

Metaphors and Problematizations

Notes for a Research Programme on New Materialism

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Abstract The “ontological turn” in social theory is a major intellectual wave of recent years. Focusing on feminist new materialism, the paper outlines elements for a research programme on this topic. It elaborates first on the conceptual exchange between scholarships in social theory and biophysical sciences, dwelling on the constitutive role of metaphors. Then it considers the role of a profound socio-cultural transition that has begun in the 1970s and reached a full-fledged expression at the turn of the millennium. This transition has triggered a “problematization” (in Foucault’s sense) that, pivoting on the notion of indeterminacy, associates social theory, cutting-edge biophysical science and neoliberal rule.

Keywords: New materialism; ontological turn; neoliberalism; metaphors; indeterminacy.

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I. Introduction

Feminist new materialism is an intellectual movement belonging to the broader wave of the so-called “ontological turn” in social theory (e.g. Escobar 2007; Dolphijn and van der Tuin 2012). We can talk of a wave – emerging in the late 1990s to gain growing prominence in recent years – because a similar trend is detectable in a number of disciplines: geography, sociology, anthropology, philosophy, political theory, science and technology studies (STS), humanities and so on. In general terms, and drawing on Michael Burawoy’s (2005) typology of social science labour, two coordinates help identify the ontological turn: first, an “academic” concern for the limits of post-modern approaches, with special reference to linguistic deconstruction and culturalist readings, in accounting for the biophysical world and human agency; second, a “public” concern for the

inadequacy of these approaches in triggering social change. In both respects the case is made for “bring[ing] the material back in” (Hekman 2010, 3), according to post-representational epistemologies and “flat” and relational ontologies. Scholars and approaches like Gilles Deleuze (e.g. 1994; Deleuze and Guattari 1987), Alfred North Whitehead (e.g. 1978), Bruno Latour and Actor-network theory (e.g. Latour 2005), and practice theory (e.g. Schatzki *et al.* 2001) feature prominently as inspirational sources, providing support to an attack on the reality/language and ontology/epistemology dualisms – with all the implied dichotomies (nature/culture, mind/body, subject/object, organic/inorganic, animate/inanimate, reality/representation, matter/information etc.) – in favour of accounts of the world as populated by fluid, contingent entities (networks, assemblages, hybrids and so on). According to this view, as Anemarie Mol and John Law (2006, 19) nicely put it: “knowing, the words of knowing, and texts do not describe a pre-existing world [but] are part of a practice of handling, intervening in, the world and thereby of enacting one of its versions – up to bringing it into being”.

Feminist theory is at the forefront of this intellectual movement, and one of its distinctive traits is that it builds to a significant extent on scientific advancements. In the following, I address in two ways the pivotal role of science in these theoretical elaborations. First, I deal with the conceptual exchange between scholarships in social theory and biophysical sciences, dwelling on the constitutive role of metaphors. Second, I expand my outlook beyond scholarly dynamics to consider a broader milieu – namely, the profound socio-cultural transition begun in the 1970s and come to a full-fledged expression at the turn of the millennium.

This contribution has no aspiration to be more than a preliminary note for a research programme on the underpinnings and implications of a broad convergence on a particular way to account for the biophysical world and human agency. This programme should be akin to what Foucault called an “ontology of the present” (Foucault, 2007), that is, a study of the problematization of our time. With the term “problematization” Foucault refers to the conditions by which “certain things (behaviour, phenomena, processes) become a *problem*” (Foucault 2001, 171, emphasis in original) and certain answers to these problems become conceivable; conditions instigated by social, economic and political processes that “can exist and perform their action for a very long time before there is effective problematization by thought” (Foucault 1997, 117-118). Moreover, if one wishes to remain faithful to Foucault’s genealogical method, analysing the problematization in which we live does not mean to argue, building on some transcendental vantage point, that something is good or bad, right or wrong, true or false, but rather to show, from within the immanence of the situation, “that practices are problematic, dangerous, fraught, and in need of additional attention” (Koopman 2013, 92).

2. Feminist New Materialism

Introducing a collection of essays devoted to feminist new materialists, Diana Coole and Samantha Frost remark that: “everywhere we look [...] we are witnessing scattered but insistent demands for more materialist modes of analysis and for new ways of thinking about matter and processes of materialization” (Coole and Frost 2010, 3). These demands are urged first and foremost by current advancements in technoscience. “New physics and biology make it impossible to understand matter any longer in ways that were inspired by classical science” (Coole and Frost 2010, 5), overwhelming “the ability of cultural theorists to critically digest and engage them” (Kirby 2008, 7). Actually, in physics, life sciences, biomedicine and elsewhere, material phenomena are increasingly conceptualized in terms of porous boundaries. Distinctions between physical and biological, natural and technological systems, ontology and epistemology, blur. For example, epigenetics challenges the gene/environment and brain/body dichotomies (Papadopoulos 2011). The inorganic realm is increasingly depicted as having vitalistic connotations, while life is simultaneously infused with dematerialized characterizations – textuality, information, codification (Keller 2007; 2011). Also, mining and processing of huge amounts of data generate unforeseen insights where knowledge and production of reality, discovery (of interesting relationships within the data) and invention (of meaningful associations among data), can hardly be distinguished (Calvert and Fujimura 2011; Cambrosio *et al.* 2014). Accordingly, new materialists depict matter as anything but “inert, stable, concrete, unchangeable and resistant to socio-historical change” (Hird 2004, 224). Matter exhibits agency, inventive capacities, generative powers. It is “not a thing but a doing” (Barad 2003, 822); an incessant process of becoming. Texts and signs can also be reconfigured as “substantively or ontologically material. [...] ‘Life itself’ is creative encryption” (Kirby 2008, 9); a continuous rewriting of itself. The ontological divide between machine and organism is also to be reformulated, according to the “penetration of computational processes not only into every aspect of biological, social, economic, and political realms but also into the construction of reality itself” (Hayles 2006, 161).

