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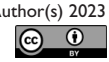

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Between Self-Tracking and Alternative Medicine: Biomimetic Imaginary in Contemporary Biohacking

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Abstract

While anthropological and social studies of the body have extensively explored self-tracking cultures, they have so far overlooked the phenomenon of biohacking, which represents a distinct though overlapping mode of contemporary techno-asceticism with its own set of norms and frameworks for bodily self-use. This article seeks to address this gap by examining biohacking within the context of self-tracking cultures and its simultaneous alignment with alternative health cultures. By analysing a substantial collection of recorded Biohacker Summit presentations, the study argues that biohacking reintroduces a dualistic biomimetic imaginary while simultaneously striving to transcend such dichotomies through a univocal emphasis on information processing. In particular, this is evident in the biomimetic impulse to align their interventions with the principles found in nature and to perceive technologies as subordinate to 'natural' biological processes, the privileging of the human sensorium as a bridge between science and nature, and the ultimate inclination to discard technology in favour of intuition and embodiment.

Keywords

biohacking, biomimicry, complementary and alternative medicine, cybernetics, naturalism, self-tracking, senses, techno-romanticism

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This article examines the techno-naturalist, or 'biomimetic', imaginary of contemporary biohacking, emphasising its hierarchical prioritisation of nature over technology, while placing this emerging community within the context of evolving self- and healthcare landscapes. These landscapes are characterised by novel trends in personalised medicine and consumer-driven well-being, the globalisation of diverse healing modalities, mobilisation of lay health groups, and increased scepticism towards scientific expertise and, in some instances, the welfare state (Brosnan et al., 2018: 2; Salmenniemi, 2022). To achieve this, I analyse a substantial collection of public in-group presentations delivered by prominent biohackers, which serve as forums for establishing and organising key principles of the community (Hepp, 2020). Specifically, my aim is to examine the underlying ideology of naturalism, often referenced with the term biomimicry or nature imitation, promoted within these presentations, and to lay the groundwork for future research on its social and political implications.

Biohacking points to a loose assembly of somatic and semiotic techniques of the self and an accompanied ethos of self-directed bodily transformation, somewhere at the rapidly emerging intersection between data-driven self-tracking and complementary and alternative medicine (CAM). On one hand, biohacking is firmly rooted in a dataistic and experimental idiom of self-tracking cultures, such as the Quantified Self, another 'pioneer community' (Hepp, 2020) with which biohacking retains close connections. On the other hand, it is equally grounded both ideologically and practically in the use of alternative therapeutic modalities – ranging from light, sound, heat/cold therapy and plant medicine to techno-assisted meditation and breathwork – balancing the 'masculine' reason of its technoscientific leanings with a 'feminine' intuition, embodied knowledge and a sensory cosmology drawn from alternative health cultures.

What distinguishes biohacking as a mode of contemporary techno-asceticism (in the sense of 'self-improvement') is a simultaneous idealisation of nature and the sensing body as its metonym, often encompassing a biomimetic imaginary that extends beyond technological innovation (cf. Dicks, 2023). This broader interpretation of biomimicry signifies inspiration derived from natural processes and an emphasis on 'innate' bodily capacities for healing, adaptation and

regeneration, underlining the belief in nature's ability to recover from disturbances and maintain equilibrium. 'Natural' well-being in the biohacking community frequently reflects a desire to align their interventions in a biomimetic manner with the principles and patterns found in nature and to draw inspiration from the latter's complexity, efficiency and resilience, sometimes aiming to replicate or enhance these qualities within their own biological systems. In this framing, however, there is little room for the recognition of nature's complexities and potential conflicts, and consequently for understanding nature as a space for contestation and politics (cf. Hester, 2018).

Whereas computing is the cherished craft of hackers (Coleman, 2016), biohackers 'compute' the human body and its psychosomatic interface with environment, merging experience and experiment to augment intuition (see Pedwell, 2022). Alternative therapies have been described as predominantly *sensory* practices having to do with knowing and experiencing the body in ideally beneficial although possibly non-conventional ways (e.g. Barcan, 2011). In a related fashion, the conceptual centrality placed in biohacking on sensory perception as a privileged interface between the body and the environment seems a promising starting point to interrogate its ideological investments and its complexities with contemporary cultural dominants including individualism, consumerism and neoliberalism.

Cybernetic Lineage and Its Contemporary Offshoots

According to proponents, while intimately associated with various self-tracking, therapeutic and enhancement technologies – such as wearable devices like blue-light blocking glasses, worn in the evening to enable natural melatonin production, that have become visually iconic of biohacking – biohacking is not necessarily reducible to them. What motivates these technologies, measurements and interventions is a broader style of thought that glosses the *hacking* in biohacking as something along the lines of 'using the environment to manipulate one's (hidden) biology'. This widely circulating shibboleth, seemingly simple yet strategically obscure in its generality, has been programmatically brought home by US biohacker Dave Asprey. In Asprey's formulation, which he asserts to have introduced to the English language and included in Merriam-Webster's

dictionary, biohacking is defined as the art and science of changing the environment around you and inside you, so you have more control over your own biology (see, for example, Asprey, 2017).[1]

