmellere's approach develops at the intersection of sociotechnical M&R and organization studies to make sense of how structures and social orders change and stay the same. Her analysis combines an attention to machine properties with organizational structures, power, and micro social practices. This still novel, and relatively unexplored, perspective is how we'd like to label this last strand: one focused at the sociotechnical M&R dynamics between organizations and social actors.

Leavitt Cohn (2019), Glouftsios (2020) and Bellanova & Glouftsios (2020) can be conceived of as further recent works in this strand. Leavitt Cohn (2019) discusses the maintenance of an old code in a space mission. She describes how legacy codes are not appreciated, but more begrudgingly accepted as something to live with despite their endurance, not because of it. The author discusses how the old code is tied up with the mission, or organization more broadly, and how a specific group of maintainers have to keep it updated, keeping this "patchwork" (2019, 438) relevant and stressing its relation to the organization's past. Through keeping a legacy code, and reminding coworkers of its relevancy to the history and future of the organization, these maintainers also maintained the integrity of the organization, the author concludes. In this, maintenance work is tied to the functioning of an organization: "it is not so much the code, but the relational assemblage of software and organizational work that these engineers must tweak and adapt in order to prepare for the future" (2019, 436). All in all, Leavitt Cohn (2019) points to the dynamics of M&R as sociotechnical processes, stressing herein the effects of M&R on organizational processes. According to her, to maintain is to organize. The space mission was (partly) organized through the maintenance work of these maintainers; keeping the past in the present, enacting obduracy.

A further case is presented by Glouftsios (2020) who studied the M&R practices in maintaining two large information systems, the SIS II and VIS, which are deployed by the EU for migration management, law enforcement and border security. He describes these systems as unruly objects, which are made docile and workable through constant maintenance. Focusing mainly on the dynamics of (in)security, Glouftsios (2020) discusses M&R practices as part of the constant enactment of security. In this, he discusses maintenance and IT workers as security workers, and simultaneously discusses how border guards, police and data analysts are

made relevant in M&R practice through trainings and evaluations (Bellanova and Glouftsios 2020, 15). M&R are here discussed as a key part of how the EC gains and controls the means to govern international mobility, by discussing M&R in relation to a powerful organization like the EC, and the mundane practices of border guards and data analysts. All in all, Bellanova and Glouftsios (2020) practice the "intermediate level of analysis" that Colmellere (2015) calls for: they discuss the interplay between M&R practices of organizations and those more everyday M&R practices.

4. European Order and the Maintenance and Repair of its Migration Crisis

To what extent can the perspectives raised by the literature on M&R discussed up to now help us to understand the European institutional order in the informational management of migration as a matter of maintenance and repair? We suggest that a novel and potentially innovative research direction can be carved when studying the European order as a set of continued socio-technical M&R practices. From the previous overview of M&R in social science and STS literature, we have thus identified six insights that can be extended to the field of European migration management, and support the development of a framework to understand the maintenance and repair of the European order.

First, M&R teaches us that any order needs to be taken as inherently fragile (Jackson 2014). Similarly, as evidenced in the introduction, abstract macro organizations, or orders, such as the EU, are characterized by fragility and precariousness. Especially in the field of migration management, the EU is intrinsically conceptualized as a fragile order. Every continued "flow" of (unauthorized) mobility to Europe is considered a threat or a crisis (Tazzioli and De Genova 2016). In order to fully illustrate the fragility of Europe as a configuration of organizations one can turn to the decisions published in 2015 by the European Council (2015a 2015b). Here, the EC called the Hotspot Approach into existence in order to shape "informational and bureaucratic standardization" (Pelizza 2020, 269). This approach was accompanied by a series of infringement decisions lodged by the EC (European Commission 2015a), forcing EU member states to collaborate in informational cooperation. The image of the EU that emerges is then one that recalls Jackson's (2014) insights of any abstraction being simultaneously stable and powerful, but also fragile and precarious.

Secondly, as recalled by Denis and Pontille (2015) practices of M&R need to be understood as situated practices that shape an order. This or-

der is not to be taken as a negation of vulnerabilities, but it emerges by taking vulnerabilities into account. In the EU's efforts at migration management, this can be best highlighted by turning to the various data infrastructures in use that require maintenance and back-ups. For example, Bellanova and Glouftsios (2020, 10) describe the SIS II[2] system as the flickering foundation of the Schengen area; pointing to the inherent fragility or vulnerability of the system. The vulnerability of the SIS II system can emerge through various means; through the use of outdated local systems to something so banal as the breaking of cables somewhere in the countryside. This fragility is accounted for in the architecture of SIS II, containing a centralized back-up and copies of the central database stored at various national facilities. The European data infrastructures are the mediators through which the EU is made stable and obdurate. At the same time, as data infrastructures are materially and socially constituted, they themselves require updating, upkeep, and other types of maintenance (Glouftsios 2020).

Thirdly, order requires constant re-enactment, or said differently, obduracy is achieved by performing it iteratively. This is revealed also in the field of migration management. For the execution of much of the process of receiving and relocating people on the move, for example, the EU organization for border control and management Frontex receives a steady annual increase in funding (European Commission 2015b) and the International Organization for Migration (IOM) was mobilized to organize the relocation of migrants deemed eligible to stay in the EU (IOM 2018). These moves make clear that a powerful order such as Europe needs to continuously respond and adapt to various processes and pressures. Furthermore, mobility forces the EU to expand some operations and take up a collaboration with non-governmental actors, such as IOs. Through these collaborations, the EU is enacted anew, yet along different boundaries that comprise new actors.

Fourth, there is a politics in M&R (Graham and Thrift 2007). M&R dynamics enact power relations or asymmetries, as previously illustrated by Barnes (2017) and Ureta (2014),. Similarly, a case in point in the field of the informational migration management are the communities of practice that regularly assemble at events organized by European agencies. EU-Lisa, the EU agency for the operational management of large-scale IT systems, for example, organizes yearly roundtables for various industry-partners to discuss digital solutions for emergent issues in border control and migration management (EU-lisa 2017; 2018). Here, heads of large commercial businesses such as Accenture and Thales present their wares of security software or hardware to senior bureaucrats, policy managers, and directors of the EC and various ministry representatives of MSs. In the last years, the proliferation of professional networks and working

groups dedicated to the informational management of migration has revealed de facto new assemblages that are constituted through the constant work of maintenance and repair of European relationships. At meetings and conferences, the formal boundaries of European institutions are made blurry, while trans-organizational arrangements keep this European collective going; updating and maintaining it. These networks can be read as buffers, as per Ureta's (2014) repair by buffering: they serve to mediate the issue at hand and binding multiple motivations and enactments together in a diffused network. The EU then, is stretched and diffused in this governance network; a dynamic network of state and non-state actors, an actor-network beyond the state (Passoth and Rowlands 2010; Pelizza 2016). Similarly, Pelizza (2021, 18) describes how, through the informational management of migration, the state becomes only one of the many actors in a network made up of "global corporate contractors, the FBI and the US security regime, the EU Commission, national authorities in Athens, and thousands of fingerprinted individuals, to name a few". We see novel relations, and asymmetrical power relations emerge through the goal of maintaining the EU in the migration crisis.

Fifth, these M&R dynamics can best be studied by focusing on the socio-technical infrastructures at a strategically selected organization (Colmellere 2015). The tacit knowledge of maintenance workers in any organization (Henke 1999), as well as their work of helping others remember the fundamentality of some material infrastructures (Leavitt Cohn 2019), needs to be understood as to maintain the structural integrity of an organization, while organizations are key in understanding the maintenance of more macro orders. As described above, also in the field of migration management an intricate network beyond only state actors emerges through the organizing of M&R practices for the EU. In this network, it is strategic to study specific organizations to highlight how M&R takes place in an organization, as part of the maintenance of a larger structure or abstraction. The hypothesis here is that valuable insights can be gained by turning to (non-EU) organizations to highlight how the EU's attempts at M&R through informational migration management plays out in practice, and which novel dynamics emerge in terms of practical, policy and epistemological positions (Passoth and Rowlands 2010).

The sixth insight stresses that M&R practices also shape "a particular epistemology of public order" (Denis and Pontille 2020, 21). The last insight is thus that M&R can also be done or found in knowledge practices. The notion of repair by numbering as introduced by Ureta (2014) is especially helpful to make these epistemological aspects of M&R visible. In the field of migration management, we shall turn to one strategic organization to illustrate this insight: the International Organization for Migration (IOM). The IOM takes up a unique position in the M&R dynamics

of Europe, which can be used to illustrate the re-enactment of Europe as well as the ways in which M&R intersects which various knowledge practices at specific organizations. The IOM runs their own data collection and analysis department; the Global Migration Data Analysis Centre (GMDAC), with which they help shape the EU's "migration crisis" through knowledge practices. Through these data practices, they aim to:

> foster better analysis, use and presentation of IOM data, establishing IOM as a key source of reliable data on migration through strategic partnerships, and to act as a data hub for decision makers and practitioners seeking the best available statistics. The Centre also contributes to the development of IOM's global migration governance framework (IOM 2020).

The GMDAC serves as the knowledge-branch of the IOM, their task is to collect and analyze data on migration, in order to support member states in managing migration. The GMDAC operates in multiple partnerships with organizations as diverse as the Organization for Economic Co-operation and Development (OECD), McKinsey, United Nations International Children's Emergency Fund (UNICEF), the UN and the European Commission's Knowledge Centre on Migration and Demography (IOM 2019). Through this work with GMDAC, the IOM builds a central database about Europe's migrant population and ongoing migration. In this, they deliver the numbers, by which the normal and crisis states are identified; allowing for norms to be set which delineate when 'migration' is under control, and when it has been normalized. Like the Transantiago (Ureta 2014), migration is enacted as a problem to be fixed by increasingly approaching a numerical normality. In this dynamic, in which the IOM takes up many of the tasks of practically governing migration, the GMDAC works to both assure the IOM a role as key referent, and to enact migration as a technocratic management issue which temporarily exceeded a normal state to which the situation must return. The knowledge practices of the GMDAC serve to grasp Europe's migration crisis in numerical terms and from a birds-eye view. Broeders (2011, 60) described the work of categorizing the flow of migrants as a key part of the work of securitizing the borders of Europe; similarly, we emphasized this work as M&R practices wherein Europe is maintained. This example also illustrates how M&R practices are also knowledge practices (Denis and Pontille 2020), and how these knowledge M&R practices constantly (re-)enact a particular order.