Karen Barad’s “agential realism” is exemplary of this view. She regards phenomena as “the ontological inseparability of agentially interacting components. That is, phenomena are ontologically primitive relations – relations without preexisting relata” (Barad 2003, 815). Phenomena, in other words, are not representations of things but things as such. Entities are continually reconstituted through material-discursive “intra-actions”, where neither the material nor the cultural aspect takes precedence. For example, the material set up of foetal imaging simultaneously supports and is influenced by a politics of individual autonomy and subjectivity. The foetus that the scientists can see as an object is also the foetus that law defines as an independent subject. Hence, “the foetus is not a

pre-existing object of investigation with inherent properties. Rather the foetus is a phenomenon that is constituted and reconstituted out of historically and culturally specific iterative intra-actions of material-discursive apparatuses of bodily production” (Barad 2007, 217).

All that, according to new materialists, poses ethical and political questions in front of which “the dominant constructivist orientation to social analysis is inadequate” (Coole and Frost 2010, 6). Social change cannot be based on “reconstructing subjectivities, discourses, ethics, and identities [...] [because] the material realm is irreducible to culture or discourse and cultural artefacts are not arbitrary *vis-à-vis* nature” (Coole and Frost 2010 25, 27). If feminism has successfully challenged all sorts of appeals to the facticity and prescriptiveness of nature, the latter is not necessarily “a repository of conservative political investments” (Kirby 2008, 8). Once nature is seen as dynamic, active, and unpredictably open, it is no longer an obstacle but rather opens the way to “a liberating anti-humanism” (Colebrook 2008, 74), in light of which human agency results disempowered and defective, distributed and limited, hence also modest, careful, responsible and opposed to the dominative hubris (Bennett 2010). Oppression (of women and anyone or anything else) can be fought only if recognized as an actual reality that cannot be effectively addressed through discursive deconstructions and indeed often stems precisely from the unwarranted separation of matter and language. Therefore, the approach to critique inherited by the philosophical and sociological tradition, with its ultimately ineffective focus on argumentative “errors and points of contention” (Grosz 2005, 27), is to be replaced with affirmative standpoints that build on thingness and corporeality as sites of resistance, creativity and hope, ethically relevant in their being the result of choices that materialize particular states of reality.

Feminist new materialism is not isolated in making this case. As hinted, similar arguments are advanced in a number of fields, from post-development theory to geography, from sociology to STS. According to these arguments, the greater analytical strength of ontological approaches goes hand in hand with its capacity to support a new season of emancipatory politics. Arturo Escobar (2010), for example, talks of “ontological struggles” with reference to counter-hegemonic processes in Latin America, which build on indigenous ontologies where human and non-human entities are enacted together in mobilizations against dams, drilling, mining, deforestation, transgenic agriculture. Amin and Thrift (2005) similarly talk of flat ontologies as the basis of new emancipatory politics, focused on an “ecology of hope” and an immanent, affective and decentred account of the world. Latour’s (2004a; 2004b) plea for a “new constitution”, aimed at overcoming the nature/society and science/politics divide and at replacing a constructionist critique eventually “run out of steam”, can also be enrolled in this intellectual movement.

To sum up, new materialists account for their commitment to “bringing the material back in” by pointing to both “academic” and “public”

elements of dissatisfaction about the way feminism, and the social sciences in general, have addressed the biophysical world and human agency. Science advancements, as we have seen, feature prominently in this context, as both a challenge and a source of inspiration.

3. From “As” to “Is”: Metaphors and the Conceptual Exchange between Biophysical and Social Sciences

As widely known, it is not the first time that the biophysical sciences influence the social sciences and philosophy. Comte and Marx took the notions of organism and metabolism from biology. Ecological thinking has affected significantly the Chicago school of Burgess and Park, as well as a variety of socio-systemic approaches. As for Darwin, one needs not insist on the multifarious influence of the notions of adaptation and selection on social theorizing and inquiry. Biology is important in Deleuze’s philosophy while Whitehead’s one draws to a significant extent on his background in mathematics.

Similar examples could take books. What may be worth recalling is that influences work also in reverse. Ernst Haeckel, the “father” of ecology, borrowed heavily from social imaginary for his account of organisms. He equated cells to individual citizens in an organized social community, and described the animal body as a “monarchy of cells” compared to the “republic of cells” of the vegetal body. Darwin acknowledged the influence of Malthus on his reflections on the asymmetry between the dimension of the offspring generated and the number of adults that reach the reproductive age – hence the influence of environmental factors in limiting what otherwise would be an unlimited expansion of life. Similarly, he acknowledged his indebtedness to Herbert Spencer for the definition of the concept of “survival of the fittest”. For Stephen Jay Gould (2002), in his formulation of the natural selection principle Darwin was also influenced by the invisible hand of Adam Smith (in his turn, according to Alexandre Koyré (1965), inspired by Newtonian physics).

As for today, a number of studies account for the conceptual cross-fertilization of the social and the biophysical sciences: from evolutionary biology (Keller 2002) to cybernetics (Hayles 1999); from nanosciences (Dupuy and Grinbaum 2004) to chemistry (Lehn 2004) and immunology (Tauber 1997). The latter possibly offers the most striking evidence of conceptual exchange. Immunology has borrowed heavily from military imaginary (attack, enemy, recognition, borders etc.) and from philosophical speculations about the self, while in its turn increasingly affecting the way in which security issues are accounted for in the social and political realm (Esposito 2011).