What initially piqued my interest in Asprey's gloss was its rootedness in a distinctly cybernetic lineage of thinking. Andrew Pickering (2010: 20; see also Dorst, 2016) describes as functionally indispensable for cybernetics an adaptive worldview and a performative ontology of the black box – the same black box through which Dave Asprey reframes his body in promoting his brand of self-experimental performance science. In other words, armed with a hacker mentality and fuelled by an arguably Enlightenment-sounding fantasy of biological self-mastery, Asprey refashions his bodily self as a system in intimate coupling with its environment, amenable to wilful manipulation by experimenting on its input–output correlations.[2]

By the same token, Minna Ruckenstein and Mika Pantzar (2017) have identified *transparency*, *optimisation* and *feedback loops* as some of the grounding metaphors orienting the Quantified Self community (see also Lupton, 2016). In short, they describe the dataistic practice of self-discovery as being driven by an idea of pervasive quantification of life that affords for the management of this vital process through manipulation of its constitutive feedback loops and correlations. As the fourth thematic node in their schematic outline, the authors consider *biohacking*. In their interpretation, this notion basically refers to an ethos of entrepreneurial self-experimentation through which these individuals become 'the ultimate authors and creators of their own lives', to the point of possibly promoting alternative or controversial health paradigms (Ruckenstein and Pantzar 2017: 411). However, since biohacking has evolved into a distinct community equally engaged in the naturalistic and sensorial discourse of alternative therapies, further work on its ideological underpinnings and conceptual logics is justified.

Previous scholarship pertaining to 'biohacking' is challenging to summarise not only due to the dispersion of these analyses across the domains of social and natural sciences but also because of the diverse range of (partially overlapping) practices associated with DIY biology/medicine, self-measurement and self-enhancement that fall under this term across distinct geographical contexts.[3] Conforming to the broader inclination highlighted by Mirjam Grewe-Salfeld (2022: 20–21), wherein she observes that 'academic

inquiries into biohacking do seldomly end with a concise and clear-cut definition of what these practices are', I also underscore the significance of biohacking's underlying values and experimental methodologies rather than focusing on definitions. Prominent antecedents that share this standpoint have concentrated on the practices of self-measurement and self-enhancement within various pioneer communities, such as the Quantified Self (e.g. Lupton, 2016; Reagle, 2019), Grinders (e.g. Doerksen, 2017) and citizen scientists (e.g. Ahteensuu and Blockus, 2016; Delfanti, 2013). Noteworthy contributions among these studies have explored various aspects including the phenomenology and ontology of self-tracking (e.g. Ajana, 2018; Ruckenstein and Pantzar, 2017), the micropolitics and cultural implications of adopting new health technologies (e.g. Fox 2017; Nafus, 2016; Wade, 2018) and the ethical dimensions of data collection, security and surveillance linked to these practices (e.g. Hong, 2020). Notably, Grewe-Salfeld (2022) offers a comprehensive analysis of the cultural politics underpinning the biohacking ethos, underscoring the conceptual interrelatedness among the range of practices. In particular, she emphasises the need for greater involvement from the arts and humanities in the ongoing discussions around the production and (popular) use of scientific knowledge and technologies, seeking to increase reflexivity regarding the cultural repercussions of biomedicine and its technologies.

In response to this imperative, while also extending its scope to encompass the landscape of current medical pluralism, I contend that earlier research has yet to comprehensively investigate the political and ideological implications of contextualising contemporary biohacking as a nascent convergence between self-tracking and alternative health cultures. It seems to me that when data-driven self-measurement is articulated with alternative medicine and its emphasis on the 'natural' body, sensory experimentation and cosmic interconnectedness (e.g. Barcan, 2011), a biomimetic impulse to perceive technologies as both subservient to and imitators of 'natural' biological processes gains prominence. Specifically, I suggest this is manifested in the privileging of an increasingly differentiating human sensorium as an onto-epistemological bridge between science and nature, and the ultimate inclination to discard 'tech' in favour of intuition and embodied knowledge.

Biohacker Summits: Curating an Ethos

> Biohacking is not just about getting chips into your hand – it's very much looking into the science of some of these things that's been 'alternative', that we actually now know work. (Olli Sovijärvi, YouTube #1, n.d.)

This analysis primarily relies on a dataset comprising more than 100 hours of publicly available video recordings from the Biohacker Summits held between 2016 and 2022. In addition, I also participated in person at the 2020 and 2022 editions of the event, which took place in Helsinki, Finland.[4] These international gatherings serve as pivotal platforms for individuals involved in the biohacking community, including technology developers, scientists, entrepreneurs, venture capitalists, self-experimenters, early adopters, consumers and media representatives. They attract both established figures and up-and-coming individuals who share an interest in the fields of health, well-being, science, technology and self-improvement. Organised annually by the Finnish Biohacker Center, an authoritative entity in the field, these events play a crucial role in curating the biohacking community. The centre takes on a non-technical role by overseeing event organisation, branding and generating publicity besides contributing to the promotion, retail and value creation surrounding biohacking products and practices through platforms, such as podcasts, workshops and webinars.

