BST Body, Space & Technology

Brightwell, Celia 2025 Biotechnological Luxury and the Ageing Body: Neuralink and 'Forever'. *Body, Space & Technology*, 24(1): pp. 1–17. DOI: https://doi.org/10.16995/bst.18373

Open Library of Humanities

# Biotechnological Luxury and the Ageing Body: Neuralink and 'Forever'

**Celia Brightwell,** Chair of Digital Cultures, Technical University of Dresden, DE, celia.brightwell@tu-dresden.de

This paper develops a critique of the Neuralink brain-computer interface as an intended general population device through a reading of the short story 'Forever' (2020) by xenofeminist theorist and author Amy Ireland. It explores the co-constitutive relationship between ageing and technology, in which technologies are shaped by ideas about ageing, and ideas about ageing are shaped by technologies, through the figure of the 'grey cyborg.' By pairing literary analysis with a science and technology studies (STS) perspective, it examines how the ageing body is shaped through culture and technology. It focuses on the speculation that Neuralink will eventually contribute to 'unlocking human potential' through the preservation and enhancement of the human brain. The ideological framework that underwrites Neuralink is contrasted with the portrayal of a de-ageing technology in 'Forever.' This story centres a conflict between a wealthy male gerontocrat who has been 'de-aged,' and grey-haired female anti-immortality operatives that sabotage the technological gerontocracy infrastructure. Through my reading of this text as xenofeminist theory-fiction, I interpret the sabotage as directed not towards the material technology but instead the systemic power disparities that it risks entrenching. I argue that the story's network of ageing anti-immortality activists represents a feminist posthumanism capable of politicising the application of technologies such as Neuralink as a consumer device. By contextualising 'Forever' and Neuralink together, this paper challenges prevalent narratives about ageing and demonstrates how xenofeminist theory offers new possibilities for situating ageing with technology within broader critical understandings of bodies, technologies and their interfaces.

## Introduction

> 'We are already cyborgs.' – Elon Musk, 11 June 2023

When Elon Musk posted on X that 'we are already cyborgs,' he echoed the figure's recent resurgence in analyses of transhumanism (cf. Stefan Sorgner's *We Have Always Been Cyborgs* (2022)) and its earlier application within feminist critiques of science and technology (cf. Donna Haraway's 'A Cyborg Manifesto' (2016[1985])). Musk's Neuralink, a brain computer interface (BCI) that involves surgically implanting a chip to allow humans to cognitively control a computer or mobile device, is a prototypical cyborgian technology. BCIs such as Neuralink are connected to a suite of technologies that aim to solve the 'problem of human mortality' (Wu and Rao 2017). The company's stated mission is to 'create a generalised brain interface to restore autonomy to those with unmet medical needs today and unlock human potential tomorrow' (Neuralink, n.d.). This paper focuses on the latter goal to unlock human potential. Musk also focuses on a futuristic tomorrow, describing Neuralink's 'overall aim' as being a more 'general population device' (Regalado 2020). While Musk and Haraway may both agree that we are already cyborgs, this paper draws on feminist technoscience theory to develop a critique of Neuralink as an intended general population device, and what this represents for the ageing and mortal human body.

As a hybrid of machine and organism, fiction and materiality, the cyborg is a suitable figure through which to map social and bodily reality (Haraway 2016 [1985], 5–6). In calling for researchers to 'grey the cyborg' and attend to 'the age, technology, science, and gender junction,' feminist technoscience scholars Kelly Joyce and Laura Mamo note that in popular culture 'the cyborg is often imagined as a youthful, male computer user or action figure, a body-machine at work and play' (Joyce and Mamo 2007, 100). The grey cyborg challenges this cultural imaginary, and the technoscience dream of an 'invulnerable and immortal' body (Woodward 1999, 283) that can live without ageing altogether. As a body-machine that retains a signifier of ageing, the grey cyborg represents ageing with technology. This is to choose ageing despite Western culture's great preference for youth (Woodward 1999, 286), and despite the options for anti-ageing biotechnological intervention available to some within advanced capitalism (ibid.). What does it mean to become old for those who, out of choice or circumstance, do not enhance their ageing bodies with what is currently biotechnological luxury? What may be lost if the body is technologically rendered invulnerable, immortal, and ageless? Within a culture that prefers the young and prizes new technology and its potential to increase control and efficiency, 'old' is 'not only antithetical to our dominant values, but dangerous' (ibid. 288). Borrowing a phrase from Aimi Hamraie and Kelly Fritsch's 'Crip

Technoscience Manifesto,' I argue that ageing can become a 'difference that matters' (2019, 20). Re-conceptualising difference amidst normative constructions of the body, Hamraie and Fritsch describe how using and not using certain technologies becomes a practice of disability justice. Technologies that have undesirable side effects, exist only to make non-disabled people comfortable, or are the expensive products of the medical and military-industrial complex are rejected; those that facilitate widespread forms of access are demanded (ibid. 16). To 'grey the cyborg' and to retain age as a 'difference that matters' requires a new model for ageing with technology.

