

Glass Shards of Printed Crystal Tears

“How nice it would be if we could only get through into Looking-glass House! I’m sure it’s got, oh! such beautiful things in it! Let’s pretend there’s a way of getting through into it, somehow, Kitty. Let’s pretend the glass has got all soft like gauze, so that we can get through.”

–Alice from *Through the Looking Glass and What Alice Found There* by Lewis Carroll.

Had Nara not glanced at the filters shining light upon the glass store, she would have never grappled with overextending her sense of selfhood for a chance at longevity. At the celebratory run for her hundred and twenty first birthday, she would recall the glass’s blue-light filter diverting the smart phone’s artificial lights, while the lenses of the outdoor glasses turned grey under the illuminating sunlight. Even though the memory occurred almost a hundred years prior, Nara still envisioned the rays infiltrating her iris.

There is little chance of glass material becoming obsolete because of how widespread, affordable, and accessible the technology has become. Glasses reflect the ideologies of sight and foresight; they pose great implications for our future.

Nara visited the Vision Spring glass store due to well-placed targeted advertisement. Nara had worn the same battered pair of glasses since she learnt to read in the first grade. With her mom working as a nurse and having lost her dad during the COVID-19 pandemic, Nara intended to find a job that could increase her family’s income, while using fame and visibility to increase her imagined lifespan. The ad read:

Did you know that glass technology has managed to decrease socio-economical inequalities by improving 32% of productivity and 20% of income? Glasses have become so widespread, affordable, and accessible,

that the military no longer considers eyewear users disabled. Uncorrected refractive error has cost the global economy \$272. Imagine how much you could accomplish with a new pair of glasses! Come to Vision Spring TODAY (Vision Spring, n.d.).

When Nara thought of glasses, she imagined glint shiny watches, light bulbs glinting in the gold synchronicity of fairy lights, and the rushes of dopamine adjacent to a smartphone's screen. Her old, battered pair of glasses did not come to mind. With the light rushing between the screens, the blue-light and sun glass filters, and the midday afternoon twilight, Nara decided to buy a pair, all the while thinking back to the advertisement and how her own income would also increase by 20%.

In Nara's mind, she could draw immortality with a new pair of glasses. Maybe not the more ecological or glamorous option for eternal livelihood, yet she pictured herself as a supernatural entity. The ten million tons of glass disposed every year took millions of years to decompose. Less than half of disposed glass got recycled. Glass appeared invincible; even able to beat death. Not even her dad had beat death.

3D printing organ technology might make surgeries and transplants more affordable, while providing employees with body-enhancing pills that diagnose and prevent sicknesses from entering their bodies, improving the overall access to healthcare of the global population.

Year 2027

Longevity. Digital transplants. Wireless Communication.

After graduating from nursing school, Nara got a job at a clinic for visually impaired patients. Nara learnt that her patients and their families reflected a larger society increasingly concerned with the importance of health. With glass eyewear as the beginning, Nara pictured the

interaction between bodies and the healthcare she provided becoming as customizable as the interaction with a smartphone. With extending lifespans as her goal, research had become her passion.

“Remember that Spider Man Scene? Tom Holland’s second installment: *Far from Home*,” Morpheus said.

Nara nodded.

“So, Nick Fury hijacks Tom Holland’s Peter Parker’s vacation. There, Peter gets access to Tony Stark’s old glasses, which are powered by artificial intelligence, allowing Peter to access information in real time. We call it glass technology, sweetheart, but it’s all optical fibers.”

Nara did not remember Morpheus’s real name. She called him Morpheus, yet his friends called him E.D.I.T.H, based on the acronym of Tony Stark’s old artificial intelligence glasses. His fanbase knew Morpheus as his YouTube handle, J Laser.

“Babe, I know what you are going to say. With you, it’s always about data transmission,” said Nara.

“And you don’t have your own obsessions, Nara? With you, it’s all about plastic organs. At least my fixations originate from life rather than death.”

Nara pursed her lips and scrunched her eyelids with the teary remnants of paternal love and long-repressed painful memories. Morpheus muttered a quick apology and hurried to hold her hand.

