MARCH 2024 • ISSUE 43

THINK

IDEAS • MALTA • RESEARCH • PEOPLE • UNIVERSITY

ISSN 2306-0735

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editorial

Cyberspace

Humanity has come a long way from the primitive stone tools it developed to survive. Since then we have made great strides through metalworking, steam engines, aviation, space exploration, and, of course, cyberspace.

To unlock this brave new frontier, we have leveraged, among others, brain-computer interfaces, nanotechnology, and artificial intelligence. The exciting possibilities within our grasp put the machinations of science fiction to shame. Domestic Robots, Generative AI, and virtual reality have already become part of our daily lives, and there is no sign of this development slowing down!

Whereas we should not ignore the dangers that new technologies may bring, it might be more productive to look at the way this technology could improve society and our own lives. Cyberspace has the potential to modernise education and usher in unparalleled convenience for those with limited abilities.

Join us as we explore the cutting-edge research being conducted at our University that is pushing the frontiers of cyberspace further!

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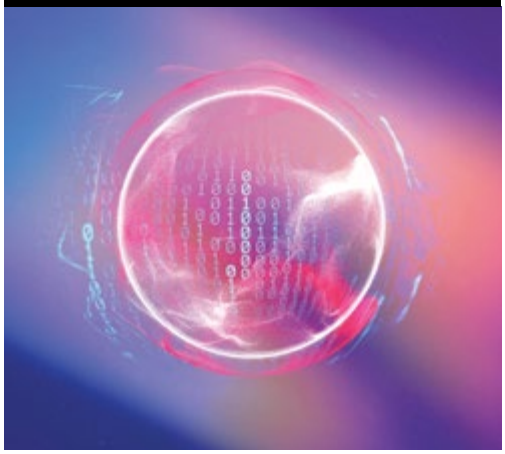

Ever-perfect and ever-growing, a spherical orb hovers within a human-made void, in a liminal space between cyberspace and physical reality.

focus articles

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L-Università ta' Malta

Modernising Mediterranean Flatbread

Author: **Inês Ventura**

What do *focaccia*, *ftira*, and *pita* bread have in common? If delicious or irresistible were some of the words that came into your mind, you're correct. But that's not why UM and a host of other partners are studying it.

Flatbread – one of the first processed foods made by man – has been a staple food in the Mediterranean area for centuries. Its first record dates from a 14,400-year-old hunter-gatherer site in the Black Desert in north-eastern Jordan. Interestingly enough, bread production based on wild cereals may have encouraged hunter-gatherers to cultivate cereals and thus contributed to the agricultural revolution in the Neolithic period.

Flatbread, traditionally made from flour, water, and salt, can be found across the Mediterranean. In Italy (*focaccia*), Malta (*ftira*), Greece (*pita*), Croatia (*lepinja*), Jordan (*taboon*), Portugal (*bolo-do-caco*), and Egypt (*baladi*), this culinary phenomenon reflects the unique bread traditions of each region. However, after all of these years, can these recipes be made healthier?

FLAT-BREAD-MINE has recently received over €2 million of EU funding in a PRIMA – Partnership for Research and Innovation in the Mediterranean Area – call to develop this type of research. The PRIMA programme is an Art.185 initiative supported and funded under Horizon 2020, the European Union's Framework Programme for Research and Innovation. This project, which encompasses several steps of flatbread production including food safety, sustainability, personalisation, and convenience, involves 18 partners from 10 different countries, with INRAE (National Research Institute for Agriculture, Food and the Environment) in Nantes, France serving as the leading institution. Dr Patricia Le Bail is the coordinator of the project. UM is a partner in this project through the participation of Prof. Vasilis Valdramidis, visiting associate professor at the Department of Food Sciences and Nutrition, Faculty of Health Sciences, and Prof. Luciano Mule Stagno, the Director of the Institute for Sustainable Energy. 'We are combining the skills, knowledge, and expertise of numerous partners to deliver a product that addresses several concerns at the same time,' explains Christopher Magro, one of the Maltese researchers involved in the project.

'The UM focuses on food microbiology and food safety,' says Magro. 'We were responsible for identifying mould and bacterial contaminants present in the flour of every one of the countries participating in the project.' These contaminants can make the food unsafe for the consumer or reduce its shelf-life. 'It's a concern that poses significant challenges, even more so with the problem of climate change,' continues Magro, 'where a large increase of rain and temperature can create perfect conditions for fungi to grow and proliferate (forming mould).' Some moulds can produce harmful and invisible metabolites called mycotoxins that, according to the World Health Organization, harm human health.

Other partners are investing in specific steps of flatbread production, such as milling, baking, or manufacturing. As a consortium, all stakeholders are trying to improve the nutritional quality of the flatbread either by testing alternative ingredients (such as legume flours) or by trying to reduce its glycemic index. Nutritional values ensured, the project also aims to establish the most sustainable production process possible for obtaining safe, highly nutritional food at an affordable price.

Backed by a diverse international consortium, the FLAT-BREAD-MINE project seeks to transform the timeless tradition of Mediterranean flatbreads. Focusing on safety, sustainability, and nutrition, the collaborative efforts aim to forge a healthier, safer, and more delicious future for this ancient culinary staple.

THERE WILL COME SOFT RAINS

Author: **David Mizzi**

We have the technology to turn night into day, to create entirely new worlds, to conquer the seas, the skies, and even to begin foraying into space. The ingenious minds of engineers, developers, and inventors have brought robots, AI, and VR to life. While the arts might not seem to have anything to add in this regard, it is the writers, musicians, and artists that invite us to reflect (and who entertain us) about our relationship with technology. We decided to take a look at a particular story related to technology…

'There Will Come Soft Rains', is a short story written by Ray Bradbury, originally published in 1950 as part of his collection of short stories titled *The Martian Chronicles*. The story begins with an automated house announcing 'Today is August 4, 2026, today is August 4, 2026,' before it begins its daily routine. The house dutifully cooks and serves meals, cleans the house, prepares whiskey and cigars, and sets up the nursery, despite its occupants having been evaporated by a nuclear blast. In spite of the advanced technology, the house is unaware of the annihilation of its inhabitants. Toward the end of the story, a tree bough crashes into the house, knocking cleaning detergent on the stove and setting the entire house ablaze. The house is destroyed, save for a lone wall, which continues to tell the time: 'Today is August 5, 2026, today is August 5, 2026, today is…'

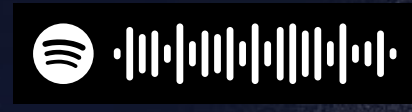
Having tiny robot mice (or Roombas) clean the house or a robot prepare meals is certainly a delightful way to utilise technology. However, it is this same technological advancement that enabled a nuclear holocaust in Bradbury's story. The latest scientific advancements that allow us to enjoy virtual lectures and hours of digital content are also part and parcel of the deepfakes that fuel misinformation.

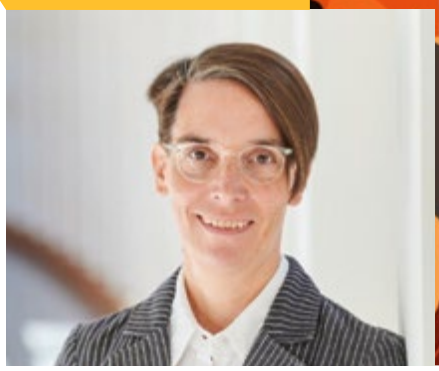
Taking a step further towards the virtual, just as Bradbury's house persists independently of individual users, we ought to spare a thought for our own digital footprint: the websites, social media profiles, and other digital artefacts that would continue to exist in cyberspace long after us. Ultimately, for all of its technological prowess, the house was unable to save itself from the forces of nature: wind and fire. In fact, this question of nature versus machine is frequently explored in different aspects of pop culture and literature. Bradbury makes a clear reference to Sara Teasedale's poem (published in 1920), which shares the same name as his short story, 'There Will Come Soft Rains':

Not one would mind, neither bird nor tree,
If mankind perished utterly;
And Spring herself, when she woke at dawn,
Would scarcely know that we were gone.

While the march of technological progress continues, bringing with it new opportunities and exciting developments, it is worth taking a moment to examine our relationship with technology. How will we use technology to shape the future? Will the march of progress lead us to a brighter tomorrow or, to paraphrase George Orwell, will the future be a boot stamping on a human face – forever?

The story itself is one of Bradbury's most widely read stories, and it has sparked an array of adaptations. Players of the *Fallout 3* videogame can find the McCellan's family house in Georgetown, a direct reference to the story. Meanwhile, those who'd like to hear the story for themselves can find a reading (from 1975 and by Leonard Nimoy, no less!) on Spotify.





Feminism in Foreign Policy

Author: **Ambassador Tanja Beyer**

'As long as women are not safe, no one is safe in a society.' A Ukrainian woman made this statement to German Foreign Minister Annalena Baerbock in Shyrokine, a village close to Mariupol, only some two weeks before Russia invaded Ukraine. During that time, I was Consul General of Germany in Eastern Ukraine and witnessed the encounter. I will never forget the moment because this statement, made at the very time and place, perfectly highlights a key principle of Feminist Foreign Policy (FFP).

However, let's make it clear: this policy is not exclusively by women, for women, but involves all genders and addresses issues of other marginalised groups too. Equality and inclusion of everybody has long-lasting effects. It can lead to more stability, strengthened peace efforts, and improved resilience. It broadens the foundation of states and societies. It is positive for everybody.

As a Scandinavian man once shared with me, the slogan 'He for she' really means 'He for he,' because men too profit from equality. Therefore, it was a very conscious decision to assign the responsibility for Germany's FFP to a man, State Minister Dr Tobias Lindner at the Federal Foreign Office.

To put FFP in a nutshell: it tackles failure to implement the '3 Rs', these being:

- Rights: Around the world, the rights of women and marginalised groups are restricted or not recognised at all. For instance, 189 states to date have committed themselves to promoting legal and de facto equality by ratifying the Convention on the Elimination of All Forms of Discrimination against Women, yet legal frameworks and implementation often remain incomplete.
- Representation: As is the case worldwide, including in Germany – for example in the German Bundestag (Parliament) and in the leadership of large companies – women and marginalised groups are under-represented in political, economic, and societal decision-making processes.
- Resources: Equal access to resources takes aim at financial resources as well as immaterial resources such as networks and education.

Studies have shown that societies are more peaceful and prosperous when everybody can participate in political, social, and economic life. Peace and security are more sustainable when decision-making on security issues is inclusive by design. We know that peace treaties co-written by women are 20% more likely to hold than others. According to the Council on Foreign Relations, global growth of up to 26% could be achieved by equal participation of women in the labour market.

Of course, Feminist Foreign Policy is not a perfect formula to end all suffering. It's not a magic wand which can immediately resolve dilemmas in foreign policy. It is about creating awareness for problems and an invitation to further develop solutions together, all of us, every day.

Scan the QR code to access the guidelines of Germany's Feminist Foreign Policy.

Hannah Montana: A Perfect Wake-Up Call

Author: **Essa Qasem**

For those from a generation that used to be religiously tethered to their television sets awaiting a new episode of *Hannah Montana* every week, the Nobody's Perfect song must stand out. Not just for its infectious melody, but for its evergreen insight, which cements its place as a pop culture classic.

Released in 2007, the song's core message of embracing imperfection resonates strongly with Hannah's character arc on the show as she frequently faces multiple social and emotional challenges head on. This of course comes with the inevitability of making mistakes along the way.

The song opens with an assertion that everybody makes mistakes. The chorus, with its simple yet profound refrain, 'Nobody's perfect, I gotta work it,' encapsulates the essence of a healthy approach to learning. Mistakes are valued positively. The aim is to not shy away from making mistakes, but rather to own up to one's failings, rising back up again and starting anew.

Put in context, educational systems often overemphasise perfection and high achievement. These systems are riddled with habitual oversight over a student's journey through a predetermined liminal space orchestrated so that millions of students synchronically hit the same note as part of a monotonous symphony. It wouldn't take a genius to recognise an educational institution's aim: attend our lectures, pass our exams, and leave our premises.

The fated consequence: students hesitate. They are repelled from committing to the learning curve and finding refuge in academic nuances and imperfect experimentation. Education becomes an antonym for learning, mistakes a synonym for incompetence: an enterprise appeased by students who are complacent to its flaws and afraid to move the needle.

We have a lot to learn from Hannah Montana. Her anthem encourages listeners to recognise that perfection stems from a learning curve guided by multiple failures. The song's upbeat tempo mirrors the optimistic resilience needed to navigate the challenges of life. To view perfection as a realistic, reflective gauge rather than a pressurising unattainable standard. Instead of punishing mistakes, as a society, we should foster a supportive environment that promotes resilience and perseverance, echoing the sentiment of the song's lyrics. 'Nobody's Perfect' reminds us that setbacks are temporary, and success is often the result of tenacity and a positive attitude.

Cyberspace

Cyberspace typically refers to the digital environment; such as social media platforms, websites, and virtual reality. For this Edition we took a closer look at the research that blends the line between cyberspace and physical reality, and closes the gap between man and machine through Thought-Controlled Wheelchairs, Education in Virtual Reality, Deepfake Technology, and Robots.

BrainCon's Non-Invasive Approach to Thought-Controlled Wheelchairs

Author: **Timothy Alden**

Going beyond electric wheelchairs, the BrainCon project is creating a smart wheelchair that moves according to what a person is thinking. By using advanced technology, users would be able to control their wheelchairs using just their brain signals! Furthermore, these are not just any brain signals but imagined speech, which is less tiring than imagining movement. **THINK** *meets with the team to find out more.*

Electric wheelchairs are widely used, but they are usually controlled by the rider using a joystick. But what if there was a way to control a wheelchair using only brain signals? By sensing electroencephalographic (EEG) signals from the brain and using them to control a smart wheelchair, BrainCon aims to create a wheelchair that users can guide along with just their thoughts. This can all be done without resorting to invasive technology such as brain implants.

Dr Natasha Padfield, systems engineer at the Centre for Biomedical Cybernetics at UM, explains that the project stands apart by offering non-invasive solutions, as a lot of research requires brain implants to read the signals. Meanwhile, this project works with data from a cap with electrodes placed on the scalp. Many brain-computer interfaces (BCIs) one hears about are implanted in the brain via a surgical operation. These give much better signals, Padfield explains, but they are risky and very expensive.

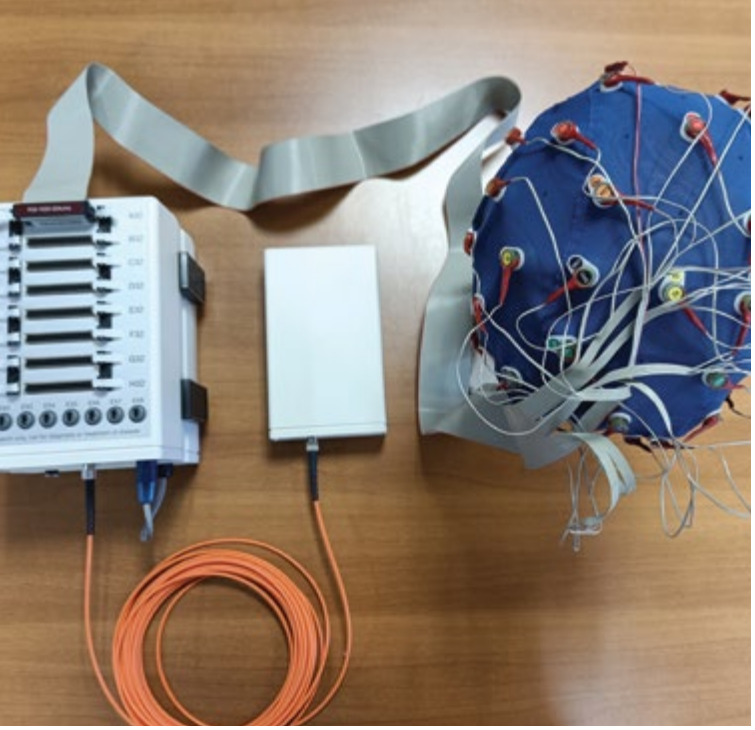
'The EEG cap is more available and accessible as a solution than implants and is more comfortable. It makes it more likely for people to use it. People have the misconception that our area of research has already been studied, but the difference lies in the cap. The challenges arise from there, as we do not have implants directly in the brain,' Dr Ing. Marvin Bugeja, senior lecturer of Systems and Control Engineering, states.

