

NESSERA



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E ECONOMICS**S** SOCIETY**H** HISTORY**T** TRAVEL**K** KNOWLEDGE**W** WELLBEING**P** PSYCHOLOGYPAUL JONES
EDITOR

PROLOGUE

THE SECOND EDITION OF TESSERA IS A RENEWED EXPRESSION OF JOY, FAITH AND INTELLECT. THROUGHOUT THE EDITORIAL PROCESS I HAVE BEEN DETERMINED TO CAPTURE THE DEPTH AND BREADTH OF ACADEMIC ENDEAVOUR IN OUR COMMUNITY.

The intention is always to highlight an eclectic range of interests, to encourage pupils to pursue the things they care about, to explore them in depth and to see where the journey leads. Submission to Tessler is an opportunity for pupils to define the terms of an enquiry, to pursue a topic with untempered passion and to share it with their peers.

In the face of the challenges of the past year we know that the strength and faith of our community remains a compelling force for good. These pages are a demonstration of our Benedictine ethos, not in a constructed and mannered way, but because it is what guides us and is layered throughout everything we do, especially teaching pedagogy and student endeavour.

My role in this process is pragmatic and professional. I gather together the submissions and read them with awe. I am reminded throughout that I am intensely proud to have edited this journal, and of the breadth and diversity of this amazing school.

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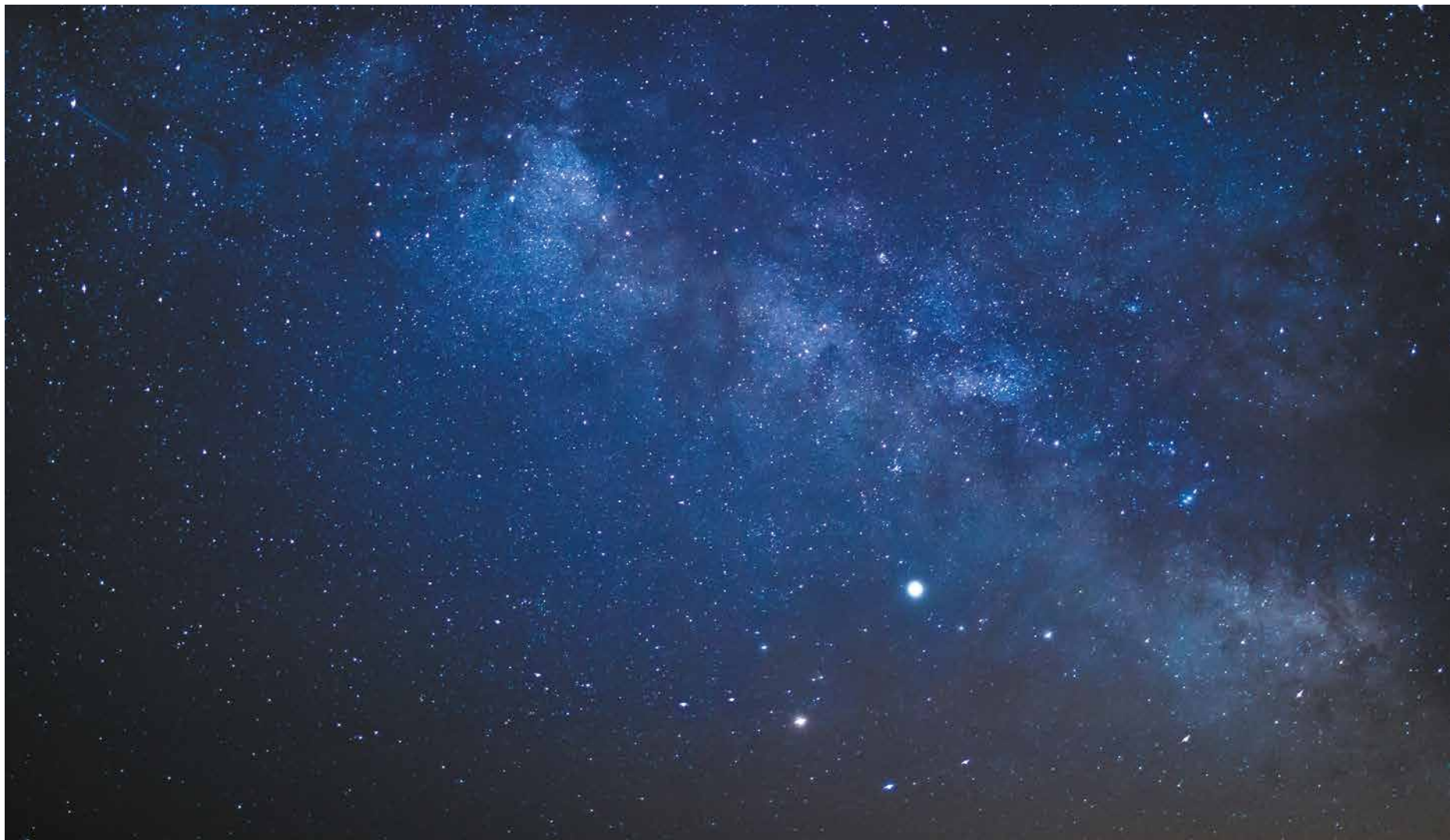


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THE BENEFITS OF SPACE EXPLORATION

'WE CHOOSE TO DO THESE THINGS, NOT BECAUSE THEY ARE EASY, BUT BECAUSE THEY ARE HARD'



FREDERICK DALGLIESH

MANKIND HAS A DEEP DESIRE TO KNOW WHY AND HOW THINGS HAPPEN AND TO PUSH THE BOUNDARIES OF WHAT IS POSSIBLE. THIS IS EMBODIED, BOTH METAPHORICALLY AND PHYSICALLY, IN SPACE EXPLORATION.

However, criticism of the project is never far away. Some argue that the US government spends too much of the federal budget on the space programme; money which could be invested into other parts of society. There is a tension between long-term gains, abstract aims – courage, our thirst for exploration – with our immediate, short-term needs.

Six hundred million people watched as Neil Armstrong took the first steps on the Moon and basked in the shared sense that the impossible was possible. The Apollo program inspired people to believe in space exploration as a force for the development of the human race. It pushes the boundaries of our scientific age through collective effort, but also has the capacity to inspire people, uniting them behind a common goal or aspiration.

Spin-offs in strange places

As well as the global scale of ambition, there are some startling trickle-down effects from the space programme, extending even to household objects. Innovative solutions to the inhospitable environment of space are often repurposed for use on Earth. Solar panels, baby food, swimsuits, scratch-resistant lenses, and smoke detectors all stem from space technologies. Temper foam, more commonly referred to as memory foam, is elastic and firm yet can mould itself to anything. It was invented so that a person's body weight could be distributed evenly and so comfort would be maintained during long distant flights. This technology is now mainly used in mattresses, as it not only retains heat but allows for a comfortable night's sleep.

In space, everything is reused. Astronauts need water, so NASA scientists developed special filters to purify the water supply during shuttle missions.



The technology created has since been used at municipal water plants in developing countries as well as in medical facilities for water purification.

The list goes on. Technology used by Deutsche Bahn to check hydraulic brakes on trains can be traced back to sensors used to measure re-entry conditions of European spacecraft. Think about this next time you're interailing in a stifling train carriage somewhere in eastern Europe.

The head of the European Space Agency (ESA) technology transfer programme said that, since the start of the programme, they have developed an additional 250 spin-offs. NASA claim a staggering 2000 spin-offs since 1976. Some of these are now everyday items; visor protection for astronauts ensures your smartphone and glasses remain scratch-free. It is a 'dual ion-beam bonding process' if you really want to know, and involves a thin, diamond-like layer.

It isn't just household items and our convenience that have benefitted. When NASA engineers developed a scanning system in order to locate a safe landing spot on the moon, it

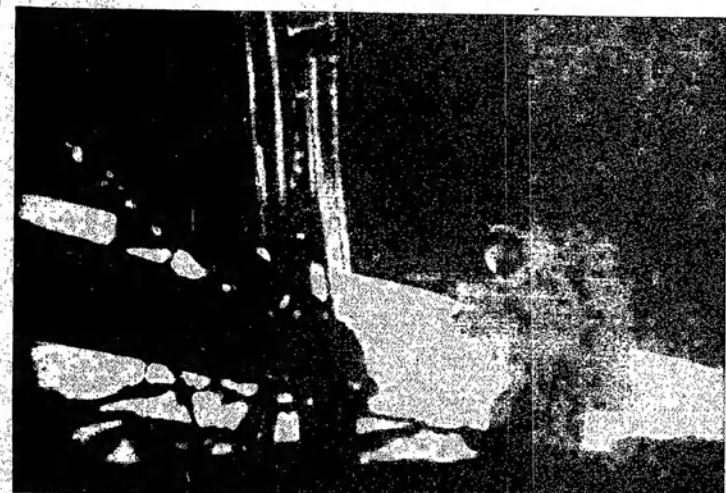
involved the use of high-frequency sound waves, magnets and super-computers. This new scanning technology was based on ultrasound and the technology has been applied to CAT scans in hospitals around the world, producing detailed pictures of organs and other body structures.

In space no one can hear you spend money

NASA received 0.47% or \$21.5 billion of America's total discretionary budget in 2019. This money pays a highly skilled workforce and goes to the wider community through personal spending. In the 1960s the Apollo program amounted to 4% of all federal spending, with 34,000 employees and 375,000 contractors. The total cost of the Apollo project equates to \$153 billion. This is balanced against a projected 'return' of \$181 billion. NASA's economic impact is calculated at \$21.6 billion in sales and benefits plus \$355 million in federal corporate income taxes¹. In addition, Frank M. Salzgeber, Head of ESA's technology transfer programme office, said that the space program supports 75 new start-ups yearly across Europe.



Armstrong and Aldrin steer Eagle to a perfect touchdown



Neil Armstrong steps from the lunar module lander to become the first man on the moon.

3 56 am : man steps on to the moon

By ANTHONY TUCKER

Men are on the moon. At 3 56 this morning Armstrong stepped from the lunar module and set foot on lunar ground. It was the fulfilment of a dream which men have shared since the beginning of recorded history. Aldrin followed his commander down the steps of the lander—already named Tranquillity Base—19 minutes later.

Armstrong reported that the surface seemed to be a very fine powder into which his feet sank about one-eighth of an inch. He could see his footprints clearly.

Armstrong's first words on the moon were: "That's one small step for man. One giant leap for mankind." The first television view millions on earth saw was Armstrong's foot descending slowly. Then there was his full figure.

"It's a very soft surface, but here and there where I poke with the sample collector I run into a very hard surface," he said. "It appears to be the same material." The moon "has a harsh beauty all its own," Aldrin reported. "It looks like the desert of the United States, but it is very beautiful."

Aldrin experimented with movement in the low gravity, and remarked that a moonwalker had to be careful to lean in the direction he wanted to go or he would lurch around "like someone slightly inebriated." When they started to examine their surroundings Aldrin reported finding a purple rock.

The decision to walk early was made three hours after the lunar module Eagle had made a perfect landing at 9 17 p.m. four miles downrange from the chosen site. The spacecraft was steered manually to clear a boulder-strewn crater "the size of a football field." It was a moment of extraordinary tension and silence. The lunar module curved gently down over the Sea of Tranquillity, its drama heightened by the calm, almost casual voices of the astronauts and the mission controller at Houston.

The landing was perfect. Spacelift Centre and the world seemed momentarily stunned by the announcement. Armstrong, Aldrin and the lunar module were seen on television screens. The landing site was a flat, sandy plain, which would shelter the lander. Armstrong and Aldrin reported that the surface was a fine powder. The lunar module was seen to descend to the surface. The lunar module was seen to descend to the surface. The lunar module was seen to descend to the surface.

'A step for a man—a leap for mankind'

Luna keeps secret

Neil Armstrong, the Apollo 11 commander, crawled feet-first out of the lunar module's hatch shortly before 4 a.m. today and climbed down a ladder to become the first man to set foot on the moon.

"OK, Houston, I am on the pad," he said at 2 59 a.m. as he stepped down on to the lunar module's extended leg. He described the lunar soil as like powdered charcoal and said his boots were in only about an eighth of an inch.

"This is one small step for a man," he said as he stepped from the lunar module on to the moon, "but one giant leap for mankind."

He reported finding no difficulty in moving about on the moon's gravity, one sixth of that on earth. Half way down the ladder he pulled a lever to deploy the television camera that recorded his first historic step on to the surface.

As the television pictures came on at the Space Centre in Houston a wild cheer went up from your televisions. The moon's surface was seen to descend to the surface. The lunar module was seen to descend to the surface.

Soil collected. After getting his balance, Armstrong's first action was to stoop into a hip pocket in case he had to make a rapid return to lunar module, Eagle.

Shortly after that he was joined on the surface by Edwin Aldrin. At Aldrin's laced-out of the hatch, guided by directions from Armstrong, he joked: "I'm making certain not to look at..."

The black and white television gave superb pictures of both Armstrong and Aldrin as they stepped onto the lunar module's landing gear. Aldrin said: "I can bend down easily. I can shut my eyes. It really seems easy."

Pause for thanks. Nearly three hours after touchdown, Aldrin sent a special message to Houston. "This is the LM pilot," he said. "I'd like to take this opportunity to ask every person listening in, wherever and whenever they may be, to pause for a moment and contemplate the events of the past few hours, and to give thanks in his or her own way."

Aldrin is an elder and lay preacher of a Presbyterian church at Webster, Texas. He is 40 years old and is the youngest of three children.

Motor as brake. From that moment, with the engine mounting second by second and with the minimum intervention from earth, or from the orbiting Collins, the lunar module bore Armstrong and Aldrin over the surface of the moon as a brake and slowly tilted until it was upright and ready for landing.

On the down-past "high-gate" at 2 00 p.m. with the brake, the spacecraft rotated so that its nose pointed directly at the point at which the final approach began.

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The Apollo 11 landing site, circled on the map, is on the southern border of the Sea of Tranquillity, close to the lunar equator. This area is one of seven chosen because of their comparative absence of obstacles. The other landing sites, some of which would bring men close to earlier unmanned moon landing spacecraft, will be used in later Apollo missions.

In 1997 a poll was carried out in order to learn the public's view of NASA spending and federal budget share; the approval rating was a low 20%. However, American taxpayers spent less than \$9 per person on NASA; a tiny amount of an individual's tax goes toward the NASA budget. In contrast, the defence budget stands at \$686.1 billion. There are dissenting views. Ralph Lapp (1968) wrote in the *New Republic* that NASA should be able to sustain itself as a private company. Mike Wall criticises NASA for sinking money into the Space Shuttle program with less money available for long-term missions to Mars and deep space. Some cite the 'per flight cost' – a whopping \$1.6 billion per flight, and question whether this represents value for money.

Resources and survival

There is a clear imperative to space exploration: our survival. Stephen Hawking was attuned to the dangers for humanity: 'I don't think the human race has a moral obligation to learn about space, but it would be foolish and short sighted not to do so. It may hold the key to our survival. I see great danger for the human race.' Overpopulation, scarcity of resources, global pandemics, climate change and pollution threaten our future. Hawking argued that we must 'voyage out into the blackness of space to colonise new worlds across the cosmos'.

Scientists argue Mars is the most promising planet. It is similar to Earth; a Martian day lasts 24 hours.

There are polar caps and sun-baked deserts, giant volcanoes and mighty canyons. However, the Martian year is far longer, 687 Earth days, since it follows a much larger orbit. Mars was formed at roughly the same time as Earth, 4.5 billion years ago, and through the same process as Earth: it was bombarded by comets and asteroids. Therefore, the materials which make up the planet are also similar. The lower gravitational field is a bonus in space travel terms; less fuel is required to get there. It has water and is on the edge of the habitable zone. This region can support liquid water if concentrated greenhouse gases are able to increase the atmospheric pressure (Zubrin, McKay, 1993). Mars also has a geological history which suggests it once contained a dense atmosphere which was similar to Earth's today. There are disadvantages: namely low light for plant growth and no magnetic field, meaning damaging solar winds and radiation. The atmosphere of Mars is 100 times thinner than that of Earth, and made up of 95% carbon dioxide. It could sustain life but will need 'rapid heating' through terraforming. There are doubts as to whether the atmosphere holds sufficient carbon dioxide or this has to be 'engineered'. However, NASA say that 'terraforming Mars using the planet's known carbon dioxide will thus need technologies far beyond our current grasp. Any such efforts will have to be very far into the future'². Space visionary/quirky billionaire Elon Musk challenged this view, suggesting we could detonate thermonuclear bombs at the poles, vaporise the ice caps and liberate water and carbon dioxide.