In this framework, the role of metaphors can hardly be overestimated. In a seminal study, George Lakoff and Mark Johnson have shown that

metaphors are crucial to conceptualization and reasoning. We use inference patterns from one conceptual domain to reason about another domain. Even fundamental ideas, like time, causation, morality, the self, are “almost entirely structured by elaborate systems of conceptual metaphor” (Lakoff and Johnson 2003, 249). Metaphors help give coherence to experience. They allow us to understand one kind of thing in terms of another. Moreover, as Lakoff and Johnson note, new metaphors create new realities because thanks to them we start to comprehend our experience differently, acting and producing consequences accordingly. They stress also that the truth-value assigned to new metaphors depends on the extent to which our understanding of a metaphorical sentence fits our understanding of a situation. Of course, in the concepts we use to understand the situation other, already established, metaphors are at work.

This is important because it shows how metaphors open a space not only for cross-disciplinary migration but also for views and beliefs borrowed from the broader socio-cultural milieu. Sensemaking depends, at least in part, on metaphors that make sense. And they make sense because they fit into broader landscapes of meaning. Ludwik Fleck (1979) has notoriously insisted on this point. “Thought collectives” develop at the intersection of scientific and broader social circles, and “proto-ideas”, that is general notions or images drawn from religion, philosophy or other sources, help structure new fields of research. Moreover, as Isabelle Stengers (1987) has remarked, notions initially borrowed as metaphors tend – in their nomadic journey through problem-fields – to morph into concepts provided with literal truth-content, around which theories are built that bear no memory of their origin¹. Also, the way in which the story of the transfer is told depends on its eventual success or failure. In case of success, the story tends to be one of “propagation”, as a spontaneous process. The reason for the successful adoption of a concept seems to be its intrinsic adequacy to phenomena; its intellectual productivity. In case of failure, the story tends to be one of “propaganda”, that is of mistakes, ideological drifts, seduction of mere verbal analogies².

Some criticisms addressed to new materialism and the ontological turn point precisely to the transformation from “as” to “is” that concepts

¹ Also Lakoff and Johnson seem to incur in this drift when they argue, on the ground of evidence from brain imaging, that metaphorical mapping is realized physically as neural maps. As far as I know, the causal connection between concomitant physical processes in brains and psychic processes in mind has not been proven. To say but one of the many disturbing questions related to the issue: blood takes some seconds to flood a brain area, whereas thought is obviously much quicker, so what happens in the meantime? Hence, saying that “metaphor *is* a neural phenomenon” (Lakoff and Johnson 2003, 256, my emphasis) is a statement provided with metaphorical, rather than literal, truth-content.

² The example suggested by Stengers is 18th-century chemists’ use of the Newtonian concept of interaction forces, which has been subsequently blamed, from the vantage point of quantum mechanics, as a case of intellectual laziness.

undergo in their metaphorical journey. For example, Nicholas Rose remarks that social theory's increasing borrowing from the biological leads to "a strange form of conceptual gerrymandering: [...] biology is translated into ontology, ontology is transmuted into politics. [...] Biological claims evade critical interrogation where they seem to give support to a pre-given philosophical ethopolitics" (Rose 2013, 11-12). Judith Butler makes a similar case in regard to Vicky Kirby's attribution of textuality to things and ontology to signs. Kirby says that, in so doing, she has in mind "the code-cracking and encryption capacities of bacteria as they decipher the chemistry of antibiotic data and reinvent themselves accordingly. Are these not language skills? Is this not a very interesting case of epistemology as ontology?" (Kirby 2008, 9). Butler, however, warns against taking explanatory models as inherent to the phenomena being explained: "I am sure that encryption can be used as a metaphor or model by which to understand biological processes, especially cell reproduction, but do we then make the move to render what is useful as an explanatory model into the ontology of biology itself? [...] What of life exceeds the model? When does the discourse claim to become the very life it purports to explain?" (Butler, quoted in Kirby 2008, 10).

Of course it is the very notion of biology that, as notes Maureen McNeil, has a "slippery double valence, designat[ing] both the operations and features of the human body itself, and the study of its functioning" (McNeil 2010, 435-436). Yet the problem is not limited to biology. Another example comes from Trevor Pinch's review of Karen Barad's major work (Barad 2007), which builds on Niels Bohr's physics. For Pinch, "Barad, like Karl Popper, seems to assume the very grounds that much science studies has contested. How is it that scientists can agree that phenomena are the same or agree on what makes an experiment repeatable? Once it is realized that repeatable experiments themselves come from a culture of trust, a shared form of life and shared practices [...], then the orientation is focused once more on humans. [...] I find it deeply puzzling that Barad can call for a more situated account of science and at the same time fail to situate the very part of science she is talking about, while drawing in a realist mode upon experiments to support her position" (Pinch 2011, 439).

Similarly, in his review of N. Katherine Hayles's (1999) book on post-humanism and cybernetics, Dennis Weiss (2000, 10) remarks that: "while criticizing Wiener and Maturana for adhering too closely to the realist, objectivist discourse of the sciences, Hayles seems to fall victim to the same problem". Latest research in evolutionary psychology and biology allegedly provides incontrovertible evidence of the decentred, distributed, emergent character of the self against the untenable assumptions of a unified self that were central to Wiener's and, to some extent, Maturana and Varela's accounts – assumptions that, according to Hayles (1999, 5), are aligned with a liberal model of possessive individualism "entwined with projects of domination and oppression". The problem, then, is that

Hayles's "key distinction between the true awareness of the distributed self and the false unified self seems hard to maintain in light of the reflexive epistemology she adopts" (Weiss 2000, 11).