IDENTIFYING THE RESEARCH GAP

Prof. Ing. Kenneth P. Camilleri, joined by Prof. Ing. Simon G. Fabri, Dr Tracey Camilleri, and Dr Ing. Marvin Bugeja, leads the team at the UM, which leverages the biomedical engineering and the control engineering strengths of both the Department of Systems and Control Engineering and the Centre for Biomedical Cybernetics, leading to the development of the BrainCon initiative. Padfield, employed as a postdoctoral researcher, took previous department research on a smart wheelchair to the next level. The challenge was to eliminate the need for a joystick at all and use signal processing to convert EEG brain signals into commands: Left, Right, Speed Increase, and Decrease.

'A smart wheelchair fully controllable through thought is crucial for someone who has quadriplegia and even people with motor neuron diseases. When people have these diseases, their brain signals remain the same when exerting these commands, but their muscles are unable to do the movements required to activate a joystick, for example. BrainCon is mostly aimed at people who cannot use a joystick,' Padfield explains.

Padfield points out that in other research studies on this theme, motor imagery is often used. This refers to the idea that the person imagines moving one's hands, legs, or tongue. Imagining these movements sends specific brain signals from the EEG electrodes to a computer, which can then use software to interpret the signals. One does not have to execute the actual movements, as the signals are very strong in the motor cortex, where they can be detected accurately with EEG, a method to record the electrical activity of the brain. Nonetheless, it can be tiring to imagine these movements over a long period of time. Furthermore, these movements are not intuitive, such as when one tries linking tongue movements to



Left to right: The BioSemi EEG recording equipment consisting of an amplifier (left) and cap with 32 sensors. The smart wheelchair being used in this project, developed by the Department of Systems and Control Engineering. Demonstrating EEG signals being recorded from a subject using the BioSemi EEG recording setup and displayed on-screen.

Photos courtesy of the BrainCon team

Left, Right, Forward, or Backward. Therefore, another objective of the project was to replace such signals with imagined speech instead, which is easier for the subject.

There is a significant research gap on this level, Padfield elaborates. Imagined speech has been studied in relation to controlling graphical user interfaces, but less so for physical devices such as a smart wheelchair. When controlling a moving object like a wheelchair, accuracy is essential, and the control must be reliable. Therefore, one of the key challenges of BrainCon is to stabilise the signals being decoded from the brain and avoid random misclassification from the data.

'If the subject becomes a bit distracted, there will be a lot of noise in the signals. The human body has a lot of electrical signals which we might capture that we do not wish to translate into commands. Sometimes, even if a person is paralysed, parts of their body may twitch slightly. Even electrical signals from light in a room can introduce noise,' Padfield clarifies.

TURNING SPEECH TO MOVEMENT

Padfield and the BrainCon team have been working on a stabilisation technique for this system. The training algorithm is interactive, using a machine learning technique called reinforcement learning. The algorithm is trained on the individual. An initial 15-20 minute interactive session with the classifier software results in a more accurate and customised service. Padfield states that the researchers intend to test the actual, physical BCI wheelchair both with healthy participants and participants with mobility issues who have higher levels of mobility. However, some individuals who have a high level of disability usually require a custom wheelchair that is not available to the research team. For these individuals, the BrainCon team has thus developed a simulation test via computer to get feedback from the patient.

During the project's inception, the BrainCon team worked with a doctor in the United Kingdom, Dr Andrei Agius Anastasi, to collect feedback from patients which could feed into their work. Agius Anastasi spoke to people with significant spinal cord injuries, and they were interviewed about what they would want out of a brain-computer interface, as well as what their perceptions and needs might be. While there had been interview-based studies of BCI applications, there was not much data specifically on BCIs being used with wheelchairs.

When asked what the main challenges of the research have been, Padfield indicates that the actual decoding of imagined speech is quite difficult. The team had to first go through a lot of different classifiers. Padfield explained classifiers as standard algorithms with various applications. While some are used for EEG data processing, they weren't specifically designed for the team's particular classification problem. 'Essentially they are like tools for anyone doing machine learning. We used some classifiers which have been popular in EEG signal processing and trained them with our data,' explains Padfield.

'The EEG works with 32 electrodes which produce a large amount of data. This data is reduced to a feature vector. The feature vector simplifies the data using a variety of statistics.

Some, such as mean and median are quite straightforward, while others are more complex, such as a summary of the frequency content in the signal. This condensed data is fed into the classifier which identifies what the person is thinking. However, due to the noise in the EEG data, and issues like the subject not always concentrating or being completely consistent in their thoughts, the classifier output tends to have misclassifications. We had to do some innovative maths to smoothen the classifier output and generate more accurate results,' elaborates Padfield.

Padfield warns that beyond the difficulty of smoothing the signals, they have had to deal with the subject's idle states. When the subject is not focusing on controlling the wheelchair, they may be imagining all sorts of things which might be falsely interpreted as potential commands for the smart wheelchair. In such a so-called idle state, they would not want their random thoughts to lead to the movement of the smart wheelchair. The challenge is that it can be hard to discern imagined speech from the idle state, and as you increase the number of imagined speech commands, the problem grows. 'One way to address this is to compromise and have two intuitive imagined movement commands and two imagined speech commands. This would be a stepping stone to a fully imagined speech-based system. So you might have, for example, imagined left and right-hand movements to turn left and right and then "speed up" and "slow down" as the imagined speech commands.'

As the team moves towards concluding the project, Agius Anastasi (having since returned to Malta) is set to help the team train the software on patients from Karin Grech Hospital to put theory into practice. Padfield also explains that beyond the project itself, funding has already been won from MCST to explore research on speech imagery further. BrainCon highlighted the challenges of decoding such data, and the gaps in the literature present an opportunity to take this research to the next step, though people must still be recruited for this new initiative.

Looking at even longer timelines, the team might eventually opt to try and commercialise their research. However, as the product would be classified as a medical device, there is extensive testing needed and barriers which would need to be overcome, requiring more planning and preparation far beyond the project. Nonetheless, they have identified the Commercialisation Voucher Programme from MCST as a promising way forward to potentially make this info a reality.

The possibilities opened by new technologies and research in these fields offer boundless opportunity. Being able to control technology through thought alone offers the chance to significantly improve many people's quality of life. It also makes one wonder what other applications might be in store, affecting the world in unexpected and exciting ways.

The authors would also like to acknowledge the project: 'Setting up of transdisciplinary research and knowledge exchange (TRAKE) complex at the University of Malta (ERDF.01.124)' which is being co-financed through the European Union through the European Regional Development Fund 2014–2020.

EXPLORING SPACE AND PLACE IN ART THROUGH HYBRID PRACTICE

Digital Arts students during an Erasmus+ workshop inside the CAVE

Author: **Elena Said**

In the ever-evolving realm of art, boundaries are constantly being pushed, including the frontiers of spatial dynamics. **THINK** *speaks with* ***Dr Trevor Borg*** *about the evolution of spatial exploration in the arts and how the technical intricacies of the Department of Digital Arts' hybrid practice are contributing to this.*

From Renaissance attempts to capture 3D spaces on 2D surfaces to the virtual challenges of traditional boundaries, the exploration of space and place in art persists. 'The concepts of "Space" and "Place", which are inherently connected, have undergone an evolution over time. While there was a period when the two were interchangeable, contemporary theories now acknowledge a distinction between them, however, still recognising their close proximity,' declares Dr Trevor Borg, Head of the Department of Digital Arts at UM.

A SENSE OF PLACE

Artists, architects, and philosophers have always been keen to explore and delve further into the intricacies of space and place, trying to understand how both can be depicted, defined, and perceived, and how they might converge and spill into one another. Place-oriented contemporary practice in Fine Arts draws on the work of important thinkers to make meaning of the spatial elements that constitute our surroundings.

During the Early Renaissance, artists experimented with linear perspective, unlocking the ability to create optical depth on 2D surfaces. Artists created a sense of depth by having all parallel lines converge on a single point, known as the vanishing point. 'The idea of depth was often created through a vanishing point, with items at the back appearing smaller. Artists also played with colour to create perspective, emphasising details in the foreground while objects in the background became paler and lacked definition,' explains Borg.

Over the years, artists became interested in exploring other aspects of place by reconfiguring traditional aesthetic methods and incorporating diverse, thematic considerations. A contemporary artistic exploration of place embraces social, cultural, political, and ecological aspects alongside the more aesthetic ones to capture deeper underlying meanings that penetrate beyond the visible (or not so visible) surface layers.

A digital projection inside the CAVE

A student project carried out by Renata Stoyanovska, Marie Christin Pieper, and Maria Mihailescu

Walking as an art practice (an art practice in which walking is a central part of the process or experience), popular with Dadaists and psychogeographers among others, has continued to gain momentum over time. It has now evolved into an important component of place-oriented practice. Such walks often allow 'slow-looking' and thorough mapping of place, which encourages viewers to deliberate and reflect to gain deeper insights or appreciation. At times, walking as an art practice involves groups of people and even communities in a bid to explore what constitutes place through deeper engagement.

Experimental approaches involving space-time juxtapositions in film and moving-image representations allow movement in space complemented by audio that contributes further layers to our perception of place. Furthermore, computer-generated imagery can recreate environments and visual content that are either modelled on existing places or imaginary environments that have no physical reference point or association with a physical place. Video games have introduced further intricacies as they allow players to experience virtual environments online, where they can meet and compete with their peers without having to leave their homes. In some cases, they can redesign the environments they inhabit online according to their preferences.

Borg notes, 'Some artists adopt a phenomenological approach, becoming part of the place and space in a practice known as "dwelling". Sensory experiences gained through direct engagement complement the artistic aspect and the possibilities technology offers. Similarly, contemporary art installations that allow visitors to walk through and immerse themselves in the work introduce complex spatial dynamics that encourage engagement through movement. The visitor may walk either physically or virtually through the space created by the work and sometimes also be able to engage with it. Emerging technologies have given rise to hybrid practices that entwine the physicality of materials with digital and virtual realms coupled with artificial intelligence. Contemporary art practice considers all the elements discussed here to present a more immersive encounter.

CONTEMPORARY REDEFINITION OF SPACE AND PLACE

Space and place are themes that regularly emerge in contemporary Fine Art practice. The work of art may depict an object in space, a particular place, and it can also open a space through which we may experience 'other' places. Borg explains how Edward S. Casey employs the term 're-implacement', which can be juxtaposed with Gilles Deleuze and Félix Guattari's notion of 'deterritorialization', both terms considering the relocation of one context into another.

Technology, such as augmented and virtual reality (VR), allows artists to push the boundaries of space even further. With such technologies, one is not only able to perceive something in 3D but can also position oneself within that surrounding space and move within it. Similarly, even a simple camera that is connected to the internet is capable

SIntegraM cave

of transporting us to other places around the world across different time zones. 'This is when the relation between space and time gets more blurred, as you can be in a different place at a different time but in the same virtual meeting space, such as with online meetings,' clarifies Borg. You can also project yourself into a place where you are not.

To allow students to engage with research that develops around notions of space and place and to create and utilise such an experience, the Faculty of Media and Knowledge Sciences in collaboration with the Department of Criminology has set up an 'Immersion Lab', funded by the ERDF SIntegraM project and the University of Malta. This lab includes different technologies relating to virtual and augmented reality, including a CAVE (cave automatic virtual environment). In the CAVE, lifelike visual displays are created on its sides by projectors positioned outside it, allowing students to experiment with space for their art research projects. 'It's an immersive lab that offers the ability to create and experience virtually any type of desired space,' remarks Borg. The way it works, in simple terms, is that you can create or import any type of environment within this immersive space which viewers can experience through VR technology. The computer-generated place can be an existing one, such as a historic site, or an imaginary one, and the viewer may interact with it in different ways.

The Department of Digital Arts is dedicated to fostering contemporary Fine Arts research in both traditional subjects and emerging technologies. It offers a variety of focuses, including but not limited to studio practice, immersive technology, interactive art, and moving images from video to animation. Borg emphasises the importance of hybrid practice, which combines physical as well as digital media to investigate a wide range of issues.

In pursuit of encouraging students to explore diverse themes, the department consistently invests in new equipment and collaborations with other departments and entities outside the University. The Department of Digital Arts emphasises the importance of practice-based research through the various art courses it offers. Borg explains, 'theory emerges from the practice as we engage in artistic research to further our knowledge of the subject being investigated'. By integrating studio practice with emerging technology, the department gives students creative opportunities to enrich their learning journey. Borg describes this as a journey that opens up new creative spaces for practice-based investigation.

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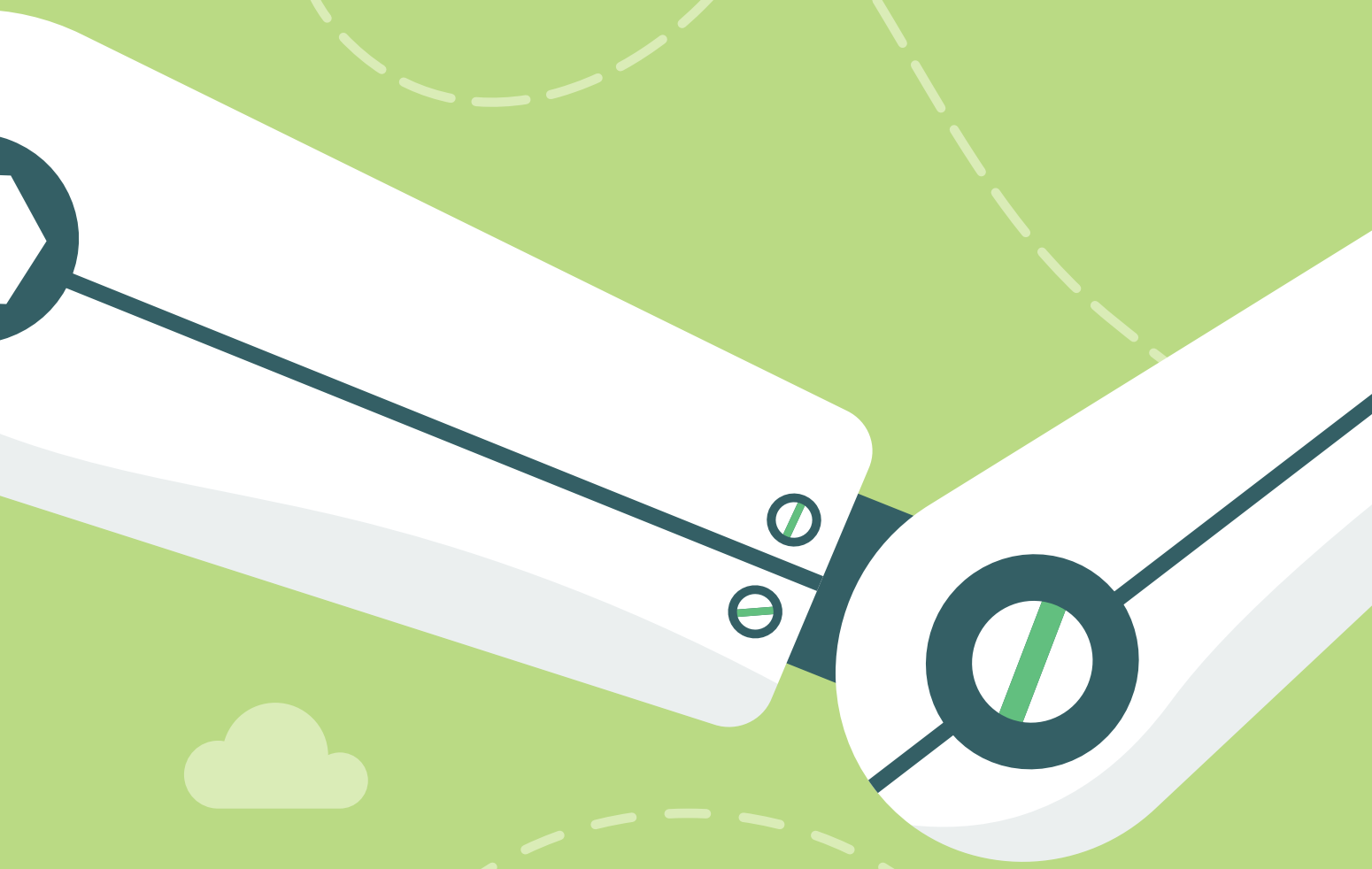
Robot-Inclusive Spaces:
unlocking the key to robot-friendly environments



Author: **James Moffett**

THINK *pays a visit to the Robotic Systems Laboratory at UM to learn about the research and development of domestic robots that may soon become a common sight in our homes.*

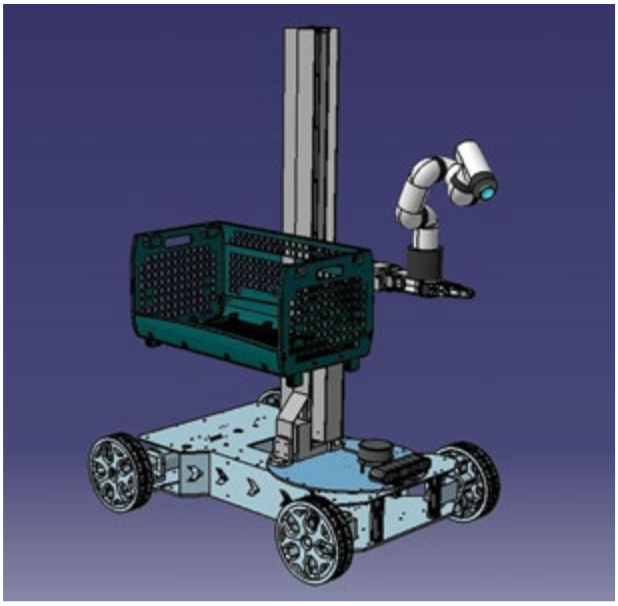
Domestic robots working and caring for us in our homes has been in the collective imagination for decades. Visions of futuristic-looking droids doing household chores while their mortal masters relax and spend quality time with the family have been the goals of many and a natural progression towards ushering in the new millennium. In the almost 25 years since 2000, humanity has come a long way in its staggering advancement of technology. However, what was once envisioned as science fact has remained partially on the edges of science fiction.

