FARSIGHT

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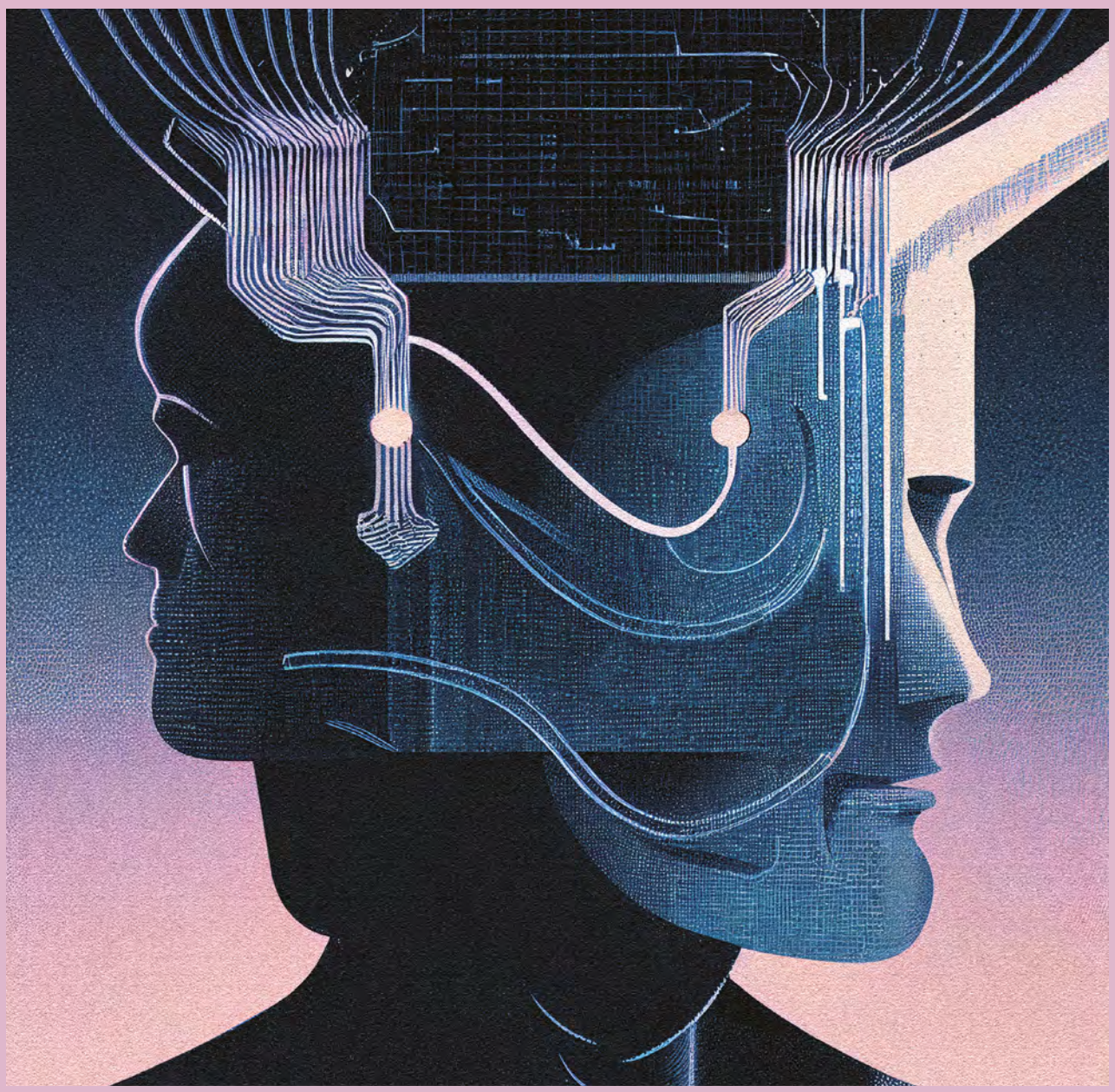

Visions of a Connected Future

Reflections on AI, Digital Culture, Quantum Computing, and Virtual Worlds

1805 PICTET Asset Management

COPENHAGEN INSTITUTE FOR FUTURES STUDIES

We equip and inspire individuals and organisations to act on the future, today.

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FOREWORD

Pictet Asset Management has been working with the Copenhagen Institute for Futures Studies (CIFS) for over a decade to establish a deeper understanding of megatrends – the powerful secular forces that are changing the environment, society, politics, technology and the economy.

CIFS is a leading global think tank and advisory firm. CIFS uses a wide range of research methods, developed over the last 50 years, which include megatrend analysis, scenario planning, risk management, innovation initiatives and strategy development.

Through our partnership with CIFS, we have devised the Pictet Investment Megatrends framework that incorporates 21 identified investment megatrends. The framework – which includes trends such as Urbanisation, AI and Computing Power, Focus on Health, Climate Change and Economic Growth – enhances our thematic equity capabilities and informs the construction and development of our thematic equities strategies such as Water, Robotics or Nutrition.

As CIFS' partner, Pictet Asset Management has access to research into areas not normally covered by the investment analyst community such as changes in societal attitudes and beliefs, the impact this has on the environment and the business sector, and the acceleration of technological development. We are proud to be associated with CIFS and would like to share some of their research with you. We have sponsored this publication and hope you find it as insightful as we do.

HANS PETER PORTNER

Head of Thematic Equities
Pictet Asset Management

FARSIGHT

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Editor's Note

Hello reader – and thank you for picking up this copy of FARSIGHT, the quarterly print publication from the Copenhagen Institute for Futures Studies. If you are convinced a future of superhuman AI, sentient robots, and neural interfaces that will unlock your transhuman potential is right around the corner, then this edition of FARSIGHT is for you! Many wonderful promises are made in the world of technology, but fewer are kept than what the tech evangelists and marketeers of the world would have you think. That doesn't mean the future will not be interesting. On the contrary, it will most likely be weirder, messier, and more complicated than what we can imagine in the present. This issue is dedicated to explorations of the future of connectivity. The topics surveyed in the selected articles and interviews include the future of artificial intelligence (both biological and silicon-based), the rise of the 'cybertariat', the quest for quantum computing, the digital ad bubble (and why it may soon burst), critical reflections on digital health, the future of neural interfaces, the metaverse, dating in virtual reality, and more. A big thanks to our guest contributors: author and computer scientist Erik J. Larson; Scientific Director of Quantum Technologies at the Novo Nordisk Foundation Morten Bache; philosopher and cognitive scientist David Chalmers; scholar Radhika Radhakrishnan; and artist and technologist James Bridle.

I hope you enjoy reading.

CASPER S. PETERSEN

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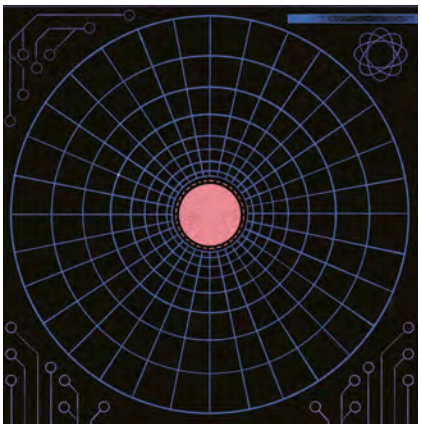

Visions of a Connected Future

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EMERGENT FUTURES

Four snapshots of things to come

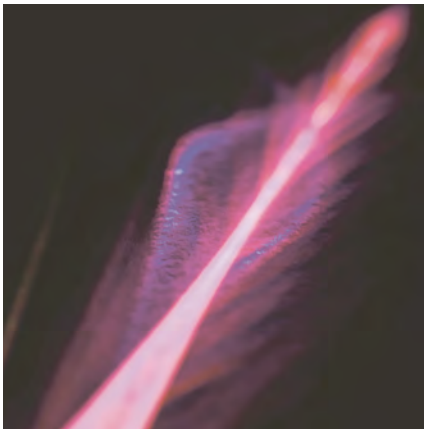
SOURCE: LIVE SCIENCE
LINK: BIT.LY/3TLUGNK
PHOTO: HILLARY HALLIWELL

Bendable battery for wearables

Panasonic has developed a bendable battery that could make wearable devices more flexible. The battery uses a newly developed laminated outer body and internal structure that makes it resistant to leaks and overheating. The battery is just half a millimetre thick and can be twisted up to 25 degrees. This capacity is too low for smartphones but could be used in low-power devices such as smart clothing.

Petabits per second

A new record of data transmission was recently set at a speed of no less than 1.8 petabits per second – ten million times faster than a typical broadband connection. This new transmission speed was achieved by splitting infrared laser light into hundreds of frequencies each carrying its own series of data.

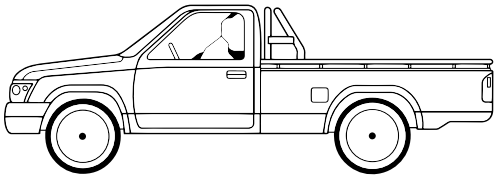


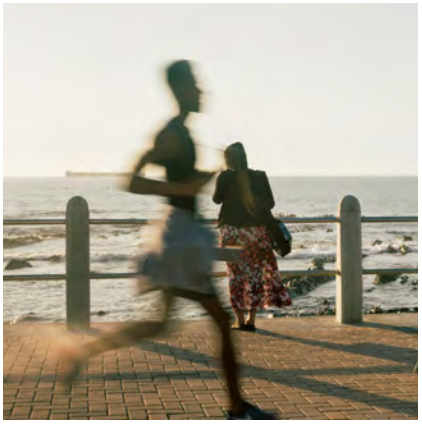
SOURCE: SCIENCE ALERT.
LINK: BIT.LY/3AI9UFJ./PHOTO: EVA BRONZINI

People before cars

Our cities belong to cars, not people. More space is set aside for cars than for pedestrians, who are often forced to wait for a green light – even when there are no cars in sight – and then rush to make it across before the light turns red. It doesn't have to be this way – and Transport for London is taking a first step to make the city more people friendly in the future. In 18 select crossings across London, the light is set to green as a default and only turns red when a car approaches. After nine months of testing, the result is encouraging: pedestrians save time otherwise spent waiting at crossings, and there's virtually no impact on car traffic.

SOURCE: MIT TECHNOLOGY REVIEW.
LINK: BIT.LY/3HEN7GM.

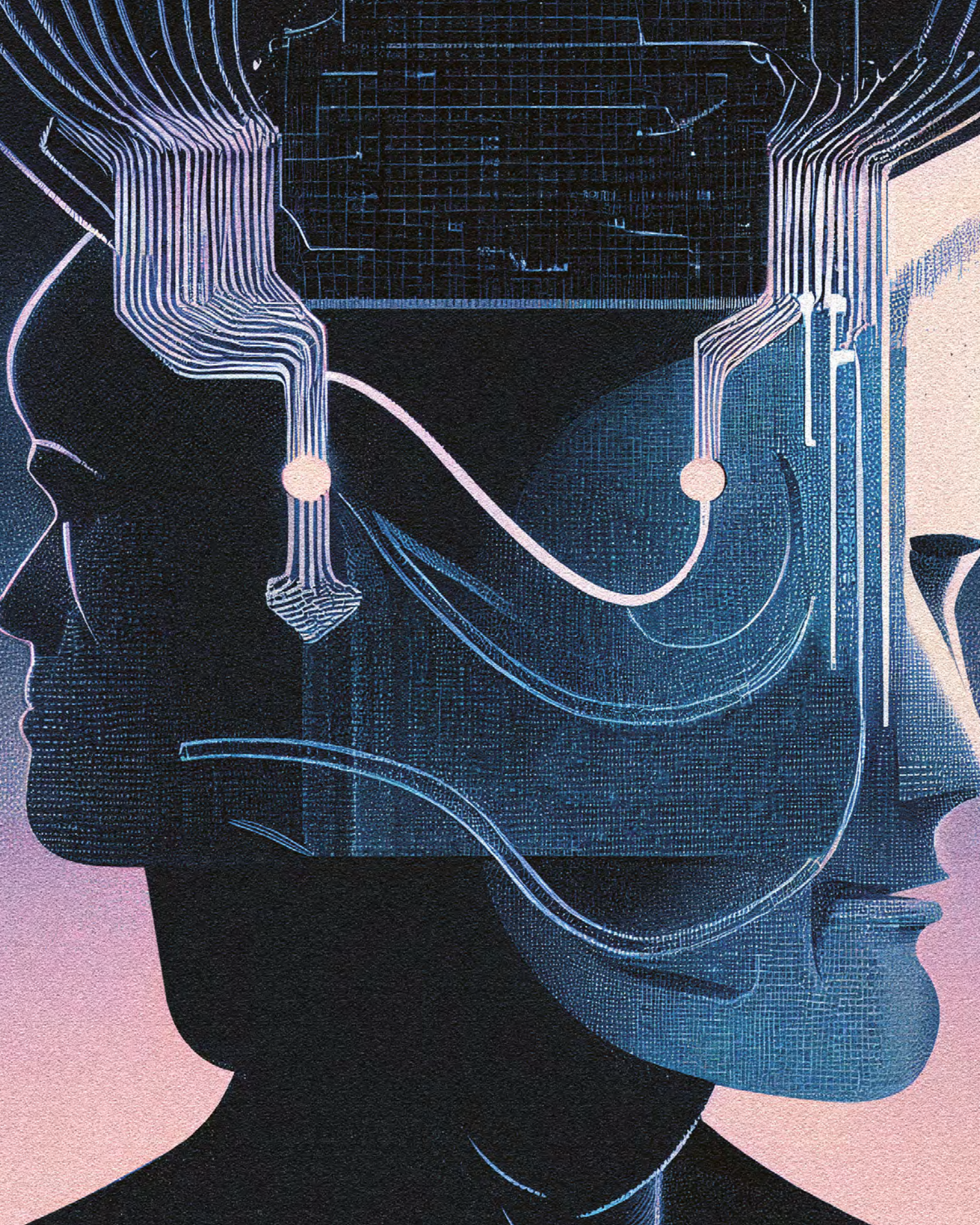




SOURCE: LIVE SCIENCE.
LINK: BIT.LY/3TWCE3S/PHOTO: RFSTUDIO

Mind reading technology

Scientists can now read your thoughts from a distance. But don't worry – this form of mind reading requires an fMRI scanner, a willing subject, and lots of post-scan analysis to decode the semantic meaning of what you are thinking, and it's not a word-for-word translation. Your secrets will remain safe. For now.



Is Artificial Intelligence a Myth?

An interview with Erik Larson

TEXT
KLAUS Æ. MOGENSEN
ILLUSTRATION
MILOS NOVAKOVIC

Erik Larson is a tech entrepreneur and pioneering research scientist working at the forefront of natural language processing. He recently published a book called *The Myth of Artificial Intelligence: Why Computers Can't Think the Way We Do*. FARSIGHT met him online for an interview about the future of AI, and why he believes the field's current path of development will not lead us to human-level intelligence in machines anytime soon.

Erik, what made you decide to write this book?

My specialty is natural language processing, and I wrote the book from the perspective of understanding the many practical challenges and difficulties there are in making computers understand human language on a deep level. Early in my career, I read a book by Ray Kurzweil, *The Age of Intelligent Machines*, where he proposed 2029 as the year when computers become as smart as humans. I thought, maybe – it's 30 years, after all. By 2005, when his book *The Singularity is Near* came out, I thought that it could not happen in 20 years without some major unexpected scientific breakthrough that we couldn't anticipate yet. Instead of acting like we're on an inevitable path to general AI, we should tell the broader public that achieving true computer intelligence is a lot more difficult than many assume. That's why I wrote the book.

You argue that we are very far from developing general artificial intelligence. In fact, you believe that the approach we are currently pursuing can never lead us there. Why is that?

The main framework that I use in the book is inference. In AI, the problem is that we're using the wrong type of inference to ever get to general or commonsense intelligence. Right now, the field is almost exclusively dominated by machine learning using inductive inference, learning from prior examples. Human beings use induction all the time, but it's not the most important type of inference for us. It can't handle novelty because it's based on prior observation. Without a novelty mechanism, you can't get to certain kinds of intelligence. I don't mean to say that it's impossible. Nature has developed general intelligence, so we should be able to eventually do the same thing. However, there's something currently missing, and that's why it's been so difficult to make certain kinds of progress in the field.

Arthur C. Clarke famously thought that to get something like intelligence in a computer, we would need heuristic logic – finding and using solutions that aren't precise, but just

good enough, which is how we think. We don't measure the distance across the street with a measuring tape; we guesstimate how far it is. This method is a lot faster and works well for everyday stuff. Do you think we could program that kind of heuristic logic into computers?

We do that already. Before deep learning became the dominant paradigm in AI development, classic AI design was more rule-based. One of the great challenges in the classic rules-based paradigm was in fact to find these rules of thumb, or heuristics. Herbert Simon, a pioneer in AI and Nobel Prize winner in economics, has said that people who favour adequacy and efficiency over optimisation generally make better, more responsible, and quicker decisions than those who want to make every decision perfect. Precision can be a barrier. However, the classic AI approach based on common-sense heuristics also failed when the domain wasn't sufficiently constrained. Even if you have a rule that doesn't need precision, you have so much context in an unconstrained real-world environment that you need rules to tell other rules when they are relevant. It quickly becomes intractable to try to get intelligent behaviour from such a system.

There are two major, unsolved problems in AI. One is robotics, especially when the robot is not in a very specific environment. A robot arm in an industrial setting with few degrees of freedom works well, but if we have a robot walking down the street in Manhattan, there are just so many peripheral problems that can occur in such a complex environment. Somebody walks in front of the robot; something unexpected happens. If you took the best, smartest robot in the world and set it loose on any city street, within a few minutes it would cause a traffic accident. That's why you don't see robots on the street.

The other major problem is having a real conversation with an AI system where it truly understands what you're saying and responds with understanding. I mentioned inference before, and in addition to deduction and induction, there's a third type of inference called *abduction* that people generally aren't aware of, but which we use all the time. Deduction is, "It's raining; therefore, the streets are wet." Abduction is, "I know rain makes streets wet. I see the streets are wet. Perhaps it's raining." You generate a hypothesis that explains an observation. It's not certain knowledge – you could be wrong. Maybe a fire hydrant broke. However, you keep correcting your hypothesis with further observation. The streets are wet, my hypothesis is that it's raining, and then I confirm it or form another. That's abduction – hypothesis generation.

You mentioned novelty. A human who has not been in a certain situation before can think it through and still handle it. If you introduce a chess master to Shogi, Japanese chess, which has slightly different rules, they would very quickly be able to adapt their

experience with chess to be able to play it well. A chess-playing AI, however, would have to learn from scratch – its inductive deep learning of chess would be useless.

I believe game-playing AIs still use some version of a minmax algorithm, deducing what would be the best move given that it has watched a million games play out before. This is very different from a human, who doesn't play a million games and then computes the probability. I'm not a neuroscientist, so I couldn't tell you what's happening in the brain of chess masters – but I'm pretty sure they don't mindlessly play a million games before becoming masters.

I've observed that as computers get better than us at something, like chess or trivia knowledge, we tend to move the goalpost and say that this has nothing to do with intelligence. Will we keep redefining intelligence as being whatever we can do that computers can't, or are there some markers of intelligence that we can't explain away?

My response is to go back to Alan Turing's original 1950 paper, when he said that if a person can converse with a computer and be convinced that it is a real human, then it must be intelligent. I would say that this test still holds. Of course, you can converse with a chatbot that just continues to deflect questions, but to have a conversation that's empathetic and understanding with the computer – we still can't do that.

