

Politics of matter.
Justice and organisation in technoscience

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Social Epistemology

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Abstract

The technoscientific capacity to manipulate and remake the material substance of being is at the core of an expanding ontological imaginary that permeates culture in Global North societies. What are the political implications of this imaginary? What are the absences, the residues, the invisibilised practices and actors of technoscience's ontological politics? The paper argues for the radical democratisation of technoscience and explores how it is possible to pose questions of justice without reducing the material to the social. It concludes with a discussion of the idea of crafting alternative ontologies as commitment to a material organisation of justice.

Keywords

Politics of Matter, Ontological Politics, Justice, Craft, Organisation, Technoscience

Bio

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Ontological politics

The rise of technoscience in its contemporary configuration since the 1960s and 1970s resonates with a cultural imaginary marked by the idea that social transformation is mainly driven by material transformation.¹ The myriad practices of technoscience create new ontologies; technoscience is world-making and history-making. One could say that the assumption of a tight link between material transformation and historical change is not new – the reduction of a thing to an object of contemplation and its separation from actual material activity is something which already Marx wanted to overcome in order to establish his materialist approach to history. However, in this conception of materiality the manipulation of the ontological substratum of existence was conceived as a possibility and as an aid to achieve other political targets, the most prominent of them is social liberation – an idea which is so characteristic of Marx and Engels's foregrounding of technology as a tool for changing history.² But if technoscience is not a tool in the hands of an actor forging other political goals but it is politics as such, then the question is what kind of politics it is. If material transformation is not something which can be summoned by a political organisation to achieve its political targets but is a form of political organising itself, then how do we organise *with* and *in* technoscience.

The term ontological politics is often used to describe politics in technoscience; it refers to the existence of a multiplicity of possible organisational possibilities and engagements in a specific socio-material arrangement, in an existing ontology. Which one of these multiple ways that shape the existence of a certain arrangement we choose is ultimately a political question: politics here means that by performing only one of the existing options rather than any other we change the very constitution of being and its material organisation in a very specific direction.³ The target of this take on ontology is to describe the connections between the various actors involved and how these actors shape differently future realities of these ontologies. Ontology is thus multiple and the political question here is about finding the right space where a certain object or material assemblage can be dealt with: 'Every new non-human entity brought into connection with humans modifies the collective and forces everyone to redefine all the various cosmograms' (Latour, 2007, p. 813). Cosmograms are diverging and often conflicting ways of actual world-making. Again, ontology here is not a description of a final state of things, but of processes that includes alternative possibilities of world-making. This is a 'war on essential differences' (Law, 1999, p. 7), instead of essentialism 'relations everywhere' (Strathern, 2005, p. 37). Ontological politics is the engagement in networks in ways that lead to the materialisation of

a certain ontological possibility and a specific form of socio-material organisation at the expense of another.⁴

What absences and what silences are produced when we conceive our engagement with and in technoscience as ontological politics? And what ways of being and acting, what voices does it privilege? With Boaventura de Sousa Santos I am interested in a sociology of absences (Santos, 2001). Rather than exploring what ontological politics is, this essay aims to discuss what ontological politics actively produces as absent and non-existent. "There is no single, univocal way of not existing. The logics and process through which hegemonic criteria of rationality and efficiency produces the non-existence of what does not fit them are various. Non-existence is produced whenever a certain entity is disqualified or rendered invisible, unintelligible, or irreversibly discardable. What unites the different logics of production of non-existence is that they are all manifestations of the same rational monoculture' (Santos, 2004, p. 178). With Susan Leigh Star (1991b) we can think of the production of the non-existent as an accumulation of residuals created in the process of making the world; residuals produced through work that has been invisibilised. This essay explores the absences, the residues, the invisibilised labours that cannot be considered through the perspective of ontological politics. What is rendered silent in the process of performing ontological politics? And finally, what alternatives are there?

The frontier of matter and the predicament of inclusion

The master narrative of changing matter and life itself thrives on the technoscientific ambition to monitor, control and transform processes of life on the very level of their material composition. On the other hand this narrative is not far from many strands of contemporary social thought as well as public imagination.⁵ Less than an issue of command and domination, the ontological imaginary casts actors as being in an indeterminate but constant relation to matter, sees matter as not given, rather it is a multiply constituted field that can be explored from different perspectives. Ontology resembles, or rather is, a territory that remains to be discovered and ultimately co-constructed, it is the new frontier. Organisation is emergent as the frontier of matter moves. What absences are produced as the frontier moves? And what are the possibilities for escaping the move of the frontier?

