Ecological thinking, material spirituality, and the poetics of infrastructure

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Abstract

This speculative essay pays tribute to Susan Leigh Star's thinking by engaging her attention to ecology, metaphor and spirituality in a terrain of contested knowledge and practice: contemporary soil ecology. Star's contrast between ecology and networks challenges the seductive metaphors of network extension in radical ways, and invites us to pay attention to 'spaces between' left unseen but that can disturb the workflow of productivist technoscience. Ecological thinking is also at the heart of Star's work on infrastructure, together with attention to invisible work. A metaphorical displacement of infrastructural analysis in naturecultural relations makes visible (soil) ecologies *as* infrastructural, alive with much more than material ecosystemic meanings. Star's call for including spirituality into our analysis can open ways for reading new forms of *naturecultural* material spirituality that are challenging a self-centred humanity and transforming our imagination of community. Finally, ecological poetics could be a name that articulates ecology, metaphor and spirituality as the on-going creativity of materiality and meaning at the heart of infrastructural ecological work. While following these moves, another legacy of Star's vision remains vital: to stay with the trouble of ambivalent *betweenness*, rather than seeking purification of our technofutures in pre-existent categories of right and wrong.

Introduction

When a scholar captures your affections, what is passed on to us is hard to fathom. Beyond theories, concepts and methods, we inherit gestures and ways of doing. This has been my feeling since joining the collective homage and mourning for Susan Leigh Star. Star's work has opened unusual ways of thinking and knowing for many of us. When I was a young feminist philosopher trying to understand the singular power of the sciences I first encountered the commonly named 'Onions Paper' (Star, 1991: 50) and the introduction to her edited volume *Ecologies of knowledge* (Star, 1995). These texts became foundational for me. More than a decade after discovering her work and only after some years of enjoying the privilege of her friendship I can hardly accept she's gone and that I am participating in posthumous celebrations of her. Rereading those writings, I longed to talk to her again, to tell her how astonished I was to realise I had forgotten how much was in them, the many lines of thought and seminal questions she had opened in early science and technology studies that are far from being closed, and mostly, how much her ways, and some of her insistent yearnings, have unwittingly marked me, shaped my own work, become part of the infrastructure of my soul. To put it in her own words when paying tribute to her teacher Mary Daly: within a 'subjective-collective', thinking is *weaving* (Star, 2009: 335) and the threads we weave with rarely belong only to us. But Star's influential gestures and ways of doing go well beyond what we usually call scholarly or *intellectual* knowing. She fostered particularly caring 'modes of attention'¹ to marginalised experiences that, as she always made explicit in her work in science and technology studies, were marked by radical feminist thinking. Part of the magic of her work and scholarship is thus an affectively charged politics of knowledge fuelled with love for seemingly unimportant but very tangible experiences, bodies and relations. And so I thought that in writing to celebrate her contributions I would engage with how Star's very singular knowledge politics had shape-shifting effects in our ways of knowing. I would explore how this might happen through her untamed and imaginative thinking, working in mysteriously affective ways. But in the process, shape-shifting happened again, bringing to me notions I had not expected. Reading some of Star's writings which I was unfamiliar with, those that focus on 'infrastructure' (Star, 1999; Star & Ruhleder, 1996), moved in unexpected ways my ways of thinking my current topic of research fixation: the contemporary collective reclaiming of the soil under our feet as a vital ecology. This essay speaks of how this led me to engage with relatively subtle dimensions of Star's scholarship: her attention to ecology, to metaphor and the relation of both to spirituality. What unfolds is a particularly powerful entanglement of ecological thinking and material spirituality, a form of 'ecological poetics' (Selby, 1997) at the heart of contemporary reclamations of the soil.

The essay starts by addressing Star's commitment to attention to marginalised experiences and how this relates to her preference for ecologies in contrast with the notion of networks. This lays out a questioning of the predominant atmosphere where ecology appears as a 'background' against which technoscience develops – allowing planetary ecologies to serve as field for network extension rather than obliging a responsive relation. A second section engages with alternative ways of thinking revealed by envisioning soil ecology as an *infrastructure*, and reflects on Star's practice of metaphor. Finally engaging with Star's call to integrate spirituality and community in science and technology studies, I focus on spiritual meanings of soil. The paper concludes with a reflection on *ecological poetics* as a possible naming for reimagining naturecultural spiritualities.

I. 'Spaces between'

oh seductive metaphor
network flung over reality
filaments spun from the body
connections of magic
extend
extend
extend

who will see the spaces between?

From *The Net*, S. Leigh Star, 1995

Star often interrupted the flow of thought and ideas with poems. *The Net* was included in her introduction to *Ecologies of Knowledge*, a foundational collection for the field of science and technology studies. These verses disrupt celebrations of virtual reality, the language 'of computer hype', a pervasive discourse at the time they were published. The poem slows down the triumphalism surrounding networking successes, expressing both fascination and hesitation about metaphors promising flights of spreading extension to our corporeal finitudes. It does so with a question: *who will see the spaces between?* Star's efforts to look after spaces between are well known. In spaces between she saw the violence and pain in the lives of the forgotten, the silenced, the erased, the invisible worker and her 'deleted' work, all residual categories like the 'none of the above' or not elsewhere classified; the 'anomalies', and all the singular experiences destroyed by bureaucratic mechanistic arrangements that privilege the norm. *The Net* calls for attention to see those spaces between, to interruptions in overconnected networks that reveal fissures in technoscientific cultures.

