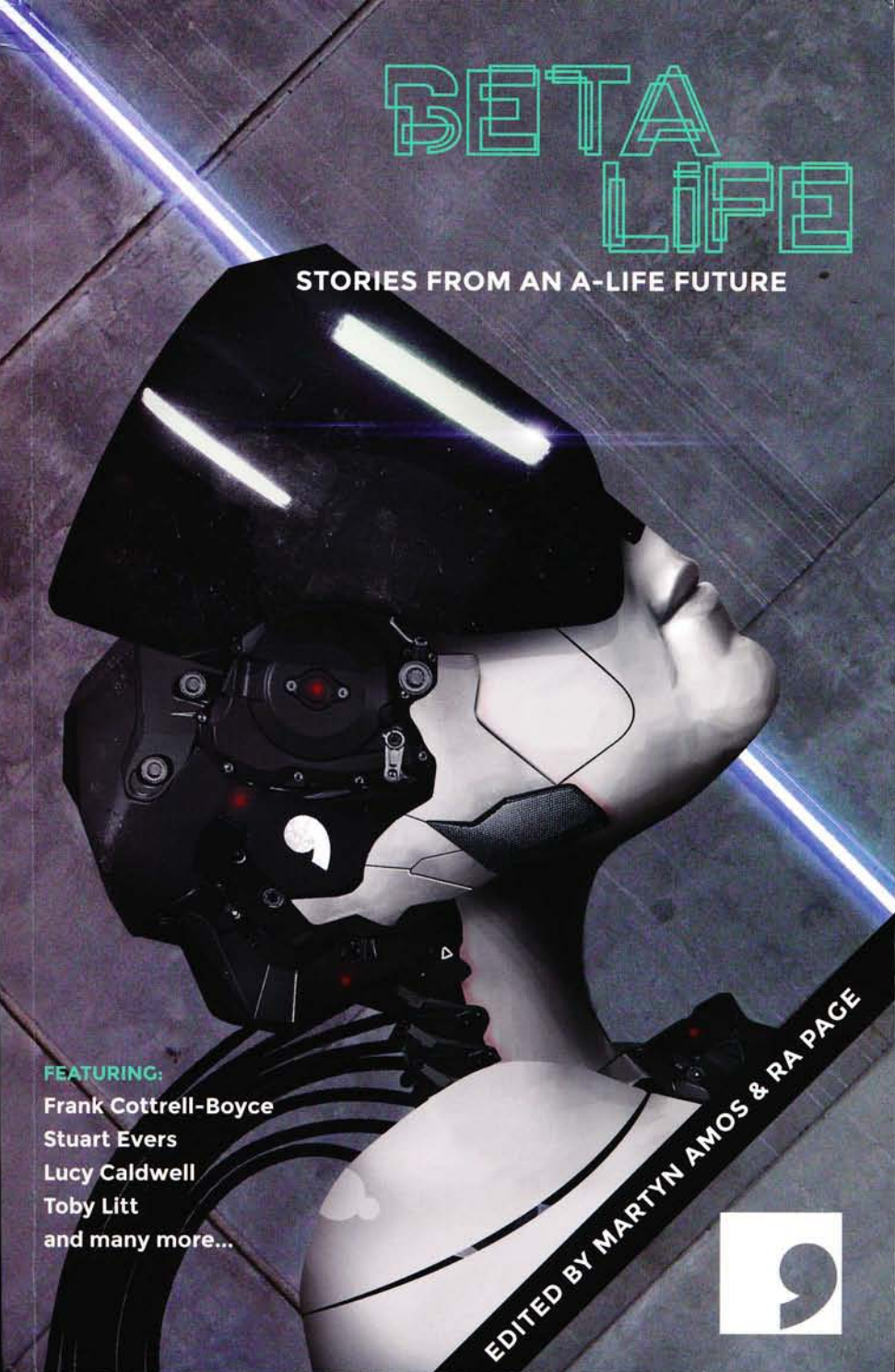
BETA LIFE
STORIES FROM AN A-LIFE FUTURE
FEATURING:
Frank Cottrell-Boyce
Stuart Evers
Lucy Caldwell
Toby Litt
and many more...
EDITED BY MARTYN AMOS & RA PAGE

Computers are changing.