We must 'voyage out into the blackness of space to colonise new worlds across the cosmos.'

² Rice, 2019

Spacecraft Soyuz and Space Station
Credit: 3DSculptor / iStock /
Getty Images Plus / Getty Images

‘We have a desire – and a right – to dream and explore.’

NASA astronauts Robert Behnken, foreground, and Douglas Hurley board the SpaceX Crew Dragon spacecraft for the Demo-2 mission launch, Saturday, 30th May 2020

© dpa picture alliance / Alamy Stock Photo



Climate scientist Michael Mann from Penn State University has challenged this idea and the attendant risk of a nuclear winter.

Aside from the potential for colonisation, resources are an important area of research, focusing on the Moon and asteroids. The latter contain iron and magnesium silicates, as well as metallic nickel-iron, platinum and other elements. They have a low gravitational field, meaning they are easy to access, and could be used as refuelling stations in the future. The Moon contains cobalt, iron, gold, platinum, titanium, tungsten, and uranium and helium-3. Crucially, helium-3 has the potential to fuel nuclear reactors offering clean and efficient power

generation, with no radioactive waste. It is emitted by the sun and carried through space by solar winds. It is estimated that 1.1 billion tonnes of helium-3 have been captured in the top few meters of the Moon's surface, worth \$3 billion a tonne. 100 tonnes of helium-3 could fuel the Earth for a whole year.

It isn't just resources though, that have scientific and material benefits. NASA argue that space exploration expands technology, creates new industries, and creates alignment between nations. For example, 15 countries were involved in the construction of the International Space Station. The ISS provides opportunities for exo-medicine, or medicine in zero gravity.

Gravity has an effect at a molecular level on everything. Using the ISS means gravity can be completely eliminated from the equation. Medical advancements as a result of working in zero gravity include programmable pacemakers and laser angioplasty.

Catastrophic risk vs spectacular reward

Space travel is inherently risky. Errors tend to be catastrophic, resulting in the death of the crew and destruction of the space craft. Four disasters have taken place in space, with 18 lives lost³.

³ Christensen, 2019

The majority of disasters take place on Earth during the preparation phase. On 27th January 1967, a flash fire swept through the Apollo I command module during a launch rehearsal test. The three men inside the module perished despite the efforts of the ground crew. Despite the devastating tragedy, NASA and Christensen argue that it transformed the space programme and the response led to the success of Apollo 11. Similarly, the Challenger disaster in January 1986 became a case study in institutional practice and changed the way NASA worked, increasing safety and effectiveness.

One area of concern is pollution of earth orbit with 'space junk'. The ESA estimates that there are 3,200 large bits of space junk orbiting the planet. Since there is no air resistance in space, once space debris starts moving, it doesn't slow down. It is a significant threat, both to working satellites, and the ISS. These are just the big ones; there are 34,000 man-made objects which are greater than 10cm – and pose a significant risk on impact. The chain reaction scenario was explored to brilliant effect in *Gravity* in 2013. Space travel is expensive in nominal terms, but it is not a binary argument. Money can be spent elsewhere, but that does not take into account the wider benefits of the space programme. These are scientific, material and also holistic; the desire to learn and discover what surrounds us can be satisfied. What's more, ambition is what drives humanity to better itself. We have a desire – and a right – to dream and explore. **T**

SELECTED BIBLIOGRAPHY

Vatsal, Vishesh, (2018) All the Arguments For Space Exploration Ever. Medium. (10th May 2018) [online] available at: <https://medium.com/teamindus/all-the-arguments-for-space-exploration-ever-677858e7e0ae> [accessed 12th November 2019]

2010, Top Ten NASA Spinoffs. Zidbits. (last updated 1st November 2017) [online] available at: <https://zidbits.com/2010/11/top-ten-nasa-spinoffs/> [accessed 29th October 2019]

2006, Earth: Past the point of no return. Phys.Org. (last updated 16th January 2006) [online] available at: <https://phys.org/news/2006-01-Earth.html> [accessed 25th December 2019]

2020, Space debris by the numbers, European Space Agency. (last updated 2020) [online] available at: https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers [accessed 7th January 2020]

Wormald, Benjamin, (2014) Americans keen on space exploration, less so on paying for it, Pew Research Centre. (last updated 23rd April 2014) [online] available at: <https://www.pewresearch.org/fact-tank/2014/04/23/americans-keen-on-space-exploration-less-so-on-paying-for-it/> [accessed 15th November 2019]

Lapp, Ralph E., (1968) A Case for Cutting NASA's Budget, The New Republic. (last updated 30th March 1968) [online] available at: <https://newrepublic.com/article/60759/case-cutting-NASAs-budget> [accessed 14th November 2019]

Wall, Mike, (2012) Should NASA Ditch Manned Missions to Mars? SPACE. (last updated 5th August 2012) [online] available at: <https://www.space.com/16918-NASA-Mars-human-spaceflight-goals.html> [accessed 15th November 2019]

McKay, Christopher P., Zubrin, Robert M., (1993) Technological requirements for terraforming Mars, NASA Ames Research Centre. (last updated n.d 1993) [online] available at: <http://www.users.globalnet.co.uk/~mfogg/zubrin.htm> [accessed 17th December 2019]

EXPLORING POLONIA

| POLISH MIGRATION TO BRITAIN

NIKODEM BAEHR

As a Polish pupil in Downside I am both within and without; a part of the school community, culture and tradition, but also a part of Poland. Being aware of the wider context of Polish migration to the UK I wanted to find out more about the cultural context and background. The best place to start is the end of the Second World War when the Soviet Union took over. Socialism and a centrally planned economy became Poland's economic system. During the time of communism, the country had an economy which was run by the state. The high degree of centralisation and restriction had a profound effect on our cultural identity. However, in 1989 this changed almost overnight: years of opposition from *Solidarność* and the end of the Berlin Wall led to a pivotal moment in history; the socialist and capitalist systems came into collision; all restrictions on the movement of people evaporated.

There followed several milestones, from 1989 to now. Poland introduced 'shock therapy', making dramatic changes to the economy and transforming to a free-market economy (Kenton, 2019). Between 1990 and 1991, more than half of the state-owned companies were privatised (Dąbrowski, 1995).

By the end of 1991, around 80% of Polish shops were owned privately and more than 40% of the goods from abroad were imported through the private sector.

Devaluation took effect on 1st January 1995. Prior to this, prices for sugar or coffee were reaching thousands of zlotys. For example, in December 1990, a kilogram of sugar cost around 5000 zlotys (Koszyk Polityki, 1991). Polish people could not travel abroad whenever and wherever they wanted. Their passports remained 'state property', held in police stations and released only if the authorities deemed it appropriate.

Polish standards of living were low, partly due to Soviet influence and the hierarchies of communism. But the post-communist transition was the key marker. There was a shortage of products on the market, including food (Cieślak-Wróblewska, 2020). GDP collapsed after the fall of communism; inflation rocketed. The government reduced wages, removed price controls and privatised the public sector. As a result GDP decreased significantly by almost 10% (IMF, 2019). Gross agricultural production declined by 2.2% in 1990 and by 2.4% in the following year.

Consumption, one of the components of aggregate demand, declined but increased in the following year (Bratkowski, 2020). The Balcerowicz plan avoided the terrifying spectre of hyperinflation – projected to reach 7000% by the end of the year (Cieślak-Wróblewska, 2020).

As a part of the reform process Poland applied for European Union membership in 1994, joining in 2005. Poland's accession to the Union imposed many changes. In the years 1990-2000 the average annual growth of GDP was 4%. Overemployment ended, state sector jobs reduced from a Cold War high of 12 million, and the economic transition imported western-style, capitalist values.

By the end of 1991 unemployment had risen to 12.2%. State-owned collective farms suffered the most with the removal of substantial state subsidies. Those people who had enough money could purchase 'their' old land back; only a third managed to do so. With substantial job losses many sought agrarian work abroad.

1980-1990
NSZZ



‘By 2015, Polish people became the biggest foreign group living in the UK, at nearly a million and more than India, the next highest.’

Large-scale emigration

The most important reason to move from one place to another is the vision of an improvement in living standards and personal skills, often accompanied by a dream of higher wages. The substantial wage gap between Poland and the west is a clear motivator. In 2018, the difference between the annual wages in the UK and in Poland was \$15,000. A person working in McDonald’s in the UK is paid an hourly wage 5.5 times higher than a person who has the same job in Poland. The ‘Big Mac index’ is equally telling; a UK McDonald’s cashier could buy two Big Macs for one hour of pay: in Poland they would be able to afford a small section of one burger – maybe the lettuce. According to Reinis Fischer, Poland sits in 22nd place in the average net salary ranking in 2018. Denmark leads the ranking with an average of €3,270 per month, compared with 784 in Poland.

There is a pattern in surveys on emigration; many Polish people work and live abroad, but they want to support and help their families financially. In the last 12 years, Poles who worked in the EU countries have sent almost zł234 billion (£47 million) back home. There is a desire to transfer resources back and to support those still at home. As long ago as 1885, Ernst Ravenstein, in his book *The Laws of Migration*, wrote that ‘the most common reasons for emigration are: bad and burdensome rights, high taxes, unattractive climate and surroundings. However, none of these reasons can be compared to the desire for having more money and other materialistic items and improving one’s standard of life’ (Georgica, 2018). For most Poles, this extends to improving the standard of life of those closest to them, even if they are paradoxically furthest away.

Destinations

EU accession saw a significant increase in migration. The UK, Germany, the Republic of Ireland and the Netherlands became the four most popular destinations (Bevanger, 2019). All are within the Shengen area and the UK has the biggest labour market and one of the highest minimum wages in the world. In 2018, it accounted for 53% of the median wage (The Economist, 2019).

An initial exodus of 26,000 citizens was followed by smaller increases, 3,000 or so. As of 2017, there are around 2.5 million expatriate Poles, with 90% in EU countries (Kostrzewska, Gudaszewski, 2018), or 7% of the total population and more than the population of Warsaw. It became evident particularly in the UK. By 2015, Polish people became the biggest foreign group living in the UK, at nearly a million and more than India, the next highest.

Outside of the EU, the USA has gone through four waves of Polish immigration. The latest wave began in 1989 (Ania, 2016). The figure remains substantially lower than that for the UK, at 219,000 people. The American Polish diaspora – or Polonia – is substantial but has become established over a much longer time frame, in keeping with the USA’s ‘immigrant’ identity.



The Palace of Culture and Science, Warsaw, Poland
Credit: Marcus Lindstrom / iStock / Getty Images Plus / Getty Images

Who leaves?

People who live in the countryside or the eastern, poorer part of Poland are the most eager to leave the country. They account for 38% of those who have emigrated (MT, *Newsweek*, 2018). Least likely to emigrate are residents of metropolitan centres like Warsaw and Krakow. These account for 12%.

Young people with secondary or higher education are more likely to emigrate (Georgica, 2018). 53% of people who want to leave the country are either unemployed or still at university; it is a form of ‘brain drain’. Similarly, people who have a secondary education, either vocational or comprehensive, account for half of the emigrant population. Two-thirds of emigrants living in the UK between 2001 and 2011 spoke English either well or very well.

The majority of Poles who officially emigrated to the UK between 2001–2011 occupied elementary jobs. Accounting for another third were skilled trade workers and process, plant and machine operators. The most common industries where Polish people found a job were hotels, restaurants and the distribution of goods. Almost every third person worked in those industries, sometimes regardless of prior qualifications, i.e. post-university degrees.



Conclusions

For Polish emigration pull factors outweigh push; the reasons are economic, not political or social. 2.5 million people have left the country since 1989. People decided to emigrate with the advent of freedom after the fall of communism. They started looking for better places to live and higher wages. There then followed significant movement of people after accession to the EU in 2004. Again, there is an underlying theme of economic migration. As of 2020, almost a million Poles have moved to the UK. It is accessible and for a majority of Polish people, English is their second language.

Since 2005, 99.5% of pupils have been taught English in primary and secondary schools (Okólski, Salt, 2014).

The expatriate view of Poland has been that it is an unstable state, subject to challenging reforms and an uncertain future. The Polish diaspora would far rather be in Poland, their home, but the desire for a better life is the main driver behind the significant step of moving to another country; and many seek to return home at some point. One other element is clear; the history of culture and both the UK and Poland is intertwined; Polish pilots fought at the Battle

‘The recent process of migration and expatriation brings benefits to both nations, and my experience at Downside is just one example; I benefit from the experience, the cultural exchange, and I am able to use these experiences in my life.’

of Britain; there is a shared history of cultural and intellectual endeavour. The recent process of migration and expatriation brings benefits to both nations, and my experience at Downside is just one example; I benefit from the experience, the cultural exchange, and I am able to use these experiences in my life. I look at other people in the diaspora, past and present – Sir Joseph Rotblat, Waldemar Januszcak, Mel Giedroyc, Peter Serafinowicz and Paweł Pawlikowski who makes films exploring the world through cross-cultural interaction – and I see hope for the future. **T**

SELECTED BIBLIOGRAPHY

Barczyk, K., (2011) *abc maturzysty*. Geografia Adamantan, Poland
 Privatization in Poland and East Germany: A Comparison. Vol. I, edited by Quaisser W., Woodward R. and Błaszczak B., part written by Dąbrowski J., pp. 289-303, Osteuropa-Institut München, Germany (1995)

Privatization in post-communist countries vol. II edited by Błaszczak B. and Woodward R., part written by Baehr J., Kwieciński T. pp. 67-93, CASE, Poland (1996)

Tyrakowski, S., *Polski przegląd migracyjny*, Emigration Museum in Gdynia, 2017. Can be found at: http://www.polska1.pl/pl/dzialania/polski_przeglad_migracyjny

Fallenbuchl, Z.M., *The Polish Economy since August 1980*, pp. 361-379, published online: 14th April 2015

Glenn, E. Curtis, ed. *Poland: A Country Study*. Washington: GPO for the Library of Congress, United States of America, 1992

Krzykowski, K., ‘Kapitalizm z ludzką twarzą? Ja tego nie doczekam’, TVN24BIS, Poland, 9:20 4th June 2019. Can be found at: <https://tvn24bis.pl/z-kraju,74/od-4-czerwca-1989-do-2019-30-lat-wolnej-polskiej-gospodarki,941461.html>

Kenton, W., *Shock Therapy*, Investopedia, updated on 7th October 2019. Can be found online at: <https://www.investopedia.com/terms/s/shock-therapy.asp>

The Big Mac Index, *The Economist*, 15th January 2020. <https://www.economist.com/news/2020/01/15/the-big-mac-index>

OECD (2020), *Average wages* (indicator). doi: 10.1787/cc3e1387-en (Accessed on 12th February 2020). <https://data.oecd.org/earnwage/average-wages.htm>