There is a commitment to justice in Star's workⁱⁱ. She knew what it means to be an outsider, however *within*, but she coupled this awareness with a sturdy sense of humour, never situating her outsidership on a higher moral ground. So though her particular path into the thinking of injustice is well revealed by the way she persistently asked *cui bono?* we should remember that Star's *cui bono* is very different from that of a *justifier*, or a righter of wrongs, very different too from a *cui bono* satisfied by suspicious debunking – *who benefits from the crime?* – driven by desire to reveal the hidden motives indicating that something may not be what it appears at first to be. I believe she would have identified the guilt and boredom at stake in these satisfactions – something to remember when we see moral punishment replace social justice. Star's commitment to justice has nothing to do with *adjustment*; on the contrary she'd rather question the bases of rule as, for instance, *The Category* (Bowker & Star, 1999). In other words, Star's pragmatics of investigating consequences at the margins is absolutely not reducible to exposing the benefits of those who have something to gain. Rather, if there is a moral calculus here it would direct us to realise the loss which comes upon us when we overlook other possible worlds hidden or silenced in marginalised spaces – including the fun of them! Further, this is not about a balance sheet between gains and losses; there is no equivalence.

This is because for Star, spaces between are not only about pain, violence and survival: these fissures are also about possibility. Spaces between are created when things fall off established charts, creating split-selves; multiple memberships in different communities of practice: new forms of living are born in spaces between. In negotiations within, and with these *uncharted belongings*, we create possibility. Attending to spaces between is also about fostering these possibilities. The feminist Chicana poet-thinker Gloria Anzaldúa reclaimed the Aztec word *Nepantla* to name a state of political and spiritual in-betweenness in which those marginalised and

oppressed by existing regimes engage in strategies of survival (Anzaldúa, 1987). Both Star and Anzaldúa were *nepantleras*, dwelling at the borderlands of existing categories, fostering a poetics of creative resistance in the middle worlds. This work is as important as attention to violence and pain because the interstices of alternative possibility are also obscured by seamless accounts of both technological progress and doom.

So to say that Star had a commitment to justice wouldn't by itself capture her mode of attention to marginalities. I have used in another context a notion of 'speculative commitment'—borrowing from Isabelle Stengers' work on speculative philosophy (Stengers, 2002) — to speak of Star's and other feminist scholars' singular contributions to science and technology studies (Puig de la Bellacasa, 2011). Trying to think how things would be different if we saw the world through *spaces between* indeed reveals a strong attachment to situated and positioned visions of what a liveable and caring world could be: Star did take sides (Star, 1991). But her commitment is *speculative* because she would let neither a given situation nor even her own position — i.e. an acute awareness of pervasive dominations and exclusions — confirm in advance what *is* or *could* be. I can nearly hear her saying: how boring would that be! The question '*who will see the spaces between?*' is thus a yearning to which no definitive answer can be given. We do not know, however *good* our intentions, whether we will be able to see spaces between. But also, perhaps more importantly, we do not know what spaces between *can become*. The fact that her hesitations about the liberatory feel of the network metaphor expressed in *The Net* comes as a question rather than a judgement exposes a singular carefulness in Star's commitment, an assumed vulnerability that contributes to the creative force of her affective knowledge politics. Rereading her renowned 'onions paper', I realised that, of course, Star had thought about this *indeterminacy* of commitment. Thinking with Howard Becker and with John Deweyⁱⁱⁱ, she affirmed that 'we involve ourselves in many potential actions; *these become meaningful in the light of collective consequences*, jointly negotiated'(Star, 1991:50, my emphasis).

One of these crucial collective negotiations of still indeterminate commitments is happening today around multiple sites of ecological breakdown faced by Earth's people — i.e. not only humans — raising questions of naturocultural justice rather than just 'social', read 'humanist'. In the light of these collective consequences I want to explore the challenges to speculative inquiry that Leigh's interpellation towards network thinking might pose. To the question: What *spaces between* are being created by the drive for extension of the very ontology of technoscientific networks? We might need to add this one: what creases and cracks are being created by the tensions between the power of creative networks and ecological relationships on Earth? It is Star's preference to speak of ecologies rather than networks that triggered this wondering.

II. Ecologies – 'networks-without-voids'

'A web is composed of filaments,
and a seamless web should be an oxymoronic term.
There is no empty space in a seamless web,
but our image of network is that it is filaments with space between.
For this reason I prefer ecology.' (Star, 1995:27)

Coming from a scholar whose work developed at the beating heart of the network kingdom — information and communication technologies — the persisting character of this ecological stance across her work has an enigmatic character. Less if we know how important was the metaphor of ecology for early 20th century Chicago sociology, the pragmatist philosophical roots of symbolic interactionist sociology in which Star was trained (see chapter 2 in Clarke, 2005; Clarke & Leigh Star, 2007)^{iv}. Of course, here ecology does not refer specifically to 'natural' ecosystems but to a particular form of relating. An ontology, with its correspondent mode of thought and attention

to ecological thinking, is here distinguished from network living and thinking. However the terms of distinction in the quote above are somehow enigmatic, they sound more like a poetic riddle hidden in an academic piece. This style works to ensure that the terms of reappropriation of this subtle critique of networks are left open. In other words, to turn this into a blanket judgement against the idea of networks (or of ANT), would be as much as blatant misreading as it would be to ignore the importance of the distinction at a moment when Star and other fellow (feminist) thinkers (such as Adele E. Clarke and Joan Fujimura) were voicing concerns about network thinking (*and* ANT). Not the least because Star's argument here was embedded in her work of gathering a volume with seminal interventions in STS at a time in which the concept of network is gaining importance in the field. While she is indeed making a point by asking the shape-shifters of the then emerging discipline not to 'simply create a professionalization movement with respect to non humans and thus becoming scientists in a way that often makes us uneasy', the invitation is radically open: 'let us change the way science is organized'. One way, she says, would be to engage in a 'reclaiming of the term network of some of its unfortunate *discontinuous* connotations and affiliations' to go for 'networks-without-voids for an ecological analysis' that would also be 'epistemologically democratic, including toward our own work organization' (Star, 1995:27).