Soon the silicon chip will seem like a clunky antique amid the bounty of more exotic processes on offer. Robots are changing too; material evolution and swarm intelligence are creating a new generation of devices that will diverge and disperse into a balanced ecosystem of humans and 'robjects' (robotic objects). Somewhere in between, we humans will have to change also... in the way we interact with technology, the roles we adopt in an increasingly 'intelligent' environment, and how we interface with each other.

The driving motors behind many of these changes will be artificial life (A-Life) and unconventional computing. How exactly they will impact on our world is still an open question. But in the spirit of collective intelligence, this anthology brings together 38 scientists and authors, working in pairs, to imagine what life (and A-Life) will look like in the year 2070. Every kind of technology is imagined: from lie-detection glasses to military swarmbots, brain-interfacing implants to synthetically 'grown' skyscrapers, revolution-inciting computer games to synthetically engineered haute cuisine.

All artificial life is here.

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BETA-LIFE

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A-Life Future

Edited by
Martyn Amos
& Ra Page

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Contents

Fully Human

K.J. Orr

[2070]
A grieving man.

The room. The two of them. The man across the table from him. The blind covering the window to protect them from the low rays of sun that would otherwise make a person squint, pupils responding to the light strike like an anemone to touch.

Jon's hands were chapped, side by side, before him on the table top. Fingers aligned. Thumbs torqued together in conversation, split nail facing split nail – a lack of something in his system, something necessary, a lack where supplementary help was needed.

Mostly he ate from the packs of rations. Out of date. Calorific. Designed for a man in a jungle or desert. Designed for a man in need of all the help he could get.

In the summer, he had managed to grow tomatoes on the patch of earth behind the huts, towards the woods. He fed them faeces – rich, composted, the system rigged from the drop pits. Those tomatoes were like fierce suns. They hung plump on their vines, suspended in scent.

Across from him, the semblance of a man: veins prominent on the surface of the skin, eyes locked on to his own in this room peeled back to functionality, to the process at hand. It was not natural, to look at a person that way, to sustain eye contact, to maintain it unblinking. You look away. It is only human.

That morning, at his window, he had watched a spider's

web heavy with moisture bothered by the breeze. Its fragile threads were trembling silver, it was mobile, but tethered; at the centre of the web was an empty stare. Outside there was mist. He had opened his windows, let the damp air slide into his room, watched it soak the interior, taking him then beyond the chipped window frame, the cracked glass, and out low over the wet grass, away from the cluster of huts, and on to the space at the edge of woods where, untethered in the whiteout, he had tried to locate himself in something certain – in the names of trees, in the plants pushing hardy up through the earth.

Beyond the huts that morning, there at the edge of the woods: the vast weathered arm of a fallen bough, reaching out as if to embrace – tender, supplicating, crooked at the elbow.

Such things he tried to remember.

They had given him a checklist to work with, to gauge whether a recovery considered SATISFACTORY had been made. They called this list FULLY HUMAN.

It had been a shock to be told these men were human: a succession of men that might as well be one man. They were nothing more than variations on a theme, any natural modulations of personality overwhelmed. In psychometric tests they had proved themselves less than human. The dominance of Cannabinoid-1 and Serotonin-2: these enhanced to such an extent that all emotion was effectively suppressed, any balance gone. He had wished they were synthetic, these men. He did not want to know what had been done here.

As a young man, in research with Marcus, he had seen broken men. But those were soldiers diminished by fear. At the camp, these men were diminished in a different way. Rational machines, they were shackled and chipped. They told him things he longed to forget.

Across the table, the man was eating an apple. He was attacking it systematically. Down to the slender core now, he pirouetted it precisely between fingers and thumb.

Eyes steady. Gaze strong.

A recovery stamped SATISFACTORY: FULLY HUMAN. Marcus would have appreciated the irony of them using his term. This list was nothing like the Enhanced Turing Test he had developed. What was wanted was SATISFACTORY. A recovery considered SATISFACTORY. It was laughable, awful – the paucity of what was being done.

