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Non/living Matter, Bioscientific Imaginaries and Feminist Technoecologies of Bioart

Marietta Radomska 

Department of Thematic Studies (Gender Studies), Linköping University, Linköping, Sweden

ABSTRACT

Bioart is a form of hybrid artistico-scientific practices in contemporary art that involve the use of bio-materials (such as living cells, tissues, organisms) and scientific techniques, protocols, and tools. Bioart-works embody vulnerability (intrinsic to all beings) and depend on (bio)technologies that allow these creations to come into being, endure and flourish but also discipline them. This article focuses on 'semi-living' sculptures by The Tissue Culture and Art Project (TC&A). TC&A's artworks consist of bioengineered mammal tissues grown over biopolymer scaffoldings of different shapes and require sterile conditions of a bioreactor and constant care in order to survive. The article explores how bioart-works are always already intertwined with multiple (bio)technologies and techniques of care and labour, forming specific feminist technoecologies that challenge conventional bioscientific and cultural imaginaries of embodiment and the relation between physis and techné. TC&A's sculptures expose life as the non/living: the processual enmeshment of the organic and inorganic, living and non-living, and growth and decay. The article argues that thinking with and through the feminist technoecologies of bioart mobilises philosophical inventiveness: not only does it problematise the entwinement of technology and biomatter and of culture and nature, but it also prompts us to rethink the ontology of life.

'Semi-living' sculptures made of bioengineered animal tissue, butterflies whose wing patterns were genetically modified, paintings grown from bacteria: these are but a few examples of bioart. Bioart (an abbreviation of 'biological art') may be briefly defined as a current of contemporary art that involves the use of biological materials (cells, tissues, organisms) and scientific methods, tools and procedures. While its roots can be traced back to the 1930s when artist Edward Steichen for the first time employed genetics as an art medium, bioart as a field has been growing in the context of contemporary bio- and nanotechnologies (cf. Mitchell 2010). Throughout the past 20 years in particular there has been an increasing number of bioartworks, and commentaries by both artists and critics, that argue for the importance of the

CONTACT Marietta Radomska  marietta.radomska@liu.se

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question of life, its manipulation, and related ethical dilemmas in the context of contemporary technoscience.

Bioartworks challenge Western cultural and bioscientific imaginaries¹ of sealed, self-contained bodies and the accompanying firm distinction between life and non-life, natural and artificial, and human and non-human. It is these binaries that – since the inception of Western philosophy – have not only served as key coordinates for ontology ('what exists') but also formed the ground for ethics: for example, being deemed 'human' or 'non-human' has meant being ascribed a different value and, therefore, being exposed to different treatment. As histories of sexism, racism, colonialism, speciesism and the destruction of the natural environment have taught us, not all humans have been considered 'human enough' and not all living beings have been ascribed the status of 'life'. Being expelled from the ontological status of the human or of the living entails consequences at the level of ethics (respective ways of treatment, e.g. exclusion, discrimination, exploitation). Moreover, the exploitation of humans and non-human forms of life is often interrelated. Thus, if feminist theory and practice aim to work against such mechanisms and processes, they also need to interrogate the ways Western thought defines both human and life in an ontological sense.

Bioartworks challenge conventional understandings of life as clearly distinguished from non-life and they expose an ontology of life ('what life is') where the living is immersed in a multitude of relations with its milieu: 'dead' yet organic elements; natural and artificial substances necessary for the 'creation' and maintenance of the artworks; laboratory setup; and last, but not least, (bio)technological procedures and protocols. In this way, bioartworks provide feminist thought with a space where Western habits of thinking about life are questioned in a playful, yet explicit way (cf. Lapworth 2015).

While grounding itself in the tradition of new materialism (e.g. Coole and Frost 2010), feminist posthumanities (e.g. Åsberg and Braidotti 2018) and Deleuzian feminist philosophy (e.g. Colebrook 2010; Grosz 2011), this essay aims to explore the ways in which bioart intervenes in our understanding of life's ontology. It is these perspectives that have demonstrated the relevance and urgency of the questions of matter, nature, the nonhuman and life for feminist theory. Thus, I employ an optics informed by feminist critiques of the conventional understanding of matter (as inert), the subject (as rational and autonomous) and the human (as superior to and independent from the nonhuman). I recognise the gendered and anthropocentric character of the traditional Western conceptualisations of matter, nature and the human, critically assessed by numerous feminist scholars (e.g. Haraway 1992; Irigaray 1985; Lovibond 2000; McCormack 2012). In other words, my investigation of an ontology of life exposed through bioart is premised on the feminist new-materialist and posthumanist rethinking of matter, nature and the human, always already informed not only by the above-mentioned critiques, but also by the situatedness of knowledge production (Haraway 1988) and the entwinement between ontology and ethics (Barad 2007).

On feminist technoecologies

In order to examine bioartworks' philosophical potential, I employ the concept of *technoecology* as my navigational tool: a device that helps to unravel bioart's potential for nuancing our comprehension of the ontology of life. Technoecology draws attention to the inherent entanglement of nature and culture, the entity and its milieu, the ecological

and the technological, as well as the dynamics and complexity of these multiple relationalities. In this way, technoecology forms part of the feminist new-materialist and posthumanities theoretical landscape: it can easily be compared to such concepts as, for instance, 'natureculture' (Haraway 1992), 'assemblage' (Deleuze and Guattari 2004), 'somatechnics' (Sullivan and Murray 2009) and 'transcorporeality' (Alaimo 2010): they all capture the linkage between nature and culture, and embodiment and technology, while nuancing – each in its own way – different aspects of this relation and its components.