Much could be unpacked from those words. In continuity with the attention to spaces-between, an ecological analysis of networks would involve imagining 'networks-without-voids'. In that sense we can see that ecological thinking is for Star deeply grounded in the attention to that which escapes dominant visions but is still *vital* for the living of a world. Together with this ontological point goes the fact that ecological thinking commits to foreground these spaces. Again this is illuminated by how, in her 'Onions paper', ecological analysis appears in contrast with network thinking and early ANT vocabulary:

Every enrolment entails both failure to enrol and a destruction of the world of the non-enrolled. Pasteur's success meant simultaneously failure for those working in similar areas, and a loss and world-destruction for those outside the germ theory altogether. (...) ... 'a stabilised network – and thus a 'successful' one - is only stable for those who are 'members'; and this involves the private suffering of those who are not standard members and the non members. (Star, 1991: 49)

Taking up Bruno Latour's example of the pasteurization of France, Star reminds us how Pasteur's networking success meant also *failure* and *loss*. It involved a '*world-destruction*' that didn't have to do with the scientific controversy between Pasteur and Pochet, but with the '*ecological effects* of Pasteurism and its enrolment'. Leigh mentions bodies of knowledge destroyed by germ theory and that are being reclaimed only now: 'immunology, herbal wisdom, acupuncture, the relationship between ecology and health'. We can also take from here that one of the roles of the epistemological democracy she was calling STS to foster includes paying attention to the ecological effects of network enrolment that can be perceived in spaces between.

Putting together Star's hesitations about the seductive metaphor of networks and her preference for ecologies invites is an invitation to think speculatively about what more could be said about the contrast between these ontologies/modes of thought. Together with other thinkers (feminist and beyond) in STS, Star was attentive to the exclusions produced by stabilised networks and their seductive extensiveness. *The Net* manifested how network thinking is in love with extension and circulation. Of course, *stabilisation* is key for the success of extending networks, but only until the next opening. The word of network is *alliance*, the provisional, the switchboard. Dimitris Papadopoulos has drawn my attention to the inherent *productivism* in the term network (Papadopoulos, 2011). Networks induce an addictive fantasy of freedom – well attuned to the 'free' global marketplace. Networks speak of particular ways of relating that of

drawing lines of connection between one point and other, leaving behind countless spaces as background for their agency flows. Agency and power are indeed distributed, yet never evenly. We must always remember, in Star's words, that a stabilised network – and thus a 'successful' one – is only stable for those who are 'members' – involving often the privatisation of pain for those who are not standard members, or non members at all.

An ecology, by contrast, evokes a site of intensities, synergies and symbiotic processes within relational compounds. Ecological circulation functions in cyclic interdependent ways rather than by extension. In contrast with the distribution and circulation of agency between multifarious agents that defines a network, what characterises an ecology is that the world it composes is inseparable from a certain *durability* of the *ethos* and practices at stake in a relatively stable territory (Deleuze & Guattari, 1987; Stengers, 1997). In other words, the dominant existential drive of an ecology is not so much to extend itself but to hold together resilient relationships – that are, of course, not necessarily nice, one need only to think of the intimate and interdependent relations between predators and prey (Stengers, 1997). Ecological thinking is attentive to the capacity of relation-creation and by how different beings affect each other, what they do to each other, the internal *poiesis* of a particular configuration. This is not to say that a focus on networks necessarily overlooks relations that hold together as stable but that extension remains the beating heart of network thinking. The very existence of the verb 'networking' exposes the particular quality of this dynamic mode of thought, as does the interest in alliances and connections (usually strategic). Finally, though relational thinking is common to both network and ecological thinking there is an important difference consistent with the attention to what holds together: speaking of ecology inevitably invokes life and death. Ecological thinking involves the acknowledgement of finitude (and renewal) and therefore a certain resistance to the deliriums of infinitude of extension metaphors. That is also why ecological thinking cannot avoid ethical and political thinking of consequences of world-destruction and, as a corollary, of the possibilities of regeneration.

Leigh had the art of 'staying with the trouble' as Donna Haraway would say (Haraway, 2010). While the task she gave to herself was to look out for the spaces between, and she never held back from expressing her views about injustice, she always spoke of our ambivalent relations to technodreams rather than purifying them into right and wrong. *The Net*, for instance, also speaks of yearnings for interplanetary connections that ICTs could allow to fulfil. In this spirit, the point couldn't be to infer that networks cannot be ecological nor that ecologies cannot benefit from networks. Thinking further, this contrast between network thinking and ecological thinking shouldn't lead to create a new binary but rather invite to engagement with the historicity of our concepts and imaginaries^v. The question is rather: can the contrast between ecologies and networks speak of different collective consequences of scientific and technological developments in the current state of ecological breakdown? The need to think the problem strikes me when ecological concerns become so easily translated into a lure compatible to network-extension and its perpetual futurosophy. One can think of the boom of 'sustainable' business. Look at how, today, the prevalent solution to ecological breakdowns is an *extension* of greentech markets. Here is *green* policy: does your house have a high carbon footprint? Install *triple* glazing; we will give you the money – never mind the tons of PVC *tripling* toxic trash. And what will be our stance when most expressions of doubt and concern about the desirability of a technology are easily dismissed as backward or *simplistic*, when reminders of the possible ecological destructions by extensions of a network are silenced by the orders of economic realism? And what happens to 'progressive' network thinking when we bring to the forefront the 'background stage' of technoscientific networks: that is, increasingly crushed planetary ecologies?

I have no answer to such questions *in general*, and in order to avoid moralistic binarism (its *either* networks *or* ecologies) I want to stay with how Star's work fosters modes of attention to think of networks in an *ecological* way rather than 'connectionist', that is, one that tries to avoid

instituting irrelevant ‘background stages’. We can do so by following a line of thought in which Star’s ecological thinking manifests fully: the ontological and ethical attentions she gave to ‘infrastructure’, intimately coupled with her care for the ‘residual’ categories and labours hidden (Star & Bowker, 2007). The next section thus continues this exploration of Star’s ecological thinking with an exploration of soil ecology as *infrastructure*.

III. The infrastructure of *bios* – the power of metaphor

‘Biology is an inexhaustible source of troping.
It is certainly full of metaphor, but it is more than metaphor.’

