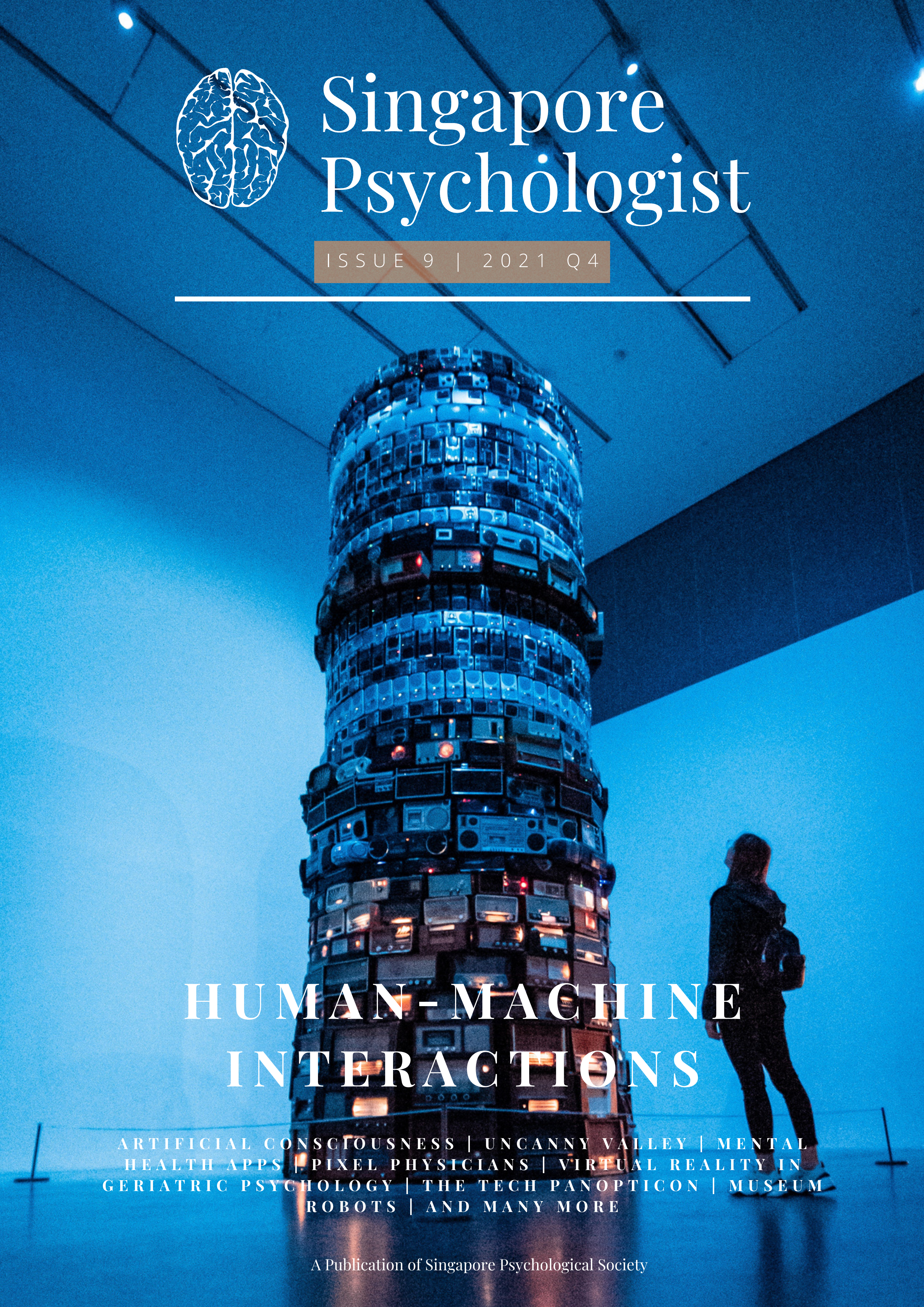
Singapore Psychologist

ISSUE 9 | 2021 Q4



HUMAN-MACHINE INTERACTIONS

ARTIFICIAL CONSCIOUSNESS | UNCANNY VALLEY | MENTAL HEALTH APPS | PIXEL PHYSICIANS | VIRTUAL REALITY IN GERIATRIC PSYCHOLOGY | THE TECH PANOPTICON | MUSEUM ROBOTS | AND MANY MORE

A Publication of Singapore Psychological Society

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HUMAN-MACHINE INTERACTIONS

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Singapore Psychological Society
(Established 1979)

EDITOR'S NOTE

In our final issue for the year we round out our series of transactional perspectives with a focus on human-machine interactions. In the field of psychology, the cognitive revolution shifted the focus onto mental processes, which were also of interest in the fields of neuroscience and computer science. The ease with which we now search for targeted or random information online stems from psychological research on mental processes such as learning, perception, memory and, of course, cognition—or thought. Since the revolutionary beginnings in the 1950s, intersections in research from a number of disciplines has condensed into the field of cognitive science, and new advances now bring together cognitive science, artificial intelligence, and robotics. In this issue our writers probe the intersections between the humanness of machines and the machinelike aspects of humans, emotional responses to human-like appearances, applications of machine learning in everyday life, and the narratives we gain by expanding our social worlds to include nonhuman entities such as robots. When I first explored the scope of this topic myself I very quickly noticed the rapid advances that have been made in robotics and how successful roboticists have been in enhancing the emotional appeal of these bundles of steel, iron and aluminium. While I'm fully aware that a robot consists of a motor, a sensor system, a power supply and a computational system, it seems I can't help but feel myself in some way emotionally attached, whether they represent human or animal forms. A recent video clip from Boston Dynamics of two bipedal robots (of a model called Atlas) performing parkour—navigating an obstacle course and doing back-flips—inspired empathy from many including myself when we viewed the bloopers version; alas poor Atlas! This was the "me" version of the robot, stumbling into obstacles and falling short on jumps, yet getting up and trying again and again. Nothing to be afraid of there, surely? And yet at least part of our human fascination with machines stems from a fear of being superseded by them. Several of our writers explore the pros and cons of everyday human interactions with machines.

Dr Denise Dillon
Editor-in-Chief

Vice President's Address

Machine *learning*, artificial *intelligence* (AI), natural *language* processing (NLP)—these concepts once touted as science fiction are now actual algorithms and statistical analyses that assist in key decision making (or are themselves the decision-makers). It is often difficult to grasp that something so uniquely human—i.e., learning, intelligence, and language—can now almost be replicated in mere metal and electricity, and at times even superior in terms of speed and accuracy.

Yet it is also in our nature to consistently create and improve. We create machines to do what we ourselves are unable to and we better our lives through countless improvements to the prototype. What happens then if we invent something that continuously does the inventing, that exercises creativity on our behalf? If the machine is learning, will it still be considered a machine? Similarly, if we are superseded by machines, have we lost our unique humanity?

In this final, third chapter in our series of transactional perspectives (see our previous issues on human-environment interactions and human-animal interactions), we explore the uneasy interactions between humans and machines in the realm of psychology. For a discipline so focused on our humanness, it is indeed counterintuitive for us to seek wisdom in these new scientific frontiers. Yet the wealth of knowledge gained from deep learning and using big data is immeasurable in social sciences research. After all, one could argue that machines are mere extensions of our collective potential, tools for us by us.

Now, the next pertinent issue of human-machine interactions in the field of psychology would naturally relate to practice. Could machines further aid us in psychological diagnosis and intervention? And should they become quicker, more accurate, and more cost-effective than a qualified psychologist with years of training, would you seek psychological help from a robot psychologist? Perhaps it might ironically only be through machine learning that we can predict a future like this.

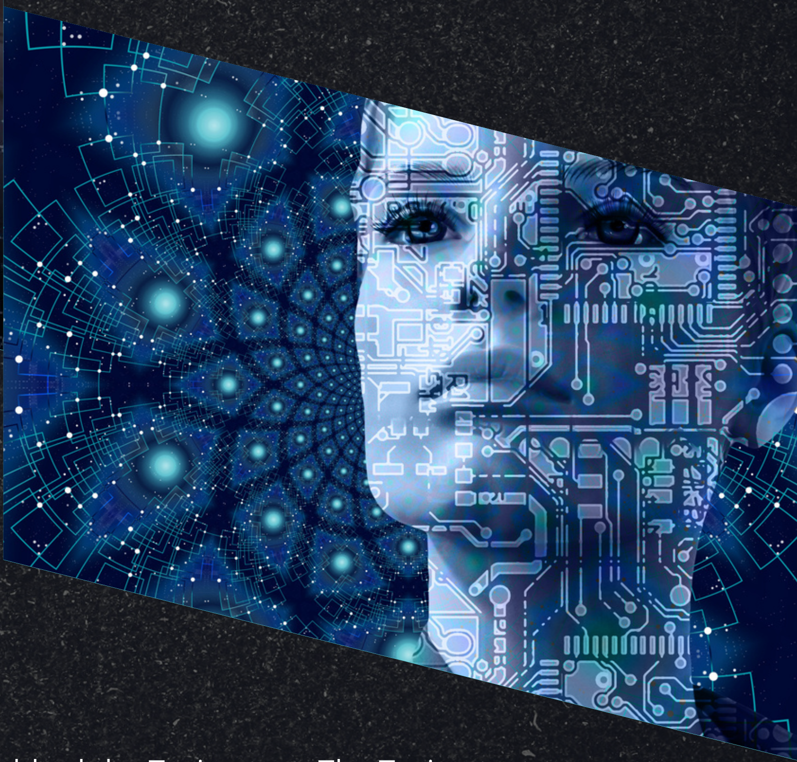
Read on and get psyched!

Mok Kai Chuen
Vice President (Outreach)

Artificial Consciousness: Can Machines Ever Become Conscious?

by Xavier Lim

Contemporary entertainment industries have populated the theatrical and gaming landscapes with fictional tales exploring futuristic accounts of humans living in tandem with self-aware robots and sentient machines. It is likely that you would have encountered the intricacies of machines evolving to become conscious beings at one point. The idea that artificially intelligent machines can evolve to overtake humans, also dubbed the technological singularity (Shanahan, 2015), has also recently gained traction in the psychology community. In this article, we examine the feasibility of such claims—can machines ever become conscious, and how do we truly determine if a machine is intelligent?

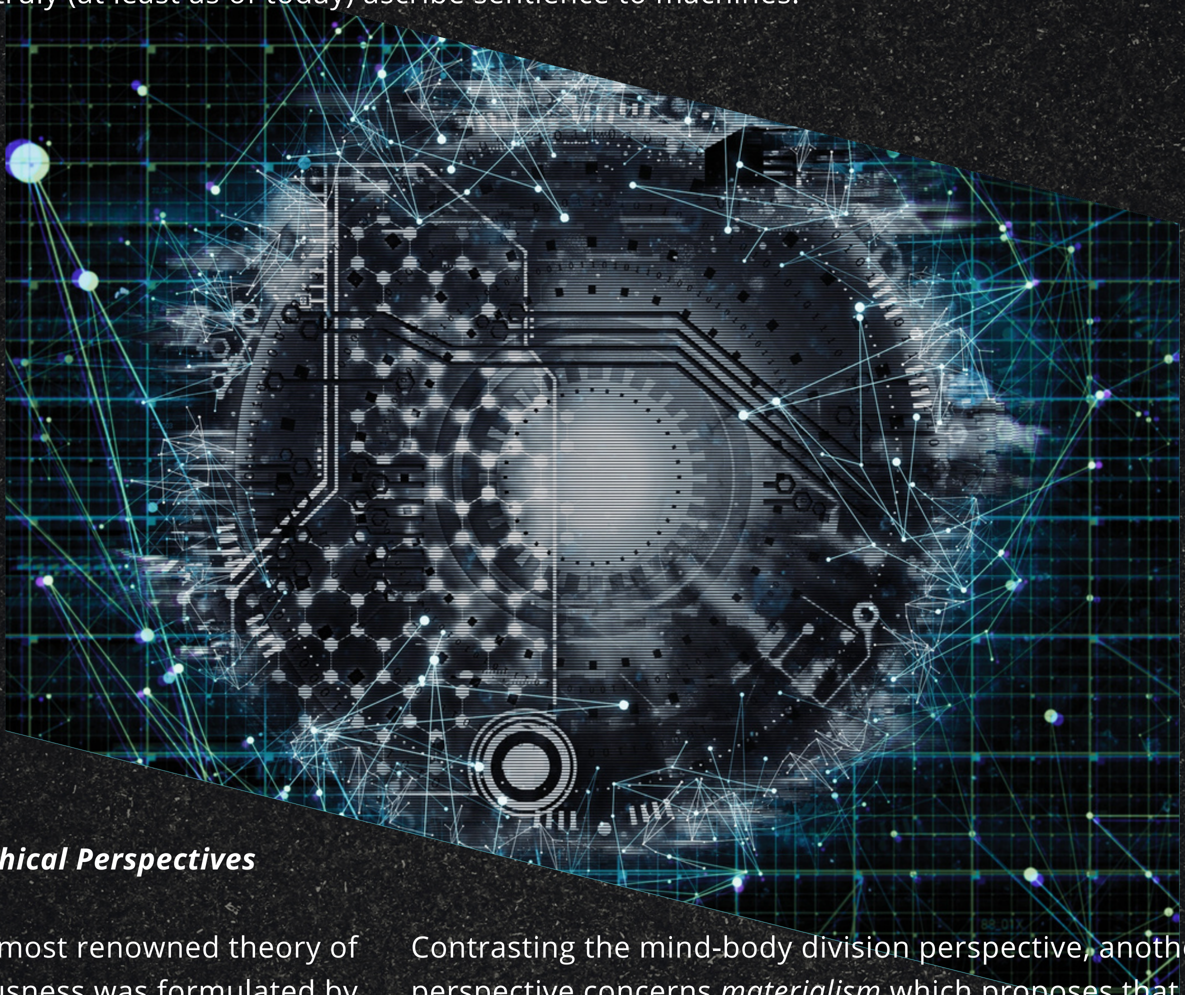


Experimental Attempts to Delineate Intelligence in Machines

We begin our discussion on historical attempts to determine if certain machines or programs can possess human-like intelligence, to which machine enthusiasts would recognise the pioneer of such efforts—Alan Turing. Turing proposed an experiment to assess machines' ability to imitate human behaviour, dubbed the Turing test. The Turing test (Turing, 1950) requires a human to judge a text-only conversation between a human and a machine; if the human cannot reliably differentiate the machine from the human, the machine passes the test and is said to be intelligent. To date, several chatbots have already passed the test (Vardi, 2014), but cannot be ascribed sentience as the experiment does not capture internal, subjective experiences—what we know as consciousness.

Understanding Consciousness

To better understand what we know about consciousness, we shall explore the field of artificial consciousness (or machine consciousness), which is a field that combines insights from computer science, psychology, and philosophy, to understand the foundations of consciousness. Even though researchers have not arrived at a consensus on the constituents of consciousness (Reggia, 2013), the different perspectives proposed to date could be useful in understanding the inductions derived from Turing's experiments—specifically, why we can never truly (at least as of today) ascribe sentience to machines.