The concept of technoecology consists of two compounds: 'techno', referring to technology and *techné*, defined as 'craft; practical knowledge; practice'; and 'ecology', the notion that is etymologically linked to *oikos* (Greek term for 'house, environment') and describes relations between living systems and their environments. In this article, the concept of technoecology relies on the recognition of the inherent relation between technologies and human and nonhuman bodies, put forward by feminist and queer scholars writing in the tradition of somatechnics. They describe this relation as 'a chiasmatic interdependence of *soma* and *techné*: of bodily-being (or corporealities) as always already technologised, and technologies as always already enfolded' (Sullivan and Murray 2009, 3). What they thus emphasise is 'the inextricability of *soma* and *techné*, of "the body" (as a culturally intelligible construct) and the techniques (dispositifs and "hard technologies") in and through which corporealities are formed and transformed' (3). In other words, technology is understood here as a dynamic force intertwined with human and nonhuman nature at the very level of ontology.

Furthermore, in the vein of Félix Guattari, 'ecology' refers here to a complex system of relationalities between entities and their environments, including 'the whole of subjectivity and capitalistic power formations' (Guattari 2008, 35). In *The Three Ecologies*, originally published in 1989, Guattari asserts – in a similar way to Haraway and other feminist scholars – that 'nature cannot be separated from culture' (29): the destruction of the natural environment cannot be comprehended or attended to in separation from the global economy of advanced capitalism, cultural changes, social and political crises, and individual human subjects. This multiplicity of relations and processes requires an ability to think creatively and 'transversally' (29). Thinking transversally means going beyond the separate boxes of disciplines (e.g. transgressing the border between art and philosophy) and remaining attentive to the ever-changing geo-political, social, cultural and environmental conditions. It is this ability to think transversally, critically yet creatively, that Braidotti (2006) calls for in her theorisation of ethics of sustainability, informed by the co-dependency of the human and nonhuman and working towards endurance and sustainable change in the conditions of advanced capitalism.

In the context of rising neoliberalism, Guattari, whose concepts Braidotti takes as a crucial inspiration, underscores the importance of collective action and conceptual creativity that are informed by respect towards difference and the recognition of ever-changing relations and processes. His take on ecology as the entwinement between nature and culture, human and nonhuman, and entities and their dwellings, converges with diverse feminist materialist conceptualisations of nature/culture, matter/meaning, and an emphasis on ethics, conceptual inventiveness and thinking beyond the limits of disciplines (e.g. Barad 2007; Braidotti 2006; Haraway 1991; MacCormack 2012).

The concept of feminist technoecology combines these perspectives: an understanding of bodies and technologies (in the sense of practices, applied knowledges, procedures,

and conventionally understood techniques, machines, and tools) as always already enmeshed with one another; and the notion of ecology as a dynamic complex of multiplex relationalities between processes, meanings, entities and environments.

Feminist technoecology delivers what we might potentially find in other concepts pertaining to feminist analyses of nature and culture: it attends to some of the aspects of the nature/culture relation addressed to a different degree in the case of, for example, the concept of somatechnics. Yet, whereas the latter emphasises the enmeshment of bodies (often theorised as implicitly human) and technologies, technoecology underscores *multiplicitous relationalities* between differential organic and inorganic matter, 'hard' and 'soft' technologies and techniques, as well as other power mechanisms and processes. Consequently, as an analytical tool, feminist technoecology concentrates on a meticulous examination of these complex relationalities and their dynamics.

In the context of bioart, technoecology attends to the enmeshment between the living and non-living that form part of bioartistic practices. Furthermore, technoecology allows for mapping out manifold relations between (bio)technologies, techniques of care, biopolitical mechanisms, scientific discourses, cultural imaginaries, and biological matter, which are all woven into the ways we approach (human and nonhuman) life on a daily basis. Thinking bioart with and through the concept of feminist technoecology mobilises philosophical creativity with its critical potential: not only does it problematise the entwinement of technology and biological matter and of culture and nature, but also prompts us to rethink the ontology of life.

On the non/living

Drawing on select examples from both bioart and bioscience, I suggest that describing what we conventionally call 'life' as the 'non/living' is a more suitable way to articulate the dynamics and necessary entanglement of the processes of living and dying and growth and decay (see Radomska 2016). The slash ('/') in the term non/living emphasises this entanglement and processual dynamics at work. As Barad explains in the context of her theorisation of time, space, and matter, the potential of the slash lies in 'indicating an active and reiterative (intra-active) rethinking of the binary' (Juelskjær and Schwenne- sen 2012, 19). Similarly, the slash in the non/living shows that the living and non-living (and life and death) are not a binary opposition, but are intra-active, dynamic, and enmeshed with one another. As I demonstrate below, bioartworks expose life as the non/living: the processual enmeshment of life with death and the organic with the inorganic. Simultaneously, technoecology – as an analytical approach to bioart projects – renders the non/living more specific and helps us understand the ways these pieces intervene in the conventional understanding of life.