5. Conclusion: Maintaining Europe. Repairing Migration Management

In this scenario, we have set out to understand the persistence or obduracy of macro orders, despite their fragility. We aimed to address a central tension that is present in much theorizing in STS, while building on the vocabulary developed within STS. Within the discipline of STS many dichotomies have been opened up to scrutiny, such as subject/object, micro/macro, and agency/structure. In this, much attention has been given to the micro and the agentic, allowing to highlight enactment, performativity and emergence. This attention has opened up many avenues for research; however, it makes difficult accounting for obduracy without resorting to overly deterministic accounts or structuralist modes of analysis. In order to stay with the sensitivity for the role of everyday work and agency we extended insights from STS literature on maintenance and repair to account for order. As M&R practices are always in relation to an infrastructure, or existing set of practices, they are key in accounting for obduracy of order while keeping the analysis with everyday interactions and practices. As such, thinking with M&R helps us to explain and analyze obduracy without using said obduracy as an explanation in itself.

Foregrounding M&R allows one to highlight everyday practices, the role of sociotechnical infrastructures, while also accounting for the fact that these orders don't radically shift every day. We turned to the EU as a set of practices and organizations, as an order that is constantly being maintained in response to its ongoing "migration crisis" to illustrate the various ways thinking with M&R opens up a novel analytic for accounting for obduracy. This "crisis" presented an acute case in which M&R became visible as seen in the quick response of EUrope to update and streamline informational exchange systems. Thus, we take this informational migration management as the key site where EUrope is maintained and repaired. We have distilled six key insights which we inherit from STS M&R research and combine to shape a framework for thinking with M&R in accounting for obduracy. The six insights are the inherent fragility of any order (Jackson 2014), the complementarity of order and vulnerability (Denis and Pontille 2020), the constant work of re-enactment required by any order (Denis and Pontille 2015), the power relations or asymmetries that are enacted or distributed in M&R, as well as in the maintenance of Europe (Ureta 2014; Barnes 2017), organizations that can function as a tactical site as the interplay between everyday M&R practices and the stability of a structuring organization (Colmellere 2015), and finally, knowledge practices and infrastructures that play a significant role

in the maintenance of any order. Focusing on M&R practices at strategic organizations makes it possible to discuss the interplay between everyday social actions and macro orders, while taking these orders to be fragile yet powerful, to be obdurate but not unchanging.

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[1] In this paper we refer to the European Union (EU) as the historically circumscribed attempt at a supra-national form of governance. We sometimes use "European order" as a synonym that however stresses how even institutions can be performed and are not fully obdurate. They are both distinguished from what we refer to as "Europe", a community of belonging (Anderson 2006) that includes not only institutional actors, and it is often declined in the plural, as it might entail multiple, diverse "Europes" (Pelizza 2020).

[2] "SIS II" stands for *Second Generation Schengen Information System* and functions to make information exchange between national border controls, customs and police possible. It collects and transfers data on individual people, as well as goods, documents and money.

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Angela Balzano
Per farla finita con la famiglia. Dall'aborto alle parentele postumane [Doing Away with Family. From Abortion to Posthuman Kin], Milano, Meltemi, 2021, pp. 200

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Hoping for reproductive degrowth as a path to multispecies justice and non-familistic unprecedented alliances, in her latest book Angela Balzano reframes the Foucauldian analysis of biopower and biopolitics according to a transfeminist, materialistic and ecosystemic approach, and carries on her longstanding dialogue with such authors as Donna Haraway, Sarah Franklin, Melinda Cooper and Catherine Waldby, to name but a few. The book adopts a situated interdisciplinary perspective that has the feminist Studies of Science and Technology as its point of departure, and has a theoretical approach that sometimes adopts a pamphlet-like style. Here, *figurations*, intended as located and transformative cartographies, entangle theoretical focuses (identified in the book as "*ritornelli speculativi*" [speculative refrains] with contemporary embodied accounts (called *Embedded Living-withs - Convissuti radicati*), which root them in the situated experience of Balzano as a transfeminist activist and academic and inside present and historical Italian feminist struggles for reproductive justice.

The book fills a considerable gap of much contemporary debate around reproductive labor, which, as in the case of Social Reproduction Feminism (Arruzza, Bhattacharya and Fraser 2019), often still maintains a taken-for-granted humanism due to its Marxist roots, and, at the same time, distances itself from the winding technophobias of some eco-veg-feminist positions. Reading this book, it becomes crystal clear that the flourishing of multispecies lives is not incompatible with new technologies of re/production in the abstract, it is rather incompatible with the capitalistic system that prioritizes more profitable animal-machines compositions, colonizing "disposable" lives for the sake of totalizing value extraction. At the same time, distinguishing between primary and secondary goods is not necessary, given that extractivism regards wheat as well as silicon and that both extractivism and our so-called "ecological footprint" are not the same for everyone, which among other things makes the definition of Anthropocene meaningless, unless we disaggregate its parts and confront it on a political level.

Can the contemporary re/productive system be turned against itself and reconceived in playful, desiring and generative ways to counter its present identitarian, xenophobic and necrophilic semantics and pragmatics? Can this be done with *re-spect* for other-than-human lives, that is setting aside the human exceptionalism that dictates the agenda of anthropocentric solutions for imminent catastrophes, which coincidentally see the same

responsible actors as the only visible victims to whom tailored solutions are addressed? After all, extinction is a classic fantasy of privileged humans, for whom the worst-case scenario is something yet to come, whereas there are catastrophes that clearly happened because of such privileged subjects and still mark the memories and experiences of many, such as slavery, genocides, forced migrations and factory farming. "Homo sapiens was born because other, not white and non-Western, humans have died and because entire ecosystems have been adapted to his needs", writes Balzano without ambiguity (p. 69, book reviewer's translation).

The book includes three chapters whose "musical" structure opens and closes with two corresponding Intros and Outros. In the first chapter, going from the figuration of Trotula, the first renowned Medieval medical practitioner, to the history of abortion in Italy, the transfeminist fight for chemical abortion and its artistic tactics (the *Sfertility Game*, collectively created by the Favolosa Coalizione and illustrated by Percy Bertolini) are discussed to counter the fundamentalist constellation of the pro-life imaginary and political alliances. Balzano deals with science, in her own words, as a "huge case of mansplaining" (p. 28, book reviewer's translation), in which female human and nonhuman bodies are signified by a plethora of normative roles that, while regulating them, also instrumentalize their value and reinforce their re/productive functions: think about the birth of modern gynecology and its racist-sexist complicity with slavery, as well as the capitalization of female animals inside the animal-industrial complex. Here, the author also discusses the male hormonal contraception, experimented from 1999 to 2012 at the Sant'Orsola Hospital in Bologna, but whose trial has been discontinued notwithstanding the limited side effects compared with female oral contraception.

In the second chapter, the concept at the core of the book, the *Cyborgfare*, i.e. the automatized biocapitalistic regime that succeeds to the workfare – without actually replacing it – is introduced by means of a transspecies posthuman family of figurations that goes from ectogenesis to cloned and genetically improved animals (the well-known Dolly the sheep and the lesser-known Rosita, the cow producing super-proteic milk), through the HeLa cells expropriated from the body of Henrietta Lacks and, eventually, the social robots as a blatant example of contemporary feminized labor. Always complexifying her arguments, Balzano wonders whether what Herzig and Subramanian (2017) call "life in the age of bioeverything", the present time in which biotechnologies value everybody all the time (cognitive labor included, which is never disembodied), only territorializes our desires without escape.

However, Balzano's lucid reasoning never leads her to refuse such biotechnologies *per se* and further problematizes how different (never merely additive) technosocial compositions must always take into account the different partialities that are configured together. Thus, which different compositions they can make happen, depending on the embodied actors and

the networks they are imbricated into. This is clearly explained through an apparently "futuristic" (although already technically implementable) example such as ectogenesis, that is the growth of a foetus outside of the uterus, which could potentially be employed either for heteronormative pro-life reasons or for transfeminist liberatory ones, although undoubtedly the current socio-economic conditions do not seem to privilege any of the minority scenarios that Balzano wishes for.

The last chapter, containing the proposal of the author for re/productive degrowth, centers around posthuman trans-species kinships, going back to the much divulged and misinterpreted slogan "Make Kin not Babies" by Donna Haraway (2016) and situating it, among other examples, in the geopolitical routes of outsourced parenting and migrating minors travelling alone. Rephrasing Paul Preciado against catholic nationalism, Balzano intones the slogan "closed legs, open harbors" as a way to reclaim a "vulvar" autonomous space of pleasure, desire and – why not – dysfunctionality, that is strongly political (so different, for example, from the one longed for by Patricia MacCormack, 2020, who appeals to a vulvar principle which is detached from actual women's bodies) and subtracted from the all-pervading power of capital. A further anti-dualistic corrective of the presumed return of Haraway to earth is then offered when Balzano differentiates the latter's chthonic and compostist vision of Gaia from the hypothesis of James Lovelock: "Haraway is not Lovelock, she does not forget that feminist techno-science has a lot to learn from the knowledge of the earth" (p. 131, book reviewer's translation). This goes hand in hand with never taking the advancements of technoscience for granted, but always problematizing the social norms that orient them. Let us consider the case of gene editing of CRISPR-Cas 9, a relatively inexpensive technique that can be employed with "corrective" functions and that could be considered a biomimetic technology, given that it is already used by bacteria, working as a kind of immune system. What are the social norms that such technique supports? Who is funding these studies? For whom? Do the goals of the resulting assemblages pursue a sympoietic a-hierarchial becoming-with, or the existing hierarchies of the living? By working with "nature", biomimicry risks orienting its generative "pluripotentiality" and emerging processes towards the privatization of specific forms of life incorporating it into the economic realm and further extending the colonization of zoe (Johnson and Goldstein 2015). On the contrary, what posthuman kinships require is taking care of and composting with different and proliferating assemblages like those that the Diatoms, the last figuration that Balzano introduces, create: microalgae actually working as chthonic goddesses, invisible breathing Amazons travelling across borders being nurtured by and nurturing multiple ecosystems, that are shared among many dimensions, spaces and agents.

This book talks about technosocial, naturecultural assemblages but also

works like an assemblage itself, where several writing styles and heterogeneous subjectivities are brought together in a way that gives space to differences while making them resonate the one with the other in "melodic landscapes": here, plural voices, human or not, answer the questions that the author alone cannot respond to, nor would she claim the right to. Self-determination is most often a privilege, reproduction is not the same for everyone, reproductive technologies are not accessible to everyone everywhere in the same way: the explicit choice of a feminist standpoint that overtly criticizes universality by dismantling the disembodied truths of science and its narratives, but at the same time never opts for relativism as the alternative, continuously makes it clear that no technology exists in a void, so no technology can be discussed without considering the network of practices and apparatuses in which its representations and imaginaries are embedded. At the same time, no body, not even the one incorporating the authorial voice, can speak in the singular and always requires to be located in relational webs crosscutting the lines of class, gender, ethnicity, ability and species, which makes it impossible to yield to both utopian and dystopian scenarios.