Although more individuals have recently joined their ranks as co-authors, the organisation has been personified by its three primary figures: Teemu Arina, Olli Sovijärvi and Jaakko Halmetoja. These three are renowned experts in their respective fields, covering future technologies and self-quantification, functional medicine and nutrition. In this regard, biohacking does not fit neatly into the category of a grassroots movement, given that it relies on curation by an 'organisational elite' of interactional and experience-based experts who define and speak on behalf of the community (Hepp, 2020). Such experts may not always possess formal credentials but are recognised for 'knowing what they talk about' (Eyal, 2019: 8–9).[5] Their impact and recognition within the field are evident as Finnish biohackers are frequently invited as speakers at various health and wellness events. Furthermore, their publications, such as the *Biohacker's Handbook*

and *Biohacker's Stress Book*, enjoy popularity and can be found in larger Finnish pharmacies.

In contrast to the more extreme manifestations of invasive body modification and DIY biology seen in related communities, such as the Grinders (Doerksen, 2017), the Finnish biohacking community and its neighbouring scenes, such as Estonia, exhibit a relatively more mainstream focus on 'softer' forms of personal self-improvement. That is, in Finland, biohacking is characterised by its strong association with the holistic wellness milieu, reflected in its public image that places considerable emphasis on natural environments, remedies and healing modalities. Examples of this include the promotion of edible wild plants, the use of naturopathic treatments, such as functional mushroom tinctures, and engaging in activities such as winter swimming in outdoor settings (see also Lindfors, 2021).

Biohacker Summits offer a multisensory experience that combines various elements, such as technological gadgets, cutting-edge supplements, networking opportunities, therapeutic treatments such as hot and cold exposure, food courts, artistic performances, film premieres, 'brain training' tournaments and lively dance parties. Their visual imagery features vibrant neon colours, accompanied by high-energy electro music and mesmerising visuals. Reflecting the influence of the community's hacker origins, the ethos of openness and accessibility permeates the events, fostering a sense of celebration and tribal identity among biohackers. The attendees themselves may exhibit an 'urban nomad' style, characterised by distinctive hairstyles, bodily modifications, such as tattoos, and functional clothing choices (cf. Klesse, 2005, on 'Modern Primitivism'; also, Davis, 1999).

The core of these summits consists of stage presentations that commence early in the day and extend into the lighter evening programme. These presentations, keynotes and shorter product pitches encompass a range of biohacking practices, technologies and scientific knowledge that are deemed relevant to the emerging community – not to mention the occasional visionary techno-romanticism related to life extension or wild human–machine assemblages. Indeed, the thematic breadth of the presentations and pitches can be bewildering, encompassing topics as seemingly mundane as the benefits of

ergonomic chairs and extending into methods for inducing flow states or unlocking brain potential, the health advantages of Japanese cuisine from a Zen Buddhist perspective, emerging supplemental categories, such as 'senolytics' for combating or reversing age-related diseases, and the traditional Indian therapeutic practice of Ayurveda. While the presentations often employ captivating and streamlined storytelling techniques, they also incorporate appropriate scientific references to maintain an engaging and persuasive tone. This balance makes the subject matter, namely health science, appear compelling to the audience.

Portrayed as key to the rhetorical success of both original cybernetics and its subsequent permutations (Bowker, 1993; Turner, 2006: 25), such persuasive ability to move between different discursive fields and registers – from scientific to ecological to therapeutic to spiritual – seems productive for biohackers also in other regards. In specific, it is suitably aligned with the appropriation and integration of various CAM practices within the purview of evidence-based science seemingly celebrated by the community. As an example, such perspective is reflected in the epigraph to this section with its implication that science is finally revealing truths that have eluded us thus far. Underlining the key role played by the notion of 'integration' in the persuasiveness of CAM representations, Colleen Derkatch (2016: 155–166) notes that 'the new science of alternative medicine' emerging in the past few decades has been frequently presented as resolving several sets of oppositions (mainstream and alternative, old and new, East and West, care and cure) by rendering them futile or outdated at the outset. In a related fashion, analogies between seemingly novel biohacking techniques and existing therapeutic modalities are not necessarily drawn to invoke some long-standing historicity for the practice, as if biohacking would have existed from time immemorial – although this is also occasionally implied. Rather, they tend to point towards the lasting cultural validity of its basic principles on a higher level of abstraction, on which (Western) science is of course the supreme epistemic authority (cf. Bowker, 1993: 122). In this manner, the principle of 'self-knowledge through self-measuring' can be suggested as informing, say, both Indian Ayurvedic medicine (with its pulse readings) and contemporary self-tracking cultures.

My analysis is grounded in a collection of video recordings, along with field notes, capturing face-to-face lectures that have been professionally edited for commercial purposes using multiple cameras. In interpreting these materials, I draw on the extensive body of literature in linguistic anthropology that explores the role of (commodified) narrative and embodied performance in shaping shared values and worldview (e.g. Bauman and Briggs, 1990; Black, 2021).

It is important to note that my perspective on biohacking is shaped by rehearsed performances within a professionally curated in-group event, rather than everyday or journalistic accounts of the phenomenon. Nevertheless, it can be argued that such reflexively calibrated, condensed and highly portable presentations play a crucial role in the formation of distinct social groups and identities (also Hepp, 2020: 940).