In what follows, I concentrate on artworks created by the Tissue Culture and Art Project (TC&A), an Australian artistic duo formed by Ionat Zurr and Oron Catts in 1996. TC&A specialises in projects that involve the making of the 'semi-living'² sculptures consisting of bioengineered animal tissues seeded on biopolymer scaffoldings of various shapes. The duo has become increasingly known for the series *Victimless Utopia* (VU, 2003–2006), consisting of artworks that, in an ironic and provocative way, engage with technoscientific ideas of growing materials such as meat and leather in a laboratory. As the artists reiterate in numerous interviews, VU focuses on different forms of the consumption of

animal bodies. Although TC&A has been prolific in their output of newer projects exploring the issue of life in a biotech lab (e.g. *Futile Labor* (2015)), I have chosen to focus on *VU* for two reasons. Firstly, *VU* has gained a prominent place in the general public's awareness as a series of unusual artworks that deal with the futuristic scenarios of laboratory-grown meat and leather. Secondly, *VU* – unlike other TC&A's projects – challenges humans' hypocritical attitudes towards nonhuman life (e.g. concern with the destruction of tissues used in bioscientific research, combined with a disregard for nonhuman lives in industrial farming) in an explicit way. Posing the question of an ontology of life (what 'life' is) in the context of *VU* entails an ethical reflection (how we relate to that which is deemed 'life') and also, potentially, revisiting our everyday approach to different forms of life.

Looking at TC&A's artworks through the technoecological lens requires not only an analysis of the art projects, but also an attentive engagement with the cultural, philosophical, historical and techno-scientific contexts in which they are embedded or, in other words, a complex feminist technoecology of various entities and processes. In the following sections, I will first look at TC&A's background, the history of tissue engineering and current debates on laboratory-grown meat. All these components form part of the feminist technoecological analysis of TC&A's projects. I will then turn to TC&A's own take on the status of their works and a discussion of *DIY DVK 01*, a project that forms part of *VU* and, as I will show, brings to light both the hypocritical and contradictory human relation to nonhuman forms of life, and the entanglement of *physis* (matter)/*soma* (body) and *techné*. Finally, I will concentrate on a radically immanent ontology of life exposed through the feminist technoecological analysis of bioartworks and the potential they may open for a rethinking of ethics.

Technoecologies of tissue cultures: TC&A's historical background

The TC&A was initiated in 1996 as 'an on-going research and development project into the use of tissue technologies as a medium for artistic expression' (TC&A 2001). It was realised in collaboration with the Department of Anatomy and Human Biology, University of Western Australia (UWA) and the SCITECH Discovery Centre. Since the beginning, one of their major concerns has been 'the seamless interaction between living entity and nonliving entity outside of the human body', as well as the blurring of boundaries between organisms and their milieu (TC&A 2002). Through their works, TC&A examines the notion of living matter, its agency and death, while looking at how the connections and relations between entities play a substantial role in the formation of these entities. In other words, they explore the dynamics of the non/living to be encountered in a bioscientific laboratory (cf. Johung 2014). TC&A asks how the use of semi-living products may affect the risks connected with new and old technologies (traditional agriculture vs. biotechnology), and how shifting the mode of production from manufacturing to growing may influence the environmental issues inherent in the processes of both production and consumerism broadly considered.

Growing meat

The conceptual and material link between growing and manufacturing seems to be even more significant in the context of current scientific attempts to grow 'laboratory burgers'

(Ghosh 2013, 2015). In 2013, physiologist Mark Post and his team at Maastricht University revealed the outcome of their research: a stem-cell beef burger, which was presented and evaluated by food experts in London. At the time, the cost of producing such a burger was \$330,000 (Maastricht University 2015). Two years later (in 2015), it had dropped to \$11 per burger (Stone 2015). In cooperation with animal protein industry, Post and Maastricht University have launched *Mosa Meat*, a company that aims to improve the technology of growing animal meat in the laboratory and further reduce the costs so that bioengineered beef becomes commercially available within the next five years (Ghosh 2015). Laboratory-grown meat seems to be a long-awaited alternative from the point of view of environmental science experts. In a context where animal agriculture is responsible for at least 18% of worldwide greenhouse gas (GHG) emissions,³ the bioengineering of meat brings hope for a substantial reduction in the environmental costs: according to Tuomisto and Teixeira de Mattos (2011), culturing meat in a laboratory may reduce GHG emissions by 78–96%, land use by 99%, and water use by 82–96% in comparison to traditional animal farming (the percentages vary depending on the specific type of livestock).

However, as Post admits (and TC&A endlessly emphasises), growing animal tissue in a laboratory is not a cruelty-free procedure: it involves the use of foetal calf serum as an essential medium for culturing the tissue. Post hopes to develop a synthetic or plant-based alternative for the calf serum in the future, but it is worth remembering that currently laboratory-grown meat is not an ‘innocent’ product, it involves the procedure of killing: foetal calf serum is produced from the blood harvested from bovine foetuses that have been removed from the bodies of slaughtered cows. This aspect of culturing meat is often overlooked by the media and animal rights activists, such as Newkirk (2013) from PETA, who enthusiastically presents it as an ‘animal-friendly’ version of meat (cf. Baggini 2013). In their commentaries and work, TC&A underscores that such an uncritical and non-reflective vision of a utopia in which all meat is grown in laboratories seems as a gesture to be rather naïve, intrinsically humanist, and inscribed in the logic of capitalist consumerism, which transposes the violence onto less visible levels. Moreover, they suggest that tissue culturing and the production of semi-living entities on a massive scale could lead to the emergence of a ‘new class for exploitation’ (Catts and Zurr 2006, 5), where the exploited are not necessarily fully developed complex organisms but, instead, their fragments: cells and tissues. TC&A’s category of the semi-living, which describes an entity composed of living cells or tissues and non-living materials (biopolymer base), is also a form of the non/living. In this context, we may ask whether the ‘new class for exploitation’, invoked by TC&A, is in fact only a future scenario. Does it not, rather, form part of the present in which the non/living (of different kinds: cells, tissues, proteins, etc.) is already being manipulated and manufactured by both science and industry?