This paper seeks to explore the implications of compulsory youthfulness for technology through analyses of Neuralink and what I read as a grey cyborg narrative in the science fiction short story 'Forever' (2020). In the analyses of Neuralink and 'Forever' that follow, I surface ageing as a locus of resistance. Itself a hybrid method, I follow the process of 'reading the cyborg' Anne Balsamo establishes in *Technologies of the Gendered Body: Reading Cyborg Women*, combining science and technology studies (STS) analysis of technology and literary analysis of a science fiction text (1996, 3–4). I begin with an analysis of Neuralink as an intended general population device, arguing that as a 'new' technology emerging from a technological culture of widespread ageism and advanced capitalism (Woodward 1999, 288), it risks petrifying, rather than destabilising, the preference for youth. I follow this with a close reading of 'Forever,' written by Amy Ireland, author and member of xenofeminist collective Laboria Cuboniks. In Ireland's words, xenofeminism is 'an attempt to equip queer, trans and feminist politics for the social, material and technological challenges peculiar to the complexity of our century' (Ireland 2017). 'Forever' centres on a conflict between a wealthy male gerontocrat's radical de-ageing experiment, and grey-haired female anti-immortality activists that sabotage the gerontocracy infrastructure. By analysing Neuralink and 'Forever' together, I develop an account of how the ageing and mortal human body is produced culturally and technologically, and endeavour to present a counter-narrative to the futuristic tomorrow envisioned and engineered by Musk. I conclude by returning to feminist technoscience scholars' preoccupation with countering the technoscience dream of invulnerable, ageless, immortal bodies.

Where STS ageing studies scholars have focused on technologies specifically designed for aged bodies, such as the walking frame (Joyce and Mamo 2007, 111), the present challenge is to uncover the concept of ageing reflected in Neuralink as a device intended for the general population. To do this, I use the model of exploring the co-constitution of ageing and technology set out by socio-gerontechnologists Alexander Peine and Louis Neven. This model lends itself to studying 'how materiality – in general and including devices, software and infrastructures – matters and comes to matter for older people'

(Peine and Neven 2021, 2,847). The interventionist logic Peine and Neven identify is evident in transhumanist accounts of the Neuralink chip in relation to the biomedicalised ageing body: 'If it is now the case that ageing processes are also widely identified as disease, then the political importance of promoting the health span is obvious. Human upgrading by means of RFID chips is an exciting starting point' (Sorgner 2022, 160). Such a logic can be understood as an expression of the technoscience dream that Musk's expressed worldview and portfolio of technologies represent. While not explicitly targeting the ageing body, Neuralink frames the human body as inferior to its technology, marking the unenhanced body as obsolete. Signifiers of the unenhanced ageing body, such as grey hair and wrinkles, therefore also come to signify the ageing body's fragile claim on a future dominated by those who access biomedical interventions.

## Neuralink

In 2011, bioengineer Pedram Mohseni and brain specialist Randolph Nudo started researching how an electronic chip could treat traumatic brain injury (Regalado 2017). Despite proving their prototype could help brain-damaged rats, they found it difficult to attract investment and so by 2015, the pair sold the name of their startup, Neuralink, for tens of thousands of dollars to Musk, the richest man in the world (Lipton et al. 2024). In 2023, after securing Food and Drug Administration (FDA) approval for Neuralink's first human clinical trial, Musk raised $280 million through the Founders Fund, Peter Thiel's venture capital firm (Longevity Technology 2023). Researchers in the field of BCIs suggest Neuralink could be available for general consumer use within decades, alluding to the swiftness with which Botox passed from medical use to being a mass consumer product as an example of a similar pipeline for Neuralink (Jewett 2024). Examples of 'unlocking human potential' it is hoped Neuralink will achieve range from 'bypassing low-bandwidth mechanisms such as speaking or texting to convey the thoughts' (Marsh 2018), to rock-climbing without fear or seeing a radar with superhuman vision (Regalado 2020), and ultimately achieving 'a merger with artificial intelligence' (Coin, Mulder, Dubljević 2020). My focus is on Neuralink's general goal to 'preserve and enhance' (Fiani et al. 2021) the human brain.

I locate the second phase of Neuralink's mission within three connected ideological frameworks to describe how this technology reflects Silicon Valley neoliberal capitalism. These frameworks include The Californian Ideology (Barbrook and Cameron 1995), The Mindset (Rushkoff 2022, 9), and the TESCREALists (Gebru and Torres 2024). In 1995, media theorists Richard Barbrook and Andy Cameron identified a global orthodoxy stemming from a Silicon Valley combination of cybernetics, free-market economics, and counter-culture libertarianism, which they termed The Californian Ideology

(Barbrook and Cameron). Both Musk and Neuralink have been identified as belonging within this ideology (Vdovychenko 2021). In *Survival of the Richest*, Douglas Rushkoff expands on The Californian Ideology in what he terms The Mindset, describing a mode of Silicon Valley escapism in which technology billionaires such as Musk can use their technology to 'rise above and separate from humanity' and 'leave the rest of us behind' (Rushkoff 2022, 9). The chief concern for Barbrook, Cameron, and Rushkoff is how the technologies developed by those within this ideology or mindset program the sensibilities of the rest of society, which has no such escape route. The idea of the future described as belonging to Musk is of using technology to 'neutralise and dominate' the unknown and to 'actively seek the endgame,' in which the billionaire emerges as a superhero that, through the technology he develops, can 'escape from the apocalypse of [his] own making' (ibid. 10). In turn, Rushkoff's The Mindset is connected to the notion of TESCREALists (transhumanism, extropianism, singularitarianism, cosmism, rationalism, effective altruism, long termism) that Timnit Gebru and Emile Torres introduce in their description of how the intended development of artificial general intelligence (AGI) – a hypothetical form of AI capable of surpassing humans in any cognitive task, instead of AI developed for specific tasks – is heralding a second and more radical wave of eugenics (2024, 3). Identifying Musk's worldview as consistent with their concept of TESCREALists, they warn that these 'harmful ideals have resulted in systems that perpetuate inequity, centralise power, and harm the same groups that were targeted by the first-wave modern eugenics movement' (ibid. 21). The authors cite Ashlee Vance's biography of Musk (2016), in which he is described as believing that 'soon enough, we'll be able to download our brains to a computer, relax, and let their algorithms take care of everything,' with an underlying message that 'humans are flawed and our humanity is an annoying burden that needs to be dealt with in due course' (Vance, as cited in Gebru and Torres 2024, 25). Examined from the context of these ideological frameworks, Neuralink's mission to unlock human potential can be re-appraised as part of Musk's approach to re-shaping humanity.