From the beginning, my methodological choices have been guided by my interest in understanding the self-perceptions of biohackers and how these perceptions align with the conceptual and ideological framework of the community. To gain a comprehensive understanding of this framework, I conducted a thematic analysis of the materials, categorising the wide range of presentations into general subject areas, such as health science, genetics, personalised medicine and self-experimentation, ageing and longevity, dietary and supplemental technologies, movement and physique, brain and consciousness, and peripheral or unique topics (e.g. 'mediumistic art' or cosmetics as 'beauty technologies'). While considering each year's specific theme (e.g. 'Reversing Ageing, Extending Healthspan' in 2022), I excluded individual product sales pitches and topics that appeared to be singular in nature. Instead, I focused on identifying similarities and connections between different subject areas, aiming to uncover more paradigmatic or conceptually oriented examples of speakers and presentations that could better delineate and illuminate the emerging terrain.

In light of the extensive collection of over 200 presentations – that arguably do not cohere into anything like a unified whole but rather represent a kaleidoscope of viewpoints on health management – I have chosen to concentrate on a subset of approximately two dozen key presentations that seemed to (or that were explicitly delivered so as to) speak for the collective sentiment. Specifically,

I have identified examples that conceptualise biohacking as a systematised approach to bodily self-use by staging technologies and interventions in relation to natural biological processes, which at this point had become a central focus of my interest. By narrowing down the corpus to this smaller set of presentations, I have begun to identify recurring ideas and normative ideals concerning 'natural' well-being, biomimicry and the manipulation of the body as a black box. Let me next introduce some further examples of biohacks as bodily and aesthetic tactics that strategically undercut the distinction between therapy and enhancement.

Hacking the Biocomputer: Therapeutic Enhancement

Hacking is an imprecise term for a systematised intervention and approach applicable in a variety of sites and contexts: it is equally possible to 'hack' a string of code as it is a mountain climb, a business endeavour or a meal. Taking note of the flexible nature of hacking and the popularity of an informatic metalanguage in contemporary culture more generally, Gabriella Coleman (2016: 158) describes how the range of activity wedded to the term has expanded exponentially since its coinage some 60 years ago: 'Bloggers share tips about "life hacks" (tricks for managing time or overcoming the challenges of everyday life); corporations, governments, and NGOs host "hackathon" coding sprints [. . .]; and the "hacktivist," once a marginal political actor, now stands at the center of geopolitical life'. Aligned with the general tendency, the hacking in biohacking may be described as referring to a loose collection of methods, tactics, procedures and logics that vary in formality and functionality from purposeful interruption of a normative biological process to simply doing exciting things with one's body (see e.g. Carney, 2020: 21; also, Reagle, 2019).

I suggest reframing and understanding the hacking in biohacking as simply a mode of engaging with science and technology that is relatively more performative than representational. Andrew Pickering describes as *representational* the traditional mode and ontology of modern science where science is equated with statements and assumptions that are either true or not and nature framed as corresponding to these descriptions or not. By contrast, what he calls a *performative* mode of engaging science and associates with a paradigmatically

cybernetic *modus operandi* addresses the action and performance of scientific praxis in a way that a representationalist–referentialist conception would hardly invite or allow (Pickering, 2010: 73; also, Latour, 2004: 210–213). In biohacking practice, this mode is encapsulated by self-experimentation, with the proviso that it is possible to self-experiment by using one's own body/self as both a medium and object of experimentation. That is, one can experiment with both 'something else' (say, the effects of a certain supplement on one's brain or immune system) *and* one's selfhood, with a further understanding that these two entities might also end up fundamentally entangled (as evidenced by psychopharmaceuticals; see also Langlitz, 2006: 84). Personal or 'small' data produced in this self-experimental fashion can be then shared, juxtaposed and incorporated within 'big data' provided by the broader community of biohackers and population statistics.

A considerable number of actual biohacks, to illustrate this practice with further examples, might be simply described as falling within the domain of small-scale *therapeutic* and *enhancement* technologies and techniques.[6] For instance, one might consider an everyday routine favoured by biohackers of consuming an appropriate amount of the amino acid L-theanine alongside one's daily cup of coffee which allegedly inhibits the 'jitters' (overstimulation, anxiety) occasioned by excess caffeine intake for certain individuals. Or take the slightly more complex tactic of pairing a brand of cacao extract called chocamine with an appropriate monoamide oxidasis (MAO) inhibitor – cinnamon works fine, as does a plant extract called *Rhodiola rosea*, commonly known as rose root (see van Diermen et al., 2009) – with the aim of using the MAO inhibitor to extend for the user the mildly euphoric or 'blissful' effect of the alkaloid phenylethylamine provided by chocamine. If these minor tactics discussed by German biohacker Maximilian Gotzler in his presentation are considered biohacks, they are hacks in the sense of manipulating existing nutritional or 'nutraceutical' practices by tweaking their associated biochemical processes with the aim of enhancing one's self-experience in terms of both well-being, productivity *and* delight.