Tissue engineering: a brief history

TC&A’s work is directly rooted in the field of tissue engineering. An understanding of life as ‘technology’, or more precisely ‘technologies of living substance’ (Landecker 2007), that both gives rise to the idea of the manageability and manipulation of living matter at a molecular level, and contributes to the birth of biotechnologies, may be traced back to the very end of the nineteenth century when Jacques Loeb and other biologists were

conducting research on the physico-chemical basis of life (5). This work involved the *in vitro* culturing of tissues that had been isolated from their parent organisms. The growth of tissue outside of the body was demonstrated for the first time in 1907 by American embryologist Ross Harrison. While Harrison showed that the fragments of tissues could be sustained in a nutritious medium in a sterile container for a couple of weeks, Franco-American surgeon Alexis Carrel, who conducted his research on cells and tissues, succeeded in developing methods to sustain living tissue that was (almost) 'immortal' or 'permanent'. Since then the culturing of tissues has developed, become standardised, and is widely employed in biomedical research; it now forms one of the most important areas of biotechnology and this shift in importance has greatly affected the understanding of the cell and the body by both science and culture (13).

Currently, cells and tissues are no longer exclusively bound to bodies but have become plastic materials to be manipulated, shaped and sustained through technological means. While discourses around tissue engineering emphasise the merging of technology (laboratory procedures and practices) with biological matter, it differs from the *soma/techné* coupling conveyed by somatechnics. Whereas the former underscore the malleability of cells and tissues through the means of technology, the latter concentrates on the enmeshment of the biological and technological. Furthermore, feminist technoecology as a broader analytical lens not only recognises the soma-technical entanglement of biomatter and technology, but also emphasises the involvement and complexity of discursive and material factors and their temporal and spatial scales. It recognises a multiplicity of micro- and macro-processes (social, cultural, political, technoscientific, etc.) involved in the creation of bioartworks and the accompanying meanings.

Looking at the history of tissue culturing and its ethico-political dimension – as part of this feminist technoecological analysis – cannot be done without evoking the ways in which gender, race, and class are entangled in the history of medical research. The first human cell line, developed in 1951 in Baltimore by George and Margaret Gey, was named 'HeLa' after the person Henrietta Lacks, a poor black woman who died in 1951 of cervical cancer and who – without knowledge or consent – became the donor of the employed cells (cf. Skloot 2010). Thanks to techniques such as the freezing of cell cultures, the HeLa cell line has spread worldwide over the past few decades. Additional experiments during the 1960s resulted in the creation of hybrid cell cultures (the cells' cytoplasm and nuclei contained genetic material from different species). Thus, both the idea of immortality and the malleable and generative character of living matter were seen in a new light (Landecker 2007, 180–203).

Tissue bioengineering draws attention to several issues crucial to the rethinking of life as the non/living. Firstly, it points to the processual character of non/living matter: structures and functions are framed as the 'processes of duration' (von Bertalanffy (1952) cited in Landecker (2007, 13)), and physico- and biochemical processes are understood as the foundations of life. Secondly, tissue culturing demonstrates plasticity as an essential characteristic of non/living matter: its capacity to be altered and manipulated without resulting in its 'death', and its unpredictable transformations. Thirdly, cell lines and tissues grown in the laboratory expose temporality and duration as key features of life: generative physico- and biochemical processes extend beyond the lifespan of an organism, or even a generation. Finally, all these aspects deeply problematise the conventional understanding of both life and death, as two distinct, clear-cut realms. A feminist

technoecological approach recognises bioartworks' historical and cultural context, while paying attention to the enmeshment between nature and culture, and bodies and technologies.

Feminist technoecologies of semi-living sculptures

TC&A employs tissue engineering as a medium for artistic creation. They construct degradable biopolymer scaffoldings onto which the suitable cells are seeded. These constructions are placed in bioreactors and provided with nutrients and optimal growth conditions. The cells are selected according to their 'artistic quality' (i.e. their utility for a particular piece (Catts and Blunt 2001, 134–135)). As mentioned, the use of bovine foetal serum as a medium in creating semi-living artworks is necessary. It is currently impossible to substitute the serum with a synthetic alternative, which does not make the process cruelty-free and keeps the victims (i.e. slaughtered cows and unborn calves) undisclosed.

TC&A emphasises that their primary objective is to sustain the semi-living sculptures of different geometrical shapes, complexity, and sizes, 'for long periods', and, thus, to create a new class of artistic 'objects' which 'blur the boundaries between what is born/manufactured, animate/inanimate and further challenge our perceptions and our relations toward our bodies and constructed environment' (135). This blurring of boundaries, including the boundary between what is considered living and non-living, as the artists seek to demonstrate, is connected to the ways in which we approach the non/living. It interferes in the split between things that are alive and thus requires an adequate ethical response and mere non-living objects which do not involve the same approach. TC&A's sculptures—which are composed of living cells and inorganic materials and are entirely dependent on the laboratory setup (i.e. sterile conditions and nutrients) – not only challenge the traditional division between life and non-life, but also tackle the issue of ethical relations with these hybrid objects.