THE GAMING QUEST FOR KNOWLEDGE

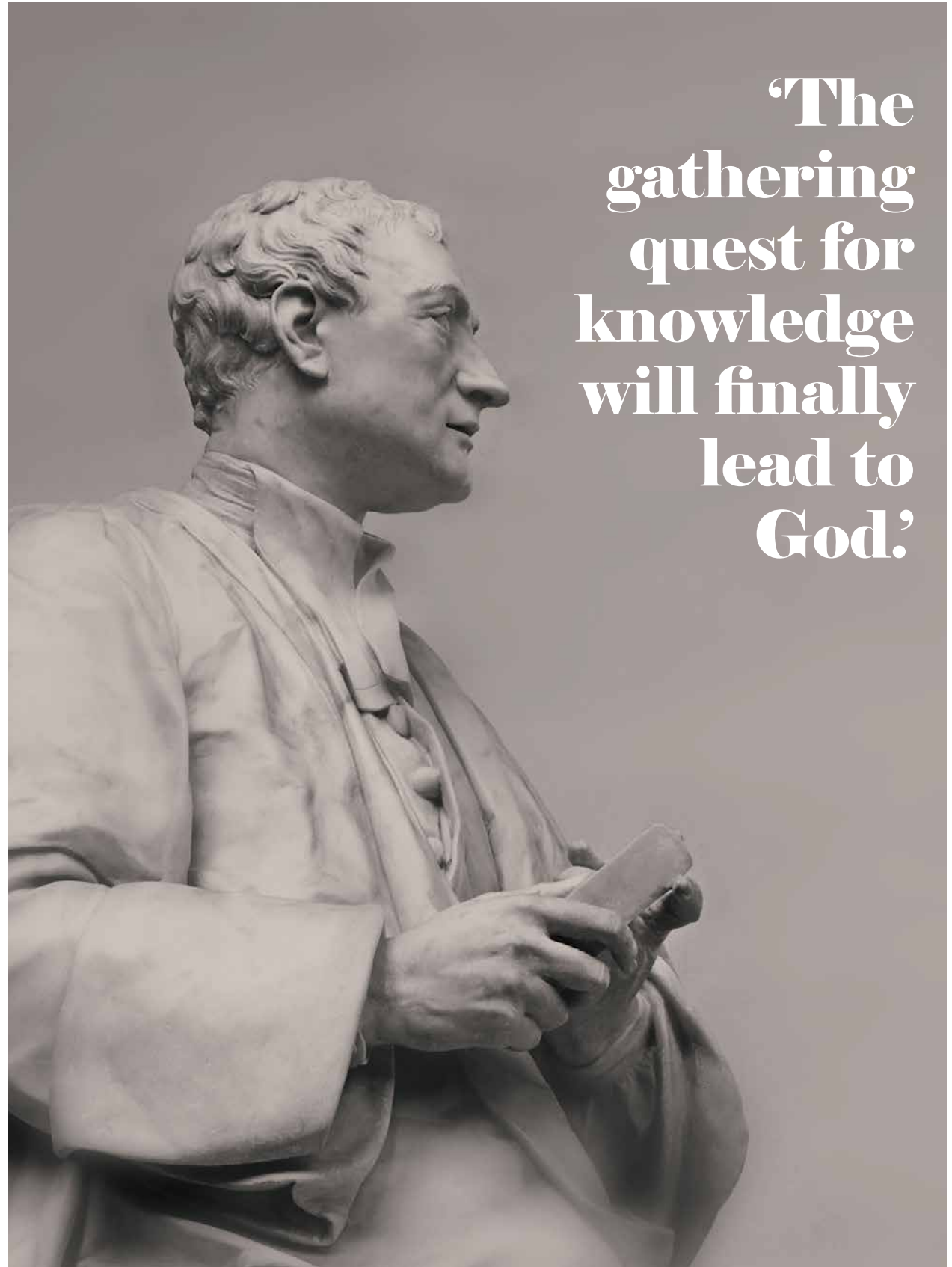
THE FAUSTIAN PACT, FRANKENSTEIN AND THE BIBLE

JUDETTA WHYTE

The quest for knowledge is a significant part of human experience, whether to improve lives and current circumstances or out of sheer curiosity. Life as we know it today would be unthinkable without the knowledge that we gain through science, scholarship and religion. While many would agree with this concept, it could be argued that the ultimate source of knowledge originates from a more powerful being, an omniscient God that holds all the answers to who we are, what we know and where we are going. If none of us have complete knowledge and answers about the mysteries of the universe, then surely this must lead us towards God.

Our desire to gain more knowledge motivates us towards seeking answers to life's greatest questions. Ecclesiastes 1:16–18 states: 'My heart has understood great wisdom and knowledge. And I set my heart to know wisdom and to know madness and folly... For in much wisdom is much grief, and he who increases knowledge increases sorrow.' This suggests that human knowledge alone cannot have the answers to life's problems and questions because even with all our qualifications and endless research, life still has profound problems. Additionally, this verse also reiterates the struggle of not being able to know more than we already do and the increasing frustration that is associated with this concept. Near the end of his life, Sir Isaac Newton commented: 'I have been paddling in the shallows of a great ocean of knowledge.' He felt the frustration of not being able to encompass more which demonstrates how human intelligence alone requires something greater in order to harness more knowledge.

'The
gathering
quest for
knowledge
will finally
lead to
God.'



This concept is significant in the message addressed through Mary Shelley's *Frankenstein*. Shelley warns against the reckless pursuit of knowledge without wisdom. Victor attempts to surge beyond accepted human limits in order to access the secret of life – with devastating consequences. Shelley recognises that knowledge is supplementary to human power; wisdom is knowing how to use it.

Victor Frankenstein's passion for knowledge contributes towards his demise. He allows his thirst for knowledge to control his life. His primary goal was to find a way to dissolve all sickness and keep the human body alive, whilst in the process defying God by creating life from death. Victor's act of unnatural creation causes destruction. Implicit is that the reckless pursuit of human

knowledge and enlightenment is dangerous. To paraphrase, any increase in knowledge is accompanied by an increase in sorrow.

Likewise, Robert Walton is driven by the same muscular desire for advancement: 'one man's life or death were but a small price to pay for the acquirement of the knowledge which I sought, for the dominion I should acquire and transmit over the elemental foes of our race.' Whilst Victor's obsessive hatred of the monster drives him to his death, Walton pulls back from his treacherous mission, having learned from Victor's deathly example. Shelley suggests that the obsessive quest for knowledge often begins as a story of self-sacrifice, a type of noble rationalisation that this obsession is all for the greater

good of humanity; however if we go too far with our desires for more knowledge, both Frankenstein and Walton's fates result in a destructive arrogance and ambition which exposes the fragility of human nature before God.

Although the pursuit of knowledge can end in devastating consequences, it allows us to comprehend that the capacity for human knowledge is limited. In these circumstances many turn to God to provide an answer to the mysteries of life. The pursuit of knowledge and excellence is at the core of Christianity, in modish terms – living our best life, being the best person we can be. It is the underlying motive which is important. In 1 Corinthians 10:31, Paul reminds us that we are called to glorify God in everything we do, including the pursuit of knowledge. The Westminster Shorter Catechism echoes this point with the words 'Man's chief end is to glorify God and to enjoy Him forever.' For the Christian concerned about his motives, this is the appropriate starting place. Both Paul and the shorter catechism bring us to centre on the capacity of knowledge to unlock potential. In contrast with Victor Frankenstein, the glory of God is the motive for Christian agency, glorifying His name rather than our own.

The literary canon is rich with texts analogous to this idea. Milton's *Paradise Lost* suggests that obedience to God and God's wisdom is more important than the pursuit of higher knowledge. However, Marlowe's *Dr Faustus* focuses less on obedience, suggesting that higher knowledge can be acquired as long as you know how to use it.

Throughout the play, we recognise that Faustus' selfishness and foolishness make him an unsuitable candidate for higher knowledge and that his path leads to destruction. It mirrors the progress of Adam and Eve in *Paradise Lost*. They are empowered with wisdom, but their unnecessary thirst for more leads to disobedience and the fall. In our prelapsarian world it has become the defining metaphor. Like *Frankenstein*, both texts present the tension between wisdom and knowledge. In *Dr Faustus*, the message evoked is that true wisdom is recognising when to curb one's appetite for knowledge and instead steward the knowledge one has. This corresponds to *Paradise Lost* which implies that obedience to God should be the priority and one should trust that God has supplied one with whatever knowledge one needs in order to function in society. It is also integral to the Benedictine ethos; stewardship of gifts is a part of our existence.

Science and relevant human knowledge have proven our capability of ameliorating our experiences and making sense of them. However, they have yet to define the abstract complexities of life; 'the human condition', that catch-all term for our fallibilities and thoughts and everything in between. Immanuel Kant stated that 'science is organised knowledge and wisdom is organised life'. Therefore it is necessary for us to desire greater wisdom in contrast to more knowledge. Moving on from this concept, some philosophers would argue that education and upbringing do not shape our lives sufficiently as there are many intelligent people who live carelessly.

FOR IN MUCH WISDOM IS MUCH GRIEF, AND HE WHO INCREASES KNOWLEDGE INCREASES SORROW;

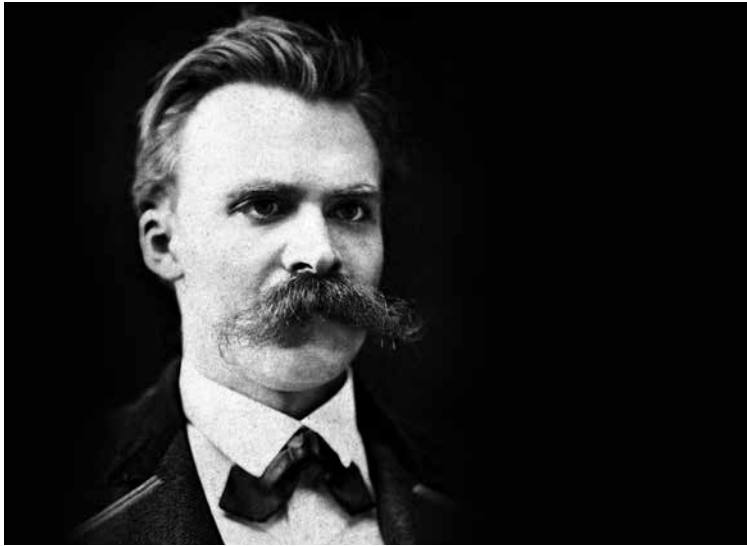
Growth in knowledge has increased our ability to control our destiny, whilst also increasing our capacity for evil. Nicholas Maxwell, an English philosopher, argues that in spite of producing so many technical wonders, we still suffer from a huge 'wisdom gap'. He suggests that the goal of academic inquiry should be the pursuit of wisdom rather than knowledge. Although science and our resident knowledge provide comfort, vested interest acts as a limiter, preventing solutions to real problems of real people.

Knowledge looks at opportunity, wisdom looks at humanity. If science were to integrate the pursuit of knowledge with the pursuit of wisdom more effectively, it could play a far more trenchant role in improving society. In our pursuit of knowledge and the delicate symbiosis between knowledge and wisdom, the guidance of God becomes significant. As Ecclesiastes 2:26 recalls: 'For God gives wisdom and knowledge and joy to a man who is good in His sight; but to the sinner He gives the work of gathering and collecting, that he may give to him who is good before God.' It is a framework to handle the 'gathering and collecting' properly. Friedrich Nietzsche – who this discussion invariably visits, briefly, for tea and conversation – stated that 'The human spirit, human enquiry and the human quest for knowledge and self-knowledge are only possible if we consider God to be dead because the idea of God deciding what is good or bad from outside the system ultimately limits the questions we can ask, and therefore is the worst imposition of power.' Paradoxically, Nietzsche was recognising that 'scientific rationalism' was a threat to the guiding precepts of religion and God, but also precipitates a moral crisis.

Many humanists and secularists believe that this is the only life we have – there is nothing else – therefore we owe it to ourselves and others to make it the best life possible. They believe that when people are free to think for themselves, using reason and knowledge as their tools, they are in a better position to solve the world's problems. An appreciation and knowledge of the arts, literature, music and crafts that we inherit from the past and nourish can continuously enrich our lives and lead us to greatness rather than God. Therefore, this implies that humanists take responsibility for their own lives and relish the adventure of being part of new discoveries through seeking new knowledge.



Still from the film *Mary Shelley*
© Giddien Media – Parallel Films
TCD / Prod.DB / Alamy Stock Photo



Instead of finding solace in prefabricated answers to the great questions of life, humanists enjoy the open-endedness of a quest and the freedom of discovery that this entails. Atheists, humanists, secularists – all exist within a guiding moral framework, predicated on the primacy of the life we have.

Christians believe that true knowledge can only be gained through struggle. For example, Clarence G. Wilson states that: 'All that ever was and all that is revealed is not known to man, nor ever will be known to man. Man can only see and comprehend what is in his limited physical and mental realm of understanding and capability; anything beyond that must be shown to man through the spirit of God that is within man and a man can only realise that knowledge through his devotion to God. All things will resolve back into the Father from whence it came, each will resolve back into its own roots.' This suggests that through God, we are able to gain knowledge and gaining more knowledge should lead us back to God. In short, the unfathomable big problems can only be revealed by Him.

This is significant as it enables Christians to feel a sense of relief over their problems and allows them to comprehend that they cannot comprehend; 'everything requires knowledge but knowledge requires the help of God'.

In conclusion, it could be considered that it is impossible for human beings to be capable of finding the answers to all life's unknown questions alone as we are not omnipotent beings. Whilst the constant search for acquiring more knowledge has proven to be beneficial towards functioning in a society that is consistently evolving, it is true that we will always be facing greater issues especially if we fail to apply that knowledge with wisdom. As Louis Pasteur recalls: 'In good philosophy, the word cause ought to be reserved to the single Divine impulse that has formed the universe. Little science takes you away from God but more of it takes you to Him.' A moral or even spiritual framework, based on belief of improvement, help and ethical truth, is essential. From a Christian perspective, this role is fulfilled by God. God: the gathering quest for knowledge will finally lead to him. **T**

SELECTED BIBLIOGRAPHY

Shelley, Mary, *Frankenstein*, Penguin Classics, London, 2001

Milton, John, *Paradise Lost*, Penguin Classics, London, 2003

Blanchard, J., *Where Do We Go From Here?* Evangelical Press, 2003

Marlowe, Christopher, *Dr Faustus*, Dover Thrift 1994, London

Moore, T. M., *Ecclesiastes: Ancient Wisdom When All Else Fails*, Downers Grove, IL. Intervarsity Press, 2001

Bentley, Colene, 'Family, Humanity and Polity in Frankenstein.' *Criticism: A Quarterly for Literature and the Arts*, Volume 47.3

Reville, William, 'A little knowledge leads away from God, much...leads towards Him', *Irish Times*, shorturl.at/fBRX8

S

LINKED TOGETHER LIKE A CHAIN REACTION

SEBASTIAN HALL

In 1939, General Motors exhibited a futuristic model city with driverless cars on automated tracks. Autonomous vehicles (AV) offered a glimpse of a utopian future and a compelling alternative to the dangers of manual-driving. A hiatus followed while technology struggled to catch up with ideas. AVs in the current form became viable after a series of competitions held by the U.S. Defense Advanced Research Projects in 2005. It led in turn first to Google's Waymo programme, swiftly followed by other major manufacturers.

What is the future that will unfold?

AVs typically use a combination of cameras and lasers to detect and create a map of their surroundings. This data is fed into a central computer, which processes the information and decides what to do next. It sends commands to servos and controllers that enable the car to control all the physical systems such as the brakes, motor, steering and so on. So far so good. However, ethical issues are created by the computational part of the system – the decision making.

This seems to be a subtle echo of the conception of the automobile itself and its widespread adoption within a short space of time. Estimates range from being available to buy a fully-autonomous vehicle in 2019 (Sanburn, 2012, in Boeglin, 2015, p.2.) to 2031 for the same level of progress (LeBeau, 2019, n. pag.). Tesla cars are available to buy today with hardware sufficient for Level 4 automation (although the software is only capable of Level 2), (Korosec, 2019, n. pag.). This shows that full AVs may arrive sooner than we think. There are 60 companies registered to test self-driving cars on the road in California alone.

The man machine

According to the World Health Organisation (2004, p.4), road accidents result in 3,000 deaths daily, and are the second most common cause of death for people between the ages of five and 29 (WHO, 2004, p.4). However, 96% of child road deaths are in low and medium income countries (WHO, 2004, p.4.). AVs will have minimum impact on these.

THE ETHICS OF AUTONOMOUS VEHICLES

Nevertheless, the argument is that they will reduce road deaths and improve access to personal mobility.

At a basic level, humans are sentient, and machines are synthesised. Machines calculate but cannot write poetry. Machines are well suited to some applications where they act reliably and quickly. However, they need programming; they are dependent on the algorithm. AI is the game-changer, providing a self-learning curve. In theory, an AV has the capacity for instant responses and analysis of any situation. This becomes complex when we hand over control of 'human' outcomes to inanimate machines.