In all these examples, as we can see, objections point to the veridical status granted to scientific evidence. What is found problematic in the accounts of Kirby, Barad, Hayles and others is that on one side, as regards the approaches they criticize, scientific truth appears – borrowing Foucault – “a thing of this world, produced only by virtue of multiple forms of constraint” (Foucault 1980, 131), while on the other, as regards cutting-edge research, their critical detachment disappears and their outlook becomes more akin to an “analytic of truth”: an account of how old concepts are replaced by new ones, as provided with greater closeness to truth. To give another example, Mark Hansen criticizes Deleuze for his reliance on an account of organisms that “is alien to the conceptual terrain of current biology” (Hansen 2000, 18). In other words, the usefulness of Deleuze’s theory would be limited by its drawing on biological models that are no longer valid. Then one might ask why current biology should be granted greater ontological validity; why we should not treat it with the same caution, given that there is no reason to think that current views on matter and life will not be superseded by other ones, perhaps completely different.

4. Broadening the Outlook: Indeterminacy and the Socio-cultural Transition

According to the criticisms above, the dynamics of travel (of concepts) and forgetting (of their metaphorical aspects) puts new materialism and comparable positions in the ontological turn at odds with their own post-representational premises. Older accounts of the biophysical world and human agency are deemed incorrect, while new accounts of the ontologically fluid state of reality allegedly depict the world as it is.

To come to terms with this contradiction, I think one has to go beyond scholarly issues (the movement of the intellectual pendulum to and fro the culture/matter, or realism/constructivism, polarities; the background in biophysical disciplines of many scholars engaged in STS and neighbouring fields), to address the broader socio-cultural milieu, as a source of meaning that facilitates the convergence of different disciplinary perspectives and the transition of concepts from “as” to “is”. This is no doubt a risky and tricky move, yet, I believe, a necessary one for a genealogy of the ontological turn.

A possible point of entry into this issue is the question of indeterminacy. As we have seen, in new materialist approaches ontological indeterminacy, ambivalence or contingency are not only stressed but take positive, emancipatory connotations: as enabling non-determination rather

than constraining non-determinability; as opportunity rather than problem. In tracing the genealogy of this outlook, then, we should distinguish between the growing *relevance* of indeterminacy, which is a story dating back at least to the beginning of 20th century, and the changing *outlook* on indeterminacy, which is a more recent trend. In physics, chemistry, biology, economics, computer science and elsewhere, growing acknowledgment of the import of indeterminacy has for long been complemented with strategies for coping with it, claiming capacities of handling in spite of incomplete characterizations of the state of affairs³. At some point, however, things have started to change. Today, indeterminacy no longer is a problem, but rather becomes a resource. Ecology, for example, has traditionally built on the idea that ecosystems tend to balance after perturbations. From the 1970s onwards, however, the thinking of Eugene Odum's generation, with its assumptions of order and predictability, has gradually been replaced by a new view, according to which there is no spontaneous tendency to equilibrium in nature: no progressive biomass stabilization; no diversification of species or movement towards greater cohesiveness in plant and animal communities. Change goes on forever, with no direction or tendency to stability; no cooperation, consistency and holistic organization but rather competition, patchiness, fragmentation, individualistic association. Disturbance or perturbation is argued to be not extrinsic but intrinsic to ecosystems. Hence contingency and disorder are not against life, but what life depends on. "Populations rise and populations fall, like stock market prices, auto sales, and hemlines. We live [...] in a non-equilibrium world" (Worster 1990, 11).

Similarly, in chemistry and physics, attention has increasingly focused in the last decades on dissipative structures. Thermodynamically open systems, where the spontaneous formation of dissymmetry and bifurcations leads to unpredictable reorganizations of matter, have been conceptualized as the rule rather than the exception. Again, this is not regarded as a problem, but as a crucial "enabling" feature. For Ilya Prigogine, whose work has gained decisive momentum from the 1970s onwards, both Boltzmann and Darwin replaced the study of "individuals" (organisms or particles) with the study of populations, showing that slight variations over a long period of time produce evolution at a collective level. Yet, while Boltzmann described an evolution towards uniformity and equilibrium, Darwin accounted for the appearance of new species. "Significantly, these two theories had very different fortunes. Darwin's theory of evolution [...] remains the basis for our understanding of life. [...] Boltzmann's interpretation of irreversibility succumbed to its critics" (Prigogine 1997, 21).

Another example comes from cybernetics. According to Hayles (1999), the first wave of cybernetics (1945-1960), whose central figures

³ Quantum mechanics and Keynes's account of subjective estimates as triggers of rational decisions are good examples coming from completely different fields.

are Norbert Wiener and John von Neumann, takes homeostasis as its crucial notion. The central problem, for machines as well as living organisms, is to ensure control over their operations and integrity in a chaotic environment. The second wave (1960-1980) builds on the concept of feedback, which introduces a loop between observer and observed systems, hence the notion of reflexivity on which Humberto Maturana and Francisco Varela develop their theory of autopoietic systems, physically open yet informationally closed. The third wave of cybernetics begins in the 1980s and stretches to the present. Hayles identifies it with artificial life. The crucial conceptual shift, here, is from self-organizing systems to emergent systems. The contingent, disordered character of a world where the natural and the artificial are increasingly indistinguishable becomes a vital resource rather than a troublesome feature that systems have to handle.