Musk's views towards AI and AGI are contradictory. In 2014 he told an audience at MIT that Larry Page and Google were 'summoning the demon' (Rushkoff 2022, 94) by experimenting with AI, and he has claimed that his intention to colonise Mars is partly to have a 'bolt-hole if AI goes rogue and turns on humanity' (ibid.). Despite sounding a public alarm bell about the dangers of AI, and three months after signing the Pause AI letter, Musk announced a new organisation to develop 'maximally curious' AGI (Gebru and Torres 2024, 20). He has stated that Neuralink will allow humans to 'compete' with a potential 'superintelligent rogue AI' (Rushkoff 2022, 94), and that a 'merger of biological intelligence and machine intelligence' will be necessary to ensure we stay economically

valuable (Marsh 2018). The Physicians Committee for Responsible Medicine continues to express concern regarding Neuralink, noting that Musk's goal for the BCI to achieve symbiosis with AI is 'not necessarily in line with developing treatments for patients,' and that a non-invasive device would be more likely to improve quality of life for 'elderly and paralysed people' (Physicians Committee 2024). Musk's concerns about the increasing abilities of AI reflect a fear of human frailty and finitude associated with the ageing human body, which represents the limit to the power and control afforded by technology (Woodward 1999, 291). Just as Rushkoff describes billionaires such as Musk as seeking to 'leave the rest of us behind' (2022, 9), Musk fears being 'left behind' by AI (Rogers 2019). Following the logic of *if you can't beat them, join them*, he hopes that through Neuralink 'we can actually go along for the ride. We can have the option of merging with AI' (ibid.). Parsed alongside his professed vision of Neuralink becoming a general population device, it is not clear who the 'we' is – who will be able to afford Neuralink, for example – or whether Musk's 'we' is really an 'I.'

The human body is a frontier on which technology such as Neuralink is used to 'neutralise and dominate' (Rushkoff 2022, 10) the processes of ageing and death. The framing of the human body as frail and inferior compared to the machine is an integral part of Neuralink's mission to become a consumer device. The implant is sealed in a biocompatible enclosure that withstands physiological conditions 'several times harsher' than those in the human body (Neuralink n.d.). It consists of 1,024 electrodes that are distributed through 64 threads, which are 'so fine that they can't be inserted by the human hand' (ibid.). Neuralink has designed its own surgical robot to insert these threads, and the robot's needle is 'thinner than a human hair' (ibid.). Presenting the technology as harsher, more precise, more delicate than the human sets the premise for the body in need of an upgrade for future viability. Opposition between the biological and technological frames Neuralink as necessary, for example to 'stay economically valuable' (Marsh 2018), rather than as desirable, such as the type of augmentation that may be chosen through morphological freedom. This opposition is unnecessary. BCIs are prototypically cyborgian technologies, and the cyborg 'has the potential…to disrupt persistent dualisms that set the natural body in opposition to the technologically recrafted body' (Balsamo 1996, 11). The opposition between the 'natural' body and Neuralink appears to continue after its insertion, with BCI researchers describing the difficulty of designing technology that can survive the 'corrosive' environment of the living brain (Regalado 2020). For instance, 'the inside of the brain is an unfriendly place when it comes to electrodes, a briny soup that eats away at the hard, pointy bits neuroscientists have used for decades to listen in on synaptic chit-chat. Immune responses coat those electrodes with glial cells, defensive gunk that eventually renders

them inoperative' (Rogers 2019). And the body does reject Neuralink; 85 percent of the tendrils slipped out of the brain of the first human to join its clinical trial (Jewett 2024). While 'brain tissue is soft and flexible,' the wires that connect to it are 'rigid,' which can cause scarring and immune reactions that limit the implant's effectiveness with time (Wu and Rao 2017). The perpetuation of Western culture's 'troubling dualisms' (Haraway 2016[1985], 59) between the biological and the technological manifests in Musk's worldview, his mission for Neuralink, and the brain tissue that hosts the device.

The short story 'Forever' presents the ageing body as a frontier upon which opposing visions for humanity's future of ageing with technology play out. Science fiction narratives such as 'Forever' offer a 'heretical counter-movement' and alternatives to the 'fantastic expectations of individual perfection' (Miller and McFarlane 2016, 213, 215) that Neuralink's mission to unlock human potential represents. Through my reading of 'Forever,' I develop a critique of Neuralink in which ageing emerges as a locus of resistance.

## 'Forever'

Most of 'Forever' is written from the first-person perspective of Mr Bettencourt. He has regained consciousness after an experimental nine-month de-ageing procedure in a 'first-tier private clinic' (Ireland 2020, 15), made possible through the inherited wealth he uses to pay for these 'outrageously expensive' (ibid. 16) modifications. While he recovers in bed, he talks to his wife, Dee, who has rejected de-ageing procedures. They discuss the anti-immortality sentiment emerging from an activist group called White Cell. By the end of the story, it becomes clear that Dee has become a White Cell operative. Dee 'loops' Bettencourt – hacking his mind jack so that instead of immortality, his consciousness is stuck in the same circular memory *forever*.