The book has the merit of combining the theoretical and the empirical as in the more fruitful tradition of feminist STSs, whose also borrows the self-reflexive approach. It does not only problematize the current applications of technoscience that look for the extraction of lively capital through numerous case studies and with a strong theoretical backing; it also has the merit of supporting the plea for a truly liberated and ecosystemic technoscience, one that is eventually accessible and usable beyond the privilege of a certain kind of human being and possibly oriented to the well-being and flourishing of all lives: "We can connect to the network or to the earth, we do not have to choose" (p. 22, book reviewer's translation), writes Balzano: what we should try to avoid is the language of management and rather adopt one of *respons-ability* that puts forth our involvement in others' lives as well as our constitutive co-dependency. Our entangled partialities and vulnerabilities are a condition of possibility, not a lack thereof.

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Silvia Cervia

Genere e scienza come costruzione sociale. Il ruolo delle istituzioni nello sviluppo della ricerca [Gender and Science as a Social Construction. The role of institutions in research development], Milano, FrancoAngeli, 2018, pp. 216

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The gender issue, a topic widely addressed in feminist science studies in previous decades, has also recently emerged in the public sphere and as a target for institutional policies in academic and research environments. One reason for this emerging attention involves the European Union's (EU's) incentives for universities to address the underrepresentation of women in research and innovation and to adopt specific gender equality plans and strategies. The book *Genere e Scienza come costruzione sociale* by Silvia Cervia retraces the process of the progressive definition of the issue as a social construct, specifying the role that feminist reflection and activism played in this process while revealing its hidden pitfalls. The theme is highly relevant because, as the author points out, gender and science constitute a paradigmatic arena for exploring the process of building scientific knowledge and its meanings.

The volume explores the vast research literature about female participation in science in the arduous attempt to reconstruct a taxonomy of concepts that, as highlighted in the analysis carried out in the initial chapters of the book, coexists in a multiplicity of interpretative perspectives. This work reconsiders different theoretical views in the sociology of science, such as Merton's normative system of science, the sociology of scientific knowledge, the empirical programme of relativism (Collins 1985; Collins and Pinch 1993), laboratory studies (Latour 1997; Knorr Cetina 1995), and the post-academic science (Ziman 2000), looking for traces of the gender issue and any points of similarity (or disagreement) with the feminist reflection on the relationship between gender and science. In this excursus, the author focuses in particular on the distinction between elements that are *external and internal* to science that contribute to gender segregation. External elements refer to forms of (self or hetero) exclusion of women deriving from the organizational functioning of science and its practices, while *internal elements* correspond to *material* (objects of investigation)

and *conceptual* (concepts, theories, knowledge) *domains* characterizing science as a cultural and gendered product (pp. 17-18). The analysis adopts the feminist epistemological perspective, shifting attention from female exclusion from science, to science as a gendered social and cultural activity, as well as the operative arm of ideologies and power.

The book focuses on the black box of the mainstream version of gender *and* science as an issue and tries to open it through the interpretative keys provided by the constructionist perspective.

Cervia identifies the ideological rationality that informs the dominant rhetoric of public policies and the inherent process of universalizing and normalizing the different positions developed over the years by feminist activism. This analysis approaches public research funding policies as an "ideological apparatus, aimed at constructing the truth through a process of objectification and universalization that operates through the distribution of awards (positions and grants) and punishments (lack of recognition and funding)" (p. 95, my translation). The author examines the institutional documents of the EU and governmental agencies (reports, work programmes, and *vade mecums*) of the last twenty years, assuming the indissolubility of the format-content link as a constitutive element. The study analyses the discursive mechanisms and practices implemented by European government institutions, highlighting the justification regime adopted to legitimize the introduction and development of policies and interventions and to attribute the value of truth (*fact-making*) to the meanings produced (*sense-making*) by these same institutions.

The analysis explores the framing of the binomial construct *gender and science* and its declination in institutional and discursive practices aimed at building an incremental political-institutional legitimation of it. In this process, the narrative underlying the mainstream scientific literature is schematized as a sequence of "political seasons" (p. 98) – *fixing the women*, *fixing the institutions*, *fixing the knowledge* (aimed respectively at increasing the participation of women in science, transforming the institutions of science, and transforming scientific knowledge content) – described as the result of a natural process of osmosis between the progress of scientific knowledge about the issue and the design of dedicated policies. The thesis supported by Cervia is that this reconstruction shows a "substantial discontinuity with the feminist tradition, betraying its structural/institutional criticism" (p. 176, my translation). The analysis, proposed as part of the feminist institutionalist research program (Mergaert and Lombardo 2014), highlights the translation process of the political promotion of gender equality in standardization procedures implemented by selecting topics, objects, and perspectives recognized and legitimized as pertinent. In denouncing the normalizing effect of the narrative of European public policies, Cervia identifies a new alliance between knowledge and power, enrolling specific feminist positions in a project aimed at strengthening the claims of science to objectivity and universality. According to the author,

the evidence-based approach adopted by governmental documents led to the focusing of elements external to science (interpreted as micro and macro) to the detriment of internal ones, and the discursive practices adopted by both mainstream literature and European institutions have brought about the universalization of standpoint feminism. The perspective of standpoint feminism is therefore recruited by EU institutions in a "project capable of re-founding science as stronger and more objective overcoming the myopia of gender-blindness, and at the same time obscuring other voices, much more radical, which, shunning all universalizing discourses, highlight the knowledge/power character of the discourse of science (post-modernism) and the plural value of domination, while highlighting the artifactual character of scientific knowledge" (pp. 175-176, my translation).

The book does not adopt an STS approach properly in scrutinizing the social construction of gender and science, but the STS theoretical perspective offers a fascinating framework to read Cervia's work.

In the last decades, in line with post-structuralist feminism that defines gender in terms of practices continuously reproduced in social interaction, STS studies have unveiled practices that obscured subjectivity as a constitutive part of scientific knowledge and theorized gender and technoscience as reciprocal modelling, investigating gender *in* technoscience and the gender of technoscience as well as gender as a product of technoscience. In Haraway's analysis (1996), the experimental technologies that in the second half of the seventeenth century anchored the definition of the scientific method, produced the boundaries and standards to define and control what could be considered scientific knowledge and what could not. Haraway revealed the situated and sociohistorically constituted nature of this process, which claimed the establishment of the experimental method as productive of universal knowledge. Judy Wajcman's (2010) techno-feminist approach, in which technological artefacts are both the conditioning elements and the products of gender relations, enables to consider gender relations as materialized in technoscientific practices, while gender, in turn, acquires meaning and character through its inscription and incorporation into technological devices and infrastructures.

Therefore, within the STS approach, the distinction between external and internal elements collapses, and these elements are relocated within a co-evolutionary socio-material network, being mutually co-constructed and modelled in a process of continuous redefinition. Public research funding institutions can be investigated as actors that (re)direct the techno-governance of science and community policies, and the Foucauldian conception of apparatus used by Cervia can be extended in agential realism of Karen Barad by identifying the apparatuses not as "mere observing instruments but [as] boundary-drawing practices – specific material (re)configuring of the word – which come to matter" (Barad 2007, p. 140). In this sense, they act as apparatuses operating in the construction of gender and

science as an issue in scientific institutions. From this view, change in techno-scientific governance systems is an internally heterogeneous process in which regulatory systems, technology, and society mutually constitute each other, giving rise to socio-material systems and structures.

This perspective opens up challenging lines of research in the STS field aimed at understanding the socio-material practices of construction of gendered technoscience inscribed in the implementation of European policies and at understanding innovation, science, and gender in their making.

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Federico Cugurullo
Frankenstein Urbanism. Eco, Smart, and Autonomous Cities. Artificial Intelligence and the End of the City, London and New York, Routledge, 2021, pp. 228

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It is a fascinating journey the one that Federico Cugurullo invites us to take on the trails of an urbanized Dr. Frankenstein and his awkward creatures. The book adopts Mary Shelley's notorious character as a guiding metaphor to observe the contemporary urban experimentations across the development of contemporary eco-cities, smart cities and autonomous cities in seek of the perfect urban equation. As pointed out by the author, Dr. Frankenstein has at least one good point: cities are unjust, unequal, unsustainable. They overconsume resources and represent one of the major sources of global carbon emissions. They must be changed for better and that requires experimentation. The how, where, to which ends, by and for whom of these experimentations are precisely the matter of the book.

The quest for building the ideal city has ancient roots, and, in the first section of the book, the author proposes a genealogy of ideas underpinning the notions of "ecological" and "smart city". The common starting point is the Aristotle's concept of eudaimonia and the idea of the city as a place built by humans to realize human potential in harmony and happiness. The book then describes how the "eudaimonic city" has been reinterpreted by thinkers, urbanists, and activists across centuries (including Bacon, Spinoza, Geddes, Le Corbusier, Wright, Register), connecting the tradition of environmental philosophy, planning theory, urban design, and geography with the current debate on smart, sustainable, and experimental urbanism. In this sense, the eco, smart, autonomous city labels become the latest expressions of an endless attempt to transform a fragile ecosystem made by complex social, political, economic, and cultural processes.

The empirical focus offers a documented and critical analysis of two case studies: Masdar, a city built from scratch in the Abu-Dhabi metropolitan area, and the portions of the Special Administrative Region (SAR), where the Hong Kong smart city vision is implemented. In so doing, the book contributes to move the attention from a literature mainly centered on European and North American cases towards some of the world largest urban projects taking place in the Middle and Far East, where the levels of investment and political-economic integration have impressively upscaled in the last decades.

Given the title, it will not be a spoiler to say that the book tells a story of failures, whose hubris consists in pursuing grandiose projects that are prematurely abandoned to their destiny and turned into monsters, as they do not fit with the expectations. The "Frankenstein urbanism" introduced

by the author features a radical incompleteness and fragmentation, where projects are more instrumental to exploitation and profitability than to improvement and sustainability, and where technocratic solutionism produces a chaotic and patchy urban landscape which lacks a regulating vision.