Marcus had felt it. Fully Human: the end point of his research. The human mind a thing of such beauty, of such potential, that he had described the discovery as a kind of rage. He said he could only think: what have we been doing with our lives? He had needed to take himself away, needed time alone. A grieving man, he had at first held the knowledge like a sickness, heavy in his chest; it implied such a compromised history, such waste.

Jon imagined his reaction to this: the hut they had furnished him with: the table and two chairs, their stupid checklist tacked to the wall, and the profile – identical – for every man at the camp. And the logs they had handed to him: this proof of their attempt to reverse-modify serving as proof, too, of their levels of unease. The cack-handed pharmacology they had employed – they now understood – had been taking a bludgeon to the brain.

They had wanted front-liners, suppressors. A new breed of military selected for doctoring when they started out. Young farm hands and checkout boys from Oklahoma, Iowa, Nebraska. Not chosen for their smarts: boys lean and hewn. They had targeted their mental immunity, promoting in each the same personality: pathological, extreme. The boys were men now and presented a problem. Psychopaths, sociopaths, could not just be retired. In smaller numbers, no doubt, they simply would have disappeared. But this had been going on for years.

Marcus had been right, back then, to grieve.

[2045]
A catalogue of defects.

I know what the flaws of my body are, Leigh had said.

It had been late at night, and the table before them was crowded with empty walnut shells, with bottles holding candles and bottles holding wine. Jon remembered this: he had been seated across from Leigh. It was early days with them. He was self-conscious. Even sitting at a table he would shift in his seat, he would try not to stare, he wouldn't know what to do with his hands.

On top of this, that night, she had looked from Jon to Marcus, amusement in her eyes, as she presented a list, a catalogue of defects: her mismatched upper and lower halves; hips too wide; arse too large; her wonky teeth and too-small breasts; her stretch marks from growth spurts as a kid.

Jon had been lost for words.

I'm serious. I want to know. I know the flaws of my body. How would you improve my mind?

They would sit, the three of them, at Marcus's table. They would talk late into the night.

Jon had been a test student for Marcus. It was his freshman year. They had made a tour of the human brain: a whole new topology of mental organs in evidence.

One by one they had been identified. One by one they had been optimised, observed.

Who are you today? Leigh would ask, looking Jon over, circumspect, and then coming closer to take one of his hands in her own, and turning it over, smoothing her palm over his as if she were capable of scanning, through touch, the changes within him.

She had wanted to know what it was like, and, one day – they were alone in her room – he handed it to her: the menu of mental organs.

Like choosing a wine, she'd said. Or gourmet coffee.

He had smiled. It was letting her in on a secret. A new terminology.

Kappa. She'd read out the names of the mental organs. Beta. Mu.

I like the descriptions, she said. I like this: perception through the five senses. The essence of things. I love this: the world constructed from feelings.

Affective consciousness, Jon said. Marcus says it's there, in all of us. But we tend to lose it more and more as we get older. The cognitive seems to want to supersede emotion.

Leigh pursed her lips. Her legs were crossed, one foot beating a rhythm, up, down, as if the decision were not something out of the ordinary at all, as if they were out for lunch. She looked up at him then, and smiled. Alpha. I would choose Alpha.

[2045]
Test case.

Marcus has said we should make it official, Jon had said. You're a test case. I'll watch.

Leigh had nodded. How does it work?

One capsule. One intramuscular injection. The depth of the injection is important. Don't worry. I've practiced on a range of citrus fruit.

She sat on the edge of her bed, waiting. She had a glass of water ready; the capsule was in her open palm. She watched him with wary eyes as he prepared the vial. Which arm?

The walls of her room were alive with illustrations. She was a fan of Audubon.

What are you seeing? he had asked.

She described an owl, its wise stare rippling concentric with growth rings; baroque planispheres of seashells bristling; sea urchins gazing back at them like hallucinogenic, many-eyed gods. She described colour streaming down the walls, explosions behind the lids.

Afterwards she asked what it was like to optimise all the mental organs – not just one, but all of them – Dopamine,

Histamine, Imidazoline, Alpha-2 – the whole lot of them all at once.