Donna Haraway (Haraway & Goodeve, 2000)

Experts in infrastructural analysis please forgive me for displacing this complex notion into an unlikely terrain: the soil below our feet. Yet I have to bear witness to the fact that ‘Steps for an Ecology of Infrastructure’ (Star & Ruhleder, 1996) as well as the methodological text ‘The Ethnography of Infrastructure’ (Star, 1999) provide a beautiful way to unpack the specific wonders of soil ecology. Thinking with these texts the final home of all residues appears as more than just an accumulation of dirt, more than the solid ground upon which we circulate: it emerges as a crucial infrastructure of *bios* (Puig de la Bellacasa, forthcoming 2013). The story can be told as what Geoffrey Bowker (quoted in Star, 1999: 380) has named an ‘infrastructural inversion’ – or should I say a *conversion*? It could be entitled: ‘How a city dweller discovered the magic of dirt between the pavements’. As Leigh and Rudheler note, people ‘do not necessarily distinguish the several coordinated aspects of infrastructure’ (Star, 1999: 381). This accounts for the ‘embeddedness’ of infrastructure, for the fact that it is ‘sunk into and inside of other structures, social arrangements and technologies’. The ecology of soil is embedded in the food we eat, the air we breathe, the water we drink. Most children of the scientific-industrial age rarely notice this. But lately more of us do as ecological activists have started talking of ‘peak soil’, that is a moment of global ‘resource collapse’ of this limited essential compound of lively matter, a far more looming devastation than any other ‘peak’ (Shiva, 2008; Wild, 2010).

So the personal infrastructural revelation was not that personal after all. Firstly, again, soil ecology is learnt ‘*through membership*’ – another characteristic of infrastructure according to Star and Ruhleder. For me the discovery of the importance of soil ecology that made soil pass ‘from background to topic’ came through encounters with a community, a ‘social world’ (Clarke & Leigh Star, 2007) of knowledge makers across multiple memberships and for whom soil has been topic for long: soil scientists, gardeners, ecological activists – and even indigenous people fighting the destruction of their land. Another characteristic of infrastructure: its particular ‘reach or scope’ always ‘goes beyond a single event or one-site practice’ (Star, 1999: 381). Infrastructure manifests its existence locally, through our material everyday relationships with it: though soil is everywhere, and the breakdown has become planetary, we can only engage locally with it. The calls for planetary awareness are thus often starting from the local level, creating interdependent discussions. Secondly, the infrastructural inversion happened at a ‘the moment of breakdown’, identified by Star and Rudheler as the moment when: ‘The normally invisible quality of *working infrastructure* becomes visible’. Something is not working well in our soil ecologies. As Star and Rudheler show, even the use of ‘back-up mechanisms’ further emphasises the occurrence of an infrastructural breakdown. We can think of the fertilisers industrially produced to repair poor soil, unable to nourish, revealing not only that something is gone wrong but further affecting infrastructural arrangement by their very intervention (i.e. further destroying soil ecology’s capacities for regeneration). In other words, if soil ecology was working and healthy, most of us could go just around without really noticing it. Noticing it is an event, what we do with that event is what matters: our responses are part of the relational infrastructural arrangement.

Within this general breakdown is a shift that is rearticulating, however slightly, a sense of community. A re-learning of soil as infrastructure is being fostered by scientists and ecologists (including 'lay' gardeners and farmers) for whom knowledge of the soil involves attending carefully to its inhabitants and its ecology.

Good organic farmers, and a few conventional ones, are acutely protective of their soil, treating it with the commitment, concern and empathy normally reserved for close family members. I have seen organic farmers sniffing and even tasting their soil, and disrobing its virtues with familiarity and affection. A handful of healthy soil can contain millions of life forms from tens of thousands of different species [...]. Pesticides, fertilisers, animal wormers [...] can all drastically reduce these populations, not by just a few percent but by 10 or even 100 per cent. Imagine the outcry from WWF if anyone could see the carnage.

So if you can't see the fungi, bacteria and invertebrates and you don't feel inclined or qualified to taste your soil, how do you know it is healthy? (Watson & Baxter, 2008: 14)

Depending on *who* is looking at soil and *for whom* that work is done some things are considered important and others not. Soil doesn't reveal the same aspects whether it is a scientist who looks at it through her microscope or a gardener who digs her plot – for a living or for fun. But there is something that joins them all. Neither sees soil as an irrelevant backdrop for burying the debris that networks of technoscientific leave behind while they reconnect to find 'solutions' (e.g. fertilisers). Their work is drawing attention to spaces between the pavements, bringing the '*backstage of elements of work practice*' to the forefront. This perception relates too with awareness brought in by ecologies of 'managing' excess. It is only relatively lately, late 20th century, that waste non-susceptible to decay has become a highly ethically charged category of matter. If it cannot become soil, we have a problem. But also, most interestingly, the meaningfulness is intensified of calls to care for the invisible, non human, labourers of the soil that make it possible (Lowenfels & Lewis, 2006). What is being indicated is that this mostly invisible infrastructure only lives and works well if we humans work and live with proper attention to processes of soil renewal, if we *live well* with its invisible workers, such as worms and microbial communities (i.e., by not pouring fertilisers and pesticides into their habitat).

The lessons emerging from the reclaiming of soil are in tune with Star's call for networks without voids: there cannot be such thing as an irrelevant background in an ecological worldview. Soil ecology is not an extensible network, an infinite resource, it is an infrastructural arrangement essential to life on this planet. Looking at this ecology as infrastructure involves thinking about modes of relationalities in interdependency, that is, some kind of community. The changes in the meaning we give to human's belonging to soil ecology might change the community itself. But to say so also reveals something about Star's approach to infrastructure: that it is not only about *materials* but also about meanings that are neither separable from, nor reducible to, what we usually conceive as materiality (Barad, 2007).