*Author Amy Ireland reads 'Forever' (ŠUM journal 2019).* https://www.youtube.com/watch?v=___kX6bvd9_Y.

This story contains four themes I use to develop a critical reading of Neuralink. These include the affordances of Bettencourt's mind jack, Dee's rejection of biotechnological luxury, the stratified clinic, and White Cell's sabotage of gerontocracy infrastructure. 'Forever' also provides two distinct narratives of ageing with technology: Bettencourt's de-ageing procedure reflects his desire to preserve himself and his position of power and authority, and Dee's rejection of biotechnological luxury reflects a political alternative.

## Affordances of the mind jack

A mind jack helps 'upgrade' Bettencourt's memory, which is necessary to counter lapses – a side effect of his experimental life-extension treatment (Ireland 2020, 17). The mind jack serves a similar function of enhancement and preservation expressed in the second phase of Neuralink's mission. It does more than counter lapses. It is a thorough ledger of experience at high resolution, enabling instant and perfect reconstruction of any conscious or unconscious experience – resembling Musk's claim that 'we are already cyborgs' because 'our memory is overwhelmingly outsourced to computers – they remember everything with extreme precision down to the pixel' (Musk 2023). Bettencourt's mind jack offers such a depth of information that it can potentially be classified as a new consciousness, which, if true, means he would be 'backed-up for life' (Ireland 2020, 17). The language Ireland uses to convey these affordances – upgrade, high resolution, backed-up – emphasises the hybridity of Bettencourt as a human-machine subject, and mirrors Musk's own language 'down to the pixel.'

This augmentation leads to seemingly irreversible biological losses; as Bettencourt tries to adjust to his new body and consciousness, he worries he might not be able to find his way back (ibid. 15). His '*old* mental defence system' struggles and fails to assemble itself (ibid. 19, emphasis added). His biological memory is now 'just a blank' (ibid.). The interactions between Bettencourt and Dee show that her un-jacked mind retains a type of advantage: she guesses his thoughts with 'telepathic acuity' (ibid. 16). And while the mind jack helps Bettencourt 'detect a note of ridicule' that would have otherwise escaped him, it does not help him understand the source of Dee's derision (ibid. 17). After seemingly 'bypassing low-bandwidth mechanisms' (Marsh 2018) as Neuralink intends, Bettencourt becomes 'completely abstracted' from 'human relationships' (Ireland 2020, 15).

The procedure has additional, ironic side effects. It is the de-aged Bettencourt who appears 'like a dementia patient' (ibid. 17). Appraising the new technologically mediated 'alternative timeline' version of himself in the mirror, Bettencourt switches from first to third-person pronouns, suggesting a sundering from his former biological self has taken place. This appears to be consistent with the opposition between the biological and

the technological implied in the description of Neuralink as transcending the strength and dexterity of the human body. 'Forever' suggests that within its technological paradigm, the mind jack and the human brain are incompatible. However, I argue that this story is not a cautionary tale against humans using cyborgian technologies per se – just those that seek to preserve the human body. The desire to *preserve* underlying Bettencourt's choice to use de-aging technology – the preservation of not just his own body but his position of power as a wealthy man, augmenting this with eternal youth – makes him a target for White Cell. Ultimately, the crystal-clear recall of the mind jack becomes the instrument of an everlasting punishment as it is used to 'loop' him.

## Biotechnological luxury

While no age is provided for Dee, Bettencourt, who is around 60, is chronologically 'way older' than Dee, though he now appears 19 after he got 'de-aged' (ibid.). Signifiers of Dee's age come from Bettencourt's appraisal: 'The skin around her eyes folds into deep, unfortunate runnels…She seems old' (ibid.16). In Bettencourt's view, Dee's 'stubbornness' has 'cost her a certain level of biotechnological luxury' (ibid.). Seen from another angle, instead of stubbornness, this is a political rejection of de-ageing technologies such as Botox that seek to preserve – ageing as 'a difference that matters' (Hamraie and Fritsch 2019, 20). As with the mind jack, Dee's unpreserved body retains a different type of power over Bettencourt. He acknowledges her 'innate eroticism,' and the fact that 'despite her ageing face, she still looks as handsome as ever' (Ireland 2020, 19). It is significant that he is still attracted to his now phenotypically, if not chronologically, older wife. The signifiers of Dee's age align with other qualities to mark her as now irreconcilably different from Bettencourt: Dee takes pleasure in crudeness, unlike Bettencourt's 'relentless civility and erudition' (ibid. 17). Dee is 'warlike,' 'martial,' her grin 'wicked,' while Bettencourt is 'vacant,' 'lost,' 'otherworldly,' 'almost angelic' (ibid.). Dee stands for the collective, in solidarity with the activists from 'down in fourth' and below, while Bettencourt is proud to belong to the private top-tier of the clinic. Alongside these attributes, Dee's age invokes an alternative worldview: one in which accepting age replaces preserving youth, and the collective replaces the neoliberal individual.

In youth-obsessed Western culture, where the big business of cosmetic and lifestyle interventions reifies the association between youth and life itself (Joyce and Mamo 2007, 103), Dee's visible signs of ageing are 'anti-assimilationist' (Hamraie and Fritsch 2019, 11). Later in the story we meet her fellow White Cell operative, 'a woman with grey hair and a stolen arm jack' (Ireland 2020, 20). The members of White Cell are not feminist luddites: they demonstrate the political relationship to technology Hamraie and Fritsch set out in their manifesto, choosing to use some technologies (arm jack), and rejecting

others (mind jack, hair dye, Botox). Their rejection of even relatively non-invasive anti-ageing technologies can be read as a rejection of the desire to preserve. Seen from this angle, Dee's runnels and her companion's grey hair signify ageing as anti-preservation.