In short, a generalized turn from order to disorder – simultaneously descriptive and normative – seems to begin in the 1970s, gaining growing momentum in the following decades. It is then sensible to explore the link between this broad intellectual shift and the contemporaneous, equally encompassing social change. Bob Jessop (2002) has depicted the latter as a transition from “Keynesian welfare national states” to “Schumpeterian workfare postnational regimes⁴. Other scholars talk, more simply, of the shift from Fordism to post-Fordism and financial capitalism (Boltanski and Chiapello 2005), or of the advent and progressive strengthening of neoliberal rule (Harvey 2005). The association between the two transitions – the academic and the social, or socio-cultural – strengthens if one reflects that, if indeterminacy is the semantic thread of the former, insecurity is the semantic thread of the latter. People’s exposition to the “risks” of the new world (dis)order engendered by post-Fordism or neoliberalism may differ according to the opportunities and protections related to the occupational link with the new economy, yet this (dis)order and the implied centrality of unpredictability and insecurity have increasingly become a shared framework of meaning, a taken for granted condition of life (Azmanova 2010).

The problem, of course, is how to read this association. Drawing upon an analysis of a corpus of literature in business management, Luc Boltanski and Eve Chiapello (2005) conclude that the post-Fordist reorganization of capitalism has crucially built on the integration of the “artistic cri-

⁴ In Jessop’s description, the first regime aims at full employment and economic planning, prioritises social policies over economic development, centres policy-making and implementation on the national scale, and grounds public choice on neo-corporatist models; the second regime aims at increased competitiveness of national and local economies, focuses on technological innovation, places economic development over social policies, centres policy-making and implementation at the supranational and local scale, and grounds public choice on public-private partnerships and stakeholder consultations and negotiations.

tique” that the social and intellectual movements of the 1960-70s had addressed to state-organized capitalism, translating the plea for freedom, autonomy and creativity into a case for flexibility, networking, communication and permanent education. Critics of neoliberalism talk of an elite hegemonic project (Harvey 2005), stressing how well identifiable academic circles, think tanks and international institutions have actively supported and policed the spread of neoliberal ideas (Mirowski and Plehwe 2009).

Singling out specific, influential sources of diffusion of ideas, however, does not correspond to explaining why such ideas are found interesting and convincing by wide and diversified audiences. The reason of the spread of the values of the new economy well beyond its actual borders (Sennett 2006) and of the enduring consensus over the fundamental beliefs of neoliberalism in spite of repeated *débâcles* (Centeno and Cohen 2012), is probably to be sought at the level of fundamental ontological and deontological beliefs⁵.

As a matter of fact, new materialist “affirmative” standpoints about contingency and indeterminacy resonate with the way in which science and the biophysical world are being “neoliberalized” – no doubt a disturbing alignment, if one considers the emancipatory implications generally associated with the ontological turn. “Neoliberalization” of science and nature is usually taken to mean, on one side, changes in the institutional set up and functioning of science – the start-up company, the scientist-entrepreneur, etc. (Lave *et al.* 2010) – and on the other the increasing management of natural resources and environmental issues through market-oriented arrangements (Castree 2008).

However, more profound features can be detected. As Antoinette Rouvroy remarks in her study on the relationship between genetics and neoliberalism: “the social/economic/technical/political structure of society and innovation [are] related to each other, as part of the same metabolism, interacting in a dialectical manner, each being performative for the others” (Rouvroy 2008, 6). Similarly, for Melinda Cooper “the history of neoliberal theories of economic growth and biotechnological visions of growth needs to be pursued simultaneously”, namely the economic crisis of the 1970s has found a reply in a series of legislative and regulatory measures “designed to relocate economic production at the genetic, mi-

⁵ Foucauldian scholarship has stressed the peculiar veridical mechanism of neoliberalism, as a political project that seeks to create a social reality that it maintains already exists. On one side institutional practices and rewards are developed in order to expand competitive entrepreneurship. On the other, neoliberal intellectuals claim to purport not an ideal, but a reality: human nature (Lemke 2003; Read 2009). As a consequence any failure of the market, any evidence opposed to the promised increase in freedom and efficiency simply marks the distance between a trans-historical reality and contingent flaws, constraints, oppositions and irrationalities (Pellizzoni and Ylönen 2012).

crobial, and cellular level, so that life becomes, literally, annexed within capitalist processes of accumulation” (Cooper 2008, 19).

Whatever the intentions of technoscience theorists and developers, the de-standardization of life operated by the life sciences, with their increasing focus on the extremes rather than the norm, is consistent with growing demands for flexibility and speed of change. “Even in the work of Prigogine and Stengers the new political economy of nature sounds suspiciously like the new political economy of neoliberalism” (Cooper 2008, 42).

One may disagree with possibly too trenchant arguments, yet neoliberalization appears in many ways to be intertwined with technoscientific change, as both a trigger and a consequence (Pellizzoni and Ylönen 2012). For a start, there is plenty of evidence that disequilibrium, unpredictability and indeterminacy are central to neoliberal rationality. Pat O’Malley (2004), among the others, is particularly effective in showing how for neoliberal theories and policies proper calculations of risk are the exception, while reasoned bets over unpredictable futures are the rule. Uncertainty is seen as premised on entrepreneurial creativity, which requires intuition, foresight, flexibility, experiential judgment, rules of thumb and so on. Turbulence and contingency, as produced by global trade, innovation-based competition and floating exchange rates do not mean threatening uncontrollability, but lack of limits, room for manoeuvre, opening up of possibilities.