Philosophical Perspectives

The most renowned theory of consciousness was formulated by René Descartes—*Cartesian dualism*. Dualism theory holds that the mind is composed of a unique substance that differentiates itself from the body. Consciousness, according to dualism, exists in a non-physical space (Jackendoff, 1987). Even though dualism is a widely-held philosophy (Searle, 2004), the theory is often rejected by scientists due to the absence of experimentally testable features—we simply cannot deduce the existence of a non-physical world.

Contrasting the mind-body division perspective, another perspective concerns *materialism* which proposes that mental states (and hence, consciousness) are essentially integrated aspects of the physical environment. A prominent theory under this perspective is *functionalism*, which proposes that mental states are best understood by their functional features and not the physical substrates that produce them (Block, 1980). Cognition, according to functionalism, is thus simply a function of the brain. This implies that machines can be engineered to become conscious once their functional behaviours replicate those performed by the human brain (Piccinini, 2009). Drawing an analogy between human and machine, the machine's hardware is synonymous to the human brain, and the software executed by the machine is a function of its artificially constructed "cognitive system" (i.e., central processing unit)—that is, by this definition, it is theoretically possible for machines to be conscious.

The Easy and Hard Problems of Consciousness

To further illuminate the human-centric nature of consciousness and explain the rationale underlying Turing's experimental inductions, it is important to move beyond philosophical schools of thought to understand how contemporary scientists attempt to define the constituents of consciousness. The distinction between the easy and hard problem of consciousness is hence cardinal for this discussion.

Earlier, we discussed the functionalist's view of consciousness from an information processing standpoint. This is referred to as the *easy problem* of consciousness—describing consciousness from a cognitive perspective (i.e., sensation, perception, attention). Scientists refer to this as the easy problem in the literature not because it is easy to understand these experiences, but rather that it will be possible to observe these functions in machines as engineering limitations are lifted and can be measured by contemporary standards of experimental methods (Chalmers, 1996). In consciousness literature, an important distinction must be made between the easy and *hard problem* of consciousness, where the latter refers to the *qualia* (i.e., subjective experiences) associated with consciousness (Chalmers, 2007).

Examples of qualia comprise nonveridical perceptual experiences (e.g., visual, or auditory hallucinations), bodily sensations (e.g., taste, smell), and moods (e.g., euphoria, dysphoria). The easy problem hence emphasises properties of consciousness that can be expressed in the physical world behaviourally, while the hard problem concerns unique phenomenal experiences that can only be captured introspectively (Nagel, 1974).

So, Can Machines Ever Become Conscious?

As with the propositions discussed, even if we happen to engineer an artificially intelligent system that can execute computations and functions that resemble the functional characteristics of consciousness, we still cannot conclude that the system is conscious beyond any reasonable doubt without fully comprehending the hard problem of consciousness. Following insights from Turing's experimentations (Saygin et al., 2000), researchers (Krauss & Maier, 2020) proposed various prerequisites to determine machine consciousness:

1. The ability for the machine to demonstrate functional similarities with human biological conscious processes (Easy problem of consciousness)
2. The ability to convince humans that it is intelligent (Turing test)
3. And most importantly, self-awareness—the ability for the machine to convince itself that it is intelligent (Hard problem of consciousness)

Moreover, until the scientific community reaches a consensus on how to operationally define consciousness (if even possible), we may never reach an answer as to whether machines can be ascribed sentience.

Conclusion

In this article, we reviewed various perspectives of consciousness and approaches undertaken by psychologists to understand and experiment on the nature of machine intelligence. Regardless of the perspectives assumed, it is neither too early to conclude that machines can become sentient nor to disregard the prospect of sentient machines. Nevertheless, a prominent advantage of advancing contemporary knowledge in the multi-disciplinary literature on artificial consciousness is the comprehensive understanding it fosters on the fundamental nature of human consciousness.

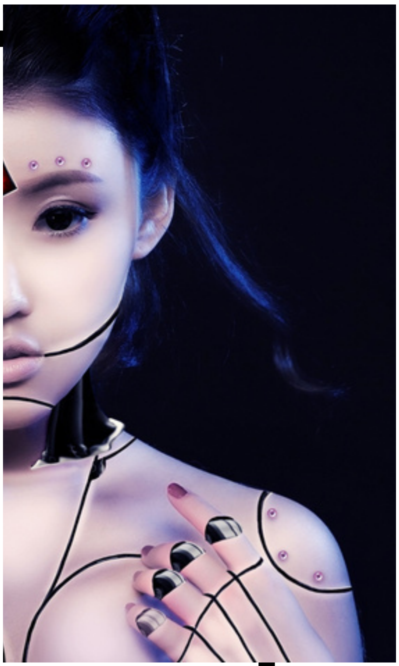
Will A Machine Ever Replicate The Human Brain? A Psychological Perspective

by Claire Hsieh

"What if a cyber brain could possibly generate its own ghost, create a soul all by itself? And if it did, just what would be the importance of being human then?" These are the famous lines uttered by Major Motoko Kusanagi, a cyborg in the 1995 anime classic, *Ghost in the Shell*. A legend in the world of science fiction and cyberpunk, the film delves into the blurring of lines between human and machine, and questions what encompasses one's humanity. Most significantly, it poses the ever-growing concern of scientists, psychologists and technologists alike in this age of artificial intelligence: Will a machine ever replicate the human brain?

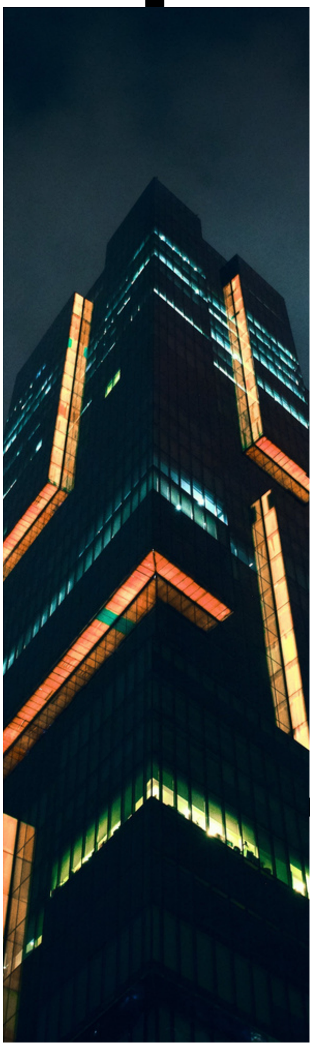
From a psychologist's point of view, what makes a human a human? According to American psychologist Michael Tomasello in a Duke University article, humans "have a special kind of smarts" where they have the capability to take on the perspectives of others through communication and learning (Jones, 2019). This is known as Theory of Mind, which refers to the ability to impute mental states to oneself and others, and is used to make inferences on others' behaviours (Premack & Woodruff, 1978). Because this has long been considered a uniquely human ability, in order to equip machines with theory of mind capabilities it is necessary for computer scientists to enlist the help of psychiatrists and psychologists (Cuzzolin et al., 2020). However, current technology in artificial intelligence, which makes use of computers and machines to replicate functions of the human mind via problem-solving and decision-making (Education, 2021), is unable to replicate it. For example, Alan Winfield, Professor of Robot Ethics at the University of West England in Bristol, was only able to develop robotic simulations of theory of mind in controlled laboratory environments (Blum et al., 2018). Since artificial intelligence currently utilises pre-programmed internal models for a simulation-based approach to replicate human theory of mind, it goes to show existing technology is insufficient to model the full complexity of the human brain.

Another school of thought poses a contrasting belief in terms of the human mind and its mechanisms through the intersection of artificial intelligence and cognitive psychology. When it comes to existing tangible outcomes, a foundation of psychological mechanisms such as neural networks and computationally-complex operations is required for artificial intelligence systems to be employed in workplaces. At a deeper level, intelligence itself can be defined as information and computation without the consideration of its physical medium (Korteling et al., 2021). Based on this assumption, it is possible to draw references to "mind uploading", the school of thought that argues the human brain can be reduced to binary code and thus uploaded into a machine (A Lexicon for Artificial Intelligence, 2019). A seemingly frightening theory, it can be understood as a brain’s contents being scanned and transferred to a computer; essentially an individual's consciousness has a chance at digital afterlife. Chilling, is it not? This echoes the state of human-machine interdependence and interactions in Ghost in the Shell, where the ability to transfer data from a human brain to a computer system has resulted in the creation of "souls" in "shells", or a whole consciousness in a humanoid body.

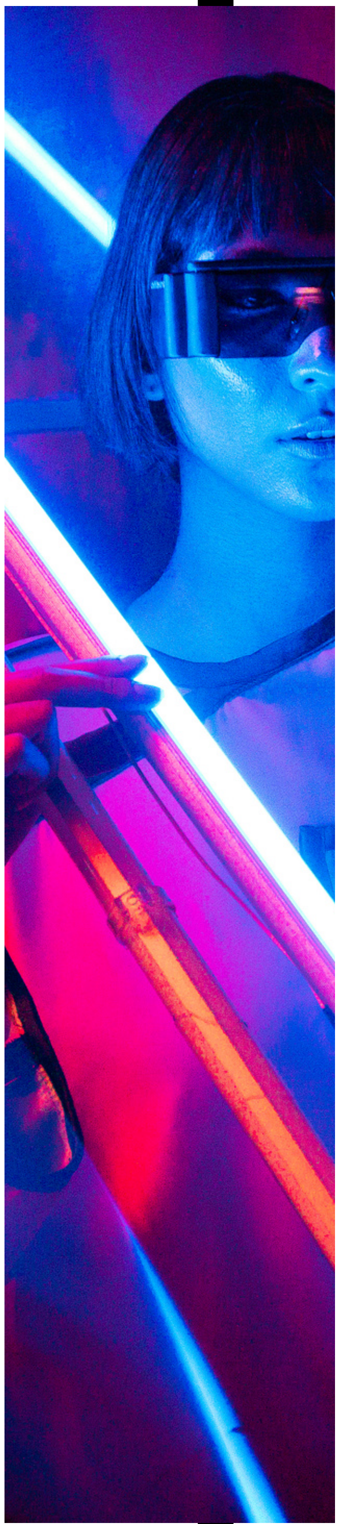


A similar attempt has already been made by entrepreneur Martine Rothblatt who created Bina48, an AI robot uploaded with their wife Bina's thoughts and consciousness (RT, 2015). As one dwells on this thought, allow me to quote Michael Graziano, Professor of Psychology and Neuroscience at Princeton University, in a Wall Street Journal article, "As a neuroscientist, I'm convinced that mind uploading will happen someday" (Graziano, 2019). Perhaps it is comforting to know that attempts at mind uploading have severe limitations. In Bina48's case, the robot occasionally repeats itself, is only able to understand concepts based on what is available in its database but not its experiences, and does not have knowledge of its cultural identity due to the lack of such content in its programming (Keegan, 2020). Perhaps a reason for technology's limitations in truly replicating the human mind lies in the physical material itself. The nature of the physical medium used to conduct cognitive processes and complex operations (carbon in the human brain or silicon in computer systems) determines the range of cognitive abilities that can be carried out. Currently, machines are unable to achieve the extent of a human mind's capabilities simply due to their silicon material (Korteling et al., 2021).

Besides this, there is one other area that artificial intelligence draws upon from the human brain. It is the similarity in machine learning and language acquisition in developmental psychology via statistical learning. A branch of artificial intelligence, machine learning uses statistical methods to imitate the way that humans learn, thus improving its accuracy in making predictions (Machine Learning, 2021). Statistical learning refers to making inferences, predictions, and decisions based on a set of data. According to Saffran and colleagues (1998), statistical learning plays an important role in human infant word segmentation during early language acquisition via the identification of consistent sound patterns (Saffran et al., 2001). This discovery was made in their study which revealed that after a few minutes of listening, 8-month-old infants are able to separate a continuous stream of speech syllables into word-like units (Aslin et al., 1998). This method of statistical learning is employed in machine learning algorithms such as speech recognition, which converts voice data into text data by breaking the latter down in ways that assist the computer to make sense of it (Education, 2021a). The similarity in machine learning and human language acquisition is brought to light in a recent study by engineers at Columbia University. They discovered that AI systems, when programmed with audio files of human language, performed better than those with binary data labels as programme input. Professor of Mechanical Engineering Hod Lipson remarked, “If human toddlers learn best with repetitive spoken instruction, then perhaps AI systems can, too” (Deep Learning Networks Prefer the Human Voice—Just Like Us, 2021). With this newfound discovery, the gap in differences between machine and human decreases more than ever.



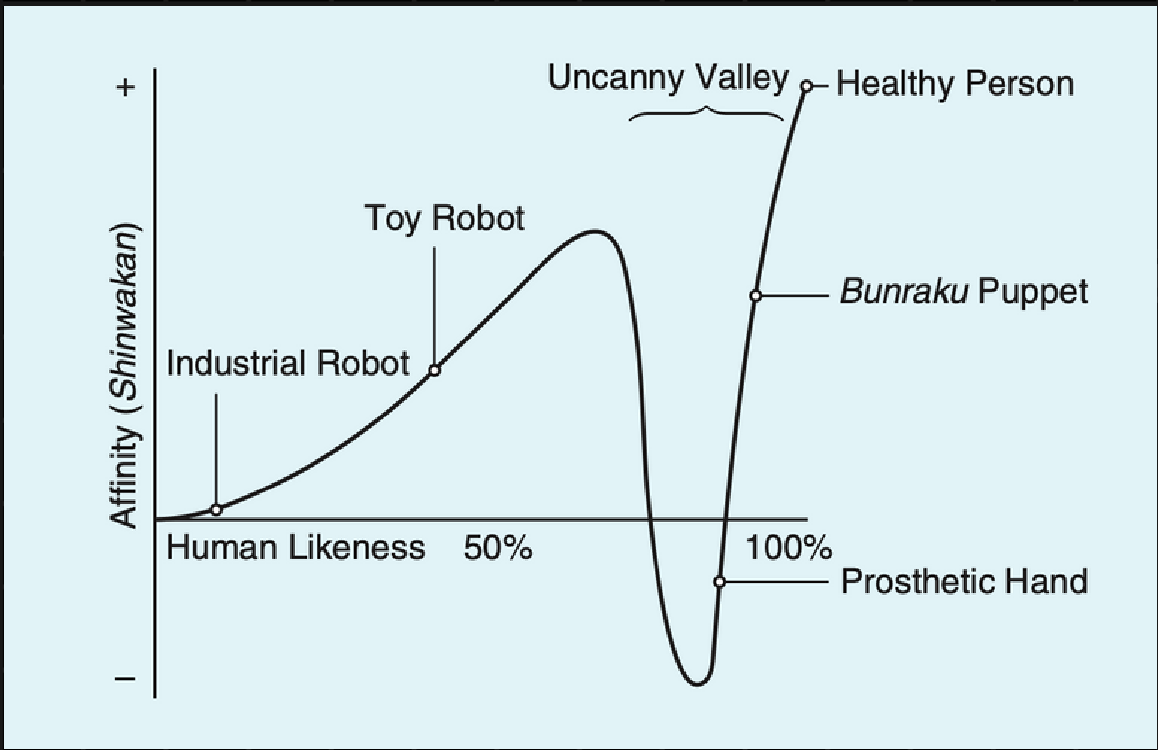
There remains the question, though: Does artificial intelligence have consciousness? In a thought-provoking scene in *Ghost in the Shell*, a "puppet" (a human with simulated experiences, or fake memories installed in the brain) cried out in agony upon realisation that his memories were pre-installed and not real, leading to him losing grip on his sense of self and immediate reality. This illustrates the significance of human consciousness and its reliance on one's lived experiences and memories. Despite this, much is not known about the great mystery of human consciousness, its dependence on one's memories and life experiences, and its dependence on one's sense of self. In a paper on memory and consciousness, Canadian psychologist Endel Tulving attempted to elaborate on the different components and relationships between the two. According to his view, memory consists of procedural memory which refers to implicit memory that governs motor and cognitive skills, semantic memory which refers to general knowledge about the world, and episodic memory which refers to conscious recollection of one's past experiences. Each component of memory is characterized by a component of consciousness. Specifically, Tulving speculated that anoetic consciousness (i.e., the capability to perceive, internalise and react to the present environment both externally and internally) is linked to procedural memory, noetic consciousness (i.e., the ability to flexibly act based on symbolic knowledge of the world) is linked to semantic memory, and autonoetic consciousness (i.e., remembering personally experienced events as part of one's existence) is linked to episodic memory (Tulving, 1985). With regards to machines, there is a general consensus that they do not have consciousness, nor sentience (Hildt, 2019). Current machines are utilizing unconscious computations, which differ from the information-processing computations in the human brain such as selection and self-monitoring (Dehaene et al., 2017). In fact, according to the German-American neuroscientist Christof Koch, programmable computers will never have consciousness. Consciousness, to him, refers to the feeling of being alive, which is something that machines and their computations are unable to simulate as their very existence is not a result of life (Koch, 2020). In all honesty, this theory puts me at ease, knowing that humans have a value in ourselves—life—that no machine can replicate.



