The Invisible, and Growing Ecological Footprint of Digital Technology

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The elements of our lifestyle which we most closely identify with tend to be off-limits to any critical discussion. This is one explanation as to why recent research on the impact of digital technology is missing from the popular ecological debate. But as 96% of British adults have a mobile device[1] the footprint of digital technology can no longer be ignored. From electronic waste to carbon emissions, it's taking on a life of its own.

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As the author William Gibson famously said of his new buzzword, 'cyberspace', in 1984, *"There is no 'there', there."*[2]

'Digital humans' are disconnected from their ecological footprint in the real world; there is no perceptible link between the 'user' and the footprint of the 'machine' which allows them to occupy 'cyberspace'.

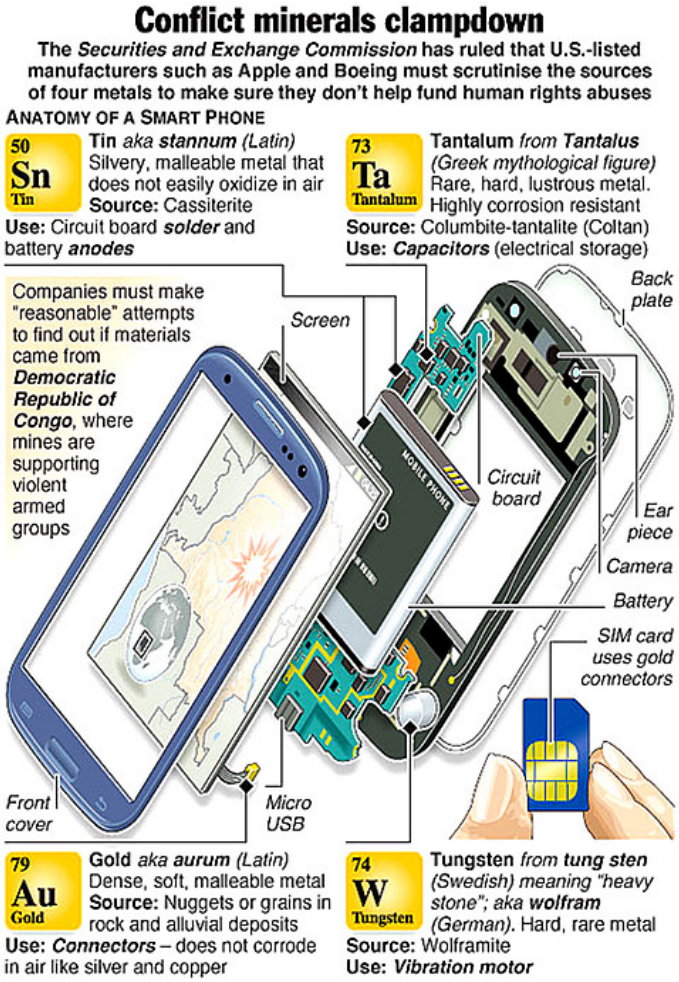
Digital technologies confer on their user organisational and economic power. The smartphone has become a hub that enables an advanced stage of consumerism to exist, spanning the globe. The reality of the digital lifestyle is, however, very different from that which can be perceived from the everyday use of these devices. It is a complex web of technology, networked communications, globalised manufacturing, transport logistics, and resource extraction.

Embodied resources

Apple has the most comprehensive manufacturing data[3]: Roughly 80% of the 82 kilo carbon footprint of the *iPhone 11* is expended in manufacturing; and another 17% by the user charging it – *assuming that the device is used for three years*. Scrap the phone after 18 months and the production impact is nearer 90% of the total.

'Use' by the individual represents a minimal part of the footprint of digital technologies; four-fifths or more of the impact comes during production and transport of the device[4]. However, no allowance is made here for the energy demand when the phone connects to 'the network'.

While the energy used to power the device is quite small, as technology hits the limits of miniaturisation, more data processing takes place



across the network rather than inside the phone. This further amplifies the impact of the 'system footprint' outside of the user's direct perception{5} – from hundred or more kilos per year, to well over a tonne for intensive use{6}.

Collectively 4% of the world's electricity is now consumed by information technologies{7} and the global data network linking them together{8}.

Rare resources

Of the 83 stable chemical elements, up to 70 of them can be found in a smartphone. It is metals which make smartphones so versatile; each may contain up to 62 different metals{9}.

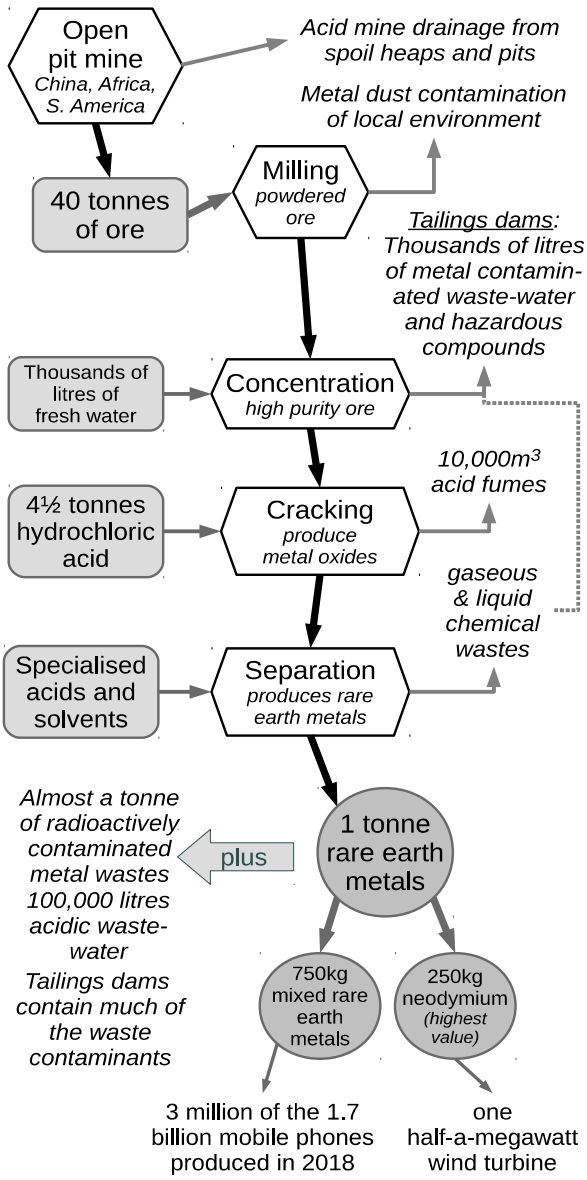
The critical element in all digital technologies are 'rare earth elements' (REEs). REE is a bit of a misnomer, as they are not as rare as gold and other metals. The problem is that they only exist in a very few places on the planet where their concentration – enhanced by natural geological processes – makes mining viable.