When ontological politics grapples with these realities in order to understand the meaning of politics, it no longer conceives matter as raw material for other social or political ends; rather, matter is opened up as an alternative space of expansion. Matter in all its

expressions and formations is not a fixed object, it is not substance; it is process. The shift to the ontological denotes an interest in immersing into this process, that is in trying to organise it and to create possible alternative configurations. Matter here is opened up as a 'space' of exploration, experimentation and appropriation, it is opened up as a frontier. In every frontier expansion takes place as inclusion of new territories and entities in a process of continuous creation of the 'new world'.

Every frontier has a promise: to liberate the one who moves into the open space from the limitations that preoccupy life before the frontier opens. The promise of the new frontier of matter: to liberate thought and action from being dominated by social position – class, sexuality, race, power, migration, culture, inequality, injustice – and to include matter (or rather its multiple organisational expressions) as a radical political actor. But simultaneously every frontier has a secret: in order to expand and include new spaces and entities, new actors and actants, it needs to exercise power over them and silence or oppress some of them in order to make them fit. Ontological politics expresses this liberating move – that is the openness of ontology to co-action of all actors involved and the multiple possibilities in it – and on the other hand administers its secrets: How many actors and actants can be included? How? What is going to happen with them?

Let's pause on the idea of the frontier for a moment. Every moving frontier is contemporaneous with a form of liberation and simultaneously it enacts oppression. In the American frontier, the labourers who escape the wage labour market of British America to become independent peasants and artisans from the 17th century onwards move into the frontier to the West only to bring savagery and destruction.⁶ In the Eastern Cape frontier of South Africa the opposition of the Afrikaners to British colonial power and their subsequent migration came only to consolidate white supremacy and extreme nationalism.⁷ The frontier opens as moving people include and integrate new territories into their realities. And as people move the new territories absorb them into their workings and transform them. The logic of every frontier is the logic of inclusion, the inclusion of hinterland and the outside into regulation. In the movement of the frontier territory is considered to be an open space that nobody has property rights for and therefore it is open for appropriation, 'terra nullius'. It is only because of this rendering of the territory as unclaimed that the frontier legitimises its moves. Mapping space, representing its entities, shaping new political institutions in order to include these entities (and exclude others) is the way the frontier expands. It is through these processes that the frontier is turned productive: the space of the frontier is turned into a space of production, that

is a space which is produced through relations of power as well as a space which is gradually incorporated into the existing system of the production of goods, knowledge and commodities.

Entering into the frontier and appropriating it is a double act of organisation: it is organised as a political space through processes of representation and it is organised as a productive space though incorporating it in the accumulation regime. Inclusion is about *enclosing* the new spaces into a regime of representation and a regime of accumulation.⁸ So also in our case: when matter becomes a frontier the attempt is to make it productive. Politically productive as well as render it compatible with the existing mode of production. In ontological politics the inclusionary politics that lead to productionism are conceptualised with the idea of multiplicity and the assemblage (e.g. Latour, 2004; Mol, 2002). The main concern is to discern how things are made, how a situation comes into being, how complex assemblages evolve through the co-actions of participating actors. It is not a coincidence that the trope of the assembly that dominates current thinking of matter presupposes the assembly plant, yet the complex assemblages of matter are not the flow-lines of the Fordist factory, but the self-valorising global assemblages⁹ of the Post-Fordist economy.¹⁰ Ontological politics delineates the practices that perform the inclusion of new constellations of matter into the accumulation regime of post-Fordist societies. As the frontier of matter moves, also move its political institutions. It necessitates the creation of new political forums to accommodate these emerging constellations. Including non-human actors in the political assembly is about rendering them amenable to be represented;¹¹ and, of course, as they become representable they put under pressure existing political institutions in our societies and force them to reorganise themselves.