Before immersing into exploring these meanings, a word should be said about the effects of this somehow displaced appropriation of Star's understanding of infrastructure. Initially thought conceived to analyse the relational products of human actions and technologies, it reveals their potential to engage with a non human made world. But every good western thinker indoctrinated into secular science has been warned against anthropomorphism – or other such things as *hylozoism* 'an attribution of purpose, will and life to inanimate matter, and of human interests to the nonhuman' (Schaffer, 1991: 182). Indeed I can be held accountable here of something that we could call *anthroporganizationalism*: the attribution of human organisational practices to natural worlds. And it will not be enough a justification to claim that STS has widely questioned the

distinction human/non human both for analytical and political reasons. Indeed, there is still some trouble in compounding together without distinction all-things-non-human (Papadopoulos, in print). So what work is being done by the breach of specificity of my displaced engagement with infrastructure?

Maybe there is something in Star's work that presages why I have felt somehow 'authorised' to engage her notion of infrastructure in this way, to stretch it as a form of analysis into a naturecultural ecology. In displacing infrastructure, I could have also been taken by a quality of writing that makes of theory also a trope. In other words, Star's way of speaking of *infrastructure* has taken me as *metaphor*. Before examining further the consequences of this metaphorical use, we can look at what it involves in terms of elucidating her modes of attention. *Star-the-poet* belongs to a feminist clan of inspiring godmothers (among which are famous Haraway, Anzaldúa, Barad) exploring alternative ways of knowing our world, among which is a materialist understanding of meaning. Material worlds can be source of metaphor or trope which doesn't means, as Haraway warns, that they are *only* metaphor.

Star's poetics were not just contained in the poems she included in her writings. I have two very vivid impressions of gestures that affected me beyond the reading her work. One was how she had presented herself in a bio accompanying the programme of a talk she was giving. I was fairly struck by the fact that she presented herself *first* as a poet, and then as an academic. As a person struggling with my own academic identity – fearing its fairly isolating effects – I was inspired, feeling some relief that such a position was possible. Another vivid memory is that of her presidential lecture at the annual meeting of the Society for Social Studies of Science in 2006. There she told the story of a startled and enchanted encounter with a bob cat near her home. She described this moment of recognition between two earthy beings sharing the same grounds of life at the edge of radical alterity as the kind of interruptions that she invited us to *weave into* the thinking of technology. She didn't tell us how. The call was compelling in more mysterious ways. When telling the story in her soft voice, she interrupted the flow; one could have heard a feather fall. She had that power.

But more explicitly it is her work that affirmed metaphor as a powerful force, one that can build community by transgressing across splits. In her words:

Because we are all members of more than one community of practice and thus of many networks, at the moment of action we draw together repertoires mixed from different worlds. Among other things, we create metaphors – bridges between those worlds.

Power is about whose metaphor brings worlds together, and holds them there. It may be a power of the zero-point or a power of discipline; of enrolment or affinity; it maybe the collective power of not-splitting. Metaphors may heal or create, erase or violate, impose a voice or embody more than one voice (Star, 1991: 52).

What bridgings are produced by engaging metaphorically with infrastructure? Perhaps an ecological, relational-intensive, way of thinking infrastructural arrangements in naturecultures could include in the same breath ecologies and networks, relations and connections. But mostly, for me, what defying the perils of metaphorical *anthroporganizationalism* does to the ecologies of soil is to push us to acknowledge their importance as something that is being *made* (not given), not a 'resource' but an active organisation involving humans and non humans that requires our participation for its renewal and liveliness, not only for its use and consumption. Moreover, this infrastructure of *bios* processes many 'meanings' that most of us only have human ways of accessing: scientific research, gardening, agriculture, eating, composting. Other possible 'bridgings' could be happening in reclaiming of soil between ecological movements (understood in the largest sense possible), and the sciences of soil through what soil can mean across these

worlds. These involve some cosmopolitical recompositions (to borrow Isabelle Stengers' notion (Stengers, 2005)) by which different fields of practice are working towards a change in how we give care and attention to this overtly present, but relatively ignored world (*cosmos*). It is because these changes in material practices are not separable from changes in consciousness and meanings that in next section I follow Star's message about the bridging qualities of metaphor into another terrain that she invited us to explore: spirituality. I address the reclamation of soil through a 'spiritual' dimension rooted in its powerful metaphorical-material meanings. In turn, this contributes to a larger notion of a Star-inspired argument for ecological thinking: if ecology is infrastructure, spirituality might also be seen as infrastructural to ecology. And by *thinking spirituality as infrastructural* this ethereal term gains in thickness and flesh, exposing a rather *material* form of spirituality.

IV. Soil's messages – a material spirituality

We all come from the Goddess
And to her we shall return
Like a drop of rain
Flowing to the ocean

Chant of the Goddess, Reclaiming ritual chant

A rainbow of soil is under our feet:
Red as a barn & black as a peat.
It's yellow as lemon and white as the snow;
Bluish gray ... so many colors below.
Hidden in darkness as thick as the night:
The only rainbow that can form without light.
Dig you a pit, or bore you a hole,
You'll find enough colors to well rest your soul.

A Rainbow of Soil, F.D. Hole, 1985

The song above is by Francis D. Hole a professor of soil science, , renowned also for his lyrical approach to his object of study (Hole, 1988). The ritual chant comes from the spiritual-political neopagan movement, *Reclaiming* whose members have been involved in ecological activism as a way to restore relations with Earth – their focus of worship, the Goddess. Both songs introduce this section to indicate that there is more than a transformation in sociomaterial and economic practices at play in the shift of awareness with regards to soil ecology. A change in affections and consciousness, a change in the sense of community is occurring in which organised rationalities (sciences of soil, ecological movements) as much as mundane matters (the basic need of humans for food) are rearticulating imaginaries of human belonging. I am mostly thinking with people who attend to the soil as an organic living habitat. However it is more widely that the living aspect of soil manifests a powerful metaphorical edge that mingles with the spiritual, and not only in 'western' culture. This being the culture I know better, and of which much has been told about its compulsive separation of human beings from the 'natural', it is the Judaeo-Christian theological weight of mud that comes to my mind when seeking to tell a spiritual story about the infrastructural quality of soil for earth's communities.