Without the lens of xenofeminist theory, which seeks to create an affirmative feminist politics equipped for the technological challenges of our century (Ireland 2017), it would be possible to interpret 'Forever' as sympathetic to 'early ecofeminist dogma that womanhood (1) is defined by its proximity to nature and (2) is therefore predisposed as separate from technology' (Konior 2019, 235–236). Contrasted with Bettencourt's seemingly malfunctioning upgrade, Dee and her companion's apparently 'naturally' ageing bodies are strong and capable, an ostensible argument against technological modification. At face value, the *naturalness* of anti-immortality sentiment is also supported: '"White Cell." Nature's immune system. Get it?' (Ireland 2020, 18). The cell, as both microscopic biological organism and subversive political group, reifies the layers of sabotage Ireland captures in naming the activist group. Dee refers to the discrepancy in life expectancy between men and women that Bettencourt has technologically subverted: 'I'd always assumed you'd die before me, since, you know, statistically, women live longer than men' (ibid. 17). However, reading 'Forever' as theory-fiction makes it possible to reconcile the story with two statements in *The Xenofeminist Manifesto*: 'If nature is unjust, change nature,' and 'our future requires de-petrification' (Laboria Cuboniks 2018, 93, 13). In 'Forever,' ageing and death are not portrayed as nature being unjust but as necessary for the de-petrification of the future. Bogna Konior leaves no doubt as to xenofeminism's position on ecofeminism or technology: 'against feminist luddites, xenofeminism embraces the artificial and desires to drive a stake through the heart of ecofeminist affirmations of women as caring parental and environmental protectors' (Konior 2019, 233). White Cell's sabotage of the gerontocracy is consistent with a feminism that is violent in its affirmation of 'a future untethered to the repetition of the present' (Laboria Cuboniks 2018, 93). As interventions that amount to biotechnological luxury, the mind jack and Neuralink risk preserving the power of those who already have it.

## The stratified clinic

The inherited wealth that makes Bettencourt's de-ageing possible is a theme throughout 'Forever.' The clinic is vertically stratified: the wealthiest are at the top with access to 'experimental technology' that, it is inferred, can bypass 'certain ethical and legal' regulations (Ireland 2020, 17). It is protected with security 'of the highest order' (ibid. 18), and we are reminded that Bettencourt 'paid for this' (ibid. 15) with his family's money (ibid. 16). Groups from lower tiers fight the application of the technology through both institutional (attempting to change its classification) and underground

(White Cell) practices. Dee shares a glimpse of what's happening 'down in fourth:' 'anti-immortality sentiment, protests, kids with contraband jacks or exoskeletons lifted from the factories where they work' (ibid. 18). These kids working in factories and lifting contraband technology are fighting the 'geros,' the wealthy people that can afford the biotechnological luxury to de-age and extend their lifespans at the top.

In this exchange, Dee and Bettencourt discuss the White Cell anti-immortality manifesto.

> Dee: '"*You're* the one who's trying to freeze things into place. They're fighting in the name of time. Of change. That's *active*, not reactive." She pokes one of the nutrient bags suspended above my head that has the clinic logo on it. "That infinity symbol? Kinda looks like an hourglass if you turn it on its end."'
>
> Bettencourt: 'But they have no idea what they could be depriving us, I mean, *human-ity* of. This is going to change everything. Politics, economics, religion. It will be the greatest transformation in human history…and *I* will be part of it.'
>
> Dee: '"You get a few families of wealthy gerontocrats monopolising 'continu-ity enhancement' or whatever the *fuck* the latest PR euphemism is, and everything changes a great deal once, then never again…"'
>
> Bettencourt: 'This is not about trying to control time… it's about… being rational. It's about optimising the human capacity for – '
>
> Dee: '"You're afraid of death," she interrupts. "It's got nothing to do with the transformation of humankind. You're afraid of things going on without you"' (ibid. 18–19).

Bettencourt's slip between describing benefits for himself instead of humanity hints at what critics of transhumanism warn could become a future in which 'socially moribund masses are forced to serve the technoscientific super-project of Humanity 2.0' (Thomas 2024a, 166). Situating transhumanist missions such as the second phase of Neuralink within our social, cultural, political, and economic context highlights how it risks increasing inequality (Thomas 2024b). Examining Neuralink as a product in the portfolio of the world's wealthiest person and emerging from the system of advanced capitalism, the mission to preserve and enhance takes on new significance: what else is preserved in addition to the brains of those who will be able to afford Neuralink?

Within advanced capitalism, a highly competitive social environment and its demands of increasingly efficient behaviour (Thomas 2017) determine which

transhumanist values become dominant, which technologies are developed, and who can access them. This risks 'the commercial imperative' becoming 'the true architect of the future human' (Doede 2009). Within such a system, those not using a technology like Neuralink – whether by choice as is implied by Dee's rejection of biotechnological luxury, or by lack of access as is implied by the description of kids 'down in fourth' with contraband jacks – risk becoming economically and socially moribund (Thomas 2017). Those who reject it, such as Dee, take on the role of deviants (Joyce and Mamo 2007, 104). Unless Neuralink was developed based on a different set of values, and within a different economic system, it is easy to see the risk of it being the domain of 'wealthy gerontocrats monopolising "continuing enhancement"' (Ireland 2020, 18). Therefore, despite the techno-materialism of xenofeminism, a technology such as Neuralink risks 'petrifying' the current social and economic order. Ageing and mortality are framed within 'Forever' as part of the 'de-petrification' (Laboria Cuboniks 2018, 93, 13) required for the future.