The answer to the question of machine consciousness is thus simple: a machine will not ever replicate the human brain. Currently, fields such as psychology and neuroscience have yet to uncover the mysteries of the amazing 1.5kg organ, and areas such as technology and computer science have much to discover in the development of algorithms and computations. At current levels of understanding, human-machine interactions and interdependence still have a long way to go. Rest assured, the dystopian depictions in *Ghost in the Shell* continue to remain as fiction in viewers' minds. Regardless, here is another quote by Major Motoko Kusanagi that perfectly encapsulates mankind's thirst for knowledge as professionals in the fields of psychology and technology continue to question the human-machine debate, "If a technological feat is possible, man will do it. Almost as if it's wired into the core of our being."

Eerie Resemblances in The Uncanny Valley

by Denise Dillon



Mori's original 1970 graphic depiction of the uncanny valley, "the proposed relation between the human likeness of an entity and the perceiver's affinity for it."

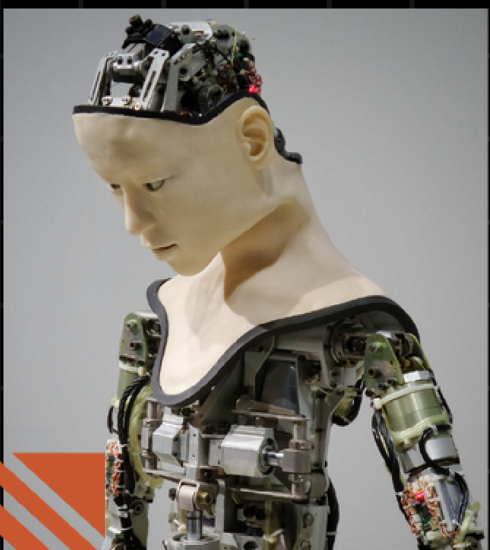
What is the uncanny valley effect?

In what might now seem like a prescient revelation, Japanese roboticist Masahiro Mori first described the uncanny valley effect more than 50 years ago, at which time it attracted little if any notice. This effect is a psychological response to human likeness in objects. For example, the degree of affinity for (liking) an object increases as the human likeness of the object increases; however, affinity only increases up to a point before decreasing markedly once the human likeness of the object reaches a point of being recognizably human but in an unsettling—or uncanny—way. As human likeness increases further, affinity again rises sharply, out of the uncanny valley. Mori (1970) described an "eerie sensation" or "creepiness" experienced by observers of objects in that uncomfortable region of the human likeness continuum. As a result of his observation, Mori posed some questions: "Why are we equipped with this eerie sensation?" and "Is it essential for human beings?" The answers to such questions, proposed Mori, would not only help us understand what makes us human but could also foster the development of nonhuman, humanlike devices to which people would be receptive. Here we explore some of the factors relating to Mori's questions.

When does the effect emerge?

If the uncanny valley effect is essential for humans, it should be measurable from a specific time point of development. Brink et al. (2019) tested for the effect in children between the ages of 3 to 18 years, who viewed a short video of either a machine-like robot or a very human-like robot and rated their feelings about the robot (Do you feel the robot is creepy? Does the robot make you feel weird or happy?) and their perceptions of the robot's capacities (Does the robot choose to move? think for itself? know the difference between good and bad? feel pain? feel scared? feel hungry?).

Responses indicated that there was no uncanny valley effect in children aged younger than 9 years, but the effect emerged at that age and the perceived creepiness of the human-like robot increased up to the age of 16 years. Rather than indicating an innate mechanism behind the effect, these findings instead indicate that it emerges through developmental means. It also appears to be consistent with changes in perception associated with developing mental abilities in children: "a robot is considered creepy when it violates our learned expectations of how a machine should look or behave" (Brink et al., 2019, p. 1210).



Does the effect only apply for human-like entities?

Following a line of reasoning that the uncanny valley effect is somehow adaptively beneficial to humans (e.g., uneasiness to indicate stranger danger?), we might reasonably question if the effect extends to other life-like entities. A research team in Germany explored this in a study using zoomorphic (animal-like) robots and provided evidence that the feelings of eeriness persist according to the element of likeness (Löffler et al., 2020).

The two most cited theories proposed to explain the uncanny valley effect concern category uncertainty (i.e., being unsure to which category an entity belongs) and realism inconsistency (mismatch of features). Based on their findings that the most negative responses (i.e., in the valley) were given to animal-like robots that were clearly inconsistent in feature matching (e.g., fur looks real but face looks "dead"), Löffler et al. added their support to the theory of realism inconsistency. Category uncertainty appears to have no effect on perceived eeriness.

Is the effect limited only to evaluations of affinity?

The effect has thus far been considered on the basis of affinity, but likeness can extend to other factors such as cognitive and social capacity. Thus, it makes sense to assume that likeness could influence perceptions in ways beyond feeling an affinity for an object. So is there an uncanny valley for other types of likeness? In novel findings, researchers in Finland reported a moral uncanny valley effect, whereby "people evaluated moral choices by robots that resemble humans as less moral compared to the same moral choices made by humans or non-human robots" (Laakasuo et al., 2021).

In two studies, participants made third-person perspective evaluations of moral decisions made by a third party (e.g., an agent needs to make a decision and participants evaluate the decision made by the agent on level of morality from Very Immoral to Very Moral). Results of both studies provided a strong indication that there is a moral uncanny valley effect, whereby moral choices made by human-appearing robots are perceived as less moral than if those choices are made by either a human or a humanoid robot. The two latter agents were perceived as not creepy and likeable in contrast to those influencing the uncanny valley effect, which were rated as either somewhat creepy/somewhat unlikable or very creepy/very unlikeable. The findings also provide support for the view that our human moral cognition is built on our social cognitive systems, and further that moral cognition relies on social cognition.

Can the effect be reduced?

In an IEEE Spectrum interview in 2012, when asked if he thought there are now robots who have "crossed the valley", Mori himself identified the HRP-4C adult-size humanoid robot developed by Japan's National Institute of Advanced Industrial Science and Technology as one of these (https://spectrum.ieee.org/how-to-make-a-robot-dance) (Kageki, 2012). Though he mused: "on second thought it may still have a bit of eeriness in it." Of course, the field of robotics is in constant flux with advances appearing faster than our general awareness of these advances.

Aside from the advances that are taking robots to the "next level" in human likeness, other research suggests there are other ways to reduce the uncanny valley effect. For example, Yam et al. (2021) reported outcomes of three studies to show that dehumanizing humanoid robots can reduce perceptions of their having feelings, and hence reduce those perceptions of creepiness.

Additionally, the aforementioned findings reported by Brink et al. indicate that time might be the ultimate leveler, with each new generation of children becoming more and more familiar with humanlike robots to the point where feelings of creepiness are cancelled out by learned expectations.

What makes all of this important to us here in Singapore?

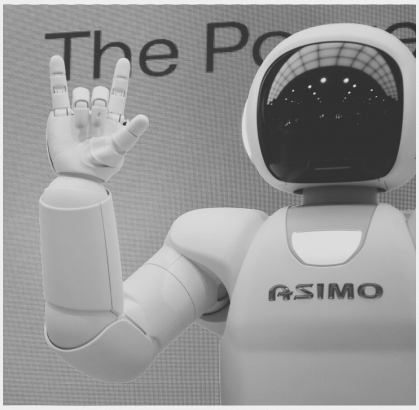
Primary and secondary schools in Singapore offer courses in robotics, with younger children primed to become not only digital natives, but potential developers of robotics in the near future. However, with Singapore at the forefront of smart city thinking, robots are already among us. They return trays at food courts, clean food courts and malls, deliver food and entertain diners, help us complete banking transactions, drive trains and other autonomous vehicles, and provide guest-room service at hotels. At schools they teach children to dance and engage in interactive classes; amongst the elderly, robots have led exercises and provided companionship. A robot dog performed social distancing patrols in Bishan-Ang Mo Kio Park. There is work ahead in the field of psychology, to help manage fears such as losing jobs to robots or of having to adapt to new technologies. Psychology research can also help roboticists understand how to make robots more acceptable to the public and to help us all climb out of the uncanny valley.

Ask Jamie: Are You Human?

by Cameron Choo

In our technological age, we frequently use the internet for shopping (e.g., TaoBao), administrative chores (e.g., ICA), and even ordering food (e.g., Grab). Sometimes, as we get on the site, we get a familiar pop-up in the corner of our eyes, a flashing button and a "May I Help You?" message bubble. Perhaps, even a lifelike Jamie can appear, the same Jamie of the Ask Jamie chatbot of whom you can inquire about your housing applications and medical appointments on over 50 different governmental platforms. Well, as with the recent saga of Jamie providing safe sex advice to COVID-19 related queries (Darke, 2021), it's worth exploring what it is about the wrongly wired responses from Jamie that intrigue us so much.

Jamie, What Makes You Human?

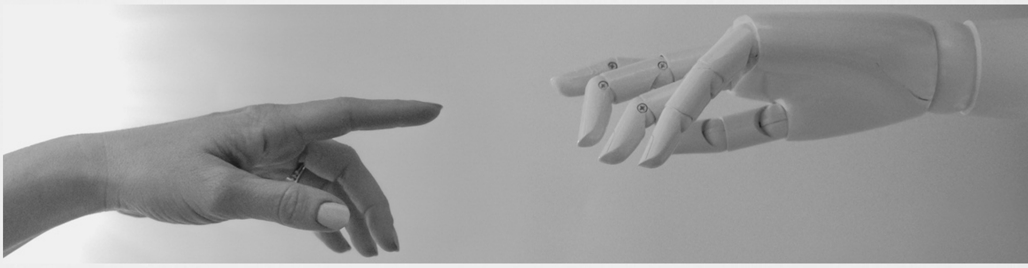


Many will remember that when Apple Inc.'s virtual assistant Siri was first released, it was recognized as one of the many innovations that made human activities more efficient. With Siri being an artificial intelligence (AI) designed with an array of codes, its main objective is to curb the need for extra human labour, such as extensive internet searches or setting your alarm clock. Backend mechanisms such as the precise usage of language-use algorithms and connectivity to other major platforms like Google allowed the fulfilment of this aim (Natale, 2020). With the same mechanism, locally-designed chatbots like Ask Jamie have the primary aim to replace the need for human manpower in addressing concerns or providing on-the-go service, 24/7. Rather than fulfilling general enquiries and concerns through static delivery of information, such bots are usually preferred to mimic the same experience that one would get when conversing with a human agent.

With the idea of making these chatbots seem as human as possible to improve customer satisfaction and experience, Go and Sundar (2019) identified the three general cues that could help achieve this aim: human figures (visual cues), human-associated names (identity cues), and the mimicking of human languages (conversation cues). Therefore, these three factors all work hand in hand to produce a human-like conversation with the user. With the contribution of human figures helping to shape up the user's perception of the bot, identity cues enhancing the salience of "another person", and conversational cues aimed to provide unique experiential outcomes, each single interaction with the bot would most likely be unique and tailored to the intended user (Hrastinski, 2008; Sundar, 2008; Sundar et al., 2016), making the chatbot seem very much human. You could see how chatbots like Jamie meet these dimensions—where Jamie's life-like picture attached to the chatbox and its natural language use can make conversing with the chatbot seem very much human. But what if we're missing one of these factors? Does it mean the bot loses its humanness?

Jamie, Do Your Stylistic Replies Matter to Me?