Perhaps one of the easiest ways to look at this dilemma is to consider the trolley problem of Nyholm and Smids. There are two variations: the first considers a driverless trolley heading towards five people on the track ahead. They will be killed unless the trolley is diverted. The dilemma comes when there is someone on the escape-track. Taking action exchanges five deaths for one 'responsible' death, whereas inaction results in five deaths without responsibility.

In the second variation a driverless trolley will kill five people unless a man is pushed in front, stopping the trolley but at the cost of his life. A utilitarian response would be to take the action that results in fewest deaths. Ethics, however, introduces agency and responsibility. In terms of AV, this is the crucial discussion, involving decisions, process, acceptability and responsibility. Current arguments tend to suggest that the AV should take the path resulting in least death. This does not take into account the cultural value of one life over another or other, tangible and intangible considerations, including, if we pursue it far enough, the doctrine of double effect, in which some believe the outcome can justify the means, i.e. kill some lives to save far more.

The point is that decision making is framed by conscience and understanding; different actions can have identical outcomes but be completely different in terms of morality. This would imply that some machines could be 'good' decision makers, or some vehicles could be more ethical than others. They could be programmed with abstract notions encoded, adjusting their decisions from a quasi-cultural level.

It requires an effective framework, regulation and definition, and yet this is not forthcoming. Some US states favour deregulation to encourage industry and jobs. International regulation is crucial to ensure a smooth and effective development of AVs. It would need a clear document outlining factors in decision making, how vehicles should act if they lack

the time to make a more calculated decision, and examples of morally acceptable outcomes from scenarios.

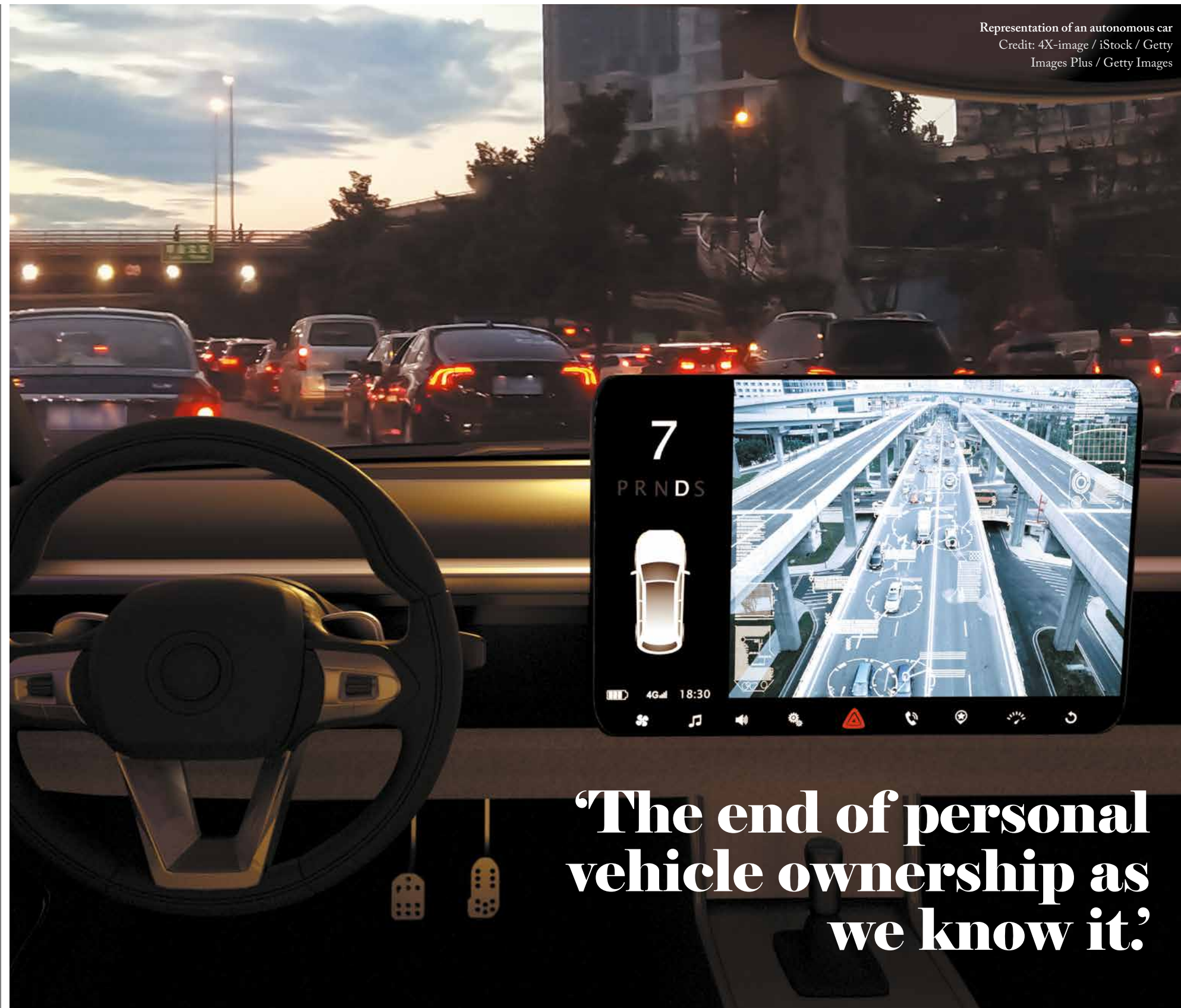
Standard regulation would reduce uncertainty. It is worth remembering that humans are unpredictable. If AV was demonstrably predictable they would become a mainstream phenomenon much more quickly.

Distractions booming in Sensurround

Mainstream cars are increasingly 'internet-ready'. They are wired, and full of both software and hardware. It opens up significant possibilities for safe autonomous movement. Here is a possible scenario: A driver makes an emergency stop. The driver behind takes time to react, process and act, then apply the brakes. This ripples through the line of traffic and a pile-up ensues. However, with AV control, vehicle one stops and notifies the following cars, they stop safely; danger is averted. Similarly, speed restrictions could be enforced, emergency vehicles move other cars to the side well in advance, and so on. Human fallibility and reaction time are removed from the equation.

However, connectivity for all vehicles is both simple and intensely complex. Hacking is a possibility – on a terrifying scale. Extensive controls and safeguards would be required to avoid a science-fiction style meltdown. However, the internet has significant positive potential. It could transform the safety of our roads for the better through improved flow, safety and predictability.

Representation of an autonomous car
Credit: 4X-image / iStock / Getty
Images Plus / Getty Images



‘The end of personal vehicle ownership as we know it.’

‘THE IDEA OF SHARED OWNERSHIP IS BOTH ENVIRONMENTALLY AND ETHICALLY BENEFICIAL.’

Uber self-driving car in San Francisco
Credit: JasonDoiy / iStock.com



Built by design to take you beyond space and time

In terms of ownership, Hudda et. al. (2013, p.11) suggest that AVs could be the end of personal vehicle ownership as we know it. At present, personal vehicles are in use 3% of the time. This is an ineffective use of resources. Shared-use could reduce journey cost by up to 80% and reduce the amount of expensive and inefficient vehicle parking. The idea of shared ownership is both environmentally and ethically beneficial.

This model would mean standardisation. A subscription model would result in people using vehicles as they arrive. The service would also have to account for cleaning the vehicle, as it would not be a very successful service if someone could get into a vehicle straight after a family and there were crumbs everywhere, not to mention the possibility of spreading illness and disease. Beyond that, it destroys the notion of cars as status symbols: our purchase of an eye-wateringly expensive car, not because of an intrinsic need, but because we want people to see that we have this car and it makes a us better person.

This city of pure confusion

Jack Boeglin writes about this subject (2015, pp.176-185). He places AVs into four overlapping categories:

- » **Discretionary** – allow users to control certain aspects of the vehicle, for instance driving style and route choice
- » **Non-discretionary** – allow users no control of driving except destination
- » **Communicative** – vehicles share data with other vehicles and companies
- » **Uncommunicative** – vehicles share no information.

The first two categories refer to freedom of the user, and as Boeglin points out, there are strong arguments for supporting both sides. Most users would prefer discretionary vehicles because they offer some control and decision making. Finding default parameters that are approved of by all the user base is tricky. Different people have different travel preferences. On the other hand, non-discretionary vehicles have the potential to be standardised and comply with safety parameters. It would ensure all vehicles behave in predictable ways.

‘Computer action; robotic satisfaction.’

The latter two categories refer to information sharing. As mentioned earlier, communicative vehicles have benefits in terms of safety and efficiency for the road network. Waymo, the AV company owned by Alphabet Inc., has driven eight million miles on the public highway in California, with 16 accidents, all of which were the fault of human drivers’ ponderous reaction times and slow reflexes. With communicative AVs these accidents would have been much less likely to have happened, but with the attendant risk and compromises discussed earlier.

It is worth noting that these are private companies. Google, Facebook and other large internet companies hold large amounts of personal and private data. The recent introduction of legislation to protect users’ data helps ensure companies are responsible. That being said, however, there will always be a risk that these companies could sell or analyse data for advertising or other purposes – see Cambridge Analytica and so on.

This remains an ethical disadvantage to AV use. While governments continue to introduce new laws on data and data management, they are always a few steps behind the companies. Apart from fining companies, there is very little governments can do to prevent data being sold and shared, especially when our government routinely sells data, including NHS health records. No matter what the intention, it is questionable if companies should be able to analyse personal data, and with the potential tracking and movement data that AVs will generate, people’s movements, addresses and actions are accessible. The servers that contain this data are by no means safe from hacking, and once the company has the data, the prospect of a fine is offset somewhat by the potential rewards.

AVs involve AI and machine learning. Ryan Calo, assistant professor at The University of Washington School of Law, points out that machines like these can under some circumstances be treated like products, but under others may not. He writes that modern robots are the first example of software and physical interaction being combined, creating a new and completely different problem of liability. The presence of AI in AVs makes this more complicated by adding uncertainty. Companies are responsible for the way a product functions. Calo suggests the possibility of granting products with AI some form of middle ground between the lack of responsibility of an object and the presence of responsibility for a human.

Coeckelbergh describes the AI decision-making part of the AV as a ‘car driver’, suggesting that the AI driver should be treated as if they were human. This makes sense in many ways, and Coeckelbergh gives the example of collisions and how limited visibility, mechanical control and many other factors should be taken into account. Boeglin on the other hand, writes that AVs should be considered as electronic agents that are acting on behalf of an individual or company. This would encourage manufacturers to insert safety precautions and possible software limitations that ensure the AV is as unlikely to cause damage or injury as possible.

The differences between the opinions of industry scholars highlights how inconclusive the area of responsibility and liability is. The absence of a regulatory framework remains an issue.



Expanding the horizon, expanding the parameter

The prospect of AVs reducing road deaths, making road use safer and more convenient, is promising. Response time and other factors, including the lack of emotion, are strengths and potential weaknesses. Programming errors are a secondary concern with potential consequences.

The broader, abstract question of accident ethics is problematic. The key factor is government involvement and regulation. By taking responsibility for the ethical, moral and legal framework, governments can empower companies to develop AV technologies. Data use and ownership is a similar issue – not just for development of AV but all tech industries.

A more active stance for governments would be beneficial. It should reduce controversy and ambiguity in areas of responsibility and liability, while setting down crucial guidelines for the use of software and hardware design. Government regulatory influence is important to an industry that perhaps tries to exclude external control. Careful intervention, thought and ethical research would paradoxically be liberating to this exciting industry. The AV is potentially a marvel; dependent on our definition of what we want the future of transport to look like. Cleaner? Safer? Greener? It's a no-brainer. **T**

SELECTED BIBLIOGRAPHY

Neil, D., (2006) Before the Rumble Seat [online]. Los Angeles Times, n.pag. Available at: <https://www.latimes.com/news/la-hy-125mbz21jun21-story.html> [accessed 9th February 2020]

UCSUSA (2018) Self-Driving Cars Explained [online]. 2nd ed. UCSUSA, n.pag. Available at: <https://www.ucsusa.org/resources/self-driving-cars-101> [accessed 9th February 2020]

LeBeau, P., (2019) Relax, experts say it's at least a decade before you can buy a self-driving vehicle [online]. CNBC, n.pag. Available at: <https://www.cnbc.com/2019/07/29/experts-say-its-at-least-a-decade-before-you-can-buy-a-self-driving-car.html> [accessed 9th February 2020]

Nyholm, S., and Smids, J., (2016) The Ethics of Accident-Algorithms for Self-Driving Cars: an Applied Trolley Problem? [online]. Springer, pp.1276-1282. Available at: <https://link.springer.com/content/pdf/10.1007%2Fs10677-016-9745-2.pdf> [accessed 9th February 2020]

Harris, J., (1985) *The Value of Life*. Routledge, pp.88-97

Lubben, A., (2018) Self-driving Uber killed a pedestrian as human safety driver watched [online]. Vice News, n.pag. Available at: https://www.vice.com/en_us/article/kzxq3y/self-driving-uber-killed-a-pedestrian-as-human-safety-driver-watched [accessed 9th February 2020]

Eliot, Dr. L., (2019) Avant-Garde AI Driverless Cars. Lance B. Eliot, pp.111-138

Motherboard (Vice Media, LLC) (2018) Tractor Hacking: The Farmers Breaking Big Tech's Repair Monopoly [online]. YouTube, n.pag. Available at: https://www.youtube.com/watch?time_continue=1&v=F8JCh0owT4w [accessed 9th February 2020]

Richtel, M., Dougherty, C., (2015) Google's Driverless Cars Run Into Problem: Cars With Drivers [online]. Paris Diderot University, n.pag. Available at: https://www.eila.univ-paris-diderot.fr/_media/user/claude_dupuy/google_cars_text.pdf [accessed 9th February 2020]

Dog close up
Credit: cgdeaw / iStock / Getty Images Plus

DEAD



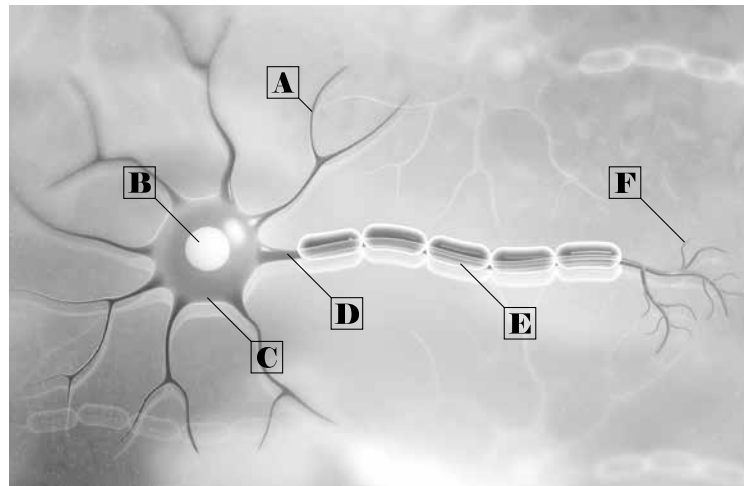
MENTIA

IS DEMENTIA, SPECIFICALLY ALZHEIMER'S DISEASE, A UNIQUELY HUMAN DISORDER?

EXPLORING THE RELEVANCE OF CANINE DEMENTIA TO OUR UNDERSTANDING OF THE DISEASE

Alois Alzheimer, along with Oskar Fischer, first identified the microscopic plaques and other hallmarks of dementia. By the 1960s, CT scans and technology allowed a greater structural understanding, particularly in regard to the formation of proteins in the brain. As a result of scientific progress, our understanding of dementia now allows targeted treatment. Dementia is caused by neurodegeneration, meaning the damage and death of the neurons within the brain. Frontal-temporal dementia contrasts to Lewy body dementia, affecting the frontal lobe and the motor cortex. In addition, many patients with advanced Alzheimer's show, under a CT scan, a widespread deterioration to the hippocampus, which is linked to memory and neurogeneration. Plaques in the brain limit neuron regeneration.

The question of whether animals develop dementia rests on our cognitive and neural differences and is an important one for science and human health; it allows us greater insight into causes and cures. For Paul Bernard, 'dogs and cats may suffer from cognitive dysfunction syndrome, which is similar to dementia or Alzheimer's in humans.' Age causes similar changes – increased anxiety, decreased ability to perform tasks or listen to commands, changes in sleep cycles. Captivity is significant as increasing lifespan allows ageing effects in the brain to occur in domesticated animals.