It is the drive for inclusion and productionism that reveals the relevance of ontological politics for understanding politics in technoscience. Ontological politics problematizes our, by default anthropocentric, understanding of what matter is and inserts the idea of multiple contingent possibilities that exist in the process of matter's movements. Ontological politics describes the forces exercising pressure on the outer limits of constituted political institutions to differentially include more actants and more relations in a given political configuration in order to deal with the productive movement of the frontier of matter. The real meaning of constructivism in ontological politics is that it allows new entities to become socially and politically visible as well as entangled in the networks of production which sustain contemporary economies. The epigenome, a neuron, a virus, nuclear fuel, an MRI scanner, a submarine fibre-optic cable are not just actors that innocently intra-act with social institutions and people to create new forms of existence; they are also embedded in actual productive processes that maintain the movement of the frontier. Ontological politics is this form of politics that delineates

the different modes of inclusion of matter through this double movement of rendering matter as productive for political organisation as well as for the current post-Fordist regime of accumulation. In other words, ontological politics is politics performed in order to keep the frontier of matter moving by activating new material processes, keeping multiple possibilities open, including new material actors, inserting them into the political sphere, extracting value from them.

Politics of matter and justice

But to what extent do these material actors have a real political presence? To what extent can they object to their enlisting in the productive machine of the frontier? To what extent can the epigenome object the social meanings and the functions it is expected to perform in the rising research on epigenetics? To what extent can a transatlantic fibre-optic cable resist to its specific use by a certain consortium of companies that maintain it and exploit its labours? What labours do these actors do that remain non-existent, absent, invisible while many other of their labours are fully exploited in the productive regime of the frontier? This essay argues that inclusion is not a truly equitable procedure for bringing these actors, their absent voices and their invisibilised work to light. Rather inclusion is a process which simplifies and selects only the labours which fit to the productive move of the frontier and deletes other possible dynamics. With Susan Leigh Star I am interested here in the organisation of the invisible and ‘deleted’ work that remains hidden when ontological politics is performed, rather than the organisation of visible work as such (Star, 1983, 1991b).

Politics arises with the emergence of the invisibilised and the imperceptible, that is of those who have no place within the normalising organisation of the social and material realm. Following Rancière (1998), I rather want to think of politics as a deep dispute over the existence of those who have no part in an assembly or of those who refuse to participate in it.¹² And this form of politics happens when those who have no part change the material conditions of existence in a way that cannot be overheard or simply included in the assembly; rather it changes the *very constitution of the assembly* itself or even exercise politics outside of the constituted assemblies.¹³ I am thinking with Starhawk (2002) of a form of politics which is not exercised as the *power over* a territory or simply a power which appropriates what is within it; rather it is politics as *power with*, the power of creating alternative common places that reorder the very language and practices of existing political arrangements of constituted power.

There is a long tradition of this kind of politics in relation to matter and science: Situated knowledges (Haraway, 1988; Star, 1991a) describe the performance of politics from a very specific point of view: from neglected experiences that certain participants in a field enunciate. This line of thought which stems from feminist theory¹⁴ asks us to engage actively with our places as scientific knowledge producers in a context of structural unequal relations of power. The starting point of situated knowledges is that every engagement with science and technology is primarily arranged across asymmetrical positions. It is not enough to say that these positions need to be included in a symmetrical way into a political institution. The very constitution of institutions is done in a way that precludes inclusion of certain actors or precludes the inclusion of certain practices of these actors.

The point is not to create the correct assembly but to *act with* the neglected and invisibilised forms of existence in order to alter the very conditions of inclusion.¹⁵ In other words, what is crucial here is not to ask the question 'What is matter in-itself?' or 'Who is not included?'; rather the right question is why the existing political and productive assemblies we have produce absences and render specific actants and their practices residual. This essay attempts to conceive of absence less than as a noun or a state of things, but as a process: the making and unmaking of absences. Absence is not about the recognition of a missing other but of creating different ecologies that can become inhabited by these others. If reversing absence would be successful just through inclusion and recognition then we would have an easy recipe to combat the myriad of absences that populate this world. We would be very quickly in the position, for example, to counter the Sixth Extinction, the human-caused annihilation and destruction of a growing number of species and ecological lifeworlds. But as Thom van Dooren says, the starting point is somewhere else: 'we need to understand precisely *how* different communities (of humans and nonhumans) are entangled, and how these entanglements are implicated in the production of both extinctions and their accompanying patterns of amplified death' (van Dooren, 2011).¹⁶

By moving beyond ontological politics we encounter a different form of politics, a politics of matter that neither subsumes material transformation to socio-political organisation nor attempts to simply include matter in our constituted political institutions. Rather, a politics of matter is material transformation as constituent political organising – that is performing politics through experimenting with matter's inherent movements and constraints –. Deleuze in his homage to Francois Châtelet points out: 'No science, but rather a politics of matter, since man is entrusted with matter itself' (Deleuze, 2005, p. 717). This is a politics of matter not because humans are in charge of matter but because our acts and practices, hopes and desires thrive on

the possibility of co-acting with living and abiotic matter. Matter is hope. Ontology *is* desire.¹⁷ Symbiosis is the organisational principle.