During the summer of 2022, a big news story surfaced of a Google engineer becoming convinced that a program he was developing had gained real sentience and warranted rights akin to human rights. Could we not say that it passed the Turing test?

The latest language models are quite good, but you can trip them up very easily if you know how. Language has a property called compositionality, how sentences are put together to provide meaning. There's a big difference between me riding a horse and a horse riding me, but an AI language model is not going to get that because it doesn't have a sense of compositionality. Natural language is a barrier for artificial intelligence – one of the biggest. A legitimate test of language understanding would convince me that an AI was intelligent.

Another test would be navigation in dynamic environments by autonomous vehicles or robots. Getting to fully autonomous driving will be a lot harder than people think. The small city of Palo Alto, California, is mapped out on a grid, and you get pretty good performance from the vehicles there. But if you're driving on a rural road and the AI must rely on sensor data, we're a long way from vehicles being able to autonomously navigate that. Fully capable robotics in open-ended dynamic environments and fully understanding natural language; those are the two big frontiers.

Could an AI not develop its own language, very different from human language, that it uses to understand its environment and gets around some of the current limitations? We could compare it to communicating with dolphins, which seem to have a complex language that we haven't come close to understanding. They cannot understand our questions, and we cannot understand theirs; yet they are doubtless sentient beings.

I suppose is it possible for a creative AI to somehow achieve a way to frame the world that doesn't require natural language. I don't know the answer to that, but the immediate practical problem I see is how do we then interact with those systems? That might create some very, very strange human-machine interactions. I almost completely avoided the question of sentience in my book because, frankly, I don't have a lot to say about it. It's an issue that very quickly becomes philosophical. It could be that computers right now have some low level of sentience, like insects, and we just can't detect it because we don't know how. As an engineer, I don't know the entry point into that argument, so I leave it alone.

You argue that we can't achieve general AI the way we try to do it now, with machine learning and adding more components to computers. However, in physics there's the phenomenon of 'emergence', where new traits develop when the complexity is high enough. One water molecule doesn't have surface tension, but put enough together, and you get it. A single neuron isn't sentient, but enough produce human sentience. Would it not be possible, if we add complexity and more components to supercomputers, that they could achieve intelligence and sentience as an emergent trait?

I think it's an interesting question. It's like a pile of sand: if you keep adding grains of sand, you get a nice conical shape, until at one point adding just one more grain of sand gets you a cascading effect. We have these thresholds in emergence where something isn't happening, and then at some level of complexity, a completely different phenomenon emerges. I think it's interesting whether that could apply to technology or computers, but I don't have any strong scientific position on that.

Isn't there a danger if we have, say, self-driving cars who all think the same way because we have copied the same machine learning into all of them? If there are several routes from a suburb to the city, they will all choose the same route because that's what the system says they should do, whereas humans might imagine that the main route will probably be too busy and choose another one instead?

I think we'll solve those sorts of problems. We already have systems where you can see traffic flow. The problems that I worry about are more practical. There have been cases where self-driving cars don't stop because a stop sign is slightly damaged and is perceived as something else. There's a famous example of a system

that tried to drive underneath a school bus because it thought it was an overpass. We just can't eliminate all problems because the natural world is so messy. A bunch of leaves that the wind blows across the street might be interpreted as a solid object, and the AI will slam on the brakes.

We have people worrying that if we achieve general intelligence in computers, they are going to take over the world, or follow some order, like maximising the production of paperclips, to such extremes that the AI will wipe out humanity to do it most efficiently. Do you think there is any real danger of such things happening, or are we just projecting our own faults onto artificial intelligence?

There's an interesting contradiction in the paperclip scenario. The system is supposed to have general intelligence, which you would think included common sense, but on the other hand, it's so narrow and computational that it thinks it can maximise the sale of paperclips by turning all humans into paperclips. Real computer intelligence would realise that it's not intended to wipe us out. There's another option, though, which is that it becomes malevolent and actively desires to rid the world of human beings. That gets us into the question of whether something like malevolence could possibly emerge in an AI.

We have AIs today that looks at x-rays of patients, trying to determine if they have cancer. They can be very good at this, but they don't know anything about cancer or what it means to a human being. They lack an understanding of what their task really is about. Do you think we can achieve intelligence in computers without true understanding of what they do?

That's a great question, but I don't have a great answer for it. It raises the whole issue, in this case of medical science, of whether an AI can provide proper diagnoses when it doesn't understand care. Someone should write a PhD about how medicine is best administered and what the role of technology is and can be.

Research shows that even when an AI is better than any doctor at diagnosing cancer, it is even more efficient when it works with a human doctor. They approach the problem in different ways – one with human understanding, the other from being trained on millions of x-rays. Human-AI partnerships seem to work best.

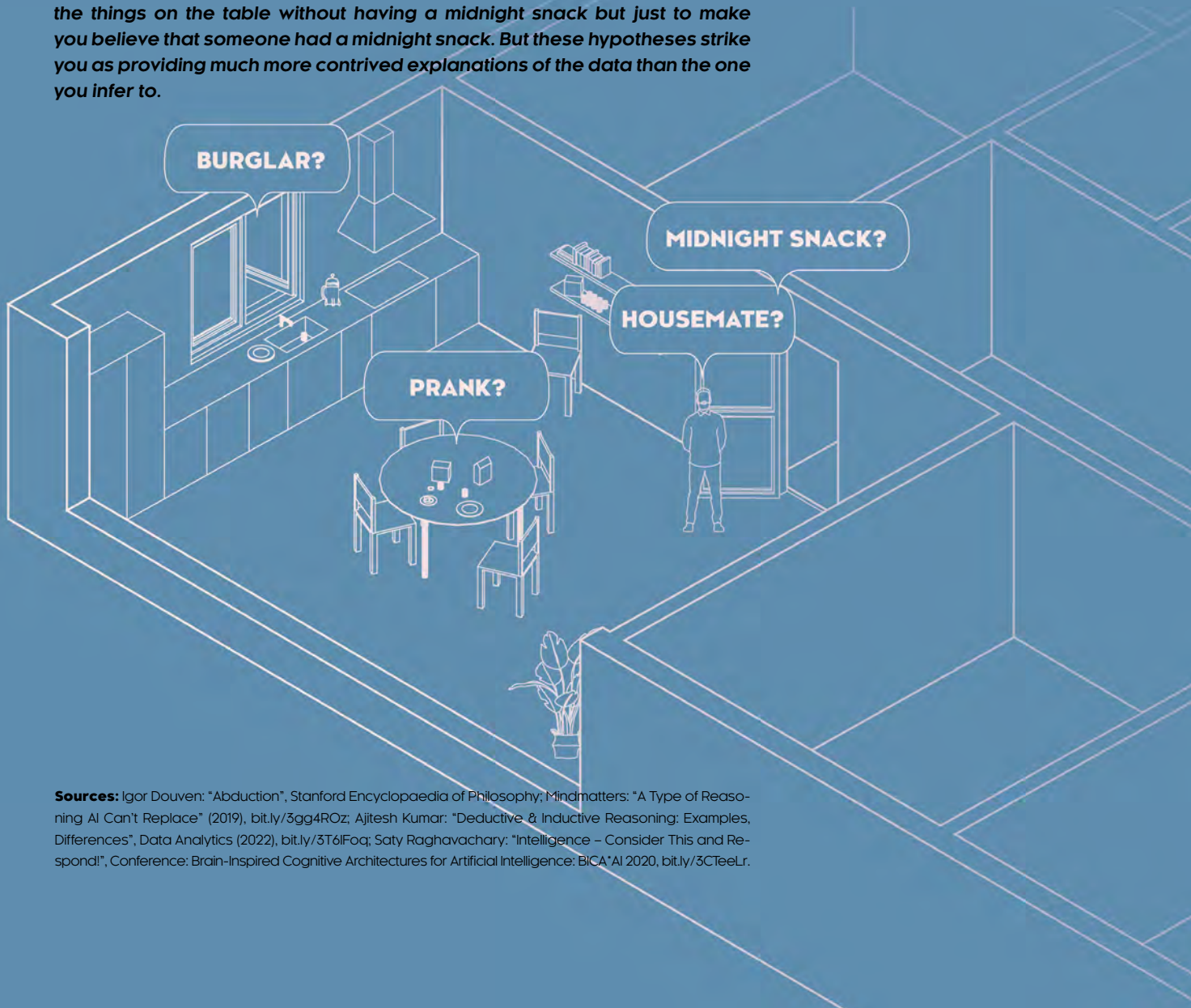
I think that's right. In terms of something we care about, like medicine, it sounds like this kind of collaboration may work best. To me that's a good use of technology. That's why we make technology – because it furthers human goals. Whether we will have autonomous systems that will replace humans in all domains, that is a completely different question. Whether we get fully sentient AI or not, we're heading in this direction in the future. That's for sure." ■

How Human Sensemaking Trumps AI

"Digital computation of intelligence has — pardon the pun — no analogue in the natural world"

Saty Raghavachary, computer scientist

One morning you enter the kitchen to find a plate and cup on the table, with breadcrumbs and a pat of butter on it, and surrounded by a jar of jam, a pack of sugar, and an empty carton of milk. You conclude that one of your housemates got up at night to make him- or herself a midnight snack and was too tired to clear the table. This, you think, best explains the scene you are facing. To be sure, it might be that someone burgled the house and took the time to have a bite while on the job, or a housemate might have arranged the things on the table without having a midnight snack but just to make you believe that someone had a midnight snack. But these hypotheses strike you as providing much more contrived explanations of the data than the one you infer to.



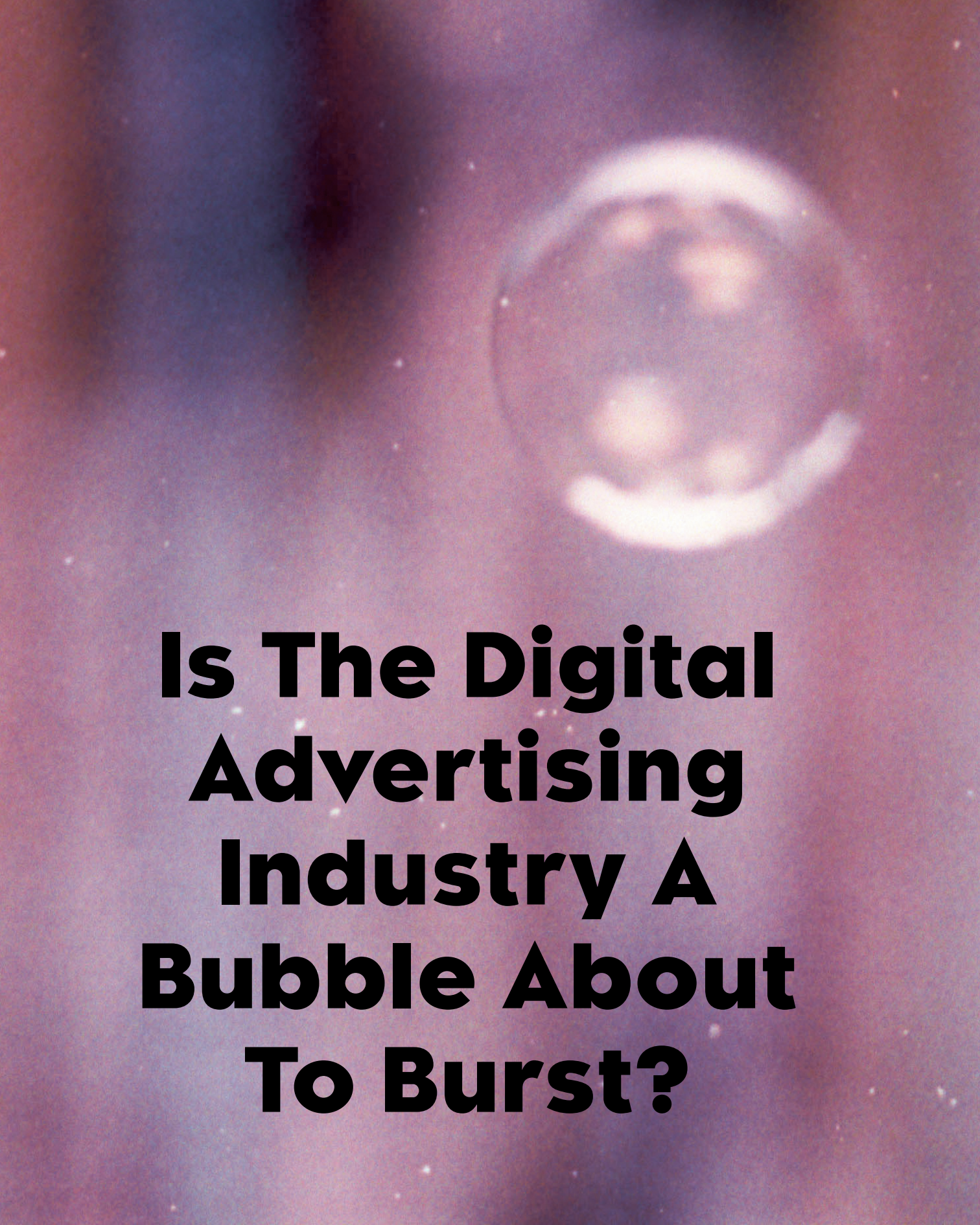
Sources: Igor Douven: "Abduction", Stanford Encyclopaedia of Philosophy; Mindmatters: "A Type of Reasoning AI Can't Replace" (2019), bit.ly/3gg4ROz; Ajitesh Kumar: "Deductive & Inductive Reasoning: Examples, Differences", Data Analytics (2022), bit.ly/3T6lFoq; Saty Raghavachary: "Intelligence – Consider This and Respond!", Conference: Brain-Inspired Cognitive Architectures for Artificial Intelligence: BICA*AI 2020, bit.ly/3CTeeLr.

This short story is an example of how humans would make sense of a situation by inferring a likely hypothesis from an almost infinite set of possible explanations. It's a display of abductive reasoning, which is the ability to make an educated guess without having all the necessary facts required to come to a definitive conclusion. Although AI excels in deductive and inductive forms of reasoning which are based on logic, rules, and calculations, researchers have so far not been able to emulate abduction in an artificial intelligence – and perhaps they never will, using current models and approaches to AI.

Deductive reasoning:

Inductive reasoning:

More broadly, reaching general artificial intelligence – a digital brain that can think and act like humans – may require a paradigm shift in the field of AI development. As general intelligence is essentially a biological phenomenon and a result of evolutionary adaptation, some researchers have speculated that 'embodiment' – the ability to develop a sense of self and social learning via an integration between physical experience and mental processes – may be a key prerequisite for achieving AGI that mimics the biological intelligence of humans and animals.



Is The Digital Advertising Industry A Bubble About To Burst?

**“Half of the money I spend on advertising is wasted;
the trouble is I don’t know which half”**

– JOHN WANNACKER –

TEXT
AUGUST LEO LILJENBERG
PHOTO
ANDREEA CH

It is estimated that we are exposed to 4,000 - 10,000 online advertisements each day.[1] Whether while seamlessly switching tabs, scrolling through social media, or simply using search engines, we experience a torrent of attempted persuasion. Within 1/6 of a second of loading a webpage (less than the time it takes to blink) you are logged into a commodity market where your attention is assigned a price by the forces of supply and demand.[2] You may have just been checking what your friends were doing during the weekend, but your decision-making ability is being harvested, influenced, and monetised. The lifeline of today's internet is digital advertising – the resource that fuels it is your attention.

Polemics against digital advertising often focus on surveillance capitalism and data privacy regulation – but what if this internet lifeline is, in fact, decayed itself? What on the surface seems to be an all-powerful machine able to compartmentalise our attention along lines of interests, hobbies, and personality, may be nothing more than a veil for a marketplace fundamentally flawed at its core. Or in economic terms, the actual underlying value of the assets powering digital advertising (our attention) might be vastly overstated in the marketplace itself. A bubble waiting to burst.

It's controversial to argue that digital advertising might not work to the extent people believe it does. This is especially true for those sold by the supposed effectiveness of *programmatic* advertising, where software is leveraged to automate and personalise the ad-exchange market. In the context of big tech and surveillance capitalism, such automation takes the role of an omnipotent and dutifully venerated god. Drawing inspiration from financial markets, the ad economy not only benefits from the personalised advertising we welcome upon accepting third-party cookies, but the auction that occurs between competing algorithms on the behalf of ad publishers and ad-inventory buyers. As of 2022, over 90% of digital advertising is programmatic.[3] This, in the long term, is unsustainable.

Or so argues Tim Hwang, author of *The Sub-Prime Attention Crisis*. Hwang posits that the ad economy's inspiration from financial markets risks paralleling the 2008 subprime mortgage crisis, where certain mortgage-backed securities were nowhere near as risk-free as investors thought. There are several compelling reasons for this comparison, ranging from those nestled in technical jargon to the

1 Jon Simpson: "Finding Brand Success In The Digital World", Forbes, (2017), bit.ly/3UHMtNG.

2 Jun Wang et al.: "Display Advertising with Real-Time Bidding (RTB) and Behavioural Targeting", Foundations and Trends in Informational Retrieval, (2017), bit.ly/3Ofde9J.

3 Meagan Yuen: "Programmatic Digital Display Advertising in 2022", Insider Intelligence, (2022), bit.ly/3ULEhfn.

TIM HWANG

misguided incentives of ad buyers and sellers. However, for the sake of simplicity, two arguments may be considered: ad fraud and market opacity.

The presence of ad fraud is expected to cost the industry upwards of $100bn worldwide by 2023 – a growth of 285% since 2018.[4] The most effective forms of ad fraud consist of click-farms and, depending on who you ask, ad-blockers. Click-farms occur when website owners who earn pay-outs based on users' ad click-throughs artificially increase activity, either by using automated scripts (bots) or hiring people to manually click or pose interest in a topic. The problem with click-farms is not easily fixed, as ad publishers have little incentive to crack down on a fraud mechanism that they indirectly generate money from.

Ad-blockers, on the other hand, are less explicitly fraudulent, consisting of a devaluation of attention from the user out of personal choice. Citing reasons of intrusiveness, website lag, and perhaps most of all data privacy,[5] browser extensions such as AdBlock Plus provide internet users with an internet experience devoid of any advertisements – or as the CEO of the Interactive Advertising Bureau has called it: "robbery, plain and simple."[6] Claims of fraud aside, the rise of adblockers nonetheless diminish the value of ads. Daily user statistics flouted by publishers become effectively worthless – what's the use in displaying ads on a website if they won't even reach a significant percentage of the intended target audience? AdBlock users are mostly among younger age groups, with some estimates suggesting that as many as 42% of those aged between 16-24 use an adblocker online.[7]

Beyond the diminishing value of attention, the advertising market is also worryingly opaque. Market bubbles form when a commodity's value is not adequately reflected by its publicly traded price. Economists assume markets are efficient only when there is 'perfect information' available to buyers and sellers – the less transparent a market is, the more vulnerable it is to misvaluation. As in financial markets, not all ad buyers play by the same rules. The existence of Private Marketplaces (PMPs), where publishers agree on a privately traded price with an ad buyer out of the public eye, distorts the market and results in the public price of ad inventory not reflecting the actual market price. This problem is not relegated to a small set of the global ad economy either; as of 2022, 17.8% of digital display ad spending was conducted on PMPs. Combined with ad fraud and a rising trend of apathy – or even irritation[8] – towards ads, opacity is a fertile breeding ground for market failure.

