8. Lithium for the Metaverse: Myths of Nuclear and Digital Fusion

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> *I'm so happy 'cause today I found my friends, they're in my head. (Nirvana, "Lithium")*

How does lithium feel? I don't think I have ever touched lithium, at least not in its elemental form, but increasingly this lightest metal is to be found all around us, for instance in smartphone batteries. A part of our everyday reality, lithium simultaneously remains the stuff of science fiction: lithium, especially lithium-6, is a key fuel for nuclear fusion, which brings the sun to earth. If nuclear fusion is ever harnessed as an energy source, human expansion will accelerate even more dramatically into extraterrestrial space and cyberspace. I therefore imagine lithium to feel *weightless* and *frictionless*, as in bodies defying gravity, whether in real life (IRL) or in the Metaverse, the virtual/augmented/mixed reality (VR/AR/MR) world recently popularized by Mark Zuckerberg and his avatar. But lithium is not manna from heaven. Like the black fossil golds that continue to propel a growth-addicted globe, this white gold (or white oil) will increasingly manifest itself as *the* post-fossil conflict mineral (along with cobalt, manganese, nickel, and graphite, which are also essential materials for today's batteries). Like fossil, lithium hurts, as the quest for it is driven by the same old burn-out logic that dominates the planet now.

Lithium is also an anti-depressant. As Kurt Cobain sings in the Nirvana song named after the drug on the 1991 album *Nevermind*, he is "not gonna crack" because today he found his friends in his head. Cobain's reference to imaginary friends is a fitting way to describe life in the Metaverse. In the Metaverse, the user tunes into a universal brain, logging out of their body and material reality. For transhumanists to reach Nirvana would mean *total fusion*: the mind uploaded into the cloud. This essay pierces this fusion myth.

Batteries

Lithium (Li, atomic number 3) is a soft, silvery-white alkali metal. Under regular conditions lithium is the least dense of all solid elements, and like all alkali metals, it is highly reactive and flammable. The name "lithium" derives from *lithos*, which is Greek for stone, as lithium was discovered from a mineral. In 1817, Swedish chemist Johan August Arfwedson detected the element while analysing petalite ore. Lithium does not occur freely in nature but only as part of usually ionic compounds (an ion being an atom or molecule with an electrical charge). The world's largest lithium reserves are in Chile, Iran, Australia, China, and Argentina. In Europe, the largest reserves are in Portugal. Lithium is mostly found in ocean water: five thousand times more than on land yet at extremely low concentrations, making the isolation of lithium from salt water a very complex operation.[1]

Lithium is used in rechargeable batteries for electronics such as smartphones, laptops, and cars. Currently, these are lithium-ion batteries, a type of rechargeable battery in which lithium ions move through an electrolyte (a medium that contains ions) from the negative to the positive electrode during use, and back when charging. Invented in the 1970s, lithium-ion technology was first used commercially in 1991 by Sony. In 2006, Tesla revealed prototypes of its Roadster model, a year later Apple launched the iPhone—two breakthrough products fuelled by lithium-ion.[2] For now, lithium-ion remains the industry standard, but in the coming decades this technology is expected to be replaced by solid-state batteries. Solid-state batteries still work with lithium ions moving through the battery. In contrast with lithium-ion batteries, however, the electrolyte is not a flammable liquid but a solid material. This makes them safer and also increases their energy density potential.[3]

In the transition from a fossil-based global economy to one fuelled by renewable energy sources, lithium will thus clearly continue to play a key role—or remain a key *actor*, as new materialism would have it. Already in 2014, Tesla and Panasonic agreed to cooperate on the construction of a battery manufacturing plant, and in 2020, Tesla secured the rights to a site in Nevada to produce lithium from clay deposits. Two years later, Tesla CEO Elon Musk tweeted that his company may indeed get into lithium mining directly: "Price of lithium has gone to insane levels! … There is no shortage of the element itself, as lithium is almost everywhere on Earth, but pace of extraction/refinement is slow."[4]

1 See also: Royal Society of Chemistry.

2 See also Liu.

3 See also Phiddian.

4 See Clifford.

Lithium-6

I will return to the current reality of lithium mining, but I first want to speculate about lithium's future. Every once in a while, news about nuclear fusion pops up, as for example in early 2022 when researchers at the Joint European Torus (JET) experiment in Oxfordshire set a new record for the amount of energy produced in a sustained fusion reaction (Sample). JET is part of ITER, the International Thermonuclear Experimental Reactor megaproject headquartered in France that is co-funded by the European Union, China, India, Japan, Russia, South Korea, and the United States. "*Iter*" is Latin for *path* or *the way*, in this case to the neverland of "a potential source of safe, non-carbon emitting and virtually limitless energy," as we read on the ITER website.