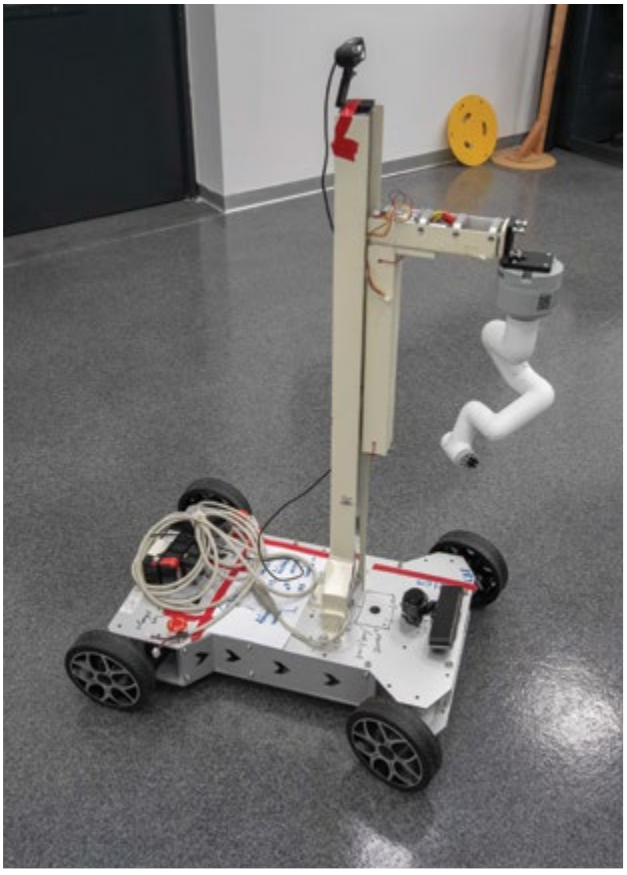
'This idea of a domestic robot has been an aim since robotics started,' says Prof. Ing. Michael Saliba, from the Department of Mechanical Engineering at UM. Together with doctoral student Prabhu Rayudu Naraharisetti, he showcases their current research project on robot-inclusive spaces. 'I remember reading an article in the early 80s,' says Saliba, 'that by 1993 we will have household robots, but it has proven to be a much more difficult problem than originally thought.'

ROBOTICS RESEARCH UNDERWAY

One of the biggest challenges to creating household robots is the generally disorganised nature of the home environment. At the Robotic Systems Laboratory, several different aspects of the environment and associated elements of robot design are being analysed, with various prototypes also being built and tested to try and address this issue. Developed initially as part of a master's student project, the aim was to see how environments could be made more robot-friendly. This would then entail designing robots which can, for instance, manipulate the handles of most common doors and drawers. 'The more things are unstructured in the environment, the more complicated the robot has to be,' says Saliba. 'The robot would need to be more similar to a human being so it could cater for all types of handles and other such objects.' Following on from this, Prabhu's Ph.D. is now attempting to make such robots more autonomous by adapting the environment within which they will operate to enable simplification of the robot's design.

Saliba and Prabhu demonstrate one such machine that has been designed in the shape of a low rectangular base with wheels, together with a vertical linear motor (the 'spine') extending out of its metal body, a horizontal arm, and a gripper. 'We are adding this one now at the top,' says Saliba – pointing at a small robotic arm that looks very similar to that of a person. 'This is a more dexterous manipulator, but still, the environment will be designed in order to make the whole device as simple as possible.' That is the essence of a robot-inclusive environment.





***Top:* A provisional design showing a low rectangular base with wheels, together with a vertical linear motor (the "spine") extending out of its metal body, a horizontal arm, and a gripper.**

Image courtesy of Prabhu Naraharisetti, Prof. Ing. Michael Saliba, and Prof. Ing. Simon Fabri

Photo of the actual robot by James Moffett

STRUCTURED AND UNSTRUCTURED SPACES

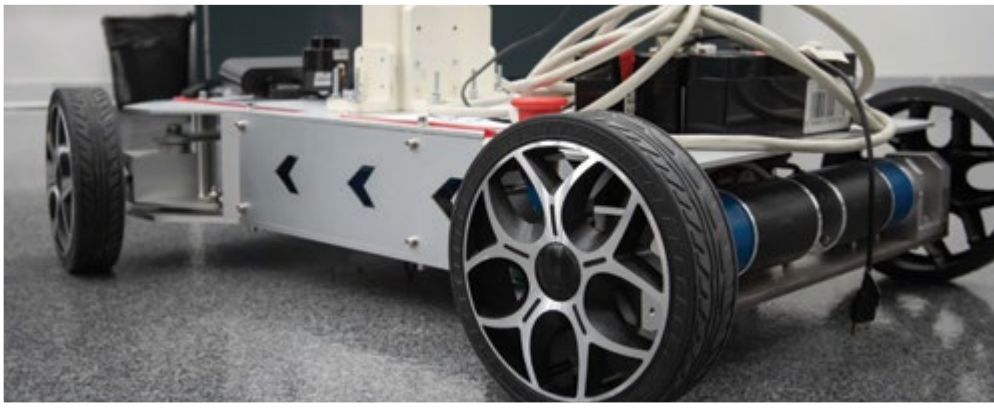
The idea of robot-inclusive spaces demands knowledge of the actual environment in which the robot itself will be performing tasks. The mechanics of the robot would need to be designed according to the space it will be in. This would help simplify the design process and, at the same time, make the robot as effective as possible in carrying out these operations. The difference between a structured and unstructured space depends very much on the objects within that same environment. Despite having a kitchen in which appliances, cupboards, and tables remain in the same position, other movable objects, such as chairs, can be easily shifted around the room – thereby altering the original layout the robot was first operating in. 'We are trying to arrange the home space in such a way that the robot will have to encounter fewer objects or obstacles in its way,' says Prabhu. The team is focusing on three aspects to tackle this issue: observability, manipulability, and accessibility.

As Prabhu explains, 'With observability, we are actually giving the robot support. The robot will recognise some kind of sign or visual marker, and it can go to that thing. So in essence, we are increasing the observability of the environment.' For manipulability, those parts of the environment that need to be handled are simplified and standardised, and robots can then be equipped with specific arms and grippers that allow them to access or grasp the items much more efficiently. Accessibility, in turn, looks at how reachable the spaces and objects are, within the environment in which the robot will operate. 'We have developed an index to quantify the robot-inclusiveness of the space,' explains Saliba. This index attempts to mathematically assign a number to a particular space and thereby enable the researchers to compare it with other spaces based on a scale that demonstrates low or high robot-inclusiveness.

AN ESSENTIAL TOOL FOR THE ELDERLY

Together with this, the team at UM which also includes the participation of Prof. Ing. Simon G. Fabri from the Department of Systems and Control Engineering, deals with the convertibility of an environment to make it more robot-inclusive. In fact, the original incentive of this research, which is still an integral part of the project, was to assist old people to remain in their homes for longer and maintain their independence through the assistance of such robots. Yet, each home is unique, so how can this technology cater for the different spaces and environments that exist?

This is where a separate index developed by the research team comes into play. 'We defined the convertibility index to quantify how easily a particular home can be



Close-up of the arm and the wheel base of the robot.
Photos by James Moffett

converted to spaces having various degrees of robot-inclusiveness,' says Saliba, 'because we want to try to minimise the costs and time, together with effort and client dissatisfaction, of the conversion process.'

The primary mechanics for a robot's manoeuvrability occur at its base. 'When it comes to mobility, our previous model featured a three-wheeled base,' says Prabhu – and this is being upgraded to a four-wheel base robot which can take much bigger loads and is significantly more stable.

Besides the concept of robot-inclusiveness and the creation of an index for determining the level of robotic complexity required for a particular space, Prabhu's Ph.D. is also focused on the robot's autonomy. 'There are vision sensing, image interpretation, mapping, path planning, navigation, voice recognition, and other features,' says Saliba. Carefully written algorithms play a crucial role in designing a robot that can understand and interpret instructions to carry out the tasks required. 'Various general algorithms for autonomous robot navigation in unstructured environments already exist,' explains Saliba, 'but the idea is that the robot-inclusive space helps us to simplify these algorithms.'

LOOKING FURTHER AHEAD

With Prabhu's doctoral research in its final stages, the development of such algorithms is complete and will lead to the implementation and testing of the new robot within its designated environment. Much work is being carried out in this particular field within the Robotic Systems Laboratory and is currently aimed especially at aiding people in their homes. The challenge now is to push the boundaries and limitations of the technology even further. While research on robot-inclusive spaces is being limited to single-floor environments for the time being, another stage will involve the experimentation and testing of robots that can negotiate stairs – which is a very challenging feat from a mechanical point of view. 'Another future stage,' reveals Saliba, 'would be to understand the general needs of people, not just the elderly, with respect to robotic assistance.' Even something as simple (for humans!) as clearing the table may be implemented, and the possibility of remotely operating such robots when not at home is also something that will be part of future developments.

Advancements in robotics do not happen overnight, nor in isolation; rather, a global network of like-minded individuals and researchers – passionate about this field – contribute their own discoveries and innovations that help build the knowledge and skills necessary to take this technology to the next level. Certainly, what is happening at the University of Malta is one aspect of this vast sector, but it is nonetheless an integral part of recapturing our imaginations as we inch closer to science fiction becoming a reality.

Learning in Cyberspace

Author: **David Mizzi**

Virtual reality (VR) technology has made huge advances in the world of video games, embracing a whole new level of immersion and engagement. But what if we could use that technology to make our classrooms more immersive? Researchers at UM are designing the classrooms of the future through VR!

As you step into the room, you hear the familiar hum of conversation. Your classmates are spread around the classroom, chatting animatedly. As your professor stands at the front, waiting patiently, you notice the clock striking on the hour. Suddenly, a giant heart materialises in the centre of the classroom, accompanied by your professor's otherworldly voice, 'Today we're going to explore the biology of the human heart.'

As the lecture unfolds, the heart begins to expand, each vein and muscle tissue intricately labelled. What seemed like an ordinary classroom has transformed into a captivating space where the boundaries of reality and imagination intertwine. Welcome to education, where classrooms exist in the extraordinary realm of virtual reality!

THE VR CLASSROOM

Developing a VR world requires a fair bit of tech, first and foremost: the actual VR headsets. These are large goggles that are worn on the user's head. Once you put on the headset, you're effectively 'in' the virtual world. Controllers, one strapped to each hand, allow you to interact with the world around you. Stepping into the virtual world is incredibly immersive, so it comes as no surprise that some video games are also making use of VR. But how does this work for educational purposes?

Paul Psaila is a master's student working with Prof. Matthew Montebello, head of the Department of Artificial Intelligence at the Faculty of ICT at UM. Using the popular game engine, Unity, Paul decided to create his own VR classroom. 'We're testing an AI being used in a VR classroom to dynamically change the classroom to tailor it to each individual student.' Montebello elaborates that, 'the goal here is immersion. It's in a first-person perspective, so the body experiences it first hand.'

'Essentially, you can have an actual classroom from anywhere. A student can log in and join a classroom, as opposed to a Zoom meeting. This gives variety to the learning environment. Plus, because you're already in a VR environment, you can have unique experiences where you put virtual objects in the environment to show and teach,' explains Paul. For example, you can show actual objects in motion when teaching physics or an actual 3D model of a heart for biology. This takes something like conventional diagrams in textbooks and completely modernises them.

The beauty behind this kind of technology is the customisation aspect. The virtual environment can be anything. 'If you're doing maritime education, you can have an underwater environment; aspiring lawyers can be put directly into a courtroom simulation. You're essentially training them through a simulation,' explains Montebello. This is the same kind of technology that Ford uses to train their big rig drivers or which pilots use before training on an actual plane.

We're testing an AI being used in a VR classroom to dynamically change the classroom to tailor it to each individual student. The goal here is immersion. It's in a first-person perspective, so the body experiences it first hand.

When it comes to Paul's world, the idea is to create a different virtual world for each student while still allowing them to interact with each other. 'When you customise a product or service, it gains value. We want to add that to education,' adds Montebello.

CUSTOMISED EDUCATION

Every student is unique; they have their own learning styles, particular interests, and specific needs. However, having teachers create specific material catered to each student in their class is an extremely daunting prospect. With AI, this is something that could easily be facilitated. 'The idea here is to start with the environment first,' explains Montebello. A student with an interest in sports would have their profile. Their virtual classroom environment could be sports-themed, while another student in the same class, interested in fishing, for example, would have a different profile, and their classroom would change accordingly. Yet, they'd still be in the same class and interacting with the same students.

'For now, the learner profile is developed based on their actions in the virtual world to create a profile. But in the future, it could be possible to import a pre-existing profile,' explains Paul.

Besides Paul, there are also four other undergraduate students: Pedro Guidobono, Luke Cassar, Janice Xerri, and Gianluca Sciberras, who are working on a similar project. 'By having a group of students working on similar ideas, we can encourage a system where they can use each other's research. For example, one of the other students is working on creating a learning profile that collects information about a specific user, such as what websites they like, their strengths, interests, and needs. This profile could also be integrated into Paul's world,' explains Montebello.

Learning within virtual reality goes beyond a simple Zoom call or online conference, where students are passively receiving information. By having avatars, or virtual personas, students can interact directly with each other and the class. By using generative AI to scan their faces, the avatars could have a physical likeness. Alternatively, avatars could also be something completely different, more akin to character creation screens in video games.

Left to right: Pedro Guidobono, Janice Xerri, Gianluca Sciberras, Prof. Matthew Montebello, Luke Cassar, and Paul Psaila. ***Photo by James Moffett***

However, this customisation isn't limited to just the students and their digital representations. The technology goes much further than that! For example, a lecturer would be able to simultaneously deliver the same lecture in a variety of languages. 'Through the use of AI, you can have a generative AI develop and prepare a lecture in advance, in any language. This allows for further customisation, so a student would be able to hear a lecture in their native language,' adds Montebello.

'We're converting one of our labs to an audio-visual studio. The lecturer would record a 3-minute video clip of themselves speaking, and this would give the AI the information it needs to generate more videos using the lecturer's likeness. The AI would then be able to translate the lecture into a variety of languages, and the avatar itself would even be able to deliver the lecture in those languages,' Montebello says.

While VR could revolutionise the way lectures are given, it could also help to modernise the way students are assessed. Instead of simply having students write their assignments or exams, VR could be directly incorporated. You could have exams that use videos or 3D models. For example, in the case of architecture, you could have students inspect a building through VR and try to identify potential issues or faults.

BACK TO REALITY

Despite its exciting prospects, there are still challenges that need to be overcome. One of the biggest challenges is the barrier of entry in terms of price. Each commercial headset can cost anywhere from €500 to €3,500. Ensuring that each student has a headset could very quickly add up. Furthermore, some people can experience a degree of motion sickness through VR. 'When it comes to motion sickness, the technology has improved a lot, for example by increasing the refresh rate,' explains Paul. 'The technology has come a long way, but some people might still be unable to use the technology. In this case, they would be able to log on virtually through their desktop, for example, instead of using a VR headset.'

However, the technology could have a huge impact on individuals with disabilities. Controllers are being developed for people with specific disabilities, and those who are physically challenged can experience a whole new level. In fact, within the AI department at the Faculty of ICT, VR has been used to show how individuals with autism experience the classroom. This has helped to inform lecturers and students and allows them to create a more appropriate environment.

The potential for VR technology is immense. Given the unparalleled levels of immersion and engagement that VR provides in video games, it only makes sense to harness and apply this capability to education. Montebello concludes, 'When it comes to VR learning, it is only our imagination and creativity that are the limit!'