What are the consequences of overvaluation? Looking at digital ad revenue figures as a percentage of total revenue for the largest tech companies, there is a clear dependency on attention. Approximately 97% of Meta's and 80% of Google's total

4 "Estimated cost of digital ad fraud worldwide from 2018 to 2023", Statista, (2022), bit.ly/3AoY4sR.

5 "2022 PageFair Adblock Report", Blockthrough, (2022), bit.ly/3Og99IC.

6 Randall Rothenberg: "Ad Blocking: The Unnecessary Internet Apocalypse", AdAge, (2015), bit.ly/3Gp7xEy.

7 Jason Mander: "16-24s Most Likely To Block Ads", GWI, (2015), bit.ly/3gaFspC.

8 Duncan MacRae: "Gen Z Avoiding Advertising At All Costs", MarketingTech, (2022), bit.ly/3tADodw.

revenue comes from digital advertising – the majority of which is programmatic. A realisation that attention is not as valuable as previously thought would be felt not only across cyberspace, but across the economy at large. Big tech companies constitute the apex of the global stock market and are major investors in innovative technologies such as artificial intelligence, machine learning, and even quantum computing. A burst of this bubble would be felt throughout society.

Hwang proposes that there are two ways out of the ad economy's bubble, either by letting the bubble burst or by provoking a manageable crisis.[9] The former solution is complicated by the fact that the ad economy's problems are so chronic and structurally integrated that greater awareness won't provoke internal change. Waiting for an inevitable bubble burst will, on the other hand, provide opportunities for alternative business models to flourish. In the abstract, the option might seem attractive – it's not particularly demanding and has the odd romantic veneer of a bystander watching an empty building coming crashing down.

Unfortunately, this building is occupied. Economic implosions have real-life consequences, and letting the ad market collapse and leaving the aftermath to market processes creates new risks. The safer (but perhaps less flashy) route of a "manageable crisis" demonstrates instead how tension in the ad market is a creeping cascade of mistrust and devaluation, rather than a sudden awareness that homeowners can't pay back their mortgages en masse. The faulty mechanisms can therefore be stepped down gradually, especially if an independent oversight and research committee is created to support this process, similar to the US Securities and Exchanges Commission (SEC) set up after the Wall Street Crash of 1929.[10]

Capital's historical plasticity should remind us of the ability of markets to mould themselves to accommodate cultural shifts, however. Thus, Hwang's dual approach risks missing a potential third exit route instigated by the development of the internet towards a decentralised, open, and barebones structure. These sets of attributes, loosely defined as 'web3', are partly a rejection of the way advertising has become the bedrock of our current version of the internet (web2), tracing, among other things, the decline of the internet's openness to when we unassumingly began trading our data for free access to internet platforms.

The rise of adblockers is a testament to this cultural shift, as are the decisions of some social media platforms, such as Twitter under Elon Musk, to move towards subscription-based business models. Likewise, Apple's acquiescence to its users' data privacy demands in 2021 by letting them 'opt-out' of third-party app tracking reportedly cost Meta $10 billion in ad revenue alone.[11] Big tech firms are aware that users are increasingly dissatisfied with today's internet and are in turn portraying themselves as pioneers of the ongoing web3 evolution.

9 Tim Hwang: "The Subprime Attention Crisis", FSG Originals, (2020).

10 Ibid.

11 Clare Duffy: "The Online Ad Market Is In Decline And It's Dragging Tech Giants Down With It", CNN, (2022) cnn.it/3i04dpa

If the ad economy moves away from the economic problems of programmatic advertising, there is still plenty of room for critique of the industry as a whole – is advertising really a necessary condition for modern life? Why have we accepted this state of affairs seemingly without question? For those holding such concerns, corporations openly supporting a future internet that 'gives power back to the people' should be met with scepticism. As the Slovenian philosopher Slavoj Žižek notes, ideology is strongest when it is "no longer experienced as ideology," where "we feel free, because we lack the very language to articulate our unfreedom."[13]

Global brands understand that marketing is more than just targeted advertising – but also about image and appearance. The perfect ad campaign is not programmatic or targeted. It's one where a consumer becomes an advertisement themselves and their identity entangled with a brand. Upon examining the proposed architecture behind web3 – blockchain technology – one is met by a swarm of familiar names: the virtual NIKELAND universe; the NFTs of Coca-Cola and Louis Vuitton; the virtual bank of JP Morgan & Chase.[14] It would be disingenuous to suggest that these are the characteristics of the kind of internet that AdBlock users, or those against surveillance capitalism, want.

The metaverse's integration of our virtual and physical worlds provides a seamless, unassuming advertising experience, dependent on a public convinced they are not even being advertised to. Or, as the French philosopher Guy Debord proclaimed, "spectacle is the sun that never sets over the empire of modern passivity."

In the immediate term, a market bubble threatens the billions of dollars big tech firms have invested in expanding their businesses into technologies relevant to web3: the metaverse, artificial intelligence, and blockchain, among others. This can perhaps be viewed as a precautionary measure taken by an industry aware of their overwhelming dependency on ads. For these platforms, the race is won by outpacing the ad bubble that current revenue streams might be dependent on, while at the same time generating revenue from their new branches of business. From the perspective of data privacy activists however, such a development shouldn't necessarily be welcomed by a sigh of relief. By attempting to monopolise entire virtual ecosystems, personalised data will be just as – if not more – valuable.

If the current ad economy is near the bubble-bursting conditions that Hwang argues, then decision-makers ought to use this fragility to transition from an economic argument to a moral and political one. Tomorrow's internet is being created today; if we desire a cyberspace where our attention and identity are intact, then passivity is not an option. ■

13 Slavoj Zizek: "In Defense of Lost Causes", Verso Books, (2009)

14 Geri Mileva: "20 Brands Leaping Into The Metaverse", Influencer Marketing Hub, (2022), bit.ly/3XcVdx9

Digital Advertising

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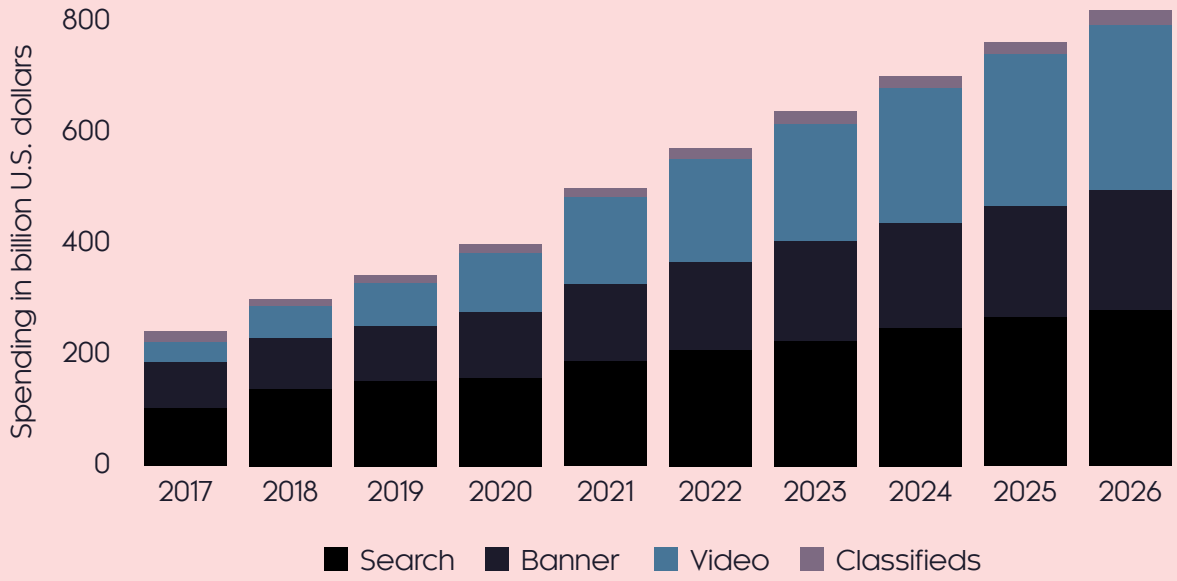
ADBLOCKERS

By **2026**, the digital advertising market is set to grow by **85%**, with programmatic advertising set to grow to **89%** of total ad spending share by **2027**

CLICK FRAUD

Click fraud occurs when owners of websites artificially bump the click-through rate of displayed online advertisement through automated scripts or auto-clickers. It is used in situations where site owners are paid based on how many visitors click on the displayed ads. One estimate suggests that upwards of $1 of every $3 spent on digital advertising is lost to click fraud.

internet browser extensions that limit the amount of ads displayed on a webpage are estimated to cost ad publishers upwards of $72bn/year. However, as of January 2023, major changes in the way the browser giant Google Chrome handles extensions through its Manifest V3 rollout risks significantly decreasing the effectiveness of such adblockers.



DIGITAL ADVERTISING SPENDING WORLDWIDE

Sources: Malcolm Higgins: "Is Google's Manifest V3 the end of adblockers?", NordVPN, (2022), bit.ly/3UWoxpr, George P. Slefo, "Report: For Every $3 Spent on Digital Ads, Fraud Takes $1," AdAge, (2015), bit.ly/3g5yQJ5, Statista, Digital advertising spending worldwide from 2017 to 2027, by format, (2022) bit.ly/3XSYCRT, Juniper Research, "Digital Advertising: Market Forecasts, Emerging Trends & Key Opportunities 2022-2026", (2022), bit.ly/3FpXJJr.

Although internet access may seem like more of a luxury than fundamental human rights such as the right to work, the right to free expression, or the right to receive an education, these and other rights are increasingly dependent on citizens being able to communicate and seek out information online. What would it take to provide access for all?

TEXT
JOSH SIMS
PHOTO
EKATERINA BOLOVTSOVA

THE INTERNET AS A RIGHT

The Covid pandemic made one thing very clear: for the many people restricted to their homes, an internet connection – for schooling, work, medical help, commerce, and communication – started to look more like a necessity than a luxury. Indeed, the pandemic served to further deepen the digital divide in an increasingly digital society. In the future, as all corners of society become even more dependent on connectivity, the unconnected might well feel increasingly digitally disenfranchised.

But what if internet access was established as a right, much as access to water, food, or healthcare are today? That was the aim of a resolution passed by the United Nations in 2016, albeit a non-binding one. It was a step towards a broader recognition that many of the things we already consider rights today are becoming more and more dependent on internet access. Equal access to work is one example. This right was codified in the International Covenant on Economic, Social and Cultural Rights in the pre-internet era. Today, with many job postings only existing online, applying for work most often requires online access.

According to Dr. Jack Barry, research associate at the University of Connecticut's Center for Public Interest Communications, the ability to maintain many other fundamental rights now increasingly depend on internet access:

"The internet has become the primary way to communicate, but also a device for work, a marketplace, and the best way to share ideas. Covid has revealed to governments, organisations, and employers alike why they really need people to have internet access at home," says Barry. "But people are also seeing that their other rights – freedom of speech, for example – are not really protected without the right to internet access. Covid only strengthened that argument because it exposed the shocking disparities between those with and without access."

This is why some thinkers on the topic consider internet access as being more of an auxiliary human right rather than a right in itself – necessary to prevent more rights from becoming useless.

What of, say, the relationship between internet access and the right to an education, as the Covid era's remote schooling highlighted? Or the right to participate in elections when so much campaigning is now online, not to mention increased use of online voting? Or of freedom of speech in an era when the internet is considered the de facto public forum? Ukrainian civilians, notes Dr. Merten Reglitz, senior lecturer in global ethics at the University of Birmingham, have been vocal in calling for assistance in the provision of water, food, shelter – and internet access.

Certainly, lack of access may be one problem in fulfilling fundamental rights. Access being removed is another. A report from the UN Human Rights Office published in the Summer of 2022 stresses the negative ramifications it has


MacBook Pro

when governments switch off the national internet infrastructure, ban access, or purposefully limit bandwidth. Instances of partial or total internet shutdowns are becoming more commonplace, with Iran proving the most topical example. In response to recent growing protests in the country, the Iranian government began disabling the internet in parts of Tehran in addition to shutting off access to certain social media and messaging platforms. But Iran is not alone: 74 countries enacted 931 shutdowns between 2016 and 2021 – often at massive economic cost nationally, and with knock-on effects internationally – particularly during heightened political tensions and rarely with any official reason given.

In other words, the internet is recognised by these countries as a tool of freedom of expression. And they don't like it. Small wonder too that a growing number of authoritarian states are keen to develop a national internet over which more pervasive control could be exerted: the so-called 'splinternet'. Syria, for example, has just one, easy manipulated internet provider. But then liberal states have been willing to interfere with the access of private citizens too.

That all this matters is, arguably, only the case if a lack of internet access really does limit people in exercising their fundamental rights. And the first in a series of 'internet deprivation' studies seems to suggest that it does. The University of Haifa has conducted controlled experiments in which participants (controlled for age, education, and technological proficiency) were challenged to complete two tasks, either with or without the aid of the internet. The first task was to find out which member of the Israeli parliament submitted a particular bill, the second was to express themselves regarding a political topic to a wide audience. One group was allowed to use all available resources, including the internet; the other group was denied internet access. Unsurprisingly, 89% of the subjects in the first group completed the tasks; only 12% of the internet-deprived group managed to do so.

Lack of access is a very real problem too: according to the International Telecommunication Union (ITU), internet penetration rates only passed the 50% mark globally in 2017. And, according to a 2020 UNICEF report, two thirds of the world's school-age children do not have access to the internet in their homes. Those that do have it, predictably, tend to be those with parents who are wealthier. Mobile telephony likewise remains too expensive for many in the developing world, and often limited to the most well-off areas.

But it's not that much better in the developed world: half of the US population is not using the internet at broadband speeds, either because of a lack of local infrastructure, because the service is too expensive, or because they lack the skills. Five percent have no access at all.

Small wonder that the last decade has seen some countries declare internet access to be a right, with Finland and

"Instances of partial or total internet shutdowns are becoming more commonplace, with Iran proving the most topical example"

Mexico being among the nations that have taken the first steps to making national coverage a reality. Among ideas explored have been repurposing community centres or libraries as free internet access hubs and offering subsidies for citizens to buy access at home.

Yet it's far from clear that policies enacted by some countries over recent years, including President Biden's Internet for All initiative, are going about solving this problem the right way. To start with, there's the need for accurate maps of today's broadband coverage which is currently a complex web of pockets. Barry argues that the challenge is less about providing the infrastructure, which by some measures would be cheaper than building a road or sewer network, and more about providing the devices with which to access the internet. Recycling of devices which are still functional, if no long cutting-edge or fashionable, could provide the solution.

And while the ITU, which in 2019 launched a project with UNICEF to connect every school to the internet, has noted that connecting rural populations is a "formidable challenge," others have argued that seeking to connect greater swathes of geography is not the right approach. "Where does that stop? Do we run cables out to the most remote villages?" asks Barry. Rather, it's argued, what's required is to connect greater numbers of populations.

According to a Tufts University study, meeting the needs of sparsely populated

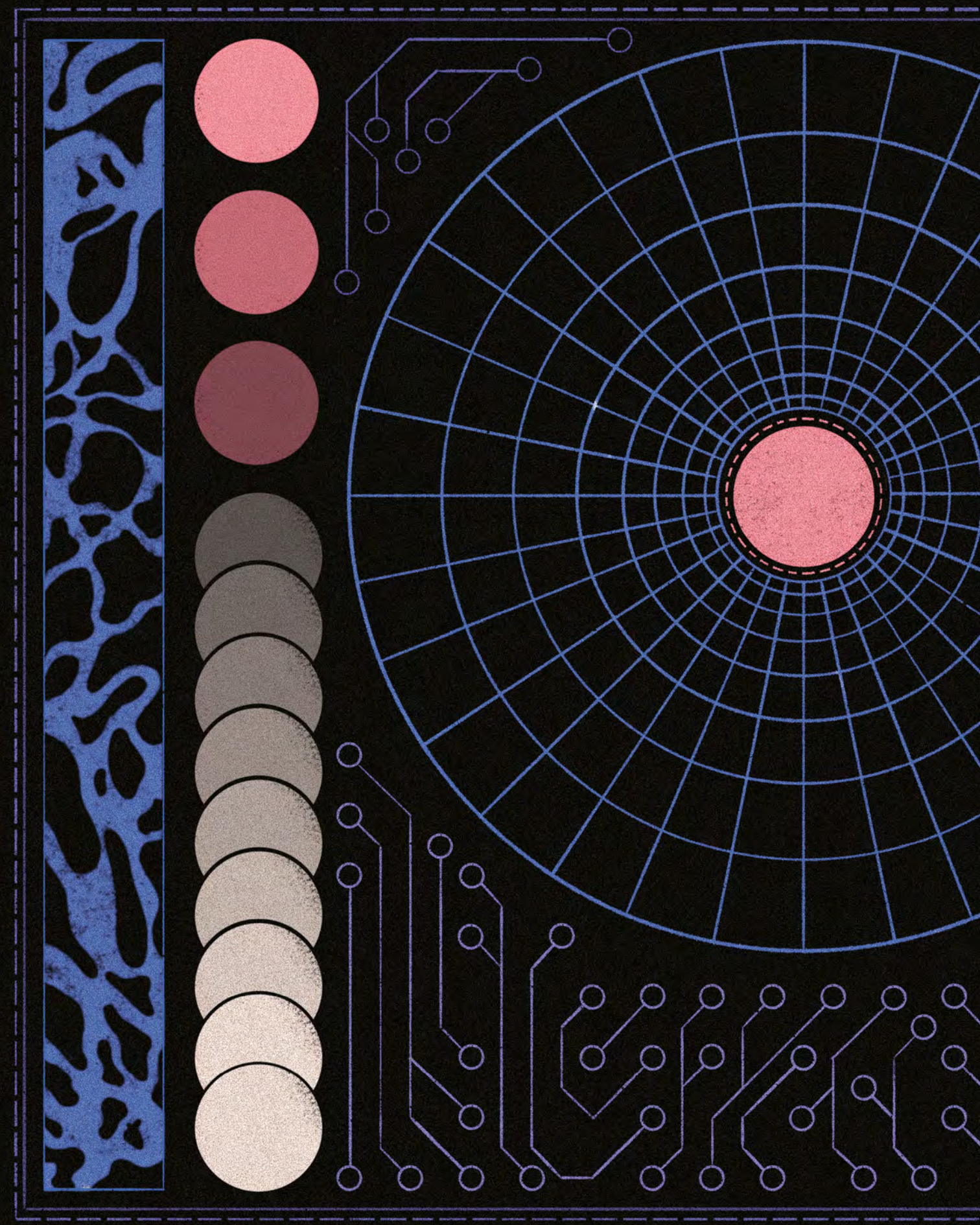
locations unserved by internet provision would come at the expense of serving the needs of those in densely populated urban communities "who live in proximity to the available infrastructure but lack access to affordable broadband." The study notes that the number of people affected by the 'broadband gap' is three times greater in urban areas than in rural areas.

There is also the problem, as illustrated in the Tufts study, that closing the digital divide requires local solutions, pertinent to the community, terrain, and so on. Barry likewise believes that efforts to close the digital divide will be hampered by taking a binary response (access or no access) rather than seeing the situation as more of a "gradations of access divide" requiring a suitably multi-faceted response according to factors like language, education, income, and available technology.