While it does not directly engage with STS, the core of the book accounts for a very well-documented political, technological, and financial entanglement that will be appreciated by the STS readership. An exercise of translation could thus suggest a possible STS version of the cases explored. Networks of human and non-human actors including ICT corporations, policy-makers, global engineering and design studios, energetic resources and their carbon emissions are shaped by conflicting and converging agendas. Urban design and planning are adapted to the research and development strategies of specific actor alliances, producing uneven social conditions that recalls the debate on artefacts and their politics. Living labs and test-bedding sites are used to produce, showcase, and exploit technological solutions to be sold to other cities, similarly to the dynamics described by laboratory and innovation studies (with the laboratory being the world). City master plans emerge as an uncertain and provisional result of different programs of action. For example, the development of the Hong Kong Science and Technology Park area (HKSTP) turns into a way to boost specific economic sectors such as ICT, artificial intelligence, and biotechnology instead of offering a smart environment for the potential inhabitants. Likewise, in Masdar the mobility project based on Personal Rapid Transit (PRT) is interrupted to accommodate the development of self-driving vehicles by one of the corporate partners. Within this context, the narratives set by the Hong Kong Smart City Blueprint and the Abu Dhabi Vision 2030 reveal insufficient to steer the eco and smart development in a coherent way. To the STS audience, the Masdar case will certainly evoke Bruno Latour's Aramis (1996), the cold case investigation on the automated train system developed in Paris. The ghost of Victor Frankenstein appears several times when Latour accounts for the mysterious killing of such a technologically advanced and long-lasting project. As happening in the Masdar PRT case, we assist to a collective assassination, as the technological endeavor is distributed across crowds of actors able to sew the stitches of the creature as much as to kill it.

The final part of the book introduces the concept of transurbanism, which indicates a shift from the urban management supported by ITC automation to an autonomous control by Artificial Intelligence (AI) without human oversight. The focus is on Alibaba's "City Brain" tested in the HKSTP area, a ubiquitous artificial intelligence able to monitor the environment and make decisions across multiple domains in an unsupervised manner. As remarked by the author, here the Dr. Frankenstein metaphor starts to teeter, since the creature overtakes in power its creator, and the city "as we know it" moves into another mode of existence. For this reason,

in this part of the book, the new urban condition challenges the limits of the critical and philosophical analysis and seems to require new tools for interpretation.

The author reflects on the ethical concerns arising from the increasing deployment of AI in cities, both in terms of environmental and social sustainability: a world performed by machine could likely diverge from the human common good; plus, the AI development depends in the extraction of rare-Earth elements, and this is already producing planetary exploitation and inequalities. To understand the implications of transurbanism, the author proposes a further theoretical step where Horkheimer's "Eclipse of Reason" takes over Aristotle's eudaimonia as the guiding concept. Following the Frankfurt School thinker, the author describes how the subjective reason and the individual fulfillment through technological empowerment is increasingly dominant over the objective reason and the pursuing of higher values such as justice, democracy, and sustainability. However, the author does not endorse an apocalyptic vision and refers to apocalypse in its original meaning, as a "revelation" of a new phenomenon that we are just beginning to understand. An eclipse of reason by technology could have started but is hardly complete, the author argues, as AI should be situated in different geographical contexts, mediated by multiple and heterogeneous social and urban processes, with diverse and unpredictable outcomes.

To conclude, "Frankenstein Urbanism" digs critically into the shiny surface of eco, smart, and autonomous cities. It offers an original and clearly written contribution to understand the digital and ecological transformations of the urban environment and the possible urban futures. Plus, the concept of transurbanism and its philosophical roots offer an innovative lens for scholars interested in the current debate on platform urbanism. Finally, the rich empirical ground and the analytical toolkit open up an interzone of dialogue for STS, with more to investigate into the material and infrastructural dimension of ecologic and digital urban transitions, and their glitchy and fragile existences.

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Arturo Escobar

Designs for the Pluriverse. Radical Interdependence, Autonomy, and the Making of Worlds, Durham and London, Duke University Press, 2018, pp. 312

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Arturo Escobar's *Designs for the Pluriverse* might look like an unusual book for an anthropologist. Rather than the usual suspects of anthropological theory, the book extensively discusses works by design theorists. Escobar explores the relevance of these theorists in efforts to make livable worlds by indigenous, feminist, and decolonial social movements in Latin America and beyond. These movements include the Zapatista and Columbian Afrodescendant movements, as well as transition town initiatives in the Global North, to name just a few. These movements aspire to a pluriverse, "a world where many worlds fit," to replace the modernist world that has homogenized and destroyed diverse ways of inhabiting the planet.

While the book has stirred up enthusiasm among designers across the globe, its truly interdisciplinary nature might be perplexing for some anthropologist readers who know Escobar primarily as the author of *Encountering Development* and other works in critical anthropology. (This is exactly what I have observed in my home country, Japan.) However, in my view, *Designs for the Pluriverse* offers an alternative mode of critical scholarship that is much needed today to respond to our worsening climate and ecological crisis. In this review, I will provide an overview of the two central points of significance of the book for reimagining critical practice. One concerns the shift from knowing to making, and the other the need for "sophisticated conjunctions" of different knowledges to tackle the unprecedented challenges of our ecological present (Jensen and Morita 2020; Jensen 2021). *Designs for the Pluriverse* itself exemplifies how these two themes are inseparably entangled and serve as scaffolding for the book's call for a shift toward making other worlds possible.

The ever-deepening ecological crises in the past few decades seem to have fundamentally altered our understanding and expectation of the modern world, especially the fundamental unsustainability of a world run by fossil capitalism. If there is any shared feeling in the Global North today, it might be the sense of losing the ground upon which everyday life and the expectation of the future are built on (Latour 2017). One salient future of today's predicament is the close linkage between this everyday sense of uprootedness with planetary processes. The proposed geological epoch of the Anthropocene points to the fundamental destabilization of the ground by illuminating how the planetary environment itself has been shaken by human activities, particularly those driven by the imperative of unlimited economic growth. This destabilization also has direct consequences for the

way critical scholarship operates. Bruno Latour has once noted that in the modernist ontology that presupposes the separation between a single reality and multiple human views on it, critical practice concerns revealing the singular real that is hidden by beliefs, political agendas, or ideologies. In other words, the critical move that aspires for deconstructing beliefs and ideologies itself rests on the assumption that the firm ground of reality exists relatively independent from human action (Latour 1999). But when the planetary ground itself is shaken by the unintended consequences of our collective actions, how can critical scholars find such a ground?

Designs for the Pluriverse contains a response to this question. The book urges designers, anthropologists, and other critical scholars to join forces with social movements that call for just and sustainable worlds. Here the Zapatista call for "a world where many worlds fit" epitomizes the book's commitment not only to these radical movements but also to shifting the focus of critical scholarship. While the world in the modern sense, or what John Law (2015) calls the one-world world, now appears as a destructive force for not only indigenous worlds but also itself, critical scholarship can no longer draw on the world that resides "out there" to justify its political vision. Rather, as Escobar repeatedly asks in this book, critical engagement should concern foregrounding, sustaining, and strengthening other forms of worlding that nurture and draw on relational ontologies of the mutual constitution of humans and nonhumans. Here the question of ontologies becomes a normative one with an urgent call to act.

Escobar's normative take on ontologies draws on an unlikely combination of political ontology by the anthropologists Marisol de la Cadena and Mario Blaser (2018) and ontological design by Terry Winograd, the American computer and cognitive scientist, and Fernando Flores, the Chilean engineer and philosopher who served as finance minister in Allende's government. On the one hand, de la Cadena and Blaser raise the question of many worlds in the context of indigenous communities' struggle to protect their territories in Latin America, where, just like so many other places, extractive capitalism increasingly threatens to destroy their livelihood and communal relations. While shedding light on complex entanglements between people and their non-human companions such as animals, landforms, and landscapes, de la Cadena and Blaser argue that indigenous practices enact worlds, configurations of humans and non-humans, in distinct ways that do not fall into the western ontological distinction between nature and culture, subject and object (Omura et al. 2018). In collaboration with indigenous activists, these authors aspire to defend these worlds from the brutal force of extractive development. This is an elaborated version of the call for an ontological commitment that Eduardo Viveiros de Castro (2003: 4) declared almost 20 years ago: "anthropology is consistently guided by this one cardinal value: working to create the conditions for the conceptual, I mean ontological, self-determination of people".

While political ontology provides the vision for *Designs for the Pluriverse*, ontological design offers a means to achieve it. Following Winograd and Flores, Escobar directs attention to the way designed objects, tools, and systems design back their users and thus remake the world. The design of a tool, for example, assumes a certain work organization that embodies a taken-for-granted understanding of how humans and nonhumans relate with each other. Thus, designing a new tool is consequential for the sociomaterial order by either reproducing or possibly disrupting it. With Winograd and Flores, Escobar notes that the current practice of designing is deeply entrenched in the modern dualist ontology and thus the major task for pluriversal design is bringing about and exploring "breakdowns" that suspend the dominant idea of how the world operates.

Here the key question of critical scholarship shifts from how we can know other worlds to how we can make space for other worlds to emerge. By making new objects, organizations or systems, design can potentially bring about breakdowns to create this space. In terms of this focus on making, *Designs for the Pluriverse* resonates with the growing body of experimental literature that sees collaboration and making as a form of critical exploration. Escobar in fact reviews this trend, particularly the work of Tim Ingold and the emergent field of design anthropology. In addition, the past few years has witnessed the further expansion of experimental works in anthropology and science and technology studies (STS) that engage making and creative practice (Jungnickel 2020). These efforts try to integrate hands-on experience of making into critical exploration of socio-material orders (Ratto 2011), often through ethnographic practice that essentially draws on collaboration with others (Estalella and Sánchez Criado 2018).

Indeed, whether critical scholarship can shift toward making is a central question of *Designs for the Pluriverse.* Chapter 3 of the book overviews recent debates on ontologies in anthropology and beyond. As Escobar concludes, there are already rich and diverse works that critically examine the dualist ontology of modernity, diagnose it as the main cause of the climate and ecological crises, and explore non-dualist alternatives. However, Escobar questions whether such critical efforts, including *Designs for the Pluriverse* itself, still remain within the modern dualism since they are mostly theoretical discourses. Citing the biologist and cognitive scientist Francisco Varela and his colleagues, Escobar argues that an embodied sort of reflection *as* experience, not *on* experience, is needed to shift away from modern dualism (p. 98). He notes: "*the practice of transformation* really takes place in the process of enacting other worlds/practice — that is, in changing radically the ways in which we encounter things and people, not just theorizing about such practice" (p. 99, emphasis original). Design theory seems to play an important role for this embodied reflection. On the one hand, design theory is scholarly reflection on the practice of designing and making. In this regard it is not so different from other theories. But at the same

time, as Donald Schön (1983) noted a long time ago, this theoretical reflection also participates in the embodied practice of making as a guideline, vocabulary, or framework. In this regard, design as reflective practice hints at what embodied reflection would look like.