- | | | |
|--|--|---|
| A | B | C |
| DENDRITES | NUCLEUS | CELL BODY |
| <i>Receives signals from other cells</i> | <i>Controls the entire neuron</i> | <i>Keeps the cell functional</i> |
| D | E | F |
| AXON | MYELIN SHEATH | AXON TERMINAL |
| <i>Transfers signals to other cells and organs</i> | <i>Increases the speed of the signal</i> | <i>Forms junctions with other cells</i> |

Toxic aggregates

The main process causing dementia is the build-up of toxic aggregates or proteins. This stops the neurons from transferring information through synapses, pathways and sometimes affects the neuron directly. We know toxic aggregates cause neurodegeneration, but we don't know what causes toxic aggregation in the first place. In addition Prion substances – misfolded proteins – have the ability to transmit their misfolded shape onto normal variants of the same protein. They cause several fatal diseases that can be transmitted in humans and most importantly from animals. The most common of these diseases is known as (CJD) Creutzfeldt-Jakob disease. The symptoms are fairly similar but CJD has an accelerated profile of development.

Amyloid beta and Alzheimer's

Another key peptide is amyloid-beta. The main role of amyloid beta is the creation of neurons. It is also involved in memory and 'message transfer' between neurons. When too much is made or too little cleared amyloid beta builds up and causes plaques, disrupting neurons. As these plaques get larger, they consume and break the dendrites of neurons, interfering with their ability to transmit signals.

The creation of plaques is the key marker of dementia. They clump together to form lump-like structures. The plaques disrupt neurotransmitters: electrical impulses cannot be carried effectively, causing slow degeneration of brain function. The outcome of plaques is nearly always a death of neurons, memory and function degeneration and in some cases, swelling, bruising and haemorrhage. (Schaun, O, Ho, H, 2016)

The protein tau is also important; it maintains the shape and structure for the neuron's axis. When it starts to degenerate, the 'cytoskeleton' or shape becomes tangled, leading to apoptosis. We know what happens, but we don't know why. One theory links to the way oxygen is metabolised in the brain. Another is that enzymes like kinase work to change the binding and shape of neurons. (Schaun, O, Ho, H, 2016)

Combined inflammation

The combination of proteins leads to inflammation; it catalyses the speed and the severity of dementia. Recent research into anti-inflammatories used for arthritis suggested a 'lower incidence of Alzheimer's'. Inflammation can cause a range of severe outcomes, including stroke, vision loss and speech impairment; 'something may trigger a conversion from this harmless version of tau into a toxic version – and that's when the trouble begins with a toxic, sticky version.' The aggregates spread from the basal ganglia and other areas, forming deposits in the cells and outside the cells.

'DOGS AND CATS MAY SUFFER FROM COGNITIVE DYSFUNCTION SYNDROME, WHICH IS SIMILAR TO DEMENTIA OR ALZHEIMER'S IN HUMANS.'

BRAIN CROSS SECTIONS SHOWING THE PROGRESSION OF ALZHEIMER'S DISEASE

Healthy brain



Mild Alzheimer's disease



Severe Alzheimer's disease



Tau and amyloid beta proteins in this manner atrophy the brain. As damage to the neurons accumulates, due to plaques, tangles and inflammation, short-term memory is one of the first signs of dementia, then loss of motor skills and speech impairment. Long-term memory is next to go, with disorientation being late-stage.

Dementia in dogs

There is a difference between the neuron deterioration of canines compared to that of humans. However, when broken down into the biological and chemical formations in the brain that cause these symptoms of dementia (cognitive dysfunction), canines and humans may have a lot in common. For instance, impaired memory function and learning ability are common symptoms. Decline is more rapid, according to the Canine Dementia Scale (CADES), due to shorter life expectancy. Certain cells like AD Glial cells are just as important in the role of support of neurons within the brain in canines as they are in humans.

How breed affects symptoms of cognitive dysfunction

Amyloid beta plaques and senile plaques are found in canines, and both proteins destroy neurons, as in humans. Older dogs commonly develop canine cognitive dysfunction, a disease similar to Alzheimer's disease in many aspects. (Mihevc, P. S., Majdič, G. (2019) 60% of older dogs show symptoms of cognitive dysfunction.

The differences in time for these insoluble aggregates to build up, such as the amyloid proteins and taus mean that many dogs die before any real build-up causes decline of the brain. Larger dogs have a shorter lifespan than smaller dogs, making smaller dogs more apt for study in terms of cognitive decline; they have more time to develop these insoluble aggregates. Therefore, breed can have an indirect effect on the symptoms in canines.

Role of protein aggregates in neurodegenerative diseases in canines

Amyloid beta plaques are found in neurons in canines. This is unusual for amyloid beta plaques as they are normally extracellular hallmarks rather than intracellular. Similarly, amyloid beta plaques were found in cells (intracellular) in humans. This is an unusual similarity. 'In dogs, formation and maturation of A β deposits was observed by immunostaining throughout the canine cortical grey matter layers in a four-stage distribution, which is also characteristic for human AD, and this, according to some studies, correlates with the severity of cognitive deficit in the dog (Bosch et al., 2012) and varies as a function of age and size (weight) in companion dogs' (Mihevc, P. S., Majdič, G. (2019) This supports the idea that the difference in size of dog affects the symptoms of dementia and how quickly the symptoms arise. These symptoms correlate with the development of amyloid beta plaques in canines.

Immunostaining of canines and humans

The study of immunostaining is 'used to detect the distribution and localization of specific proteins within individual cells or tissues using immunostaining, defined as the use of specific antibodies to detect a single target protein.' (Maity, B., Sheff, D., Fisher, R. (2013) This can be specifically used to look at amyloid beta proteins and neurofibrillary tangles (NFTs). This can give photo evidence of the build-up of these proteins, and their association with the symptoms of dementia. 'Immunostaining is used in cell biology to study differential protein expression, localization and distribution at the tissue, cellular, and subcellular level.' By using this we can compare the protein build-up in canines and humans, and so demonstrate the similarities and differences hereby allowing us to show that AD and dementia are not uniquely human and can be seen in other animals. (Maity, B., Sheff, D., Fisher, R. (2013)

'Nepriylsin (NEP) mRNA, coding for a pivotal A β -degrading protein, was poorly expressed in the prefrontal cortex of aged dogs with CCD (Canudas et al., 2014), similar to human AD brain, where areas with higher A β aggregation express lower levels of NEP' (Reilly, 2001). This means that the mRNA (messenger Ribonucleic acid) present, which codes for the proteins to break down the amyloid beta plaques, was not expressed well within the brains of dogs with CCD. There was also the same picture within humans showing another similarity.

Problems with phosphorylated tau in canines

Tau NFTs were identified in canine brains very occasionally. 'Increased phosphorylation of TAU was observed at some amino acid sites in canine brain,' (Mihevc, P. S., Majdič, G. (2019). These tangles were uncommon as they are normally seen in human AD.

Furthermore, in canines 'cytoplasmic deposits of phosphorylated TAU' (pTAU) have been detected only in the prefrontal cortex. This pTAU was observed more and more in synaptosomes of demented dogs. (Mihevc, P. S., Majdič, G. (2019). Synaptosomes are a part of brain tissue which contains a synapse; it is prepared by homogenisation then followed by fractionation. This is dependent on the size and the density of the tissue (Weiler, I, J. 2009). This study led to the conclusion that CCD might be caused by the weakening of the synaptic function. This was different as it was not caused by the neurofibrillary tangles, but was caused by the pTAU building up.

Age correlation with tau build-up

In one study, the brains of 20 'old' dogs were studied, ranging from eight to 18 years. They were compared to 10 young dogs through immunostaining of the brain. They routinely did this staining using special staining techniques 'and immunohistochemical techniques to detect glial fibrillary acid protein, neurofilaments, ubiquitin, and beta-amyloid' (Borras, D., Ferrer, I., Pumarola, M. (1999) Scientists found clear differences in 'lipofuscin, polyglucosan bodies' and amyloid beta plaques seen in humans. Polyglucosan is large sugar-based molecules that are normally broken down, but if there is a deficiency of 'glycogen-branching enzyme' then it is not broken down fast enough, so it can build up in tissue and sometimes in nerve tissue. This has an effect on the canine brain. Similar studies showed this in humans but not to the same extent.

Scientific concluding opinions

There is a dissimilarity between canine tau protein sequence and humans. Secondly, the lifespan of dogs might be too short to develop NFTs, as A β deposition precedes NFT's formation. Thirdly, although the amyloid protein sequence is highly conserved between species, its N-terminal part is not, which might influence tau phosphorylation and its subsequent aggregation into NFTs. (Mihevc, P. S., Majdič, G. (2019). These points suggest that canines do not develop full AD. However, the similarities are significant enough for canines to be said to develop AD and dementia. We do not know the triggers for the build-up of insoluble aggregates in either canines or humans.

In light of this, examining canines as a species for testing may provide a better understanding of AD than mice or rodents. It could be argued that canines develop a form of AD. Dementia and AD are not uniquely human disorders; symptoms and formation of proteins are seen to a considerable extent and there is an overlap within the range of difference. To put it concisely, dogs can be used as a natural animal model for the study of normal ageing and human neurodegenerative diseases. **T**

SELECTED BIBLIOGRAPHY

Bale, C., (2017). A tale of two proteins. Available at: <https://medium.com/parkinsons-uk/a-tale-of-two-proteins-d76293f7f764> [accessed on 3rd January 2020]

Borras, D., Ferrer, I., Pumarola, M., (1999). Age-related Changes in the Brain of the Dog. Available at: <https://journals.sagepub.com/doi/pdf/10.1354/vp.36-3-202> [accessed 4th January 2020]

Dolman, L., MacLeod, P., (1981). Advances in Cellular Neurobiology. Available at: <https://www.sciencedirect.com/topics/medicine-and-dentistry/lipofuscin> [accessed on 19th December 2019]

Hardy, J., Higgins, G., (1992). Alzheimer's disease: the amyloid cascade hypothesis. Available at <https://www.ncbi.nlm.nih.gov/pubmed/1566067> [accessed on 3rd December 2019]

Mihevc, P. S., Majdič, G., (2019). Canine Cognitive Dysfunction and Alzheimer's Disease – Two Facets of the Same Disease? Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6582309/> [accessed on 2nd January 2020]

Noble, W., Hanger, D., Lovestone, S., (2013). The Importance of Tau Phosphorylation for Neurodegenerative Diseases. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3696910/#:po=0.500000> [accessed on 9th January 2020]

Sodhi, N., Jaggi, A., Singh, N., (2014). Animal models of dementia and cognitive dysfunction. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0024320514005165> [accessed on 25th December 2019]

Walker, L., Dhenain, M., Head, E., Hof, P., Lemere, C., Nelson, P., (2016). Is Alzheimer's Disease a Uniquely Human Disorder? Available at: <https://www.alzforum.org/webinars/alzheimers-disease-uniquely-human-disorder> [accessed on 28th January 2020]



HEALTHY BODY AND MIND

AN INTEGRATED APPROACH TO WELLBEING

EVA GOULD

A 2016 article from the *British Journal of General Practice* states: 'Mental illness and physical ill health are inextricably linked. Separating the two has led to significant health inequalities and barriers to health care for some of our most vulnerable patients.' It advocates a symbiosis – healthy body and mind. The NHS in recent years has had an enormous push towards improving treatment and care for people suffering from mental illness, moving towards a treatment of the 'whole-person'. Since 2016 it has begun testing new services which integrate mental and physical treatments, as part of its 'Improving Access to Talking Therapies' programme.

However, attitudes towards people's mental health and how it links to their physical health has not always been so advanced. Since the 1940s there have been medical advancements

in physical health. From the researchers Thomas Francis Jr and Jonas Salk from the University of Michigan developing the first influenza vaccine in 1945, to the revolutionary scientific development by scientists at Oregon Health and Science University and the Oregon National Primate Research Centre, in 2013, successfully reprogramming human skin cells to become embryonic stem cells capable of developing into any other type of body cell. Although attitudes and advancements in physical medicine have always been progressive, it is only within the last fifty years that the stigmas and prejudices surrounding mental health have begun to be alleviated. Developments in treatments and approaches to tackling mental disorders have advanced, and although historically mental and physical health were separated based

on stigma, today this is thankfully becoming a philosophy of the past.

We are at a time now where our health service is under significant and growing cost pressures. To make some necessary improvements to our NHS and to keep the NHS providing an appropriate level of service, spending is likely to have to rise by 2–3% of national income over the next 15 years. To fund these projected increases the tax system would require taxes to rise by between 1.6% and 2.6% of GDP – or £34 billion to £56 billion. As our health service becomes more expensive, it is imperative we save money where we can. The Kings Fund has warned that 'treating mental and physical health problems separately costs the NHS £11 billion a year and is no longer affordable'. The NHS is a fundamental part of our society, dealing with over 1 million patients every 36 hours.

It is inconceivable to imagine losing such an integral part of our society and so we must protect it at all costs.

It is not just the British healthcare system that needs effective integration of physical and mental healthcare. In 2014 Millman Actuaries prepared a report about the economics of integrating medical and behavioural healthcare for the American Psychiatric Association. According to Millman, integrating behavioural health into 'normal' health would save up to \$47 billion. This suggests it is important in economic terms that we move towards integrated treatment.

The fact that physical illnesses can result in problems with mental health is commonly understood. People suffering from long-term illnesses such as diabetes or arthritis cannot be cured, only managed.



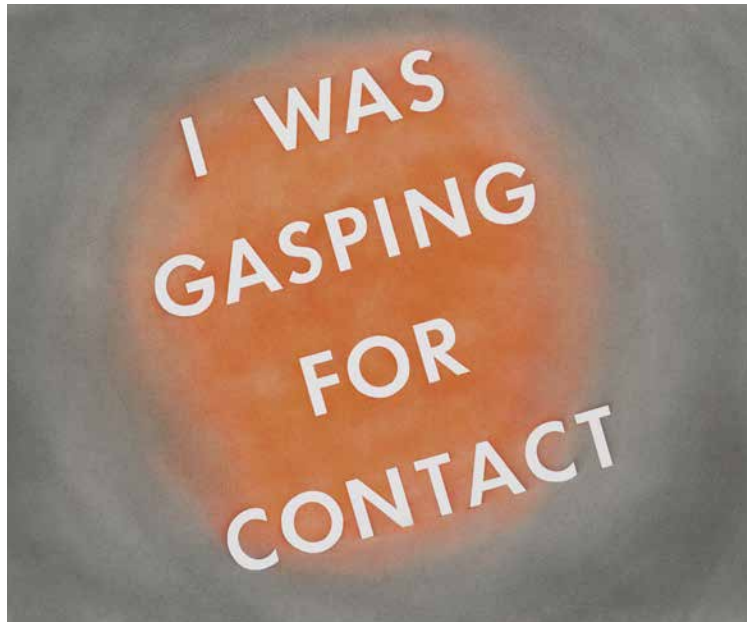
Cape Cod Morning by Edward Hopper, 1950
Credit: Smithsonian American Art Museum

People with such conditions are at risk of social isolation, low self-esteem and stigma, all of which can cause mental health conditions if not given support. Evidence demonstrates that those with a long-term condition are up to three times more likely to develop mental ill-health.

Similarly, mental health issues can give rise to physical health issues. The Mental Health Foundation reports that schizophrenia is associated with a tripled risk of dying from a respiratory disease, and doubles the risk of dying from some form of heart disease. Depression has been linked to a 50% increase in a person's risk of dying from cancer and a 67% increase from heart disease. Therefore, it is clear that mental health can have a huge impact on a person's life expectancy. A 2019 article by Aneri Pattani in the *Medical Xpress* recounts the experience of a 20-year-old woman called Diana Chao, who when she was 14 began to experience extreme pain behind her eyes when in sunlight, so much that she often felt dizzy when she walked. An optometrist diagnosed her with uveitis, an inflammatory eye disease that can send the pressure inside an eye soaring and render people temporarily blind. Over the next four years Chao visited various doctors such as ophthalmologists and rheumatologists in LA hoping to find a cause, but all her tests came back clear. One ophthalmologist finally recognised the symptoms as the same as several patients with mental illness. Chao was diagnosed with bipolar disorder and treated effectively. The article suggests that the phenomenon of mental disorders presenting physical symptoms is common.