The most immediate interface between neoliberal rationality and technoscience is represented by regulation. Biotechnology patents, for example, regard a living entity as an artefact if its basic functional parameters can be controlled (thus reproduced), establishing a correspondence between information and matter, so that rights in property over information can be subsumed into rights in property over the organisms incorporating such information, and vice versa (Carolan 2010). We are therefore facing ontologically ambiguous entities, oscillating between materiality and virtuality.

A further ontological ambiguity stems from the claim that patented artefacts are indistinguishable from nature for any practical purpose (including the need of specific regulation). Artefacts are thus simultaneously identical to and different (more usable, more valuable) than natural entities. Patents, in short, produce indefinite entities, simultaneously material and informational, ontological and epistemic in character, the economic value of which resides precisely in this ambivalent status (Pellizzoni 2011).

Carbon trading provides another example. The possibility of markets in permits to emit greenhouse gases (GHGs) or in credits earned by not emitting them rests on the operators’ acceptance of a conversion rate between CO₂ and other GHGs: the “global warming potential” (GWP), as established by the International Panel on Climate Change (IPCC). Reducing one’s CO₂ emission or buying credits sold by someone else who,

somewhere in the world, is reducing another GHG is assumed as (physically, thus also financially) equivalent (MacKenzie 2009). Therefore GWP is an abstraction, like money, since it works as an exchange rate. Yet, it is also something bound (not) to happen in the atmosphere, a(n allegedly) prevented physical thing or phenomenon. In short, GWP is an ontologically indeterminate entity, oscillating between reality and virtuality, matter and symbol, concreteness and epistemic construction. Weather derivatives (possibly the most evident example of how biophysical uncertainty can be transformed from trouble into asset) work precisely in the same way, being designed to hedge and trade securities contingent on unpredictable states of weather, either catastrophic or not.

Regulation has been and still represents a crucial avenue to the interpenetration of neoliberal rationality and technoscience imagination and application. The dominant socio-cultural milieu, however, permeates technoscience beside and beyond regulation. One example comes from geoeengineering, and namely from the still largely prospective and as yet unregulated field of “solar radiation management” (SRM) (Royal Society 2009; Macnaghten and Szerszynski 2013). Techniques aimed at reducing the net incoming solar radiation by deflecting sunlight or by increasing the reflectivity of the atmosphere, of clouds or the Earth’s surface seem apparently to belong, whatever their technical novelty, to the traditional family of techno-fixes.

There is, however, a major difference. Given the constitutively indeterminate, open-ended character of the system on which SRM aims to intervene, talking of control, even in probabilistic terms, seems inappropriate. To “control” means to keep the behaviour of a system within predefined parameters. Here we could, at best, talk of capacity to react and adapt – on the spot, moment by moment – to the constant swerves of the system. Even in ideal conditions of technical capacity the idea is, once more, of “riding” uncertainty rather than “managing” or “coping with” it.

5. Conclusion

In this contribution I provided some preliminary remarks for an inquiry into new materialism and, more broadly, the ontological turn in social theory. We have seen that cutting-edge technoscience plays a central role in grounding and legitimizing an account of the biophysical world and human agency that takes distance from both traditional realism and cultural constructivism. We have seen that the conceptual exchange between social theory and different biophysical science fields, in itself hardly a novelty, is characterized by a marked tendency to shift from “as” to “is”, downplaying the conventional aspect of scientific accounts and the metaphorical character of their transfer to different domains. We have also seen that explaining this in terms of intellectual disputes and theoretical oscillations between realism and constructivism tells only part of the

story. The other is likely to be found in a deeper, broader socio-cultural change. A number of indicators suggest that this change begins to gain salience in the 1970s and corresponds, both in terms of chronology and of the rationality at work, with the profound social and cultural restructuring engendered by the transition to post-Fordist, financial capitalism and the advent, spread and strengthening of neoliberal rule.

The precise way in which the link between this socio-cultural transition and the intellectual shifts occurred in specific areas of inquiry in the biophysical and social sciences have to be accounted for is a difficult question, on which only empirical studies may shed light. Whatever the outcome, the main suggestion of these notes is that analyses of the specific influences and conceptual transfers between scholarships – be they mediated through academic curricula, department organizations, funding schemas, integration of intellectual traditions⁶ or other mechanisms – should not neglect another sort of inquiry, focused on more fundamental movements in ontological and deontological beliefs.

From this viewpoint I think that a relevant indication is offered by the importance given by new materialists to the sheer power that current technoscience is able to express: “the extraordinary challenges and perceived success of so much scientific and technological research” (Kirby 2008, 7). It is the meaning of this “success” – its underpinnings, necessity and implications – that should be interrogated, beginning with its connections with the “operational paradigm” – the paradigm by which being and doing, existence and its actual effects, are inseparably connected – which Giorgio Agamben (2013) places at the grounds of Western modernity.

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⁶ For example, the impact of French post-structuralism on the intellectual life in the US is well documented by Cusset (2008).