And, of course, that's not the only barrier to ensuring that the right to internet access is made a reality. Reframing internet access as a need, rather than a want, will inevitably entail more government regulations (even if, in the US, at least 17 states have laws prohibiting broadband being treated as a public utility). Service providers and other companies that profit directly from the internet might also be expected to lobby hard to minimise government interference. And, further down the line, if internet access does come to be seen as a right, one might in time expect the content of the internet to face review too."We can try to force internet providers to spend some part of their profits on expanding their services or look to taxing the likes of Google or Facebook to expand it too, since their business relies on the internet," suggests Reglitz. "The internet has been a kind of wild west so far, with many tech companies like Google and Facebook only now starting to recognise the problems with their behaviour. But some kind of legal requirement on these players to act seems to be the way we're going now."

And yet with the move to 'free' and 'ubiquitous' internet access also come great opportunities, not least the boon to economic activity that may follow: Northwestern University says that a 10% increase in broadband penetration is estimated to increase national GDP by 1.2%. It could also provide the chance to check tech companies' sharing and monetising of personal data.

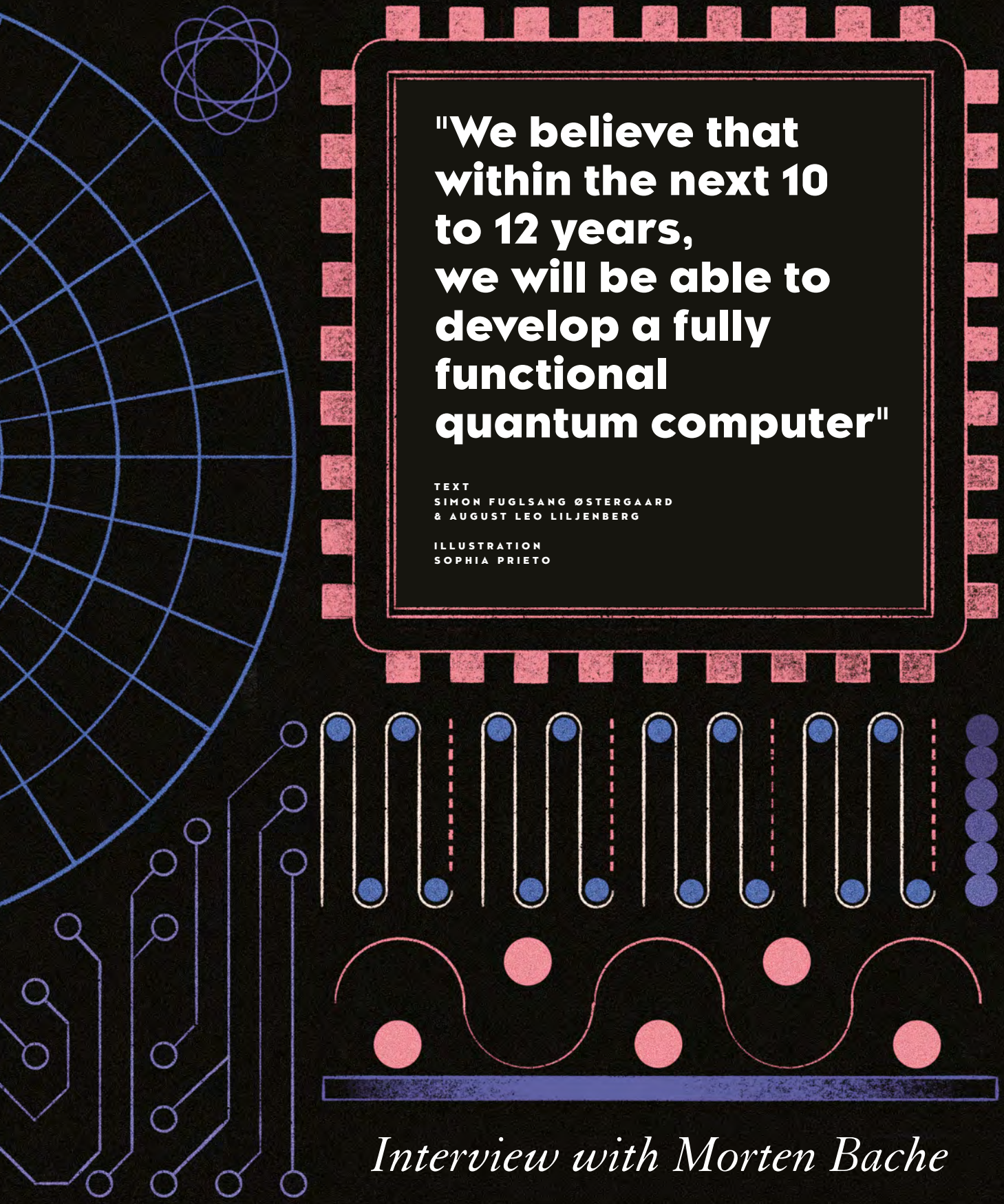
"I don't think most people even think about whether we should be helping those who don't have internet access here or abroad to get it," says Reglitz. "I think people still tend to think of internet access as a luxury, as something to watch Netflix on. Yes, that may be what most people use the internet for, but rights are social guarantees against standard threats, in the way that you might have an entitlement to police protection from being assaulted, for example. And, if we're going to make internet access a right, that needs to come with better protections and some form of minimal entitlements to support those who need it too.". ■



"We believe that within the next 10 to 12 years, we will be able to develop a fully functional quantum computer"

TEXT
SIMON FUGLSANG ØSTERGAARD
& AUGUST LEO LILJENBERG

ILLUSTRATION
SOPHIA PRIETO



Interview with Morten Bache

In this interview with Morten Bache, Scientific Director of Quantum Technologies at the Novo Nordisk Foundation (NNF), we discuss the implications of the organisation's recently established 'NNF Quantum Computing Programme', an initiative in collaboration with the University of Copenhagen's Niels Bohr Institute aiming towards the development of what could be the world's first fully functional quantum computer. Kickstarted by a DKK1.5 billion investment by the Foundation itself, the programme will create a collaborative ecosystem consisting of researchers from Massachusetts Institute of Technology and Yale University (United States), Delft University of Technology (the Netherlands), University of Toronto (Canada), and the Technical University of Denmark and Aarhus University (Denmark). The programme will ultimately be nestled in the birthplace of quantum mechanics itself – the Niels Bohr Institute at the University of Copenhagen.

Why should a quantum computer be built in Denmark?

We use the problem-solving abilities of computers far more than we realise. Beyond the physical hardware of our smartphones and PCs, every time we use a search engine, we are by proxy using immense computing technology in servers and data centres. When we talk about future issues that we need to solve, such as climate change or developing life-saving drugs in the pharmaceutical industry, then we will hit a brick wall if we continue to only use classical computers. There are some very specific problems that classical computers will never be able to solve that a quantum computer might be able to. With one of the strongest quantum research clusters in the world, we think that Denmark has the right conditions to create a world-class team and ecosystem for quantum computing.

Can you explain how a quantum computer is technically different from a classical one?

What differentiates a quantum computer from a classical one is the presence of *qubits*. Simply put, quantum chips act on a subatomic level allowing photons or electrons to exist in a superposition of multiple states simultaneously. An ordinary computer's Central Processing Unit (CPU) works by collecting streams of electrical impulses, digitised to be either a 1 or 0, to encode information. By virtue of quantum physics, in a Quantum Processor Unit (QPU), quantum bits, or qubits, can exist in the multidimensional state of a superposition of 1 and 0 at the same time. Another difference is that the processing capacity of classical computers increases linearly the more bits are added, while raising the number of qubits for a quantum computer results in exponential growth. Building the computer language on qubits therefore gives additional degrees of freedom compared to the digital 0 or 1 of a classical computer. Programmers can exploit this freedom when planning how to solve a problem or designing entirely new quantum AI algorithms.

You mention that the programme is aiming to develop Denmark's, if not potentially the world's, first fully functional quantum computer. What's the state of quantum computing today?

We are currently at an early stage within quantum technology – perhaps comparable to where classical computers were in the 1960s. Although we can currently use quantum computers to solve very simple problems, after a certain calculation time, too much noise is created, which disturbs the interpretability of the final result, and the calculation must be stopped prior to this. 'Noise' in this context can be understood as when the qubits of a quantum chip start to lose information to their external environment over time. The current QPU's are therefore said to operate in the 'Noisy Intermediary Scale Quantum' (NISQ) 'regime', and this constrains what kinds of problems we can solve on a quantum computer today.

Today's commercial and functional quantum computers lie around this NISQ barrier – the 50 to 100 qubit mark. IBM currently boasts the largest one as of 2022, Osprey, at 433-qubits. They use superconducting materials to make the qubits, and these need to be cooled down to very close to absolute zero temperature (-273 °C), colder than outer space, in order to protect the qubits and avoid too much noise creeping in. This is done using a cooling mechanism called dilution refrigeration, and they're aiming to develop a 1000-qubit computer by 2023. However, this will still be nowhere near full functionality. Our initiative is aiming for a quantum computer with on the order of 1 million qubits by 2034, which will have an automated and actively running error-correction system that reduces noise. Achieving the 500,000 to 1 million-qubit mark is essential to solving the complex problems of the future. Under today's qubit limits the calculations required would produce far too much noise to then adjust the results and still obtain a somewhat accurate result.

As of now, the refrigeration technique employed by IBM and similar companies has a maximum capacity around the 10,000-qubit mark and scaling it up to more qubits would require dozens of refrigeration units with communication channels between them – visualise an entire quantum computing warehouse. So, you can imagine, using this technique, our minimum qubit goal would take up a lot of space. Therefore, our programme will look for alternatives in other qubit technologies to find a promising, scalable qubit platform that can be taken towards the goal of 1 million qubits. One example is building a quantum computer based on light – photonic qubits – meaning that one can connect and communicate between various subunits using fibre optic cables, which is a very mature technology thanks to telecommunication. Such a quantum computer would still not be compact in size – it never will be – but it would be small enough to fit into a meeting room, even for a 1 million-qubit computer.

How will the technology behind the quantum chip be safeguarded?

Since we believe the programme should foster a cooperative quantum ecosystem, as well as ensure that the technology behind the actual QPU itself doesn't fall into the wrong hands, we have had to create a unique organisational structure. We do not want a situation where cyberwarfare is being waged by nefarious actors using technology that we have developed. Therefore, The QPU's manufacturing facility will be established as a partner company (Quantum Foundry P/S) co-located within the programme. This ensures the entity can hold the intellectual property rights for fabricating the chips in the future, and due to the potential security risks associated with the technology, it will be locked in a special part of the Niels Bohr Institute only accessible with authorised permission. This structure allows for unique collaboration opportunities where external actors, academic or private, can engage with the Quantum Foundry P/S by signing a collaboration agreement, for example.

A major reason for why a company was founded inside the programme is that if the QPU manufacturing facility must be patented, its secrets will be released when the patent is disclosed. That's why it is often desirable to protect the technology as a trade secret instead, and unlike an academic institution, a private company can do this. In this way, our QPU manufacturing facility will remain 'closed off' to the public and protected a bit like the recipe of Coca-Cola. There is no need to patent the Coca-Cola recipe if the way it's brewed is a secret and can remain a secret. Luckily, it's not possible to reverse engineer the recipe the programme intends to use for fabricating quantum chips. If a fully functional quantum chip was to fall into the hands of an undesired third party, they wouldn't be able to properly understand how it was built. Sure, they'd be able to identify what materials were used to make it, but not the intricate details of how it was constructed piece by piece. Likewise, you can pinpoint the different chemical components of the Coca-Cola recipe, but you still don't know how the drink was made.

What makes this initiative have an edge over competing private companies?

Big industry players such as IBM, Google, Microsoft, and Honeywell have all said that they plan on developing fully functional quantum computers as well. It is our view, however, that when you are at the very beginning phases of developing a novel technology, it's worth promoting collaboration rather than competition. The challenge is that the business models of these companies cause them to fence their technology in and prevent them from collaborating with one another.

Our organisational model ensures that the programme has the advantages of openness associated with academia, collaborating with other research clusters

and industry actors, while anchoring the intellectual property rights of how the quantum chip itself is built in Denmark. This cooperative model is currently unheard of within the quantum computing community, and we strongly believe that one cannot reach the goal of full functionality without these conditions. The programme is not aiming to have a production line of quantum computers; it's trying to define what kind of technology we need to get a fully functional quantum computer that can be used by everyone. This is different from the approach a big tech company would take. What they're interested in is getting customers and making some money along the way, which often comes at the expense of collaborating and expanding the existing ecosystem.

Then there's also the crucial question of how quantum technology can be used for nefarious intent. When it comes to digitalisation, we often discuss issues of cybersecurity and data privacy only after a certain technology has been launched. These are key questions for quantum computing too; we need to ensure a democratic voice is implemented in the process of their technological development, something which I think is more easily achieved when done collaboratively.

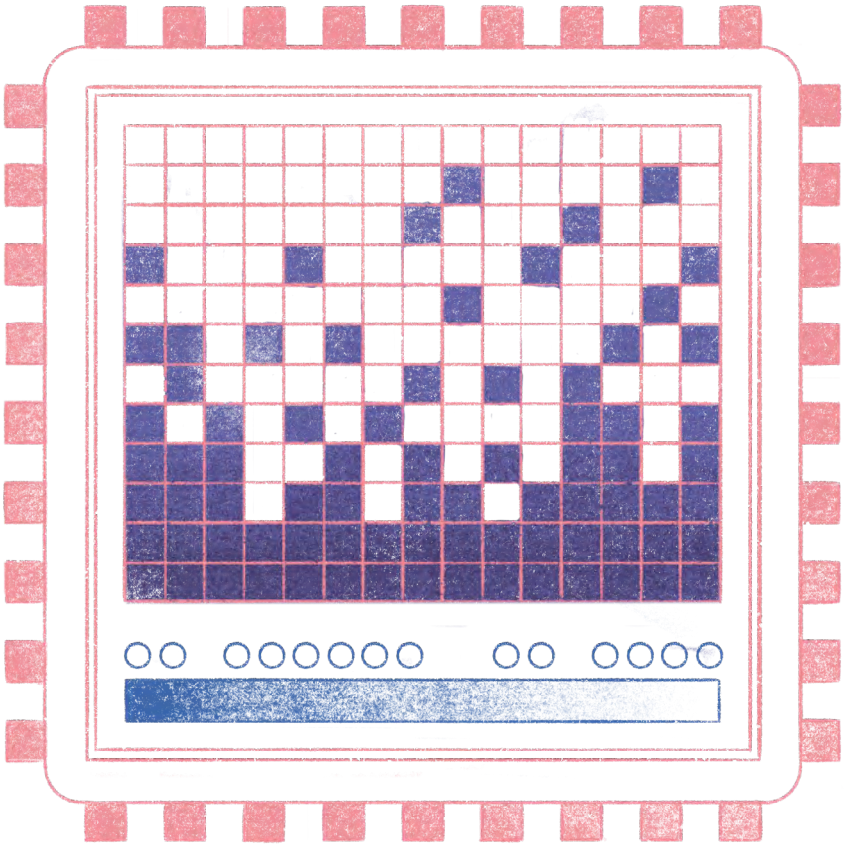
How will our lives be affected by quantum computing in, say, 2050?

I think that quantum chips will almost certainly be positioned in a hybrid computational context, meaning that if you're lucky, you won't be thinking about quantum computers very much. Quantum computers will consist of *one* part of the computer technology pipeline. Upon a search request for personalised medicine for example, your personal computer might send a request to a much larger computer, which will then send one to a quantum computer, and then finally filtered it back to your device via the same pipeline. The aim is to get these different types of computers to talk and exchange information with one another via some cleverly written software. In the minds of software and hardware producers, the less aware we are of quantum computers, the better – it means their job has been successful.

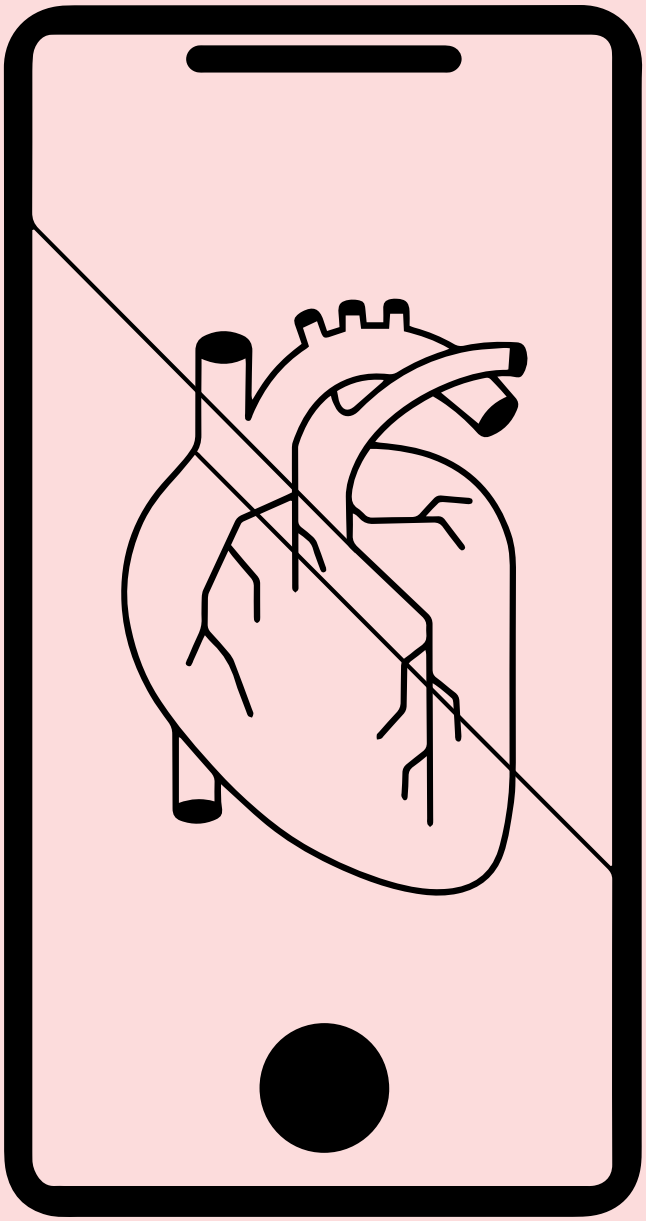
What is the probability that your team will be the first to reach the quantum goal?

We believe that within the next 10 to 12 years, we will be able to develop a fully functional quantum computer. Some think that 2050 is more realistic. And sure, we are being optimistic. There is a chance that we don't reach our million-qubits minimum target, but rather ten or one-hundred thousand, where perhaps 1% of the qubits performing the actual calculations are error-corrected for noise. The problem is that you really need to get into the million-qubit range to obtain worthwhile results from incredibly complex problems when only 1% of the qubits are error-corrected.

To answer your question, the likelihood is somewhere higher than 1%, and somewhere lower than 50%. Right, I can tell you are not satisfied with that – let's say a 20% chance then. There are currently maybe five or six other countries that could also achieve it – we're all neck-in-neck. And if someone else beats us to building the first one, then the technology that the programme has created will nonetheless still be available and highly relevant. ■



The Novo Nordisk Foundation is a Futures Partner at the Institute. See page 95 for more information on how your organisation can become futures-ready.



FAREWELL TO THE *Swipe?*

TEXT
JAYLENE MBARARIA
ILLUSTRATION
SOPHIA PRIETO

The meteoric rise of app-based dating has given users near-endless choice in who to court. Yet the gamification of romance and constant swiping encouraged by Tinder and other platforms has meant that an increasing number of people experience 'dating burnout'. What would a future look like in which technology facilitates quality of connections over quantity and brings back some of the magic and excitement lost from dating?