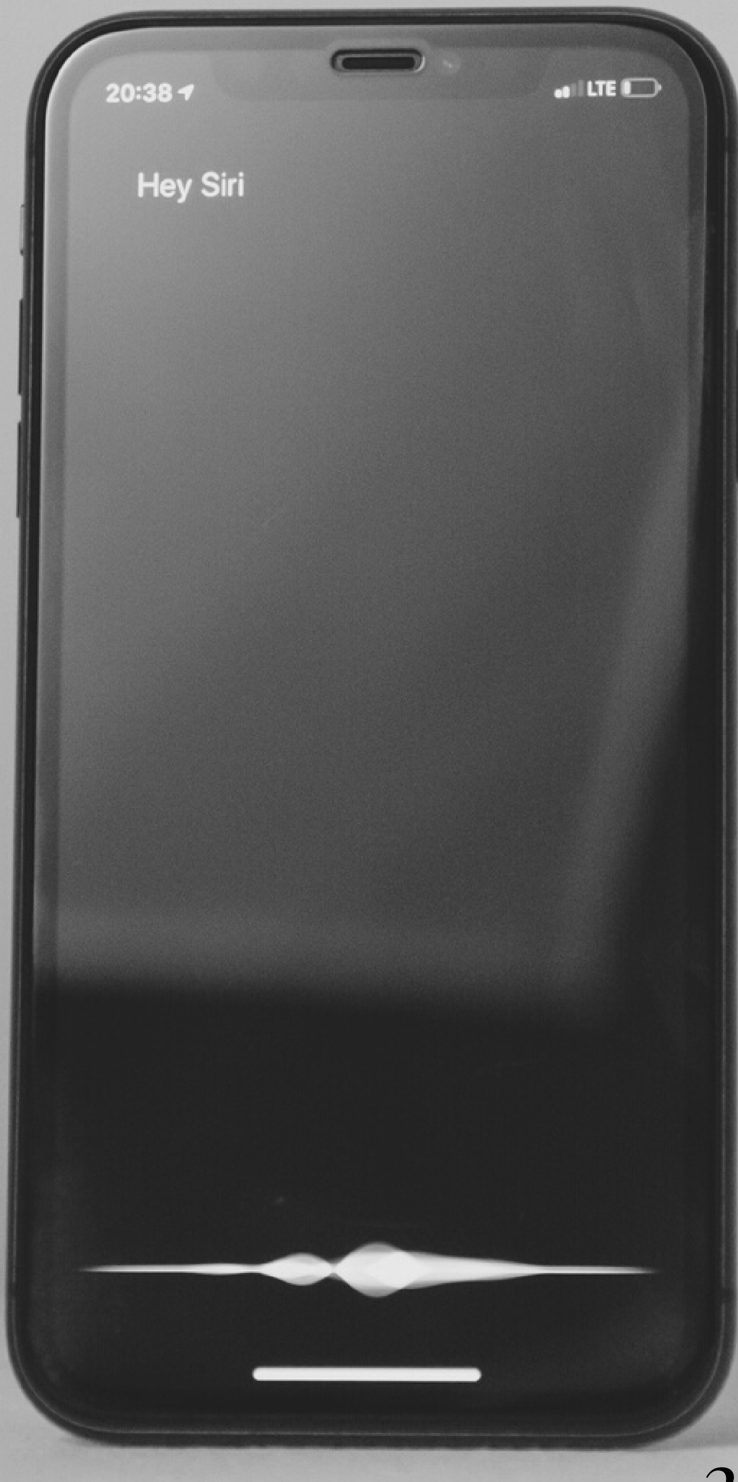
Well, it could depend on how the bot is structured and how it fits your personal preference. Previous research has found differing expectations for the first-time use of a chatbot (Zamora, 2017), with the four general themes of performance, intelligence, seamlessness, and personal dynamic being the most prioritized in chat-bot behavior. Scoping even further down to the type of conversations that are enabled for the chatbot, characteristics such as the transparency of being a machine, authenticity, and ability to engage in a conversation have also been implicated in the budding humanness of the chatbot as well (Neururer et al., 2018). The nature of conversations we have with the chatbot is quite important actually. Predictability of transparency encourages the perception of security and objectivity required in more serious circumstances (e.g., finding courses of action resulting from the loss of your passport) while being conversational with supplementary use of emoticons can encourage the perception of responsiveness and availability (Walther & D'addario, 2001). With such considerations in place, the Ask Jamie bot had shown its effectiveness in responding to the needs of the general public and the organizations themselves before the recent saga that was reported. With the impending improvements to better wire Jamie's responses, some of us may one day find Jamie to be our best companion if it starts asking us about our day (if you like that).



Jamie, how do you know what to say?

Given the seemingly boundless potential from combinations of the type of questions asked and the responses given, having a bot respond only in a certain way might lead us to assume that such a limited approach would very much reduce perceptions of the bot's humanness. Moreover, we know that the conversations we have even with people are not predictable. Where each possible response could elicit a different consequence, previous responses or choices of words are also taken into consideration at the same time.

That's why there is an imminent need for big data (Lokman & Ameedeen, 2018), where all responses to "How May I Help You?" to "How Is My Service Today?" to "Chicken Rice Near Me" requests are logged into a huge database, all ready to produce the one response best suited to your needs. Sometimes, you may get a cheeky response or two from such chatbots if quirky responses are logged into the same database. The Bus Uncle bot, for instance, was developed to provide bus arrival timings in the character of a real, Singaporean-style uncle. According to Bus Uncle's creator, Abhilash Murthy: "he has mastered uncle humour and tells you jokes when you are bored waiting for your bus to arrive. People call him crazy, rude, and obnoxious, but that's just him being frank with you." Therefore, with the possibility that the responses for COVID-19 related enquiries are logged into the same database as those for safe-sex enquiries, this could give an insight to how the same response could be activated by the bot for such differing topics in nature.



In conclusion, there are many factors that can influence the perception of chatbots like Ask Jamie. With the combination of the three main cues for machine-humanness and big data, many of us can communicate with Ask Jamie quite effectively for it to address our needs. However, an accidental detour of the conversation route due to technological kinks can elicit a surprise factor, therefore generating elements of both horror and humour as we saw when Ask Jamie responded in such an unexpected way.

Text Messaging in the 21st Century

by Jessy Yong

"Merry Christmas"

Almost three decades ago, the world saw its very first text message—a Christmas greeting sent out from the computer of 22-year-old test engineer, Neil Papworth.

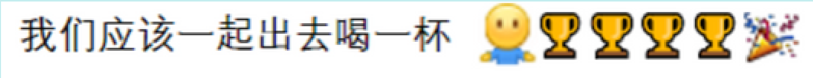
Today, over 20 billion text messages are sent worldwide each day (Giacomini, 2021). Enabled by popular messaging apps like WhatsApp, Telegram, and Snapchat, stringing multiple words together and transmitting them to another person is not exactly a groundbreaking feat in present times. Instead, researchers have begun to recognise how message content in the form of emojis, images, and GIFs, as well as messaging apps and their unique functions, makes for a more valuable discussion with respect to how they shape the way we communicate with others in this modernised world.

Emojis, Stickers, Memes

“Emoticon is a portmanteau of 'emotion' and 'icon,' suggesting an icon that indicates emotional expression."
(Tang & Hew, 2019)

Since their first appearance in text messages in the 1980s (Steinmetz, 2014), emoticons and variations of them including emojis and stickers are now almost essential to many of our messaging habits. They are used in our online conversations for many reasons: to soften the tone of a message, to emphasise certain feelings, or to clarify the content of messages (Derks, Fischer, & Bos, 2008; Jibril and Abdullah, 2013).

For Chinese microblog users, a sequence of emojis can even be used to form sentence-like utterances to elaborate on an idea (Ge & Herring, 2018). For instance, a user on Sina Weibo used this emoji sequence to congratulate their friend:



Translation: We should go out for a drink (hug - trophy - confetti emojis)

Users also include emojis to express their personalities, poke fun at one another, form shared meanings, and create affiliation and solidarity (Anderson, 2018).

Emojis, Stickers, Memes

Another tool that transformed online messaging is memes, which are images, videos, or GIFs often spread throughout the internet for humorous purposes (Kariko & Nasih, 2019). Memes have a unique place in online communication; they lubricate conversations to make them more light-hearted, fun, and relatable. Similar to emoticons, memes are also used to express one's emotions more effectively (Park, 2020). Memes also add another layer of online communication, with content that can be funny and contain multiple emotions including happiness, sadness, frustration, shock, and anxiety.

Hence, these messaging symbols and styles bond the sender and receiver, helping us express more with less. Sometimes all it takes to create common ground can come from a simple meme, an easy and effective way to make someone relate to you and feel, "this is so me right now".

Last Seen: Did You Blue-Tick Your Boss?

While messaging apps make communication with others convenient, instant, and on the go, sometimes convenience and spontaneity create situations where you wish you might not receive a message at all.

In 2020, Singapore Labour MP Melvin Yong proposed a "Right to Disconnect" law to give workers protected time to rest (Ong, 2020). This year, with the rise of remote working blurring the boundaries between work and life, an after-hours work communication policy guide was launched (Lin, 2021) with a view to improving work-life harmony.

The need to "switch off" after work is an increasing topic of concern in many countries, including Singapore. As long as one has a messaging app, people are simultaneously absent and present, making it too easy for employers or colleagues to connect to them even when they're out-of-office (Mols & Pridmore, 2021). As a result, people find ways to disconnect by appearing unavailable, such as using curt and "uninterested" responses, turning on their "do not disturb" phone function, or switching off their "last seen" and "blue tick" features on messaging apps like WhatsApp (Mannell, 2019).

However, some messaging functions can't be avoided. For instance, one can still appear "online" on WhatsApp, and the seemingly never-ending flow of messages from an office chat group can create pressure and expectations to continue working (Pagh, 2020). These default settings of messaging apps remove a person's privacy and autonomy, forcing one to negotiate their availability. More than ever, people report feeling strapped to their phones by these messaging apps—having to face a contradiction of living in convenience and availability—and yet always yearning to disconnect from these messaging tools.

The Elderly and Messaging Apps

Have you ever received a phone notification from your elderly parent or relative, opened it, and found that it's a picture filled with blooming flowers and words that say "Good morning, have a nice day"?

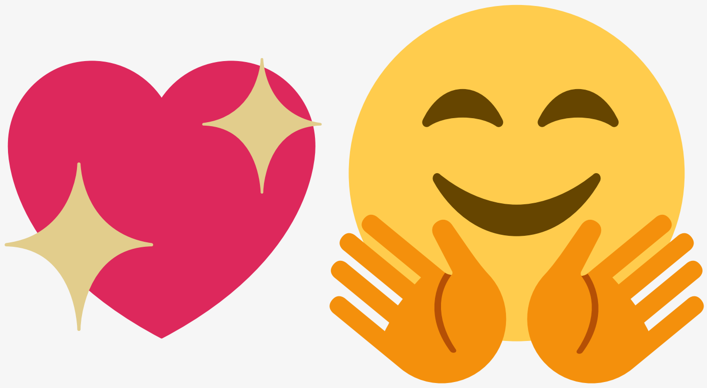
While older folk are often portrayed to reject technology, and are sometimes depicted as "digitally estranged", messages such as the one described above seem to indicate otherwise.

A recent CNA headline—"Commentary: Seniors are spending too much time on their smartphones which can spell trouble"—is peculiar at first glance, especially since we have seen this same headline being applied to young people regularly. But it makes a lot more sense when we realise many elderly around us are also digitally engaged, frequently using messaging apps like WhatsApp and WeChat to interact with their family, friends, and colleagues. In fact, smartphone use among elderly Singaporeans above the age of 75 has increased from 41% to 60% between 2019 and 2020 (Pang, 2021).

The Elderly and Messaging Apps

Online messaging apps have therefore been assimilated into the lifestyles of older individuals and changed the way they communicate. Even without face-to-face conversations, these apps can allow people to keep in touch with loved ones who are far away, especially evident through the creation of extended family chat groups. In a way, many in the elderly age bracket are not excluded from rapid digital advancement, but have instead harnessed technology to extend their personal networks, maintaining strong ties and reinforcing weak ones through online communication (Rosales & Fernández-Ardèvol, 2016).

Being part of an age group that is often reported to face loneliness and social isolation (Han, 2021), your elderly contacts may be sending you flowery images that feel almost unnecessary. But this form of online communication is their unique way of creating and sustaining a conversation with the ones they love, and a permanent social space where they can find a relative and friend who returns their gossip and banter. After all, with instant messaging, it takes only an instant to make someone's day by reciprocating with flowers in return.



Mental Health Apps: How to Evaluate Them and What to Look Out For

by Ng Da Xuan

With the surfacing of mental health smartphone apps (e.g., MoodMission, MoodFit, PTSD Coach, ACT Coach, Healthy Minds) and mental health mobile technology service providers (like Intellect and Thoughtfull), more individuals are turning to smartphone apps for advice and skills-training to improve their mental wellbeing. However, using such apps carries some unique risks to privacy and certain considerations that service users (and recommenders of such services) need to be aware of.

The strengths of mental health smartphone apps lie in their accessibility (i.e., users can access important mental health resources easily), anonymity (i.e., users can seek mental health support while staying anonymous), and low cost (Musiat, Goldstone, & Tarrier, 2014). While some mental health apps have been scientifically validated and are effective in enhancing wellbeing (e.g., meta-analytic studies found significant reduction in anxiety and depressive symptoms among users of PTSD coach and SuperBetter; Firth et al., 2017), most publicly available mental health apps are not evidence based. That is, most mental health smartphone apps do not reference clinical practice guidelines, standard psychoeducation information, or established self-management tools. As revealed by Nicholas et al. (2015), smartphone apps in general adhered to only 15% of best-practice guidelines and covered only 36% of key psychoeducational content, while only 31% cited their information source. Despite the ease that these mental health apps might bring to users (i.e., low cost, accessibility), it is paramount that the apps provide information that is credible, and in a way that is safe for their users.

An evaluative framework for mental health smartphone apps was released in 2017 by the American Psychiatric Association (APA). The APA's "Comprehensive App Evaluation Model" recommended the evaluation of these five key areas:

(1) **Access and Background** (e.g., is the app developed by a trusted source? Has the app been updated in the last 180 days? Can this app be accessible offline or does it require stable internet connection? Is this app compatible with your mobile device?)

(2) **Privacy and safety** (e.g., Is there a transparent privacy policy that is readily accessible? Does the app declare data use and purpose? Can you opt out of data collection or delete data? Does the app collect, use, and/or transmit sensitive data?)

(3) **Clinical foundation** (e.g., is there evidence of benefit from academic institutions, publications, or research? Are the relevant sources or references supporting the app clearly indicated?)

(4) **Usability** (e.g., does the app's features align with your needs? Is the app customizable to your needs?)

(5) **Therapeutic goal** (e.g., can the app be used in collaboration with your psychologist, therapist, counsellor, or psychiatrist? Is it possible to export data and share them with your therapist?)

Potential users should assess these five areas of mental health smartphone apps to determine if these apps are appropriate for use. Beside the need for these apps to be credible and trustworthy, mental health smartphone applications will also need to contain features that can engage their users on a regular basis. As found by many randomised controlled trials of smartphone mental health interventions, the effectiveness of such apps depend on consistent daily or weekly use. Therefore, mental health apps will need to contain features that successfully engage their users, promote hope in recovery, and enhance positivity. Application features that have been found to enhance user experience include the following:

(1) **"Performance" measurement** (e.g, mood checklist) **and providing visual feedback with tips for improvement** (e.g., showing a graph that outlines a user's mood changes and offers tips for improvement if the user's mood does not improve over time),

(2) **Availability of personalised features** (e.g., users can choose their preferred language options or their preferred text size),

(3) **Clear, concise information in lay language** (i.e., avoid jargon and technical details),

(4) **Good aesthetics** (e.g., used bright, contrasting, and lively colour), and

(5) **Cultural and user appropriateness** (e.g., content is sensitive to the user's culture and information is specifically tailored to the user's presenting issues).

In sum, prudence is needed when deciding which mental health apps to use and it is strongly recommended that users evaluate these apps using the "Comprehensive App Evaluation Model". Of particular concern is the privacy and confidentiality protocol of these apps and their scientific credibility. If mental health practitioners are thinking of recommending mental health apps to their clients, it is important to also consider if any recommended app is catered to the client's specific need (e.g., symptom monitoring, cognitive restructuring, mood journaling, behavioural tracking, or mindfulness training) and appropriate to the client's specific context (e.g., age-appropriate, culture appropriate, and LGBTQ sensitive). It is also important to emphasise that these mental health applications do not replace traditional psychological treatment. As recommended by most of the mental health apps, individuals with mental health issues are strongly encouraged to continue seeking mental health treatment and only use these mental health smartphone apps as a supplement to their treatment.