Furthermore, cases of contamination with fungi, bacteria, mycoplasma or viruses in tissue engineering are common and TC&A's artworks are no exception. Contaminants not only alter the appearance and behaviour of the tissue, but also interfere with the functioning of its cells, such as metabolism, growth, the structure of membranes and chromosomes (Ryan 2008). The elimination of the contaminant is often impossible to achieve without affecting or destroying the entire culture. In the case of contamination, the multiplication and growth of the microorganisms are entwined with the decay and death of the infected tissue. TC&A uses such incidental occurrences as part of their projects.

Looking at TC&A's bioartworks through a feminist technoecological lens draws attention to the ontological threshold between the living and the non-living, and demonstrates that the non/living cannot remain contained within clear-cut frames. Since tissue cultures are the colonies of cells growing outside of the host organism, the artworks aim at challenging the conventional understanding of the body and, consequently, making us enquire about our relation with differently (dis)embodied forms of the non/living. In this way, they contest the picture of the self-contained and proper body, characteristic of Western cultural and bioscientific imaginaries, which have been exposed and problematised by numerous feminist theorists and philosophers (e.g. Shildrick 1997, 2009).

Furthermore, feminist technoecology opens up questions that are political in kind: TC&A's artworks draw attention to the issues of the patenting of living organisms and

their fragments, the concomitant discourse of copyright and the dystopian, yet widespread, ideas of manageability, fabrication and total control over life (cf. Dixon 2009; Zylinska 2010). As the artists note, their projects seek to critique the increasing presence of the so-called 'engineering mindset' in the biosciences (Catts and Zurr 2012a). They argue that a 'single engineering paradigm' involves a perspective that perceives nanotechnology, synthetic biology, and neuro-engineering as means of guaranteeing (future) control over living matter and, consequently, permitting scientists to 'monopolise life' (Catts and Zurr 2012b, 151). TC&A uses irony as their artistic strategy in order to problematise and ridicule transhumanist dreams. The artists employ biotechnological tools and create objects that could be seen as examples of biodesign in that they use the same tools and procedures and mimic the standard bioengineering process. They do so, however, not with the aim of finding new technological solutions, but, instead, to disclose the logic of the 'governing of life' prevalent in the field of biodesign (cf. Catts and Zurr 2015)

A critique of anthropocentrism is often at stake in bioart; however, there is always a risk of it becoming a performative contradiction: despite their declarations of doing away with anthropocentrism, artists exercise power over nonhuman entities, which become the raw material to be manipulated and killed in the name of art. While there is always a chance of perpetuating anthropocentrism when seeking to offer a critique, it is important to look at different strategies of eliminating human bias, and their potential for imagining non-anthropocentric and non-speciesist understandings of the non/living.

TC&A's explorations

TC&A's artworks are not limited to the animal tissues, the materials on which they are seeded and the containers in which they are placed. They form part of an assemblage that includes the laboratory/exhibition setup, as well as the artists and audiences that participate in the decision-making process concerning the survival of a sculpture: its sustenance or destruction. For practical and sometimes legal reasons, as the artists claim, the artworks cannot be sustained forever. In this context, the killing of a sculpture – as TC&A often emphasises – can be seen as a specific gesture of care undertaken in multiple ways: for instance, by using chemical solutions, or touching the object and thus, contaminating it with microorganisms. Contamination directly contributes to the decomposition and death of individual cells and fragments of the tissue, although this does not mean that the material metamorphoses of the sculpture cease in the moment of contamination. Rather, the biological matter of the tissue becomes both the habitat and sustenance for the infecting microorganisms. The transformations of the tissue overlap with the growth and metabolism of the contaminants, while blurring the contours of each of these processes. The death of the semi-living artworks grown in the sterile conditions of a bioreactor simultaneously contributes to the flourishing of other non/living forms.

The non/living does not remain enclosed as separate, self-contained entities; it unfolds in numerous directions and manners. Observing artworks created by TC&A often means taking an active position in 'the performance of life and death' of the presented project. As the artists underscore, this draws attention to the issues of ethics and responsibility shared by both the artists and their audience. Yet, TC&A does not stop at pointing to ethics as a key field with which their works engage. The artists are also aware their projects

do not fit into conventional taxonomic categories. Instead, they dwell in an undecidable, monstrous space of the in-between. In this space, organs, tissues and cells that originally formed part of a complex organism from which they have been separated, continue to live under laboratory conditions and with extensive technological support. This technoecological space is not essentially human:

Much of this living biological matter can, in theory, be co-cultured and fused (cell fusion), or share its sterile environment (to varying degrees of success). Age, gender, race, species and location do not play the same roles ... as in other living bodies. (Catts and Zurr 2006, 2)

In this way, TC&A narrates not only the relationality between human and nonhuman organisms and their fragments, but also between the living and non-living, organic and inorganic, and *soma/physis* and *techné*.

While the artists' commentaries expose the relationality between different entities – components of bioart projects, the concept of the non/living underscores processuality. In the context of the non/living, entities can be seen as a coagulation of material forces or nodes in which intensities intertwine. They are themselves assemblages forming part of larger assemblages (like cells and tissues), which may be described as expressions of material forces (cf. Deleuze and Parnet 2002). There is no fixed boundary between the living and non-living, organic and inorganic, or life and death. They are transformations, processes enmeshed with one another. Thus, the relationality underlined by TC&A can be understood as an actualisation of a processuality that is constitutive of the non/living.