Psychologists suggest a reason for this could be related to the stigma surrounding mental illness, especially in cultures that perhaps stigmatise mental health concerns. It highlights the importance in understanding the umbilical link between physical and mental health. If we continue to treat them as separate entities, and if we do not give mental health the right attention it requires, many more people will continue to suffer.

University of Cambridge Professor Edward Bullmore explored these links in his key text, *The Inflamed Mind: a radical new approach to depression*. His book explains how, and why, we now believe mental disorders can have their root cause in the immune system and 'outlines a future revolution in which treatments could be specifically targeted to break the vicious cycle of stress, inflammation and depression'. Bullmore's core belief is that for years it was accepted that there was a 'brain-blood barrier', a separation between any interaction between the brain and the immune cells and proteins circulating in one's blood. However, Bullmore suggests that the immune system can change the function of the brain, and this can cause depressive feelings. An experiment carried out by Meta-Analysis called 'Functional Neuroanatomy of Peripheral Inflammatory Physiology: A Meta-Analysis of Human Neuroimaging Studies' produced data which on average showed a robust effect of inflammation on brain activity, thus aligning with Bullmore's belief that inflammation can cause changes to how the brain works. These results 'localised the effect of inflammation to particular parts of the brain that



are already known to be involved in depression and many other psychiatric disorders'. Bullmore's research not only helps us to understand the symbiosis of mind and body, but can also provide new treatments for mental disorders, going by the basic idea that if inflammation can cause depression, then surely anti-inflammatory drugs should be as effective as antidepressants. A 2019 study with the catchy title 'Effects of immunomodulatory drugs on depressive symptoms: a mega-analysis of randomized, placebo-controlled clinical trials in inflammatory disorders' treated thousands of patients with an anti-inflammatory drug for arthritis and other bodily disorders that are commonly associated with depressive symptoms. The overall results showed that patients treated with the drug had significantly improved mental health scores as a result. By understanding this link between depression and inflammation, and using anti-inflammatory drugs as a treatment, the way we treat mental illness and the effectiveness of treatments may be revolutionised. As science and medicine continually develop it is essential that we overcome our latent prejudices towards mental illness and develop a full understanding of how mind and body are deeply intertwined.

In very basic terms, our DNA is what makes us who we are. Of course, there are many other influences, but on a fundamental level it comes down to our genetic code. It would only make sense then, that our genetics can also impact on our likelihood of developing mental disorders. It is only very recently, however, that scientists have begun to understand exactly how our genetics influence our chances of developing depression. A 2001 article published on the NHS website details a study conducted by researchers from the Institute of Psychiatry at Kings College London, and other centres in Europe and North America, and published in the peer-reviewed *American Journal of Psychiatry*.

The study was a 'genome wide linkage study' which aimed at identifying areas of DNA that might contain genes contributing to a person's susceptibility to major depression. The study looked at DNA from 971 sibling pairs who all suffer from recurrent depression. The findings from the researchers found that a region on the short arm of chromosome 3, called 3p25-26, is linked to severe recurrent depression. Although, depression, as well as other mental illnesses, is a combination of environmental, social and genetic contributions, and the research into understanding exactly what role our genetics play in mental illness is still very recent, there is clear evidence to confirm that our genetics, specifically the chromosome 3, have links to depression. An article from *The Independent* stated 'scientists have for the first time established a genetic cause for depression narrowing it down to a single chromosome'. These findings are a significant development in our understanding of mental illness and is definitive evidence of the connections between our mind and body.

To conclude, the World Health Organisation defines health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'. To treat mental and physical health as separate entities would be like eating a cake without mixing the ingredients. Although separate components, the ingredients must interact and combine in order for the cake to work. Similarly, in order for us to succeed as people and live fulfilling lives, we must ensure we respect our bodies as one whole being, with all aspects, both physical and mental, interacting together. **T**



Office in a Small City by Edward Hopper, 1953

Credit: Granger Historical Picture Archive / Alamy Stock Photo

'Similarly, in order for us to succeed as people and live fulfilling lives, we must ensure we respect our bodies as one whole being, with all aspects, both physical and mental, interacting together.'

SELECTED BIBLIOGRAPHY

Pattani, Aneri, *She Kept Losing Her Eyesight*, *Philadelphia Inquirer*, www.shorturl.at/uwxR5 22nd January 2019

Naylor, Chris, Bringing together mental and physical health, Kings Fund, https://www.kingsfund.org.uk/sites/default/files/field/field_publication_file/Bringing-together-Kings-Fund-March-2016_1.pdf, March 2016

Weaver, Ally, Potential economic impact of integrated behavioural healthcare, *Psychiatry.org* <https://www.milliman.com/en/insight/potential-economic-impact-of-integrated-medical-behavioral-healthcare-updated-projections>, 12th February 2018

Bullmore, Edward, *The Inflamed Mind*, Short Books, January 2019, London



P

STRICTLY THERAPEUTIC

WIKTORIA LASSAK

THE BENEFITS OF
BALLROOM DANCING

Music consists of fundamental elements such as rhythm and melody. Temporal organization, patterns of pitch over time, phrases, chord sequences all contribute to the formation of complex relationships between individual structures. It draws heavily on our brainpower; through memory and pattern recognition. As such it is a fertile area of study for conditions relating to the brain. For example, steady beat detection is linked to the basal ganglia; its activity has been studied in rhythm discrimination tasks for Parkinson's disease patients and healthy participants. Discrete musical elements have significant influence on the brain structures responsible for maintaining coordination, movement and memory. At this point, something like the intense choreography of ballroom dancing becomes fascinating; it addresses all areas in this interlinked study.

When we listen to music, we often start to dance or spontaneously move to the rhythm and beat. Studies show increased induction of several brain areas involving motor, auditory areas (Grahn and Brett, 2007) and temporal lobe responsible for memory skills (Hines, 2018), while reproducing or responding to rhythm and beat. Often the same brain structures are activated for musicians and non-musicians – the basal ganglia and the cingulate cortex. However, for non-musicians during tempo, meter and pattern discrimination, additional structural activations in the brain – the bilateral posterior lateral cerebellar hemispheres, to be technical – were observed. Musicians had much higher activations during discrimination tasks, requiring more novel and complex strategies to process and act.

Activation of the brain parts during certain operations

There is a significant connection between rhythmic auditory and rhythmic motor systems where the perception and production of rhythm underpins similar neural mechanisms. It has a strong influence on the organisation of movement in neural time and space. We know that rhythm makes the brain fizz, whether we move to it or not. The idea of an 'internal' beat is important, and the basal ganglia and supplementary areas are the important structures for this (Grahn and Brett, 2007). The cerebellum is also activated during rhythm listening tasks, and it is linked to our internal 'timing'. According to Konox and Jutai, music engages the most important and complex neural systems for attention and memory tasks. As an example, sensory memory, and even more precisely, echoic memory, is associated with auditory perception and allows us to perfectly remember a sound for two seconds, with melody and pitch 'held' in our working memory.

Sensorimotor rehabilitation

The work of Paltsev and Elner shows that the auditory-motor pathway leads to an excitability of motor neurons. Rossignol and Melvill Jones went further, showing that cues from auditory rhythmic structures in turn affect muscle activation patterns – they make our legs shake in time! More recent studies show that our 'gait parameters', the way we walk and move, improve with rhythmic stimulus, with a regular rhythm being essential to reduced variability.

Play something syncopated and the effects are lessened. It is significant in case studies of Parkinson's by Hackney and Earhart, using ballroom dancing as a model due to the rhythmic and cooperative nature of the skill. Furthermore, McIntosh found in 1997 that when led by metronomic and musical-rhythmic cues in time – or coupling ranges – people with Parkinson's Disease were more able to synchronise their stride patterns. Additionally, the influence of dopaminergic medication on gait parameters was studied. In contrast, the medication that improves the production and uptake of dopamine in the brain, which is lacking in the basal ganglia of PD patients, had no influence on synchronisation patterns.

Cognitive rehabilitation for AD patients

Since learning and recall are enhanced while combined with emotion, the importance of music to memory is an area of study. Researchers discovered that functions of short-term memory in patients with Alzheimer's Disease were enhanced when prefrontal-amygdala connections were activated. As projected, hippocampal networks were activated in healthy subjects (Thaut, 2008, p.76). It is crucial to remember that hippocampal neural connections decline in AD patients and the amygdala relates to emotional context. Therefore, emotions and memories associated with music hold significance for memory therapy. Music can facilitate short-term memory functions in dementia. Furthermore, it gives the foundations for wider studies in case of stronger clarity of musical memories than non-musical memories and their intact survival for longer periods of time in disorders connected with memory loss or cognitive deterioration.

Ballroom dancing and the elderly

The significance of music and rhythm is not limited to subjects with Parkinson's or Alzheimer's. The ageing process affects us all; there is a progressive decline in our sensorimotor and cognitive functions, paralleled by an increased prevalence of diseases. A cheery prospect. However, by pursuing certain activities there is a therapeutic benefit. Ballroom dancing is a paired activity; it is done in partnership. This is important for simple reasons of interaction and participation. It also involves rhythm, memory and postural control, initiating movement and terminating it and connecting with a partner during the movements, anticipating and responding.

Ballroom dancing involves many hours of training focused on technique and maintaining the frame of a body. It improves posture and balance. According to Kattenstroth, amateur dance groups showed very good results in geriatric concentration tests. In comparison to non-dancers they had better hand-arm function, preserved muscle strength and sharper sensorimotor coordination. Furthermore, learning new steps is associated with geometric and three-dimensional thinking; this enabled a tangible and significant development in learning capacity, retention and action. In everyday terms, the benefits are positive. A focus group in Brazil involving elderly subjects learning different ballroom dances yielded warming outcomes. The participants appreciated the new opportunities dancing gave them, citing leadership

and independence, but also a freer sense of imagination and creativity. They referred to an 'uplift in self-esteem', but also other tangible effects – a greater flexibility and a sense of 'elegance in movement' (Lima, Vieira, 2007).

Alzheimer's disease and dementia

Patients with Alzheimer's participating in a short-term waltzing programme were observed to make a significant progress in procedural learning (Rosler et.al 2002). While practising salsa, patients improved across measurable parameters, like the Berg Balance Scale which led to a significant decrease in risk of falls (Muir). This is a profound benefit; it is impaired cognition, balance and judgement that lead to falls, and falls are a significant danger for the elderly. Reduction of this kind of incident is life-changing and demonstrates the significance of dance therapies for the vulnerable.

In music therapy for patients with Alzheimer's, sensory stimulation and mental processes organisation are targeted. Studies show an improvement in speech and self-expression, drawing on the engagement in conversation between subjects, and an increase in interaction. (Aldridge, 1994) Dance and movement therapy led to an improvement in visuospatial abilities and planning tasks. A specific study using Latin ballroom dance lessons led to improvement in feelings of happiness for both patients and staff. The combination of music, rhythm and movement is compelling and does great things to brain activation.

'In addition, rhythm in music has a significant influence on movement in time and space. Music engages complex neural structures associated with attention and memory tasks. It improves our perception, as well as our motor and cognitive skills.'

Older couple dancing at home
Credit © iStock / Getty Images Plus



‘...ballroom dancing has a unique combination of artistry, coordination, memory and interaction.’

Cognitive functions show a progressive decline in patients with dementia; dance therapy can be considered to have a significant therapeutic impact, none more so than the Argentinian tango, where attention is divided between balance and navigation.

Conclusion

Ballroom dancing training has been studied to be a cognitive and sensorimotor task that helps improve memory and motor skills of patients struggling with Parkinson's and Alzheimer's Disease. It leads to brain structural and behavioural changes related to balance, gait and both working and long-term memory. The specific and dangerous physical symptoms of both Parkinson's and Alzheimer's – falls, resting tremor, bradykinesia – are ameliorated by music and dance therapy. The physical impact works in harmony with intangible but significant improvements like greater happiness.

Differences in the quality of movement in disabled elderly were observed in situations associated closely with music and dance performances. Crucially, these improvements were visible in more everyday life. Ballroom dancing had an impact on their stride length and flow, with improved balance and decreased risk of fall. Cognitive skills such as dual tasking and planning skills were improved in all areas – away from the dance floor.

Many positive effects of ballroom dancing, observed in both motor and cognitive skills of the elderly, were long-lasting. Life is more enjoyable for participants, they socialize more, interact, and it brings joy and greater satisfaction. It is perhaps worth noting that these benefits are also on tap for the rest of us! In terms of this investigation, it is conclusive: ballroom dancing has a unique combination of artistry, coordination, memory and interaction. It is a highly effective therapy for the elderly. **T**

SELECTED BIBLIOGRAPHY

Grahn, J.A., Brett, M., (2007) Rhythm and Beat Perception in Motor Areas of the Brain. *Journal of Cognitive Neuroscience* 19(5) (2007), pages 893-906

Hackney, M.E., Earhart, G.M., (2009) Effects of Dance on Movement Control in Parkinson's Disease: a Comparison of Argentine Tango and American Ballroom. *J Rehabil Med* (2009), pages 475-481

Cuddy, L.L., Duffin, J., (2004) Music, memory, and Alzheimer's disease: is music recognition spared in dementia, and how can it be assessed? *Medical Hypotheses* 64 (2005), pages 229-235

Kattenstroth, J.C., Kalisch, T., Kolankowska, I., Dinse, H.R., (2011) Balance, Sensorimotor, and Cognitive Performance in Long-Year Expert Senior Ballroom Dancers. [research article] *Journal of Aging Research* (2011), pages 1-10

Lima, Maristela Moura Silva, Vieira, Alba Pedreira, (2007) Ballroom Dance as Therapy for the Elderly in Brazil *American Journal of Dance Therapy* 29(2) (December 2007), pages 129-142

Jerde, T.A., Childs, S.K., Handy, S.T., Nagode, J.C., Pardo, J.V., (2011) Dissociable systems of working memory for rhythm and melody. *NeuroImage* 57 (30th May 2011), pages 1572-1579

Ivry, R.B., Keele, S.W., (1989) Timing Functions of the Cerebellum. *Journal of Cognitive Neuroscience* 1(2) (April, 1989), pages 136-152

Hansen, M., Wallentin, M., Vuust, P., (2012) Working memory and musical competence of musicians and non-musicians. *Psychology of Music* 41(6) (2012), pages 779-793

Gaser, C., Schlaug, G., (2003) Brain Structures Differ between Musicians and Non-Musicians. *Journal of Neuroscience* 23(27) (8th October 2003)

Schlaug, G., Jancke, L., Huang, Y., Staiger, J.F., Steinmetz, H., (1995) Increased corpus callosum size in musicians. *Neuropsychologia* 33 (1995), pages 1047-1055

Reitz, C., Brayne, C., Mayeux, R., (2011) Epidemiology of Alzheimer disease. *Nat Rev Neurol* 7(3) (March 2011), pages 137-152

Pollock, A.S., Durward, B.R., Rowe, P.J., Paul, J.P., (1998) What is balance? *Clinical Rehabilitation* 14 (2000), pages 402-406

Dauer, W., Przedborski, S., (2003) Parkinson's Disease: Mechanisms and Models. *Neuron* 39(6) (11th September 2003), pages 889-909

Nussbaum, R.L., Ellis, C.E., (2003) Alzheimer's Disease and Parkinson's Disease. *The New England Journal of Medicine* 348 (3rd April 2003), pages 1356-1364

Paulus, J., Müller, M., Klapuri, A., (2010) State of the Art Report: Audio-Based Music Structure Analysis. Conference Paper (January 2010)

Earhart, G. M., (2009) Dance as therapy for individuals with Parkinson disease. *European journal of physical and rehabilitation medicine* 45(2) (June 2009), pages 231-238

Gilbertson, S., Aldridge, D., (2008) *Music Therapy and Traumatic Brain Injury: A Light on a Dark Night*. London and Philadelphia, Jessica Kingsley Publishers