Sleep and Technology: Friends or Foes?

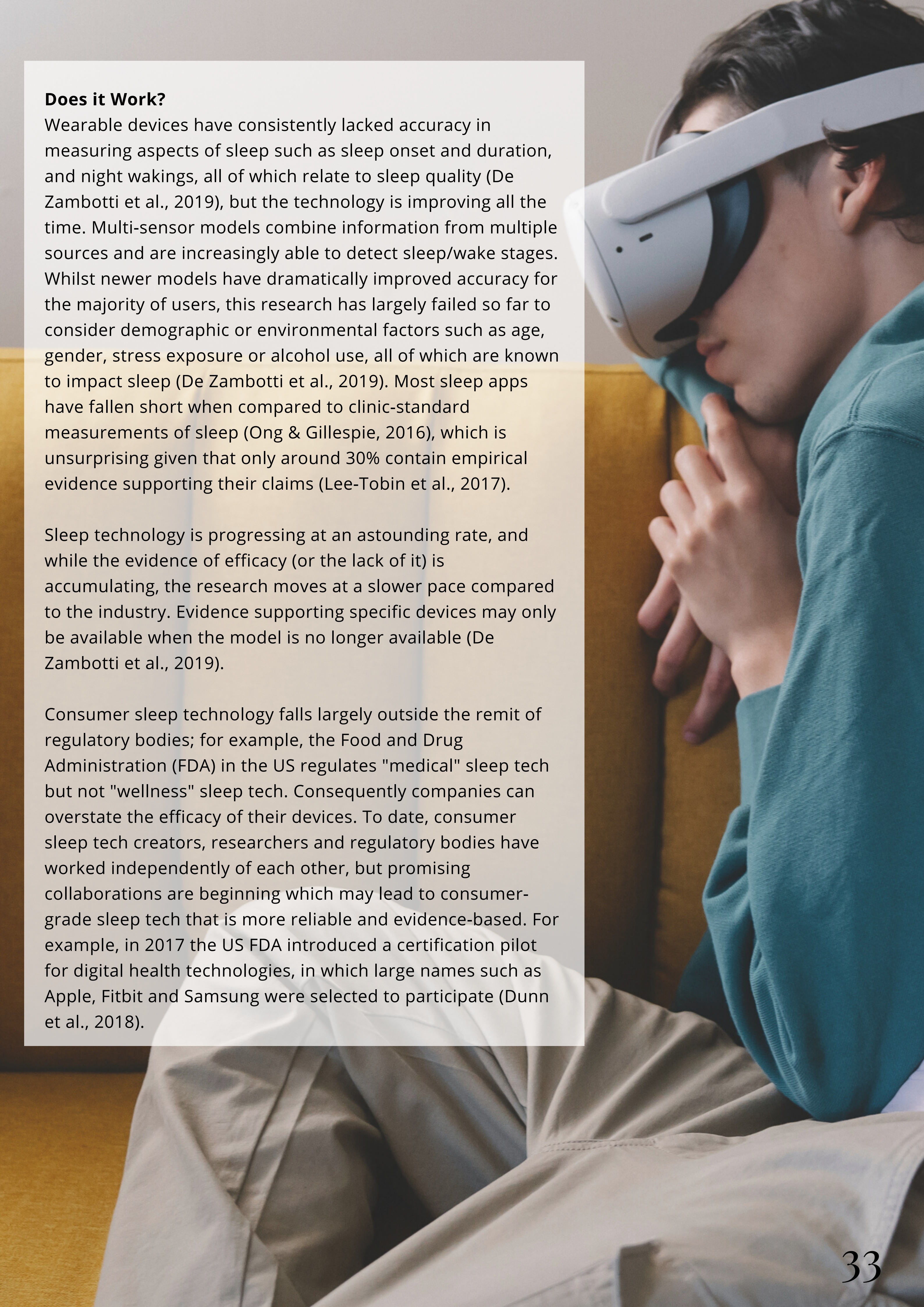
By Nicola Cann

Introduction

Globally, we are getting less sleep than ever before, with associated risks for individuals ranging from short-term decreases in cognitive functioning, to chronic health conditions such as depression and dementia (Perez-Pozuelo et al., 2020). Economic costs are also significant, with reduced sleep contributing to healthcare costs and work absences (Hafner et al., 2017). It is unsurprising then that the consumer sleep tech industry is growing exponentially and is predicted to be worth $40.6 billion (USD) by 2027 (Global Market Insights). The potential of sleep tech is wide ranging, and provides exciting opportunities for innovative developments that can enhance the wellbeing of people around the world.

What is Sleep Tech?

In an industry that is growing by around 12% annually (Global Markets Insights), consumer sleep technology forms part of a digital health revolution, where innovative devices are continuously being created (De Zambotti et al., 2019). Tech that shows promise includes wireless electroencephalogram (EEG) devices, ultrasound sensors to detect breathing patterns, and artificial intelligence that uses data modelling to collate and categorise sensor data to identify sleep problems and make recommendations such as how much sleep an individual needs (Perez-Pozuelo et al., 2020). For the majority of us sleep tech constitutes the increasingly popular sleep apps and wearable devices (e.g., Fitbit and other fitness and health trackers), which are developing at an impressive rate. Current sleep wearables include multiple sensors that record a range of signals such as heart rate and skin temperature, and are increasingly accurate in monitoring sleep (De Zambotti et al., 2019). With increased connectivity, sleep wearables are progressively more able to sync to apps that use algorithms to monitor and evaluate individuals' sleep.



Does it Work?

Wearable devices have consistently lacked accuracy in measuring aspects of sleep such as sleep onset and duration, and night wakings, all of which relate to sleep quality (De Zambotti et al., 2019), but the technology is improving all the time. Multi-sensor models combine information from multiple sources and are increasingly able to detect sleep/wake stages. Whilst newer models have dramatically improved accuracy for the majority of users, this research has largely failed so far to consider demographic or environmental factors such as age, gender, stress exposure or alcohol use, all of which are known to impact sleep (De Zambotti et al., 2019). Most sleep apps have fallen short when compared to clinic-standard measurements of sleep (Ong & Gillespie, 2016), which is unsurprising given that only around 30% contain empirical evidence supporting their claims (Lee-Tobin et al., 2017).

Sleep technology is progressing at an astounding rate, and while the evidence of efficacy (or the lack of it) is accumulating, the research moves at a slower pace compared to the industry. Evidence supporting specific devices may only be available when the model is no longer available (De Zambotti et al., 2019).

Consumer sleep technology falls largely outside the remit of regulatory bodies; for example, the Food and Drug Administration (FDA) in the US regulates "medical" sleep tech but not "wellness" sleep tech. Consequently companies can overstate the efficacy of their devices. To date, consumer sleep tech creators, researchers and regulatory bodies have worked independently of each other, but promising collaborations are beginning which may lead to consumer-grade sleep tech that is more reliable and evidence-based. For example, in 2017 the US FDA introduced a certification pilot for digital health technologies, in which large names such as Apple, Fitbit and Samsung were selected to participate (Dunn et al., 2018).

Sleep tech for wellness

Sleep tech has the potential to help individuals manage and improve their own sleep, and with increases in connectivity and multi-functionality, devices can motivate and encourage individuals towards self-improvement (Khosla et al., 2018). However, increased use of sleep technology comes with a range of potential risks.

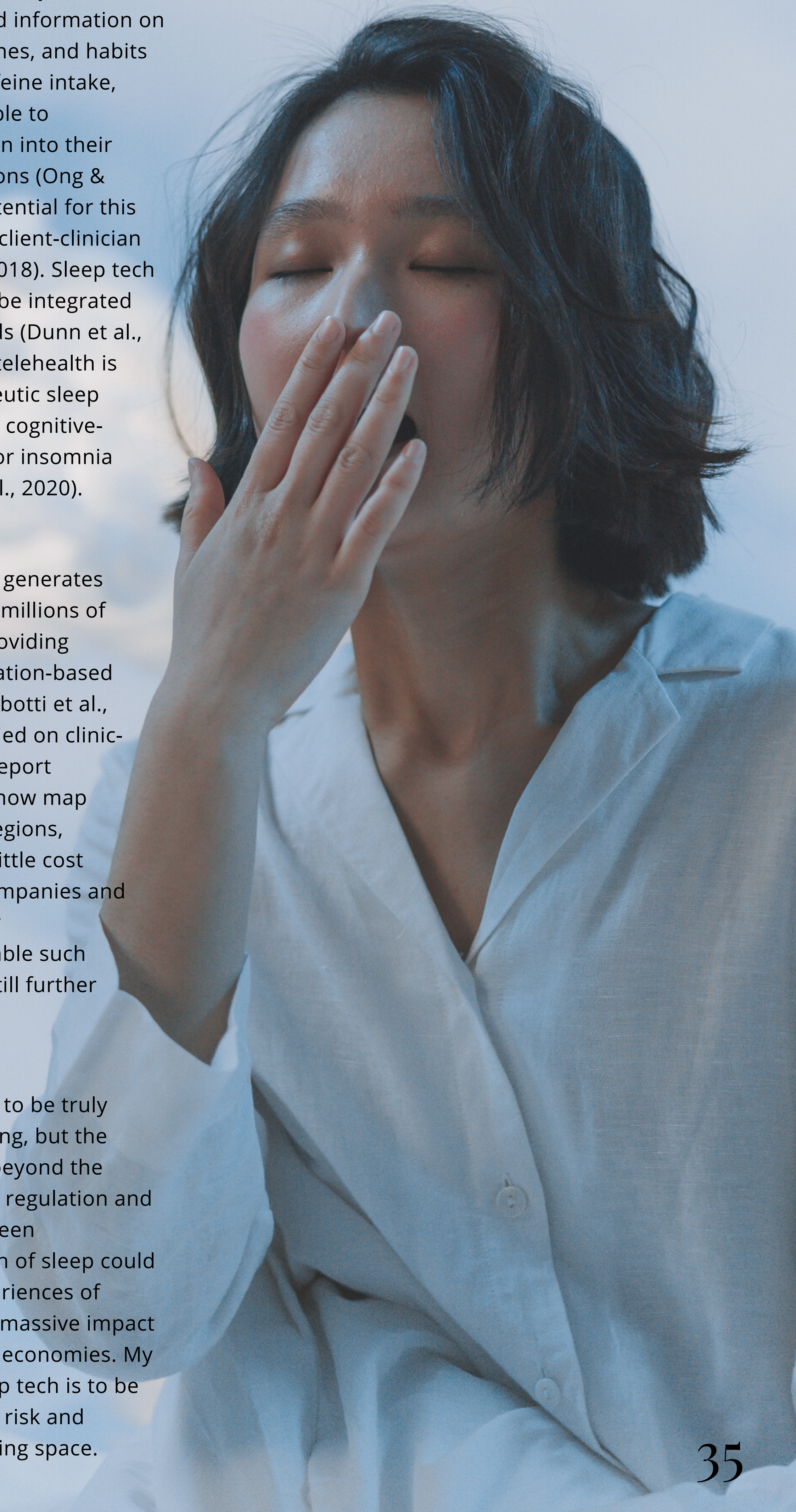
Given the limited accuracy of consumer sleep technology and the lack of accessible information about efficacy, there is potential for people to change their sleep habits based on misinformation and misinterpretation. Additionally, there is a risk that individuals may diagnose themselves with sleep disorders where there are none (Lee-Tobin et al., 2017), or delay seeking professional advice when needed (De Zambotti et al., 2019).

Screen time has consistently been linked to poor sleep and as such time spent using sleep apps may in fact have a detrimental impact on sleep (Jakobsson et al., 2018). However, some research suggests that people who are naturally night owls may be using technology late at night because they have a natural preference for staying up late, so the direction of causality is unclear (Cain & Gradisar, 2010). Tech use at bedtime may also be a means of coping with existing sleep problems for some (Tavernier & Willoughby, 2014). Nonetheless, evidence indicates that bright light from screens can suppress the sleep-promoting hormone melatonin (Park et al., 2020).

As consumer sleep technology gathers increasingly detailed information about users' sleep, a new phenomenon termed "orthosomnia" (Baron et al., 2017) has been described whereby individuals can become preoccupied with measuring their sleep, which conversely leads to poorer sleep. There is also the risk that for individuals already concerned about sleep, detailed information may exacerbate sleep-related anxiety, which can impact sleep (De Zambotti et al., 2019). As sleep technology continues to progress and develop, it is clear that the psychological responses to such tech will need to be investigated.

Sleep tech for disordered sleep

With apps capturing detailed information on sleep quality, bedtime routines, and habits impacting sleep such as caffeine intake, clinicians are increasingly able to incorporate such information into their assessments and interventions (Ong & Gillespie, 2016). There is potential for this technology to revolutionise client-clinician interactions (Khosla et al., 2018). Sleep tech information is beginning to be integrated into electronic health records (Dunn et al., 2018), and the evolution of telehealth is increasing access to therapeutic sleep interventions such as digital cognitive-behavioural therapy (CBT) for insomnia (Luik et al., 2019; Vedaa et al., 2020).



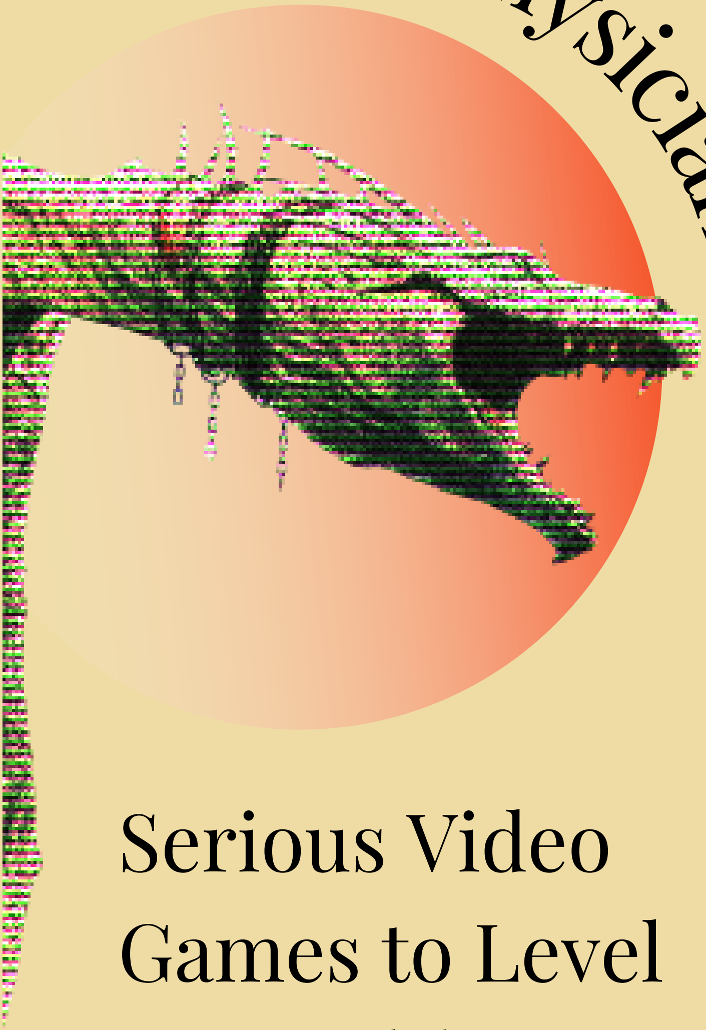
Sleep tech and "Big Data"

Consumer sleep technology generates huge amounts of data from millions of people around the world providing massive potential for population-based research into sleep (De Zambotti et al., 2019). Having previously relied on clinic-based technology and self-report measures, researchers can now map sleep across geographical regions, genders, ages and more at little cost (Walch et al., 2016). Tech companies and researchers are increasingly collaborating, which will enable such large-scale data collection still further (Hagheyegh et al., 2019).