Morpheus and Nara had connected when she finished nursing school thanks to a mutual interest in optical fibers. Optical fibres used laser-powered electrical energy to turn laser signals into photons — electromagnetic light; energy-carrying particles. The photons travelled as light through thin fibers until they reached their destination, where optical receivers decoded the

information on the digital light signals, converting them to electricity, and displaying them on digital screen (Corning, n.d.). At least, that is what Morpheus had explained to Nara when she still knew him as J Laser, back when she meant the same to him, as any other commenter on his YouTube channel.

“Maybe, with a 3D printed cornea, your brother could see again, Morpheus.”

“We do not yet know the mirror molecules behind the wonders of the looking glass, Nara. For all we know the light will travel through the broken glass, making as one with the world wide web, until the moon shines upon us in the reflection of a 3D printed, data transmitted Frankenstein.”

“Glass is often the preferred material for creating complicated microscopic objects, including lenses in compact, high-quality cameras used in smartphones and endoscopes, as well as microfluidic devices used to analyze or process minute amounts of liquid” (University of California Berkley, 2022).

Even when Morpheus made Nara fearless and powerful, having introduced her to the wonders of glass in healthcare, he beware of introducing the technologies in his own body and making himself as one with the machine. Nara possessed no such remorse. She argued that 3D printed artificial glasses had worked on dogs. If God had not scowled upon such a naïve animal, why would he scowl upon those who could use the miracle to enact improved change?

“Change for whom?” Morpheus would argue. “Those in the right side of the digital divide? What about those without access to the internet, will they also not get access to fancy wireless WIFI pills?”

Nara tutted. She had ordered another overpriced latte with the iPad provided by the cafeteria. For all his moral posturing about moral technology consumption and personhood without printed optical fibres, her boyfriend sure loved eating at trendy coffee shops that served only technological, lab-grown, bite-sized plates. Unlike Morpheus, Nara posed no objections to her body turning into the playground of an electronic interface; manifesting into frames of electrical senses vibrating into currents of digital data. Nara thought that availability surely preceded affordability, if not quality of service.

“I think you are missing the big picture, Morpheus.” Nara took a sip of her latte. “Through data transmission, optical fibres could wirelessly connect 3D printed organs to the web. The printing of real-size anatomical organs using a patient’s cell will revolutionize medicine and the shortage issue with finding appropriate organs for transplants.”

“Perhaps.” Morpheus’s eyes crinkled in a smile. “Yet will I dare take the chance of risking my brother’s health for an underdeveloped technology? After watching the Matrix, should I use glass corneas to plug my brother into a machine and make them as one?”

While Morpheus made his brother rely on eyewear, his dramatism opposed the internet of bodies. Nara had found his J Laser YouTube channel in the early days of her research into foreverness. At the time, Morpheus’ brother grappled with a new blindness sprung from a car accident, in which glass gleamed over the windowpane, through the sunlight and into Cecil’s eye.

And so had begun his fixation upon optical fibers and replicating Spiderman’s E.D.I.T.H glasses. Hours spent interacting with his followers on the comment section had led to choosing Nara as his assistant, for a project in which A.I. glasses would leave Marvel’s cinematic universe and jump into his Cecil’s frames. Edith, as his friends dabbled him, combined a screen that

emitted light using organic molecules with an ARDUINO hardware that captured webcam photographs scanned text. While Nara danced in a poor imitation of Spiderman around the living room and Morpheus watched repeat reruns of *Spiderman: Far from Home*, their constructed Wolfram Alpha coding system scanned processed the information and searched the internet to return the most relevant results (Cook, 2019).

Since the optical fibers found in glass enable data transmission, and glass is an optimal material for 3D printing artificial organs, then 3D printed organs could transmit wireless information to the internet about the body, to show information and take preventive action. This way, medicine will overlap with technology. Ghislaine Boddington names this interaction, the internet of bodies: alive, connected, and collective, referring to the interaction of a virtual and physical future, involving our bodies and our senses.

“Maybe you should read Ghislaine. Then you would realize that your iPhone already monitors all your data. Your body *is* an interface.” Morpheus sighed.

“When will we figuratively see eye to eye, sweetheart?” Morpheus stood out and pulled Nara’s chair. “I think our luncheon pushes its conclusion. Is my brother stopping by your practice today?”

Morpheus put on his company issued ENVISION alternate reality glasses, while Nara put on her own brand-new golden pair, which reflected the sunlight in an array of rainbow shades.

