Artificial Intelligence

The duality of 'ghost' and 'machine' has emerged numerous times since being introduced by British philosopher Gilbert Ryle in 1949. From Arthur Koestler's 1967 book *"The Ghost in the Machine",* with his criticism of reductionism, to Michael Kosslyn's book "*Ghost in the Mind's Machine*: *Creating and Using Images in the Brain"* (1983). Moving to the present, we have a documentary film "*Ghost in the Machine*" (2019) produced by DragonLight Films, in association with the Faraday Institute for Science and Religion and Cambridge University's Leverhulme Centre of Future Intelligence. And a range of commercial films provides additional evidence of our fascination with androids and our potential future, and the interplay between consciousness and intelligence.

New fields have evolved, such as Computational Psychiatry, using artificial intelligence (AI), deep learning (underpinned by neural networks), and virtual reality (VR) to study borderline personality disorder or to combat depression. Computational Psychometrics has entered the lexicon, particularly in the learning and assessment fields (von Davier et al, 2019). A new journal was introduced in 2019: *Nature Machine Intelligence* (https://www.nature.com/natmachintell/), an online - only publication of the prestigious journal Nature, providing research reports and commentary on AI, machine learning, and robotics.

So what is Artificial Intelligence (AI)?

Some fairly straightforward definitions focus on one element, such as robotics or computer programs designed to defeat human world champions in games like chess and Go. A comprehensive perspective is provided by Trent and Lathrop (2019), with the observation that the early promise of advanced technologies is often not sustained.

Morelli (2019), in citing Barney (2019), contends that AI is the collection of technologies and algorithms that imitate one or more of the following human abilities:

- Natural language processing: understanding and communicating in a human language;
- Knowledge representation: creating models based on what a system learns or perceives;
- Reasoning: using data to answer questions or draw new conclusions;
- Learning: adapting to new situations and extrapolating patterns;
- Sensing: perceiving objects or people;
- Object manipulation (in some cases): moving objects in a physical space.

Wilks (2019) believes that it is appropriate to nominate Alan Turing as an initiator of this field. Drawing in part on Turing's early work from the 1930s, Herbert Simon and Allen Newell in 1956 invented a 'thinking machine' called the Logic Theorist. This was probably the first program to simulate aspects of complex human problem solving, and was a forerunner to the development of cognitive psychology. AI in some form has been with us for many years but the basis for the recent surge is the reduced cost in computing, the computational possibilities on a single chip, and the significant increase in data volume and velocity (Morelli, 2019). Artificial intelligence is often fuelled by 'Big Data', a topic popular in the media (in relation to targeted retail marketing for example, and privacy concerns). Google returned 8 billion hits for "Big Data" (25 September 2019), and 5.7 billion hits for "AI". "Big Data University Courses Australia" produced 300 million hits, a significant number even with 'noise', whereas substituting "Psychology" for "Big Data" produced 190 million hits.

Social media analysis, facial recognition and other applications have received popular and academic attention, but these will not be addressed in this article.

Some applications of AI in our lives

Health and Robotics

Wilks (2019) sees a bright future for the development of artificial companions for infirmed or lonely people. Unlike Siri and Alexa, he believes that a companion agent would have no central or over-arching task, would

be capable of sustained communication, and be linked to one particular individual. This agent would have access to the internet for information and would establish a relationship with the user that would have an 'emotional' element. The Japanese PARO seal (http://www.parorobots.com/) provides a kinaesthetic experience through the use of numerous servo motors beneath the skin. While seemingly providing a very useful service, questions have been raised regarding the unintended consequences for both recipients and care givers when using such 'carebots' https://www.kalw.org/post/robotic-seals-comfort-dementia-patients-raise-ethical-concerns#stream/0

Other developments include the use of robotics and 3D- printed bespoke surgical tools, and potentially body parts. Robotic devices are providing amputees with greater control over some prosthetic devices, with an algorithm providing the user with high dexterity, or robust grip (Zhuang et al, 2019).