We may thus differentiate biohacks into distinct types or classes by the way they fall between therapeutically oriented in the first case (i.e. L-theanine healing a prior 'illness' or providing a quick fix for a

problem) and enhancing or perhaps 'recreational' in the second (i.e. upgrading or altering what is considered the baseline condition). However, rather than presenting therapeutic interventions and human enhancement technologies as seemingly divergent tactics, biohacking straddles the whole therapy versus enhancement dichotomy by incorporating and re-naturalising the two into a univocal vision of human optimisation. In practice, this is done by wilfully making use of existing therapeutic treatments for enhancement purposes, typically in the name of proactive risk reduction and preventive healthcare (for a critique, see Dumit, 2012). Indeed, given that social and political discussion on bioethics has moved from an earlier therapy versus enhancement lockdown associated with the 1990s onto the currently popular dichotomy of anti- and pro-enhancement positions, biohackers land firmly in the latter group (Morrison, 2015).

On this matter, biohackers also like to remind us that many accepted treatments and existing therapeutic interventions, such as basic dental care and prostheses, are 'augmentations' in the sense of enhancing human capacities beyond the norm. By rhetorically incorporating such unmarked sociomaterial practices as using eyeglasses, drinking coffee, having a sauna, sunbathing, or 'forest bathing' (as the preferred term for indulging in the beneficial effects of an arboreal atmosphere) within the purview of biohacking, the notion of self-optimisation is naturalised and rendered morally accessible, even inevitable. Such technoscientific regimentation and co-optation of everyday behavioural or nutritional practices might be considered as an aspect of what Anthony Giddens (1991) has described as reflexive modernity and exemplified by smokers who have been made increasingly aware of the negative impact of tobacco smoke on their health. To the extent that it has become virtually impossible for us to escape this type of knowledge about the negative *and* positive effects that various behavioural and nutritional practices can have on us, the technoscientific lifeworld embodied by biohacking merely mirrors our immersion in a biopolitical regime where, as Abi-Rached and Rose (2010: 191) suggest, even choosing not to intervene in our biological processes constitutes a form of intervention. Yet, given the therapeutic and medical context, such broadened awareness may also inadvertently entangle us once more in a medicalising system we may have initially sought to elude (Derkatch, 2016: 145).

Biomimetic Imaginary in Action

In this section, I commence by critically acknowledging the foundational cybernetic premise of informatisation, according to which human and nonhuman life could be quantified, codified and manipulated down to the biochemical detail (see, for example, Pruchnic, 2008; Thacker, 2003). Characterised by John Lardas Modern (2021: 36, 59–60) as a new horizon of epistemic and political possibility, cybernetics embodied a holistic paradigm that has fostered a pervasive understanding of self and world as essentially 'reducible to (and manipulable by means of) a neural mechanics of information processing'. Eroding the boundaries between biological and technological processes, such informatised holism not only aligns with the concept of monistic interconnectedness in CAM ontologies but has also been posited as an operational premise shared by the behavioural analytic imperative of platform capitalism (Neves et al., 2022).

Consider how this imaginary is fortified by Teemu Arina in his introductory speech to the very first Biohacker Summit in 2016, suggesting its rhetorical if not onto-epistemological centrality for the community:

> Information is primary. Information is deep in our genetics – that sort of wants to copy forward. We have epigenetics influencing that code. We have all kinds of messengers and information going throughout our bodies. Biochemical messengers between ourselves. Electric activity in our nervous systems. It's in our language, in our interactions.

We may here re-think the concept of informatisation as an interdiscursive process that relies on drawing analogies between natural/biological processes and technological/cultural relations, recognising that these opposing poles mutually shape and constitute each other. This analogy, characterised by similarity-in-difference, facilitates reciprocal exchange between the two domains by redefining nature and technology as discursive shifters whose meaning can be systematically transformed depending on the comparative framework and context of use. One prevalent formulation involves reframing nature as a more-than-human technology and a productive agency in its own right, for example, as a 'master chemist'. Within the context of advanced capitalism, this agency can be harnessed to unlock technological and therapeutic potentials, as exemplified in biomimicry

(Dicks, 2023) and biohacking. In this perspective, the informatic worldview is fundamentally rooted in an ideology of differentiation (Gal and Irvine, 2019), enabling the continuous projection of the nature–technology axis onto increasingly broader scales of comparison. This axis extends from informatic molecular structures to conceptualisations of social institutions or machinic processes as living organisms, with the emphasis shifting between the two poles.

In his presentation titled 'Decoding Symbiotic Relationships with Your Environment', Finnish biohacker Jaakko Halmetoja reframes most biohacking devices as fundamentally replicating natural functions. He stages a temporal trajectory in which our technologically saturated environment has both alienated us from our earlier natural state and simultaneously provided the potential for a return to this past: 'When I think about biohacking, most of the best tools are more or less related to [. . .] major biological systems, and we go back to the nature, we go back to the mirror that is reflecting [. . .] the past'. After touching on the importance of air and water quality to our health, Halmetoja invokes the Japanese practice of *Shinrin-Yoku* (also known as 'forest bathing') as a kind of meditation on our interconnectedness with the environment:

> I think it's for your cognitive ergonomy very important that we go into nature, reshape the mental architecture that's bombarding us . . . And there are so many different symbiotic relations with the volatile organic compounds that plants are also producing, that affect our limbic system and our nervous system. All of these things are linked, and I think that one of the points that I want to make, is that the more we are connected to the sensory system, the more aware we are what's happening around us, the more we can pick up these signals, because we can see, like microcosm in macrocosm, wherever you put your focus, you start to go deeper and start to find things.