In the argument of *Designs for the Pluriverse*, the conversation between widely different traditions, from theories in the academic disciplines of anthropology and design, to the practices and thought of social movements, plays a key role. Casper Bruun Jensen (2021) recently noted that the planetary crisis of the Anthropocene reveals the insufficiency of existing disciplines and categories, and demands new alliances between different knowledges. What Jensen sees as important in this alliance is not an integration of different knowledges into one coherent framework. Rather, it is the "sophisticated conjunctions" of knowledges that allow different knowledges to co-exist and influence each other while retaining their respective distinctiveness (Jensen and Morita 2020). *Designs for the Pluriverse* exemplifies the significance of such a sophisticated conjunction to imagine a new form of critical practice and to also tackle the unprecedented challenges of our time.

As the ground for our modern life, including an academic one, slowly crumbles, anthropology will need to find new ways to keep its commitment to "the ontological self-determination of the world's peoples" (Viveiros de Castro 2003, 17), possibly without such a stable ground as existed in modernist ontologies. In the place of academic privilege to reflect on the world, *Designs for the Pluriverse* offers a new alliance with designers, social movements, and indigenous communities to continue pursuing this pluriversal ambition. The practice of design and making that materially and conceptually opens up space for other worlds to emerge plays a central role in this endeavor. With authors such as Kat Jungnickel (2020) and Adolfo Estalella and Tomás Sánshez Criado (2018), *Designs for the Pluriverse* breaks new ground where collaborative designing and the making of things, organizations, and events become crucial contributions of critical practice.

Designs for the Pluriverse invites readers to join the collective effort to make other livable and sustainable worlds possible by not only critically thinking, but also making and designing otherwise. The book also demonstrates how sophisticated conjunctions can serve as scaffolding for this pluriversal ambition, and the many changes that would need to occur if we were to follow this path. The ongoing climate crises will certainly force us to change our ways of doing anthropology. But if a world of many worlds is what anthropology is always after, perhaps changing the rest would be worthwhile.

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S. Grosjean and F. Matte (eds.)

Organizational Video-Ethnography Revisited. Making Visible Material, Embodied and Sensory Practices, Cham, Palgrave, 2021, pp. 182

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In the last few years, we have witnessed a *visual turn* (Hassard et al. 2018) in organizational studies thanks to the flourishing Video-Ethnography (VE) enabling to record and analyze the tacit, material, and embodied aspects of workplace practices. As stated in the introduction of the book, edited by Sylvie Grosjean and Frédérik Matte, both professors of Organizational Communication at University of Ottawa in Canada, VE pursues

three objectives: to "zoom in" on social interactions; to "zoom out" to understand the context in which interactions occur; and to "zoom with" to consider the participants' perspectives (Nicolini 2009; Jarrett and Liu 2018). VE explores how workers perform their practices in/through interaction with others, using various artefacts and exploiting multimodal resources as speech, gestures, body movements, and objects manipulations (Streeck et al. 2011). Recently, video-based studies have integrated the *multisensoriality* of experience to capture affective atmospheres of places (Gherardi 2019) and how workers use their body and rely on *sensible knowledge* to orient their practices and learn their profession (Strati 2007). The editors argue that "with the growing interest in sociomateriality (Orlikowski and Scott 2008) and the development of research on the embodied and sensory dimensions of organizational practices […] the methodological challenges of this type of research need to be addressed more thoroughly" (p. 3).

The book is divided into three main sections. Each section contains two or three chapters. For every section, this book review retraces the chapters' contents to highlight their contribution and illustrate the concepts which might be of interest for STS scholars.

The first section – *Video-Ethnography and Reflexivity-in-Practice: Making Visible the Embodied and Sensory Dimensions of Work Practice* – explores in three chapters how bodies, senses, and affects are essential in clinical decision making and shows how to adopt a reflexive approach encouraging the participants' interpretations of the video-recorded interactions. *Video-Ethnography and Video-Reflexive Ethnography: Investigating and Expanding Learning About Complex Realities*, written by Rick Iedema and Jeff Bezemer, provides an overview of both VE and Video-Reflexive Ethnography (VRE). VE respects "the spatio-temporal integrity of social organizational phenomena, as well as the messy and complex aspects as they unfold" to allow "the visualization and in depth-analysis of events that otherwise might escape our attention" (p. 18). VRE, as a participatory method, rather than researcher deciding what are the critical analytical categories, invites participants to interpret footage portraying their practices. Two case studies are presented. Using an outside perspective, the first one analyzes a trainee being guided by a mentor through a surgical procedure to develop *reflection in action*. Adopting an inside perspective, the other case involves nurses in reviewing video recordings of their infection control practices encouraging *reflection on action*. In *The Epistemic Use of the Body in Medical Radiology: Insights from Interactional Video-Ethnography* Laurent Filliettaz adopts a multimodal interaction analysis of video data recorded in a Geneva's public hospital in Switzerland. He explores the learning of newcomers in medical radiology under the guidance of experienced workers endorsing the role of mentors. Becoming medical radiology technicians implies to learn how to use technologies (X-rays, scanners, RMI) and how to position the patients' body to produce images for diagnostic or

therapeutic purposes. The patient's body acts as a resource and a means of instruction. The sensory (visual and tactile) exploration of patient's ankle guided by the mentor makes of the ankle a new learning epistemic object. The knowledge emerges as a multimodal experience jointly performed by the student and mentor using different semiotic modes (verbal question, pointing, gaze orientation, creation of a relevant visual space). "It is by 'touching' the malleoli that participants can learn to 'look' if they are superimposed, and it is by learning to 'look' at them that they can understand how to position the ankle in the case of a profile radiograph" (p. 53). The ways in which practitioners use patients' bodies for epistemic purposes provide knowledge about professional practices. In *The Two Sides of Video-Ethnography for Studying "Sensing-at-Distance"*, Sylvie Grosjean, Frédérik Matte and Isaac Nahon-Serfaty explore the sensory work for medical decision-making during teleconsultations in orthopedic post-operative visits. The two sides mentioned in the title of this chapter correspond to 1) video recordings of patient/physicians' interactions and their use of senses during teleconsultation (bright side) and to 2) self-confrontation with physicians visualizing videos of their clinical practice (hidden side). This approach identifies – as the same title suggests – various ways of sensing at distance: 1) interactional constitution of a shared place to create a sense of co-presence by reframing through technical means the doctor/patient proxemics; 2) socio-technical arrangement of a clinical frame to co-produce shared sensory cues through a cooperative work between nurse and doctor compensating the impossibility of a physician's direct look or touch; 3) embodied engagements for creating an empathetic relationship at distance. Three dimensions of sensory awareness are revealed: *sensing-at-distance together* by physicians and patients using touching and seeing to reveal the sensory aspects of the telemedicine consultation; *creating a sense of co-presence* described by physician's comments on gestures to create close relation with the patient; *be sensitive to the situation* illustrated by physicians becoming aware that "Telemedicine is not a replication of existing face-to-face consultation practices, but rather developing new types of interaction with the patients and new ways of sensing and providing care" (p. 72). The *video-in-use* acts as a mediator in medical consultations and solicitates the participants' interpretations of their videorecorded interactions. It also encourages a reflexive posture on the use of senses and helps the researchers to analyze sensory work in telemedicine.

The second section of the book, *Video-Ethnography and Organizing Spaces: Sensing Places and the Multiple Nature of Working Places*, by referring to the growing attention to spaces and places in organization studies, shows – over three chapters – the use of video shadowing and Participant Viewpoint Ethnography (PVE) in the context of flexible, collaborative, and mobile work. In *Practicing Diffraction in Video-Based Research*, Jeanne Mengis and Davide Nicolini illustrate three ways of practicing *diffractive methodologies* in health care setting: 1) reading and juxtaposing different

types of "data" and "texts" (ethnographic notes, videos); 2) reading the performing of a video recording apparatus through another for data collection and analysis to produce contrasting views and different phenomena, becoming aware of the "interferences" and "reinforcements" created by the use of various methodological practices (filming, taking pictures, painting) and choices (camera angle); (3) creating interactions among different forms of participation in interventionist research. The authors video-record the clinical practice with different camera angles (a steady camera, using wide-angle and mid-angle, and a rowing camera following the trajectory of practitioners by walking next to them or attaching a head-camera on their forehead). When analyzing data, they found that each video recording apparatus privileges a different understanding and visualization of organizational space that is multiple, processual, and acts as mediator of interactions constantly rearranged through the movement of machinery, utensils, and people. PVE is used for academic purpose and for the improvement of clinical practice, as illustrated in the study on handover between two clinical teams. Researchers select some relevant scenes to be shown to practitioners and consider different emerging interpretations. This *cross self-confrontation* creates professional dispute and controversy enabling workers to see "through the eyes of the others" (p. 93). Diffraction shows the performative interference of methods and apparatuses chosen by researchers who must remain aware of what video does not make them to see and about the "data" as results of an intra-action between phenomena and apparatuses (Barad 2003). In *Using Video Methods to Uncover the Relational, Interactional and Practical Constitution of Space* Nicolas Bencherki suggests that both video and space are relational phenomena. Through a video shadowing of a building manager in a Manhattan skyscraper, and by combining relational studies of space with Gilles Deleuze's writings on moving images, he proposes three sets of relationalities: 1) the spatial relations visible in the videos; 2) the relations that are outside the video-data but accessible to the researcher in the field; 3) the relations occurring in the observation situation. Bencherki discovers that space is a relational accomplishment, involving movements of bodies and material elements, and that space and image are both experienced through the body. The video shadowing shows how participants' and researcher's bodily position matters for the interpretation of video data. In *Participant Viewpoint Ethnography and Mobile Organizing*, Elisabeth Wilhoit Larson uses PVE to explore bike commuters in a university town in the American Midwest. First, bikers are involved in using a wearable GoPro camera to film their journey to and from work, then researcher interviews them while watching their video to allow them narrating their tacit, embodied, and sensory experience (vulnerability, stress, the turning of their head to look over the shoulder for oncoming traffic). Faced to increasingly moving organizations, with workers changing organizations more often, PVE offers researchers new tools for analyzing the shifting world of work.