The White Cell manifesto reaches Bettencourt's level of the clinic. Even the first-tier medical environment – with its attendants hovering at the bedside and drones monitoring the windows – is permeable for White Cell. In fact, the clinic was already infected; the walls were 'pus white' from the beginning (Ireland 2020, 14). The White Cell operatives can be read as agents of cyberfeminism's 'virus of a new world disorder' (VNS Matrix 1991), heralding a counter movement to the stasis Bettencourt represents.

## White Cell's sabotage

The first and last passages in 'Forever' from Bettencourt's perspective are mirrored: 'The wall rears up at an uncanny angle and folds itself suddenly inwards over my head. There's a crunch as something collides with my left temple, followed by a burst of supernatural pain which mushrooms rapidly' (Ireland 2020, 14, 20). These twin passages suggest he has been dying, experiencing 'the full resources of the body's capacity for pain,' on loop *forever*. Bettencourt next appears as a 'thin prism-shaped drive' (ibid. 20) that a White Cell operative extracts in a bunker. He has shed his biological self and obtained a type of digital immortality – something akin to futurist Ray Kurzweil's singularitarianism, in which 'humans will merge with machines, inaugurating a new epoch in cosmic history' (Gebru and Torres 2024, 6). Recognising a connection between the drive and her companion, the operative calls out to Dee by her full name, 'Deianeira' (Ireland 2020, 20) – the mythological Caledonian princess whose Greek name translates to 'man destroyer' – who explains that she 'looped' Bettencourt eight years ago. Ireland, quoting cyberfeminist Sadie Plant, points out that the masculine fantasy of control is a cursed enterprise in cyberspace: 'Entering the matrix is no assertion of masculinity, but a loss of humanity…To jack into cyberspace is not to penetrate, but to be invaded' (Plant, cited in Ireland 2017). The operatives have

breached the bunker that stores loops of 'perfect gerontocrat memory' (Ireland 2020, 21) through a crawlspace in the ceiling, using a ladder which one operative scales three rungs at a time with her arm jack.

This final scene in 'Forever' hints at a future in which grey-haired White Cell activists are ascendant instead of the de-aged geros. While one operative has an arm jack, Dee still doesn't have a mind jack: 'At least with a biomemory she won't be condemned to remember this shit forever' (ibid.). Both the arm jack and the mind jack *enhance*, but only the mind jack *preserves*. The delineation between the two jacks represents the destruction or maintenance of the status quo. The mind jack is a biotechnological luxury, designed to ensure the geros become part of the new epoch in cosmic history. The arm jack helps the operatives sabotage this world order to make way for a new one. The choice to reject the de-ageing technology Bettencourt uses is a political one: 'Fuck all the geros. Imagine thinking you deserved to live forever' (ibid.). The grey-haired White Cell operative's choice to use an arm jack, and to reject the mind jack, reflects the practice of the grey cyborg, in which ageing constitutes a difference that matters.

By reading the cyborg through 'Forever' and Neuralink, a critical difference emerges between the affordances of enhancing and preserving. Through the lens of xenofeminist theory-fiction, the potential for the second phase of Neuralink's mission to 'preserve' the power and authority of those who already have it becomes clear. Proceeding with the understanding that 'technologies are not separable from the material realities that underwrite them,' (Laboria Cuboniks 2018, 75) I conclude by considering under which circumstances Neuralink could be repurposed within xenofeminism's 'proactive politics for biotechnical intervention' (ibid. 81).

## Conclusion

'Forever' challenges dominant technoscientific imaginaries of the ageing and mortal body. This holds true for the techno-solutionist imaginary of a fragile ageing body that can and should be 'preserved and enhanced' in the face of perceived twin threats from both human ageing and mortality and rogue AIs. The White Cell operatives choose to retain visible markers of age – grey hair, unfortunate runnels – in their world of widespread ageism and advanced technological orthodoxy. The arm jack reflects a delineation between enhancing and preserving, and a relationship with cyborgian technology that is a political and affirmative choice rather than a fear-based necessity. By rejecting the mind jack, the White Cell operatives also reject biotechnological luxury and the preservation of hegemony. The operatives are ageing and mortal, powerful and fast, climbing the ladder three rungs at a time. This representation of ageing bodies shows the generative possibilities of integrating, rather than erasing, age within technological futures afforded by science fiction. Within this paradigm, ageing becomes a locus of

resistance to compulsory youthfulness – a personal choice that makes possible the political transformation necessary for a new distribution of power. In a cultural context of science fiction novels that tend to make ageing women invisible (Spruck Wrigley 2019), and a technological orthodoxy that seeks to erase age and preserve eternal youth, 'Forever' represents a new narrative and new possibilities for grey cyborg futures.

Not only are ageing female main protagonists rare in English-language science fiction (ibid.), ageing remains relatively under-addressed in feminist technoscience theory (Joyce and Mamo 2007, 100). Feminist scholars who have not focused on ageing nevertheless return to mortality, critiquing the technoscience dream of 'immortality and control over life and death' (Balsamo 1996, 1). Haraway repeatedly emphasises the importance of both 'living and dying' (2016, 2, 28, 33, 39, 40, 41, 51, 55 ...) to stay with the trouble. In *Xenofeminism* (2018), Helen Hester comes close to accounting for ageing and mortal human bodies in a politics of techno materialism. Hester warns of the 'cult of the Child' (2018, 49) – the future's default protagonist – while highlighting the risks of 'violating individual bodily autonomy' (ibid. 60) and perpetuating the population control tactics of mid-century eugenics identified as a risk in Haraway's plea to 'make kin, not babies' (Haraway 2016, 5–6). In Hester's call for 'alternative images of the future founded not solely on the Child,' (2018, 62) the White Cell operatives represent a start.