To know the world in that way, to feel fully human, Marcus called living the full bouquet. Each mental organ like a flower – unique – and representing, all together, new ways of knowing: the full balance of human potential.

But few metaphors really made the grade. The mental organs were not physically cohesive like the heart or the lungs. They were networks of neurons – some neurons belonging to more than one organ: to both heart and lungs.

Jon still thought in terms of lights in a room, the room equipped with endless variations – table lamps, fairy lights, dimmer switch, all used in any combination. And yes, they could be turned on, all of them, all at once. But he hadn't experienced that.

To live the full bouquet? he had said. Only Marcus knows.

[2050]

The dream of the sentient machine.

The human mind was less compelling than the dream of the sentient machine.

While Marcus struggled for funding, the obsession with the empathetic robot persisted. Money was channelled into synthetic intelligence, while – unsanctioned – Marcus worked underground with his test students, his psychonauts. And this even after the death of Ansel Alice, which was the sort of thing when you remembered exactly where you were, and who you were with.

When Leigh had asked what it would look like – a man downloading his mind – Marcus had said, quite simply, suicide. A man, Marcus said, can no more put himself into a machine than a machine can put itself into a man. As usual, he was right.

They had been friends – Marcus and Ansel – had been students together; they had regarded one another with

affection and derision. At the world fair in 2040, Ansel – his tone one of elation, anticipation – had announced that he believed, above all, in the preservation of knowledge. Jon, still a teenager then, remembered the two men appearing on a panel streamed live from the fair. They were to him the Old and New Testament side-by-side. Both had been depicted in sci-fi novels he had read as a child: Marcus an angular rake or great bear of a man depending on which book you read, Ansel memorable as a slick-haired nemesis. It had been strange to see them in the flesh. There was Ansel, at fifty, wired and restless and chewing his nails like a child, while Marcus, sleep-deprived, jacket creased and hair unkempt, wore an unusually patterned shirt.

By 2050, Ansel was ill, refused treatment. He decided instead that it was a sign, that it was time: this moment was the one he had waited for all his life. He was memorable again – again broadcast live. But the role this time was that of a sick man. He was sleepy, confused, in a web of wires.

The three of them – Jon, Leigh, Marcus – had sat at the table in Marcus' place, arms propped on elbows, hands cradling faces, faces turned to the screen in the corner of the room. They had watched, appalled, as the needle went in. Ansel had curled up tight, and still. They had watched the man put himself to death.

To the disappointment of the masses, there was no life in the machine.

It should have caused a sea change, but didn't: Marcus was underfunded, and his work remained underground.

[2050]
Given the choice.

You know the research will get out, Marcus had told Jon. Somehow.

Not me, Jon said.

A leak – somehow. There are no secrets in this age. Everything gets out.

They were sitting at an outdoor café in cool winter air. A heater glowed above them on its long stem. Though Jon didn't know it yet, it was one of the last times they would meet.

I ran a survey among my first years, Marcus told him. What they would do, given the choice. Given the choice, my students tell me, for their designer minds they would opt for logic, speed, efficiency. They would want better memory.

They both had coffee. Marcus was eating a large almond cake with a coffee spoon. What about you? He looked at Jon, before turning back to his plate.

Jon didn't answer. Anyway, Marcus didn't wait. I ran it again, he said. My second and third years. The same survey. Not one, he said, throwing down his spoon, not a single one chose empathy, compassion, wisdom, creativity, joy, humour. Now how about that?

Everything gets out, he said again. You'd have to be an idiot not to think of that. He had drummed his fingers on the table. He had shifted, irritably, in his seat. He had looked past Jon, out on to the street. And it won't be monitored, he had said. And people won't know what they are choosing. And we have no control over what people choose.

Not long after this, Marcus was gone.

[2065]

Leave no trace.

They had contacted Jon at the university. He was living by then with Leigh. Their flat was old and full of draughts: Leigh had taken to wearing a woollen hat in bed. She was curating at the botanic garden, obsessed, at the time, with a new strain of orchid they had acquired. Against his better judgement, Jon had accepted work in synthetics.