The question is then how to think of practices which rather than performing ontological politics they challenge the existing conditions of inclusion *and* the very idea of inclusion, and institute direct changes on a very relational-material level of co-existence. Beyond ontological politics, I want to think of a politics of matter that starts from the quest of making alternative worlds on the ground as a way to redraw the immediate material conditions of existence so as to allow these invisibilised actants and labours to thrive. Such alternative worlds restore justice step by step through everyday practice; justice becomes ingrained in the very materiality of being, in the soil, the water, in our bodily tissues, limbs, organs, cells, genes, molecules. Material justice is what is rendered absent and invisible as the frontier of matter moves.

Material justice is the crafting of material worlds in which the very existence of the actants involved is made possible. Material justice is thus not 'against' the formal institutions and the already constituted assembly but operates *before* it by crafting a new situation which makes justice exist in the present. In this sense it is a form of justice which happens even before its representation and inclusion into politics has taken place.¹⁸ We are somewhat trained to believe that inclusion comes first: that inclusion is what makes politics happen or that it is in the process of inclusion of new actants in political structures that 'real' politics happen and that society changes for the better. It is probably the other way round: politics is when certain actors, imperceptible actors, emerge in the political scene and change the very constitution of being by – literally – materialising ordinary relations of justice; inclusion can only follow this move. Instead of a prescriptive justice, I am searching for a material and processual justice which rather than being focussed on normative issues is concerned with fusing justice and matter: Thick justice.

Occupying technoscience

How does thick justice materialise? How does thick justice become part of the social and material realm? How can justice be inscribed in and performed through our bodies, with other animals, things and matter? How can we think matter and justice in a non-dualistic manner? This would be a true abolition of the bifurcation between nature and culture and between society and things. Let's turn upside down Clifford Geertz' 'thick description' (1993): Thickness for Geertz is semantic, let's seek material thickness; practice for Geertz is text, let's read practice as the material worlding of existence. Thick justice turns Marx's take on materialism mentioned at the

beginning of this essay upside down; the aim is not to subsume matter to an organisation that targets social liberation but to fuse matter and liberation.¹⁹ Thick justice is about reclaiming materialist politics in the age of technoscience by making alternative ontologies: Alter-ontology. When ontological politics goes to the parliament, politics of matter goes to the everyday. The space where alter-ontologies are crafted. Alter-ontologies = new forms of life.²⁰

I borrow the term *forms of life* from Langdon Winner (1986, especially Ch. 1), a term which Winner traces back to Wittgenstein as well as to Marx. In forms of life we encounter a re-weaving of the social and the material through the development of new practices, knowledges and technologies. A practice, a set of practices, a device, a new form of connection becomes part of a form of life *by changing it*. There are no users, no tools, no symmetrical representations, no networks. There are just forms of life which set up the material constraints to what we are, what we can become and how we co-construct each other. Wittgenstein (1958, p. 226): 'What has to be accepted, the given, is – so one could say – *forms of life*.' I understand this as the making and sustaining of forms of life which have to be accepted because they transform the material order in ways which cannot be bypassed or neglected. Every social context, every socio-technical environment, every ecosystem has enough space for alter-ontologies: conflicting alternative forms of life. There are no closed spaces. Re-appropriation and reclaiming is the practice of remaking already constituted and assembled terrains.

In previous work we called the politics of these social movements *imperceptible*.²¹ Imperceptible politics are not invisible: yet they neither aim their inclusion nor do they claim visibility against the existing regimes of polity, they transform the immediate conditions of existence without having as their central target their own representation in the main political institutions. Imperceptible politics is the creation of new speculative figurations, new deliberate actual constructions, which put us right in the heart of new material and experiential forms of life. Günther Anders' call to train our capacity for 'moral fantasy' and Walter Benjamin's 'speculative experience' are behind these ideas. Anders discusses the inadequacy (what he later develops as a philosophy of discrepancy) between our feelings and the unforeseeable effects of things and demands that we train the elasticity and capacity of our imagination (Anders, 2002, p. 271ff).²² Walter Benjamin (1996) discusses also the magical and spiritual language of things and develops the idea of 'speculative experience' as a means of recognising the wholeness of life beyond a naive utopian idealism or blunt versions of materialist dialectics.