Feminist technoecologies of 're-life-ing'

TC&A's series *VU* (consisting of three sub-projects: *The Disembodied Cuisine*, *The Victimless Leather*, and *DIY DVK 01*) has been conceptualised to tackle the issues of animal consumption (in the form of both meat and leather), exploitation, and commodification. All three subprojects emphasise the biopolitical logic described by Wolfe (2012): the ongoing growth of phenomena, such as industrial farming, with its severe consequences for nonhuman animals, humans, and the environment, is accompanied by a technoscientific fascination with the idea of the 'victimless utopia'. In this context, the notion of 'victimless utopia' means a world in which biotechnologies and other scientific advancements guarantee the untroubled production of meat and leather without killing nonhuman animals (as exemplified in the research on culturing meat).

Here I exclusively focus on the third part of *VU*: *De-victimiser Kit (DIY DVK 01, 2006)*. *DIY DVK 01* is designed as an absurd device that allows people to deal with the feelings of guilt experienced when consuming meat (dead animal bodies) or after killing a nonhuman animal through the use of technology (Catts and Zurr 2006; Senior 2008, 79–82). In other words, the contraption is conceived as a 'vacuum cleaner' for conscience. The kit consists of a very simple tissue culture installation and is used to sustain, proliferate and extend the life of parts of the dead bodies, 'at least until the guilt recedes', as TC&A provocatively puts it (Catts and Zurr 2006, 8). This 'performative installation' is presented as a peculiar 're-life-ing' (or literally, bringing back to life) of fragments of the flesh of deceased animal bodies. Furthermore, the audience is encouraged to take part in the performance by both caring for the tissues and making decisions about which cultured tissues are to be maintained and which are to be killed. While telling the story of *DIY DVK 01*, the artists

emphasise its context: the project was originally carried out and presented in Barcelona, where, on the one hand, there is a tradition of bull-fighting that is subject to increasing local critique and, on the other, an increasing number of fast food restaurants that specialise in serving beef burgers (6).

TC&A sees the primary aim of the project in challenging the problem of human/nonhuman animal relationships (or, put differently, the hypocrisy of anthropocentrism) and the surrounding cultural imaginaries. As they point out, the death of an animal killed in *corrida* (i.e. for reasons deemed 'aesthetic') and of the one butchered for meat – regardless of the symbolic value ascribed in each case – boils down to the same thing: in both cases, the fate of the animal is determined beforehand. The unique character of the Barcelona edition of the project, given that it was arranged in this specific cultural and social context, consisted of 'bringing back to life' fragments of tissue taken from a fighting bull by seeding it onto a minuscule replica of a souvenir-shop statue of a bull (8). Subsequently, the tissue culture grown from the bull was compared with the tissue grown from meat sourced from a slaughterhouse. At the closing performance of *DIY DVK 01*, the viewers were encouraged to interact with the semi-living elements and, most importantly, to make a decision about which of them (the '*corrida* bull' or the 'beef cow') should be brought back to 'its cultural [ly] accepted position of dead meat' (8).

As TC&A notes, *DIY DVK 01* is designed as a nonsensical appliance that exposes our hypocrisy about living and non-living systems in an almost hyperbolic way. The contraption enables one to sustain 'life after life' or, as the artists suggest, to 're-life' the fragments of bodies that have been previously 'killed'. Its presumed aim, namely, the elimination of the feeling of guilt, which is considered to be more significant than the death of an animal, draws attention to the paradoxical character of the device. It shows that our own comfort matters more than the life or death of other creatures. The artwork reveals discrepancies not only in our (human, but hardly ever humane) approach to nonhuman animals, but also in our trust in and the popular understanding of the possibilities and limitations of biotechnologies, and the accompanying prospects and fears. By setting up the project in a manner similar to so-called DIY bio workshops,⁴ the artists draw attention to the importance of critical and ethical reflection that should accompany our engagement with the living substance in the context of bioart, DIY bio practices and last, but not least, everyday life.

Finally, *DIY DVK 01* contributes to a shift in the meaning of 'life'. Although the animal is killed in a *corrida* tournament, its cells and fragments of tissues may still be alive: they may multiply, be fed and sustained. In other words, the technoecology of *DIY DVK 01* exposes the non/living as uncontainable: it is not a life attributed to and enclosed in an individual body, but instead, an entanglement of material processes and transformations, of living and non-living that exceed the frames of singular entities, to which it was originally ascribed.

Thinking with semi-living sculptures: towards an ontology of the radically immanent non/living

TC&A's semi-living sculptures expose the question of the ontology of life in a way that corresponds to the problematics tackled in bioscience, which still struggles with the issue of locating the constitutive characteristics of life. Most biologists agree that life forms should

fulfil the following criteria: (1) the entity has a body; (2) it metabolises; (3) it reproduces; (4) it is capable of movement. Yet, what counts as life and how we account for life forms that do not fulfil the above-mentioned criteria are two questions that are still being discussed. For instance, in the case of viruses, the criterion of reproduction (combined with the passing on of hereditary information) is not necessarily valid because, in order to replicate, viruses need a host cell. Even more telling examples are prions, which do not contain any genetic material, and viroids, which consist only of circular DNA.