Work and AI

Human Resource professionals may be late adopters of AI in their organisations (Morelli, 2019), yet a statistic emerging from a large 2019 survey by the Mercer group reveals 40% of respondents, across 19 'geographies', saying their organisation is using AI to screen or assess candidates during recruitment (Bravery et al, 2019). The ANZ bank in Australia is starting to use AI in their selection practices, although a 2018 article does not make it clear if Game- Based Assessments (GBAs) are being used in conjunction with automated resume screening, coding and classification https://news.efinancialcareers.com/au-en/318729/organisations-turning-artificial-intelligence-improve-recruitment-processes-heres-can-benefit-candidates-sc

> "The technology is being used to build predictive models, based on ANZ's existing employees and their performance data, to assess how aligned potential candidates' capabilities are to specific roles."

Some issues associated with the use of AI

While a randomised control study by ANZ is unlikely to be feasible, the following issues with people data need to considered:

- Definition or measurement of the criterion (for example 'performance') can mean different things to different people or organisations; and the comparison group (for example. 'regional office') may not be homogenous.
- Lack of sufficient or relevant data
- Unreliable or inaccurate data
- Restriction of range: it can be hard to develop an algorithm if the variable you are trying to predict has little variation. This is often the case with performance data based on ratings by managers. And current employees have already been filtered prior to initial selection.
- Inappropriate modelling or statistical analyses: is the algorithm appropriate when based on only one set of data but then used in another setting? How is error (and the treatment of residuals) managed?
- Bias: pre-existing bias in the input data or the judgement of program developers can perpetuate discrimination (for example the gender bias in Amazon's automated resume selection tool as noted in Dastin, 2018). However the issue of bias is not confined to modern predictive analytic techniques.
- Construct relevance: what does the input data really represent? This is a particular concern with emerging technology-based assessments where many thousands of data points such as 'click time' or 'hover time' can be gathered during online testing.

Predictive analytics can be problematic, including the prediction of sporting team performance, where the broad picture is likely to be more accurate than game specific predictions. Dawson et al (2019) provides a case study of predictive policing in Brisbane with a system that can predict long term (or broad) crime trends, but not short term (or specific) ones.

A positive example of modelling and predictive analytics was provided in the containment of the September 2019 fires on the Sunshine Coast, Queensland. The Queensland Acting Premier twice used the term

"predictive analytics" during a television interview, attributing the relatively light damage to the actions of emergency service and police personnel, in conjunction with effective forecasting techniques, perhaps in real time.

A report on BHP in *The Weekend Australian* of 28 - 29 September 2019 describes the huge impact of robots and autonomous vehicles (AVs) in industry. However the issue of bias in AI systems needs to be considered along with that of the moral dilemma that is posed in the programming of such. Dawson et al (2019) notes the significant impact of human error in car crashes. But the authors also identify several ethical challenges that may occur with AVs even where a utilitarian approach is employed, maximising benefits and reducing harm for the greater good. Should an AV, for example, 'choose' to hit vehicles with greater crash-worthiness if a multi – vehicle accident is unavoidable, and how would this affect the decision by people to drive safer vehicles? And if an AV needs to make a life or death decision, will the preservation of young lives be given priority over the lives of older people? While this appears to be true in western cultures, eastern cultures have favoured protection of the elderly (Dawson et al, 2019). Similar issues are likely to emerge with the development of 'robo crime fighters'.

The issue of future job loss is often raised when talking of robots and automated systems. A topic for another article, it may well be appropriate for AI to answer this in the future!

Ethical frameworks for AI

This has been a hot topic globally during 2019.

In September 2019, *Nature Machine Intelligence* published *"The Global Landscape of AI Ethics Guidelines",* by Jobin, Lenca & Vayena. The authors conclude that there are five globally converging themes in relation to AI and ethics: transparency, justice and fairness, non-maleficence, responsibility and privacy. The Data 61 CSIRO discussion paper "*Artificial Intelligence: Australia's Ethics Framework"*, released for public consultation in March 2019, also includes contestability (to allow a person to challenge the use or output of the algorithm) and accountability (by people and organisations). Standards Australia released a discussion paper in June 2019, "*Developing Standards for Artificial Intelligence: Hearing Australia's Voice"* and this was followed in July by the release of "*The Effective and Ethical Development of Artificial Intelligence: An opportunity to improve our wellbeing",* published by Australian Academies of Learned Academies (ACOLA).