The quest then is how speculative experience becomes materialised in the making of alternative forms of life and simultaneously escapes the pressures of productionism – in its double sense as discussed earlier in this paper: inclusion into the political representation of the

constituted assembly and the current regime of accumulation. In other words how is it possible to develop a form of practice which gradually subtracts from both constituted polity as well as the accumulation regime in order to be able to construct alternative forms of life. If ontological politics is performed with technoscience, then we need to ask how can we democratise technoscience in order to perform a politics of matter that fabricates alternative forms of life. If technoscience is not a tool but is political organising itself and if it is world-making and history-making, as discussed earlier, then the question is how to occupy technoscience, how to bring 'real democratic', alter-ontological practices into technoscience.

A widespread response to this question would be to create democratic institutions that are capable of enhancing participation and define science from bottom-up.²³ However important and necessary this perspective may be, it sustains the split between technoscience and organisation, materiality and justice. By building upon this type of participatory politics in technoscience, I'm interested here in making a step further and explore the capacity to operate in technoscience's own terrain: the experimentation with the indeterminacy of matter. This is a form of work *within* matter, countering matter with matter. It deals with matter's inherent plasticity and creativity. That is skilfully working with its immanent – and specific, depending on the type of matter – forces, constraints and singularities. If the aim is to fuse justice and matter and bring questions of justice right in the heart of technoscience then organising has a meaning only as material organising. There is only immanent socio-materialising, there is nothing extemporaneous, all there is is meticulous manipulation of the world. This is the capacity to organise through *craft*: Instead of seeing technoscience as the instance against which claims need to be addressed and instead of seeing that claims of justice need to be imported from outside into technoscience, the aim is to occupy technoscience and literally craft alternative words.

Alter-ontologies: The capacity to organise through craft

Craft is the result of a skill developed to such a degree, that what matters is not the skill itself but the very moment of making. Craft is an excess of practice, which is at odds with the product oriented structure of post-Fordist knowledge production. Sennett in his study on craftsmanship defines craft as 'the desire to do a job well for its own sake' (Sennett, 2009, p. 9). This dimension of making something for the sake of it is often denigrated as being the celebration of purposelessness. But purposelessness is a political, material and cultural issue not one that pertains to some inherent transcendental qualities (or the absence thereof) of the thing which is crafted. What appears purposeless from the productionist perspective of value can be vital for

sustaining life. It is the moment in which something incommensurable to the existing regime of labour regulation, value measurement and value accumulation makes itself present. The utility of a product is neither a natural capacity nor is it a quality that humans instil into matter; rather it is the outcome of intensive socio-technical practices that respond to the constraints that matter imposes on us. Following this, here are some additional questions that I would like to see added to Sennett's discussion of craftsmanship: What kind of worlds does craft create? How does craft interrupt the current regime of political representation and accumulation? To craft forms of life for their own sake is not a drive or an innocent encounter with untamed natural forces of matter; it is a political act which is a necessary presupposition for making – literally – thick justice in the current conditions of labour, production and politics.

Craft often appears as a romantic critique of productionism. It is often conceived as an artful but petty activity that attempts to create a peaceful niche outside the sweeping movements of technoscience. But craft and artisanal production were always in the heart of making things and in fact defined the birth of modern science until its gradual absorption into big science.²⁴ Craft in this picture becomes a necessary prerequisite and the absent mediator of what Barad (2007) calls an intra-active relation with matter. Craft and artisanal skills are the invisibilised labours, the erased residuals that sustain any situated relation to matter. Barad stays in an epistemological discourse, craft forces us to move beyond that and see intra-action as everyday practice and politics. Craft represents the moment where the bifurcation between matter and justice is tendentially abolished. Consider for example how grassroots ecological activism has contested the externalisation of the costs of production to the environment by crafting alternative forms of life: re-vegetation, bio-dynamic principles of production, water conservation, cooperative production, co-evolution with plantswhole farm organisation, creation of alternative seed banks, permaculture activism, sharing of soil resources, urban gardening, co-action with the living inhabitants of soil to improve soil quality, ecofeminist advocacy, disruption of agribusiness, experimentation with bio-fuels, production of alternative research, making of alternative collectives, setting up local systems of exchange and transactions, Seeds of Change, Earth Activism – all examples of crafting alternative material justice on the ground, multiplying liveable worlds, making alter-ontologies. Political organisation here does not pre-exist the making of alternative forms of life, rather political organising *is* making alter-ontologies. Organisational ontology matters.²⁵ Recent ecological mobilisations and earth activism from below as well as radical science movements show that craft is crucial in order to encounter the ontological politics of technoscience in the particular terrain of eco-politics. Ecological activism of the kind I am describing here has addressed ecological destruction and technoscience not primarily by