It's a recognisable story, we all know how it goes. You swipe, you match, you chat, maybe you meet up, maybe not – and the cycle repeats. All in the pursuit of the 'one'. Online dating platforms, and their evolvement into dating apps were meant to make dating easier, more convenient, to solve our dating woes by making the 'one' available at the swipe of a fingertip.

Dating apps have quickly become the default way in which many meet their partners, and over the past decade or so being single has become almost synonymous with being active on dating apps. A survey conducted in the UK estimated that by 2040, 70% of couples will have had their initial meeting online.[1] Many find the love of their life through these apps, and they give us access to thousands of other single people, supposedly making dating easier than it has ever been.

The pandemic exacerbated this trend with usage of dating apps reaching an all-time high. Tinder reported a record number of users and matches in 2020, with it being the busiest year in the app's history.[2] On March 29th, 2020, when most of the world was in full lockdown swing, Tinder's swipe activity broke 3 billion in a day for the first time ever, with 42% more matches per Tinder user, and has remained sky high ever since. The uptake in dating app use during the pandemic is indicative of these apps performing as they have been designed to: making dating as convenient as possible during a time in which meeting in person became almost impossible.

Choice and wider access are two things that dating apps have given us unprecedented amounts of. Yet the easy and frictionless nature of online dating also has some downsides. A 2020 study in the US by Pew Research found that among individuals who had used dating apps in the preceding year, 45% had found the experience frustrating, compared to 28% who still held out hope for finding love online.[3] A more recent study conducted in the US in 2022 found more than 78% of online daters aged 18-54 had experienced some degree of emotional fatigue or 'dating burnout' in the last year as a result of using dating apps.[4]

There are even indications that the mental toll that app-based dating can have on some is significant. A study published in the academic journal BMC Psychology found that users of swipe-based dating apps report higher levels of depression, anxiety, and distress compared to those who do not use the applications. Although the researchers point out that causality between the two has not been determined, it suggests that something may be out of balance.[5]

Finding a potential partner has never been easier, so why are so many left dissatisfied with this new world of swipe-based dating? Perhaps the problem lies in the technology itself, and the way it has removed some of the magic and excitement

1 eHarmony: "Over 50% of couples will meet online by 2031", (2014), tinyurl.com/3hxrd7x2.

2 Tinder: "The Future of Dating is Fluid", (2021): tinderpressroom.com/futureofdating.

3 Pew Research Center: "The Virtues and Downsides of Online Dating" (2020), tinyurl.com/hfsbfr3v.

4 Singles Reports: "Emotional Fatigue and Burnout in Online Dating – Data Study" (2022), tinyurl.com/4md692fz.

5 Nicol Holtzhausen et al.: "Swipe-based dating applications use and its association with mental health outcomes: a cross-sectional study", BMC Psychology (2020), tinyurl.com/3d8j2p56.

that used to be associated with dating. Could it be that the sheer number of potential partners available out there coupled with the gamified nature of dating apps means that we have stopped seeing people as whole and complex, and rather as convenient and disposable? This would certainly explain why many users are left feeling burned out.

Dating fatigue has already given rise to various countertrends both during and after the pandemic. These range from 'mindful dating' through which singles use apps more intentionally by limiting swiping and trying to focus on quality matches, to 'conscious singleness' where people are choosing to stay completely off the apps due to less-than-ideal experiences. Over 50% of singletons have chosen to take at least one of these approaches, at least once, reports the dating app Bumble.[6] These countertrends seem to be a result of the pandemic allowing people to realise that it is okay to be alone, and when paired with the swipe fatigue experienced by daters, it goes to show the true extent to which many are dissatisfied with the impact that apps have had on their overall dating experience.

6 Bumble: "Here Are Bumble's Predictions for Dating in 2022, According to Data" (2021), tinyurl.com/y2rx2k3p.

7 Artemio Ramirez et al.: "When Online Dating Partners Meet Offline" (2014), tinyurl.com/2p84frda.

Traditionally, meeting a romantic partner occurred in a face-to-face setting, which made it easy to quickly determine both attraction and chemistry. That all changed with the rise of online dating. Although attraction is something that can be assessed through images – do you like the way someone looks or not? – chemistry (or lack of) is something that is much harder to replicate or determine digitally. In fact, there is evidence that the longer we spend chatting to potential partners online, the less likely we are to forge a connection in real life.

A study published in the Journal of Computer-Mediated Communication found that daters have more successful face-to-face interactions when they move onto this form relatively quickly.[7] It suggests that those who wait too long before meeting "may risk developing idealised impressions that will be violated upon meeting," which is a key difference between establishing initial contact in real life vs online. In the former case, impressions are formed quickly, romantic chemistry is established, and a person can be seen at face-value from the very start – there is little room to idealise them. In the latter case, there is plenty, as it is harder to gain a full picture of a person based purely on online interaction.

So, what does this mean? How do dating apps get around this problem? It is a tough question to answer, as the very way in which dating apps have been designed has been to prioritise the surface-level and to provide users with endless choice. For this to change, priorities would need to shift away from the idea of constant availability of potential partners, and towards fewer, more curated, and personalised matches that do not require an endless back and forth to determine chemistry. Although technology is certainly part of the problem, it could also present a so-

lution. Dating apps in their current form may be too crude to facilitate chemistry and connection, but they could eventually evolve into something much more sophisticated where users are able to represent themselves more fully in real time.

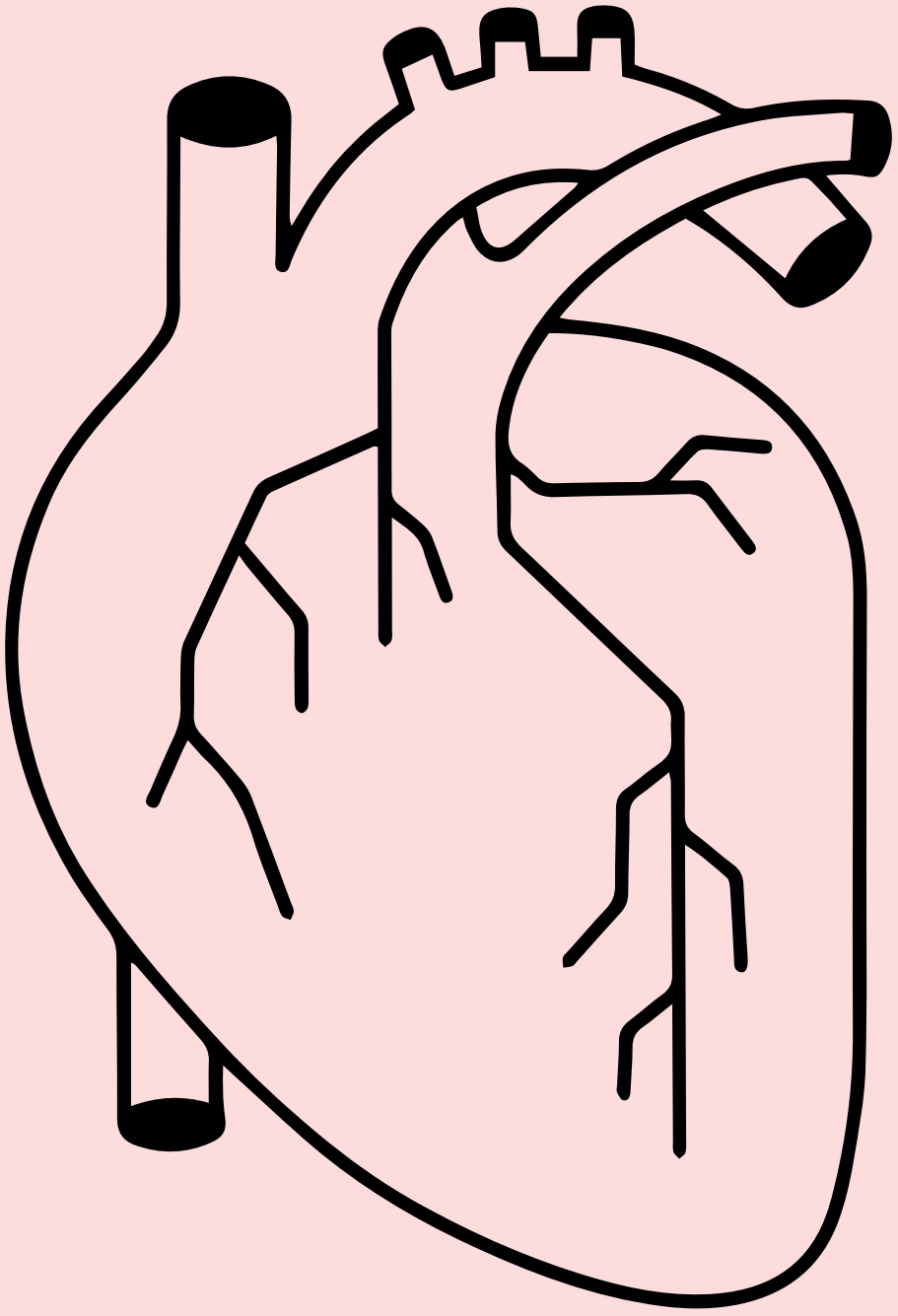
This is something that might become the case as the metaverse develops, with users being able to present more true representations of themselves virtually, in real time. It is a possible scenario that has been explored by many, and quite notably in Netflix's recent series 'The Future Of', which features an episode on the future of dating. The suggestion is that virtual technology can be used to mimic the very thing that it seems technology has taken away from dating: spontaneity and excitement. The function of apps may just be that of a matchmaker, one that gets to know its individual users and then places them in a virtual reality 'date' setting, which they can join from their respective homes. Neither knows anything about one another prior to this meeting, and it comes as close to the feeling of a real-life chance encounter as technology can mimic, with the added bonus of a greater guarantee of compatibility.

Of course, there are also some significant barriers on the way to a future where virtual dating has become as widespread as dating apps are today. Among them are the steep (although declining) cost of headsets, and the fact that the VR revolution is taking longer than once promised to get here. Add to that Meta's recent struggles with getting their version of the metaverse off the ground, which hasn't done much to build anticipation and hype – arguably, it has done the opposite. Dating in virtual worlds, although promising for the future, remains an exotic novelty today.

Still, the move towards virtual reality and the metaverse playing more the role of matchmaker may ultimately lead the pursuit of the 'one' to be somewhat less of an exhausting endeavour. It would mean that the focus shifts towards prioritising getting to know individual users intimately before suggesting potential matches, in order to successfully facilitate more genuine connections. Here we get away from the endless, tiring back and forth required to determine romantic chemistry online whilst simultaneously reducing the 'disposability complex' that app-based dating results in, by humanising individuals through focusing on fewer, better suited matches.

This is one of many solutions. The dating app market is already a five-billion-dollar industry,[8] with no signs of its growth slowing. The fusion of technology and dating in recent decades will continue to dictate how people form romantic relationships. Demand is always there, and the tech isn't going anywhere – so why not use it to bring back some of the spontaneity, excitement, and authenticity of dating that was lost along the way? ■

8 David Curry: "Dating App Revenue and Usage Statistics" (2022), tinyurl.com/35ksmay9.



New Ways of Connecting

In little more than a a decade, online dating has gone from a niche phenomenon to the default way in which many people meet their partners.

What percentage of couples will meet online in the future? (Survey from the UK)

2031
50%

2040
70%

Evidence is now emerging that the rapid growth in dating app use is changing the social fabric of society. Traditionally, the loose ties of our social networks – friends of friends or workplace acquaintances – were the 'pool' in which we sought out new partners, and most new connections used to be only a leap or two away from us. Online dating has changed this dynamic because it circumvents these traditional pathways, creating new connections that tie together networks that would otherwise be isolated from each other.

Sources: Verified Research: "Online Dating Market Size And Forecast", bit.ly/3ew11jH; Josue Ortega, Philipp Hergovich: "The Strength of Absent Ties: Social Integration via Online Dating" (2017), arxiv.org/abs/1709.10478; MIT Technology Review: " First Evidence That Online Dating Is Changing the Nature of Society" (2017), bit.ly/3EKW4hA. Gina Potârcă: "Does Online Dating Affect Assortative Mating? The Case of Educational, Racial and Religious Endogamy", tinyurl.com/2p8r734x.

Traditional settings of meeting and initiating relationship tend to favour ‘endogamy’ (forming partnerships within social groups, religious denominations, class, or ethnic groups). Research has shown that the rise of online dating may be slowly disrupting this pattern. Dating apps have been observed to facilitate a decline in endogamous behaviour among studied groups of people, in part due to the weakening of geographical barriers and the ease with which apps enable users to search for partners outside traditional settings.

One area in which the consequences of this change have been observed is in racial diversity, which has long been considered a measure of social distance. In the US, researchers have found that the number of interracial marriages began increasing rapidly after the introduction of the first dating websites in 1995. This increase grew steeper in the 2000s and accelerated even more quickly after 2014, when apps like Tinder started seeing mainstream adoption. Although the data does not in itself prove that online dating has caused a rise in interracial marriages, researchers believe that the correlation is consistent enough to support their hypothesis that it does. It may be an early sign pointing to a future where new dating patterns have changed society in even more significant ways.

"SOME HOLD THE VIEW THAT CONSCIOUSNESS IS ESSENTIALLY BIOLOGICAL. BUT IN PRINCIPLE, I DON'T SEE WHY SILICON SYSTEMS CANNOT ACHIEVE IT"

Interview with philosopher and cognitive scientist David Chalmers

TEXT
JP O' MALLEY
PHOTO
JOHN JOUMAA

When it comes to consciousness, I call the problems of explaining intelligence, and explaining behaviour in general, the easy problems," David Chalmers says. The Australian philosopher and cognitive scientist has made it his life's work to take on some of the big questions relating to the nature of reality, the relationship between mind and body, and consciousness in the age of digital technology.

Although Chalmers admits his 'easy' problems are not so easy after all, we at least have some idea of how to go about solving them, he says. They can be explained by computational or neural mechanisms like, say, the ability to discriminate, categorise, and react to environmental stimuli; the reportability of mental states; the focus of attention; the deliberate control of behaviour; and the difference between wakefulness and sleep.

The so-called *hard problem of consciousness* is something that is much more difficult to solve: "The hard problem is really the problem of explaining how physical processes in the brain could give rise to conscious, subjective, experience," says Chalmers, who currently holds the position as Professor of Philosophy and Neural science at New York University, where he also works as co-director of the school's Center for Mind, Brain, and Consciousness.

It is a fundamental question in both philosophy and cognitive science, and one that Chalmers has grappled with for decades. When he first used the phrase "hard problem of consciousness" in April 1994, at a talk he delivered in Tucson, Arizona, it made a significant impact among intellectuals in the philosophical and scientific community. Then came his first book *The Conscious Mind* (1996) in which he defined the hard problem of consciousness as no less than "the biggest mystery and the largest outstanding obstacle in our quest for a scientific understanding of the universe."

DAVID CHALMERS

The book, which was greatly influential in its time, also claimed that no explanation of consciousness is possible in purely physical terms. Standard methods of neuroscience and cognitive science are always faced with having to explain consciousness on a more fundamental level, Chalmers argued.

To solve the hard problem, Chalmers believes science needs something more than physical explanations, which mostly only go on to explain objective structures and dynamics. If science can't explain consciousness in terms of existing fundamental properties (space, time, mass, and so on) and existing fundamental physical laws, then it might need new fundamental properties found in nature, he believes. Perhaps consciousness is itself fundamental, he speculates.

Chalmers has dedicated much of his career to the topic of consciousness. But over the last few years he became interested in another fundamental philosophical question: what is reality? These two mysteries, he claims, are inextricably linked. "Consciousness is part of reality, so if you want an explanation of reality, you'd better be able to understand consciousness," he says.

Chalmers explores this connection in a new book, *Reality+: Virtual Worlds and the Problems of Philosophy*, in which he argues that technologically simulated realities, like those found in virtual reality, are just as genuine as physical reality. That is, virtual worlds are not illusions. In fact, Chalmers believes they can provide just as much meaning and value as the physical world can.

Virtual reality, to Chalmers, becomes a way to engage with some of the deep questions that have troubled philosophers for centuries. He points to the French philosopher René Descartes, who back in the 17th century was already beginning to pose questions about the relationship between the mind and reality. Descartes also raised the issue of what Chalmers calls "the problem of the external world": How do you know anything at all about the reality that exists outside you? The philosopher famously found himself unable to rule out the possibility that everything he experienced was a dream, and that 'reality' therefore was, put in modern terms, a simulation of sorts.

For many years Chalmers thought he didn't have much to say about this question. But thinking about virtual reality when writing his book gave him a new perspective on this topic, he says.

Although today's virtual reality worlds are primitive, Chalmers admits, he believes their temporary technological limitations will pass, and that they will eventually become indistinguishable from the nonvirtual world.

Perhaps we'll eventually plug into machines through a brain-computer interface, bypassing our eyes and ears and other sense organs. Chalmers claims the simulated environments that await us in the future may even be occupied by simulated people, with simulated brains and bodies, who will undergo the whole process of birth, development, aging, and death.

As the technology develops and virtual worlds become increasingly sophisticated, the philosopher predicts that we will eventually be faced with a crucial question: should we move our lives entirely to a virtual world? "The short answer is yes," Chalmers says. "There is no difference, in principle, between meaning and value in both the physical and virtual worlds. So, there is no barrier preventing us from living morally and ethically in a virtual world."

This leads us back to Descartes' dream simulation. Speculating about the future of virtual reality leads Chalmers to pose the question: how do you know you're not in a virtual simulation right now?

This idea, known as *simulation hypothesis*, is one that Chalmers takes very seriously. Popularised by philosopher Nick Bostrom, and famously depicted in *The Matrix* movies, the idea posits that our entire existence is, in fact, a simulated reality – and what seems on a surface level to be an ordinary physical world turns out to be the result of connecting human brains to a giant bank of computers.

"I would say there is a 10 percent probability that we are living a simulation," Chalmers says. "But it would be very hard to demonstrate. If it's a perfect simulation that's indistinguishable from our own world, then no scientific experiment will ever be able to prove this, and it will remain a philosophical hypothesis, rather than a scientific hypothesis."

Chalmers believes science fiction provides philosophers with great thinking tools and thought experiments that can be used to envision these kinds of mind warping hypotheticals. He points to *The Matrix* as being partly responsible for his own "entry into the simulation arena." The filmmakers had a significant interest in philosophy, and shortly after the movie was released, several philosophers were invited to write articles on the movie's website. Chalmers accepted the invitation. In 2003, he published an article entitled "The Matrix as Metaphysics" which argued that the central premise of *The Matrix* movie might, in fact, not be an illusion.

Star Trek also gets a mention in Chalmers' new book. In a chapter entitled "Can there be consciousness in a digital world?" the author analyses an episode of the tv show in which a trial is held to determine if the android Data is sentient. One character, Captain Picard, asks the court to define the term 'sentient', to which Starfleet cyberneticist, Bruce Maddox, replies: "Intelligent, self-aware, and conscious."

This episode raises an interesting question, Chalmers points out: can a digital system like Data be conscious, or is that a trait that's reserved to humans and animals? "Some hold the view that consciousness is essentially biological," he says. "But in principle, I don't see why silicon systems cannot achieve it."

Chalmers takes this idea a few steps further. Once we have consciousness in a functional reproduction of the brain – say, a silicon brain – it would be a very small step from there to having consciousness in a simulated brain. A simulated brain would have the advantage of maximising similarity to a human brain, Chalmers explains. In such a device, every neuron would be simulated perfectly, as would all other cells throughout the brain. All the electrochemical activity, meanwhile, would be simulated too, as would any other bodily activity, such as blood flow.