The Creation of Man Meister Bertram - Grabow Altarpiece, 1375-83

The old testament tells us that God created and shaped man from the earth's matter. Adam, the first man, is named after the masculine derivation of a particular type of earth found in the Middle East, reputed to be 'ruddy', recalling the colour of blood. Here even the nouns for acre, ground, land take their name from this colour: 'adhamah' being the *feminine* root of the word – derived from Akkadian into Hebrew (Botterweck, Ringgren, & Fabry, 1997: 76). No comments needed here on how this hierarchical derivation contradicts the storytelling of woman coming from the rib of man. This account attests to what is common among many creation stories in which humans were initially modelled by gods from mud or clay – the very Latin word *human* comes from earth, ground, soil: *humanus*, humus. Soil is where organic life begins – literally - and where all life ends – dust to dust, decay.

Soil rhymes with *soul* (McIntosh, 2004). That might say it all. Some basic material truth lies in this metaphorical derivation into the spiritual dimension of soil: the fact is that we humans, like most other complex living organisms on this planet, live on the food we grow from the soil. This organic spiritual meaning of soil is explicit in western movements of neo-pagan spirituality for which working with the soil is a basic practice of *caring* for the Earth Mother (Puig de la Bellacasa, 2010), attending to a body to which all things return. Here worship involves a form of everyday ecological activism, developing material modes of attention to current breakdowns in the webs of life. Caring properly for the soil requires relearning to *know* it as a *living community*.

Earth-honoring agriculture would generate abundance, but its primary intention would be not to grow profits, but rather *to grow soil* – living, healthy, complex soil – as a fertile matrix for living, vital, health-sustaining food. To grow soil, we need to appreciate and understand that soil is a living matrix of incredible complexity, the product of immense cycles and great generative processes. (Starhawk, 2004: 161, my emphasis)

Starhawk is a spiritual neopagan activist deeply committed to organic forms of working with soil such as permaculture as a coherent engagement with Mother Earth not just as a symbol for ecofeminist spirituality but a material entity of which humans are part. Something these eco-activists voices are insisting on is on the value of a very active community labouring hard in the growing of soil, and they are relying on the new sciences of soil ecology to do this. The spiritual and scientific 'messages' of soil meet here to encourage a different relation with soil, as a living world rather than merely a resource (Ingham, 2004). Thickening the Judaeo-Christian tale, we could then add that the scientific meaning of *humus* is not strictly synonymous with soil, but only *one* component of soil, its most nourishing component, the sturdy stable end product of laborious processes of decomposition and decay made possible by lively soil communities. Could this knowledge invite acknowledgement of worms et al. as co-creators of *human's* very matter? The point here is that in these forms of neopagan spiritualities, the binary spiritual/material is

radically put into question. Soil is not seen as dust, or dirt, to receive humans after death, nor is a soulless inert matter shaped by god and infused with spirit to create a soulful form (humans): soil is in itself part of a living organic web of being of which many creatures including humans are part participating to, *working* for, its ongoing (re)creation.

We live on the invisible work happening in soil as infrastructure. But soil workers being mostly very small non humans, most of us only hear their messages through specialist spokespersons. One of the common difficulties in researching the two overlapping worlds of interest in science and technology studies – technocultures and naturecultures – is that the category of ‘non humans’ is highly differentiated. And so are their spokespersons: whether for pieces of software (technologists) or for biological beings (scientists). Who is bringing up the messages from the soil workers? Who is giving voice to the breakdown of soil’s nourishing capacities? Strong voices seem to be coming from a reappropriation of soil sciences by (everyday) ecological activists (Carlsson, 2008; Lowenfels & Lewis, 2006). They are intervening in the material-meanings of soil, seeking for more liveable spaces for humans and non humans at the heart of technoscientific productivism.

I have come to write about this cosmopolitical recomposing of naturecultural relations through the spiritual aspects of soil. One reason for this is that these aspects constituted an important aspect of the training in permaculture practices that played an important role in my personal experience of infrastructural inversion^{vi}. But also, because I am trying to find ways to listen to Star’s call in her introduction to *Ecologies of Knowledge*, to reintegrate two aspects into the thinking of science and technology: *spirituality* and *community*. In secular academia, pronouncing the word spirituality triggers all sorts of red lights and security alarms. It is my tribute to Star’s own call to bring up the word here, but also to bear witness that hers was a very material spirituality, non contradictory with her profound empiricism. It would be a lie to say that STS analysis is soulless (Latour, 1996). But paradoxically it looks as if we are often more at ease with recognising ‘souls’ and other spiritual manifestations in technoscientific networks and artefacts – the ghosts in the machines – than we are with other living actors in our ecologies. Maybe because ‘we’ create them? The fact is that in order to engage with some of the ongoing shifts in human-non-human relations for the sake of healthier ecologies of soil, we might need to stop separating these material practices from what *transcends* them. By this I mean not a supernatural world above ‘reality’, but what we could call, inspired by Leigh’s approach to infrastructure, an *infranatural* dimension: something that exceeds us individually and collectively, *but from within*. The question remains open about how to prolong Star’s call to reintegrate spirituality and the meanings we will give to it.