Haraway and Hester do not appear to address the social, political, ethical, or environmental implications of anti-ageing and anti-mortality technologies that pundits expect will define our near future. As Sorgner claims in *We Have Always Been Cyborgs*, 'Elon Musk's Neuralink and all the other companies, institutes, and task forces which work on brain-computer interfaces will have the most significant impact on the future of human flourishing within the coming decades' (2022, 30). After mobilising a series of feminist technoscience manifestos throughout this paper – 'A Manifesto for Cyborgs', *The Xenofeminist Manifesto*, and the 'Crip Technoscience Manifesto' – the one most capable of situating the ageing and mortal body alongside emergent technology such as Neuralink is the intratextual White Cell manifesto in 'Forever.' Such a manifesto may account for the conditions under which Neuralink could become compatible with the figure of the grey cyborg. The White Cell manifesto may address how ideologies, cultural imaginaries, and material realities come to shape technologies and the bodies that use them. Practical implications of such a manifesto would include requiring that new cyborgian technologies engineer the body based on affirmative desire rather than fear, difference rather than sameness, transformation rather than stasis. The commercial imperative would not be the architect of such a technology, and it would be freely available to all who desire to use it. For now, such a possibility remains a science fiction.

**Acknowledgements**

Thank you to those whose ideas and feedback have supported this work: Orit Halpern, Suneel Jethani, Richard Groß, Johanna Mehl, and the reviewers at *Body, Space and Technology*.

**Competing Interests**

The author has no competing interests to declare.

**Author Information**

Celia Brightwell is a PhD candidate and research associate at the Chair of Digital Cultures, Technical University of Dresden. Her doctoral research project Cybercrones examines how age is produced culturally and technologically through a selection of paired science fiction texts and body technologies.

**References**

**Balsamo, Anne** 1996 *Technologies of the Gendered Body: Reading Cyborg Women*. Durham and London: Duke University Press.

**Barbrook, Richard** and **Cameron, Andy** 1995 The Californian Ideology, 1 September 1995. Mute. Available at metamute.org/editorial/articles/californian-ideology [Last accessed 6 November 2024].

**Coin, Allen, Mulder, Megan** and **Dubljević, Veljko** 2020 Ethical Aspects of BCI Technology: What Is the State of the Art? *Philosophies*, 5(4):31. DOI: https://doi.org/10.3390/philosophies5040031

**Doede, Bob** 2009 Transhumanism, Technology, and the Future: Posthumanity Emerging or Sub-humanity Descending? *Appraisal*, 7(3).

**Fiani, Brian, Reardon, Taylor, Ayres, Benjamin, Cline, David** and **Sitto, Sarah R** 2021 An Examination of Prospective Uses and Future Directions of Neuralink: The Brain-Machine Interface. *Cureus*, 30;13(3). DOI: https://doi.org/10.7759/cureus.14192

**Gebru, Timnit** and **Torres, Emile P** 2024 The TESCREAL bundle: Eugenics and the Promise of Utopia through Artificial General Intelligence. *First Monday* 29(4): 1–42. DOI: https://doi.org/10.5210/fm.v29i4.13636

**Hamraie, Aimi** and **Fritsch, Kelly** 2019 Crip Technoscience Manifesto. *Catalyst*, 5(1)33. DOI: https://doi.org/10.28968/cftt.v5i1.29607

**Haraway, Donna** 2016 [1985] *Manifestly Haraway*. Minneapolis: University of Minnesota Press.

**Haraway, Donna** 2016 *Staying with the Trouble*. Durham and London: Duke University Press.

**Hester, Helen** 2018 *Xenofeminism*. Cambridge: Polity.

**Ireland, Amy** 2017 'The Stranger' Interview. Carousel. Available at blog.carouselmagazine.ca/from-the-archive-c39-schmaltz-vs-ireland/ [Last accessed 6 November 2024].

**Ireland, Amy** 2020 'Forever,' in *What the Fire Sees. A Divided Reader* (ed. Eleanor Weber and Camilla Wills, 14–20). London: Divided Publishing.

**Jewett, Christina** 2024 Despite Setback, Neuralink's First Brain-Implant Patient Stays Upbeat, 22 May 2024. *New York Times*. Available at nytimes.com/2024/05/22/health/elon-musk-brain-implant-arbaugh.html [Last accessed 6 November 2024].

**Joyce, Kelly** and **Mamo, Laura** 2007 Graying the Cyborg: New Directions in Feminist Analyses of Aging, Science, and Technology. In *Age Matters: Realigning Feminist Thinking* (ed. Toni M. Calasanti and Kathleen F. Slevin, 97–121). New York: Routledge.

**Konior, Bogna** 2019 Automate the Womb: Ecologies and Technologies of Reproduction. Helen Hester, Xenofeminism. *Parrhesia*, 31.

**Laboria Cuboniks** 2018 *Xenofeminist Manifesto*. London: Verso.

**Lipton, Eric, Fahrenthold, David. E., Krolik, Aaron** and **Grind, Kirsten** 2024 U.S. Agencies Fund, and Fight With, Elon Musk. A Trump Presidency Could Give Him Power Over Them, 20 October 2024. *New York Times*. Available at nytimes.com/2024/10/20/us/politics/elon-musk-federal-agencies-contracts.html [Last accessed 6 November 2024].