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Unmasking Deepfakes

Navigating the Shadows of Digital Deception

Author: **James Moffett**

THINK *explores how aspects of deepfake technology work and investigates the risks that come with it.*

Despite the widespread use of generative AI such as ChatGPT, Gemini and DALL·E, many users are still oblivious to the inner workings and sophisticated computing that lie behind it. **THINK** sat down with Dr Dylan Seychell, lecturer at the Department of Artificial Intelligence at UM, to clear the air and discuss how generative AI actually works.

Simply put, generative technologies refer to a category of tools and systems that use artificial intelligence to generate new content, ideas, or approximate solutions. Rather than following pre-programmed instructions, these technologies can sift through existing data and learn specific patterns to produce unique results.

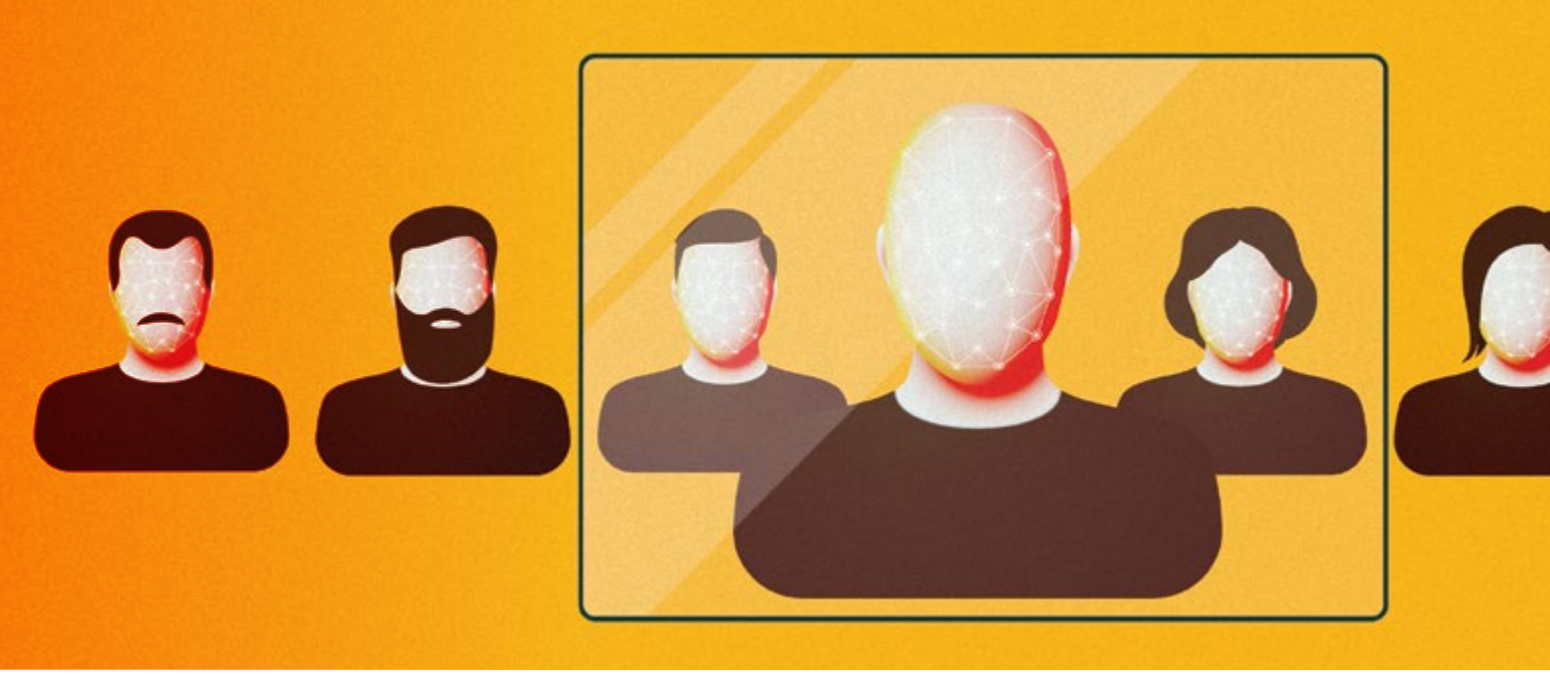
To improve the outcomes of such technologies, training is required. AI Systems such as DALL·E, ChatGPT, and Gemini are being taught with a colossal amount of data sets – a collection of data to test and train algorithms and models. For instance, a few years back, AI models were being trained on tens of thousands of images to identify particular items or objects. Nowadays, the sophisticated nature of these models requires it to train on billions of images. 'Once you are processing all that information, you are beginning to create relationships with different images that, as human beings, we are not capable of creating; and this is something which helps us work together with AI,' Seychell explains.

THE PITFALLS AND BENEFITS OF DEEPFAKE TECHNOLOGY

The sophisticated nature of AI has granted users scenarios which could not be conceived before. Tools are being designed in such a way that allows anyone to create photos of someone by inputting descriptions of a person – enabling the technology to then create an image based on the details provided. 'When we talk about deepfakes, besides giving some form of instruction to the AI tool to create a photograph, we can also give visual descriptions and images of a real person.' Therefore, the generated content will be created using the visual characteristics of the real individual being described. In this way, one can use someone's photograph and place that person in another image or video, and in a situation where this person was not actually present.

'There are a lot of dangers of using deepfake technology. I struggle to find any positives in it, to be honest,' maintains Seychell. 'It rarely happens, but when I weigh this particular technology, it is difficult to find anything advantageous about it.' One of the ways deepfakes work is through what is referred to as Generative Adversarial Networks (GANs).

To better understand GANs, let's imagine a scenario: a money forger and the police who are trying to find out



which money is a forgery. The forger needs to produce a false banknote, so he uses a napkin and writes down €500 on it with a pen. He hands it to the police, who realise it is not real money. So the forger then prints a piece of paper on a computer with €500 typed on it. He tries again, but the police still identify it as a fake. The forger then adds a bit of colour and adjusts the banknote's size correctly, and the police start to doubt but still realise it is fake money. Eventually, the forger manages to produce a banknote where the police are unable to distinguish between it and a real one.

Similarly, this process creates sophisticated and learned AI algorithms, which have been designed in such a way as to teach and learn from each other, via the generator (the forger) and the detector (the police). Despite the benefits of having an AI model teach itself in such a way, issues may soon arise that can spiral out of control. 'If the detector being placed is more sophisticated in detecting fakes, the generator will keep on generating even more realistic and convincing content,' explains Seychell. This will happen in turn until the detector fails to detect what is real or fake. 'It learns and keeps on improving,' continues Seychell. 'The more we improve detection, the more we are improving the generated content.' In this sense, using GANs makes the situation worse when it comes to recognising deepfake content.

2024 is a record for elections worldwide, with around 40 to 60 in total. This year we will witness the real test of how these things escalate.

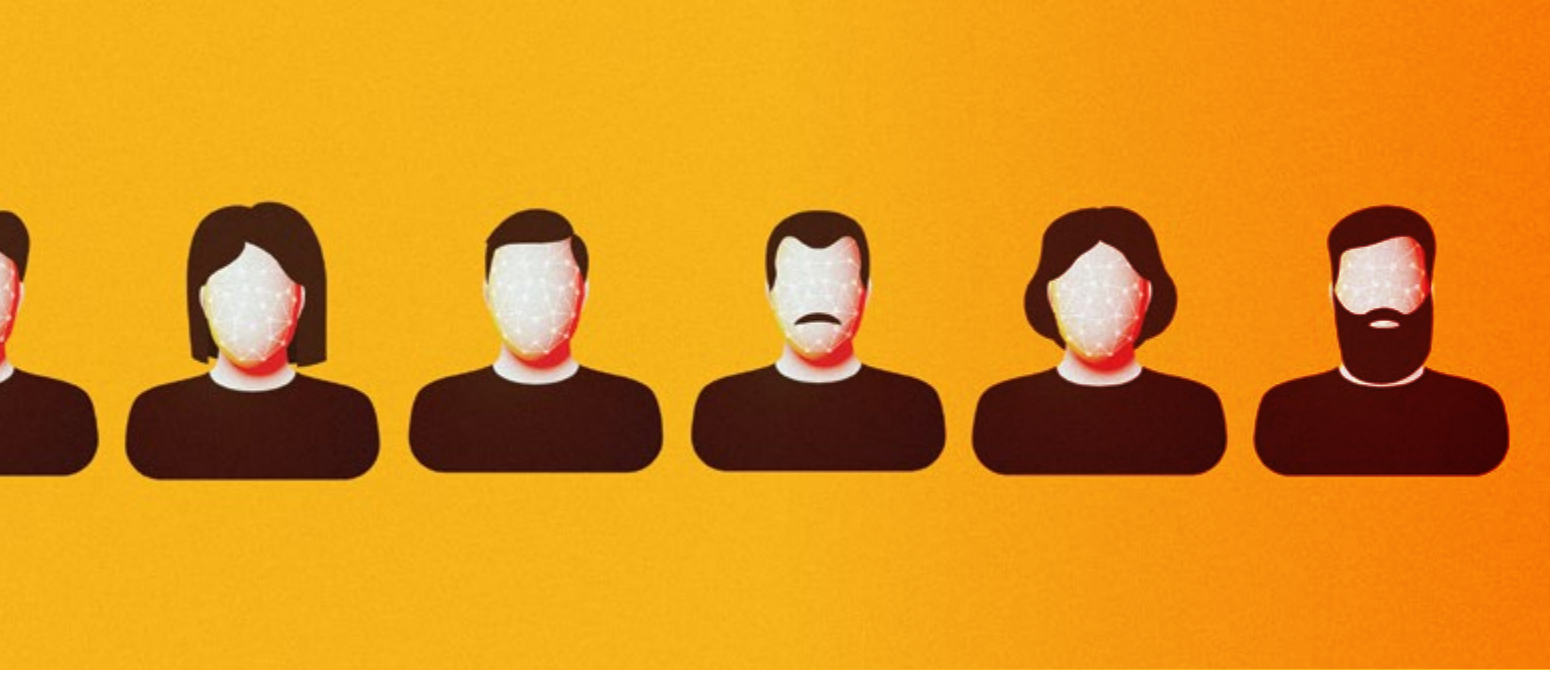
Nowadays, countless online scams disguised as advertisements have infiltrated every nook and cranny of cyberspace. Using deepfake technology to place well-known individuals in such ads and asking viewers to invest in fraudulent business schemes has become the norm. *TIME Magazine* points out that 2024 is a record for elections worldwide, with around 40 to 60 in total. This year we will witness the real test of how these things escalate.

While Seychell believes that deepfake technology does not provide many positive outcomes, there are certain advantages of employing it in particular fields. Two such possible instances are the cultural and medical sectors. Within the cultural sphere, visitors to an interactive centre may have the possibility of speaking to historical figures – brought back to life, as it were, through AI's sophisticated approach – which can instil a deeper appreciation for history in general. In addition, techniques involving neural networks and architecture can also be used to generate synthetic data that allows the training of algorithmic models to predict heart diseases or approximate the production of certain new medicines.

'There are certainly positives from this type of technology, but from the perspective of vision – when you see it generating something visual – that is where it starts to be difficult to find the pros. When you combine this technology with society, it has some ugly implications,' says Seychell. As with anything else, technologies are sometimes twisted to be used for nefarious purposes, despite their innocent origins.

BUILDING A SENSE OF INTUITION

Despite persistent warnings to be on the lookout for false advertisements, fake scam calls, and the like, with the ever-increasing sophistication of deepfake algorithms, identifying



what is real or not is becoming more problematic. As an academic and researcher on artificial intelligence, Seychell offers some pointers one can follow when encountering potentially misleading information. 'When we come across something that is not normal, or we are not completely expecting it, let us find alternative ways to verify it.' As technology users, we need to build a sense of intuition so that we do not jump to conclusions. Especially when it comes to money, Seychell's rule of thumb is to always check first. 'If we think someone we know is asking for money, but they do not normally do, pick up the phone and call them.' Verifying the legitimacy of the information before acting is a sure way to avoid falling for such deceptions.

Using this financial scenario as an example, Seychell's take on this issue extends further – outlining the clear-cut distinction between what constitutes technology and what makes us humans. 'If someone I know is asking for money, besides verifying it, as a human being I should care enough to check up on that individual to see how I can help them directly.' We need to look at ourselves and examine how we use technology in addition to the social aspect of us as human beings. What we need to ask is whether it is more convenient to send money rather than care for the person, and seeing how many are victimised by such scams, could this imply that we may be losing touch with our human selves?

TECHNOLOGY AS OPPORTUNITY

Despite the pitfalls and concerns that are brought about with every new technological development, as Seychell sums up, 'let us also not be afraid of technology. Even though we discussed the dangers, deepfakes happen to be the only topic that worries me.' Yet, there is a wealth of advantages and positive outcomes from the use of AI technology in general that we are now becoming more dependent upon. Without its use, human beings would regress, given how ingrained within our societies artificial intelligence has become – and is continuing to do so. Being aware of the utility of these tools, along with their possible negative applications, will arm users with enough knowledge to proceed at a steady, if cautious, step towards the next stage in our own evolution. Ultimately, technology aims to transform challenges into opportunities.

'If someone I know is asking for money, besides verifying it, as a human being I should care enough to check up on that individual to see how I can help them directly.'

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LuminEye
GAZING
INTO THE
FUTURE

Author: **David Mizzi**

Our eyes speak volumes, whether it's a disapproving glance from your boss or a deep gaze of affection from your partner. However, our eyes can communicate more than just emotions; they can also serve a groundbreaking purpose through eye-tracking technology. In the blink of an eye, this technology can be revolutionary for those with physical disabilities.

When I was a young boy, my mother had an ingenious way of stopping me from using the computer when I should be studying. She would simply unplug and take away the keyboard or mouse. Without either of these devices, there was simply no way for me to interact with the computer (and play video games).

For some individuals, such as those with physical impairments, using a mouse or a keyboard is simply not an option. However, some alternatives can allow users to interact with their computers without such devices. One way to improve accessibility is through eye-tracking technology. Essentially, your eyes function as a mouse. If your eyes are looking at the bottom right of the screen, the cursor moves to that part. Look long enough, and you click. In principle, it's fairly straightforward; however, actually designing the technology is a different issue entirely.

'Current eye-gaze trackers available on the market are active,' explains Dr Ing. Stefania Cristina, senior lecturer at the Faculty of Engineering at UM. 'This means they actively shine infrared light on a patient's face and eyes. The idea is to create a "red eye effect" or glints on the cornea. These allow the technology to estimate where the user is looking. The downside is that if you have other infrared sources, such as the sun, that creates interference.' Furthermore, to shine the infrared light, you need specific equipment: the eye tracker that attaches to the computer, which can be quite expensive. Users are also limited in their movement, and the hardware needs to be regularly calibrated to work effectively.

The LuminEye Project aims to create an eye tracker that doesn't require such a controlled environment and only uses visible light and a webcam. This would allow users to circumvent the need for expensive technology, as the program would detect and capture a user's eye movements just through their webcam. 'To do so, we're using passive and pervasive eye-gaze tracking,' says Cristina. But what does that actually mean?

'With pervasive eye-gaze tracking, the idea is to have technology that can be implemented in flexible conditions, for example at longer distances and not just sitting in front of a monitor or constraining users to a stationary position,' explains Cristina. 'Passive technology doesn't actively shine a light on the user. The goal is to drop infrared technology completely and allow users to simply use their webcams.' Of course, developing something so user-friendly creates its own set of challenges.

LOCATING THE IRIS

Throughout their research, the team was able to create an eye-tracker that allowed users to control a keyboard on the screen with a degree of accuracy. However, one persistent problem was the identification, or localisation, of the iris centre. For example, changes in light, a different environment, or shadows, would mean that the software would lose the user's iris.

Way back in 2007, when Cristina was still an undergraduate studying with Prof. Ing. Kenneth Camilleri (Director of the Centre for Biomedical Cybernetics), they were using geometric models to model the eye-in-head movement. This would model how the face changes based on head movement. Since then, neural networks have rapidly developed, and the team decided to incorporate them into their technology. The neural network would be trained using varied and challenging image datasets to help it better identify the user's iris under difficult lighting conditions. 'Results were promising; however, there are other challenges that come with using neural networks,' says Cristina.

'Neural networks are computationally expensive, so most commercial computers might struggle to run the programme. Our goal is to make the code as lightweight as possible,' says

The LuminEye team (from left to right): Dr Ing. Stefania Cristina, Mr Nipun Sandamal Ranasekara Pathiranage, and Prof. Ing. Kenneth Camilleri
Photo by James Moffett

Cristina. The other challenge is that neural networks are trained models, which means they need vast amounts of data to be trained effectively. 'We either capture our own data or use publicly available data sets. Since we're looking at different eye types, the data needs to be as varied as possible.' For example, using sample data exclusively with brown-eyed users to train the algorithm means that it would struggle with blue-eyed users.