V. Cues towards an ecological poetics

*I went out to the hazel wood
Because a fire was in my head.*

W.B. Yeats, *The song of Wandering Aengus*

*And the birds of the air
And the beasts of the soil
And the fishes of the desperate seas
Will know who I am
And our substance will expand
As part of everything*

Jolie Holland, *Goodbye California*

Yet if metaphorical work is about the power to bridge, the word spirituality might not work particularly well in the context of the communities of membership with which I am speculating here. This doesn't mean it is out of the landscape but that it might produce adverse effects to the project. After all, how many soil scientists would recognise themselves in the statement that their sciences are feeding into forms of Earth worshiping? But more conceptually speaking, *spirituality*, as I have been reminded by Donna Haraway, is probably still bound to be an ill suited word for materialist meaning practices. The very word spirit is entrenched in a tradition of separation of spirit and body, mind and matter. By the way, she suggested, only half joking, and quoting her partner, the physics teacher, ecologist and radio director Rusten Hogness, that we could just call it *compost*. And we can then as David Abram suggests also return to the root of the word 'spirituality', spirit, related to *spirare*, to breath, to remind that every living being needs this breathing – including good compost^{vii}. Whatever path we might choose, Star's call does not settle into a single answer. Yet we can keep the question: how can the openings she produced by pronouncing the word 'spirituality' be included in our analysis?

I will not try to provide an answer but I can share some cues. One is in the very way Star articulated the question at the heart of the STS community. In *Ecologies of Knowledge*, the question of spirituality appears through her acknowledgment of belonging to and early training in a community of knowing:

'At first, feminist scholarship was so beleaguered, so new, and so dependent on emerging community that people from all fields were welcome. So the analysis of poets was equal to if not greater than that of scientists; the experience of an eighty-year-old woman as important for the critique as that of a twenty-five-year-old (although this certainly not without its own struggle, and there was an incredibly heterogeneity in the sorts of analysis brought to bear on issues....). This was coupled with an important inclusion and participation of feminist theologians – Mary Daly, Carol Christ, Rosemary Ruether, Nelle Morton, and others – who were not afraid to tackle questions of God/dess, the Absolute, power, Imagination, and so on.' (Star, 1995: 24)

Star admitted the presence of 'silly mysticism' or that silly mysticism became an easy accusation way to dismiss the potential of these experiences. But she insisted on the joys and troubles of 'not splitting': that is, in not making any of these questions and experiences irrelevant a priori. We can also read here Star's commitment to pluralism, epistemological democracy, and an enduring belief in the fertility of relating multiple marginalities and memberships. And thus we see that the thought of spirituality appears here with the spirit of a community becoming possible also because somehow invisible. *A space between*.

This leads me to a second cue suggested by how 'spirituality' appears framed in an early special issue of the feminist journal *QUEST*, from the very time Star is describing above:

'The contemporary women's movement has created space for women to begin to perceive reality with a clarity that seeks to encompass many complexities. This perception has been trivialized by male dominated cultures that present the world in primarily rational terms. *Reality is not only rational, linear, and categorized into either/or - it is also irrational and superrational. Because we do not have a new word for this struggle to comprehend this totality and incorporate that understanding into our action, we are calling it spirituality.*' (Davis & Weaver, 1975:2, my emphasis)

This second cue also leads us to a community open to multiple memberships and an experimentation with the arts of 'not splitting'. And it can be said that this kind of non-splitting practice by which a community is created is based on a form of *faith*, a suspension if not of

doubt at least of scepticism: *because we do not have a new word for this struggle*. Because, again, we do not know if we will become able to speak for the spaces-between we are articulating. That which Judy Davis and Juanita Weaver called spirituality is also that mysterious, unexplainable, and even irrational something because unknown, a something that always dwells in the possibility of a community to come. Because the world as we remake it, even with very old pieces, is always somehow new.

A third cue when looking for meanings and effects of spiritual openings was given me at an event in celebration and honour of Leigh^{viii}. I went there with the same question in mind: how to prolong Star's calls for spirituality? I thought I'd be walking on delicate grounds, but I had got it wrong. I was far from being the only one bringing the *infranatural* into the picture. In her opening address to a panel exploring the meanings of *Cui bono*, Karen Barad started by engaging with the material practicalities of her Jewish practice; Donna Haraway offered a view of the cosmic and artistic meanings of her favourite metaphor of *terrapolitical* relationality of the game of cat cradling as used in Native American creation of myths; Jake Metcalf's presentation brought us to shiver through the miracles of audiovisual technologies with the sounds of howling coyotes in the night, recorded in Star and Bowker's home in the Santa Cruz mountains.... There is definitely something in Star's call that has not been left unheard. A very material spirituality, or that-for-which-we-do-not-have-a-final-word, was definitely present at that gathering. And it was Geof Bowker who gave me a good cue to a word that might do, for now, for the something I'm trying to get at in the ongoing collective remaking of soil ecology when he evoked the work that Leigh and him had been doing lately on *the poetics of infrastructure*. I do not know what this work would have unfolded and will still unfold. But the very mentioning of that phrasing made me come back to how Star's modes of attention found their expression through poetry. As I mentioned above, her poetry is not only in her poems but also in how always an awareness of something that exceeds us finds a pathway through her work.

Poetics go beyond the art of writing poetry and the theory of it. *Poesis* is about making creatively. The quality of making speaks to the fact that poetry is not only *about* the world – or its metaphor – it is about *making* worlds. Poets who were dear to Leigh such as Adrienne Rich are celebrated for grounding their poetry in this belief. Also, and correlatively, poetics disturbs the contradiction between metaphor and truth. Characteristically, one of the words Leigh Star kept pronouncing, without irony, when writing at the midst of the most post-structuralist – or postmodern – times was truth: '*How can we say the truth about our lives?*' (Star, 2007) This commitment to something that could be called truth marks one of the singularities of her work but it is the embodiment of a particular form of knowing in which truth has nothing to do with the equivalence or congruence with a prefigured reality but more to the contribution to its making. Such is 'the pragmatism of truth' she advocated. A truth that is about effects rather than just interpretation. Her pragmatic of consequences is based on a pluralism of truths as the condition of community.