**Longevity Technology** 2023 Neuralink Raises $280 Million Following Clinical Trial Go-ahead, 8 August 2023. *Longevity Technology*. Available at longevity.technology/news/neuralink-raises-280-million-following-clinical-trial-go-ahead/ [Last accessed 6 November 2024].

**Marsh, Sarah** 2018 Neurotechnology, Elon Musk and the Goal of Human Enhancement. 1 January 2018. *The Guardian*. Available at theguardian.com/technology/2018/jan/01/elon-musk-neurotechnology-human-enhancement-brain-computer-interfaces [Last accessed 6 November 2024].

**Miller, Gavin** and **McFarlane, Anna** 2016 Science Fiction and the Medical Humanities. *Medical Humanities*, 42(4): 213–218. DOI: https://doi.org/10.1136/medhum-2016-011144

**Musk, Elon** 2023 X post. Available at x.com/elonmusk/status/1667972757139730434 [Last accessed 6 November 2024].

**Neuralink,** n.d. Mission. Available at neuralink.com/ [Last accessed 6 November 2024].

**Peine, Alexander** and **Neven, Louis** 2021 The Co-constitution of Ageing and Technology: A Model and Agenda. *Ageing and Society*, 41: 2,845–2,866. DOI: https://doi.org/10.1017/S0144686X20000641

**Physicians Committee** 2024 Statement from the Physicians Committee on Neuralink's Purported Patient Implant. Available at pcrm.org/news/news-releases/statement-physicians-committee-neuralinks-purported-patient-implant [Last accessed 8 January 2025].

**Regalado, Antonio** 2017 Meet the Guys Who Sold 'Neuralink' to Elon Musk without Even Realizing It. 4 April 2024. MIT Technology Review. Available at technologyreview.com/2017/04/04/152788/meet-the-guys-who-sold-neuralink-to-elon-musk-without-even-realizing-it/ [Last accessed 6 November 2024].

**Regalado, Antonio** 2020 Elon Musk's Neuralink is Neuroscience Theater. 30 August 2020. MIT Technology Review. Available at technologyreview.com/2020/08/30/1007786/elon-musks-neuralink-demo-update-neuroscience-theater/ [Last accessed 23 January 2025].

**Rogers, Adam** 2019 Here's How Elon Musk Plans to Stitch a Computer into Your Brain. 17 July 2019. *Wired*. Available at wired.com/story/heres-how-elon-musk-plans-to-stitch-a-computer-into-your-brain/ [Last accessed 6 November 2024].

**Rushkoff, Douglas** 2022 *Survival of the Richest: Escape Fantasies of the Tech Billionaires*. New York: W. W. Norton.

**Sorgner, Stefan Lorenz** 2022 *We Have Always Been Cyborgs*. Bristol: Bristol University Press.

**Spruck Wrigley, Sylvia** 2019 Space Ageing: Why Sci-fi Novels Shun the Badass Older Woman. *Nature*, 575: 585–587. DOI: https://doi.org/10.1038/d41586-019-03618-w

**ŠUM journal** 2019 Amy Ireland: Forever. YouTube, uploaded by ŠUM journal 30 November 2019, youtube.com/watch?v=__kX6bvd9_Y

**Thomas, Alexander** 2017 Super-intelligence and Eternal Life: Transhumanism's Faithful Follow It Blindly into a Future for the Elite. 31 July 2017. *The Conversation*. Available at theconversation.com/super-intelligence-and-eternal-life-transhumanisms-faithful-follow-it-blindly-into-a-future-for-the-elite-78538 [Last accessed 6 November 2024].

**Thomas, Alexander** 2024a *The Politics and Ethics of Transhumanism: Techno-Human Evolution and Advanced Capitalism*. Bristol: Bristol University Press.

**Thomas, Alexander** 2024b Transhumanism: Billionaires want to use Tech to Enhance our Abilities – the Outcomes Could Change what it Means to be Human. 16 January 2024. *The Conversation*. Available at theconversation.com/transhumanism-billionaires-want-to-use-tech-to-enhance-our-abilities-the-outcomes-could-change-what-it-means-to-be-human-220549 [Last accessed 6 November 2024].

**Vance, Ashlee** 2016 *Elon Musk: How the Billionaire CEO of SpaceX and Tesla is shaping our Future*. London: Virgin.

**Vdovychenko, Nataliia** 2021 Elon Musk's SpaceX: How the 'Space Race' to Mars Adopted the Californian Ideology. 15 November 2021. *Diggit Magazine*. Available at diggitmagazine.com/articles/elon-musk-spacex [Last accessed 6 November 2024].

**VNS Matrix,** 1991 A Cyberfeminist Manifesto for the 21st Century. Available at vnsmatrix.net/projects/the-cyberfeminist-manifesto-for-the-21st-century [Last accessed 6 November 2024]

**Woodward, Kathleen** 1999 From Virtual Cyborgs to Biological Time Bombs: Technocriticism and the Material body. In Wolmark, Jenny (ed.) *Cybersexualities: A Reader on Feminist Theory, Cyborgs and Cyberspace*. Edinburgh: Edinburgh University Press.

**Wu, James** and **Rao, Rajesh PN** 2017 How close are we to Elon Musk's brain-computer interface? 12 April 2017. CNN. Available at edition.cnn.com/2017/04/12/health/brain-computer-interface-partner/index.html [Last accessed 6 November 2024].