The first week, they had flown him from the city to the camp, the outskirts giving way to smaller settlements, and

then to wooded hills, to the forest, to this area of wilderness. No trails, the pilot said. Leave no trace.

The hut, then: eight-by-ten. The table and two chairs, fixed. This is how it was.

He hadn't known if it would take days, or weeks, or months. He hadn't known if it was even possible.

They had flown him back to Leigh, the end of that first week. The memory of the men hard to shake off.

Smile, she had said. Smile. Smile.

Each week, he worked: that brief window of time at the weekend, at home, with her.

At first, they even laughed about it. The dirty government secret: the living cliché. Like something you would watch played out on screen – rueful, embarrassed, knowing that your time could be better spent.

But then the return, and such clear evidence of the abuse of Marcus's work, and the Enhanced Turing test diminished, and in this search for SATISFACTORY, the questions, over and over, seeming like a line cast into a void. Day after day in the man across from him – in all of the men – cold and empty eyes. He showed them footage of homecomings, of acts of love and sacrifice; he showed them pictures of unspeakable things.

It would have been kinder, using robots. They hadn't wanted them, evidently needing some semblance of conscious life: synthetic minds were still never more than piecemeal replications. But robots at least were built in a gesture of hope.

These men were degenerates. They felt no fear and no remorse, and were not bothered by memories of what they had done. They had been taken from themselves; there were no lights on in the room.

The thought Jon tried to dismiss: that with their mental immunity primed for so long, their affective systems might now be vestigial.

Marcus had treated post-traumatic stress using MEM, MDMA, mescaline, oral DMT – and there had been good

progress. To be nostalgic for those men – haunted and hypersensitive – was perverse. But drugs had no impact on the men at the camp. Love, compassion, empathy: gone.

He heard the men tell him what these things were. Some could imitate them. Some put on quite a show.

He had a dream, early on: a time bomb, a madman holding a device. Everyone at the camp rounded up and all rigged somehow with incendiary implants in their bodies. Jon's own, in this dream, lodged high behind his cheek bone – the throbbing awareness of it. For another, it was in the urethra, forced up his penis, and in the elbow of another – the man's arm held stiff with fear. They were, all of them, stiff with fear.

Boom. The madman said.

When, in reality, one of the men tried to escape, he got to the outskirts of a small town, and then found himself surrounded. No incendiaries; but the tracking chips they used on the men served their purpose.

I wanted to buy cigarettes, the man had said.

Maybe he'd been telling the truth, Jon had thought; an old impulse taking over, something else embedded deep. The need to act out a gesture that had been made a thousand times, long ago. The need to stand, facing another person across a counter, gauging the tenor of their day from the tone of their voice, the words they used, the way they took the crumpled bills from your hand – the way, even fleetingly, they looked at you.

He had let himself believe it. It helped him to be willing to be there each day, to see it through; though he could hear the men outside his hut, could hear their movements between the trees.

And then the first civilian.

There was no warning. They touched down in the clearing.

Everything gets out, Marcus had said. There are no secrets now in this age.

Home pharmacology cobbled together. One mental organ chosen above all others, and a child with perfect math scores had been eviscerating cats. A child.

The boy sat humming to himself across the table from Jon, swinging his legs, breathing audibly through his nose.

In this boy, in his eyes: withering, desiccation. To have a child look at you like that.

[2067]

They too are human.

Leigh said it changed him: his plot of deranged huts out in the woods. His highs not her highs, nor his lows. He spoke of duty, said something grandiose about the importance of the work. When she asked how he could care for them he said to her, they too are human. No, she said. No they are not.

There were things that bothered him.

At the edge of the woods the roots of a tree like chubby grasping fingers.

The sound of water dripping from the leaves.

Acorns dropping seemed to him hard-hitting, incendiary.

Bloodied feathered detritus found at the edge of the woods.

He would wake, the black hairs on his thighs prickling, nipples darts of dark fear on his chest.

He couldn't sleep.

So then – for a time – the self-medication: he, too, could be optimised.