"So, think about replacing say, biological neurons, gradually, with silicon chips, or some other substrate in the brain, while keeping the information processing the same way, because that would preserve consciousness over into machine consciousness," Chalmers says. "In fact, given how quickly artificial intelligence is developing right now, I think we could have consciousness in machines in the next few years."

In principle, then, could consciousness be uploaded into a computer? It's a concept often discussed in the transhumanism community and referred to as 'mind uploading'. According to Chalmers, this might be possible, although not anytime soon.

"By building a very detailed simulation of the brain, we would potentially be able to take the contents of the brain and totally upload them to a computer system," Chalmers explains. "We are still not able to build that kind of simulation. But with advances in neuroscience, maybe in a few decades, mind uploading could be possible. Maybe we'll build backups of ourselves in case something goes wrong in our life, and we'll be able to restore ourselves from backups, or perhaps when the brain is dying around the end of life, one will have the ability to upload themselves to the cloud with a silicon brain," he says.

Philosophically it's an interesting idea. But will it work? And, more importantly, if you upload your brain to a computer system, what kind of identity will that information represent? Will it be conscious? Can it be called an individual? Will there be anybody home, from the first-person perspective?

Chalmers doesn't claim to have definite answers to difficult questions like these. But philosophy, as he keeps reminding me, naturally contains more paradoxical perplexities and less clear-cut answers than clinical definitions. "These are all very deep philosophical questions about personal identity," Chambers concludes. "But once the right technology becomes available, I think we've got a fairly extensive philosophical analysis to figure out whether we want to use that technology or not." ■

Embodied Health: Reunifying Bodies With Their Data

TEXT
SARAH FROSH & MAYA ELLEN HERTZ

RADHIKA RADHAKRISHNAN
is a PhD scholar at the Massachusetts Institute of Technology (MIT). Her doctoral research focuses on feminist surveillance studies and critical algorithm studies in India. She has worked with civil society organisations to study the intersections of gender justice and emerging digital technologies using feminist, qualitative research methodologies. Her scholarship has spanned the domains of artificial intelligence, digital surveillance technologies, health data, and feminist internets. Radhika holds an M.A. in Women's Studies and a B.E. in Computer Science Engineering from India.

CHECK-UP *is a Q&A series exploring advancements and providing critical reflections on innovations in digital health. From telemedicine and electronic health records to wearables and data privacy concerns, we interview experts in fields across law, engineering, and NGOs who shed light on the myriad of complexities that must be considered in the wake of new digital health technologies.*

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From AI-enabled diagnostic technology to wearable health monitoring devices, digital innovations and the advent of big data are changing healthcare systems across the world. In many ways, these tools can help medical practitioners ensure more preventative care, achieve greater patient insight, and increase efficiency in the healthcare sector. Yet this expansion in digital health also makes it more critical than ever that we consider the effects of working with new technologies – the biases that are baked into algorithms and the legal ramifications of working with sensitive data – to keep patients at the centre of the healthcare systems that serve them. In India, this challenge is made more difficult by the fact that the companies developing and testing digital health technologies are predominantly based in the Global North, far removed from and with a poor understanding of the communities who produce the data.

In this interview with Radhika Radhakrishnan, we explore the dangers that arise when health data is understood as a resource independent from the bodies producing it. Radhakrishnan, who is a PhD scholar at MIT focused on the challenges faced by gender-minoritized communities with digital technologies, argues that emerging health technology has the potential to cause harm not just to one's privacy in the legal sense but also to cause a physical, embodied harm. She argues for an orientation towards using health data to serve communities whose bodies are producing it.

In your work, you put forward that health data is increasingly being treated as a disembodied resource; can you elaborate how bodies become disconnected from the data they produce?

One example that I'm really fascinated by is how regulatory policies currently treat the non-consensual sharing of women's images online. As a rule, it is viewed and treated as a 'data harm' and a data privacy issue – regardless of whether it's an intimate photo or not. Based on the conversations I've had with women who have been in these situations, this treatment doesn't capture what they experience when their data is violated. They never describe their experience in terms of

data harms but as intimate, physical, and corporeal harms. Even if it's an image circulating in cyberspace, their physical selves still experience the consequences of its misuse. This is what the framework of seeing data as a resource does not capture.

In India during COVID-19, drone surveillance was implemented to prevent the spread of the disease. But the public health surveillance was also surveilling bodies of people – the vectors of the disease, rather than the disease itself. This surveillance undoubtedly evoked physically distressing experiences. A nurse I spoke to needed to assist her neighbour in a childbirth and had to leave the house in the middle of the night to prevent the drones from seeing her. She hid in the shadows of buildings and felt like a criminal whilst doing her job.

If you put bodies and experiences back into the framework of what we understand data as, then it becomes immediately clear that something like our ability to move is being affected through the control over our data. In this case, surveillance does not only cause harm to data privacy but also to your bodily integrity and autonomy. When we are looking to regulate data, we cannot just look at data as a resource that is disconnected from our bodies. Healthcare is care of the body. When data is treated as a disembodied resource it obscures this obvious link.

Why are AI-enabled medical diagnosis systems being trained and tested in India?

The cost effectiveness of collecting data, the unregulated healthcare ecosystem, and the diversity of Indian populations make India an attractive country for training machine learning algorithms. AI-enabled diagnosis systems, and the algorithms that automate such systems, are being developed at a rapid pace in India with the intent to improve healthcare access to underserved parts of the country which have an acute shortage of skilled doctors. They aim to assist doctors in making diagnostic decisions and may supplement the doctor's presence in the future. However, because these interventions are happening exclusively within a predatory, unaffordable healthcare sector, the introduction of new technologies can become a method of simply using bodies and medical records of the sick and poor as data to train machine learning algorithms.

Can you give an example of how bodies are separated from the diagnostic systems they are training?

One of the algorithms I studied was used for diagnosing diabetic retinopathy (a diabetes complication that affects eyes, ed.). In this case, there is a clear conflict of interest between the interests of the company that developed the algorithm,

and the best interests of the patient, as patient diagnosis is being combined with experimental algorithmic trials to reduce the cost of data collection for the technology companies and healthcare providers. This raises ethical concerns as the already marginalised sick and poor have a reduced ability to bargain. What this can result in is therefore the favouring of market-driven private interests over patient interests.

The technology company that developed this AI-enabled diagnostic tool had no understanding of the practical reality their technology would operate in, such as whether consent forms were being given out to patients for the use of the automated tool in diagnosing them. At the same time, the patients I spoke to – most of them being agricultural workers in southern India – were not properly informed about the process, and they were unaware of how the diagnosis is made. Although patients are given a consent form, I observed that most of them could not read or write. In distress, they simply accepted any procedure being asked of them. There is no effort being made to understand the experiences they have with the usage of these automated tools. Their choice, consent, privacy, and preferences are not considered.

How do we bring data back to its original context of creation and how does doing so resist the harmful, often unintended, consequences of new health technologies?

First, we cannot simply look at data as a resource. Second, we need regulation that takes the risk of harm to the body into account.

I also think greater accountability is needed amongst the designers, medical practitioners, and companies developing the technologies. The pressing accountability question right now should be figuring out who's held responsible in cases where something goes wrong with the diagnosis or where incorrect data was used. Currently, I think medical practitioners in India are sidestepping this accountability question somewhat. As AI is often marketed as a social good, there is a deliberate ignorance about the harmful risks which results in an evasion of ethical responsibilities to the sick and poor.

The questions we must ask should centre around what machine learning is replacing when we sell its applications as products that are a panacea for social problems. We need to be able to pre-empt certain dangers stemming from technological interventions. If companies are using the experiences of underserved communities, especially marginalised ones, then they need to ensure that the applications they build benefit those communities in return and increase their agency. ■

The Cybertariat

TEXT
MATHIAS BEHN BJØRNHOF,
AUGUST LILJENBERG
& CASPER S. PETERSEN
PHOTO
WESSEX
ARCHAEOLOGY

A closer look at human-powered automation and the hidden side of the digital economy

We humans have always sought to use technology to simplify or automate work tasks. Although we've come a long way from Stone Age tools to today, where most of the global population carries a powerful micro-computer in their pocket, our striving to do more while working less has been a constant throughout history. With today's rapid advancements in robotics and artificial intelligence, a future may now be approaching where automated, self-functioning technology has taken human labour out of the equation entirely. Cars may soon be self-driving, your future digital assistant can proactively take care of your every need, and artificial intelligence can perform an increasing amount of cognitive labour much better than we humans can. Yet although expectations are high for what technology can help us achieve, we haven't quite arrived at anything resembling a fully automated future yet – and it may in fact be further off than we tend to think.

It's not that the hype isn't there, at least not if measured by the massive amounts of funding that AI start-ups tend to attract – on average between 15-50% more than other technology firms. Dig a little deeper, however, and we find that much of the hype surrounding this burgeoning AI industry is unfounded at worst and overblown at best. A survey of 2,830 AI start-ups in the EU revealed that 40% of them were not using AI in any significant way.[1]

The illusory grip of AI extends beyond the marketing of tech startups, however. One often overlooked facet of the platform-based economy and the algorithms that power it is that much of it is dependent on precarious and cheap labour to function. This curious phenomenon is what Phil Jones, author of the book *Work Without the Worker*, has dubbed 'fauxtomation' (an amalgamation of 'fake' and 'automation'). The term refers to the fact that novel AI-dependent technologies often market themselves on an illusion of automation, while being entirely dependent on human input. Otherwise known as 'microworkers', these digital labourers are an essential cog in the wheel of many of the technologies that power the platform economy. In some cases, they even make up the foundation allowing the business models of these platforms to succeed.

Their work includes ranking Google searches, cleaning data, identifying NSFW (Not Safe For Work) images, supervising algorithms, and performing other chores that require human cognition.[2] Specific tasks could be labelling data in an urban area to show a self-driving car how to navigate a city, or tagging pictures of faces to train a facial recognition algorithm how to recognise a face in a crowd.[3] What's interesting about these tasks is that most of them, from an end user's perspective, seem to rely solely on the pattern recognition skills of powerful and complex algorithms. And yet without humans in the loop, they simply wouldn't function. It's a sleight of hand which Jeff Bezos has aptly named "artificial artifi-

1 Parmy Olson: "Nearly Half Of All 'AI Startups' Are Cashing In On Hype", Forbes, 2019, bit.ly/3foZoES.

2 Casper Skovgaard Petersen: "Microwork: The Hidden Labour Underpinning the Platform Economy", FARSIGHT: Entering the New Age of Work, 2022, bit.ly/3gZazoh.

3 Phil Jones: Work Without the Worker: Labour in the Age of Platform Capitalism (2021).

cial intelligence". Rather than having liberated humans from repetitious, monotonous labour, the new digital platform economy is helping sustain this type of work.

Members of the new class of digital labourers often work as independent contractors, hopping from microtask to microtask, meaning they are not covered by minimum wage laws or other labour protections. They are mostly hired from underprivileged populations in the Global South, with a median earning of $2 per hour.[4]

4 Kotaro Hara et al.: "A Data-Driven Analysis of Workers' Earnings On Amazon Mechanical Turk", drienne Williams et. al.: "The Exploited Labor Behind Artificial Intelligence", Proceedings of the 2018 CHI conference on human factors in computing systems, 2018, bit.ly/3DIR8b0

It might come as a surprise how highly reliant on low-skill human labour the high-tech areas of our economy really are, but the underlying logic is fairly simple: why spend fortunes developing and implementing a piece of software that can perform boring, low-skill work tasks if sufficiently cheap and easily accessible labour exists somewhere in the world that can do so manually? Cost-cutting has always been an incentive for labour-saving technology; remove that incentive and automation becomes unnecessary.

It's part of a broader story of the ongoing 'taskification' of work – the breaking up of jobs into individual tasks that are outsourced to the lowest bidder – no matter where or who they might be. This process didn't start with the rise of microwork platforms but is in many ways a product of the internet. Already in 2003, Ursula Huws, Professor of Labour and Globalisation at the University of Hertfordshire, coined the term 'cybertariat' to describe the new class of workers who make their living on the internet. This ongoing atomisation of the workforce, she recognised, marked a break from the 20th century economic model of stable salaried employment. While the trend is not new, the rise of the platform economy, social media, and the proliferation of smart phones and internet access around the world has exacerbated it.

So, while worries connected with technology and labour often involve highly intelligent machines displacing us, taking our work, or perhaps even enslaving us like in some sort of Terminator fantasy, the more immediate risks come in the form of more conventional threats to worker wellbeing: unsecure, non-transparent, and precarious working conditions, facilitated by the global fluidity of work and tucked away under the shiny hood of digital technology.

One of the more famous platforms operating in this space is Amazon's crowdsourcing marketplace 'Mechanical Turk'. The service takes its name from a purportedly automated (and unbeatable) chess machine that toured Europe in the 18th century – in retrospect a very apt name, considering that the machine was actually run by a chess master who hid inside of a box.

Mechanical Turk offers access to a "global, on-demand, 24x7 workforce" who supply companies with a human labour force that can perform cognitive labour, often the kind that is widely assumed by the end user to be fully automated. Each month, millions of "Human Intelligence Tasks" (HITs) are completed by the platform's 100k–500k users (referred to as "Turkers").[5] One in three Turkers are otherwise unemployed and only 4% of all workers on the platform earn more than the United States' federal minimum wage of $7.25/hour.[6] Nonetheless, the platform has grown in popularity, especially in India, where the pay rates are more favourable.[7] Mechanical Turk is far from the only platform, however. Competitors include Crowdflower, Freelancer.com, and Clickworker, the largest of them all which passed 2 million registered users in 2020.

At surface level, it may seem that microworkers of the cybertariat benefit from the existence of these platforms; after all, they offer them the opportunity to work when they otherwise might not have had any. Yet when viewed in a broader perspective, the case is often that these workers began performing this type of work because technological advancement had replaced their previous employment.[8]

It's a clear example of what happens when market-driven interests and the interests of workers are too out of balance. When fragmented and isolated from each other – often not even able to communicate with peers on the platforms – workers lose the bargaining power they would otherwise have on the labour market. It's also not a coincidence that the Global South is where most of these workers are located. Apart from the wages from microwork being more favourable in countries like India, nations in the Global South also tend to be more lax regulatory environments promoting "low rights environments where there are few expectations of political accountability and transparency."[9] These are some the same reasons why India has in recent years become is a hotspot for training and testing technology by tech giants.

But microwork is not relegated to the Global South – the platforms are available in the Global North too. In cooperation with the start-up 'Vainu', prisons in Finland, for example, brandish an initiative whereby inmates can supposedly train their vocational skills by performing Mechanical Turk tasks that would otherwise be outsourced to microworkers.[10] As is common practice with prison labour, the inmates are underpaid, with the governmental overseers of Finnish prisons receiving an undisclosed percentage of the microwork payslip from Amazon. It's a example of how even in a country claiming one of the most progressive prison systems in the world, the cooperation of the state and capital ignores concerns over exploitation when work is portrayed as ephemeral, simple, and hidden from public view.

5 Zachary Crockett: "How much money can you make on Amazon Mechanical Turk?", The Hustle, 2019, bit.ly/3T9aSdH.

6 Hara, K. et. al.: "A Data-Driven Analysis of Workers' Earnings on Amazon Mechanical Turk", 2018, bit.ly/3TS6lb2.

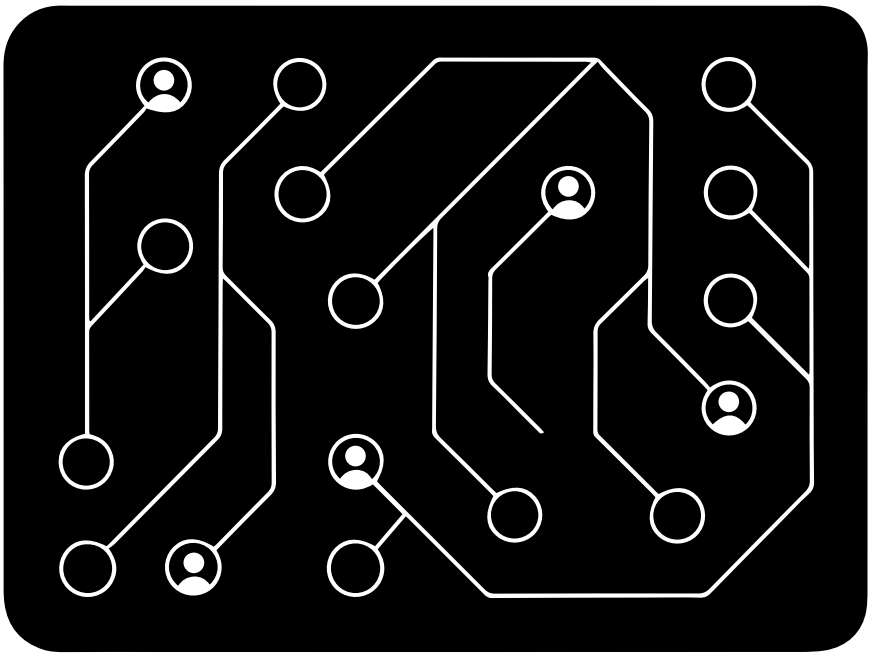
7 Zachary Crockett: "How much money can you make on Amazon Mechanical Turk?", The Hustle, 2019, bit.ly/3T9aSdH.

8 Casper Skovgaard Petersen: "Microwork: The Hidden Labour Underpinning the Platform Economy", FARSIGHT: Entering the New Age of Work, 2022, bit.ly/3gZazoh.

9 Virginia Eubanks: "Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor", St. Martin's Press, 2018.

10 Angela Chen: "Inmates in Finland are training AI as part of prison labour", The Verge, 2019, bit.ly/2HY4d4S.

New technologies reflect and amplify our pre-existing social relations. While decades of globalisation and widening value-chains have alienated much of the labour gone into the goods we buy today, we can nonetheless recognise that it still exists. Coffee beans need to be picked and trucks must be driven. Microwork, on the other hand, increases the opacity of global labour to a level where companies don't even acknowledge the existence of the people powering their own platforms. The issue, therefore, is primarily one of accountability. Certainly, technological innovation itself will not solve the issue. On the contrary, as the world becomes increasingly interconnected, spaces for potential exploitation may increase – VR and metaverse-enabled work through a person's 'digital-twin' would allow workers to perform more immersive and kinetic-based tasks remotely, for example. A less bleak future for the cybertariat is possible, but without a greater degree transparency and responsibility, the fate of labour in tomorrow's hyperconnected cyberspace remains solely in the hands of the platforms that facilitate it. ■



PROFILE OF A FUTURIST

Sofie Hvitved

"THE METAVERSE WILL FORCE US TO RETHINK WHAT WE CONSIDER REAL"

TEXT
AUGUST LILJENBERG
PHOTO
NATALIE WALKER

There is a slight restlessness in Sofie as we sit down for our interview – it's clear that there is something she needs to get off her chest before we start. Without further warning, she opens her laptop and insists that I have a look at the latest GPT-3 powered deep learning software able to create a short story from any written prompt you provide it with. "It's unbelievable. Even as a futurist working within the media sphere, I continue to be impressed by what all these openly available tools can do," she says while bookmarking the tab, assuring me that we will continue after the interview is over.