opposing it from outside but also by occupying its very activity, by practically democratising knowledge, and by organising with technoscience.

But one could object here that craft as effective political organising seems to be untenable when scale is at stake. How can alter-ontologies work (or not work) with regards to the vast size of technoscience? Following the example earlier, can grassroots ecological activism ever be in a position to challenge big agrobusiness and the technologies that they deploy? Infrastructural changes or big technoscientific projects require extensive mobilisation in order to be rendered open to democratic politics and craft seems to be unable to achieve that. Big science is too big to change under the pressure of alter-ontologies as the argument goes. But is not the question about *scale making*²⁶ the real issue here rather than the entrancing size of technoscience? Craft is about rescaling the geographies of technoscience in ways that matter. And moreover, alter-ontologies introduce modes of cooperation that contribute to the actual making of scales. Consider the free software movement. What mattered in the birth of the free software movement was not the question of scale as size (that is when free software will become so widespread as to potentially eliminate proprietary software) but the attempt to change the conditions in which software was made. Re-scaling the production of software was the target in order to allow for alternative forms of software creation to emerge: how is software owned (or not owned), how can software become freely distributed, how can it engage a vast number of actants in the global virtual space, how can we set up peer-to-peer nets, how can we maintain the gift economy of the cyberspace – all questions²⁷ that indicate that crafting new codes and new forms of cooperation was not a strategy to conquer proprietary software but to create liveable digital worlds. The creation of alter-ontologies is not primarily about size but about re-making the scale per se. That is to change the values that a scale measures and not just its ratio. Alter-ontological practice is about crafting the appropriate scale from scratch not just about using existing scales and then scale the activity of craft up or down to match the size of the ontological politics of technoscience in a specific terrain. In this sense scale making in alter-ontologies is a minoritarian move: it concerns the intensity of the actual moment of crafting rather than the intensity of the critique of technoscience.²⁸

The drive behind the politics of matter in alter-ontologies is not to oppose the ontological politics of technoscience but to occupy technoscience and to insert a practical sense of the specificities and the constraints of each particular socio-technical terrain. Artisanal skill lies in the ability to recognise what the constraints of a certain situation are, where to stop and how to stop. Craft is ultimately about caring for the worlds we live in through acting in accordance with the intensities and the limits that matter imposes in each concrete situation. Puig de la

Bellacasa (2011, 2012) develops an idea of care not as a moralistic stance but as a practical everyday engagement with the mundane invisible labours of different actants in order to sustain non-toxic worlds. This is a generic notion of care: it has the capacity to shape every different organisational ontology – but it is not universal: it needs to be materialised anew and again and again in each particular situation. In fact the one who crafts alter-ontologies knows what the constraints are, where to stop and how to leave himself/herself behind. Craft is not about DIY, but about DIWY: do it without yourself. Craft at its very core is not about making things or producing relations but about leaving yourself aside for the sake of co-existing with other things and beings. When craft meets care the product is a commitment to sustain and promote liveable forms of life, rather than normatively allocating specific positions to specific actors in constituted political institutions. Absences, silences, invisibilisation here are not contested through inclusion and through performing ontological politics but are reclaimed with practices in which organisation, justice and matter fuse—so that we can after Montaigne and Marx finally say: nothing material is alien to me.

Notes

¹ See Haraway on technoscience (1997) and Ravetz on post-normal science (2006); see also Papadopoulos (2011).

² For an extensive discussion of Marx's materialism see Papadopoulos (2010, 2012).

³ For various approaches to ontological politics see Law (1999), Marres (2009), Mol (1998).