CAUSES OF THE RWANDAN GENOCIDE

EXAMINING COLONIAL COMPLICITY, OLIGARCHY AND PROPAGANDA

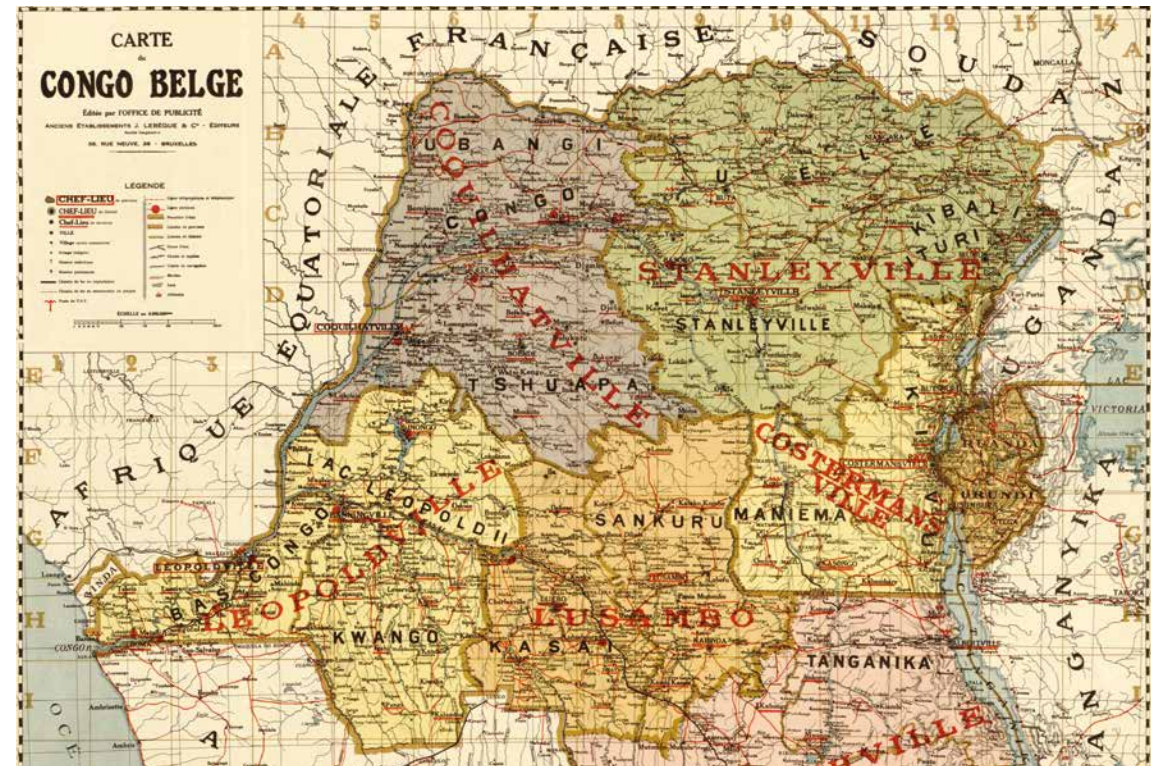
ALEXANDER WICKHAM

The Rwandan genocide exceeded the holocaust in terms of the rate of killing by a factor of five. Between April and July 1994 1,074,017 people were killed. The victims predominantly belonged to the Tutsi ethnic group, whilst the perpetrators were Hutu. The killings came as a response to the Rwandan government's instruction to the Rwandan people to kill members of the Tutsi ethnic group without mercy, after the president's plane was allegedly shot down by Tutsi rebels. The origins of the genocide are complex; with some evidence to suggest that Belgian colonial involvement in the country might be a factor. Robert Guest suggests there was a historic co-existence prior to colonialism. Hutus and Tutsis lived in close proximity, spoke the same languages and inter-married. On arrival the Belgians recognised a ruling class, and showed favour to this group.

The aristocratic upper classes were synonymous with the word Tutsi, wealth and privilege; the Tutsis controlled the central government and the monarchy. King Rwabugiri – a Tutsi – was said to have been oppressive and violent. Executions and torture occurred on a daily basis.

The roots of conflict existed, with an emerging amity-enmity complex, stemming from a fear of the unknown, natural tribalism, and colonial intervention (Keith, (1948), p.82). Hutus longed for a foreign power to liberate them from their suffering, seeing the Belgians, when they first arrived, as potentially the saviour figure (Vansina, (2004), p.197). There is evidence to suggest a Belgian obsession with race. There was a process of ethnic certification, including a classification scheme through physiological characteristics.

This enforced a rigid physical divide by ethnicity, including physical ID cards. This became horribly significant during the genocide. A divided country is easier to control, especially in Rwanda; a tribal preoccupation with internal affairs (Dallaire, (2003), p.47) suited the colonists. The Belgians were intent on profit through coffee production; the Heart of Darkness approach, where tribal squabbles allowed them to exploit resources and people. They favoured the Tutsis, widening the social gap. Education was reserved for the Tutsi upper classes (Lemerchand, (1970), p.73), while the civil service, created by the Belgians, was overwhelmingly Tutsi. (Melvern, (2000), p.14). Catholic missionaries, such as the Group Scolaire, created through conversion a further layer of elitism, and there was a process of political and administrative reform which replaced Hutus in power. It entrenched power and fostered resentment, a febrile mix.



Map of the Belgian Congo © The History Collection / Alamy Stock Photo

Hutu power

The Rwandan government planned the genocide months in advance (BBC News, (2011)). The shooting down of President Habyarimana's plane was not a cause but an excuse. Real authority was said to reside with the president's wife, Agathe Habyarimana (Melvern, (2000), p.47). Rwandans called her after a terrifyingly powerful character from Rwandan history, called Kanjogera. She formed a political circle, known as Akuzwa, motivated by the concept of 'Hutu Power'. The group published a propaganda magazine, *Kangura*, supporting notions of 'pure Hutu race' and the exclusion of Tutsis from all walks of life.

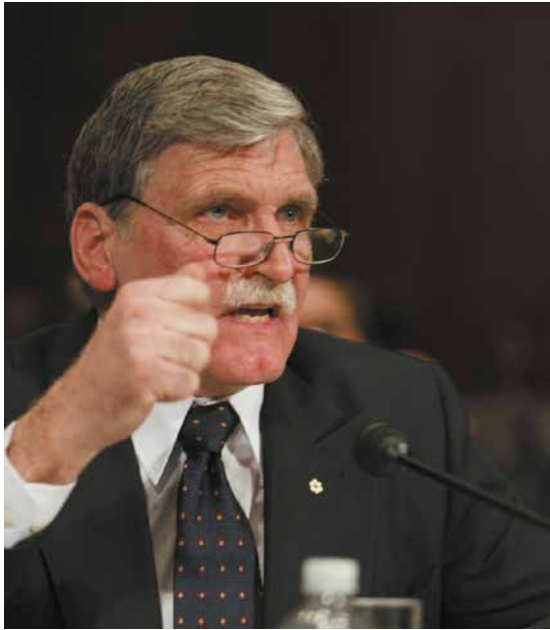
The idea of ethnic supremacy is linked to Belgian colonisation. The Hamitic migration hypothesis was propagated by Belgian missionaries who described the Tutsis as a foreign race, casting them as invaders. Tacit recognition of 'superior' Hutus was also prevalent. However, there were longstanding divisions within Rwanda and a backdrop of internecine conflict. Once combined with colonial advancement, ideas of superiority and eugenics, it became a toxic miasma of hatred.

Oligarchy

Whilst the framework for ethnic conflict may have been established and expedited by Belgian policies, Rwanda became an independent republic in 1962. In the lead-up to the genocide, killings involved conscripted militias. The government was an oligarchy led by Akuzwa and Agathe Habyarimana, with the aim being to eliminate pro-democracy threats and secure power. A death squad linked to family members of the Bushiru, the core of Akuzwa, was active. In March 1993 *Le Nouvel Observateur* wrote that the death squad was performing 'ethnic purification' against the Tutsi (Bijart, p.329). According to journalist Jean Carbonate, the killings were 'organised policy'. The Belgian Ambassador, Johan Swinnen, reported that a militia had been instructed to pillage homes in Bugesera in 1992 to make it look like an ethnic conflict, when in fact members of the MDR and PL (pro-democracy groups) had been killed. Violence and killing at the instigation of the oligarchy were precursors of later horror.

**‘Tutsis are
cockroaches!
We will kill you!’**

Ntarama, Rwanda – 25th June 2011: after the Ntarama church massacre clothes and shoes of the victims were put on display in the church memorial
© ElizabethHoffmann



Lt Gen. Romeo Dallaire. At a hearing on 'Genocide and the Rule of Law', held at the Senate Building Washington DC, USA – 5th February 2007
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'Simply jamming [the] broadcasts and replacing them with messages of peace and reconciliation would have had a significant impact on the course of events.'

Propaganda

In the build-up to the Rwandan genocide, the government used propaganda to encourage ethnic hatred against the Tutsi, including Radio Télévision Libre des Mille Collines. Mass ownership of radios – some were given for free to local authorities (Human Rights Watch, 2004) – made it particularly effective. The largest shareholder in RTLM was President Habyarimana. RTLM preyed upon the deep prejudices of many Hutus. Their hateful rhetoric – for example, 'Tutsis are cockroaches! We will kill you!' – was placed alongside sophisticated humour and popular music. It normalised obscene and violent hatred and is seen as complicit in encouraging 'ordinary' Rwandan citizens to join in with the killings. It had its origins in Akazu's journal, *Kangura*, which promoted the notion of a 'pure Hutu race' (Melvern, (2000), p.49). The journal published a 'Hutu Ten Commandments' in December 1990, instructing Hutus to mistreat and harm Tutsis (Kangura, 1990).

It is a crucial element of a governmental endorsement of genocide. The combined force of *Kangura* and RTLM was potent. The target audience of unemployed, disenfranchised and delinquent (Melvern, (2000), p.81) was the one most likely to take part in the genocide. The Rwandan government appealed to the educated classes through *Kangaru*, and to the masses through RTLM.

Whilst Belgians were clearly not responsible for the propaganda, their inaction is significant. At the time the Belgian Ambassador, Johan Swinnen, repeatedly warned Brussels that the radio station was dividing the country, yet they failed to enforce Article 19 (International Centre Against Censorship, (1996), pp.85-86). He met with Habyarimana in March to discuss the 'hate rhetoric'. But there was a clear reticence to become further involved. The commander of the UN task force in Rwanda, Romeo Dallaire, claimed that 'Simply jamming [the] broadcasts and replacing them with

messages of peace and reconciliation would have had a significant impact on the course of events'.

Whilst the Belgians might be seen as complicit, there was a wider inactivity on the part of the UN and its biggest partner, the US. President Clinton was unwilling to commit troops on the ground after a disastrous mission to Somalia in 1993.

There was also little in terms of mineral resources, i.e. oil, or proximity to a theatre of influence, that would normally precipitate intervention. It remains a deep regret for Clinton. On a state visit to Kigali in 1998 he stated: 'It may seem strange to you here, especially the many of you who lost members of your family, but all over the world there were people like me sitting in offices, day after day after day, who did not fully appreciate the depth and speed with which you were being engulfed by this unimaginable terror'. He later admitted that swift action would have saved lives; and

the events and the failure of the international community to prevent genocide 'had an enduring impact'.

It is clear that Belgian colonialism intensified the pre-existing divide between the Hutus and Tutsis, laying the groundwork for the hostility to come. Yet in terms of direct causes, the Rwandan government is culpable. They distributed propaganda and manipulated an economically deprived people in order to satisfy their racist ideologies.

The Rwandan government has taken significant steps to avoid a repeat of this historic genocide. It is significant that the Rwandan government has made it illegal to ask someone what their ethnicity is and that there are national days of mourning each year.

The national mourning period begins with Kwibuka (Remembrance) on 7th April and concludes with Liberation Day on 4th July. The week following 7th April is an official week of mourning, known as Icyunamo. As a result of the genocide, nations collaborated to establish the International Criminal Court in order to prosecute genocide, crimes against humanity, and war crimes. In the international community, many see the rapid US and UN intervention in Kosovo in 1999 as a direct corollary of their inaction in 1994. **T**

SELECTED BIBLIOGRAPHY

Guest, Robert, (2004) *The Shackled Continent: Africa's Past, Present and Future*. London: Macmillan Publisher Limited, p.113

Melvern, Linda, (2000) *A People Betrayed: The role of the West in Rwanda's Genocide*. London: Z Books Ltd, p.165

Lichfield, John, (1996) Guide to Zaire Crisis: The difference between a Hutu and a Tutsi. *The Independent*, viewed 16th November 2019

PBS News Hour. (1999) The Heart of the Hutu-Tutsi Conflict. PBS News Hour, viewed 17th November 2019

<https://www.pbs.org/newshour/politics/africa-july-dec99-rwanda_10-08>

Dallaire, Romeo, (2003) *Shake Hands With The Devil*. Toronto: Random House Canada, p.47

Prunier, Gérard, (1995) *The Rwandan Crisis: History of a Genocide*. London: Hurst and Co Publishers, p.29

Newbury, Catherine, (1988) *The Cohesion of oppression: Clientship and Ethnicity in Rwanda, 1860-1960*. New York: Columbia University Press, p.10

Urvin, Peter, (2001) Reading the Rwandan Genocide. International Studies Association, Volume 3, p.77

Lema, Antione, (1993) *Africa Divided: The Creation of Ethnic Groups*. Chartwell-Bratt, p.59

Lemarchand, Rene, (1970) Rwanda and Burundi. New York: Boston University African Studies Centre, p.106

Sanders, Edith R., (2015) *The Hamitic Hypothesis; It's Origin and Functions in Time Perspective*. Cambridge: Cambridge University Press, p.521

S

NEVER MIND THE KILLER ROBOTS

SHOULD WE BE WORRIED ABOUT ARTIFICIAL INTELLIGENCE?

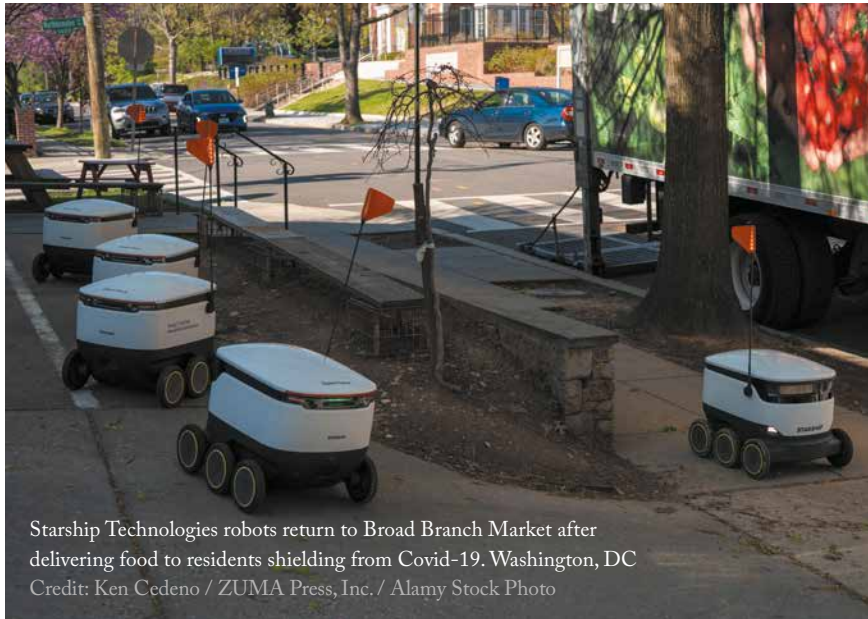
Asimo the robot created by Honda at the Edinburgh Science Festival © Guillem Lopez / Alamy Stock Photo

RUPERT SHARIFI

Artificial Intelligence (AI), or Machine Intelligence, is the theory and development of computer systems with the capability to perform tasks that would in any other case require the human mind to achieve. These include learning or problem solving. While this in itself may not be means for concern, the risk lies in the practical application of these developing technologies.