Superimposed with chemical formulas of, for example, 'phytoncides' – the scientific term for the volatile organic compounds with antimicrobial qualities emitted by certain plants and trees – the presentation is visualised by natural imagery of lush green forests, plants and fungi. Speaking to a CAM ontology of cosmic interconnectedness seemingly compatible with and even legitimised by science, Halmetoja suggests tapping into these correspondences

between different dimensions of a single whole (inner/outer, microcosm/macrocosm) in one's own experience. That is, while the technoscientific apparatus may provide us with an enhanced awareness of the informational traffic between ourselves and our environments, this third-person approach ultimately pales in comparison with our infelt bodily capacity to plug into these signals and correspondences through our senses.

A similar biomimetic imaginary whereby natural processes retain their privileged position also steers the rationale of 'reverse-engineering' often encountered in biohacking contexts. In his presentation '11 Powerful Ways to Trigger Flow at Work', Maximilian Gotzler describes binaural beats – audio wave frequencies that are used for manipulating and inducing brain states, such as interhemispheric coherence – as a 'perfect example of biohacking' in the sense that this technology centres on the logic of reverse-engineering brain wave function (see also Robbins, 2000). Binaural beats and similar biofeedback technologies are thus based on first unlocking the physiology behind certain brain states, after which it (ideally) becomes possible to reverse the process by inducing or 'programming' these brain states through manipulating and stimulating physiology (see also Chia, 2018). Comparably with the field of biomimicry from where the notion of reverse-engineering is indeed lifted, the categorical divide between the natural and the manufactured is, however, ultimately reinstated, with biological functions understood as being merely replicated and translated in, or beneficially provoked by, the technological domain (see Goldstein and Johnson, 2015; Johnson, 2010: 179–180; also, Dicks, 2023).

To invoke another example, consider infrared light therapies, which might be seen as attempts to mimic the beneficial effects of a sunset. However, from a biomimetic perspective, these therapies are considered to inevitably fall short of capturing the 'full spectrum' of natural sunlight to which our bodies are innately attuned. This perspective effectively places technologies within a broader ecological or biocentric framework of cosmic interconnectedness, moving away from traditional views of culture as the mastery of nature through technology. Yet, as pointed out by Rosi Braidotti (2013: 84–85), such holistic approaches that perceive the world as a 'single, sacred organism' tend to relegate culture and technology to an analogical role,

merely replicating authentic engagement with natural phenomena and dualistically siding with an essentialised natural order.

Bridging Science and Nature: Back to the Senses

If biohackers, despite their preference for being seen as anti-dogmatic, draw on an institutional foundation, it primarily rests on science, technology and what can be termed 'expert knowledge'. While far beyond the scope of this article, the complex relationship of biohacking with science, scientific method and the ever-shifting nature of scientific or medical facts (see Dumit, 2012), could be tentatively conceptualised using Bruno Latour's (2004) distinction between 'primary qualities' of science, achieved through sophisticated apparatus and methodology, and 'secondary qualities' of everyday cultural experience. These secondary qualities, while phenomenologically real, are more elusive and challenging to quantify.

Coincidentally, these two registers also serve as the lenses through which biohackers evaluate themselves. We can categorise them as an external quantifying register, grounded in technoscientific measurements, and an internal experiential register, rooted in bodily and sensory self-perception (cf. Chumley, 2013; see also Versteeg et al., 2018). These two registers are often seen as representing different value systems and are held in a tensional relationship. Biohackers, however, appear to treat them as complementary, using both in conjunction (see also Chumley, 2013: 172). However, while admittedly bringing the two registers into productive dialectical contact, biohacking betrays an inherent hierarchical dualism by ultimately privileging the internal register of irreducible individuality and an increasingly differentiating human sensorium at its centre.

Viewing the human body as a system to be stimulated in search of a response, with the ultimate goal of mastering that response, represents a fundamentally behaviourist perspective that betrays a curious monism at the heart of biohacking. Flying flagrantly against what Jean-Luc Nancy (2002) has described as bodily opacity, that is, the idea that the body is always a stranger to itself, biohacking mobilises a discourse of psychosomatic transparency, similar to self-tracking cultures. Proponents commonly envision a future-oriented temporal trajectory and associated technology able to monitor and measure an increasing number of signs and signals trafficking the

body–sensorium–environment coupling (see also Ruckenstein and Pantzar, 2017: 406–408). This imaginary is also vividly portrayed in the Biohacker Summit 2016 trailer (see YouTube #2, n.d.) which showcases various biohacking techniques alongside relevant bodily measurements, such as cortisol levels for sleep and brown adipose tissue measurements for ice swimming.[7]

While biohackers authenticate self-enhancement by referencing science and technological measurements, they do so by simultaneously challenging the prevailing ideology of sensory mistrust that characterises self-tracking cultures (see Lupton, 2016). This is the idea of the natural human senses as somehow fundamentally deceptive, which can be seen as a normative re-formulation of Latour's earlier distinction. Biohackers resist this position by discursively leveraging technologies in the service of an increasingly differentiating sensorium as a metonym of an authentic relationship to one's own human nature (see also Hong, 2020). They view the 'natural' body as inherently wise and capable of healing itself, positioning themselves as merely 'helping nature do its job' by supporting the body's innate propensities and capacities – one of the lasting tenets of CAM (see Barcan, 2011: 22–23).