“Yes, babe. Do you want me to take him your new prototype? To assure him that you are making strides after joining the new start up, high tech glass company?” Nara’s eyes gleamed.

Nara thought ironic how Morpheus worked with the material that maimed Cecil, perhaps hoping to peek inside the looking glass and bend the material like a will less gauze. Still, Morpheus feared a house built from glass. Glass could kill. Glass could heal.

The company ENVISION uses this real-to-virtual-world interaction to change the world short sighted people interact with visual information. ENVISION glasses scan texts and recognize faces, allowing short sighted people to engage with visual information and receive immediate audible feedback, as an accessibility carriage system enabled by transmedia storytelling (Myers, 2022).

Year 2032

In her girlhood, Nara had chased Pokémon and feared Facebook's metaverse. She wanted to live in perpetual company of the organic world, not a screened virtual reality of illustrated vectors and videographed landscapes. Still, despite her husband's will, she had volunteered herself and Cecil for an experiment to, in Morpheus's words colonize the body; in her own words, to make it invincible."

Despite her role as Cecil's primary nurse practitioner, the hospital's surgeons had never allowed Nara to watch a procedure. The consequential explanations felt muddled in misunderstandings, with the doctors muttering over a spilling cup of coffee, while playing with their keys to drive home after the twenty-five-hour shift. Whilst the surgeons attempted their most to relay the procedure's findings, exhaustion preceded clarity, details passed by their conscience, and the development in Cecil's condition felt usure.

Morpheus did not object to the first part of the experiment. He could not, as he had invented the machinery himself. After leaving ENVISION with the ambition to cure blindness,

he created Mojo Lens, a company that used contact lenses with microLED displays lights the size of a grain of sand to share critical information, while smart, battery-powered sensors, built into a scleral contact lens corrected vision (Mojo Vision Inc, 2022).

Nara now used Mojos Lens's technology rather a new fancy glittery pair of glasses. She loved layering digital images and infographics onto real-life events; controlling the digital alternate-reality display with a flick of their eye. She felt power in layering reality and using glass to enhance her own body. Unlike traditional artificial reality lenses, her contacts did not use cameras to sense eye movement but sat on her eye adjusting to its movements (Stein, 2022). Still, the technology did not suffice for Cecil.

The internet of bodies explores how technologies such as 3D printing will surround our bodies in data ecosystems. The internet of bodies will blend our physical and virtual worlds in three key areas: our identities will become hyper-enhanced and multisensory, our spaces will prompt a convergence of the body and technologies of the body for convergent cocreation, and our bodies will become a data interface (Boddington, 2021).

By implanting a glass medical implant on Cecil's eyes, Nara hoped her brother-in-law would recover his sight. The surgeons ensured the bioglass capsule cornea would update Cecil's real-time vital information, personalizing his iris to transmit data and fits his needs. Cecil would become the first patient to undergo such a procedure. Cecil accepted, Morpheus opposed him, and Nara assured that she would look after her family. No one *else* would breathe a last laugh on her watch. So, the three reached a compromise –Nara and Cecil joined Morpheus's experiment.

And so, Nara and Cecil joined a group of eleven patient-caretaker duos trialing Morpheus's new mixed reality glasses, a tele-consent system that allowed the caretakers to absorb the surgery's information as if they stood in the room (Yun et al., 2022). Cecil would not only recover his sight but make his eyesight invincible.

A smart eye built from gesture technology. Blood pulsing in the heart, synchronizing breathing, and informing a glass optical fibered eye. Artificial reality lenses that react to information outside and inside your eye. Within her elation for Cecil, Nara felt jealous she could not try the technology herself and link her own vision with the web.

Gesture technology enables the interaction between medicine and technology, through “multi-modal data feeds from our personal biosignals” (Boddington, 2021). Through motion caption, gesture technology responds to data gathered through muscle movements, the sound of blood flow, the breath, and the heartbeat. Moreover, “the internet of bodies has been extended through the use of gesture tech, using multiple biometric data feeds from the body, non-verbal signifiers and communicators which display, through a variety of actions, our feelings, our emotions and our intent.”

Year 2042

“You ready, my love?”

“Just a minute, Morpheus.”