The third section of the book – *"Outsider" and "Insider" Video-Ethnographer: Exploring Multimodal and Multisensorial Workplace Setting* – contains two chapters presenting VE as a useful device to capture multi-situated interactions in work contexts. *Doing Video Ethnography Research with Top Management Teams* by Feng Liu, Michael Jarrett and Linda Rouleau analyzes Top Management Team (TMT) strategic decision-making in meetings. They propose three ways of including participants perspectives to close the gap between "insider" (emic) and "outsider" (etic) views. The *refining approach* consists in incorporating participants' feelings and interpretations of the video-recorded meetings to modify, enrich, and refine the researchers' interpretations. The *distributive approach* establishes a mutually enriching relationships between researcher and participants involved in longitudinal research. The *holistic approach* engages participants in data collection and interpreting results. This emic-etic approach rests on proximal rather than distal relationships and creates collaborative data collection methods and interpretations. The study uses two types of cameras: a video capturing a classic viewpoint of the action (outside/etic view) and a light cam on the participants' head to get their (insider/emic) view. This dual perspective provides new and surprising results on emotions and produces novel insights for teams concerning their leadership and the TMT dynamics. In *Complementing Video-Ethnography: The Uses and Potential of Mundane Data Collected on Social Media*, Viviane Sergi and Claudine Bonneau show that the pervasiveness of Facebook, Twitter, Instagram, Snapchat, TikTok in all spheres of daily activities, including work, means that they are "increasingly implicated in all kinds of workplace phenomena that are within the areas of interest of organizational scholars" and that they are "a site where the mundane experience of work can be explored" (p. 156). The authors maintain that mundane life is relevant to understand "dimensions of work that tend to be less visible, such as affective, sensory and experiential dimensions" (ib.). Through posts combining photo and texts, workers narrate how they view and feel their own working experience and shed light on the backstage. This allows video-ethnographers to extend their presence and pursue their research through various channels, temporalities, and spaces, having access and documenting aesthetic, affective, and sensorial facets of work.

The book valorizes the potentialities of video-ethnography making visible material, spatial, emotional, and sensory dimensions of workplace practices through the integration of participants' perspectives. Its reading can surely enrich the approach of STS scholars interested in these sensorial dimensions and in the situatedness of knowledge produced in and through intra- and inter-actions between human actors, heterogenous artifacts, visual technologies, and scientific practices.

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Andrés Jaque / Office for Political Innovation

Mies e la gatta Niebla. Saggi su architettura e cosmopolitica, Leonforte, Siké, 2021, pp. 226 [*Mies and Niebla the kitten. Essays on architecture and cosmopolitics*; Italian translation edited by Gianluca Burgio and Ramon Rispoli of *Mies y la gata Niebla. Ensayos sobre architectura y cosmopolitica*, Barcelona, Puente, 2019]

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It happens rarely – at least to me – to be positively surprised by a publication. The contrary – being startled and baffled – is more frequent. But, I guess, the majority of the times one ends reading a book or an article simply filing it under the "interesting-relevant-worth-taking-into-account-and-discuss" label or the opposite one.

Mies e la gatta Niebla. Saggi su architettura e cosmopolitica [*Mies and Niebla the kitten. Essays on architecture and cosmopolitics*], Italian

translation of a Spanish publication, is one of the rare cases of a book that has surprised me positively.

The book is a collection of twelve essays written by Andrés Jaque, renown Spanish architect, head of the Madrid-New York based architectural practice Office for Political Innovation (OPI), as well as professor of architecture and director of the Master of Science program in Advanced Architectural Design at Columbia University.

Except for the first one, *Politics of the everyday* (my translation), which through a quick review of Jaque's past architectural interventions introduces his approach to architecture, the rest of the essays are quite autonomous pieces distributed into five sections called "Domestic space as political space" (my translation), "Mies as rendered society", "Household parliaments" (my translation), "Architecture as reproduction of the biosocial" (my translation), "Sex and the non-city". As the titles of the sections suggest, these essays tackle diverse issues like the negotiations of, and within, everyday domestic spaces, trajectories of domestications of the built environments, modernity or, better, modernism as purification, the rearticulation of space and of power through architectures that act as media and media that act as architectures, urban development related to luxury and finance. These issues are tackled focusing on very diverse objects such as: an hospice for priest, Ikea, California residential houses, television as technology, telenovelas, fertility clinics and luxury towers, Milano2, Grinder, water lilies and male escorts homes, funeral homes and no-return valves, gay porn and the New York real estate market, besides the Barcelona Pavilion originally designed by Mies van der Rohe and Lilly Reich in 1929 in order to represent Germany at the International Expo of Barcelona and rebuilt in 1986. The latter is the core of the book and also at the origin of its title.

The various topics tackled by the essays are clearly of interest for STS scholars (and not only). Nevertheless, they and the often peculiar and unexpected objects at issue are not the main reason of my surprise – although the unpredictable trajectories and connetions of some of them are indeed the reason for my apprecciation of individual essays.

In order to understand in which way the book has positively struck me, let me start by admitting my initial partial lack of knowledge of Jaque and OPI's manifold projects, interventions and researches. Indeed, I knew about Jaque only because I read, probably without the attention it deserved, an interview Albena Yaneva did with him (2015) about cosmopolitical design. Such partial ignorance made me open to surprises (positive, but also negative ones), given I could not really know what to expect from the book.

Moreover, I should also admit my prejudice against architects writing "theory" or referring to "theory", especially to "theory" elaborated outside the architectural field. Such attitude affected my disposition to surprises.

My prejudice was not reduced by Ramon Rispoli (one of the two editors

and translators of the Italian edition) introducing the book as coming from one of the "voices that, in the field of architectural research […], claim today – from a perspective referable in general to the tradition of […] STS, and, more specifically to some theoretical orientations like Actor-Network Theory […] – the necessity to look at buildings as assemblages" (p. 9, my translation). However, my curiosity was elicited.

By reading through, one discovers that the book is not at all concerned with "theory". It mainly presents accounts related to empirical researches carried out through interviews, observations or documentary analysis, in order to design OPI's projects and interventions. Few other essays are descriptions and reflections about these very projects and interventions. Precisely on this lies one of the major sources of my surprise: the book completely overturned my prejudice.

Most of the essays are, indeed, the outcome of such research work: some in a more articulated and thorough way, like the research on Milano2 and the Barcelona Pavilion (see also, Jaque 2018); some are more sketchy, being in a preliminary, hypothetical or explorative stage, like the ones about fertility clinics or sex, luxury and the New York's urban development; some others are in the form of collections of vignettes and life stories, like the essay on California residential housing.

Jaque has thus used Actor-Network Theory as a method – i.e., what it actually is, despite the name. It is a method enabling researchers to "follow the link[s] [informants] make among […] elements that [by using another approach] would have looked completely incommensurable"; and it is a method that, by following such links, enables to write "good accounts", which describe networks, i.e. "a string of actions where each participant is treated as a full-blown mediator" (Latour 2005, 141; 128).

By considering buildings and architectural interventions as "material devices" [*dispositivi materiali*] and inquiring about them through the notions of "interscalability" and "trajectories", Jaque has done exactly what Latour suggests, providing descriptions of them as cosmopolitical assemblages.

For iconic examples of "participant […] treated as a full-blown mediator", I suggest the reader checking the story of no-return valves in waterpipes and their role for New York's urban development (pp. 202-204), to which also Gianluca Burgio (the second editor and translator of the book) turns in his postface; or, the more articulated story of the curtains used in the Barcelona Pavilion (pp. 102-103). The two kinds of curtain used – heavy or light – play not only a role into different interscalar networks related to constructive constraints, industrial districts, craft cultures, nations on display, international market relations, but also, when in contact with the wind, dispose different compositions of the pavilion, contributing to generate a controversy about the fidelity of the reconstructed pavilion to van der Rohe's and Reich's design.

As you have probably understood, the book can be read as a collection

of social researches – precisely as a collection of STS' social researches. This has been my approach and the one I suggest *Tecnoscienza*'s readers taking if, like me, they do not have a detailed knowledge of OPI's projects and interventions.

The book could – and probably should – also be read by constantly referring to OPI's projects and interventions, to which the essays refer. However, this reading presupposes a good knowledge of OPI's work or, alternatively, a back and forth between the book and the OPI's internet site, given the frugality of images in the former: they are few, small and black and white – a very rare configuration for an architecture book.

The back and forth between the book and the OPI's site would not only compromise the autonomy of the book itself, but also a relaxed and enjoyable reading that it disposes. Each account is, indeed, a narration written with literary sensitivity, designed to engage and take the reader through it. As for the Italian edition, this is also the result of the good work of the translators and editors, the architects Burgio and Rispoli.

By leaving to the readers the pleasure of diving into the book and be surprised themselves, I will not say much more about its contents – and certainly nothing about Niebla the kitten.

Before coming to the conclusions, I just want to highlight two points, which I deem can further show the relevance of the book for STS scholars in general, also for those not especially interested in architecture and urban studies.

The first point regards the Barcelona Pavillion (see also, Jaque 2018). Jaque describes its rebuilding as a way to construct a purified version of modernism. In the 1986 version of the building, a big and not easily accessible basement has been added, as storage for maintenance tools, replaced elements of the pavilion, equipment used for events taking place in the pavilion and other beings. This basement is invisible and inaccessible to visitors, who only enjoy the upper part as an absolute example of modernist architecture, completely detached from the rest, from the passing of time and the deperibility of materials. Of course, this crystallized image of modernism is only possible thanks to what lies in the basement and to the traffic between the basement and the upper part, before and after the visits. I wonder why Jaque and other commentators did not notice that the Barcelona Pavilion in its entirety is a wonderful tangible translation of Latour's diagram of modernity as presented in *We have never been modern* (Latour 1993, 11). There, you see the lower part – like the basement – called "hybrid networks" where the work of translation takes place, and the upper part where non-human nature and human culture are kept separated through the work of purification. As for the Barcelona Pavillion, the purification of the upper part takes place by distinguishing what is van der Rohe's "authentic" design (i.e. his intentions, often forgetting Reich's contribution) from the compromises made for rebuilding it – a game visitor often play (Jaque 2018).

As for the second point, it is related to the essay *Transmedial Urban Planning* (pp. 155-174, my translation), which I deem of interest especially for Italian STS scholar. The essay – a surprise within the surprise – is the account of an inquiry into Milano2, a semi-gated community Silvio Berlusconi built in the 1970s, which paved the way for becaming a media tycoon. Jaque, through documentary research, interviews and participant observations on site, shows the connection between the urbanistic logic of Milano2 and the one of commercial television Berlusconi developed later on, both based on the segmentation of consumers – be they inhabitants or television viewers. As far as I know, such connection between the two phases of Berlusconi's enterprise were never explored in such a way.