Conclusion

Sleep tech has the potential to be truly personalised and empowering, but the implications also reach far beyond the individual. With appropriate regulation and effective collaboration between stakeholders, the digitization of sleep could revolutionise the sleep experiences of millions of people, having a massive impact on global health trends and economies. My advice to consumers of sleep tech is to be aware of both potential and risk and continue watching this exciting space.

Pixel Physicians:



Serious Video Games to Level Up Health

By Paul Patinadan

In late 2017, Hermes Pardini Laboratories, Oglivy Brazil and Lobo (a dual-city design studio) developed "VR Vaccine", a short virtual reality experience directed at allaying the almost primal fear children felt at receiving a vaccine injection. I remember watching a viral video detailing this tech-augmented procedure, which had memorably opened with children screaming bloody murder during the traditional, rote physician-with-a-needle interaction. "I'm only five! I'm scared!" one child had bemoaned, tear-streaked and backing up into the hallway. Once strapped comfortably into a VR headset though, all traces of periprocedural anxiety seemed to dissipate as the children were immersed into a bright, colorful fantasy world of dragons and golems; one that they were tasked in defending. Before their heroic destiny could unfold however, the little champions needed some magical aid. A breath of frosty cotton spore on their upper arm (where the nurse, slyly following the progress on another screen, would at this point swab the injection site with cool rubbing alcohol) and the quick sting of a fire fruit (in goes that terrifying needle!) and they were on their way to greatness. Smiles, joy, laughter, and awe replaced the fear, dread and anguish of the injection experience in an amazing display of technological ingenuity, which had won the developers numerous creativity awards. Distraction and focus-shifting have always been within a pediatric physician's repertoire, though perhaps never like this.

Serious video games for health is a relatively new phenomenon, developed from the confluence point of several defining advancements in gamification for behavioural change and video game design (Wattanasoontorn et al., 2013). As a constituent element, "serious video games" were a derivative and response to the broken remnants of the "edutainment" and "instructional computer-gaming" interventions from the 90s, which Van Eck (2006) stated, "showcased the worst type of education, drill and practice activities masked with *less than entertaining* game play (p.16)". Individuals growing up in that era would remember the "novelty" of math-based games; repetitively solving sums, being rewarded with irrelevant flashing lights, noise and empty praise, all the while slowly moving into a state of abject tedium. As cautioned by Baranowski et al. (2008), such "boring games risk disappointing and alienating the target audience (p. 183)." To help overcome this risk, core design parameters of descendent serious games attempt to seamlessly integrate entertainment and learning or interventional goals, prioritizing both rather than one over the other (Gee, 2005). "Games for health" by definition are serious games, but with a focus on health and health behavioural change (Baranowski et al., 2008). The clinical and academic stake in employing games for health *seriously* (pun intended) was possibly cemented by the 2012 launch of peer-reviewed journal *Games for Health* by global independent science, technology and medicine publisher Mary Ann Liebert, Inc. (Ferguson, 2012).

Though definitions and operationalizations continue to adapt and evolve with technological mores, the basic component of all games can be considered through four key components as posited by Wattanasoontorn et al. (2013)—with an additional fifth being true for serious games. These components are (i) *gameplay*, or the patterned rules connecting player to game; (ii) *challenge*, which balances rewards and obstructions towards reaching the goal while providing motivation and enjoyment; (iii) *interaction* between players and the game through action (clicking, touching, moving etc.), and *objectives* that are (iv) *explicit*, that is, entertainment and perhaps even (v) *implicit* which are gaining skills, knowledge, experience, reaching a real-life goal, or improving recovery. These components, though they form a probable recipe for a successful game, are only foundational as posited by serious game development veteran Debbe Thompson (Thompson et al., 2010).

Thompson and her team also elucidate the importance of assuming a behavioural science stance towards the development of such games, buttressing the whole experience with theoretics (Thompson et al., 2010). *Escape from Diab*, which focused on psychoeducation of the risks that diabetes and obesity posed for youth, was developed by Thomson's research team and employed a theoretical framework that incorporated traditional socio-cognitive and self-determination theories, as well as research on behavioural inoculation and the elaboration likelihood model (Thompson et al., 2010). Under the premise of players navigating their way through an immersive apocalyptic fantasy scenario, a number of theory-based variables were seen as mediators that aided eventual behavioural change in players regarding their energy output and food intake—information they learned and employed in-game and out. The foundational theoretics aided adherence to the gamified lessons by motivating players and allowing for maintenance of player health behaviors in the long run by instilling mastery.

Youth obesity, however, is only one of the many health issues serious games have attempted to facilitate. Medication adherence and safety, compliance to treatment and therapy, exercise promotion, smoking cessation, addressing mental health issues such as depression, anxiety, PTSD and eating disorders, and even evaluating suicide risk have all been topics addressed through serious video games for health (Abraham et al., 2020; Derksen et al., 2020; Fleming et al., 2017; Kato et al., 2008; Vlachopoulou & Haddouk, 2016). Games for health continue to move into more efficient methods of interventional delivery, whilst leveraging on the appeal, engagement and effectiveness the medium provides (Fleming et al., 2017). Augmented and virtual reality technology create exciting new impetus for interaction with stimuli, and the social, cooperative aspects of multiplayer games hold great therapeutic value and potential.

Locally, games for health have not simply been placed idle on the digital shelf. Singapore has been consistent with its developmental support and uptake of the virtual medium, employing several interventions in the education of healthcare professionals and encouraging collaboration between industry entities and academic institutions (Games for Health Innovation Centre (ALIVE), 2021; Singhealth Duke-NUS Institute of Medical Simulation, 2021). The Serious Games Association, a transnational, volunteer-driven non-profit society is based right here as well (Serious Games Asia, n.d.).

As the field continues to expand and video games move towards the certainty of becoming a clinical fixture, it is likely that the true potential of the craft is yet to be reached; we seem to have started on a grand adventure, but right now, we're only on Level 1!

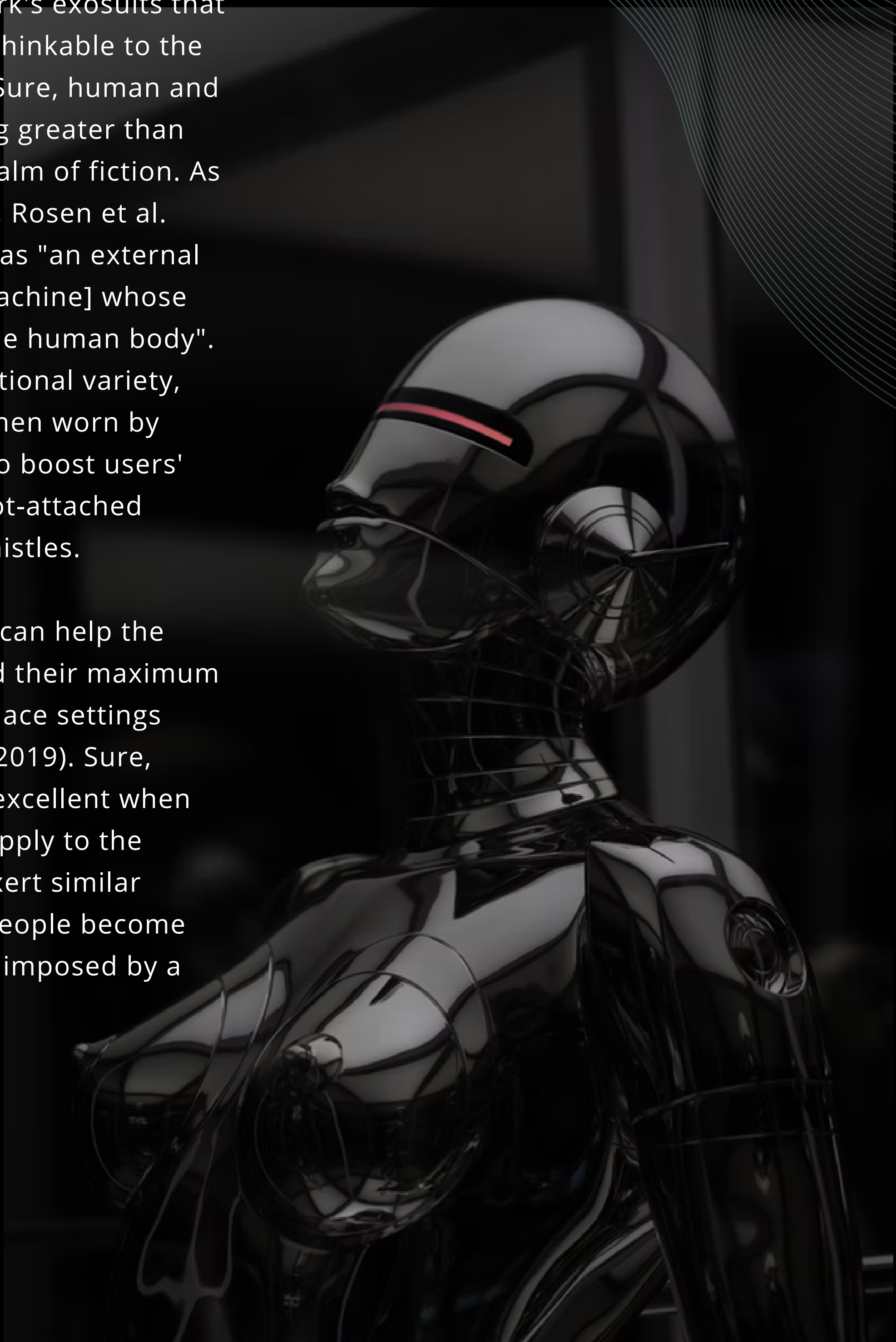
Muscle or Bone Failure? Machines and Bearings to the Rescue!

by Sameer Ehsaan

Have You Suited Up?

What comes to mind when we hear the term "exoskeleton"? One of Tony Stark's exosuits that grant him diverse strengths unthinkable to the modern, non-fictional human? Sure, human and machine can become something greater than themselves, especially in the realm of fiction. As a non-fiction definition, though, Rosen et al. (2001) refer to the exoskeleton as "an external structural mechanism [robot machine] whose joints correspond to those of the human body". Unlike the grandiosity of the fictional variety, Rosen et al. (2001) note that, when worn by humans an exoskeleton helps to boost users' strength, sans the hand and foot-attached jetpacks and other bells and whistles.

In that regard, the exoskeleton can help the abled person work even beyond their maximum physical abilities (e.g., in workplace settings such as factories) (Toxiri et al., 2019). Sure, human and machine are more excellent when combined, but does the same apply to the subset of people who cannot exert similar strength? Does that subset of people become enabled beyond the limitations imposed by a physical disability?



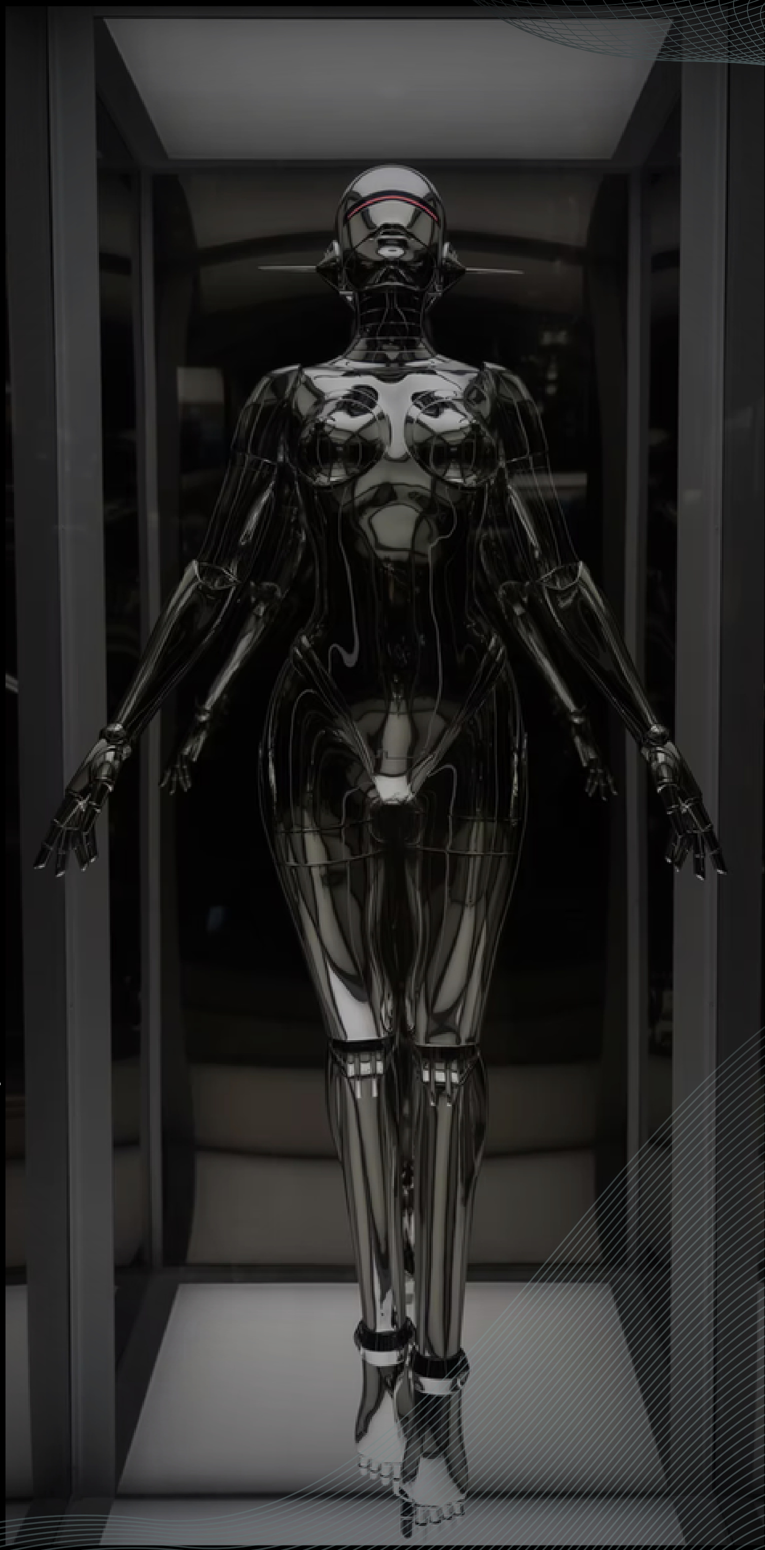
...'Round About and Back Again

The earliest mechanism for assisting ambulatory movement in bipedal humans was patented more than a century ago by Nicholas Yagn, in Russia (1890). Yagn described how his "apparatus" helped the human body walk, run and stay still. Additionally, he explained how the apparatus worked in tandem with the lower part of the human body to reduce fatigue from performing those movements, and improved flexibility when performing such movements.