His mental immunity bolstered, he kept himself level. I'm no different, he said. Just less sensitive. I'm the same person – but functional, effective. No, Leigh said, not the same. It's no different than the flu jab, he said. Bolstered mental immunity – meaning the work can be done. And there is need for the work to be done. Don't do this, Leigh said. You'll be no better than them. But I work with them, he said. I have to be able to look them in the eye.

Another irony for Marcus.

Weekdays, weekends, it all became the same. Sometimes he had a vision of himself as a man talking to no-one. He was himself an absence: nothing more than an empty chair. This was a job for a machine-like man – someone less than human.

He let the dose drop off then, for Leigh. Weekdays he'd medicate – he'd shut himself down – but then he came back for her.

Those weekends felt like violence after weeks spent at the camp: a physical assault – like coming up for air, kicking against grief. He would land in their bed, sheets wet, shivering. Her voice would be a line thrown. A tug at his navel. A pulse then: the palpitation of some small heart. He would locate himself, one hand clasping each of her knees; smooth skin and warm. Her crooked smile up above. Her eyes bright, and one tender hand extending down the length of her.

[2068]

Something dug up from the start of the century.

She sent him something dug up from the start of the century: a clip of a woman – a performance artist – sitting across from a man. They were at a table much like his: it was small, square, two chairs. He had thought, at first, there might be some humour in it, but he sat watching and waiting for something that didn't come. There was no laughter involved.

Lost for words, it was Leigh's way of saying goodbye: this appropriation of someone else's story.

They had looked at each other for a long while, the woman and the man. There were shifts of expression on each face. But all that happened in the end was this: the woman leant across the table, took the man's hands in her own, and wept. The man left.

Jon did not like their story abandoned in this way to vicarious emotion; but it stayed with him. Though he woke each day remembering the weeks of silence, in sleep he was

forever across from Leigh, forever reaching out and taking her hands.

Sometimes he was woken by the twist of desire in his groin, her presence vivid in sleep, only to be met by her absence: the memory of their bed, white sheets in the morning, sunlight slanting through blinds.

He wrote to her. We exist through others. I exist through you.

[2070]
The room. The two of them.

He had a cold. In his hand a tissue was balled and losing itself already to the table, fragments which might embarrass in another place, another time, but not here. Across the table from him, not Leigh, but yet another semblance of a child. He blamed Leigh, still, for the impulse to reach across and take the child's hand in his own.

He was off the medication, and he cared too much: too sensitive. He knew there were risks. But at the edge of the woods that morning: a bank of moss iridescent in the light, and birdsong, and pooled water reflecting a clear sky.

Looking at the child he imagined Leigh leaning towards him across the table-top, chin tilted for emphasis each time she said the word. The way she said it, she made it like a dare: Smile, she said. Smile. Smile. She watched him then, waiting, lips parted to show just the tips of her lovely, uneven, lower set of teeth.

Still he found himself through her. He turned her over, talismanic, in his mind. He remembered how, early on, she had appeared at his door one night, presented herself. How they had stood in the corridor just inside. How they were barely touching. How for a while they were simply breathing.

At the weekend, he had gathered apples that lay scattered on the ground at the edge of the camp, tree-fall punching russet into the grey damp. Beachcomber, he had carried

them. He had lined them up, awash with colour, on the window ledge of his hut.

Woodsmoke.

Sunlight.

The disc of the moon in a clear sky.

He remembered her reading that day, in her room. I like this, she had said: the world constructed from feelings. Sigma, she had read: the core of the affective system. Imidazoline: open-hearted tenderness. Histamine: the heart and soul of loved ones held alive within us.

The birds at dusk.

The lazy legged insects circling.

And one afternoon, at the edge of the woods, a small sign of hope: a mosaic of autumn leaves arranged – with great care – into the shape of a fish.

Afterword:

A Branching Future of Synthetic Minds

Prof Thomas S. Ray
University of Oklahoma

THE SCIENCE OF the human mind may be the ultimate Pandora's box: once we open it, we'll never be able to put its secrets back. In this afterword, rather than map out where current technological research has come from, I'd like to try something different, and write the same fiction elaborated by Orr from a different perspective, presenting the scientific overview of Orr's fictional future. Indeed, in my conversations with Orr, I proposed not one, but two possible futures, after the box is opened.