The core aspiration of biohacking can be framed as liberating the body from the external regime of 'tech' after having internalised its lessons in bodily and sensory terms, indicating a pedagogical project of teaching the body to be affected in various ways (see Latour, 2004: 205–206). 'Once you have mastered the art, you can let go of the tool', as Teemu Arina encapsulates the thinking (public Facebook-post 15.7.2021). The external regime of evaluation afforded by various human–technology assemblages is merely described as 'making the feedback loop rotate faster' and assisting the biohacker to efficiently translate any effects that various human–environment couplings have on oneself internally. Furthermore, Pantzar and Ruckenstein (2017: 7) astutely propose that self-trackers adopt a 'situated objectivity' in their data practices, relying as much on 'trained judgement' as on mechanical measurements. Biohackers align with this fundamental principle of self-tracking cultures, translating objective measurements to fit their personal experiences and expectations. However, they do so by simultaneously elevating personal sensory authentication and augmentation to an ideological cornerstone of their conceptual practice. Scientific knowledge and

measurement data are important to consider, but with a critical perspective; ultimately, personal experience and 'listening to the body' takes precedence (also Versteeg et al., 2018).

For example, after initially questioning whether installing magnetic implants would be healthy, Ben Greenfield, a central figure within US biohacking, encourages the audience to ask themselves, 'am I naturally equipped, without necessarily biohacking, to tap into my own human nature, my own innate human biology and experience some of these things myself?'

> When we look at the earth for example . . . I'm barefoot right now, if I were barefoot on the ground, I would be experiencing a natural pulsed magnetic frequency, it's called the Schumann resonance, that the earth naturally emits. In addition, your brain and your heart produce an electro-magnetic field that people around you can actually feel, can actually sense, from over 15 feet away. If you learn how to control your emotions, how to control your brain waves [. . .] you can actually develop the ability to consciously control many of these variables. How many of you in here have had reiki, reiki treatments, or any type of human-touch treatments where someone isn't actually touching you, they're just getting their hand very close to your body? If you learn how to be in touch with things like your heart-rate variability, with things like your breathing, with things like having a connection to the planet earth, you can actually, believe it or not, without getting a surgery, to put magnetic implants into your body, to be able to tap into electro-magnetism, using your own body. And that would be a form of ancestral living that might fly in the face of biohacking. But that's something that I would consider a biohack. The ability to be able to control your emotions and your heart-rate-variability. Being in touch with the planet earth. Knowing that your own brain and heart signals affect the brain and heart signals of those around you. (11:10–13:00)

Greenfield's presentation, titled 'Biohacking vs. Natural Living 2.0', pitches the human sensorium against technological sense-making, while rhetorically managing to incorporate the two within a single overarching framework of enhanced sensory and self-awareness (also available online with the title 'Ancestral Living vs. Biohacking 2.0'; see YouTube #3, n.d.). Here, 'biohacking' comes down to teaching the human sensorium to become increasingly sensitive to various

internal and external correlations, which may initially seem like the 'primary qualities' of technoscience but are, in fact, within phenomenological reach even without technology. Biohacking thus formulates the human sensorium as an onto-epistemological bridge between science and nature, in a manner that recalls David Abram's (1997) description of experimenting on the sensorium in his much-read essay 'Returning to Our Animal Senses' (later known as 'Waking Our Animal Senses: Language and the Ecology of Sensory Experience'). Whereas Abram aims to 'gradually bring our science into accord with the animal intelligence of our breathing bodies', biohackers are on a comparable quest to 'reconcile' the biology inherited from our ancestral past with the technologically mediated world we live in today. This perspective aligns connection with the body with connection with nature, while science and technology retain their derivative position in relation to the latter.

Make no mistake, the trope of an increasingly differentiating sensorium as an onto-epistemological bridge between science and nature can be regarded as a variation of the discourse of rediscovering or renewing our 'connection' to the more-than-human world as a shared feature of both therapeutic, environmental and spiritual discourses (see also Lindfors, 2021). Insofar as this connection is here imagined predominantly in terms of vital capacity and individual ability – that is, as heightened sensory awareness of the body as a metonym of nature – it betrays a liberal humanist bias in naturalising the notion of autonomous individualism as an intrinsic part of the human.

Conclusion

This article has explored contemporary biohacking as a fusion of data-driven self-tracking and alternative/holistic health cultures, and critically examined the resulting biomimetic imaginary. Beginning with the cybernetic principles inherited by biohackers from self-tracking communities such as the Quantified Self, I have traced how this techno-naturalist imaginary engenders various hierarchical differentiations and strategic re-naturalisations at multiple levels. These include relegating technologies to analogical replication of nature, invoking a 'natural order' to legitimise and inspire enhancements, and ultimate discarding 'tech' in favour of intuition and embodied knowledge. This re-naturalisation is particularly apparent in the

emphasis biohacking places on an essentially humanist and abstracted concept of autonomous individuality, aligning ascetic and primitivist ideals of sensory experimentation and heightened bodily awareness with the capitalist inclination to proliferate and commodify differentiations – by basically presenting a diverse assortment of products and practices to cater to an increasingly refined human sensorium.