GAZE INTO THE FUTURE

While the LuminEye project enables users to navigate the digital realm using just the subtle movements of their eyes, a visionary student in their final year aims to push the boundaries even further. Imagine a user, seated comfortably across the room, able to control other devices besides their computer, such as their television, using just their sight.

The main challenge is expanding the reach of eye-tracking capabilities, allowing the software to track a user's eye movements from a considerable distance away. To do so, Erik Micallef is investigating a way to superresolve sample images. The algorithm's training process relies heavily on vast sets of sample images. While images of users close to the screen distinctly capture their gaze, those seated at a distance present a murkier scenario. Nevertheless, through the process of superresolution, these images gain clarity, empowering the algorithm to recognise and interpret eye movements. This development represents a significant stride towards a more inclusive and user-friendly future, catering to the diverse needs of individuals who seek both convenience and accessibility in their technological interactions.

The LuminEye project not only pioneers a new frontier in user interface, but also makes this technology more accessible to the people who need it most. By perfecting LuminEye, the team would be able to offer an alternative to current cumbersome infrared technology and instead offer something more intuitive and versatile. Truly, we can see the future unfolding right before our eyes!

The LuminEye project is financed by the Malta Council for Science & Technology, for and on behalf of the Foundation for Science and Technology, through the FUSION: R&I Research Excellence Programme 2022. Prof. Ing. Kenneth Camilleri and Dr Ing. Stefania Cristina are the main investigators. Mr Nipun Sandamal Ranasekara Pathiranage is the Research Support Officer.

The Future is She: Girls Go Robotics

Author: **Catherine Camilleri**

Environmental sustainability is at the forefront of young people's global consciousness. Three students have proven that new technologies can be designed to address significant ecological issues, winning an international robotics competition and creating an innovative robot prototype, Rocky CO.2, that can change the way we address carbon emissions.

The need to forge a green, eco-friendly future is rapidly increasing. New advances in science and technology make it an exciting time for young people who want to solve ecological issues through digital means. In Malta, a team of young innovators are leading the way in the discussion. Sofiya Chuzhda (from Ġ.F. Abela Junior College), Antonia Ciappara (from St Nicholas College, Dingli Secondary School), and Elizabeth Kovrigina (from IES El Getares, Algeciras, Cádiz, Spain), teamed up to win an international robotics competition facilitated by Girls Go Circular, an online project that aims to enhance female representation in the digital realm. The team's revolutionary prototype, Rocky CO.2, tackles CO_2 emissions through a process called 'enhanced rock weathering', and their work has paid off.

GIRLS GO CIRCULAR AND THE COMPETITION

Girls Go Circular is a free initiative that aims to bridge the digital gender gap and motivate 40,000 schoolgirls interested in STEM (science, technology, engineering, and mathematics) by 2027, equipping them with digital and entrepreneurial skills to succeed in the circular economy. Sofiya first heard about Girls Go Circular and the robotics competition in complete Gen Z fashion: through Instagram. 'I was just scrolling through my feed, and I saw this ad pop up advertising the competition. I thought, "Wow, what an amazing opportunity." I've always been interested in the environment and how we can improve it. I said to myself, "We have to do this."' Sofiya immediately messaged her friend and fellow STEM student, Elizabeth, who was just as excited about the opportunity. 'I've always been interested in STEM, so when I heard about this, it seemed right up my alley and struck me as a very unique experience,' Elizabeth says. The duo quickly signed up for the programme and a place in the Robot Design Challenge, a competition that invited teams of three students to design a robotic prototype to address a significant ecological problem. Teams had to specify the target user and the environmental impact, as well as create an actual prototype. One team from each participating country would be invited to the Women and Girls in STEM Forum held in Brussels, and the top three would present their prototypes to their peers.

The trio from left to right: Elizabeth Kovrigina, Antonia Ciappara, and Sofiya Chuzhda

Photo courtesy of Sofiya Chuzhda

Through JA Malta, an NGO promoting Entrepreneurship, Employability, and Financial Literacy, and their mentor, Marco Calleja, Sofiya and Elizabeth were grouped with Antonia, who was already involved in Girls Go Circular, to complete their trio. 'I have always been interested in environmental issues,' Antonia explains, 'and this was a perfect opportunity to help me further both my knowledge and skills.' Together, the three students set out to identify a prevalent ecological issue and create their robot.

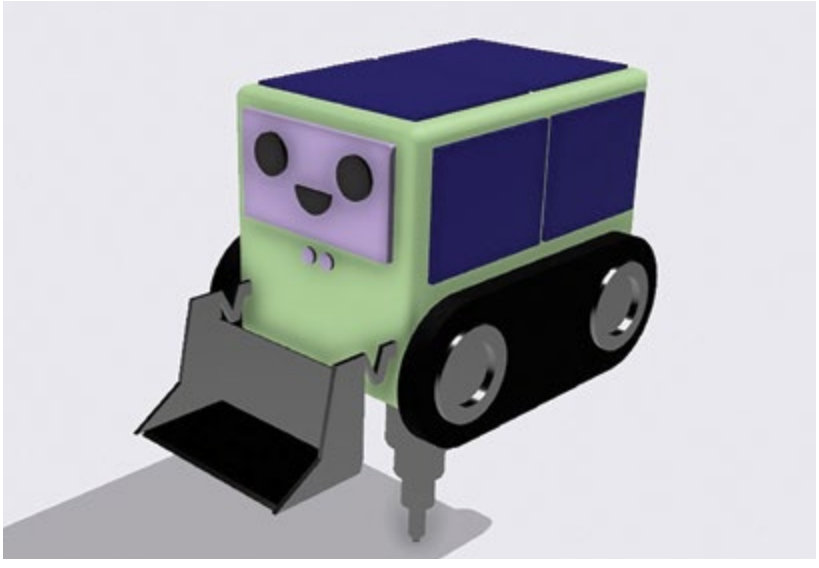
FIGURING OUT THE PROBLEM AND OVERCOMING CHALLENGES

One of the greatest challenges the trio faced was that they could not meet in person, as Elizabeth was based in Spain. 'We were the only team whose members were located in different countries, but I think working online only boosted our knowledge and experience and allowed us to put the skills we learned into practice,' Elizabeth explains. Despite the difficulty, the trio delegated their research and expanded the search for their ecological challenge, finding a plethora of possible topics they could cover.

Through their research, the trio stumbled upon a *Vox* video about carbon capture and the process of removing CO_2 from the atmosphere. They were eager to learn more. While there are numerous ways to remove CO_2 from the atmosphere, the girls were most interested in the process of rock weathering, a naturally sustainable geoengineering technique where CO_2 is permanently stored in carbonate minerals. The team also learned that this technique could be accelerated through a process called enhanced rock weathering, which opened the doors to their ecological problem and solution: creating a robot that could remove CO_2 from the air through enhanced rock weathering. But what exactly is this technique and how can it help sustain our environment?

WHAT IS ENHANCED ROCK WEATHERING?

The process is quite straightforward: CO_2 in the air dissolves in rainwater, becoming carbonic acid, and when it falls on rocks that have magnesium or calcium ions, it reacts, forming carbonates that store CO_2 in these minerals. The team discovered that this could be enhanced by accelerating the natural weathering process and breaking down ion-rich minerals to absorb greater quantities of CO_2.



Prototype of Rocky CO.2
Image courtesy of Sofiya Chuzhda

The trio accepting their award.

From left to right: Liana Svachiy (EIT Alumni Board Member), Marco Calleja (JA Malta), Elizabeth Kovrigina, Antonia Ciappara, Sofiya Chuzhda, Diana Filip (Deputy CEO of Junior Achievement Europe), and Bas Koomen

Photo from Facebook (Girls Go Circular)

While there is great global emphasis on reducing CO_2 emissions, the idea of *removing* CO_2 from the air is less well-known. 'It's not stopping CO_2 production; rather, it is removing that CO_2 from the air, which was mind-blowing to me,' says Sofiya. The team decided that a robot that could speed up this natural process by crushing rocks to increase surface area and create a widespread reaction could be designed, mitigating the greenhouse effect and effectively dispersing CO_2 that is already present in our atmosphere.

ROCKY CO.2: HOW DOES IT WORK?

Now that they had their revolutionary solution, the team set out to create their robot – a difficult feat given that none of the team members had a background in robotics. However, with the drive to create new ecologically sustainable technology, the girls designed an autonomous robot prototype to locate magnesium and calcium-rich rocks like limestone and basalt, crush them into a fine powder, and disperse them. What emerged was their innovative prototype, Rocky CO.2. Made from cellulose nanofibers and recycled aluminium and equipped with solar panels to reduce carbon emissions, Rocky CO.2 essentially functions as a drill that crushes rocks and spreads them to absorb CO_2. The rocks themselves don't absorb CO_2 rather, a reaction occurs within the ions in the rock, forming carbonates, which store CO_2 quickly and more effectively. Rocky CO.2 dramatically speeds up the weathering process, and the robot also reduces soil acidity while increasing its fertility by dispersing magnesium and calcium, making the soil more suitable for plant growth. While Rocky CO.2 may be a simple concept, Sofiya, Antonia, and Elizabeth brought innovative technology and scientific solutions to the forefront, highlighting their passion for sustainability and drive to impact our environment to forge a carbon-free future positively.

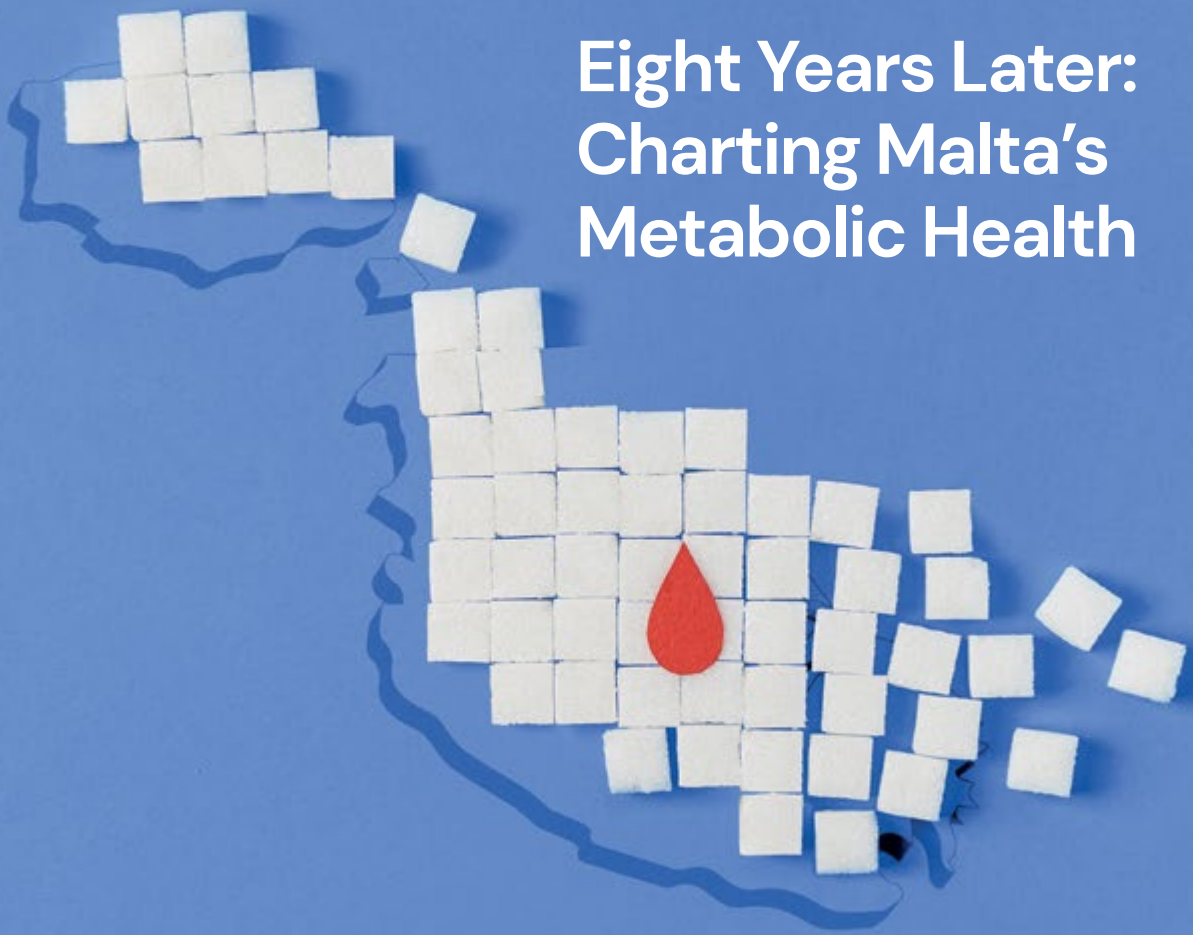
WINNING BIG AND THE FUTURE OF ROCKY CO.2

Girls Go Circular challenged their participants to think sustainably and imagine how technology can counteract ecological issues, and team Rocky CO.2 delivered. The team and their robot prototype were invited to Brussels to present at the Women and Girls STEM Forum, which was also the first time the entire team met in person, mere hours before their presentation! After a dynamic explanation of their prototype and highlighting the far-reaching environmental impact of Rocky CO.2, Sofiya, Antonia, and Elizabeth were awarded top prize by a panel of esteemed judges. Recalling the moment of victory, Sofiya remembers: 'We were all nervous but extremely excited too. I had my doubts about winning, Antonia was also not expecting it, but I remember Elizabeth gripping my hand very tightly with a confident smile and whispering that we were going to win, and as it turned out, she was right.'

ADVICE FOR GIRLS IN STEM

'Pursuing a career in STEM is already challenging enough and having to do it in a male-dominated environment only makes it harder,' Antonia says. 'However, don't let this stop you from following your dreams. Never give up because in the end you will succeed and it will all have been worth it.' Sofiya also stresses for young women to engage in initiatives like Girls Go Circular. 'Don't be afraid or let people tell you it's too hard to jump on these opportunities,' Sofiya comments. 'And always be on social media, because that is where the opportunities are advertised the most. Make your social media algorithm work for you.' Ultimately, Sofiya, Antonia, and Elizabeth have proved that young people can instigate substantial change in our world. The possibilities of what they can achieve through initiatives like Girls Go Circular are endless.

Eight Years Later: Charting Malta's Metabolic Health



Author: **Andrea Cuschieri**

The UM conducted a cross-sectional study in 2014 examining the metabolic health of the local population with a focus on type 2 diabetes mellitus (T2DM) and obesity. The question is, how has Malta's health changed since then? **THINK** *takes a look at an upcoming follow-up study to find out!*

Diabetes was recognised as a health concern among the Maltese population as early as 1886. Since then, the prevalence of T2DM has been periodically examined. Nevertheless, these subsequent investigations were limited and might not have accurately portrayed the rapidly changing health status of the country.

Responding to the evolving health scenario and the need for rigorous research investigating Malta's metabolic health, Dr Sarah Cuschieri, lecturer with the Faculty of Medicine and Surgery at UM, conducted the pivotal 'SA~~HH~~TEK – The University of Malta Health and Wellbeing Study' between November 2014 and November 2015. This cross-sectional study involved recalling 4,000 adults aged 18 to 70, residing in Malta for at least six months. Cuschieri investigated health indicators such as blood pressure, weight, height, waist circumference, and blood tests across various social demographics.

Gender disparities were highlighted, showing that males were more likely to be obese and older obese males were more prone to high blood pressure and abnormal cholesterol profiles, increasing the risk of heart disease. Yet, although the highest prevalence of overweight individuals was in the 55 to 65 age group, there was no significant difference between genders in this regard.

The SAĦĦTEK team, from left to right: Dr Sarah Cuschieri, Dr Elizabeth Grech, and Prof. Neville Calleja
Photo by Kristov Scicluna

The SAĦĦTEK study, involving a cross-sectional examination of a random sample of Maltese adults, identified a type 2 diabetes prevalence of 10.39%. Males exhibited a higher susceptibility compared to females. Among the total type 2 diabetes group, 6.31% were previously diagnosed, while 4.08% received a new diagnosis during the study. Beyond diabetes, the research revealed a prevalent presence of chronic diseases, notably with obesity levels reaching around 70% from as early as 18 years old.

SAĦĦTEK initiated a cascade of questions. The initial study revealed not just static numbers but a dynamic landscape, marked by high levels of overweight-obesity from an early age and the early emergence of chronic diseases. However, eight years is an especially long time in the fast-paced field of medicine. What happened in the years following the initial examination? How many individuals developed new chronic conditions, and what risk factors influenced them? The spectre of the COVID-19 pandemic further intensified the need for answers, sparking the decision for a follow-up study.