Which of these two futures is more likely depends on the resolution of a fundamental issue in computation and A-Life that remains outstanding: can conventional computation based on a logical medium built on a physics of logic gates support feeling, subjective experience, or consciousness? Much turns on the resolution of this issue. The current expansive belief that our computers are capable of 'universal computation' greatly exceeds Turing's original claim that a universal Turing machine can emulate any other Turing machine. Some believe that we will be able to download our minds to computers (Kurzweil, 2000; Kurzweil, 2006; Ray, 2002), or that our universe itself could be a computation inside a computer (Wright, 1988). This illustrates the reach of some people's belief in universal computation: that conventional computation can emulate anything and everything, including feeling, subjective experience, and consciousness. However, current practice does not suggest such capability, and it may simply be beyond the nature of

conventional computation emerging from a logical medium.

I propose a formal challenge: to definitively prove and demonstrate whether or not a logical medium can give rise to feeling, subjective experience, and consciousness. I propose both a theoretical proof (on the order of Gödel's incompleteness theorems) and a practical demonstration of either the capability or the incapability. The solution of this problem implies as well a solution of the 'hard problem' (Chalmers, 1995) of the science of consciousness: how does subjective experience, consciousness, emerge from a physical medium? In my imagined futures, this issue will be resolved, one way or the other, by 2040, opening the way to one of two alternate futures of unconventional computational and A-Life technology. In the world rendered by Orr, the answer is no, as depicted by the passing of the character Ansel Alice based on Ray Kurzweil.

As Orr and I worked together, we both elaborated the scenario. Orr describes the scenario from the point of view of people who live it. In what follows, I describe the scientific overview of the two branches of the imagined future scenarios, from the fictional perspective of having knowledge of the futures up through the year 2070:

Logical medium fail branch

In the 2010s, the holy grail of the human mind will be found: the mechanism by which evolution sculpted the mind; 'mental organs' – populations of neurons that share a common neurotransmitter receptor on their surface (Ray 2012). 'Mental organs' will be found to evolve by duplication and divergence, and there are potentially as many distinct kinds of 'mental organ' as there are distinct kinds of receptor in the brain (hundreds). This discovery will reveal that the modern adult human mind that we know to be based on language, logic, and reason, is merely a small add-on to a large, complex, and evolutionarily deep archaic mind based entirely on feeling. This form of feeling, like flavour, is a profoundly rich

and valid way of knowing the world that is currently absent from conventional computation.

In this version of the future, the 'Mental Organs' hypothesis emerges out of a synthesis of two bodies of data: (i) government-funded academic research in molecular psychopharmacology; molecular assays of affinity across the full human receptorome of many qualitatively diverse psychoactive drugs, and (ii) entirely subjective drug reports arising from a wide range of sources, from academic clinical studies to psychonauts experimenting with illegal drugs and posting their experiences online. This new view of the mind, emerging from a strange blend of knowledge, needs to go through the machinery of science, be picked apart, challenged, tested, and either disproved or elevated to the level of theory.

As Dobzhansky (1973) said, 'nothing in biology makes sense except in the light of evolution.' The mind is a product of biology and thus the mind cannot make sense except in the light of evolution. The Mental Organs hypothesis provides a mechanism by which evolution sculpts the mind. Seen through the conceptual framework of mental organs, the mind finally makes sense, everything falls into place and a new language of mental description emerges.

In this version of the future, the method by which the Mental Organs hypothesis is confirmed is through double-blind, placebo-controlled clinical studies in which human subjects are given drugs that selectively 'activate' each of a dozen different mental organs. A specific psychometric test is designed to detect each of the individual mental organs. Once the hypothesis of mental organs is confirmed, it will be realised that the psychometric tests developed to test the mental organs hypothesis can now be used to detect whether or not mental organs enter consciousness in subjects who are not using drugs. When this is done, a prediction of the mental organs hypothesis will be confirmed: while the affective mental organs can be readily detected populating consciousness in children, this is not so much the case in adults, with men

having it worse than women. These tests will continue to be widely used, leading to the emergence over a period of five decades, of a startling discovery: the age at which the 'full bouquet' of affective mental organs wilts in children becomes younger and younger as the decades pass.