The book is engaging, inspiring and insightful and a recommended reading for STS scholars in general. Nevertheless, I cannot avoid warning possible readers against two issues. First, Jaque uses the notion of "black box" to refer to hidden aspects of buildings or architectural interventions – for instance, in the essay about the Barcelona Pavilion, he calls the basement a "black box". However, as also underlined in Marres et al. (2018, 26), what he is pointing at is a "backstage" as Erving Goffman intended it – the "black box" is, in case, the unquestioned well-functioning pavilion resulting from the frictionless relations between the backstage and the frontstage, with which Jaque carefully interferes in one of his projects (Jaque 2018). Secondly – and this is more an issue due to the translation – by rephrasing a famous Latour's statement, in the italian edition, Jaque defines architecture as "technologically represented [*rappresentata*] society". In English, the same definition appears with the word "rendered" instead of "represented". Besides the problematic aspect of using the notion of "representation", I deem that the two words are not synonymous, and finding a more adequate translation for "rendered" would suit Jaque's approach better.

The Italian edition includes two contributions written by the editors and translators of the book, Burgio and Rispoli. The latter prefaces the book by summarizing Jaque's research path through his main notions – assemblages, cosmopolitics, design as intertwining, devices [*dispositivi*], interscalar, trajectories. The former, in his postface, recovers parts of the essays in order to connect Jaque's research to a broader debate about cosmopolitics and life with troubles. Both contributions, mainly addressed to the Italian architectural milieu, highlight the need for such a milieu to start abandoning the idea of the autonomy of architecture, which, as Jaque shows, would lead to a dialogue and a collaboration with social sciences, and especially with STS, grounded on empirical research.

Let's use this book also as a platform to develop such a dialogue.

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Veronica Moretti e Barbara Morsello (eds.)

Interferenze Digitali. Prospettive Sociologiche su Tecnologie, Biomedicina e Identità di Genere [*Digital Interference. Sociological Perspectives on Technologies, Biomedicine and Gender Identity*], Milano, FrancoAngeli, 2019, pp. 184

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When students ask me how to evaluate the quality of a book, I use to answer: "a book that deserves to be read is a book that teach us something". However, this sentence needs to be at once amended: a book must teach us something not recurring to any universalistic methodology, rather grounding its insights in embodied and embedded cartographies. That's exactly what *Interferenze Digitali* does, it provides us new pieces of situated knowledge (Haraway 1997) that take its own space and time in the framework of posthuman knowledge (Braidotti 2020). Reading *Interferenze Digitali,* edited by Veronica Moretti and Barbara Morsello in 2019 for FrancoAngeli, we not only learn a lot on cutting-edge bio/infotechnologies, but we also know more about *our bodies, ourselves* in the biomedical arena. *Interferenze Digitali* it's a cartography of the bodies that we are becoming. We are not all man and neurotypical, there is a plethora of non-conforming subjectivities that simultaneously upsets both male-centered medicine and male-centered sociology. *Interferenze Digitali* helps us in knowing these non-conforming subjectivities: in this book you will encounter non-standard bodies with all their living questions, not depicted as isolated and abstracted, rather as part of a *natureculture* continuum. All the essays col-

lected in the volume share this belief, as Assunta Viteritti states in the preface: "human beings […] cannot be understood and analyzed a priori as autonomous entities abstracted from the matter, rather they are actors intertwined in heterogeneous techniques, social spaces and network" (p. 7).

These complex heterogeneous techniques, social spaces and network in which human beings, together with others, became, need to be scrutinized all the more today that bio/infotechnologies are so pervasive and fast-changing. *Interferenze Digitali* is fully devoted to this task, in the attempt of contributing to the debate on how cutting-edge technologies are reshaping care and health. The third chapter, titled "Mano, Cervello, Cuore: Uno Sguardo di Genere e Femminista sul sapere scientifico" ("Hand, Brain, Heart: A Gender and Feminist Look at Scientific Knowledge"), written by Maria C. Sciannamblo, constitutes the theoretical framework of the collective volume. Here Sciannamblo asks the crucial question: "how do knowledge and narratives change when adopting a gender perspective?" (p. 50).

All authors agree on the starting point: to adopt a gender perspective in science and technologies studies means to embrace the situated knowledge methodologies, as Moretti and Morsello remind us quoting Haraway: "only a partial perspective can allow an objective vision" (p. 12). When the universal masculine model is no longer the only subject of knowledge, when a gender sensitive and feminist gaze is applied to science and in particular to medicine, what come in foreground are the embodied and embedded experiences of sickness, care and cure. No one of the experiences analyzed in the volume pretend to be an "all-representative case". Sickness, care and cure experiences are always grounded in highly different subjectivities, shaped by sex and gender, class, race and age: *hybrid identities,* in Morsello's words.

Female cancer patients, diabetic men, physicians, menstruating people struggling with various types of apps, enhanced bodies at work: you will encounter this and much more in the ten chapters of the volume. In chapter one Veronica Moretti focuses on the digital surveillance in the socio-medical framework, in chapter two Barbara Morsello analyses the recent innovations in genetic screenings and how the affect gender relations. As anticipated, in the third chapter Maria C. Sciannamblo provides a feminist theoretical framework for thinking science. In the fourth and the fifth chapters Marta Gibin and Valentina Cappi respectively scrutinize blogs and medical drama to highlight the ongoing mutations in desires and genders' roles. In chapters six and seven Letizia Zampino and Valeria Quaglia focus on health's self-monitoring technologies for both genders, while in the eighth chapter Flavia Atzori broaden the reflection introducing the issue of male chronic illness. Chapter nine and ten, written respectively by Lia Tirabeni and Arianna Radin, analyze the intersections between health, care and work environment, focusing not only on patients but also on medical personnel.

Let us focus on three chapters: "Identità ibride. Come le innovazioni biomediche modificano pratiche e routine nelle pazienti oncologiche" (*Hybrid Identities: How Biomedical Innovation are Modifying Oncological Patients' Practices and Routines*, Barbara Morsello); "Quando una madre si ammala di cancro: gestire la cura dei figli tra aspettative e ruoli di genere" (*When a Mother Gets Cancer: Managing Childcare between Expectations and Gender Roles*, Marta Gibin) and "Biomedicalizzare la sindrome premestruale: come le app prescrivono conoscenze e corpi" (*Biomedicalizing Pre-menstrual Syndrome: Apps Prescribing Knowledge and Bodies,* Letizia Zampino).

Before looking closely at these three chapters, I must explain that my choice is not neutral neither impartial. Morsello, Gibin and Zampino chapters interpellated me not only as a Gender Science and Technologies Studies' scholar, they also interpellated the multiple layers that build together the hybrid subjectivity that I am. Reading Morsello, Gibin and Zampino I felt involved as a daughter and as a woman, in particular as daughter of a mother with breast cancers and as a woman still in her reproductive age with all the troubles linked with having female reproductive organs, tissues and fluids in these techno-mediated yet still very misogynous days.

I emphasize here my embodied and embedded reading to pay homage at the explicit aims of the editors: "the will to start from personal and biographical experience" always joint with "our gendered perspective as young researchers" (p. 11). As for Gibin essay, I am a very partial reader, one that three times in her life struggled together with her mother against different kinds of cancer. *My mother is a cyborg*, writes Ilaria Santoemma (2020), and adding to Santoemma a Butler's novel title (1978), I would say: "my mother is a cyborg and a survivor". First the uterine cancer, followed by a hysterectomy, later she also experienced breast cancer, twice. I am an only child grew up among several serious diseases, since while my mother experienced few years of peace between a cancer and another, my father ended in hospital for chronic ulcer.

I grew up looking at my mother packing bags for the clinics: for herself as well as for my father. Now, in tune with Gibin's essay, I cannot avoid asking: who healed my family? Who cared for my mother and my father, who cared for me and in which different ways?

To answer these questions Gibin adopted the online ethnography's methodology, analyzing conversations and narratives on cancers, focusing in particular on blogs written by mothers with cancers and under 14 children. In these online diaries emerge how care and cure are strictly entailed, how they are not distributed equally among genders. Gibin's contribution shed light not only on expectations shaped by gender rules that negatively affect the subjectivities at stake, but also on the impact of sexual division of labor on the illness itself. I've seen my mother struggling against cancers as well as against social expectations and gender rules, just like the mothers/bloggers of Gibin's research. I've seen myself struggling against the

fears of losing my mother as well as against the fear of developing in my turn the same cancers, just like the daughters of the oncological patients interviewed by Morsello.

Gibin's and Morsello's essays offer us the possibility to look at oncological patients in a way that differs from the traditional bioethical approach, too focused on the patient as "autonomous subject". They are aware that bioethics, in particular in western society, adopting the concept of "autonomous subject" contributed to the spread of an egoistic and individualistic subject. They are also aware that the classical physician-patient relationship is not only hardly appliable in these days of biomedical and infotechnological innovations, but also unfair and unbalanced. They reckon the physician-patient relationship is not the only social dynamics worthy to be investigated. We see together with Morsello and Gibin that patients are more "subjectivities in relation" that "autonomous subject" and that there is a whole network of relations around patients as well as multiple layers inside them.

Morsello brilliantly shows how patients are hybrid identities that structure themselves in relation with biomedical innovations highlighting the points of view of "privileged actors: patients and their experience of embodiment of early diagnosis practices" (p. 36). Her qualitative research included 51 female patients aged 44-65, to explore their risks perceptions, genetic mutation and their attitude towards biomedical innovations. She concluded that patient's agency has always a pivotal role in "defining specific knowledge ecologies in which the body becomes both a catalyst for care practices and a self-affirmation device" (p. 47). Patients' agency is also at the center of the mothers with cancer/bloggers' self-narratives investigated by Gibin, even if as a site of conflicts and contradictions. Thus, reading Morsello and Gibin together enable us to see how agency does not correspond to a will's act, at least not for women that have to mediate and negotiate their illness with their relatives. Patients' agencies emerge from their essays as a negotiation process, one that involves different actors with diverse degree of responsibility, specific needs and know-how.

The problematization of agency is the conceptual junction of the volume but it is in the essay of Zampino that we can find a statement that clearly argues in favor of a relational agency tenet: "agency is relational and it works inside and across intra-actions among humans and non-human beings acting together in the process of constitution of emerging, situated and endless becoming assemblages" (p. 101).