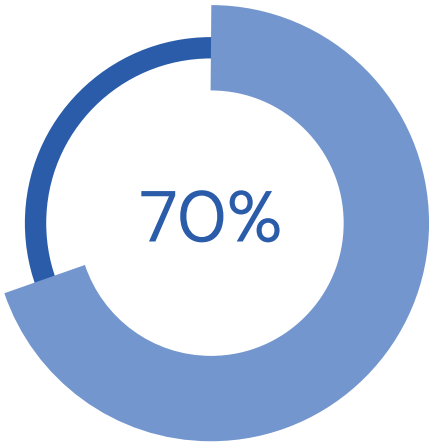
THE FOLLOW-UP LONGITUDINAL COHORT STUDY

To answer these questions, Dr Elizabeth Grech, overseen by Cuschieri and Prof. Neville Calleja, is conducting a follow-up longitudinal study to re-examine a subset of the original SAĦĦTEK participants. This study, titled 'Analysis of the Metabolic Status of the Maltese Population: A Longitudinal Cohort Study,' is a collaborative initiative between the Ministry of Education, Sport, Youth, Research, and Innovation, and UM through the Research, Innovation, and Development Trust (RIDT). Its objective is to address significant gaps in our understanding of how the health dynamics of the Maltese population have evolved. By uncovering long-term repercussions and identifying evolving risk factors, this study aims to provide crucial knowledge for shaping targeted public health strategies in response to the increasing prevalence of chronic diseases.

What sets this study apart in the European health research landscape is its focus on a smaller, yet representative sample of the population. While many health surveys across the continent are often cross-sectional, the longitudinal nature of this cohort study distinguishes it by providing a unique opportunity to track health changes over time. Moreover, as this unique study unfolds, expectations rise. Anticipations include an increase in the percentage of chronic diseases, a surge in multimorbidity, and the identification of elusive risk factors that weave the intricate fabric of metabolic health. The study will unveil, for the first time, incidence rates of diabetes mellitus, obesity, hypertension, and metabolic syndrome, providing crucial benchmarks for understanding the evolving health landscape of Malta.

BEYOND RESEARCH: IMPLICATIONS FOR NATIONAL AND EU PRIORITIES

This longitudinal study serves not only as a scientific endeavor but also as a response to both national and



Beyond diabetes, the research revealed a prevalent presence of chronic diseases, notably with obesity levels reaching around 70% from as early as 18 years old.

European health priorities. The importance of up-to-date evidence cannot be overstated. Malta's significant role in European studies on obesity further underscores the national commitment to address this chronic disease. By identifying potential risk factors, the study actively contributes valuable insights for policy and preventative strategies.

As the inaugural health examination study to assess the metabolic status of the Maltese population post-pandemic, this research provides invaluable information for both national and international contexts. This information is essential for driving effective preventative and management strategies and policies. Notably, Malta's dominance in the realm of obesity, as reported by EUROSTAT through various European studies, makes targeting this chronic disease a national priority. Unveiling evidence on potential risk factors contributing to obesity is vital in addressing this issue.

As the study progresses, it holds promise for shaping public health policies and interventions. The insights derived will function as a guiding compass, facilitating the formulation of evidence-based strategies to tackle the challenges posed by chronic diseases and the post-COVID-19 era. In the pursuit of global health targets, this study becomes a beacon, offering real-time data to inform policies that align with the ever-evolving health needs of the Maltese population. The SAĦĦTEK legacy extends beyond numbers and charts; it illuminates the path toward a healthier, more resilient future for the Maltese population and beyond. T

Acknowledgments

The SAĦĦTEK study could not have been conducted without the strong support forthcoming from the University of Malta (through the Medical School and Research Innovative Development Trust department) and from the Alfred Mizzi Foundation as major sponsors, as well as that of a host of others, including Atlas Health Insurance (Malta). The in-kind support and encouragement of the Ministry of Health, Malta, is also gratefully acknowledged. Furthermore, a note of appreciation and acknowledgement is forwarded to Professor Julian Mamo, Professor Josanne Vassallo, and Professor Neville Calleja for their continuous support and advice during the study.

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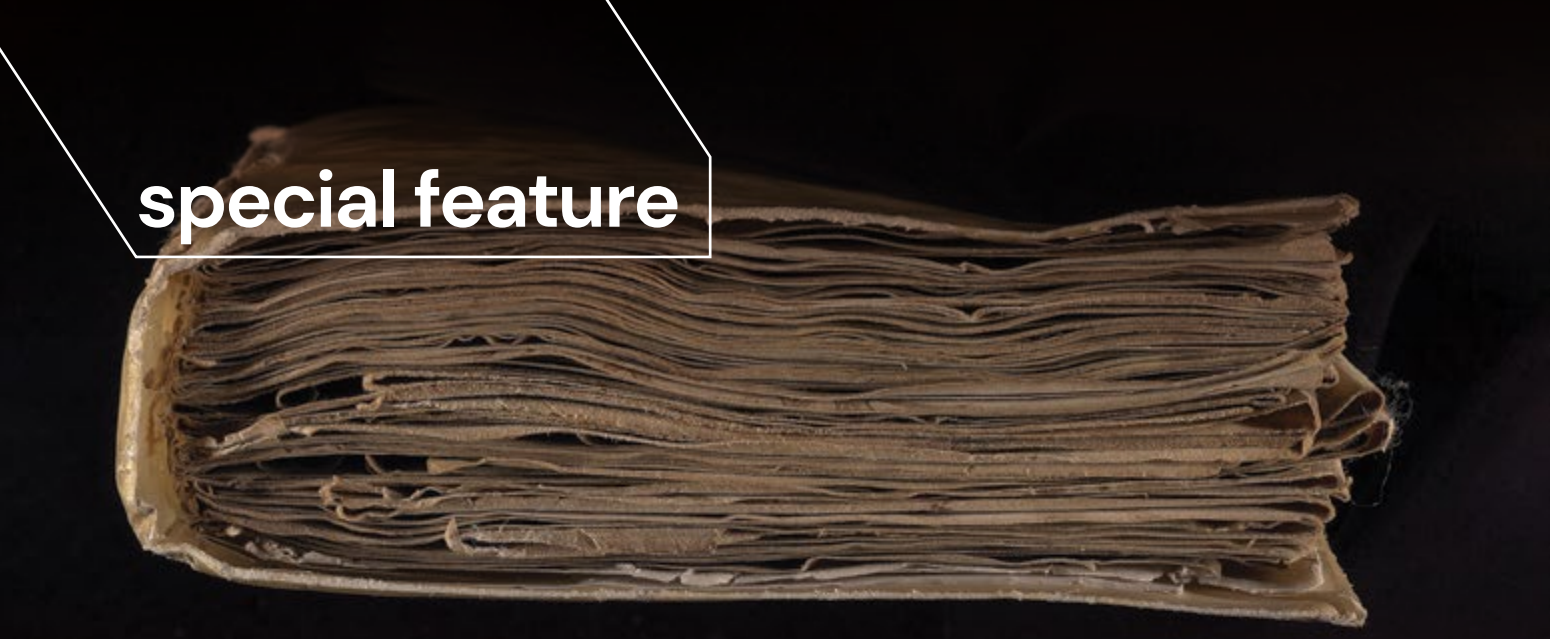


The Voynich Manuscript

Author: **Jonathan Firbank**

The Voynich Manuscript is one of the most enduring historical enigmas, attracting multidisciplinary interest from around the world. ***Jonathan Firbank*** *speaks with UM's wing of the Voynich Research Group about the history, mystery, and cutting-edge technology brought together by this unique medieval text.*

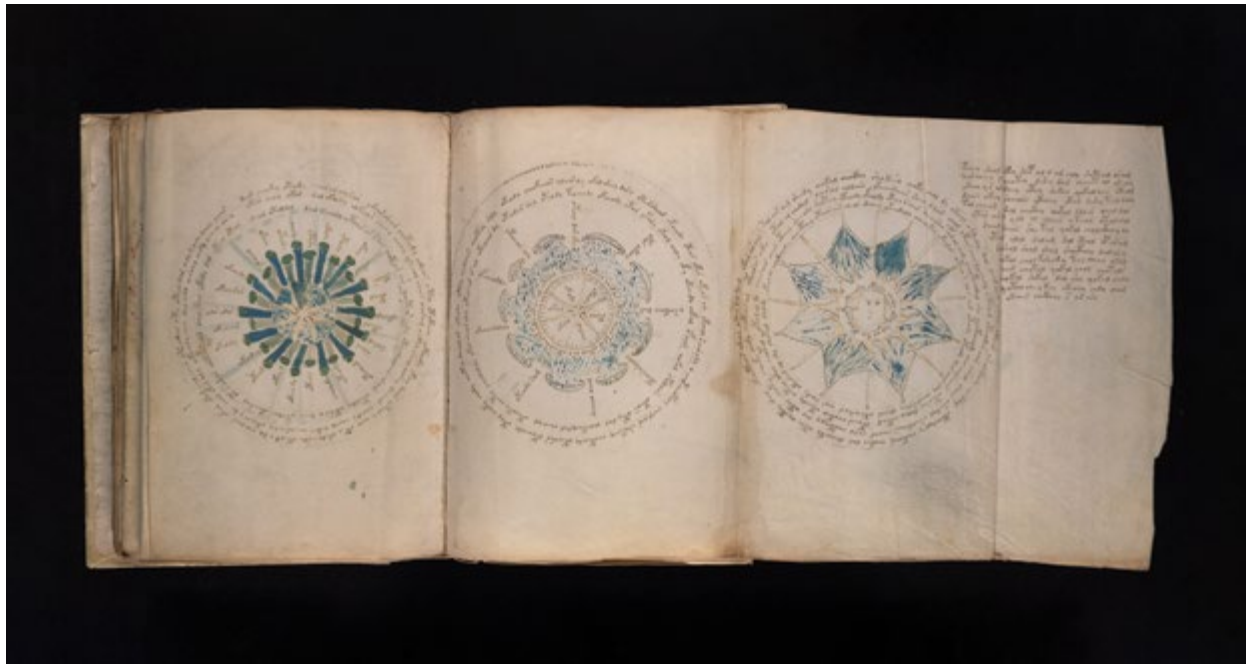
For 600 years, a unique tome has passed from person to person. Its pages, calf skins radio-carbon dated to the 15th century, have outlived at least one binding. Upon them, crude pigments form hallucinatory pictures: astrological geometry, alien vegetation, medieval castles, and tentacular tubes enveloping naked figures. These images snake around a script that's yet more mysterious: A language with its own alphabet, so indecipherable as to be considered encrypted by some scholars.

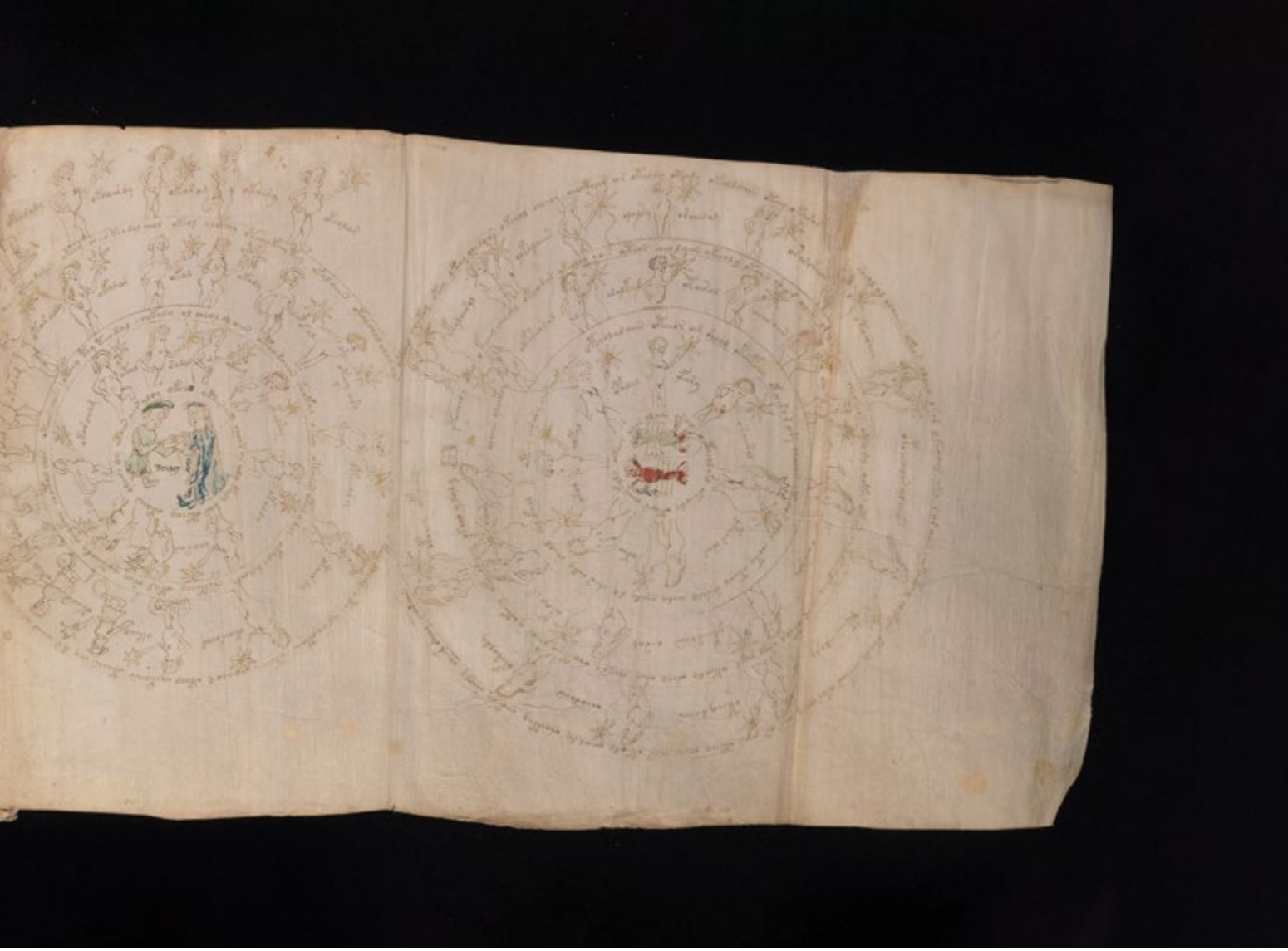
This manuscript has enthralled some of the greatest minds of their eras as they sought to unlock its meaning. It has preserved its secrets even from the latest methods of artificial intelligence, after confounding emperors and their courtiers, codebreakers and spies, and scientists for centuries. Or perhaps it was an elaborate forgery made a mere century ago, created by a socialist revolutionary ironically seeking fortune. Regardless, the sheer difficulty of discovering what the Voynich Manuscript is, and what its content could mean, is creating ever more innovation and collaboration.

A POLYMATH RIDDLE

When Wilfrid Voynich discovered the Voynich Manuscript, he sparked a growing intrigue that ensnared many of the 20th century's greatest cryptographers. Today, the manuscript is a focal point for a multidisciplinary, multinational study falling under the realm of Digital Humanities.

Nothing best exemplifies that than the research group behind UM's recent Voynich Conference. The group combines medievalists, linguists, and AI specialists from both sides of the Atlantic. Dr Colin Layfield introduces them: 'Prof. John Abela and I', both from UM's Department of Computer Information Systems 'are the "computer bods." Mike Rosner,' affiliate senior lecturer of UM's Department of Artificial Intelligence, 'is more on the computational linguistics side of things. We have two proper linguistics professors in Prof. Claire Bowern and Prof. Lonneke van der Plas,' of Yale and the IDIAP Research Institute of Switzerland respectively, 'Dr Lisa Davis, a paleographer with very good knowledge of the Voynich', from the Medieval Academy of America,





and 'Dr René Zandbergen, who is, in my opinion, the world's foremost Voynich Manuscript expert.' The Voynich Manuscript has a long history of keeping polymath thinkers in its orbit, so it is fitting that Zandbergen was a satellite navigation engineer for the European Space Agency.

Rosner elaborates: 'The manuscript has created a collaboration between disciplines which wouldn't necessarily get together otherwise. The angle at UM is on a borderline between language, computer science, and AI. But the people we've been collaborating with are people who know about ancient language and manuscripts, a study known as palaeography.' Here, these seemingly disparate fields complement each other. 'We've found that, for them, we're presenting a refreshing angle. They may have dealt with the Manuscript from a historical perspective, making comparisons with other documents of the time. Whereas we bring a technological angle based on the latest AI and computer science developments.'