In the case of terrestrial fusion experiments such as those conducted by ITER, fusion is fuelled by two forms of hydrogen: deuterium (^{2}H or D), which has one proton and one neutron, and tritium (^{3}H or T), which has one proton and two neutrons. In this deuterium-tritium (DT) fusion one deuterium nucleus fuses with one tritium nucleus, producing one helium nucleus (He, atomic number 2, named after the sun), one free neutron, and 17.6 megaelectron volt (MeV) of energy. Deuterium is a stable hydrogen isotope and is easily won from "heavy water" (D_2O), which makes up about 0.03% of all oceanic water. Tritium, however, is unstable (i.e., radioactive) and does not occur in nature. In 2022, there was less than twenty kilograms of tritium on earth, while the fission reactors that produce tritium—most of which are in Canada—are near the end of their lifetime. As *Wired* reports, before it even starts working "nuclear fusion is already facing a fuel crisis" (Katwala).

This is where lithium enters the picture, or more precisely lithium-6 (^{6}Li, so 3 protons and 3 neutrons), which is one of the two stable lithium isotopes on earth, the other being lithium-7. In fusion reactors, the walls are covered with a breeding blanket made of lithium-6 that, when bombarded with high-energy neutrons, produces tritium. The problem is that lithium-6—which is a controlled material also used in thermonuclear bombs (or H-bombs)—is not as abundant as fusion enthusiasts make it seem, because with current technology there is no industrial source of lithium-6. In natural lithium, the 6-isotope only has an abundance of 7.5 percent (the remainder being lithium-7), whereas for sustainable fusion 90 percent is needed. It is therefore still highly uncertain whether the production of tritium out of lithium-6 in a laboratory setting will work well enough in a reactor. As Steven Krivit writes, "If the test fails, the quest for fusion is over."

Meanwhile, fusion detracts a lot of resources from *truly* clean solutions while its quest perpetuates a dominant global culture obsessed with economic growth. Whether or not nuclear fusion is ever harnessed, its sustainable claim will remain science fiction. In much science fiction, by the way, fusion is often just a given, facilitating travel to the outer edges of the galaxy and the colonization of asteroids.

Here it has to be noted that the fusion drivers propelling most sci-fi imagination are fuelled by helium rather than tritium because terrestrial DT reactors are too heavy to outfit a rocket.

Magic

Let's stay in a speculative mode and extrapolate our technofeudal present, in which companies like SpaceX, Meta, and Amazon invade all spaces terrestrial and extraterrestrial. If fusion ever materializes, human expansion is expected to move further into outer space and "inward" in the direction of the Metaverse in order to further colonize people's attention. In science fiction, the Metaverse is an iteration of the Internet represented as a single universal and immersive virtual world. The name was introduced in the 1992 dystopian novel *Snowcrash* by Neal Stephenson, which describes a cyberspace in which "magic is possible." In 2021, the Metaverse became a household name when Mark Zuckerberg announced that Facebook was now Meta Platforms. "We'll be able to feel present," Zuckerberg rambles in his video presentation of the Metaverse, "like we're right there with people no matter how far apart we actually are."

Zuckerberg's optimism resonates with Big Tech's overall transhumanist belief in the fusion of human life and technology—the belief in technology as second nature. This belief is not new. In the case of the Metaverse—which is primarily an audiovisual medium—we are reminded of late-nineteenth century accounts of the cinematic experience as total immersion. As film philosopher André Bazin argued in his 1946 essay "Le mythe du cinéma total et les origines du cinématographe" ("The Myth of Total Cinema") the *idea* of cinema as an immersive medium preceded its technological realization. "There are numberless writings," Bazin contends, "all of them more or less wildly enthusiastic, in which inventors conjure up nothing less than a total cinema that is to provide that complete illusion of life which is still a long way away" (20). Cinema's magic thus paved the way for cinema as a technology, and can't we say the same about the Metaverse? Also, the Metaverse, before it is real, is preceded by the belief in a *magical* overcoming of the barriers inherent in human interaction. There is not one metaverse by the way, because besides Meta Platforms also companies like Microsoft and Epic (from the game *Fortnight*) are developing virtual worlds. The transhumanist dream is for these worlds to add up to one single Metaverse, overcoming the limitations of the human body that will remain immobile as in the cinema.