Along with the border between life and non-life, the concept of the non/living problematises the relation between living and dying, as it is exemplified by the dying tissues in TC&A's *VU* series. Once the bioengineered artworks become contaminated with bacteria and/or fungi, the death of individual cells and fragments of tissue overlaps with the growth of contaminants. Put differently, life functions and the very materiality of the tissues become resources for the infecting organisms. It is these tissues that serve as food, dwelling, and support system for the fungi, bacteria, and viruses that contaminate them. Life and death are not separate realms or fixed points. Instead, living and dying are processes: material forces that unfold, intertwine, and express themselves in what we evaluate as 'life' and 'death'.

The lens of feminist technocology helps us understand that the processuality of the non/living revealed through *DIY DVK 01* and other TC&A's projects requires an ontology that could attend to both the entwinement between organic matter and technology (captured in the earlier mentioned concept of somatechnics) and the enmeshment of the living and non-living. What thus is needed is an ontology that could account for its own 'flat' (i.e. non-hierarchical; DeLanda 2002) character on the one hand, and its multiplicity of processual differences, on the other. While the feminist technocological analysis of bioartworks performed here delivers such a framework, I suggest that this theorisation of ontology could further benefit from Gilles Deleuze's conceptualisation of life as 'radical immanence' – later adopted by Braidotti (2006) in her elaboration of life as *zoe*.

Defining immanence as 'radical' means that it cannot be immanent to or contained within anything else but itself. Deleuze's perspective is substantially indebted to Baruch Spinoza's understanding of ethics, according to which all entities and events are the diverse expressions of one 'substance' (equated with life). These different bodies (different 'modes of substance' in Spinoza's register) may affect other bodies and become affected by them. It is through these flows of intensity that bodies enter into relations with other entities, and thus increase their power. As Deleuze (1988, 22–23) underlines, encounters with other bodies are good for an entity insofar as they enhance that entity's power, dynamism, and composition. They are bad if they diminish the entity's power and contribute to its disintegration. From the Spinozian perspective, there is no transcendent agent or source of transformation. Rather, there is one radically immanent (non/living) substance that expresses itself in a multiplicity of relationalities: neither immutable nor rigid, but unfolding through modulations and affects: it is in a state of becoming where the processes of living and dying are always already intertwined.

Henri Bergson's concepts of duration and creative evolution, to which Deleuze refers, also contribute to the characterisation of immanence as 'the realm of creative processes and becomings' (Ansell-Pearson 1999, 12). In a way, creative evolution itself may be translated into the Spinozian question of 'what a body can do', which describes the creative forces of life, continuous, non-teleological processes of invention and re-invention, the

essence of which is becoming itself (12). Despite the fact that these 'creative energies of life', as Ansell Pearson argues, are 'canalised in specific bodies' (12), those bodies or species are not the final stage or a final goal. Creative evolution is ceaseless: it exposes 'life's own domain, which is reciprocal interpenetration, endlessly continued creation' (Bergson 1907, 195). Bergson shows that the notion of movement 'which is reality itself' (101) is crucial for an understanding of evolution as that which does not have any pre-established goal: 'evolution does not mark out a solitary route, ... it takes directions without aiming at ends, and ... it remains inventive even in its adaptations'. (114)

In his reading of Bergson, Deleuze argues that life is understood as the ongoing movement of differentiation, where movement is 'explained by the insertion of duration into matter' (1991, 94). Differentiation in this context means the actualisation of the life impetus (*élan vital*) – or, in other words, material forces – in an endless multiplicity of forms: entities, organisms, and processes. Furthermore, as Bergson argues, our attempts to comprehend life may give us partial views on what life is, but they can never exhaust the virtual potential of life:

Analysis will undoubtedly resolve the process of organic creation into an ever-growing number of physico-chemical phenomena, and chemists and physicists will have to do, of course, with nothing but these. But it does not follow that chemistry and physics will ever give us the key to life. (Bergson 1907, 36)

Understood thus, the processes of becoming refuse to remain contained within discrete, enclosed bodies any more than within the limited frames of theories or technologies of knowledge production.

While drawing on Spinoza's expressionism and theory of affects, and Bergson's focus on the creativity of life, Deleuze and Guattari propose an ontology that is monist, yet rhizomatic (c.f. Dolphijn and van der Tuin 2010). It is 'reducible neither to the One, nor to the multiple' (Deleuze and Guattari 2004, 23). Here, the multiple is tantamount to univocal. This unity, which comprises both organic and inorganic, animate and inanimate, and natural and artificial/technological – all of which compose the non/living – prioritises interrelations, motions, velocities. The plane of immanence is not constituted by separate entities categorised and organised according to binary, oppositional divisions. Rather, it emerges together with events, their accelerations and dynamics, as they take place. Events are produced through the interaction of forces. The framework of radical immanence provides the feminist technoecological perspective with a more nuanced and attentive approach to forces, movements, and multiplicitous processes that form part of the non/living.

More specifically, in Deleuze's work, life is understood not as an absolute immanence of the individual lives of subjects but, rather, the immanence of an indefinite life, the absolute singularity of 'a life' (2005) acknowledged as impersonal, material flows. Deleuze and Guattari's radical immanence is not constituted in reference to an outside: it is immanent only to itself and characterised by becoming (processuality) rather than being (immutable presence). Radical immanence elucidates the non/living: an enmeshment of the material processes of living and dying, composition and disintegration, and growth and decay, as they emerge in TC&A's semi-living sculptures. The non/living of TC&A's artworks is not entirely of a biological kind: the life functions of the tissues, their growth, and development take place through their entwinement with technology. The tissue cultures in *DIY DVK 01* and

other TC&A's artworks (like any form of biological matter maintained in a laboratory) require technological support without which they would not be able to survive. The framework of feminist technocology recognises this complexity and processuality of a bioartistic setup (together with its technoscientific, cultural and political contexts) and enables the unfolding of the concept of the non/living as that which captures these interconnections and processuality. Thus understood, the non/living problematises the binary categorisation of life and non-life with which we tend to frame and organise the world.