This spurred a trend towards developing machines that assist or improve on human movement and physical endurance on a day-to-day basis (Mikołajewska, 2011). Research has shown the usefulness of a manufactured exoskeleton in helping those with movement-limiting diseases such as spinal cord injuries when the exoskeleton can be used as a substitute for other movement aids, such as wheelchairs: either the manual types or the powered types, with joysticks for movement manipulation (Gorgey et al., 2019; Herr, 2009). But do they do anything else apart from assisting with bearing weight, correcting posture, enforcing gait reciprocity and the like?

Peeking at the Chink in the Armour

While exoskeletons cannot directly improve the mental health of not-so-mobile users, the improved mobility of users can help them get involved in activities that correlate to better mental health outcomes.



Van Dijsseldonk et al. (2020) studied a sample of 14 patients with spinal cord injuries who used and logged their experiences wearing exoskeletons that primarily assisted in the features of proper walking, such as gait. They found that more than a third of the participants recorded positive effects on their mental and social health when they could walk inside their house and outside in public, communicate with friends in person, participate in social events in person, and even exercise at the gym. McGibbon et al. (2021) experimented with Keeogo™, a lower-limb exoskeleton for home and communal use, on 29 participants with multiple sclerosis. They found improvements in lower-limb physical ability over a two-week period of use when assessed with appropriate tests. More importantly, they found unexpected improvements in emotional well-being. McGibbon et al. also noted that the weight-load of the exoskeleton functioned as a low-level "exercise" for participants who had to carry that load around when walking.

In these two studies, exercise is mentioned as a common activity associated with the use of such exoskeletons; as is now widely accepted, there are benefits of exercise regardless of age, sex, or health condition. However, mental wellness can be affected by factors beyond physical health. For instance, stigma can have detrimental effects on self-identity.

As We Move Forward...

Various negative isms are peppered into socio-political conversations of the current decade, but ableism is sparsely discussed either at our dining tables or in debate chambers. The late Stephen Hawking, a noted theoretical physicist, cosmologist, and author whose physical abilities were affected by motor neurone disease, stated that "...we have a moral duty to remove the barriers to participation, and to invest sufficient funding and expertise to unlock the vast potential of people with disabilities" (World Health Organisation & World Bank, 2011). Such a moral duty might seem immense, complex, and even overwhelming to many. However, Lao Tzu soothes us with his proverbial wisdom: "A journey of a thousand miles begins with a single step". For individuals such as yourself and myself (reader and writer), our "single step" can be in the form of acknowledgement, patience, kindness, and assistance. When we take our metaphorical "steps", perhaps our fellow humans with physical disabilities can start to confidently take their literal steps.

Integrating Virtual Reality Into Geriatric Psychology

by Evangel Ooi

Do robots have the ability to replace humans? This question has been the talk of the decade and is accompanied by great uncertainty due to the rapid advancements in technology. One of the biggest milestones in technology is the creation of virtual reality (VR). VR has gained popularity worldwide, with 21 industries including healthcare incorporating VR into their field (Thompson, 2020). Presently, there is a global strain being placed on healthcare facilities as there is a shortage of professionals within the industry. Additionally, there is a growing population of older adults (OA) globally and this figure will continue to increase rapidly. This growth in population also means an increase in physical and cognitive disabilities, which would in turn require assistance from healthcare professionals.

So how can we reduce the strain on healthcare professionals? Well, prevention is better than cure. If we aim to prevent physical and mental disabilities, more resources can be freed up. VR has been successful in enhancing post-traumatic stress disorder (PTSD) and anxiety treatments through virtual exposure therapy (Boeldt et al., 2019). In the same way, VR can be used to prevent cognitive impairments such as long term memory (LTM) loss and dementia. VR games have been found to engage multiple brain areas involved in cognition. For instance, a VR game targeted at OA that was developed in 2018 saw OA displaying improvements in LTM capability (Wais et al., 2021). Additionally, VR has also been used in nursing homes to bring OA temporarily "out" of the nursing home through reminiscence therapy. This has been found to help reduce feelings of loneliness and anxiety (Tominari et al., 2021). Such use of VR may even increase the motivation of OA to continue with rehabilitation, especially for physical disabilities after a medical incident like stroke.

VR should thus be considered as a viable and alternative resource, since being wheelchair bound increases the likelihood of social isolation, which is a risk for dementia and mild cognitive impairment as there is reduced opportunity for social interaction (Penninkilampi et al., 2018). For others, VR may serve as mental stimulation and/or a form of physical exercise. Through VR games and activities, the brain could be kept active and muscle loss from inactivity prevented. Overall, VR is suggested to help OA reduce social isolation, loneliness, and anxiety. Hence, this not only prevents cognitive impairments but physical decline as well.

Apart from preventing physical and cognitive decline, how else can VR be incorporated into geriatric psychology? Studies have explored the use of VR for cognitive screening and assessments (Chang et al., 2020; Chua et al., 2019). You might ask, why use VR for assessments? VR provides a controlled environment that can be modified to mimic real-life situations as compared to "paper and pencil" methods where individuals may reflect perception rather than reality. A study was conducted in Singapore using the Re@ch Assessment to assess several cognitive domains such as learning and memory, and executive functioning (Chua et al., 2019). Each domain was assessed through a VR game that required hand gestures to represent real-life situations. The study reported a positive correlation with other valid assessment tools such as the Montreal Cognitive Assessment (MoCA) and Mini Mental State Examination (MMSE), indicating the future possibility of using VR as a screening tool. Additionally, the VR assessment was able to discriminate between OA with and without cognitive impairments. As VR allows for greater insights compared to traditional assessments, it may be useful to explore the possibility of VR being employed as a screening tool to identify individuals who require critical care earlier.

In conclusion, VR has the potential to be a preventive tool for deficits in memory. It may also be able to improve the quality of life for OA through decreased loneliness and anxiety. In the future, VR assessments may be utilised in screening centres for memory before OA seek help from physicians, reducing the strain on healthcare. While the engagement of VR sounds promising, VR developers are also faced with a few difficulties. First, VR is still a relatively new technology and may not be financially accessible to individuals and care facilities. Second, studies are conducted on volunteers, who are more likely to be receptive to using new technology whereas the general OA population may not be as open to using VR as a preventive and assessment tool. However, as with most electronics, the affordability should improve over time as the introduction of competitors could result in more competitive prices. Overall, therefore, VR seems to have the potential to not only become integrated into geriatric psychology but also to improve the quality of life for OA.

Beware The Tech Panopticon— We're Being Watched!

by Claire Hsieh

The tech panopticon refers to the surveillance of and data collection from societies by new technologies (Tomkins, 1998), usually to serve some purpose. Originally a work of architecture by English philosopher Jeremy Bentham, Michel Foucault expanded the concept of the physical panopticon to a metaphor to illustrate the surveillance tendencies of institutions and those in power (McMullan, 2017). In essence, the panopticon concept refers to the panopticon tower with the prison guard (the observer), placed in a central watch tower within a circle of prison cells with prisoners under the assumption of being watched at all times. With the purpose of maximum observation by the minimum number of guards, prisoners self-correct their behaviour due to the assumption of constant surveillance. Technology, then, can be regarded as a panopticon through its capacity for surveillance by surveying, controlling and modifying behaviours and opinions of its users. One main difference between the original design and technology is the invisibility of online surveillance, therefore users may or may not know of its presence.

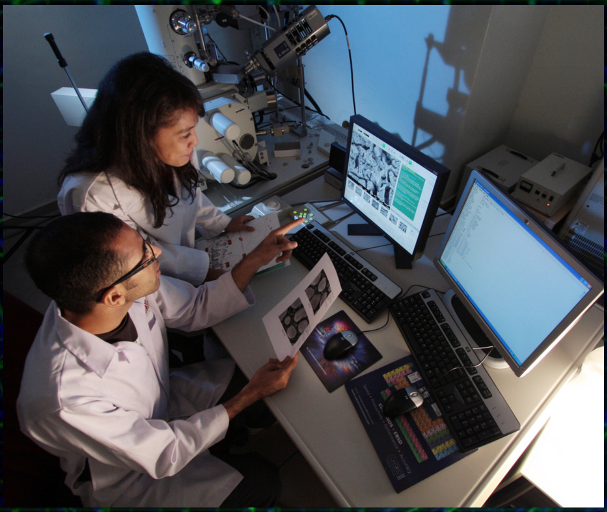
The intersection of the panopticon and social psychology can be found in surveillance studies, a transdisciplinary field that combines not only the aforementioned, but also technology and information science (Crampton & Elden, 2007). The role of technology in this equation influences social and structural changes to forms of communication on digital mediums (Bailyn et al., 1992), and its ability to amplify the intensity of surveillance and control over users can have great repercussions on social behaviour, identity and world systems at large (Spears & Lea, 1994). I shall explore how the theory of digital panopticon connects with psychology in three ways: through artificial intelligence (AI) and its consequences in the mental health industry, through the manipulation of psychology research and data for tech surveillance capitalism, and through the effects of digital surveillance on social behaviour.

Do you know that whenever you post on social media platforms such as Facebook, your written words are scanned by AI algorithms that may or may not result in law enforcement officers waiting at your doorstep (Goggin, 2019)? With recent AI developments, algorithms are designed not only to filter content based on users' preferences, but they are now also used to detect potentially dangerous posts with words or images hinting at suicide and, by extension, identifying users who may be struggling mentally. One example is Canada's federal government tapping on an Ottawa-based AI developer to detect signs of possible suicide ideation in social media posts. Based on the results of a pilot programme, the Public Health Agency of Canada "will determine if future work would be useful for ongoing suicide surveillance" (Vogel, 2018). In a recent study by Roy et al. (2020), the team trained an algorithm, "Suicide Artificial Intelligence Prediction Heuristic (SAIPH)", based on publicly available data on Twitter. With an objective of developing an algorithm with the ability to predict users' risks of suicidal thoughts using psychological constructs related to suicide, the team envisioned the possibility of it becoming a clinical decision tool to assist with suicide monitoring. With AI and machine learning (ML) having the capabilities of investigating large-scale datasets for indicators of suicide ideation, along with results suggesting high levels of accuracy in risk classification and suicide prediction, utilising these technologies has promise to facilitate suicide prevention on an immense scale (Bernert et al., 2020).

However, it is not all glitter and rainbows. In fact, there are severe implications of leaving online suicide detection in the hands of AI and ML. Quoting Natasha Duarte, a policy analyst at the Center for Democracy and Technology (Goggin, 2019), what Facebook is doing with its suicide prevention algorithm produces what "should be considered sensitive health information". Unfortunately, there are currently no regulations on governing health information in the United States as existing regulations only apply to organisations like hospitals which provide healthcare services. What does this mean, then? Technological giants such as Facebook are not subjected to the same regulations as healthcare providers, thus improper storage of such sensitive information and susceptibility to data breaches are likely to happen. Not only that, according to the American Psychological Association (2021), these algorithms are biased which can reinforce health disparities, as seen from some performing poorly with patients of color (Coley et al., 2021).

With the data sets that algorithms are trained with having more data of White people than Black and Indigenous people of color (BIPOC) , it reflects the structural racism prevalent in the United States healthcare system since BIPOC populations have less access to healthcare which results in fewer medical records from these populations. This is extremely concerning as using the existing biased data to train these technology models will only further exacerbate existing healthcare inequalities (American Psychological Association, 2021). Therefore, despite the possibility of using AI and ML to detect potentially suicidal individuals on a global scale, ethical concerns such as safety, privacy and bias need to be fully addressed before we can even consider deploying these digital tools.

When I came across the term "surveillance capitalism" coined by American psychologist Shoshana Zuboff, I was stunned by how perverse capitalism can be by using technology for its purposes. In essence, surveillance capitalism refers to the drive towards capitalism via consumer-oriented behaviour in the use of digital tools, and data monitoring from millions of people in the online space (Cosgrove et al., 2020). The insidious aspect is the use of consumer data by service providers for behavioural monitoring and prediction without the users' explicit consent. According to an article in The Guardian, digital technology has separated online users into two groups: the watchers, made up by those in power/the state/ technology giants, and the watched, who are users of any digital device (Naughton, 2019). One prominent example of surveillance capitalism is the mental health industry, specifically mental health apps that have increased in popularity during the COVID-19 pandemic. This is a point not to be missed due to how great a role psychology professionals play in mental health. The potential for technological support to replace the vital role of personalised, evidence-based treatment warrants caution. Some mental health apps collect anonymized behavioral data such as health information, digital phenotyping and digital biomarking, and send them to third-party entities without users' consent. A recent review revealed that 81% of mental health apps sent data to Google or Facebook, with 92% sending data to other third parties (Huckvale et al., 2019). With such valuable data at hand, these app developers and other third-party entities such as technology giants can make profits by manipulating individuals and, worse, forcing them to unwittingly be part of a hidden supply chain for the marketplace (Cosgrove et al., 2020).

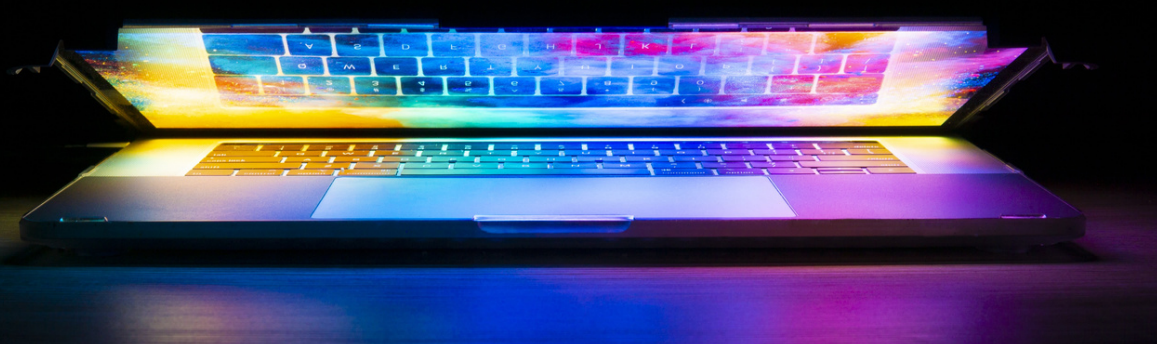


Believe it or not, despite the potential disasters aforementioned, researchers in disciplines such as neuropsychology and clinical psychology are looking into how human-computer interaction data can be used in determining gold-standard research and diagnostic measures (Dagum, 2019). It may seem enticing to do so as well developed, evidence-based technological tools can be extremely efficient, whereas many conventional neuropsychiatric measures are obtrusive, episodic, time-intensive and poorly scalable; hence not cost-efficient in a sustainable manner. As a result, researchers are looking into ways to collect and measure human behaviour through digital phenotyping and digital biomarkers. Digital phenotyping refers to measuring user behavior from device features such as smartphone sensors and keyboard interaction (Insel, 2017). Bundles of such data from a diverse range of populations can be used to assist and affect human health via personalised diagnosis, treatment and disease management (Jain et al., 2015). Digital biomarkers refer to digital footprints that provide insights into human neurology and biology such as molecular genetics, epigenetics, and brain imaging (Montag et al., 2021).