But more traditional methods are still vital, as Rosner explains: 'The big problem with the Voynich is that it's rather small. Enormous amounts of data are used to build models for AI. If you compare it to, say, Wikipedia,' a key dataset for training such models, the manuscript '[...] is a drop in the ocean. That makes it difficult to apply techniques which have been applied successfully to some other languages for which sufficient data is available.' As Layfield states: 'Techniques used on the Voynich are often old-school for exactly the reasons Mike has outlined. Many wonderful, modern techniques just aren't applicable.'

This means that technological and traditional research techniques may depend on each other to uncover the Manuscript's secrets. One example of the former is a computer-readable version, developed by Zandbergen and Prof. Gabriel Landini. Conversely, a recent breakthrough involved traditional techniques: Davis found the Manuscript appears to have been written in 5 distinct handwriting styles, by separate scribes. Abela describes how these two approaches could interact: 'As Dr Davis has stated, many medieval documents didn't survive. However, people all over the world are digitising manuscripts. There might

one day be a large enough corpus of medieval manuscripts for us to employ really cool AI techniques for identifying books written by the same people.'

The computer-readable manuscript would facilitate automated cross-referencing for the Manuscript's language. But the language may turn out to be a unique cypher, either by intention or because other examples have been lost. If the Manuscript is treated as an image, then work by its scribes in a more common language might be discovered. Abela continues: 'Deep-learning algorithms could learn the nuances in the scripts, then find documents written by the same people. I'm interested in applying Vision Transformers' (an image interpreting deep learning technique) 'to the Voynich, to try to learn more about it and its scribes. I've already worked with Colin and our students on that, using new transliteration techniques.' Future discoveries may rely on the interdisciplinary interactions exemplified by the Research Group. Cutting-edge AI utilised by Van der Plas and this article's interviewees will depend on initial interventions outside the AI space, by researchers like Bowern, Davis, and Zandbergen, who also incorporate AI in their work.

WHAT IS THE VOYNICH MANUSCRIPT?

There are three pre-eminent theories about the Voynich Manuscript. One is that it is written in a natural language lost to time. The second is that it is authentic but encrypted, written in a cypher that has yet to be decoded. The third is that the Manuscript is a hoax, an indecipherable text created to pique a wealthy collector's interest – a scam perpetrated by Voynich in 1912, or by another entrepreneurial forger centuries before. All options are on the table as there is no concrete evidence that completely supports one theory. The questions don't end there, the Manuscript's authorship has enjoyed a century of speculation. As Layfield states: 'Voynich himself claimed it was written by Roger Bacon,' the 13th-century scientist and theologian. 'Others postulate it was written by John Dee (advisor and spymaster to Elizabeth I), who then

sold it to Rudolf II,' the Hapsburg Emperor in around 1600. 'Some people think DaVinci wrote it. Others think it was aliens,' presumably because they had a lot of free time between building the pyramids and pestering 20th-century farmers. 'Every year, I get emails from people claiming to have deciphered it,' but a definitive answer has not stood up to scrutiny thus far.

One irrefutable thing, however, is that the Voynich Manuscript has long been associated with scientific development. At UM's Voynich Conference, Dr Keagen Brewer explored a compelling theory that the manuscript relates to women's health. The botanical images may depict plant-based medicine, and the images of naked women amidst organic tubes and chambers may symbolise gynaecology. This would explain the encryption, as the subject was often censored. Its scientific associations only grow from there: Bacon, Dee, and Rudolf II were all instrumental in the development of empiricism and the natural sciences, as was its (likely) subsequent owner, Kircher. Layfield continues: 'When the Voynich was rediscovered, centuries later, it contained a letter to Athanasius Kircher (dated 19 August 1665). He was the rockstar scientist of his day, working in optics, language, mathematics, physics, and natural law.' He was the obvious person of the day to send this to for further investigation.

Upon Voynich's death, the manuscript was inherited by his widow, celebrated author Ethel Voynich (best known for her novel *The Gadfly*). 'This is interesting for computer scientists since her father, George Boole, invented Boolean algebra,' computer programming's foundational mathematics.

Behind the glaring question of 'What is the Voynich Manuscript?' there hides another question: 'What is the Voynich Manuscript doing for us?' As technological achievements have accelerated, the Manuscript has kept pace. It compels innovation, it demands collaboration and, should our best efforts fail, it defines our intellectual limitations – limitations which, when we break them, may be reassessed by trying to decode it once more. The Voynich Manuscript is both a partner to and a matchmaker for academics across temporal and geographical boundaries. In that sense, the existence of this riddle may be more important than the *answer* to this riddle. Unless, of course, it was written by aliens. T

Rainbow Rabbit's Radiotherapy Journey

Author: **Catherine Camilleri**

Radiotherapy can be a frightening experience, especially for paediatric patients. The unfamiliar environment and fear of the unknown make this procedure particularly challenging for children. At the University of Malta, students from the digital health course have created a new mobile application prototype designed to support young oncology patients undergoing radiotherapy.

Digital health is a growing global industry, and M.Sc. students Gavin Schranz and Mark Agius know how impactful technology can be to streamline medical interventions and solve problems within the healthcare sector. As part of the Master of Science in Digital Health programme's first cohort, Gavin and Mark, in collaboration with their supervisors, Dr Susan Mercieca from the Faculty of Health Sciences and Dr Conrad Attard from the Faculty of ICT, have developed a novel mobile application prototype designed to meet the needs of paediatric oncology patients undergoing radiotherapy.

Gavin and Mark bring a unique blend of personal experience and professional expertise to this project. Gavin, a haemodialysis patient with a background in tech, has experienced the corridors of numerous hospitals from a young age. His journey through healthcare systems in Malta and abroad has been marked by a deep understanding of the uncertainties and fears that come with being a young patient in various treatment settings. This personal history allows Gavin to intimately connect with the emotional world of paediatric patients, infusing the project with genuine empathy and insight.

On the other side, Mark's professional experience as a radiographer at Sir Anthony Mamo Oncology Centre (SAMOC) complements this perspective. Witnessing the distress and anxiety of paediatric patients in the Rainbow Ward during radiotherapy treatments, Mark has seen the clinical side of these challenges. Together, Gavin's firsthand patient experience and Mark's clinical insights converge, inspiring them to focus on paediatric oncology patients – a group in dire need of compassionate support.

Rainbow Rabbit's Radiotherapy Journey is an immersive, child-friendly experience that helps paediatric patients become accustomed to the hospital setting while learning about their diagnosis and radiotherapy in an age-appropriate way, which can reduce the potentially daunting and distressing nature of the treatment process.

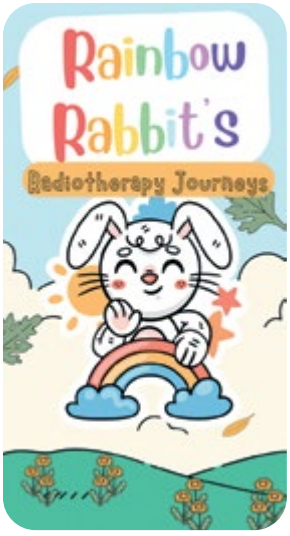
FROM COMPASSION TO CONCEPT

When brainstorming for this project, Gavin and Mark wanted to cater to a specific age and tackle a pressing real-life scenario by blending their collective expertise to solve a unique medical problem on a local level. While a variety of potential challenges came to mind, the idea of meeting the needs of paediatric oncology patients struck a chord for Gavin and Mark. As a radiographer, Mark sees first hand how paediatric patients experience distress and anxiety when receiving radiotherapy, a common treatment for cancer. Some even require anaesthesia to complete their treatment. Although radiotherapy is a painless procedure, it requires the patient to lie completely still for 10 to 15 minutes at a time, and the range of treatment can last from 5 to 30 sessions over a period of weeks.

In research involving healthcare stakeholders such as nurses, paediatric oncologists, and child psychologists, the literature showed that children between the ages of 6 and 8 tend to struggle the most with understanding the process of radiotherapy. They are less likely to comply with instructions and are more likely to be developmentally impacted by the stress of the procedure. By targeting this age group, Gavin and Mark set out to find a way for children to get used to the hospital setting and radiotherapy itself in a safe and non-threatening atmosphere. This would limit their distress when receiving treatment and decrease the need for anaesthesia.

HOW DOES IT WORK?

During their market research, Gavin and Mark were inspired by Alderplay, a tool used by Alder Hey Hospital in Liverpool to acclimatise children to the medical setting by taking them on a virtual tour of the hospital. They wanted to apply this concept to the local context here in Malta at SAMOC. By combining Gavin's IT knowledge and Mark's experience as a radiographer, the duo created an interactive prototype that introduces children to the hospital while teaching them about the treatments they will undergo. As the user enters the game, they are greeted by Rainbow Rabbit (a nod to SAMOC's Rainbow Ward) who guides them through their personalised journey around the hospital. The prototype is split into two main features, 'My Hospital' and 'My Journey', which tackle the logistical and emotional



App screenshots from *Rainbow Rabbit's Radiotherapy Journeys*

Images courtesy of Gavin Schranz and Mark Agius

Designed using icons from flaticon.com

Gavin Schranz (left) and Mark Agius (right)
Photo by Kristov Scicluna

elements of undergoing radiotherapy while using colourful imagery and cartoon animation that directly target the age group. With creative and interactive content, the game highlights what children will see when they go in for treatment and provides them with a space to process what they have experienced.

The 'My Hospital' feature functions as an interactive simulation of SAMOC, allowing children to tour 25 different rooms and familiarise themselves with the experiences, processes, and items they will see during their actual visit to the hospital. This feature is split into a three-part journey that helps children acclimatise to the application. Users can choose their own special animal to accompany them as they embark on a playful scavenger hunt and add items related to the medical field (like stethoscopes, syringes, and wheelchairs) to their inventory. This helps to desensitise potentially scary medical instruments by portraying them in a cartoon setting. Players then meet with virtual nurses and doctors at the Rainbow Ward, where their diagnosis and treatment options are explained in a metaphorical and child-conscious way, which helps younger patients gain a deeper and less distressing understanding of their illness and how it can be treated. The child also learns about radiotherapy, how the treatment is delivered, the importance of lying still, and even the sounds the machine will make. By the end of the tour, players receive a certificate that they can bring to their first radiotherapy appointment, helping them enter their first session with awareness of what the process will be like and mitigating the stress of receiving treatment.

The 'My Journey' feature serves as a roadmap of the child's own radiotherapy experience and helps them keep track of their emotions as treatment progresses. This feature acts as a visual schedule of the child's particular treatment plan so that the child can mark their progress day by day and receive a reward after completing each stage of their treatment. Additionally, after completing a radiotherapy session, the child can enter the application and choose from different feelings and emotions to express how the session was for them in a non-invasive and non-confrontational way, allowing them to chart their feelings throughout their radiotherapy journey. In this way, children can process their treatment experience while trusting the interactive and empathetic content within the application to validate their particular feelings. Together, the 'My Hospital' and 'My Journey' features work hand in hand to complement what is currently happening locally to support paediatric patients before, during, and after their diagnosis and treatment.

BEYOND THE PROTOTYPE

Gavin and Mark's prototype may have started as an academic project, but its potential to support paediatric patients and those who work in their care has far-reaching effects. To gauge the application's usability, they asked key members of the healthcare community who work closely with paediatric patients to try out the game. The application garnered excellent responses from these professionals and scored high on the system usability scale, indicating that the prototype is ready to be deployed to its target audience. Now that they have received input from professionals, Gavin and Mark look towards the future and hope to present their prototype to actual paediatric oncology patients preparing for radiotherapy garnering their feedback to incorporate into the application. In this way, Gavin and Mark can truly test how impactful their application is for young patients and adjust their design to match the needs of children undergoing radiotherapy.

The concept Gavin and Mark have put forward is versatile and can be easily replicated in other clinical areas within the medical field. An application like this can be specifically tailored to help young people of different developmental ages understand sensitive and complex topics and provide an empathetic space where patients can learn about potentially distressing treatments. Gavin and Mark have shown how digital health innovations can improve the experiences of patients, even at a young age.

The project has been selected for a presentation at the European Society for Radiotherapy and Oncology (ESTRO) conference in Glasgow in May 2024.

Say It Out Loud

Author: **Sarah Schembri**

Our everyday lives depend on reading things off screens, paper, or notices. Text-to-speech technology can help the visually impaired, but first, we need a robust technology that can handle the complexity of the task.

The power of technology can be harnessed to help daily life become more equitable for all. One example of this is text-to-speech technology, sometimes called read-aloud technology. Text-to-speech technology is available on most electronic devices and within applications such as MSWord and Adobe, and it speaks aloud the text written on the screen. Additionally, apps and devices such as ReaderPens go a step further. Instead of simply reading text on screens, they can read text on digital images or paper. ReaderPens and similar apps have the additional task of recognising the text on an image before converting it to audio. Text-to-speech tools help the visually impaired and anyone who struggles with reading, allowing them more independence and lowering the hurdles faced in everyday life.

IT STARTED WITH A DETOUR

Dr Alexandra Bonnici (Head of the Department of Systems & Control Engineering) and Dr Ing. Stefania Cristina (Senior Lecturer with the Department of Systems & Control Engineering) were originally inspired to start the Doc2Speech project when they noticed there are no ReaderPens which convert Maltese text to speech. However, before they could start development, they encountered some bigger hurdles with the software that recognises text.

When trying to read from a children's book for example, where the text is typed on top of designs or pictures, most text-to-speech software fails at correctly recognising the text. 'The software assumes that the background is a single, flat colour and mistakes the background patterns with symbols,' explains Bonnici while showing me text written on top of an illustration of a garden fence with its vertical lines running through the text. This is a problem even in established technology that reads text in English. Some advances have been made at recognising text on old documents. However, the mild distractions from yellowing stains that could confuse the text-to-speech software are nothing next to the bright colours, bold designs, and cartoon animals on unlikely adventures found

Figure 1: Text-to-speech software tends to fail at correctly recognising the text on top of colourful designs and images.

Illustrations from* How Machines Work *by David Macaulay

in children's books. Bonnici and Cristina recognised this as an important flaw, especially since text-to-speech software could be of immense help to children with varying abilities when learning how to read.

DEVELOPING THE TECHNOLOGY

The engine behind text-to-speech software is called a binarisation algorithm. The algorithm converts a greyscale image into a black-and-white one. In its simplest form, it goes through each pixel one by one and if the pixel has a value below a certain threshold, the value is set to 0 (black) while a pixel above the threshold is set to 255 (white). The result is a picture that, instead of a range of greys, has either black or white pixels, hence why it's called *binarisation*. The text on the binary, black-and-white image is easily recognisable as text to the software and is then converted to speech.

However, using one threshold for the whole picture does not work when trying to read from children's books with multi-coloured backgrounds. Bonnici and Cristina, with their team of research support officers, developed a more robust algorithm for the Doc2Speech project. Before the binarisation process, the algorithm has several other steps. First, it recognises and separates each line of text. Then, it segments each line into several sections or text windows. After these two steps, the binarisation is performed on each text window using a specific threshold automatically calculated for that particular text window. This way, the threshold is different for each window or section. This makes it less likely that the value of pixels that represent text is above the threshold or that

Dr Alexandra Bonnici
Photo by James Moffett

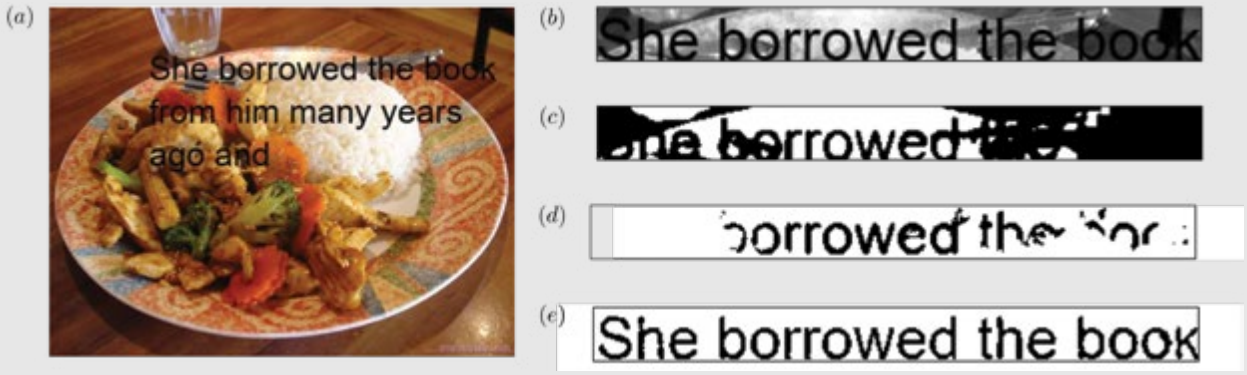


Figure 2: An example of how the Doc2Speech algorithm extracts text compared to other methods. (a) An example image from which text was extracted. The image was taken from a pre-established dataset, and the text was superimposed by the researchers. (b) A line of extracted text in grayscale. (c) and (d) The text extracted by other binarisation methods – Otsu and ROBIN respectively. (e) The text extracted by the algorithm developed in the Doc2Speech project.

pixels that represent background details have a value below the threshold. As shown in figure 2, binarisation algorithms that do not utilise Doc2Speech's extra steps fail to extract text when there is a large range of hues in the background. In the meantime, the algorithm developed for Doc2Speech manages to adapt to different backgrounds and still successfully extract the text.