The intrinsically entangled power of truth - as metaphor – and *poesis* – as making worlds - are aspects the theologian and ecological activist Alastair McIntosh discusses wonderfully in his book *Soil and Soul*. One of the ecological struggles he recounts is the resistance to final naturecultural annihilation that accompanied the progression of the British interior empire into the Scottish ecology and economy through 'clearing the land' of its people and thus severing relations of the soil communities. But he also explores the surviving remnants of this oral culture, and its modern reclaiming, through the figure and the words of *bards*. This brings us back to the poet's craft. McIntosh reminds that the historical figure of the Bard was the vehicle of recording and transmitting history. These public-poets were respected scholars and somehow politicians - their spoken knowledge of truth disturbed the distinction of scholarship, politics and

poetry. But most importantly here, the bard, as is in other cultures the shaman, was deeply embedded in a connection with a community of beings which goes beyond our-selves:

‘To the poet, historical truth could not be separated from representation in the language of metaphor. As such it is a qualitative reality rather than a black- and-white absolute. History, to the mythopoetic mind, was not just literal; more importantly, it was also a very psychological and spiritual reality... (...) the bare bones of historical fact had to be fleshed out with illustrative meaning. In this way not just the truth but also the whole truth would be told... To such a mind, nature itself has a life beyond the one-eyed seeing that allows perception only of its mundane facets... Such, then is the (...) ‘otherworld’, existing not necessarily as some distant Eden... but interpenetrating the world all around us...’ (McIntosh, 2004: 72-73).

Of course McIntosh’s use of an almost banished culture to understand the present is in itself a *mythopoetic* endeavour, rooted in a process theology of perpetual recreation. A process theology in which there is no original nor final act of creation but an ongoing process in which all beings are involved. And this recreation is intrinsically word (metaphor) and matter. This is the type of creation that we can read as *poesis*: encompassing spirituality *and making* beyond the divide between spirit and matter. The poetics of infrastructure is *in* the world rather than about/above the world. Coming back to the breakdown of ecological futures, and thinking of the kind of membership and commitment that we can hopefully glimpse in the reclaiming of soil as a living ecology, we can think about contemporary attempts to explore an ‘ecological poetics’ as ways of expressing-recreating the *infranatural*. Giving the final word to the poets seems most appropriate here. Stuart Cooke, a researcher in ecological humanities as well as a poet writes:

I am looking at ways of *articulating ecological networks*, or of allowing energy to flow through language(s) in the same way that it flows constantly between different forms and materials in an ecosystem. Ideally, I’d like my language to graft onto the ecology in question. In order to do so, poetry must become as surprising, as fractured and as many-sided as any other member of a complex ecology. (Cooke, my emphasis)

This project involves a re-articulation between very different types work^{ix}. Nick Selby, speaking of Gary Snyder’s poetics, finds meanings for an ‘ecological poetics’ in the ‘striving for a visionary integration with the land’ this means necessarily for him ‘to mark the divorce between nature and culture... the split between word and world that is exposed in our work of reading these poems, and which can be read as a product of a capitalist economy of exchange’ and of western culture. He affirms that to ‘see the poem as work-place is to expose the workings of language, and to make fraught our relationship to the object world. *The ecological lesson ... lies, finally, in an attending to the fracture in the very guts of the real*’ (Selby, 1997, my emphasis).

I will miss Leigh till the day I join the worms. Yet her uniquely creative legacy is at work. We need her to help us read the cues towards an ecological poetics (or an ‘ecopoetics’ (Gander & Kinsella, 2012: 11)) that could *attend to the fractures* – spaces between – as a possibility for re-infusing spiritual-material meanings in our thinking and making of naturecultural infrastructures. My way of keeping talking to her is by engaging with her inspirational voice through her writings, to trust that she is still speaking through our weaving with her work. The integration of modes of attention that her *poesis* transpires between ecological thought, metaphorical bridging and material spirituality, coupled with her care for avoiding easy purifications, have much to offer to the *naturecultural* collective negotiations of ecological commitments at the heart of technoscience’s networks. Starting with challenging a human-centred sense of community.

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ⁱ I owe encountering the phrasing 'modes of attention' to Natasha Myers and Joe Dumit's invitation to think the 'Lag' in the panel they organised for the 2011 annual meeting of the Society for Social Studies of Science. This has the quality of invoking both an embodied sense of modes of perception and the quality of care, of paying attention and listening that were so characteristic of Star's person.

ⁱⁱ This commitment was explored and celebrated in the conference "The State of Science and Justice: Conversations in Honor of Susan Leigh Star" organised by the Science and Justice Working group in June 2-3 2011 at the University of California, Santa Cruz.

ⁱⁱⁱ I thank Adele Clarke for reminding me of Leigh's longstanding interest in John Dewey's philosophy.

^{iv} Thanks again to Adele Clarke for making me aware of this tradition and of the fact that Star borrowed the phrase ‘ecologies of knowledge’ from Charles Rosenberg (Rosenberg, 1979).

^v It would be relevant to see, though too lengthy to discuss here, how this speculative discussion of ecology sits with the current astonishing proliferation of the ecological metaphor in numerous spheres of thought and practice. Ecology is used indiscriminately to refer to any type of relational clusters and processes without any discussion of what is implied by the notion in contrast of the previously prevalent ‘network’ (examples of this gleaned here and there are: ‘data ecologies’, ‘media ecologies’, ‘industrial ecologies’). It does seem that ecology has become a predominant turn of speech – without necessarily implying eco-ethical regimes of living but maybe, rather sadly, naturalised relations.

^{vi} See <http://www.earthactivisttraining.org/>

^{vii} Thanks to Isabelle Stengers for reminding me about Abram’s take on the word spirituality. Stengers herself explores novel relations between modes of thought and experience spiritual, scientific and philosophical. See her text ‘Reclaiming Animism’(Stengers, 2012). See also Belgian anthropologist Benedikte Zitouni’s insightful statement on ‘ensoulment’ as a way to enhance the social sciences (Zitouni, 2012).

^{viii} Conference mentioned in note ii above: “The State of Science and Justice: Conversations in Honor of Susan Leigh Star”

^{ix} ‘Articulation’ was a dear concept to Star and her community. The concept of ‘articulation work’ in particular was developed by Anselm Strauss, with whom Star collaborated and who had a strong influence in her work (Strauss, 1988).