The call for 'explainability' in AI is evident in the 2019 CSIRO publication, as well as the highly regarded *"Standards for Educational and Psychological Testing"* (2014), a joint publication by AERA/APA/NCME. "Automated scoring algorithms should be supported by an articulation of the theoretical and methodological basis for their use…the automated scoring algorithms should have empirical research support…as well as evidence that scoring algorithms do not introduce systematic bias against some sub-groups" (pp 91-92). Nevertheless, Landers (2019) argues for a more nuanced treatment of 'black box solutions', particularly where complex neural networks provide more predictive power than an alternative explainable approach.

In 2019 The Capgemini Research Institute released a report *"Why Addressing Ethical Questions in AI Will Benefit Organizations".* For consumers the key ethical concerns in AI use were found primarily in health care and insurance, with lack of consent, inappropriate data use, and "reliance on machine-led decisions without disclosure" the main culprits. These were issues raised in various European countries, as well as in China, UK and USA.

AI and the profession of Psychology

Issues with automation and the rise of artificial intelligence were raised by Innes and Morrison (InPsych, April 2017). The reader is referred to this 2017 article, as well as the "*Case Study on AI and the Impact on Psychologists*" in the ACOLA publication (Walsh, Levy, Bell, Elliott, Maclaurin, Mareels, and Wood (2019, pp 78-79). This case study is based upon an input paper by Mike Innes (2018) and is sobering reading for psychologists. Innes argues that there are four tasks that are undertaken by all psychologists: assessment, formulation, intervention, and evaluation. These four elements could well be handled by automation, and

thus overcome the influence of human biases in judgement and decision making in various domains such as psychotherapy (Lilienfield et al 2014), as noted by Innes. We could add to this recruitment and selection (Slaughter & Kausel, 2014), and human judgements more broadly (Kahneman, 2011).

Psychologists are poorly equipped to embrace technology in a manner that will ensure we 'have a voice at the table'. Landers (2019), in writing about existential threats to I-O psychologists, calls for Technology to be included in I-O postgraduate programs. The robotics industry is expected to be worth $23 billion globally by 2025, and Australia is a leader (report in *Australian Financial Review*, 12 March 2019). Further, we are totally dominated, numerically, by software developers and programmers (Putka & Dorsey, 2019). These are the people involved in people analytics, with little psychological or behavioural knowledge and variable appreciation of the ethical and even statistical issues as raised in this article. Just as we are encouraged to understand the 'language' of our clients, including business language for organisational psychologists, we need to be much more savvy in our understanding of the Psychology - Technology interface. Perhaps then we can buffer our future, and work collaboratively with others in this Brave New World.

POSTSCRIPT

The 60 page Data 61 "*Roadmap*" report was launched in Canberra by Minister Karen Andrews on 15 November 2019. *Healthcare* (my emphasis), urban development and natural resource management have been identified as some of the key areas for AI specialisation and export.

Given the impact of technology and AI on so many aspects of life in Australia, it is concerning that the profession of psychology was invisible in 2019 following the release of the three Australian reports. In the ACOLA publication there were two input papers from psychologists: Mike Innes (Adelaide, and as noted in the article) and Sharon Parker (Perth, in relation to work design), but the health domain of psychology has tended to eschew technology beyond just use of apps and other mechanisms to streamline case-based workflow. However this may change, as COVID – 19 produced significant challenges for psychologists in relation to assessment and interventions in light of the physical restrictions. We can only hope that in the near future the profession is more active in shaping education, policies, standards, and good practice in relation to effective and ethical use of AI enabled technology in society.

Peter Macqueen FAPS Nov 2019 (minor update Nov 2020)

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Note: this report was live streamed in August 2020: see link above

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(see also a more recent post re: facial recognition: https://www.reuters.com/article/us-usa-crime-face-idUSKBN1YN2V1