References

- Agamben, G. (2013) *Opus Dei. An Archeology of Duty*, Stanford, CA, Stanford University Press.
- Amin, A. and Thrift, N. (2005) *What is left? Just the Future*, in "Antipode", 37 (2), pp. 220-238.
- Azmanova, A. (2010) *Capitalism Reorganized: Social Justice after Neo-Liberalism*, in "Constellations", 17 (3), pp. 390-406.
- Barad, K. (2003) *Posthumanist Performativity: Toward an Understanding of How Matter Comes To Matter*, in "Signs: Journal of Women in Culture and Society", 28 (3), pp. 801-831.
- Barad, K. (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham, NC, Duke University Press.
- Bennet, J. (2010) *Vibrant Matter. A Political Ecology of Things*, Durham, NC, Duke University Press.
- Boltanski, L. and Chiapello, E. (2005) *The New Spirit of Capitalism*, London, Verso.
- Burawoy, M. (2005) *For Public Sociology*, in "American Sociological Review", 70 (1), pp. 4-28.
- Calvert, J. and Fujimura, J. (2011) *Calculating Life? Duelling Discourses in Interdisciplinary Systems Biology*, in "Studies in History and Philosophy of Biological and Biomedical Sciences", 42 (2), pp. 155-163.
- Cambrosio, A., Bourret, P., Rabeharisoa, V. and Callon, M. (2014) *Big Data and the Collective Turn in Biomedicine: How Should We Analyse Post-Genomic Practices?*, in "Tecnoscienza – Italian Journal of Science & Technology Studies", 5 (1), pp. 11-42.
- Carolan, M. (2010) *The Mutability of Biotechnology Patents: From Unwieldy Products of Nature to Independent "Object/s"*, in "Theory Culture & Society", 27 (1), pp. 110-129.
- Castree, N. (2008) *Neoliberalising Nature: The Logics of Deregulation and Reregulation*, in "Environment and Planning A", 40 (1), pp. 131-152.
- Centeno, M. and Cohen, J. (2012) *The Arc of Neoliberalism*, in "Annual Review of Sociology", 38, pp. 317-340.
- Colebrook, C. (2008) *On Not Becoming Man: The Materialist Politics Of Unactualized Potential*, in S. Alaimo and S. Hekman (eds.), *Material Feminisms*, Bloomington, Indiana University Press, pp. 52-84.
- Coole, D. and Frost, S. (2010) *Introducing the New Materialism*, in D. Coole and S. Frost (eds.), *New Materialisms*, Durham, NC, Duke University Press, pp. 1-43.
- Cooper, M. (2008) *Life as Surplus: Biotechnology and Capitalism in the Neoliberal Era*, Washington, University of Washington Press.

- Cusset, F. (2008) *French Theory. How Foucault, Derrida, Deleuze & co. Transformed the Intellectual Life of the United States*, Minneapolis, University of Minnesota Press.
- Deleuze, G. (1994) *Difference and Repetition*, New York, Columbia University Press.
- Deleuze, G. and Guattari, F. (1987) *A Thousand Plateaus: Capitalism and Schizophrenia*, Minneapolis, University of Minnesota Press.
- Dolphijn, R. and van der Tuin, I. (2012) *New Materialism: Interviews & Cartographies*, Ann Arbor, MI, Open Humanities Press.
- Dupuy, J.-P. and Grinbaum, A. (2004) *Living with Uncertainty: Toward the Ongoing Normative Assessment of Nanotechnology*, in "Techné", 8 (2), pp. 4-25.
- Escobar, A. (2007) *The "Ontological Turn" in Social Theory. A Commentary on "Human Geography Without Scale"*, in "Transactions of the Institution of British Geographers", 32 (1), pp. 106-111.
- Escobar, A. (2010) *Latin America at a Crossroads*, in "Cultural Studies", 24 (1), pp. 1-65.
- Esposito, R. (2011) *Immunitas: The Protection and Negation of Life*, Cambridge, Polity Press.
- Fleck, L. (1979) *Genesis and Development of a Scientific Fact*, Chicago, University of Chicago Press.
- Foucault, M. (1980) *Truth and Power*, in M. Foucault, *Power/Knowledge. Selected Interviews and Other Writings 1972-1977* (edited by C. Gordon), New York, Pantheon Books, pp. 109-133.
- Foucault, M. (1997) *Polemics, Politics, and Problematizations*, in M. Foucault, *Ethics. Subjectivity and Truth. Essential Works of Foucault 1954-1984 – Volume One* (edited by P. Rabinow), New York, New Press, pp. 111-119.
- Foucault, M. (2001) *Fearless Speech* (edited by J. Pearson), Los Angeles, CA, Semiotext(e).
- Foucault, M. (2007) *What is Revolution?*, in S. Lotringer (ed.) *The Politics of Truth*, Los Angeles, CA, Semiotext(e), pp. 83-95.
- Gould, S. J. (2002) *The Structure of Evolutionary Theory*, Cambridge, MA, Harvard University Press.
- Grosz, E. (2005) *Time Travels: Feminism, Nature, Power*, Durham, NC, Duke University Press.
- Hansen M. (2000) *Becoming as Creative Involution? Contextualizing Deleuze and Guattari's Biophilosophy*, in "Postmodern culture", 11 (1), pp. 1-42.
- Harvey, D. (2005) *A Short History of Neoliberalism*, Oxford, Oxford University Press.
- Hayles, N.K. (1999) *How We Became Post-Human*, Chicago, University of Chicago Press.