Resistance

To stay with cinema, Jonathan Beller argues that also in the digital era, the capitalist society of the spectacle remains characterized by a cinematic mode of production in which we "confront the logistics of the image" not only at the "scene of the screen" but wherever we turn (1). Increasingly, this mode of production depends on lithium, at the cost of people and the planet. An online search yields a number of documentaries and reportages that expose the socioecological reality of lithium mining. For instance, *Die Lithium Revolution* (2012, dir. Andreas Pichler and Julio Weiss, DE et al,) shows the tension between Bolivia's wish for autonomy in the exploitation of its lithium resources and German mining companies seeking to do business. Two other films, *En el nombre del litio* (2021, dir. Christián Cartier and Martín Longo, AR) and *Lithium: New Gold Rush in the Andes* (2021, Matthias Ebert, DE), take us to Salinas Grandes in Argentina, where indigenous communities resist lithium mining, as the amount of water needed for the process will contaminate their habitat. "We filed complaints and have held demonstrations to try to slow the expansion," a local activist says, "the government has already issued permits for several projects, but no one is giving us any specifics" (fig. 1). Meanwhile, in the Portuguese north, a village is threatened to be swallowed by the largest lithium mining site in the EU. "Are these electric cars so good for the environment?" asks Aida Fernandes in *The Dirty Truth behind Green Cars* (2020, DE/FR), "they will have to destroy all these mountains."

Fig. 1: Screenshot from Lithium: New Gold Rush in the Andes, 2021.

There is a certain irony in watching these lithium documentaries on a smartphone or laptop screen, because as Padraig Murphy et al. write in "New Materialism, Object-Oriented Ontology and Fictive Imaginaries" (2021), the devices attached to these screens "might have within its network the geopolitics of lithium deposits on Bolivian salt lakes" (5). In new materialist fashion, the authors draw attention to the *thingness* of media objects and practices through which imaginaries circulate, including documentaries about environmental degradation. While I do share this materialist perspective on our media-saturated culture, I am not so sure about the *new* materialist practice of calling non-living objects like smartphones *agents*, at least not when agency is attributed indiscriminately to human and non-human forms alike. In difference with new materialists' radical de-anthropocentrism, I think that a minimum of posthumanist humanism remains needed: a belief in people's ability to make meaning (the founding belief of cultural studies), in their ability to tell stories and weave social textures, and in their creation of *common* and communal spaces (as opposed to profit-driven and automized environments like the Metaverse). In other words, we need to somewhat hold on to the possibility of a collective human subject, while at the same time queering, decolonizing, and posthumanizing this subject. To say with new materialism that objects are actants (Bruno Latour) or that matter is vibrant (Jane Bennett) may be ontologically poetic, it also diverts attention from agency as resistance. I therefore prefer a *cultural* materialist understanding of agency as people's individual and above all collective consciousness of, and emancipation from, power, with power understood as the interplay between material structures (e.g., lithium mining, data colonialism) and ideological discourse (the myth of total fusion).

Nirvana, or the Metaverse as Lithium

To some this minimal posthumanist belief in agency may sound naïve in light of algorithmic control and climate catastrophe. It is as if saying that, after all, there *is* an alternative in response to Mark Fisher's *Capitalist Realism: Is There No Alternative?* Fisher argues how capitalism occupies the horizons of the thinkable, magically incorporating all critiques against it. He refers to Kurt Cobain. "Cobain knew," Fisher writes, "that he was just another piece of spectacle, that nothing runs better on MTV than a protest against MTV; knew that his every move was a cliché scripted in advance, knew that even realizing it is a cliché" (9).

And yet, I would argue that Nirvana's music and poetry *do* express a belief in the world, if only because Nirvana gives voice to the dissonance inherent in postmodernist life, or what Fisher calls capitalist realism. Take "Lithium," which depicts psychotic breakdown, both at the level of content (the manic "I'm so excited, I can't wait to meet you there and I don't care") and form (the narrator losing their mind;

the bipolar song structure alternating between the subdued verses and the explosive choruses) (see also Huber). The lithium of the title dulls these emotions while the song sets up a parallel between the drug and religion: "'cause I've found God." Lithium thus is the opium of the people in a bipolarizing world that isolates and exhausts people. Twenty years after *Nevermind*, Nirvana continues to resonate. As capitalism morphs into a technofeudal system dominated by Big Tech, people are increasingly invited to act as mindless addicts of immersive media streams all feeding into the Metaverse: a digital Nirvana luring in the cloud. Let us keep some belief in collective human agency and resist this myth of total fusion that destroys both people and the planet (fig. 2).

Fig. 2: Nirvana at climate protest in Munich, 2022. Photograph by Pola Jane O'Mara and Niels Niessen.

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