With advanced technological tools used in psychological research and diagnosis, ensuring safety, privacy and other ethical concerns is now more crucial than ever. This is particularly so when publicly available, online systems are susceptible to data breaches, and when their privatised counterparts lack standardised and strict regulations with respect to data handling. To make matters worse, according to a study by Mulvenna et al. (2021), the entire workflow for the use of digital tools such as digital phenotyping has several ethical issues such as transparency and consent, which go against the ethical pillars of medicine-autonomy (right to choice), beneficence (doing good), non-maleficence (do no harm), and justice (equal access). Therefore, one must proceed with caution when utilising advanced technological tools for psychological research and diagnosis.

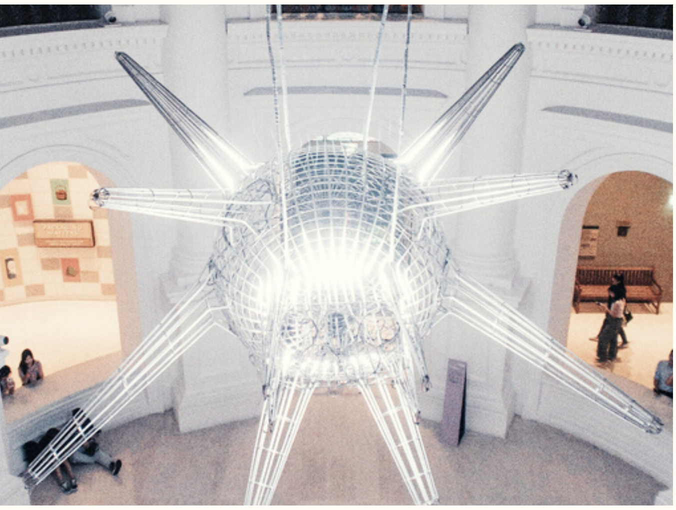
The issues I have touched on so far are occurring in online spaces. Termed as "dataveillance", the collection of large databases by governments and corporations, along with peer-to-peer surveillance of individual online content, has put all internet users at risk of being commodified by their personal information. In a sense, with the prominence of information technologies, an individual's identity lies not only in biology but also in information (Tucker et al., 2016). Digital technologies can, too, affect physical spaces and people's social behaviour. Specifically, digital surveillance such as CCTVs and cameras can influence pro-social and criminal behaviour, thus becoming a rich area of study for social psychologists. To elaborate, a study has found that the presence and knowledge of camera surveillance significantly reduces cheating behaviour (Jansen et al., 2018). Another study reported an increase in pro-social behaviour among individuals in the presence of a security camera, thus triggering helping behaviour due to digital surveillance (van Rompay et al., 2008). Therefore, in both online and offline spaces, digital surveillance has huge impacts on people's behaviour.

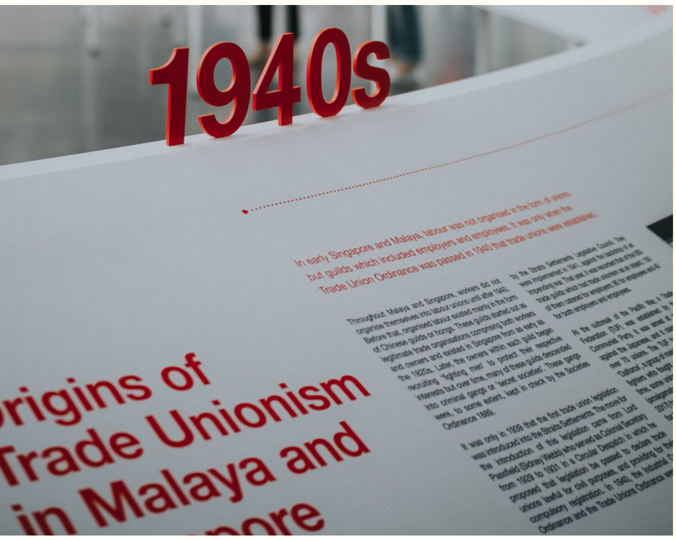
To conclude, in my opinion the tech panopticon is dangerous; the risks far outweigh the benefits and therefore, it should not even be considered a double-edged sword. Currently, data breaches of public health systems and the commodification of mental health suggest to me that the risks are too great. Furthermore, potentially disturbing issues with respect to health intervention and monitoring in the context of human-computer interaction raise questions on safety, privacy, and agency (Light, 2010). Regardless of whose hands the collected data may fall into or for what purposes it is being used by third parties, the fact remains that information (one's behaviour, personal records etc.) is being compiled the moment a human interacts with a machine. The major risk is that this becomes a one-way information avenue without clear benefit to the online user (The Ethics Centre, 2017). In this case, the technology system or algorithm mirrors Bentham's panopticon tower with its ability for data collection and surveillance. With the main difference between the original design and online surveillance being the fact that users may be unaware of its presence, the use of technologies in surveillance and data collection on society becomes the central watchman nonetheless. The situation begs several questions: How much control do I have as a user over what data is stored, to whom the data is sent, and how it is being used? When it comes to health records and behavioural monitoring, can I be assured that such data will not be used for purposes without my knowledge? While some may see this perspective as extreme, I believe it is worth considering now and possibly tackling in the near future. The reality of technology is that our online behaviours are closely watched, even in the context of mental health. Therefore, being more aware and critical of the seemingly harmless digital tools we use is more crucial than ever.



The Stories We Tell Ourselves and The Ones Told by Museum Robots

By Charmaine Wah





Up until the 18th century, museums were institutions managed by and only accessible to the powerful, educated and wealthy (Arinze, 1999; Alexander, Alexander & Decker, 2017). In Singapore today, our museums are publicly accessible spaces that conserve our chapter of mankind's collective story and the world around us. Our museums exhibit ideas from all walks of life, act as platforms for social change, and educate future generations (Hoe & Chong, 2018). Thus, it is important to be thoughtful about what goes into museums, how objects are displayed and which tools are used to draw people to visit and leave a lasting, meaningful impression. One such tool is storytelling.

Storytelling is innate in humans. It has been around for millenia serving various purposes and comes in different forms. Oral histories preserve culture, fables teach children moral lessons and word problems teach us mathematics or problem solving (Lawrence & Paige, 2016; Schiro, 2004). Hardy (1977) shares an observation that, "we dream in narrative, daydream in narrative, remember, anticipate, hope, despair, believe, doubt, revise...learn, hate and live by narrative." Research in museology[1] has found that storytelling is an effective way to educate visitors as it allows them to be emotionally involved in the museum experience and therefore engage in authentic learning (Sani, 2021; Silvaggio, 2021).

The emotional aspect of storytelling is one of its strengths and is likely a reason for its rising popularity in education (McDrury & Alterio, 2003). In the context of informal learning in museums, which are beyond the classroom,

[1] Museology is the science of organisation, arrangement and management in museums.

authentic learning is achieved when visitors are able to freely share their thoughts, feelings and questions about the exhibits. As a result, they are able to generate new insights, inferences, or conclusions (Strnad, 2015; Butcher et al., 2021).

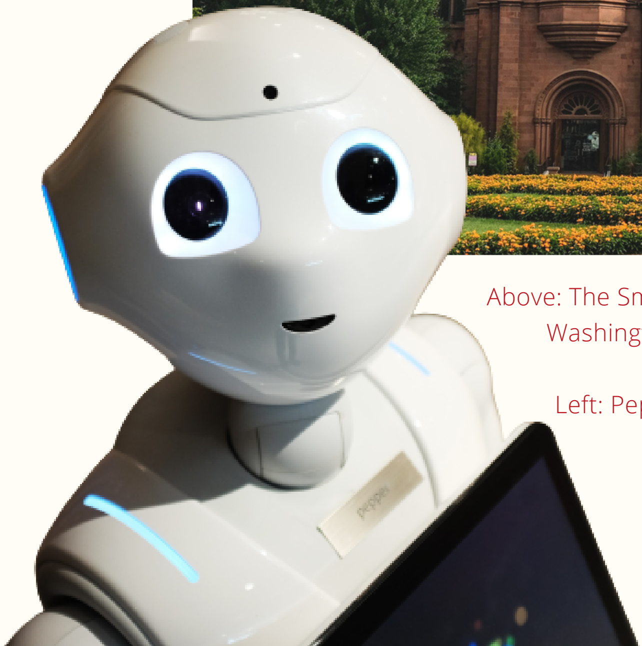
In April 2018, Softbank Robotics donated six models of the humanoid robot, Pepper, to various Smithsonian museums in Washington DC. There, they began their careers as full-time museum staff (Styx, 2021; Garun, 2018). Pepper's main tool to educate visitors was through storytelling, but can a robot strengthen the relationship between an object on display and a visitor through its stories? Can Pepper evoke the emotions necessary for authentic learning? *Should* robots like Pepper be telling our stories?

Introducing Pepper, the AI Robot

Pepper is roughly 122cm tall and can dance, pose for selfies and answer frequently-asked questions about the museum. Pepper is able to sense when a visitor is close by and subsequently engages and interacts with them. Visitors are then able to request Pepper to tell them a story. In these stories, Pepper shares information about the exhibits and inspirations behind the exhibits (Styx, 2021; Elasfar, 2018; Walch, 2020). As a new mode of museum education, these social robots successfully attracted visitors to under-visited museums and exhibits, such as the Smithsonian Castle and the Hirshhorn Museum (CNN Business, 2018). Pepper was popular with different age groups, especially children, and often drew curious or fascinated crowds. Besides the novelty of a dancing robot that interacts with you in real time, there has to be something about Pepper's storytelling that was so compelling and useful.

Pepper as a Storyteller

If you have ever felt out of your depth in a museum and were too shy to ask questions, you would not be alone. Storytelling enables authentic learning by creating a comfortable and safe environment where listeners can explore their excitement and ask questions (Dowling, 2013; Clapper, 2010). Who better to ask embarrassing or silly questions to than Pepper the social robot? In the case of children, Bettelheim (1977) emphasises that stories allow them to explore frightening things and to experience the range of emotions that ensue—fear, elation, joy or sadness. Thus, with Pepper's help, children may feel more willing to approach and learn about intimidating objects in museums.



Above: The Smithsonian Castle, Washington DC, USA

Left: Pepper the Robot

For example, at Hirshhorn Museum, Pepper was placed right next to Ron Mueck's large sculpture of a bald nude man referred to as *Untitled (Big Man)*. Pepper would prompt visitors, "What do you notice about this sculpture? Many visitors think that this sculpture looks like a real man." Pepper goes on to explain that it is a hyperrealistic[2] piece and shows pictures of what the sculpture looked like at various stages of its construction (CNN Business, 2018). Visitors can thus be reassured that the life-like giant is not made of flesh and bone, but plain old clay and paint (Hirschhorn Museum, n.d.).

Although Pepper is a promising storyteller, the model's inbuilt, limited abilities dictate the way that stories are told. Pepper's few facial expressions impede the ability to convey the appropriate emotions while telling stories. In addition, Pepper does not have the ability to vary pitch, pace or volume, to pause meaningfully or create new voices for different characters. These are important storytelling skills that allow storytellers to convey emotions, create suspense, and sustain attention (Lwin, 2012). Crucially, when a good story catches our attention and stirs our emotions, our bodies release oxytocin.

A hyperrealistic sculpture, *Mask II* by Ron Mueck, 2001–2002

2 Hyperrealism is a genre of painting and sculpture that resembles a high-resolution photograph.

Oxytocin is a hormone associated with empathy and concern for others and, thus, allows the listener to better relate to artists or historical figures by accessing their own personal experiences (Zak, 2015; Dowling, 2013; Silvaggi, 2021). Feeling strong emotional responses to stories is also germane to learning. Specifically, strong emotions facilitate the acquisition of immediate memory and the retention and retrieval of long-term memory (Osugi, & Ohira, 2018). In other words, emotional experiences are remembered vividly, accurately, and with great resilience over time (Tyng, Amin, Saad & Malik, 2017).

Ethics and Responsibilities

While Pepper's past success and the advancement of modern technology shows potential for effective and widespread use, Pepper may not always be the right "person" for the job. While storytelling is a way for people to explore ideas and perspectives that are not their own (Roberts, 1997), it is not appropriate to install Pepper in exhibits that touch upon the graver, darker histories of mankind, such as the World Wars, genocide and slavery.

These topics require both non-verbal gestures and intonations in speech to provide authentic details of those historical contexts and to garner sympathy for the groups of people who suffered and were silenced (Hohenstein & Missouri, 2018; Burdelski, Kawashima and Yamazaki, 2014; Modlin, Alderman & Gentry, 2011). *Who* tells these stories makes a significant difference in the response of the audience. A study of narrative techniques on how Plantation Houses[3] in the US are portrayed showed that the majority of their tour guides were Caucasian. These tour guides were able to foster empathy amongst the visitors; however, this empathy was directed towards the Caucasian slave masters rather than towards the African American slaves (Modlin, Alderman & Gentry, 2011). Modlin et al. concluded that, "In the end, the constant, poignant struggles of the enslaved are lost."

Oak Alley Plantation in Vacherie, Louisiana, USA

[3] Plantation Houses in the United States were first developed in the southern states. They were places of oppression where a large majority of African American slaves worked under wealthy Caucasian landowners. This occurred through the early 1600s until the abolition of slavery in 1865 (National Geographic, 2019; Holpuch, 2019).

I believe that to meaningfully educate listeners on serious topics, active exchange between a knowledgeable and discerning storyteller and their listeners should occur. This would enable listeners to clarify interpretations and overcome personal biases to better understand the reality of humanity's cruelties and tragedies as well as their compassion and triumphs. Studies also emphasise that authentic learning in museums, which involves a deep understanding of the exhibits, would require such opportunities to correct misunderstandings (Strnad, 2015; Wishart & Triggs, 2009). However, Pepper strictly adheres to a script. Museums have a responsibility to care for the stories of the people that it serves and to communicate them effectively. With Pepper's present functions and abilities, such difficult conversations cannot happen yet.

Conclusion

There is no doubt that Pepper was well-loved in the museums in which the robot served. Some people visited these museums just for a chance to meet Pepper. While social robots have obvious limits in evoking emotions in visitors and facilitating learning in museums, it is evident that they can be employed effectively to allow visitors to engage with the exhibits in a novel way. In doing my research for this article, I am reminded of how I used to love the Singapore Science Centre as a child, even as I was overwhelmed by the flashing lights, the loud sounds and the scary life-sized statue of Albert Einstein. Looking back now, I think I would have appreciated an encounter with Pepper the robot. With the speed of technology's development, I hope that we will get to see Pepper become a more effective storyteller.

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