WILL THE METAVERSE CHANGE HEALTHCARE?

Text by Dr Kenneth Lyen

When Mark Zuckerberg rebranded Facebook as Meta, declaring that entering the metaverse would be a gamechanger for his company and the world, I was sceptical. I thought he was merely trying to generate more revenue for Facebook. But as I researched the metaverse, I realised that he may be right, and it may have the potential to affect our lives, disrupt the economy, encourage social interactions, expand education, and yes, maybe even change healthcare.

The COVID-19 pandemic has accelerated our adopting of the metaverse because fears of spreading the virus deterred face-to-face contact.[1] Telemedicine shot up in popularity, and medical consultations and diagnoses were made at a distance. Medical and nursing students were taught online, and even certain specialists, like radiologists, could read X-rays and scans from the comfort of their homes. No doubt the metaverse is already transforming medicine, but exactly how is it happening?

What is the metaverse?

The first problem is defining the metaverse. The term was first coined by Neal Stephenson in his science fiction novel *Snow Crash* published in 1992. He envisioned an imaginary computer-generated universe merged with our mundane physical world which he named "the metaverse".

To date, the definition remains inconsistent.[2] A simplified view describes it as a digital universe. The Oxford Dictionary defines the metaverse as "a virtual-reality space in which users can interact with a computer-generated environment and with other users". These vague definitions mean that anything to do with computers, the Internet and digital devices can be part of the metaverse. These all-embracing definitions are widely adopted, but it means that anything goes, virtually.

Evolution of the metaverse

One might try to understand the metaverse by tracing its development. The problem is that we are still at an early stage of its evolution. We think we know what components are essential, but we are unable to predict how they will evolve, and who knows what new ingredients will be added in the future?

Several simultaneous advances in computer hardware and software have converged to create the metaverse.[3] Computing speed has accelerated over the past decades, making it possible to create animated imaginary backgrounds; we can also produce avatars with facial expressions and the ability to fly around and communicate with real people. Computers are now able to think, understand and interpret information to such a high level that their artificial intelligence is challenging our human intelligence.

A new software development is blockchain technology. Originating from the field of cryptocurrency, a blockchain stores information electronically in digital format. Each block of information is captured in groups and they cannot be changed. The blocks are linked together by "chains". One advantage of this technology is that it guarantees the fidelity and security of the record. Another advantage is that the information is decentralised and can be held by each individual.

There are other hardware inventions that are indispensable to the metaverse. For example, the development of virtual-reality headsets, goggles and gloves enables the wearer to see, hear and touch the computer-generated imaginary environment. These headsets create three major components of the metaverse: virtual reality, augmented reality and extended reality. Examples of each are given below.

Virtual reality

Virtual reality is a computer-generated, totally immersive artificial world with no sense of the real world (ie, engagement with the real world is absent). It is currently used for teaching anatomy, where a healthcare student puts on a headset and can enter a three-dimensional atlas of anatomy and physiology. This is particularly timely because access to cadavers for dissection has become increasingly scarce. By wearing a virtual reality headset, you can see and explore the digital body from the skin, the muscles, the blood vessels and nerves, all the way down to the organs and skeleton.[4]

Surgical students can also use virtual reality to inspect diseased parts of the body, like viewing a twisted fractured tibia, and learn how to diagnose and treat the condition.[5] That said, the technology may require some getting used to. One medical student told me, "Initially I was very excited to examine the body virtually, and I could see how muscles contract. But after a while I

started getting dizzy and I found the anatomical details a bit bewildering, and I grew frustrated."

There are other uses for virtual reality technology as well. Patients with dementia, including Alzheimer's disease, feel more relaxed and can recall childhood memories when wearing virtual reality headsets depicting their childhood environment. Placing a patient with post-traumatic stress disorder in a virtual but safe environment that simulates the original horrendous and dangerous environment has shown benefits to these patients.

Augmented reality

Augmented reality combines both the real world and the digital world. The net result is that it enhances one's experience in the real world by supplementing it with virtual details. A breast-feeding counsellor can train a novice breast-feeding mother wearing a headset on how to breast-feed a newborn baby, for example.[6] The training of a phlebotomist to take blood is helped by wearing special glasses that enhances their ability to see the blood vessels more clearly, enabling them to insert the needle more accurately.

Surgery can also be enhanced by overlaying radiological scans with a patient's real anatomy. One surgeon told me, "When I was removing deeply embedded cancer metastases, the ability to superimpose a CT scan helped me to precisely locate the cancer lesions. This means that surgery can be more accurate and beneficial."

However, a serious limitation of the current augmented reality is the absence of tactile or haptic sensations. "When you feel a patient's enlarged liver, you need to assess its shape and determine whether it is hard or soft, and if it is nodular or smooth," one clinician told me. The metaverse has not reached this stage of craftmanship yet.

Extended reality

Extended reality enables one to have multi-sensory interaction with both physical and computer-generated environments at the same time. This was initially applied to virtual computer games and is now being extended to those working from home but who still need to interact with other staff members or use the office machines.