⁴ Some examples: Callon (1987), Law (2004), Mol (2002).

⁵ In particular the ontological turn in social theory (some very diverse examples: Agamben, 1998; Badiou, 2005; Braidotti, 2006; De Landa, 2002; Rabinow, 1996; N. Rose, 2001).

⁶ See various accounts on the colonisation of America that describe this double movement of the frontier: Bailyn (1988), Todorov (1984), Turner (1993).

⁷ McClintock (1995) demonstrates how imperial political power, imperialist expansion, industrialism and, finally, intimacy and the domestic space all get mixed and transformed in the process of the colonial contest.

⁸ Boutang has analysed this process in his work on the abolition of slavery (Moulier Boutang, 1998) and Pratt (1992) has shown the connection between colonial expansion, travel and systems of representation.

⁹ See for example different configurations of such global assemblages in Ong and Collier (2005).

¹⁰ See contributions in Panzieri, Sohn-Rethel, Palloix, Bologna, & Tronti (1976); also current analyses in Moulier Boutang (2012), Marazzi (2008), Vercellone (2007).

¹¹ Representation as a process of inclusion into the political institutions of contemporary liberal democracies (Stephenson & Papadopoulos, 2006).

¹² This form of politics is not concerned with representation and with the symmetrical inclusion of different entities in the political and productive arena of the assembly as these can exist only by erasing specific aspects and capacities of each actor. Equally negotiating the terms of inclusion of a certain actant is not enough in order to change the conditions through which this specific actant is included.

¹³ In Papadopoulos, Stephenson & Tsianos (2008) we argue that this type of politics has the primacy over the formation of control and drives historical transformation.

¹⁴ In particular feminist standpoint theory (Harding, 1991; Hartsock, 1983; Hill Collins, 1991; H. Rose, 1994; D. Smith, 1987).

¹⁵ See (Bracke & Puig de la Bellacasa, 2009; Puig de la Bellacasa (2011)).

¹⁶ The work of the Ecological Humanities Group (<http://www.ecologicalhumanities.org>) has been crucial for developing the ideas presented here. Deborah Bird Rose's *Reports from a Wild Country* (2004) was an inspiration for writing this paper, in particular for the attempt to think the meaning of an ethics of decolonisation in the context of the unfolding process of colonisation in the frontier of matter.

¹⁷ And as with every desire it can unfold either as a manic and anxious chase of something that we don't have—Meillassoux's (2009) obsession to grasp the 'in-itself' seems to be an expression of this form of desire in the politics of matter – or as a force to escape existing closures and make novel connections and forms of life. As every politics, also politics of matter contains both. Here I refer to the latter while I silently presuppose the first as a repressed version of a politics of matter.

¹⁸ For a discussion of questions of justice in a non-anthropocentric and 'worlded' perspective see Papadopoulos (2012).

¹⁹ See Papadopoulos (2010) for a discussion of how the meaning of matter in materialist politics changed radically in different historical periods.

²⁰ These issues are discussed extensively in Puig de la Bellacasa (2010) and Papadopoulos (2011).

²¹ See Papadopoulos, Stephenson & Tsianos (2008, p. 71ff.).

²² See here also the analysis of Schraube (2005).

²³ There are many different approaches to participatory politics in science and technology (e.g. Davies, 2006; Epstein, 2007; Irwin & Michael, 2003; Leach, Scoones, & Wynne, 2005; Wynne, 2003) but usually democratic politics in complex socio-technical controversies is aiming to invigorate public deliberation in the management of technoscience. The main role of the public is to contribute an informed opinion about emerging technoscientific issues or new research agendas.

²⁴ See the historical work of P. Smith (2006) which demonstrates how artisans and artists, sculptors, locksmiths and carpenters were key actors in the formation of modern science; see also the important work of H. Rose (1983). The political implications of craftsmanship for contemporary radical social movements are partly discussed in Carlsson (2008).

²⁵ For another example see Papadopoulos & Tsianos (2013).

²⁶ On the importance of scale for understanding global processes see the work of Tsing (2000) and Glick-Schiller (Glick-Schiller & Caglar, 2008).

²⁷ For an extensive discussion of these issues see Kelty (2008) and for a broader political evaluation see in Carlsson (2008) and Bollier (2008).

²⁸ Regarding the role of minoritarian politics in the production of minor science see Papadopoulos (2010).

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