Conclusion

The aim of this article has been twofold: firstly, to examine the ways bioartistic practices (exemplified by TC&A's artworks) challenge conventional understandings of life and the body, and thus, how they contribute to a rethinking of the ontology of life; and secondly, to explore the analytical potential of the concept of feminist technocology and the ways it may help us flesh out an ontology of life exposed through bioart.

The technocological analysis of TC&A's artworks conducted here demonstrates that living and dying unfold in the same material space and are not isolated from one another. In a similar way, the human body is also a playground, where cells, tissues, and microorganisms (i.e. nonhumans) multiply, grow, degenerate, and die: these processes are simultaneous and interrelated. As a philosophical concept (Deleuze and Guattari 1994), the non/living works through the problem of the blurred boundaries between the living and non-living and life and death by exposing their processual entanglement. It elucidates life's uncontainability: material forces and processes through which these forces actualise and unfold exceed both individual bodies and the boundaries of that which is commonly deemed life or non-life.

Thinking with and through the feminist technocologies of semi-living sculptures, bioartistic practices involving audience participation and histories of tissue engineering not only problematises the dominant understanding of life (as a complex of processes common to all organic, self-contained entities) and the relation between the living and non-living, but also discloses and challenges our hypocritical and anthropocentric approach to nonhumans. Through their works, TC&A critiques the engineering approach to biomatter and life 'as raw material' (Catts and Zurr 2012b) that is increasingly present in such fields as biotechnology and biodesign. This does not mean that TC&A's own practices evade all instrumentalisation of the non/living, as they clearly involve the manipulation and moulding of the 'bits of life'.

Looking at this ambiguity characteristic of bioartworks with feminist technocology as a lens demonstrates the ways in which humans relate to the nonhuman in a broader sense: even the modes of relating that aim to be critical of human exceptionalism involve certain forms of subjection and exploitation of the nonhuman (in the form of both the exploitation of bodies and epistemological subjugation). Feminist technocological analyses show that the enmeshment of the living and non-living, and entities and their milieus form the ground for the understanding of life emerging from within TC&A's bioartworks. Simultaneously, what life means cannot be comprehended without the recognition of multiple technoscientific, historical, geo-political and cultural factors involved in the production of meanings. In line with new-materialist theorising, feminist technocology demonstrates that the revisiting of our understanding of life

needs to be accompanied by the reimagining of our modes of relating to both human and nonhuman life.

Notes

1. The concept of 'cultural imaginary' can be understood as a cultural fantasy landscape comprising a collection of images and ideas of the body and the subject as autonomous, contained and unified. This is directly linked to Rosi Braidotti's definition of the cultural imaginary as 'a system of representation by which a subject gets captured and captivated by a ruling social or cultural formation: legal additions to certain identities, images and terminologies' (Braidotti 2006; cited in Shildrick 2009, 62). Furthermore, I suggest that such systems of representation are involved in the formation of popular discourses on bioscience and biotechnologies.
2. TC&A employs the notion of the 'semi-living' to describe entities, such as cell lines, tissues or organs, that are grown in a laboratory and require sterile conditions and constant care (e.g. feeding, cleaning, etc.).
3. *Livestock's Long Shadow* (LLS), a 2006 report by the United Nations Food and Agriculture Organisation (FAO), estimates that animal farming is responsible for 18% of worldwide GHG emissions. According to environmental assessment specialists at the World Bank Group, Goodland and Anhang (2009), this evaluation is not accurate as it both underestimates and overlooks GHG emissions related to such factors as: animals' respiration; land use; undercounting of methane emissions; increase in livestock production (since 2002 as that was the data that the FAO's report was based on); undercounting of livestock in the official statistics (evaluated by the FAO in a different report from 2003, but not taken into account in LLS); not including the data concerning livestock-related deforestation and the fishing industry, among others. Goodland and Anhang argue that the correct estimate is 51% (2009, 11–15).
4. The term 'DIY bio', or 'do-it-yourself biology,' refers to the citizen-science-oriented initiative and movement that gathers individuals and communities who study biology and biotechnology beyond the frames of traditional research institutions and with the aim of popularising bioscience among those with no or little scientific training.

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Notes on contributor

Marietta Radomska is a Postdoc at the Department of Thematic Studies – unit Gender Studies, Linköping University, Sweden. She is the co-director of the Posthumanities Hub; founder of The Eco-

and Bioart Research Network, co-founder of International Network for Ecocritical and Decolonial Studies, and a founding member of Queer Death Studies Network. Her current research project focuses on ecologies of death in the context of contemporary practices of eco- and bioart. She has published in *Somatechnics*, *Angelaki*, *Praktyka Teoretyczna*, *Journal for Curriculum and Pedagogy*, among others, and is the author of the monograph *Uncontainable Life: A Biophilosophy of Bioart* (2016).

ORCID

Marietta Radomska  <http://orcid.org/0000-0001-8520-6785>

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