Few would oppose the idea that Artificial Intelligence offers potential in both commerce and industry. These changes should be beneficial to consumers as well as large corporations. Efficiency of production is a key area and has led to exponential growth in AI technology. Research carried out by PwC identified that 62% of large companies incorporated AI into their workforce by 2018. There is considerable additional scope of the integration of AI into smaller businesses in terms of productivity.

Artificial Intelligence has not only had benefits in production industries but also in other areas of business. In commerce, such as the stock market and banking, the use of Artificial Intelligence has removed the need for large trading floors in which traders relied on their intuition to judge the 'mood of the markets'. The raucous, clamouring jungle of the trading floor has been made obsolete. Intuition on the ebb and flow of the market has been superseded by automated learning systems, computer programmes which 'study' market patterns and respond to them with a speed and accuracy unattainable with human cognitive function, allowing for a more efficient reaction to changing economic situations. It makes more money.



Starship Technologies robots return to Broad Branch Market after delivering food to residents shielding from Covid-19. Washington, DC
Credit: Ken Cedeno / ZUMA Press, Inc. / Alamy Stock Photo

However, Artificial Intelligence can also have negative impacts on both industry and commerce. The stock market can be heavily affected by AI, on which it is dependent. Often AI can notice an anomaly in the market which, can result in computers beginning to sell shares, causing a chain reaction and a market crash. Human rationality – the idea of intuition, a feeling that something is going wrong – might prevent a major crash or at least mitigate the damage, where a programme might opt for the algorithm instead. AI can lead to programmable loopholes, sales made in split seconds between other sales, on the very edge of ethical probity, but it can also detect fraud.

The further implementation of Artificial Intelligence into industry could lead to a 3rd Industrial Revolution of sorts. During the first Industrial Revolution, the UK experienced many changes to the way that goods were manufactured. The production of goods was moved from people to machinery, costing people their jobs. However, people found new jobs both running the machines and gathering and distributing the products.

Our trades are no longer analogue – no typesetters, no draughtsmen. Instead we have digital professions – programmers and operators. However, it is not that simple, not like for like. In this technological revolution large industrial countries, such as China, may fall victim to significant job losses. China is the centre of most major global corporations and relies on these companies in order to provide jobs for their population.

The positive effects of Artificial Intelligence are not solely economic; it has benefits in terms of our health and well-being. Artificial Intelligence can offer greater efficiency and capacity in treating patients. Research carried out by the Oxford-based biotech company, Exscientia, suggests that the use of AI boosts the discovery of new medical drugs up to five times. Additionally, the use of AI has the potential to reduce the cost of both the discovery and the production stages by 30%. This, as a result, would reduce the growing pressure on healthcare providers and medical research companies and manufacturing costs – currently \$2 billion, rising from \$1.2 billion over ten years.

Artificial Intelligence can do this in many different ways. AI can be programmed to mimic a disease. Companies can use this to learn more about diseases and artificially test and make predictions as to what certain drugs may do to them. It does mind-boggling stuff e.g. creating ‘virtual’ cells that simulate how cancer works. The team then use an additional layer of AI to create dynamic reactions to different forms of proteins in order to see which are most effective in treating cancer. Once tested they can take the ‘promising ones’ into the lab for further testing. In terms of antibody research and vaccine development it is particularly relevant to our current situation.

Despite the great benefits Artificial Intelligence has regarding medical research, when it comes to practical application within a hospital environment things become more complicated. One challenge is legal liability. What happens when AI fails or makes a mistake? The legal implication are significant. Software developers could be held liable for a flawed algorithm. However, courts are currently reluctant to increase the breadth of liability to software developers, especially for those who create software with the purpose to aid medical professionals. So far health software has been used to aid medical professionals in their decisions, with the medical professionals having the ‘final say’ as to the further protocols moving forward. Yet if AI were to have the ‘final say’ based on algorithms that the medical professionals do not understand, who can then be held responsible if something were to go wrong?

This requires careful reform to the justice system in order to prevent a lack of clarity and to protect patients, medical professionals and software developers.

Outside of healthcare and banking, people tend to associate AI with the theatre of war. Artificial Intelligence has the potential to revolutionise warfare as currently known and shape the military for years to come. This can primarily be achieved through the capacity of AI to respond to dynamic situations. In simple terms, extensive integration of AI into the military provides the opportunity and operational capacity to orchestrate complex and changing battlefield situations. There is a human factor – those with the AI can remove their combatants from the battlefield. Unmanned Armoured Vehicles can scout out areas, protecting them from a potential ambush. They can mine-sweep, clearing a path for soldiers to move through, preventing loss of life from IEDs and other attacks.

However, there are controversies regarding the usage of Artificial Intelligence in warfare. Particularly that of ‘Killer Robots’ or autonomous systems employed to deliver lethal force. This is symbolised by the role of ‘drone warfare’, the eye in the sky, armed with missiles and ready to strike. It becomes a faceless and terrifying instrument of warfare. Furthermore, critics inside and outside military institutions have expressed concern over the potential risk of humans not being able to understand or control decisions made by Artificial Intelligence. We can remove our combatants from the field but we cannot remove civilians standing near a potential target.

Artificial Intelligence offers benefits to people globally, allowing for better economies and enhanced medical discoveries. These are unequivocal benefits: less death, better health. The grey area is warfare. However, being pragmatic, AI provides the capacity for ‘safer’ warfare in some form. As things stand, the operator remains key; their biases, decisions and the set of commands. The machines do what we tell them. **T**

‘Our responsibilities are clear: tackling unemployment; foregrounding well-being over economic gain, and saving lives. With these in mind, AI continues to have the capacity to make this complicated world a better place.’

SELECTED BIBLIOGRAPHY

Yuhas, Daisy, Speedy Science, *New Scientific American*, 24th May 2012 <https://www.scientificamerican.com/article/bring-science-home-reaction-time/>

Artificial intelligence in industry: intelligent production, Siemens, 12th September 2019. <https://new.siemens.com/global/en/company/stories/industry/ai-in-industries.html>

Palmer, Maija, and Gillet, Kit, ‘Bigger than DNA’ – how AI is transforming the pharma industry, 17th February 2020. <https://sifted.eu/articles/ai-transforming-pharma/>

Palmer, Maija, How AI is finding drugs to treat coronavirus, 15th April 2020. <https://sifted.eu/articles/ai-coronavirus-drugs/>

E

DOES A MINIMUM WAGE IMPROVE LIVING STANDARDS?

THE PARADOX OF
THE US NATIONAL
MINIMUM WAGE

JĘDRZEJ NIEPOLSKI

The idea of a minimum wage is not a new one, despite only being introduced in Britain some 21 years ago. It was introduced in New Zealand in 1894, ostensibly to prevent strikes and lockouts of employees working in extremely poor conditions. Due to its success, the Australian state of Victoria decided to establish a system of wage boards which spread nationally. In the US it took the 'New Deal' to lead to the implementation of a minimum wage. Roosevelt stated unambiguously that 'no business which depends for existence on paying less than living wages to its workers has any right to continue in this country'. A federal minimum wage followed in 1938. Today 2% of workers (1.7 million people) earn the federal minimum wage – in comparison to 13% in 1980. However, the application of state minimum wages has seen employees often receive a higher rate, removing them from the federal bracket, which explains the decline.

Unemployment

One assumption is that a higher minimum wage leads to improved living standards. However, an increase in wages does not always lead to better standards of living. This is in part due to inflationary elements as a result of the wage rise. A 'real' increase requires the new level to be adjusted frequently, without tight inflation control through the use of precise monetary policy (Belman and Wolfson, 2014). This, however, would lead to higher interest rates, which would have a negative effect on spending, consumption and investment, causing production and employment to fall (Policonomics, 2017). The idea of improved living standards via minimum wage increases is therefore somewhat illusory.

In 2018, 47.1% of workers with earnings at or below the prevailing federal minimum wage were aged 16–24. According to Neumark and Wascher (2011), the only workers with statistically significant higher unemployment after the rise of the federal minimum wage are those who are both currently not enrolled in school and have no education beyond high school. This group is most vulnerable to unemployment and other effects. As the Congressional Budget Office in 2014 predicted, if the federal minimum wage had gone to \$10.10 an hour (an increase of \$2.85), 24.5 million people could have benefited from that and only 0.5 million jobs would have been lost. The proportions for the current data are similar, so it can be deduced that a stable increase in the federal value would create a 49:1 benefit to cost ratio, suggesting minimum wage increases are a good thing.

'No business which depends for existence on paying less than living wages to its workers has any right to continue in this country.'

It is worth considering another possible outcome of the federal rise of wages – a decrease in the hours of employment. Hiring or firing is more costly than raising or lowering working time. According to Orrenius and Zavodny (2008), an increase in the minimum wage negatively affects the number of working hours for younger workers – in some cases a reduction in working time of over 30%. A higher federal minimum wage has a negative effect on employment structure by cutting hours at work; this hits specific vulnerable groups within the US.

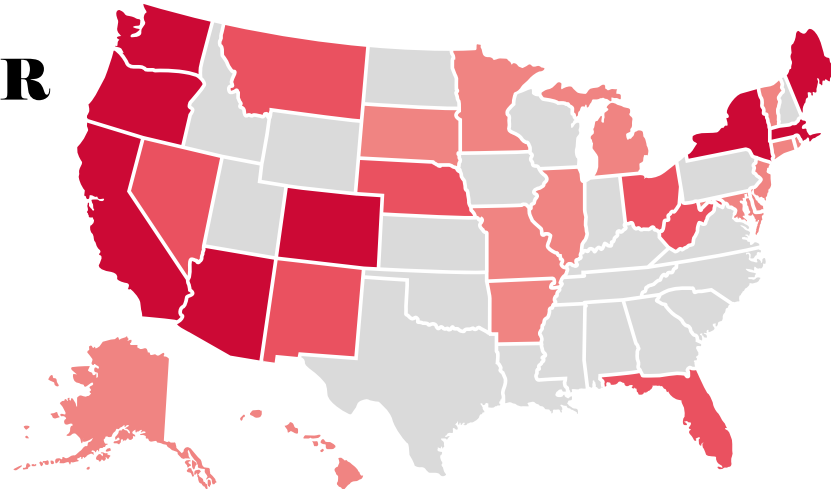
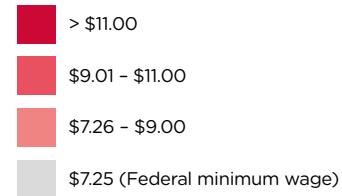
Wages and earnings

An increase in the federal minimum wage increases average hourly earnings rates, and thus, improves the standards of living for the majority of the considered employees – with the exception of those mentioned above. For some groups, however, such as single mothers whose working hours are cut after the minimum wage increase, there is a decrease in weekly salary in real terms. The food sector offers a counterpoint. According to Dube, Lester, and Reich (2011), the effect of the higher minimum wage on average earnings is positive.

The findings are consistent with Even and Macpherson's (2014) research where the hypothetical 10% rise of the minimum wage increased weekly earnings by 1.5% to 2.2% in limited-service restaurants. While considering other working sectors, Allegretto, Dube, and Reich (2011) reported positive earning effects for department stores, miscellaneous store retailers, petrol stations, and many more. Thus, even with the consideration of the possible negative unemployment or working hours effects, the higher minimum wage increases the average earnings of the majority of vulnerable workers.

MINIMUM WAGE* FOR THE US

*hourly rate for a full-time job as of 1st January 2020



Inequality

It has been argued that a minimum wage reduces inequalities in the labour market, and theoretically leads to a more equitable distribution of wealth. However, data indicates that the wage gap between richest and poorest is rising. A lack of equality in the distribution of income is a real problem in the USA. This contradicts the notion that a higher minimum wage reduces disparity.

What is clear from CPS data is that the decrease in the real minimum wage is associated with an increase in the gap between rich and poor. Income inequality rose steadily between 1968 and 2018 even when the rate of real minimum wage was increased. It suggests that continuous and sustainable growth of minimum salaries is crucial in reducing income inequality permanently. It is also vital to remember that other components responsible for more equitable distribution of income, such as unionisation or tightening of demand and supply-side policies, have to be combined with stable, higher minimum payments in order to fight with inequality effectively in the long-run.

Poverty

One of the most crucial long-term aims of minimum wage growth should be reduction of poverty. As PovertyUSA (2020) reports, 12.9% of women and 10.6% of men in the United States still live in poverty. Higher minimum salaries should change the living conditions of a significant group of workers, and thus reduce the poverty rate noticeably. It is vital to distinguish here between the two most commonly examined types of poverty: absolute and relative. According to Traidcraft Exchange (2019), 'absolute' relates to an inability to afford basic necessities such as food or shelter. 'Relative' includes all households earning 50% or less of the average household income in their country.

The easiest way to measure the changes in the number of people counted into absolute poverty rate caused by the increase in the minimum wage is to find out the total volume of transition of households either into or out of the poverty thresholds while the implementation of a new minimum wage takes place.

The level of those thresholds is adjusted to the family size and the national economic growth. Erin Duffin (2019) reports that the average number of people per family in the United States is 3.14, which means that the most common household structure is two parents and one child. Therefore, household income has to be higher than \$19,985 per annum in order for the majority of American families to live above the poverty line (PovertyUSA, 2020). What is more, according to the Bureau of Labor Statistics (2019), around 50% of all American lowest-wage families have just one earner, and thus, their income is \$15,080 per annum. It means that the payments gap between the annual minimum wage and the corresponding poverty threshold is \$4,905 for the largest proportion of the United States' households from the lower tail of income distribution (see Table 2). In order to get out of poverty, the federal minimum wage needs to rise by approximately \$2.38, from \$7.25 to \$9.63, for those families. However, the largest increase ever in the minimum wage was only \$0.70 in 2007.



Even though a higher minimum wage should improve standards of living for low-paid workers, the gap between the poverty line and the earnings of most low-income families is too high. Typical increases are not successful in moving those families out of officially defined poverty. Even if a higher salary leads to a shift above threshold for some, for others it means reduced working hours, and thus, entry into absolute poverty. Therefore, there are no consistent overall changes to poverty levels.

As Maloney and Pacheco (2012) stated, the effect of a minimum wage on relative poverty is strongly related to whether the change in the federal value has kept pace with economic growth and inflation. Put simply, the minimum wage needs to have a stronger effect on low salaries than economic growth has on higher salaries, otherwise the disparity continues to grow.

In all, the minimum wage is not a universal panacea and its potency divides economists. However, sustainable increases in the real value of the minimum wage might bring greater benefits. A continuous and sustainable rise in minimum salaries combined with lower proportional economic growth is crucial to decrease relative poverty. **T**

SELECTED BIBLIOGRAPHY

Doyle, A., (2019) 2020 Federal and State Minimum Wage Rates the balance careers [online] 20th January (updated), n.pag. [Accessed 25th January 2020; 5:38pm]. Available at: <<https://www.thebalancecareers.com/2018-19-federal-state-minimum-wage-rates-2061043>>

Wallenfeldt, J., (no date) New Deal Encyclopaedia Britannica [online] no date, n.pag. [Accessed 14th November 2019; 6:28pm]. Available at: <<https://www.britannica.com/event/New-Deal>>

Bloomberg Markets and Finance (2019) States with high minimum wages are doing fine [online]. [Accessed 18th November 2019; 7:46pm]. Available at: <<https://www.youtube.com/watch?v=IijNxVtzdwQ>>

PBS NewsHour (2015) Do minimum wage actually help the poor? [online]. [Accessed 19th November 2019; 6:19pm]. Available at: <https://www.youtube.com/watch?v=_S0KeeGO660&t=2s>

Belman, D., and Wolfson, P. J., (2014) What does the minimum wage do?, W.E. Upjohn Institute for Employment Research

Dube, A., Naidu, S., and Reich, M., (2007) The Economic Effects of a Citywide Minimum Wage, Industrial and Labor Relations Review

MacDonald, J., and Aaronson, D., (2006) How Firms Construct Price Changes: Evidence from Restaurant Responses to Increased Minimum Wages, American Journal of Agricultural Economics

Draca, M., Machin, S., and Van Reenen, J., (2011) Minimum Wages and Firm Profitability, American Economic Journal: Applied Economics

Waltman, J., McBride, A., and Camhout, N., (1998) Minimum Wage Increases and the Business Failure Rate, Journal of Economic Issues



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