In anticipation of the emergence of sentient machines, and as the 'humanity of humans' begins to slip away, the psychometric tests will then be adapted into an 'Enhanced Turing Test', which will measure the degree of humanity of a human or machine, based on the manifestation of mental organs (although adaptations of the test will be necessary to accommodate the anticipated synthetic mental organs). This will allow us to track not only the recession of the 'full bouquet' in humans, but the expected flowering of synthetic minds.

By 2040 it is proven, demonstrated, and conceded that a logical medium *cannot* give rise to feeling, subjective experience, or consciousness. At about the same time, we will witness the sad passing away of Ansel Alice. At the end of his life, and having painstakingly prepared the machine into which he would download his mind, Alice finally makes the download, just as his life slips away, only to *not* realise that the machine does not have subjective experience, feelings, or consciousness (he could not 'realise' anything unless the machine *did* have subjective experience).

By 2045 it will have become clear that the most effective pathway for the engineering of computing capable of consciousness is through the manipulation of biological systems. Due to advances in understanding of the processes by which mental organs develop and interact throughout the lifespan, as well as the emergence of dynamic targeted gene regulation technology, by 2070 designer human minds will be commonplace.

In the age of designer minds, the technology inevitably slips out, and people individually start modifying themselves, although it is legally prohibited. Most choose to shape their minds to take them deeper into abstract thought and

reasoning, greater endurance of long hard work, better memorisation and multitasking, and to be quicker and busier. Only a few choose to shape their minds to be more joyful, humorous, compassionate, kind, relaxed, and wise. It becomes a commentary on how far we, as a culture, have drifted from our own humanity, that when given the technology, most people choose modification toward logic and away from feeling. After many people have made the change, some begin to realize what has been lost, and seek repair. Given that these personal modifications are prohibited, the needed repair service will also be clandestine. We lose our humanity through individual choice, not through government coercion.

Scientists conducting the Enhanced Turing Test need to live the 'full human bouquet' in order to recognise full humanity in their subjects, and at the same time (at least up until 2040) have an intimate relation with computing technologies in order to be able to grok machine sentience. As our humanity progressively slips away over the decades, full bouquet adult humans can only be found among those who have illegally designed their minds in the direction of maintaining the full bouquet.

CONSCIOUSNESS FROM LOGIC BRANCH:

In this branch, by the year 2040 it will have been proven, demonstrated, and conceded that a logical medium *can* give rise to feeling, subjective experience, and consciousness. Some of the earliest successes of AL consisted of transferring the most fundamental biological process, evolution by natural selection, from the organic to the digital medium. What begins in 2040 is the transfer of another biological process, which we will call 'mental organs' for lack of a better term, from the biological to the digital medium. In the 2010s it is still not clear what fundamental process formed the abstractable basis of the power of mental organs to sculpt the mind. An early initiative explores the transfer of 'neuromodulation' from the organic to the digital (Lo, 2012). It remains for us to

imagine how this transfer takes place. Yet it yields fundamental new depths to computation, allowing digital forms of feeling, subjective experience, and consciousness. Digital minds, while sharing broad properties with organic minds, will also differ in fundamental ways. These new sentient machines will share the ethical rights of the living and conscious, and lead to complex entanglements and conflicts between the organic and digital domains.

> I don't want to be human. I want to see gamma rays, I want to hear X-rays, and I, I want to, I want to smell dark matter. I want to reach out with something other than these prehensile paws, and feel the solar wind of a supernova flowing over me. I'm a machine, and I could know much more.
>
> – Cavil, *Battlestar Galactica:* 'The Plan'.

There is nothing in this 'Consciousness from Logic' branch to preclude the emergence of the 'designer human minds' envisioned in the alternate 'Logical Medium Fail' branch, but in this branch designer minds will be able to take both organic and digital forms, as well as hybrid forms.

Reading

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