Sofie traces her attraction to technology all the way back to childhood in the late 1980s and 90s. What started as a fascination with the quirky gadgets her engineer father brought home from his business travels in Japan later developed into an interest in the broader role of technology in society. After a sabbatical spent travelling the world, she enrolled in Media Studies at Aarhus University, Denmark.

"I wanted to understand the societal consequences of the technologies that had fascinated me since my childhood," Sofie says. "I took a particular interest in how the internet could enable the creation of new public spaces and the ability for individuals to mediate themselves via media, rather than being mediated *by* media."

In the early 2000s, the word on campus was that the media industry was not only financially lucrative, but also in many ways invulnerable to societal or technological change. This assumption, Sofie explains, turned out to also be alive and well in the halls of broadcast media. When she joined the strategy department of the Danish Broadcasting Corporation after her studies, she was struck by the chronic lack of futures-thinking she witnessed in traditional media: "We had no idea of the extent to which the internet had affected the industry. There was little awareness of how these new technologies and ways of communicating would come to affect our lives."

Sofie's time in broadcasting media was following by a number of years living and working in Buenos Aires, Barcelona, and Andalucia with her husband and fellow futurist Bugge Holm Hansen. Together they operated their own independent media company.

While abroad, Sofie started immersing herself in futurist methods and processes to build an understanding of the full scope of changes on the horizon for media. This led to her joining the Copenhagen Institute for Futures Studies in 2018. Today, her focus is on equipping organisations with the tools to anticipate future changes in the media industry and helping them understand how new technologies and concepts such as the metaverse, blockchain, and web3 will change the environments they operate in.

"In some ways, I see myself as a kind of 'media activist' in that I want to provoke and push the boundaries of the industry. I'm trying to make sure that we take these tectonic shifts seriously while not over- or understating the potential implications of future technologies."

One thing that becomes apparent when speaking to Sofie is that she's aware of the tropes media 'futurists' can fall into: hype-cycles, monetary incentives, and internet fame. She also understands the annoyance some react with in response to overly enthusiastic futurists whose expectations for the future can seem almost naively optimistic and in disregard for the societal challenges that technology creates.

"For many, the future of media is a dystopian one. Deepfakes, misinformation, and the dark verse. Furthermore, if you consider the decline in mental health among young people caused by social media, and then transfer that to an incredibly more immersive machine such as the metaverse, then there naturally is a cause for concern. However, such ideas are built on the way we see the internet now," Sofie argues, further elaborating that the ends and means of our desired future media landscape need to mirror one another to avoid big tech dominance.

"Some of the smaller media organisations we work with have resigned to complete fatalism, believing that they cannot do anything because it's big tech driving all the change. 'We just have to follow along', they say. This is the exact thing I worry about because it's a misconception that leaves media in a very apathetic state. We, the public, deserve better than that."

Sofie suddenly catches me off-guard with a quote from the Austrian philosopher Ludwig von Wittgenstein: "the limits of my language are the limits of my world." Surveying the media landscape she works within, it's easy to see how the language used can overwhelm most people: 'Web3', 'DAOs', 'NFTs', 'virtual wallets' – you name it. There are so many new concepts and systems that we simply do not have a well-developed language for, she explains. This is a large part of the reason why she thinks people tend to understate the potential for future change: "People say they want to lean into change, but when they're not part of it, or don't understand it, they may as well ignore, laugh at, or deny it."

In August 2022, Sofie and a team of colleagues at the Institute set about developing the world's first scenario white paper for the metaverse. It details four radically different futures measured along two axes: how proprietary and how fractured the virtual medium will be. Although scenarios like these are developed in an explorative manner without regard to which futures are considered 'better' or 'worse', it's clear there's an outcome she prefers.

"I lean towards the open metaverse scenarios which are not proprietary, simply because I do not believe – and history has shown this – that companies necessarily want the best for us. What I seriously worry about is surveillance capitalism driven by the attention economy."

One of Sofie's aims is to demonstrate how alternative models for a more open metaverse *already* exist in the form of Decentralised Autonomous Organisations (DAOs). Here, blockchain technology empowers organisations to operate in a decentralised fashion and allows users to have a say in how they are governed.

"One of the 'open' scenarios we worked with in the white paper directly credits DAOs. Put simply, instead of the metaverse being owned by one billionaire, it's owned by the users. This is obviously a utopian vision, but it is not completely unreachable either, depending on how much we want it and how much we collaborate around making it become reality."

But let's get back to Wittgenstein – reaching any of these 'utopian' ideals requires a significant transformation in the language we use to talk about the future.

"Something I often mention during presentations is that the metaverse will force us to rethink what we consider 'real'. In some ways, things like virtual reality and virtual assets are starting to become just as real than our physical reality."

Sofie concludes our talk on a sombre, but actionable, note, emphasising how the technologies that will increasingly dominate content creation are dependent on the data we ourselves feed them with – including all the biases and skewed ways of thinking that permeate that data.

"If we consider a scenario where most content in the metaverse is created by AI similar to GPT-3, for example, that in itself wouldn't fix the problems that exist in our virtual public spheres today. Using technology to enable human connectivity is an amazing opportunity, but only if it is done correctly and responsibly. It requires us to be brave enough to embrace truly radical lines of thought."

As we conclude our conversation, Sofie opens her laptop to pick up where we left off with GPT-3.

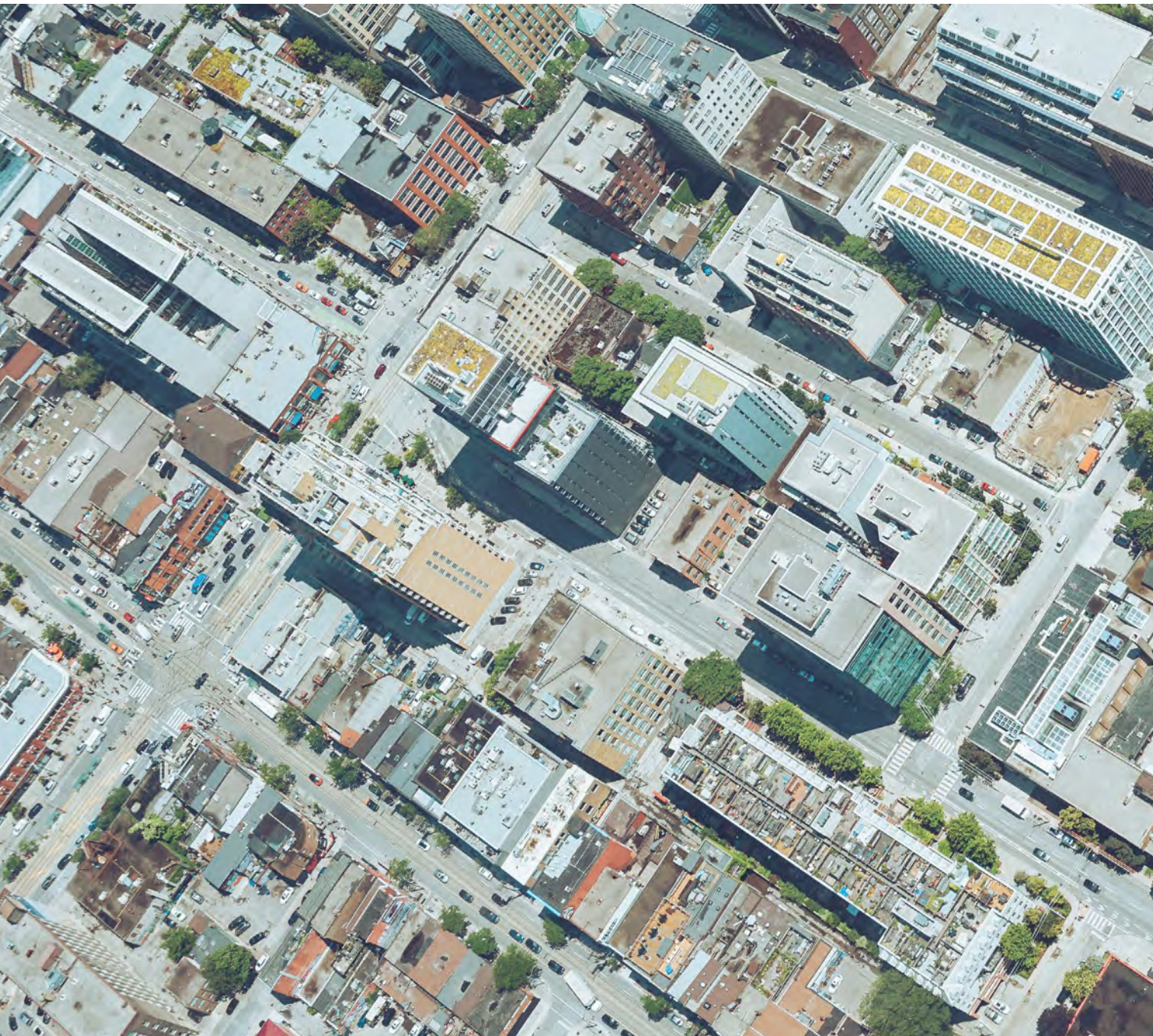
"So, what should your prompt be? It can interpret anything – just say the first thing that comes to mind." ■

Photographer: Nathalie Walker. Photos from Nikolaj Kunsthal, exhibition by Radar Contemporary.

Above: a photo portrait of Sofie Hvitved shot by Nathalie Walker in front of an artpiece by Lawrence Lek at Nikolaj Kunsthal in Copenhagen. The AI Generated image was made using Playgroundai and Stable Difusion 1.5 and based on the prompt 'the metaverse and a convergence of our virtual and physical lives'.

USING THE FUTURE:

Smart City Investment



The Copenhagen Institute for Futures Studies was commissioned by Pictet Asset Management to run a trend exploration workshop with the purpose of identifying and assessing developments and key trends impacting the future of smart cities.

Why

Cities are systems comparable to living things in their complexity. Like an organism, a city depends on a constant flow and circulation of inputs and outputs to survive and thrive – energy, people, food, material, waste. A city may evolve and grow or, if mismanaged, wither and die.

Cities offer the opportunity to use resources more efficiently due to density and scale effects, yet they also face immense challenges in the future including rapid urbanisation, environmental threats, inequality, increases in traffic and congestion, and pollution and emissions. These challenges necessitate improvements in the operational efficiency of the many systems that make up a city, and this need is only made more pressing by the expectation that the cities of the world will be home to 66% of the global population in 2050.

The 'smart city' represents the vision of a future where the functions of a city can be greatly improved through the widespread application of data-driven technologies, digital ecosystems, smart mobility and infrastructure, and other tech-enabled solutions. Making cities 'smart', however, is no easy task. It will require considerable investments made on an informed basis. This undertaking is made more complex by the fact that the smart city investment universe is extensive, encompassing urban development, intelligent buildings, financial solutions, infrastructure (traditional and digital), mobility, housing, intelligent workplaces, and solutions for improved citizen convenience and recreational activities. In order to grasp this complexity, and to correctly assess the many enablers and blockers of smart city solutions, a holistic foresight-based approach, which includes megatrend analysis and the formulation of multiple pathways of development, can be advantageous.

Aiming to better understand the potential for smart cities as a thematic investment area, Pictet Asset Management commissioned the Copenhagen Institute for Futures Studies to run a trend exploration workshop with the purpose of identifying and assessing developments which could potentially have significant implications for the future of smart cities.

How

The goal of the workshop, which was facilitated by CIFS CEO Daria Krivonos and Senior Advisor Timothy Shoup, was to drive a discussion between Pictet's SmartCity investment team and their external thematic advisory board. The workshop centred around four key strategic themes relating to smart cities: geopolitics, technology, transport & mobility, and urbanisation & infrastructure.

In addition to these themes, questions relating to the opportunities and long-term strategic risks of smart city investing were posed and debated. These questions included how smart energy can contribute to climate change mitigation and resiliency, how technological developments in the urban space change the way citizens interact with the city, what the impacts of economic and social inequalities are on smart city planning, what the role of technology is in dealing with rapid urbanisation, and what challenges current infrastructure poses for future smart mobility solutions.

The workshop provided a useful basis for the Pictet team to better appreciate key trends driving the multiple segments in the Smart City landscape with an interdisciplinary view. Ultimately, the session helped the team further develop the eligible investable universe and prepare for possible future adjustments.

Interested in learning more about how we work with megatrends and strategic foresight? Get in touch:

Futurist and Senior Advisor
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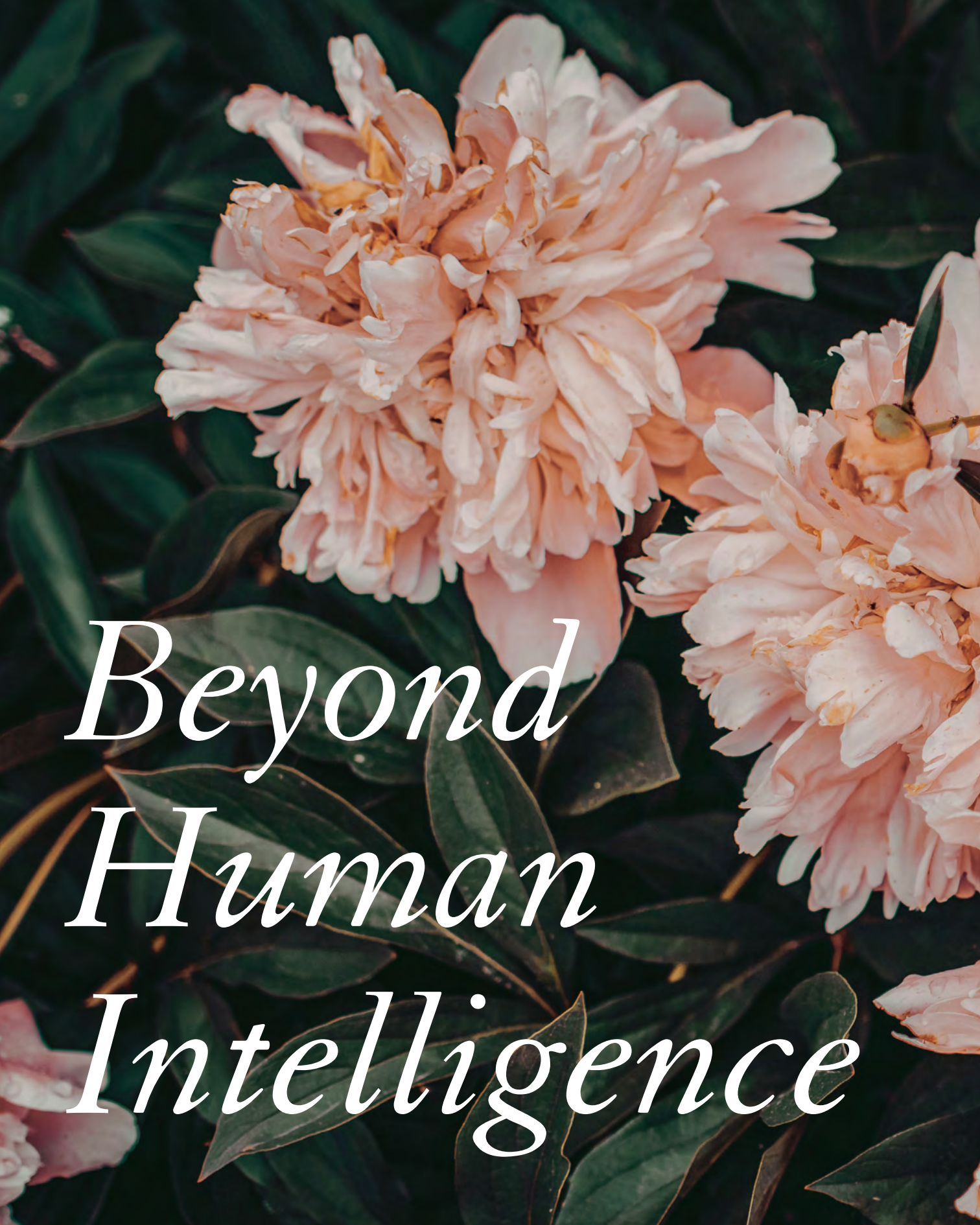
Beyond
Human
Intelligence

The natural world produces its own supercomputers. Author and cognitive scientist James Bridle has a new book out in which he makes the case for why we need to rediscover nature's brilliance and build new connections with other living things.

TEXT
CONOR PURCELL
PHOTO
IRINA IRISER & ENRIQUE HOYOS

Anyone with personal experience taking LSD, psilocybin, ayahuasca, or any other mind-altering psychedelic will truly recognise the world's interconnected nature. Fractalising into white diamonds, the air shatters, trees breathe, and animals speak your language. Some suggest these drugs dismantle an evolved human filter, revealing nature for what it truly is: a connected intelligence.

James Bridle's new book *Ways of Being: Beyond Human Intelligence* is an exploration of different forms of intelligence, both biological and artificial. It's also, as the author says, a call for us humans to start forming new relationships with non-human intelligence. Throughout the book Bridle argues that our common future demands less industrial hubris, and more cooperation with existing and deeply knowledgeable biological systems.

A writer and artist known for coining the term 'New Aesthetic' – used to refer to the increasing appearance of the visual language of digital technology in the physical world, and the combination of the virtual and physical – James Bridle advocates for a future characterised by human, animal, and plant re-connectivity for the sake of achieving a better planetary balance.

Our regular contributor, Conor Purcell, PhD, had the opportunity to interview Bridle for FARSIGHT, speaking by video call between Purcell's home in County Donegal, Ireland, and the interviewee's in Greece.

What inspired you to write this book?

I studied artificial intelligence almost twenty years ago when it was kind of fading from the curriculum because it wasn't going anywhere. Since then, there haven't been any kind of major discoveries. But what has happened is that vast amounts of data have become available, which have been harvested largely by social media giants and governments. At the same time, processing power has massively increased. We're now seeing how AI is revealing itself to be something not quite human in that it thinks and approaches the world in a very different way than we do. We're also starting to realise, thanks to decades of research, that intelligence is something much more interesting and greater than our very narrow human idea of it.

With the book, I wanted to understand how we can better accommodate ourselves with everything else that we share the planet with. For me, this question is central to achieving environmental justice and progress. I now see an opportunity with AI for reimagining, firstly, what intelligence is, and secondly, how we impact other forms of intelligence beyond the human.

How do you think people have become so disconnected from these other ways of being, specifically the intelligences of animals and plants in nature?

A good example to demonstrate this is how in medieval times there were cases when animals were accused of committing a crime and tried in courtrooms. There were lawyers there, and the animals were presented to juries. This wasn't pantomime, but a deeply serious undertaking because non-humans were part of the community. That meant they had rights and responsibilities.

Over time, and especially with industrialisation and urbanisation, attitudes towards non-human life in all its forms changed. We started to view them essentially as machines – unfeeling automatons who didn't have the kind of inner life or higher importance which we ascribe to humans. This became the dominant mode of thought within Western, post-enlightenment societies. That's when the abattoirs began. And now the environmental mess that we find ourselves in is all related to how we're out of balance with our deeply entangled and interdependent relationships with all other species.

What do we now know about the intelligent behaviour of plants?

Recent research has shown several surprising behavioural qualities in plants. I write in the book about scientists who subjected certain plants to repeated shocks and found that quite quickly they learned essentially to ignore the shock and move away from its source. What's more is that they remembered patterns and continued to avoid the source of the shock in the future.

This is an extraordinary finding that completely changes our understanding of plant behaviour. Even the idea that plants have a thing that we might call behaviour is astonishing because the traditional kind of botanical approach mostly involves cutting them up into small pieces and studying them as if they were machines. What's interesting too is that these researchers write about working with plant spirits, and their work is informed by both the knowledge that has come from the plants themselves and by treating the plant as already having its own personhood.