The future of medical implants includes the developments of new scaffold materials in the form of tissue engineering. According to National Institute of Biomedical Imaging and Bioengineering, “tissue engineering evolved from the field of biomaterials development and refers to the practice of combining scaffolds, cells, and biologically active molecules into

functional tissues.” By improving damaged tissues and organs, tissue engineering shows developments in the field of regenerative medicine.

The biomaterial from the glasses sat atop Nara’s nose entered her body, bonding with her bones and healing her tissues. The medicine recovered her organs. Her bones regenerated. As the flexible biomaterial finished weaving continuous molecular threads into Nara’s chronic wounds, the scaffold dissolved. The ions from the bioactive glass no longer found any degrading fibres left to mend, and Nara’s body metabolized the Cancer-remedying carrier drugs (Thamma, Kowal, Falk & Jain, 2021).

“Oh, how I love my salving tonic. Shall we go in, babe?”

Giorgia Lupi had painted her art exhibit in electromagnetic wires and black and white images. 3D bio-printed glasses modeled alongside medical implants. Each of the gallery’s artwork explored the interaction between the internet of bodies with tissue engineering. Nara felt awed at how parts of the artificially tissue that enhanced her own body came alive in the gallery’s technicolor models.

On the pancreas section, fibroblasts rushed to regenerate cells, curing diabetic wounds by killing bacteria and stopping the spread of infections, while an artificial intelligent algorithm automated insulin dosing inside an artificial pancreas. A neon animation of ingestible digital pills exploded in thousand of infused regenerating cells, that would reduce reliance on expensive medical transplants. On the opposite wall, next to where Cecil stood chatting with the artist herself, a sculpture of a hardware brain representative of a computer interface connected to a pair of glasses that fed off brain activity and eye movement to track attention.

Bioactive glasses enable biochemical stimulation for cell behaviour. The artificial scaffold enters the body via glasses built through 3D bioprinting, which impact cell response to

enable cell regeneration through fibroblasts –a cellular material that secretes collagen proteins that help maintain the structural framework of tissues (Lin, Mao, Zhang, Li & Chen, 2012).

Cecil's own smart eye surveyed the room as he talked with Giorgia. The glass implant landed on Morpheus and Nara. With a smile and two head nods, Cecil directed them to join in. As they approached their hosts, Nara overheard their discussion over regenerative medicine, Giorgia's field of study, which used cells and external scaffolds to rebuild tissues and organs. Giorgia herself had provided Nara with the glass that evaporated her tumor. Tonight, they would celebrate the win of life.

"It's been done, Cecil. Kralik and his colleagues used bipolar cell targeted optogenetic gene therapy in their chemical trials and managed to restore the vision of blind mice (Kralik et al., 2022)," said Giorgia.

"Don't forget the work of retinal signaling, light responses, and whatever God you choose to believe in," Cecil replied. "If you keep going, my glass retina will get jealous of the mice's high-level vision."

Nara then imagined her future bathed in crystal forevermore. She could picture her three-dimensional printed heartbeats and sending information to her smartphone through optical fibres, earning feedback from vital information, and employing the wireless information for her physicians to update real-life updates.

Nara reached on her tippy toes, let her tips linger near Morpheus's ear, and whispered: "See, Morpheus? I told you it was possible. To beat what took my dad away; to live forever."

"You are a nurse, sweetheart. Your mom is a nurse. Isn't curing enough?"

Morpheus sighed, yet Nara dreamt of a far-off future, of a birthday run that would materialize in the next century. Nara dreamt of motion capture technology capturing her sweat

and gauging how her nerves reacted to external stimuli. Her glass tendons shook as she hit the ground. When the motion capture technology noticed a rupture on the tissues in your ankle, the regenerative scaffold regenerated her tissue. Health is no longer concerned with reactive treatments but with preventive cures. Returning from her stupor, Nara head Cecil and Georgia discuss healthcare's new concern with preventive cures rather than reactive treatments.

“Nara, do you really want us to immerse ourselves in glass, and extend the lifespan of our organs forever? To live in a future when people change implants as often as we do our attire?” Morpheus caressed her cheek. “If we live hereafter, we will not grow old together.”

Nara recalled her mom's crystal tears as her dad heaved a last sigh with his organic lungs.

“Perhaps not, but you will forever be the love of my life.”