In Zampino contribution patients' agency also implies the self-aware use of pharmacological and infotechnological devices. In her essay, the role played by the online "light" programs, such as apps, is at the center of the analysis. Embracing a feminist and materialist approach, Zampino believes that apps are in relation with humans in "human-app-assemblages in which living matter is an active part in the process of co-building of bodies, mean-

ings and languages" (p. 101). Smartphones and digital body devices nowadays provide us with the possibility of using "self-tracking medical apps" and this fact itself should be object of in-depth studies for enquiring both their role as subjective agency's instruments and as bodies' controlling devices, not only in the hands of patients but especially in the hands of "pharmaceutical industries, governments, research centers" (p. 100).

As for Morsello and Gibin's essays, also for Zampino contribution I have to admit I am a deeply concerned reviewer, one that suffered of amenorrhea and folliculitis. Zampino's conclusion resonate with my personal experience as user of menstrual cycle monitoring apps. They really supported me in the attempt of gaining more knowledge on my bodily transformations. However, exactly as Zampino demonstrated through her qualitative analysis of 20 monitoring menstrual cycles apps, some apps seemed to me too invasive and scrupulous in their attempt to improve my health. The border between self-empowering, a process in which the subjectivity of the patient is pivotal, and biomedicalization, a process in which to be pivotal are the interests of biotech farms and start-ups, is a tiny and thin one. Zampino refers to the concept of "datification" to clarify the issue of biotech farms' interests. The biotech market is highly interested in gathering our biological and behavioral data, since analyzing these data allow them to "influence citizenship's choices and lifestyles" (100). I share with Zampino this concern, especially regarding women in reproductive age, too exposed to various kind of influences and social pressures and immersed in cultures full of gender biases.

New technologies appear to have both a bright and a dark side and I reckon in *Interferenze Digitali* both are explored in an excellent way. Editors and authors seem very conscious of the tiny and thin border in which all of us move when confronting with health in the XXI century. This tiny and thin border is indeed very crowded: how many times have we found ourselves and the people we love intra-acting with drugs, apps, clinics, physicians and diseases, trying to navigate the precarious paths for a better health?

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Y. Strengers and J. Kennedy

The Smart Wife Why Siri, Alexa, and Other Smart Home Devices Need a Feminist Reboot, Cambridge, MA, the MIT Press, 2020, pp. 320

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The smart wife is here to serve. Feminized artificial intelligence in the form of digital assistants such as Amazon's Alexa, Apple's Siri, or Google Home is replacing the human wife. They can also take the shape of anthropomorphic, zoomorphic, or automated home devices or robots and even sex robots. As with many technologies, smart wives are integrating themselves into our lives, offering help that we suddenly feel we cannot live without. Industry sales figures show that men are more likely to be smart home consumers. At the same time, women, especially millennial women between the ages 18 to 35, have shown a keen interest into smart home technology. In terms of gendered interest, the smart wives are being designed in male-dominated research fields of robotics, AI, and computer programming, and then further developed and commercialized in global tech companies vastly outnumbered by men. This unbalance is visible in the digital feminized workforce reinforcing the age-old stereotype of the woman as a loving and modest caregiver whose rightful place is the home.

In the book *Smart Wife* Strengers and Kennedy give the reader a close look into the almost stealthily pervasiveness of feminized digital assistants into our homes, and what the consequences are of re-inscribing outdated stereotypes such as those of a 1950s American housewife into contemporary assistants. The authors argue that the smart wives serve a patriarchal system that position women as commodities, upholds nostalgic and sexual stereotypes and paints a picture of boys merely playing with their toys.

They present a research aim of rebooting the smart wife to become a more diversified, equal technoscientific figure in contemporary society. The authors provide a detailed framework of the discourse of smart wives by weaving in the academic fields digital media, media and communication, AI and feminist and queer theory, pop cultural representations of smart wives, the industries of digital assistants, robots and sex dolls, and their own empirical research into smart home households. Their empirical work covers ethnographic interviews, observation and home tours in Australian households, and interviews with Australian industry insiders. Additionally, they have made qualitative content analyses of international popular media and trade articles about the smart home as well as promotional videos for smart home products and digital voice assistants.

The book is structured as follows. The first chapter introduces the discourse of the smart wife. Smart in this sense means digital, internet-connected, or robotic and wife refers to the archetype of someone who takes on all domestic responsibilities within a home. The main prototype for the

smart wife is the 1950s US white, middle-class and heteronormative housewife. However, she is not the only prototype of the smart wife today as digital assistants are becoming increasingly popular worldwide and thus reflect other cultural expressions. China has surpassed the US in global market share in digital voice assistants with over half of the global market share. Although quite culturally diverse, several of the Asian countries (China, India, Japan and South Korea) have a shared technological theme where the characteristics of a young, timid and sexualized woman or girl are emphasized in the digital assistant.

In their pursuit of addressing the future of domestic life and relationships between humans and AI and feminism, Strengers and Kennedy pose several questions concerning the meaning of the smart wife: "Is [the smart wife] actually helping our progress toward gender equity? Aside from keeping us company or ordering the groceries, what else is she doing in upholding systems of power and oppression in capitalist and patriarchal societies? What kind of future is she manifesting? And how can we imagine her living with us?" (p. 4). The authors continue to provide context to the diversity and complexity of the smart wife archetype by explaining how domestic responsibilities continue to fall to women around the world and how people are looking to technology to overcome this gender inequality. At a first glance, the smart wife sounds like a fantastic solution that can help solve the ongoing naggering of division of (domestic) labor taking place in many households in gender-progressive societies. At the same time, the smart wife is represented as a nostalgic, sexualized, and submissive female figure that has serious consequences in how we treat people. The increased use of social networks and robotics is further blurring the boundaries between humans and machines, which in turn affects how we understand and interact with each other (Turkle 2016). As a result, the authors are motivated by an agenda of rebooting the smart wife so it serves a progress toward gender equity and diversity. They position themselves as feminists who seek to break up the patriarchal system in order to increase diversity and equity and are inspired by technofeminist scholars Donna Haraway, Judy Wajcman, Sherry Turkle and Sarah Pink in their pursuit to liberate the smart wife. In the following four chapters Strengers and Kennedy introduce historical and contemporary smart wives from popular culture (Rosie), social robotics (Pepper), the digital device market

In chapter two Rosie - the animated, freewheeling robot housekeeper from the 1960s tv-series *The Jetsons* is introduced as representing the core values of the ideal 1950s housewife. Rosie has influenced the smart home industry when developing for instance robotic maids and vacuum cleaners. The gendering of technology is poignant in how women are completely neglected as a resource for product design even though they are the main domestic workers. Technology has been and continues to be viewed as the "men's domain" (Berg 1994). This is further exemplified by the authors' research on early adopting smart households and the concept of "digital

housekeeping" (Tolmie et al. 2007) – the activity of integrating, maintaining, and monitoring digital devices and systems. It was mostly the men who did the digital housekeeping.

In chapter three Pepper, a gender ambiguous humanoid, and social robotics is introduced. The authors discuss characteristics such as cute, friendly and human-like in relation to gender fluidity and obstacles in designing robots that are too human and as a result become fearful and a threat. Some roboticists have thus focused on developing social robots that are similar to children in order to develop care-giving relationships. In chapter four the authors take an unexpected but well sought-after turn towards the ecofeminist movement. Amazon, the largest e-commerce company in the world, is introduced through the ever-popular digital voice assistant Alexa. Strengers and Kennedy take a critical stance inwards towards their own ambition of rebooting the smart wife to support gender equity and diversity. More technology for more people is incompatible with an ecofeminist perspective that questions the capitalist labour market as it exploits the planet's resources and marginalizes women. Strengers and Kennedy argue that it is possible to change the smart wife from within the capitalist market system and challenge the system itself through an ecofeminist perspective.

Another, very lucrative aspect of the smart wife industry is that of sex robots. In chapter five Harmony is introduced as the smart wife with benefits. Harmony shares several characteristics like those of the other digital assistants and its creators share similar backgrounds as white, heterosexual, US men. Harmful acts such as robotic rape and violence towards sexbots can further play a detrimental impact on women. Strengers and Kennedy go on to argue that the robot-sexual services market is not supporting gender equality and diversity. At the same time, if for instance affirmative consent can be integrated in the design of sexbots, there are advantages to be had. Referring back to the social robots as relational, how we treat robots reflects our actions in other relationships. In chapters six and seven common stereotypes among men and women are discussed in detail. In chapter six the historical framing of women's bodies and minds as imperfect is reflected in todays' digital assistant. In the text, smart wives are described as "bitches with glitches", a derogatory name entangled with everyday sexism and passive femininity. In chapter seven the authors deal with the gendered concept of boys and their toys. The gendering of technology as a male domain has had serious implications for not only women but also to a certain extent for men as well in terms of what is implied and expected in masculinity.

In the final chapter the authors return to their two-fold aim of providing a critique of the stereotypical cultural phenomena of the smart wife and creating an intervention of the very same phenomena so as to expand possible scenarios for the smart wife to progress toward gender equity and diversity. Strengers and Kennedy have developed a manifest as a conscious

act of "staying with the trouble" (Haraway 2016). The manifest includes elements of queering the gender of the smart wife, changing the premises of who codes the smart wife, increasing female representation in technology, and embedding affirmative consent and ethical guidelines. The authors argue that the reboot of the smart wife will benefit women all over by improving the role of women intellectually and publicly, by creating a safer environment and furthering the sexual liberation on women's terms. Additionally, they emphasize that the renewal of smart wives will benefit all other genders as well.

This book is a thought-provoking and enjoyable read. The reader is taken on a journey to learn how the socio-cultural representations such as those of a 1950s US housewife are re-inscribed in many of the digital assistants we use today, and what implications this has on the smart wife industry and to a greater extent on gender equity and diversity (and the planet) in contemporary society. Even though the text is quite theory-driven the authors manage to mix it up with plenty of witty pop cultural references and market-relevant know-how which opens up for a broader audience.

Having read this book I would argue that we need to stop thinking of smart wives as merely innovative "technofixes" that will solve the division of (domestic) labor and begin thinking and caring for them as beloved, relational artefacts in order to increase equity and diversity between humans and machines alike. Similar to Haraway's cyborg figuration the smart wife is a provocative and complex entity challenging the false dichotomy of the social and the technical entangled with opportunities of changing human-machine relations and with complicated ethical issues of unsustainability and power relations. This book would furthermore be of interest for the posthuman discourse on care. The smart wife opens up for an interesting discussion on the division between things to be concerned about and matters we care for. When we reframe humans as inseparably entwined with the non-human what implications can this have on the relation between humans and our future digital workforce?

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