In essence, while biohacking presents novel opportunities for open-source citizen science engagement and potentially beneficial forms of techno-assisted subjectification (cf. Hester, 2018), it also begs for a continual re-politicisation in terms of its complexity with a range of contemporary cultural forces, such as consumerism, individualism, neoliberalism and even orientalism, akin to the broader field of alternative medicine (Barcan, 2011). Equally important, I propose that biohacking provides insights into the growing scientific orientation of alternative health, the use of biomimicry as a discursive tool whereby nature is all-too-often depoliticised and romanticised rather than framed as a space for contestation, and the ongoing naturalisation of technoscience for rationalising forms of bodily self-use (if not broader social organisation). It thus remains crucial as ever to consider the social and ethical implications that arise when individuals engage in various forms of self-directed bodily transformation to meet the demands of contemporary society.

To better understand the evolution of biohacking and its relationship to other contemporary movements and communities, it will be important to continually examine its connection to posthumanism and transhumanism, which can be argued to be closely associated, if not aligned, with biohacking. Like transhumanism, biohacking advocates for a 'better than well' approach to humanity, promoting 'morphological freedom' to alter and enhance the aspects of the body. While this theme was initially discussed in the field of bioethics, it has since become a self-proclaimed mission of various techno-ascetic communities mentioned here (see Huberman, 2020).

In contrast with a sympathetic relationship to the trajectory towards human enhancement associated with transhumanism, however, the relationship between biohacking and the more critical and deconstructive approach of posthumanism appears to be more uneasy and tense, not least for the fact that the ideas of health and wellness may seem 'literally unthinkable' in the absence of their human referent (Andrews and Duff, 2019: 127). While biohacking may explicitly embrace a

posthumanist rejection of hierarchical legacies of Enlightenment humanism in favour of acknowledging humans as 'holobionts' in ecological relationships with various microorganisms and nonhuman entities, it can be criticised for using this recognition to primarily serve anthropocentric and individualistic goals of therapeutic self-enhancement through commodified biohacks. In the process, it may downplay equally significant posthumanist endeavours that seek to decentralise the human in relation to nonhuman, more-than-human, and human others (see Ferrando, 2019). These critiques, however, require further research for a more comprehensive exploration.

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Notes

1. In fact, biohacking is defined in the (online) Merriam-Webster's as 'biological experimentation (as by gene editing or the use of drugs or implants) done to improve the qualities or capabilities of living organisms especially by individuals and groups working outside a traditional medical or scientific research environment', although Asprey is also mentioned on the webpage (see Merriam-Webster.com, n.d.). Bearing in mind that Asprey is known as a serial entrepreneur with several million-dollar businesses, one may reasonably reckon that the definition of biohacking that he is actively branding is as much a descriptive gloss as it is a 'commodity formulation' (Agha, 2011), that in this case seems to reflexively commodify intimate bodily self-use.
2. While arguably appearing to grant one with a greater sense of agency over one's health vis-à-vis a medical system that can be felt as rhetorically

disabling, such claims give pause for thought for seemingly overdriving an ethos of self-responsibilisation in a social environment where people can be seen as already encouraged to find their own solutions 'for poor health and health management, often through consumer choices within the private sector' (Dolezal and Oikkonen, 2021: 5; also, Hobart and Kneese, 2020). Relatedly, the hacking metaphor, when applied to the human organism as a bio-psycho-social entity, can be problematically apolitical, overly optimistic, and simplifying in promising seemingly straightforward 'fixes' for often complex ailments and syndromes that are also necessarily entangled with socioeconomic and political constraints.

3. See also Hepp (2020: 934) on how pioneer communities arise out of the context of many different other figurations.
4. The video package is available for purchase at the Finnish Biohacker Center, titled the *Biohacker Summit Video Recordings Bundle 2016–2022*. It constitutes an online platform that is presented as a 'course' for biohackers to complete. As a contextualising pool of material, I also draw on my ongoing media ethnographic involvement in the field through social media platforms, podcasts, interviews with practitioners, blogs texts, and popular literature.
5. Andreas Hepp (2020) describes pioneer communities as a combination of (social) movements and think tanks in a manner that has strong resonances with my work on biohacking. Pioneer communities are, by his account, communities of practice composed of tech-inspired people, with a decentralised organisational structure that cuts across different (local) groups and (global) corporations. Pioneer communities tend to present themselves as (social) movements rising 'from below'; however, on a closer look, they are typically too apolitical and too closely intertwined with the corporate world to be regarded as such.
6. Balancing enhancement and 'naturalness' may raise questions about the boundaries between what is considered natural and artificial, and the ethical implications of intervening in natural processes. However, it is worth noting that the distinction between therapy and enhancement can also be deliberately kept ambiguous, with normative assumptions regarding 'enhancement' or 'normality' often left implicit (see also Dolezal and Oikkonen, 2021; Wade, 2018).
7. So far, full psychosomatic transparency remains a Utopian trajectory structured around normative assumptions of time as progressive that mostly feeds the biohacking imaginary as a limit-case scenario. Underlying this general *desire to manage*, however, can be found an ideal and anticipation of extending scientific rationalisation onto all sorts of behavioural patterns (see also Davies, 2015: 3–5, 129).

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