Extended reality is used in medical education as well. While virtual reality only allows the student to see the simulated body, extended reality allows you to touch and move the virtual body, and you can also combine extended reality with a physical dummy. For example, healthcare workers can practise cardio-pulmonary resuscitation on a plastic dummy, but by wearing a headset and gloves, there is an overlay of digital information onto the physical world, and thus the body looks far more realistic. Surgeons can practise operating on a virtual body and will therefore be better prepared when confronted with a real patient. Additionally, it has been proposed that since medical education need not be confined to one country, one might allow healthcare workers from, say, a developing country to learn from teachers in other parts of the world, including Singapore medical schools.[7]

Other components of the metaverse

Blockchain technology could be used in the healthcare industry as well. Its function would be to decentralise patients' records and allow each patient to keep and store their own personal information.[8] They can therefore decide which reports they want stored, and to whom they will allow the data to be viewed. It overcomes the present problem where each hospital or medical centre stores patient information that is not easily accessible by another doctor at another place.

There are several other technological advances appearing on the horizon, such as robotic surgery. Robotic surgery can enable a surgeon to operate on a patient who may be in a different hospital.[9] Indeed, two or more surgeons from different parts of the world can collaborate in this type of distance surgery.

Another advancement is the proliferation of wearables like the Fitbit, Huawei and Apple watches. These devices can monitor the number of steps one has walked, their heart rate, blood pressure, temperature, skin glucose and even perform eye tracking.[10] This information can promote better health monitoring. Pharmaceutical drug trials can also benefit from monitoring more physical parameters that would alert one to potential side effects earlier.

Issues facing the metaverse

The metaverse is still in its infancy, so we are not absolutely certain what all the good and bad points associated with it are. Here are some early warning signs given by people who have already benefitted or been harmed by the metaverse.

Phishing scams

There have already been reports that cybercriminals have targeted the metaverse and robbed many investors of their money.[11]

Privacy issues

Although we are told that our data and privacy in the metaverse are protected, we cannot be too naive and believe what technologists tell us at face value. The main problem is that a handful of giant companies like Meta (Facebook), Microsoft and Apple currently dominate the metaverse, and this gives them the ability to control and manipulate what data can be entered and regulate how they are retrieved.[12] High-tech criminals will sooner or later find a way to steal stored data.

Art

When playing games such as Minecraft and Roblox, the synthetic landscape and the characters look like bulky cubes which the older generation think are unattractive. But if you look back at early 20th century Cubism paintings by Picasso or splash art by Jackson Pollock, they were also criticised for their lack of art. And when people pay large sums to buy non-fungible token art, quite a number of people also question, are they really buying art?

Infringing copyrights and patents

It is predicted that computer-generated (non-human) "new" works of art or "new" inventions will be increasingly uncovered as a mere copy of something already created in the past.[13] How can

copyrights and patents be protected in the future? Can computers be sued for infringement?

Mental health

Is the metaverse good or bad for mental health? To be able to use telemedicine to talk to a psychologist or doctor may be beneficial. Programmes that promote a good diet and daily exercises can also improve emotional well-being. However, there are computer games that some researchers claim to improve one's intelligence and emotions, while others have found adverse effects such as addiction to the games.[14]

Internet harassment and cyberbullying

For many decades, the Internet has been a milieu where harassment and cyberbullying has infiltrated. It is therefore not surprising that the metaverse has enabled this behaviour to continue, if not increase.[15]

The future

How will the metaverse affect the future of healthcare and medical education? Here are some speculations:[16]

Virtual hospitals

Currently, the A&E departments in many hospitals are overcrowded and many patients visit them for relatively minor symptoms. In the future, initial evaluation could be done online so that the triage personnel (who may be a robot) can direct the patient to the optimal department for treatment. Another change would be to allow earlier discharges after initial treatment in hospital. Better monitoring equipment at home, and telemedicine conducted by nurses, physiotherapists and other healthcare professionals could result in quicker recovery in the home environment.

Virtual reality, augmented reality surgery

Helping surgeons by superimposing scanned images onto the patient's operation sites can improve the accuracy of identifying and correcting or removing the pathology. For example, if one can recognise cancer tissues more readily, the surgeon will be better able

to remove them. Surgeons can practise on a digital twin of the patient before operating on the real patient, and this too should result in better outcomes.

Medical and nursing education

Using the full range of visual, auditory and haptic technology, plus enhancing their interactions with teachers and student peers, can make the teaching environment more stimulating. The three-dimensional virtual environment also means that students from different hospitals and different countries can benefit from the exchange. For example, one might learn about rare diseases from another healthcare facility. Currently, medical students are studying human anatomy using virtual technology. In the future, this could expand to the study of physiology, pathology and even biochemistry.

Mental health

We have already mentioned the benefits of virtual reality in treating post-traumatic stress disorder and helping dementia patients regain some of their memory. There are now also a number of new virtual reality video games to treat mental-health-related conditions such as attention deficit hyperactivity disorder, depression and dyslexia.

Final word

To answer the question, will the metaverse change healthcare? The answer is a definite "yes". How long will it take, and to what extent? Well, be (a) patient, and you will see! ◆

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