Even so, the mining of REEs for digital and "green" technologies has a significantly toxic ecological footprint (see diagram above {10} {11} {12}).

Also, the mining of cobalt in Africa or lithium in Argentina – key ingredients if lithium ion batteries – is implicated in slavery{13} and the abuse of indigenous people's rights{14}.

The concentrations of REEs in a phone, weight for weight, is less than they are in the rock from which the minerals were produced. That makes recycling the 'rare' metals from digital technologies difficult. The energy and resources required may often be greater than refining those metals from the raw metal ores.

Producing rare earth metals for digital & renewable energy technologies



In contrast gold, palladium, silver, copper, aluminium, and iron, make up 99% of the recycled value despite only being 13% of the weight of a phone{7} – and so are the metals most often reclaimed. The remainder is landfilled.

Limits to technology?

Studies suggest as little as 5% of mobile phones are recycled; and of all electronic waste in general{5} it is estimated that only 16% is properly recycled{15}.

What this means is all digital technologies are subject to the same 'limits to growth' issue that govern human society in general{16} – only more so because the availability of these metals{17} is more limited{18}.

This is the greater geopolitical issue limiting technology – including renewable energy technologies – today:

Bill McKibben recently said{19} that, *"If the world ran on sun, it wouldn't fight over oil"*. This shows the level of disconnectedness that many 'green' campaigners have over how renewable energy is produced and why, like digital technologies, it is locked into the consumption of REEs produced through global systems of resource exploitation{20}.

The reality is that rare earth elements are becoming the "new oil" of the global economy, and

conflict is already escalating{21} over their mining and supply{22}.

The 'network' & 'the cloud'

Once a 'phone' was a phone, for making voice calls. With the addition of a screen and 'slow' data communications it became a mobile computer. What has fundamentally changed the system again is 'the cloud'{23} – the use of data storage and processing power held randomly across a fast computer network.

Out-sourcing processing power and data storage adds powerful new functions to the device – from voice-command control, to language translation, to maps that guide you down the street. This increases battery life, but drives energy consumption as more data flows across the network.

Physically using a smartphone consumes little energy directly. It's what happens on the back of that which is now driving emissions and energy demand. It is calculated that in 2020 smartphones alone will surpass the footprint{24} of desktops, laptops and displays.

Operating the global phone and data network for today's 7 billion mobile phones on the planet has been estimated to emit 200 million tonnes{25} of carbon per year (MteC); add the digital network linking all devices, and that rises to 600MteC{26} – roughly 4% of global emissions. Recent projections{27} see that figure rising to 14% per year by 2040, much of that the result of new data services (also called *"The Internet of Things"*{28}) operating across the network.

...and then there's '5G'

What is driving these services is the automation of society generally: From ordering a pizza, to the 'gig economy'{29} which delivers it, to using your phone to pay for it – all this requires processing power and high-capacity network to link everything together. That is the purpose of the new '5G' network which is intended to replace the 4G network – less than a decade after its roll-out began.

Previous generations of cellular networks were more efficient per unit of data delivered. 5G is different as instead of using one channel to deliver data, it uses four. That's faster, but uses more power to communicate{30} – *perhaps 2 to 3 times more*.

5G also requires many more base stations. One cellular base station over its ten year life consumes 1½ houses-equivalent of electricity. According to the National Infrastructure Commission (NIC) there are already 40,000 base stations{31} in Britain. NIC says putting 5G along the motorway alone will require a further 25,000 to 60,000 base stations.

Why along the motorway? It's required to co-ordinate self-driving electric cars – which also adds demand for rare metals and electricity.

The 'digital lifestyle' is simply capitalism with a higher planetary impact

This introduction has skirted many issues: from surveillance, to health impacts{32}, to unregulated data exploitation, to corporate control.

Despite this the conclusion is the same. We have to debate this issue for what it represents: *Another mechanism of human exploitation based upon unfair global trade, property rights, resource extraction, and ecological damage.*

The only way to counter the impacts of this system is not to take part; or at least, not to take part *on the terms as they are offered*{33} {34}. If there is such a thing as 'sustainable' technology then it is small, and works at human scales{35}. That is not what 'digital lifestyles' offer us today.

Human technology, digital or otherwise, is a critical ecological issue inseparably tied to the processes of planetary destruction. We will not solve one without solving the other. That requires us to consciously make our own choices over which, and how much we chose to include these system in our lives – and freedom we have to configure and maintain those systems to serve our own needs.

Rare earth metals refinery tailings lake, China

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