- Hayles, N.K. (2006) *Unfinished Work. From Cyborg to Cognisphere*, in "Theory, Culture & Society", 23 (7-8), pp. 159-166.
- Hekman, S. (2010) *The Material of Knowledge. Feminist Disclosures*, Bloomington, Indiana University Press.
- Hird, M. (2004) *Feminist Matters. New Materialist Considerations of Sexual Difference*, in "Feminist Theory", 5 (2), pp. 223-232.
- Jessop, B. (2002) *Liberalism, Neoliberalism and Urban Governance: A State-Theoretical Perspective*, in "Antipode", 34 (3), pp. 453-471.
- Keller, E.F. (2002) *Making Sense of Life. Explaining Biological Development with Models, Metaphors, and Machines*, Cambridge, MA, Harvard University Press.
- Keller, E.F. (2007) *Contenders for Life at the Dawn of The Twenty-First Century: Approaches From Physics, Biology And Engineering*, in "Interdisciplinary Science Reviews", 32 (2), pp. 113-122.
- Keller, E.F. (2011) *Towards a Science of Informed Matter*, in "Studies in History and Philosophy of Biological and Biomedical Sciences", 42 (2), pp. 174-179.
- Kirby, V. (2008) *Subject to Natural Law. A Meditation on the "Two Cultures" Problem*, in "Australian Feminist Studies", 23 (55), pp. 5-17.
- Koopman, C. (2013) *Genealogy as Critique. Foucault and the Problems of Modernity*, Bloomington, Indiana University Press.
- Koyré, A. (1965) *Newtonian Studies*, Cambridge, MA, Harvard University Press.
- Lakoff, G. and Johnson, M. (2003) *Metaphors We Live By*, Chicago, University of Chicago Press.
- Latour, B. (2004a) *Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern*, in "Critical Inquiry", 30 (2), pp. 225-248.
- Latour, B. (2004b) *Politics of Nature*, Cambridge, MA, Harvard University Press.
- Latour, B. (2005) *Reassembling the Social. An Introduction to Actor-Network Theory*, Oxford, Oxford University Press.
- Lave, R., Mirowski, P. and Randalls, S. (2010) *Introduction. STS and Neoliberal Science* in "Social Studies of Science", 40 (5), pp. 659-675.
- Lehn, J.-M. (2004) *Supramolecular Chemistry: From Molecular Information towards Self-Organization and Complex Matter*, in "Reports on Progress in Physics", 67(3), pp. 249-265.
- Lemke, T. (2003) *Foucault, Governmentality and Critique*, in "Rethinking Marxism", 14 (3), pp. 49-64.
- MacKenzie, D. (2009) *Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets*, in "Accounting, Organizations and Society", 34 (3-4), pp. 440-455.
- Macnaghten, P. and Szerskyski, B. (2013) *Living the Global Social Experiment: An Analysis of Public Discourse on Solar Radiation Management and Its Implications for Governance*, in "Global Environmental Change", 23 (2), pp. 465-474.

- McNeil, M. (2010) *Post-millennial Feminist Theory: Encounters with Humanism, Materialism, Critique, Nature, Biology and Darwin*, in "Journal for Cultural Research", 14 (4), pp. 427-437.
- Mirowski, P. and Plehwe, D. (2009) (eds.) *The Road from Mont Pelerin: The Making of the Neoliberal Thought Collective*, Cambridge, MA, Harvard University Press.
- Mol, A. and Law, J. (2006) *Complexities: An Introduction*, in J. Law and A. Mol (eds.), *Complexities. Social Studies of Knowledge Practices*, Durham, NC, Duke University Press, pp. 1-22.
- O'Malley, P. (2004) *Risk, Uncertainty and Governance*, London, Glasshouse.
- Papadopoulos, D. (2011) *The Imaginary Of Plasticity: Neural Embodiment, Epigenetics and Ectomorphs*, in "Sociological Review", 59 (3), pp. 432-456.
- Pellizzoni, L. (2011) *Governing through Disorder: Neoliberal Environmental Governance and Social Theory*, in "Global Environmental Change", 21 (3), pp. 795-803.
- Pellizzoni, L. and Ylönen, M. (2012) *Hegemonic Contingencies: Neoliberalized Technoscience and Neorationality*, in L. Pellizzoni and M. Ylönen (eds.), *Neoliberalism and Technoscience: Critical Assessments*, Farnham, Ashgate, pp. 47-74.
- Pinch, T. (2011) *Review Essay: Karen Barad, Quantum Mechanics, and the Paradox of Mutual Exclusivity*, in "Social Studies of Science", 41 (3), pp. 431-441.
- Prigogine I. (1997) *The End of Certainty*, New York, Free Press.
- Read, J. (2009) *A Genealogy of Homo-Economicus: Neoliberalism and the Production of Subjectivity*, in "Foucault Studies", 6, pp. 25-36.
- Rose, N. (2013) *The Human Sciences in a Biological Age*, in "Theory, Culture & Society", 30 (1), pp. 3-34.
- Rouvroy, A. (2008) *Human Genes and Neoliberal Governance. A Foucauldian Critique*, New York, Routledge.
- Royal Society (2009) *Geoengineering the Climate. Science, Governance and Uncertainty*, London, The Royal Society.
- Schatzki, T., Knorr-Cetina, K. and Savigny E. (eds.) (2001) *The Practice Turn in Contemporary Theory*, London, Routledge.
- Sennett, R. (2006) *The Culture of New Capitalism*, New Haven, CT, Yale University Press.
- Stengers, I. (1987) *D'Une Science à l'Autre. Des Concepts Nomades*, Paris, Seuil.
- Tauber, A. (1997) *The Immune Self: Theory or Metaphor?*, Cambridge, Cambridge University Press.
- Weiss, D. (2000) *Posthuman Pleasures: A Review of N. Katherine Hayles' "How We Became Posthuman"*, York College of Pennsylvania, English and Humanities Department, http://faculty.ycp.edu/~dweiss/research/Posthuman_Pleas

ures.pdf (retrieved July 26, 2014).

Whitehead, A.N. (1978) *Process and Reality*, New York, Free Press.

Worster, D. (1990) *The Ecology of Order and Chaos*, in “Environmental History Review”, 14 (1-2), pp. 1-18.