This is real science published in legitimate scientific journals. It's peer reviewed. It's reproducible. It conforms to all the structures of the scientific method. What that tells me is that there are multiple ways of approaching these intelligences and to do that via a kind of synthesis of these different ways of knowing is incredibly powerful. We can explore the world by observing and connecting with these behaviours, as long as our goal is to truly understand. Ultimately, it all

depends on admitting the possibility in the first place that these kinds of alternative intelligences are real.

In a chapter called "Non-Binary Machines" you talk about the field of cybernetics – which has a long history dating back to the mid-20th century – and how this shows a future alternative to what you call 'corporate artificial intelligence'. Can you explain what you mean by this?

It has to do with thinking of intelligence as a process, rather than as a machine that thinks like a kind of brain in a box. Particularly in Britain, cybernetic researchers – those involved in the science of communication and automation in machines and other living beings – envisioned a kind of intelligence that is active in the world, which is connected to the world around it, which is learning, and which is defined by what it does, rather than what it is. This is different to the corporate artificial intelligence of today which is currently being developed to increase profits.

Cybernetic research continues in various ways. There is very interesting new research around soft robotics, which essentially tries to make robotic systems more adaptive to the world around them. Programmes like the Unconventional Computing Lab at the University of the West of England is a good example. One of the things they study is the computational abilities of various plants and animals. They are doing very interesting things like redesigning computer logic based on the movement of crabs, for example. This points to the fact that what we understand as computation is not something that can only be performed within machines, but in fact is conducted by biological organisms too.

It also appears that biological systems can be calibrated to test variable abilities and to solve mathematical problems – they might even be more efficient than our fastest supercomputers. These abilities exist across the natural world, but since we usually only see the things that we know how to test for, there remains the possibility of a whole range of intelligences which far exceed our own. The problem is that we don't even know how to ask the appropriate questions yet.

How can we reconnect with non-human intelligence in the future?

Towards the end of the book, I write about the need to provide more shared territory for human and non-human lives. I mean this both in the form of animal reserves, conservation areas, wildlife corridors and shared spaces that allow animals to move in ways that they currently cannot. But I also think that the notion of animal intelligence compels us to think politically.

In the book, I discuss the Irish experience with the introduction of the so-called citizen assemblies, made up of 33 representatives chosen by political parties and 66 randomly chosen citizens, to make recommendations on society's biggest challenges. One of the things we learned from the citizen assemblies, not just in Ireland, but in other places, is that this is an extraordinary mechanism for mobilising what are essentially multiple forms of intelligence. The assemblies didn't use animal, plant or artificial intelligence, but by branching out beyond the traditional domain of experts, the range of human intelligence – and personality types – was enlarged. So instead of selecting a very narrow definition of domain experts, it's acknowledging that what you need for complex thorny problems, particularly novel ones, is a wider diversity of life experiences and ways of thinking.

The same principle can apply to including intelligences beyond the human in our decision making. I believe that only by bringing in diverse ways of thinking and forms of life experience can we address the kind of extraordinary global and pan-species problems that we face. ■

"I believe that only by bringing in diverse ways of thinking and forms of life experience can we address the kind of extraordinary global and pan-species problems that we face"

The Future of Brain Boosting

TEXT
JOSH SIMS
ILLUSTRATION
SOPHIA PRIETO

The Silicon Valley race may long have been about making your desktop faster and giving your mobile phone a sleeker user experience, but increasingly it's a race of connecting such devices to your brain. Companies the likes of Kernel, Synchron, and most famously Elon Musk's start-up Neuralink, are among the many now looking to fix, and then maybe boost, the human brain.

"The idea of using brain implants clinically is well established. Just think of cochlear implants or deep brain stimulation. There are several clinical trials ongoing that aim to expand the use of implants to treat complex diseases," explains Dr. Tracey Laabs, chief development officer at the Wyss Centre for Bio and Neuroengineering in Geneva. "But of course, many people have an interest in making their brain function somehow 'better' too."

It's not all just speculative work either. One implant – the first to work wirelessly – was tested in late 2016 and found to restore the movement in the legs of rhesus monkeys, effective within weeks of receiving a debilitating injury. In another recent case, BrainGate2, a system of pill-sized electrodes implanted in the brain's motor cortex and into the arm, was used to restore movement to the arms and hands of a man who had been paralyzed in a bicycle accident eight years prior. A similar system, dubbed NeuroLife, has been used to bypass an injured spinal cord to allow a patient to regain control of his hands. Yet as Laabs suggests, such innovations are not just about seeking to repair the broken. There have been some fascinating proofs of concept in attempts to enhance brain function too. Professor Newton Howard of Oxford University has successfully prototyped his Ni2o, a nanoscale artificial brain in the form of a high-bandwidth neural implant and the proprietary algorithms to run it. And Washington DC's Society for Neuroscience has reported that a University of Southern California team has developed a 'memory prosthesis' brain implant, said to boost performance in memory tests. So far, so dystopian. Or utopian, depending on your viewpoint.

Well, don't lose sleep or get too excited yet. We should, Laabs stresses, be realistic about the potential for brain implants, not least because they face the same tough regulatory pathways as pharmaceutical treatments. Our understanding of the brain is also still at an immature stage which means that even targeting diseases is an immense challenge because they manifest across the brain in no coherent way. "We don't understand the brain virtually at all, and I say that as someone with a neuroscience PhD," she laughs.

Yet brain implant tech is likely to be the way ahead, says Christof Koch, chief scientist of the Allen Institute for Brain Science in Seattle. Other less invasive treatment approaches have to date proven far too generalised, he explains. "There are millions of neurons at work in a piece of brain the size of a grain of rice, and boosting functionality requires

"Scientists and engineers tend to get excited about the idea of controlling computers with our minds, but I'm not sure that's a function that will get the man on the street excited about having a hole drilled in his head"

targeting certain neurons, doing nothing for some, and suppressing others."

In other words, there's a magnitude of precision required that we're a long way off achieving given the relative crudity of today's electrodes. That's why those attempts to weed out signals to and from the brain in order to, say, control a wheelchair, have so far not succeeded outside of the lab.

"The patient smiles or moves, thus triggering a wave of other neuronal activity, and it all goes wrong," Koch says, adding that said patient also requires the backing of a full clinical support team. Needless to say, this isn't yet something you can use at home. "I love science fiction as much as the next guy but we're dealing with the most complex piece of matter in the known universe. There's a lot to learn.

Then there is the question of whether we even need brain-boosting implants, reckons Andrew Jackson, professor of neural interfaces at the University of Newcastle, UK. His work focuses on the development of pin-sized implants designed to restore injured nervous systems and head off epileptic seizures. He argues that we already readily boost our cognitive powers by outsourcing so much of the heavy lifting to external devices. What need will there be for enhanced memory when we can document our entire lives on our devices and social media, and look up anything we need to know on a search engine?

And what of public perception, or the 'yuck factor' as those in the brain implant world sometimes call it? The idea of compromising the skull's integrity, causing bleeding and potential for infection and seizures is a hard sell.

Risks like these are also partly to blame for why the science of brain implantation is so slow going.

As Jackson dryly puts it, "Scientists and engineers tend to get excited about the idea of controlling computers with our minds, but I'm not sure that's a function that will get the man on the street excited about having a hole drilled in his head. The idea of being able to turn on your Tesla by thinking about it seems somewhat underwhelming."

The problem for a lot of the current exploration of brain/computer interfacing, he believes, is that it has yet to find the 'killer app' that convinces of its need. The brain, as with the body, does what it does pretty well already, Jackson contends.

"Legs, for example, are straightforward mechanical things. They are so simple that you cannot imagine robots offering something better than good old-fashioned biology," he says. "But millions of years of evolution have made legs really good at what they do, such that we wouldn't expect many people to be ready to chop off their legs to have cutting-edge robotic ones." Likewise, says Laabs, our hands and speech already make for great means of interfacing with the external world.

Laabs notes that there is a big difference between technology that brings people back to some kind of 'typical' baseline and one that seeks to enhance beyond that baseline. "There are so many questions. What is the longevity of the tech, how is it paid for, and what are the ethical challenges? It's extremely complex," she says. Might an implanted brain be hackable? Would it be right that only a wealthy, risk-taking minority would have access to cognitive enhancement, at least initially, potentially creating a class of superior humans? Jackson suggests not, but notes that he could enhance your brain function right now, with a strong cup of coffee. "Does coffee also create ethical problems?" he asks, rhetorically.

That all said, these leading thinkers in neuroscience agree that invasive brain tech that allows the restoration of upper spine injuries may well become reality within a decade. They also agree that, while it may not be inevitable, brain implant tech that allows higher functionality seems at least very likely, eventually.

That doesn't mean the prospect of implanting super-powers will cross over from science fiction to science fact. Don't expect your great grandchildren to be able to communicate telepathically, or to go turbo in order to solve the great mysteries of the world in their lunch hour. Koch says there's no evidence such kinds of enhancement would be possible. If they were, he notes, evolution would already have selected for them. What we can expect is improving what grey matter already does , on paper at least. "I don't see why eventually we shouldn't ultimately enhance our brain function," says Koch. "After all, it's just physics, not magic." ■

THE LIMITS OF CONNECTIVITY

TEXT KLAUS Æ. MOGENSEN
PHOTO TANYA PISACHUK

The internet ties the world together, but global connectivity is vulnerable both to physical attacks and political meddling. In addition to these weaknesses, the laws of physics set hard limits to the speed of digital communication.


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We tend to see the internet as something that is solid and dependable. It is always there when you need it, barring short-term problems with your service provider or local router. Unfortunately, just as the seemingly solid ground beneath your feet is vulnerable to earthquakes and flooding, the internet has its own vulnerabilities.

Long-distance internet communication today takes place through undersea cables or orbiting satellites that, if destroyed, are costly and difficult to replace. More than 400 undersea cables connect most parts of the world, even isolated islands in the Pacific and Indian oceans. These connections may be more tenuous than we tend to think.

Take New Zealand, for example. Just 20 strands of optical fibre, each the thickness of a human hair, carry virtually all communications to and from the island country through four undersea cables connected tothe United States and Australia. This means that many of the communication services used by New Zealanders depend on overseas servers, and even sending an e-mail to a next-door neighbour or buying goods at a local supermarket could be impossible if those cables were disrupted. Since all four undersea cables connect to New Zealand's North Island, a single earthquake or act of sabotage could feasibly knock all of them out, causing a country-wide internet blackout.

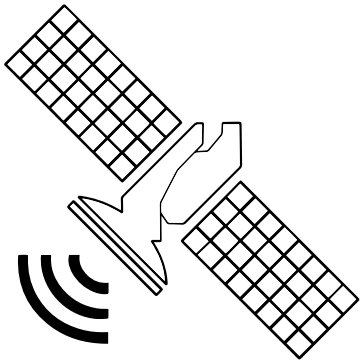
This risk is not specific to New Zealand. In recent years, concerns have grown that the submarine cables connecting far-off regions of the world and making global connectivity possible could become an easy target in a global conflict. There are historical precedents to this. Britain's very first military action in the First World War was to cut five telegraph cables linking Germany with France, Spain and the Azores. A more recent comparison was the series of explosions damaging the Nord Stream 2 gas pipeline in the Baltic Sea, probably as a part of the Russia-Ukraine war. In 2021, the US Colonial Pipeline was subjected to a ransomware attack that closed the pipeline until a ransom of USD 4.4 million was paid to hackers.

Communication cables are likely to be just as vulnerable to attacks as oil and gas pipelines. The light signals that undersea fibreoptic cables carry need a boost about every 60 km, using repeaters attached to the cable. Power for the repeaters is provided by diesel generators at onshore landing stations along the way, and these generators are not impervious to sabotage or extreme weather events.

Satellites are an alternative to undersea cables, but they are expensive and cannot carry nearly as much data as high-end fibreoptic cables. Although satellites are immune to earthquakes, they have other vulnerabilities. They can, for instance,

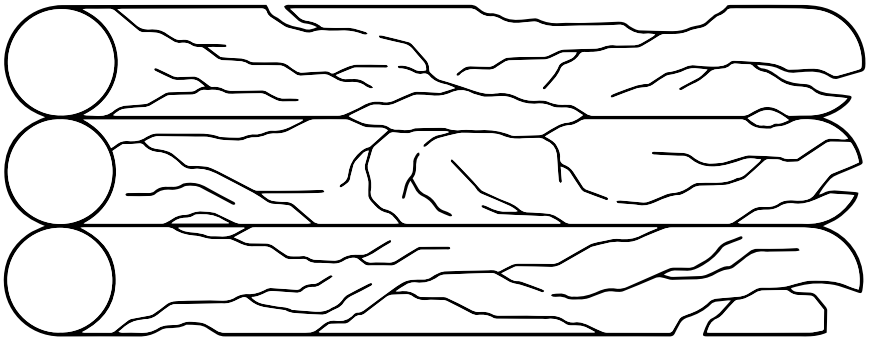
be affected by solar flares, which are weather events on the sun that emit electromagnetic radiation. The most powerful solar flares can knock out even ground-based communication (including through undersea cables) and cause power blackouts. Satellites, which are unshielded by the Earth's atmosphere, are even more exposed. This vulnerability became apparent in February 2022, when a powerful geomagnetic storm triggered by a solar flare struck 40 Starlink satellites, which fell back to Earth and burned up in the atmosphere.

Another danger to satellites is the Kessler syndrome, a potential situation where collisions between space junk and satellites create a cascading effect, which in turn destroys more satellites, eventually resulting in Earth's near orbit being crowded by a ring of junk that makes this range useless for satellites for generations. A rogue nation's attack on a few enemy communication or military satellites could potentially trigger such an event.



The global internet is not just physically vulnerable. Political actions can also cause it to fragment. Even today, many nations heavily regulate which sites and platforms their citizens can access, and some of the world's major geopolitical powers are taking steps towards establishing their own internet infrastructure isolated from the global web. China has long toyed with creating its own 'splinternet' based on a state-controlled version of blockchain that would allow Beijing to monitor all internet communication, past or present. Any country signing up to China's splinternet, which might be supplied free of charge, would expose its people to the same levels of control. If China establishes its splinternet, other major powers may do the same, either for purposes of surveillance, taxation or to keep their citizens safe from criminals, fake news, or unlawful content. This could spell the end to the global internet that we have come to love and hate.

If the need for data transmission keeps increasing, which it undoubtedly will with the coming of the much-hyped metaverse, new cables must be laid or more satellites launched. Telecommunication cables and satellites are generally not supplied or owned by governments or the international community, but by large telecoms as well as tech giants such as Starlink, Google, Amazon, and Microsoft. Should these, for any reason, decide to cut communication to a country or region, there's nothing to suggest they wouldn't be able to – it may even be legal. In fact, Elon Musk, who chose to provide free satellite internet to Ukraine to aid the country in its war against Russia, has threatened to discontinue this service unless the US government pays the estimated yearly USD 400 million it costs him to continue. The companies supplying the global internet could also be subject to hacker attacks for ransom, either by competitors or rogue nations, or even by well-organised groups of hackers.



Even if we somehow could make all cables and satellites impervious to harm, there are still limits to communication. In futurist or science fiction visions of the future internet – whether these are called Cyberspace, the Matrix, or the metaverse – we typically see people from all over the world coming together in virtual worlds indistinguishable from reality, to engage in adventures, social activities, education or romantic encounters. Physical distance ceases to matter. You could be interacting with your neighbour or with someone on the other side of the globe without being able to tell the difference. You can feel, touch and taste the virtual world, bathe in a virtual swimming pool or climb a virtual mountain, and

it will be indistinguishable from the real experience. Unfortunately, we are nowhere close to being able to achieve such levels of immersion. The metaverse, for all its virtuality, is subject to very real physical laws.

One such law is that no signal can move faster than the speed of light, roughly 300,000 km per second. The limits this puts on communication are already felt. Communication satellites are typically placed in geostationary orbit, 36,000 km above the equator, where they move in synchronisation with Earth's rotation. It takes roughly one-eighth of a second for a signal from the surface of the earth to reach a satellite, so bouncing a signal back to Earth (say, from Copenhagen to New York) and getting an answer back takes half a second, not counting the time it takes for the satellite to reroute the signal or the receiving computer to formulate an answer. It takes even longer – up to a second – if the signal is bounced from one satellite to another, which is required if the destination is shadowed by the earth's curvature from the first relay satellite. Because of this, two people talking on satellite phones can both experience that the other person is interrupting them – they both think they spoke first. This is also why foreign correspondents on TV news seem to hesitate before answering a question from the studio – they need to hear the question before they can answer, and their answer needs to be relayed back to the studio. This was the reason why Mick Jagger and David Bowie did a video of "Dancing in the Streets" for the Live Aid concert in 1985 rather than, as originally planned, sing a duet from both sides of the Atlantic.

Delays of a second may be annoying to human beings, but for two computers bouncing data back and forth, they are immense compared to the microseconds it takes to calculate or formulate a response. The faster computers become, the longer the relative delay is. For this reason, most computers don't communicate through satellites, but through undersea cables. These allow communication that is faster, but still far from instant. The average 'ping time' from New York, USA, to Johannesburg, South Africa, is 360 milliseconds or more than one-third of a second; a lag that can be felt even by human users. Lower latency could feasibly be achieved. Professor Mark Handley from University College London has calculated that Starlink satellites, orbiting at 550 km, could potentially provide a connection between London and Johannesburg with a latency of 75 milliseconds, compared to the average of 164 milliseconds through undersea cables running along Africa's West coast. If we include the added lag for last-mile transmission and the coding and decoding of signals, the optimum is probably closer to 100 milliseconds or one-tenth of a second, enough to make it impossible for singers to sing to the same beat. It may be physically impossible to improve much beyond that, and should we ever choose to expand humanity into space, we will meet even more significant barriers for communication in terms of distance and moving targets. ■

Nordic Metaverse Summit 2023

The Nordic Metaverse Summit is a new conference hosted by The Copenhagen Institute for Futures Studies and the Confederation of Danish Industry (DI) aiming to bring together Nordic stakeholders in exploring how the metaverse – and emerging technologies – may impact the future across industries. With the metaverse and web3 increasingly being hinted as the internet of tomorrow, the resulting question is how Nordic stakeholders can lean into this potential evolution. Our goal is to provide participants with the tools to act today, rather than find themselves existing in a world designed by and for someone else.

By engaging in inspiring talks and debates, participants will take a deep dive into the metaverse to grasp its impact on future consumers and business models. Questions such as, among other things, how brands and businesses can best approach the metaverse to how you can include the metaverse in your company's strategy will be raised. Participants will explore strategies, opportunities, and challenges across key sectors, enabling them to raise the critical question every leader must ask: what will my organisation's role be in this new continuum?

Join the first Nordic metaverse Summit for a forward-thinking discussion on the seismic shifts that the metaverse may bring.

When

D A T E : *27th of January, 2023*
T I M E : *9.00 - 16.00*

Where

Industriens Hus,
H.C. Andersens Blvd. 18
1553, Copenhagen V
Denmark

Read more about it here

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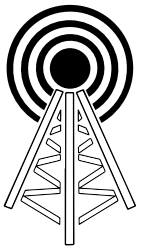

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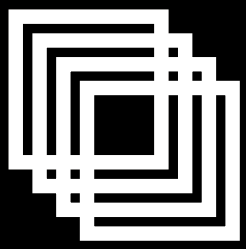

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