Dr Ing. Stefania Cristina
Photo by James Moffett

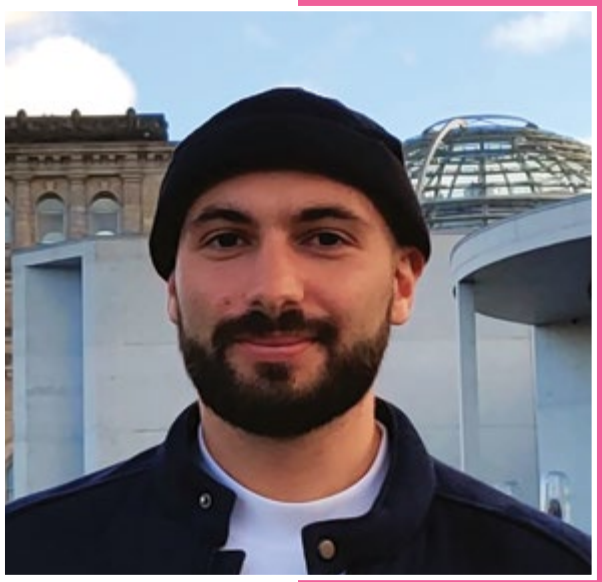
The new algorithm can be applied to text written in any language. Naturally, it can be used to read Maltese; however, more work is needed to develop the speech part of text-to-speech. Text-to-speech systems use an AI voice to read the text aloud. A computer voicing one word at a time is one thing. Reading out complete sentences, including punctuation, with the correct tonality is a complex, manifold, and essentially human skill. Most people have heard the stilted, unnatural inflexion of bus announcements or GPS directions. While the robotic voice suffices for these services, a better reader is needed to realistically help people who will use text-to-speech technology in their everyday lives.

FUTURE AVENUES OF RESEARCH

As with any scientific progress, solving one challenge leads to others. In children's books, the text and the illustrations work hand in hand to tell a story, so simply reading the text is not enough for a complete understanding. Some software already exists where you can point a phone camera at something, take a picture, and the software extracts an explanation of what the picture is. This software could be used in combination with text-to-speech to give a holistic description of what is on the page.

Top to bottom: Erica Spiteri Bailey, Luke Abela, and Andre Tabone

Photos courtesy of the Docs2Speech Team



One problem is that the software that describes photos has been trained on real pictures, not on illustrations and cartoons. The software is completely baffled when encountering an illustration of a sloth sawing a plank of wood, for example, which is a fairly pedestrian thing to find in a children's book. Furthermore, a large dataset on which the algorithm could be trained does not exist yet.

A training dataset is a large number of photos or pictures with descriptions made by humans on which the algorithm could be trained so that it 'learns' to make descriptions of new photos by itself. To create a training dataset of illustrations with descriptions, the researchers took a DIY approach. They used a style-transfer technique to convert regular photos in the training dataset (which already have descriptions attached) into illustrations in different styles. Bonnici and Cristina do not expect this to be the only solution because the variety of styles of illustration in books is unlimited, while the style-transfer techniques are limited in how they can transform a photo.

NOT THE TYPICAL KIND OF ENGINEERING

A project like Doc2Speech is the work of a team. Research support officer Ms Erica Spiteri Bailey worked on the first step of the algorithm – extracting the lines of text individually. Mr Luke Abela worked on the binarisation of the windows of text, while Mr Andre Tabone worked on the segmentation of illustration images into their individual objects.

Projects like Doc2Speech might not be the first to come to mind when thinking about engineering research, but Bonnici and Cristina encourage students to join projects like theirs. 'Students who are interested in this work will have the satisfaction of advancing the field,' explains Bonnici, while Cristina points out, 'It could help people in need, and the images are fun to work with. It's a different type of engineering!' Their research combines programming and AI with art, linguistics, and social service. The technology developed helps people live better lives, and although conceived for a specific purpose, text-to-speech technology could have many other, as yet undiscovered, applications.

This project is funded by the MCST Research Excellence Programme with grant agreement number REP-2022-006.

drUM – The University of Malta's newly launched data repository

Author: **Raelene Church**

Taking open science to the next level, the UM Library unveils drUM, an online research data repository designed to revolutionise research data management and empower collaborative exploration. drUM's purpose is to consolidate research by giving researchers the opportunity to upload the data generated throughout their research endeavours.

Every research carried out, every scientific discovery, carries with it a myriad of research data: data that is at times stowed away or perhaps even lost, and never used again.

Research data is the primary data collected by researchers to conduct and inform the research study, often also leading to academic publications. It is indispensable to ensure that the research produced and the analysis carried out are reliable, thus the availability of research data adds to the credibility of the study. Sociology Professor Godfrey Baldacchino (Faculty of Arts, UM) stresses the importance of 'a culture of data disclosure.' He emphasises that data sharing should always occur within the FAIR principles framework. This means that the data must be Findable, Accessible, Interoperable, and Reusable.

Sharing the data collected during research not only increases the credibility of the research output, but also allows other researchers to extract different results from the same data whilst facilitating the possibility of carrying out longitudinal studies. Ownership of the data is not lost when the data is shared; anyone using that data is bound to give credit to the source. Researchers who share their data may, in turn, benefit from increased recognition of their work through citations.

Progress rarely happens in a vacuum; it thrives on the foundation of past discoveries. Sir Isaac Newton, a pioneer in science, mathematics, and philosophy recognised the crucial role of past scholars in his own breakthroughs. He, like many other great minds, understood that progress builds upon the tireless work of countless researchers who came before.

Dr Ritienne Gauci, geographer and senior lecturer at UM, and also an open data ambassador for UM, argues that open data empowers geographers to tackle global issues like climate change and natural disasters. She stresses the importance of enabling a collective approach to reap practical benefits, such as improved disaster preparedness and response.

When speaking of data, we are not only speaking of numbers; data can also take other forms. In fact, research data includes data collected through surveys, experimental data, observations, transcripts, field notes,

geospatial data, biological data, images, texts, and the list goes on. It is basically any information collected during the research process.

The sheer volume, complexity, and maintenance of research data can be overwhelming. For this reason, organising and managing research data can be a challenging task, but with the appropriate tools and a well-devised plan, it becomes more manageable.

FROM CHAOS TO CLARITY

Research Data Management (RDM) is essentially the practice of managing and organising data for current and future use. It involves the planning, organising, storing, preserving, sharing, and curating of data that is generated or collected during a research project. It involves the adoption of practices, policies, and tools necessary for the efficient and responsible management of data throughout its life cycle. This includes considerations such as collection strategies, data backup and storage, documentation, and adherence to ethical and legal requirements related to data.

Senior lecturer in the Department of Geosciences at UM and open science ambassador, Dr Adam Gauci, stresses the importance of having a Data Management Plan (DMP) when carrying out research, stating that 'this improves the research process by simplifying data discovery, analysis, and archiving.' Devising a DMP when planning the research will not only ensure that the research data is safely stored for further use by the researcher or primary investigator, but it can also promote collaboration, enhance the quality and reliability of research outcomes, and facilitate global knowledge-sharing.

WHAT ABOUT DATA PROTECTION?

Collecting and sharing data can be intricate when dealing with human subjects; nevertheless, when a researcher discloses data, the expectation is not to divulge the raw, unprocessed data. Instead, one is expected to present the information in a manner understandable to others, without necessarily including all identifiable details. Part of processing personal data, in fact, involves anonymising it. Prof. Baldacchino integrates 'ethical considerations' with the FAIR principles, underscoring the vital interplay between data management, accessibility, and responsible research.

For researchers aiming to share their research data, thorough planning is essential. During the planning phase, researchers need to determine the type of data to be collected and how it will be shared. This ensures that research participants are informed about the utilisation of their personal data, enabling them to make an educated decision on whether or not to participate in the study.

EMBRACING THE FUTURE OF RESEARCH WITH drUM

A data repository is an online platform for managing and storing data. Its is much like a digital library, but instead of holding research publications, it comprises collections of datasets. Data repositories can help researchers organise, store, and share data with ease.

In October 2023, the Library launched a data repository, **drUM** (an acronym for 'Data Repository for the University of Malta'). Based on Figshare, drUM serves as a secure and accessible platform for UM researchers to store, share, and preserve research data.

'The launch of drUM marks a significant milestone in UM's commitment to open science and research excellence,' said Mr Kevin Ellul, Director of Library Services, adding that 'by providing a robust and user-friendly platform for data sharing, drUM empowers researchers to contribute to a more transparent, collaborative, and impactful research landscape.'

Through drUM, scholars can seamlessly upload and preserve their data, thus contributing to the advancement of good RDM practices. We encourage you to explore the RDM page on the UM website or get in touch with our experienced team at the Open Science Department. And, most importantly, you can access drUM online by scanning the QR Code below or through the Library page on the University of Malta's website.

Scan the QR code to access drUM online

Dr Alexia Massa-Gallucci
Image courtesy of the researcher

Ocean's Trash is Another Woman's Treasure

Author: **Sarah Schembri**

Heaps of dead seagrass on beaches are picked up and thrown away every year. However, this smelly beach wrack has value that ***Blue EcoTech Ltd****. intends to extract, reducing waste and contributing to the circular economy in the process.*

Every year, the Mediterranean Sea throws out its rubbish and lays it on our beaches. I'm not talking about the garbage that we pollute the sea with. This rubbish is organic, supports seasonal ecosystems, provides coastal waters with nutrients, and preserves the integrity of sandy beaches. I'm talking about beach wrack, which on Mediterranean beaches, consists mostly of dead *Posidonia oceanica* leaves (*alka* in Maltese).

DEAR OR ALIVE

P. oceanica is an aquatic plant that is endemic to the Mediterranean Sea and is a protected species because of the multiple ecosystem services that it provides. It oxygenates the water through the process of photosynthesis, it grows in dense meadows that provide a safe nursery ground for the larvae of many species, it sequesters (captures and stores) carbon, and it dampens the strength of waves before they hit the shore. Furthermore, the oxygen produced by *P. oceanica* (and all the other photosynthetic organisms in the marine environment) contributes to the oxygen we breathe. The oxygen released in the water percolates into the atmosphere becoming part of the air we breathe every moment during the day. Around 60% of the oxygen we breathe is produced by marine photosynthetic organisms. The benefits that this one plant provides do not stop with death.

Posidonia oceanica
Image courtesy of Dr Thanos Dailianis

Mostly during winter and autumn months, the shed leaves wash up on the shore, forming thick, spongy banquettes that provide habitat for land invertebrates. The banquettes slow down the natural erosion of sandy beaches, and as the leaves decompose, nutrients are released and washed back into the sea.

These banquettes of dead *Posidonia* are not only formed by leaves but also all the other parts of the plant that grow old and detach, ending up washed ashore. Ideally, they should be left in place for as long as possible to maximise their ecological function. However, the arrival of summer necessitates their removal as people want to use the beach and the foul odour of the deteriorating leaves is unpleasant. The government's Cleansing and Maintenance Division is in charge of clearing up the beach wrack from sandy beaches. Each year the Division gets a permit from the Environment and Resource Authority, and the appropriate machinery is used to pick up the decaying leaves from the beach, which are dumped in a landfill. Every year, the Cleansing and Maintenance Division removes several tonnes of beach wrack from the beaches and stretches of coastline interested in tourism activities. The same process happens in other Mediterranean countries too, meaning that plenty of local authorities in different countries are spending money to move beach wrack from beaches only to leave it to deteriorate somewhere else.

VALORISATION

Farmers in Malta use dead *Posidonia* beach wrack as animal bedding or as a covering to protect produce like potatoes when they need to be stored for a length of time. Despite these uses, the vast majority of beach wrack still ends up in landfills, where it releases CO_2 and methane as it rots.

This waste is one thing that Dr Alexia Massa-Gallucci hopes to address with the start-up that she has founded, Blue EcoTech Ltd. As a scientist, she recognises the significance of an essential resource being squandered and is determined to take action to address the issue. Massa-Gallucci has spent most of her career so far on marine research but decided to switch to entrepreneurship three years ago to, '[...] use my skills to make a positive impact on the environment.' Said skills have been accumulated over a long and varied career covering multiple areas of aquatic research, from pelagic and benthic food webs in Italy to fresh-water fisheries and population genetics in Ireland, to managing EU and local projects on commercial Mediterranean fish. With plenty of qualifications and experience under her belt, Massa-Gallucci believes that she could have a bigger positive impact on the marine environment by building a company aimed at making use of currently wasted marine resources. Presently, her sight is set on the *Posidonia* beach wrack.

Massa-Gallucci explained that *P. oceanica* is a marine plant, not an algae (don't let the similarity of the words *alka* and *algae* confuse you). *Posidonia*'s evolutionary ancestors are flowering plants that grew on land millions of years ago and later re-adapted to an aquatic environment. This means that the seagrass' molecular structure is made of the biopolymers cellulose and lignin, the same organic material that wood is made up of. These properties allow the plant to be utilised in various industries, from textiles to biotechnology and even plastics. The advantage of extracting these polymers from *Posidonia* leaves instead of from other plant materials is that the seagrass beach wrack is naturally renewable. We do not need to use resources to grow the plant; we simply need to pick the beach wrack up from the beaches.

Posidonia oceanica
Image courtesy of Dr Thanos Dailianis

When the *Posidonia* beach wrack is fractionated, cellulose and lignin can be extracted and processed with various biotechnological methods. Several useful materials can then be made from the extracted polymers. Cellulose can be used to make textiles such as rayon and viscose. Cellulose can also be converted into macrocellulose, nanocellulose, and sugars that can be used to make nanomaterials in the composite industry. Nanomaterials have various biomedical applications. Extruded lignin can be used for bioplastics that biodegrade and therefore do not cause the same environmental damage caused by plastics made from fossil fuel byproducts. Massa-Gallucci calls the process of extracting useful material out of marine waste *valorisation* because value and use are added to a resource.

GETTING DOWN TO BUSINESS

The biotechnological processes needed to make useful products out of beach wrack require the collaboration of experts in several disciplines. 'A successful collaboration requires that the collaborators have a shared passion and are on the same page,' states Massa-Gallucci. She talks warmly about the fruitful professional relationships she has built in the process of running Blue EcoTech Ltd. such as with Dr Inga Matijošytė, head of the Sector of Applied Biocatalysis at Vilnius University and other colleagues of the Cost Action CA18238 Ocean4Biotech on marine biotechnology.

One of the challenges for Massa-Gallucci was the transition from researcher to business owner. She has had a steep learning curve and is still learning every day about the ins and outs of funding and maintaining a business. In this aspect, Massa-Gallucci is also appreciative of the guidance and mentorship she has received, such as from Dr Stefano Acunto, who collaborated with Blue EcoTech on seagrass meadows habitat restoration projects.

The University of Malta's Take-Off business incubator has also had an important role in the story of Blue EcoTech. Massa-Gallucci was awarded seed funding via the Maritime Seed Award supported by the incubator. Furthermore, the incubator provides the opportunity to receive mentorship from experienced personnel at TAKEOFF and the University's Centre for Entrepreneurship and Business Incubation. Massa-Gallucci made use of this mentorship and advocated for the importance of getting a reality check when needed.

Using *Posidonia* leaves to produce valuable and environmentally friendly products is just one of the ideas that Massa-Gallucci has for Blue EcoTech. Massa-Gallucci is passionate about the Mediterranean Sea and dedicated to fully using all the resources we extract from it. For example, plenty of fish caught are not fit or are considered not desirable for human consumption; however, they still have oils rich with omega 3 and 6 that can be extracted and used in fish feed. The start-up has also worked on underwater reforestation projects, planting *Posidonia oceanica* meadows in areas where they had degraded.

'I was given my first snorkel and mask when I was eight years old. I put my head in the water and never took it out. That sense of wonder never left!' says Massa-Gallucci. Her passion for ocean preservation is evident when she talks about outreach activities she does as part of Blue EcoTech's mission for ocean conservation and education. You might catch her at the next Science in the City convention or citizen science campaign. There are many ways by which scientists are contributing to preserving the environment. Making a decent step forward towards creating a more circular, blue economy is an essential one. T

Is Digital Immortality Possible?

Author: **Christian Keszthelyi**

What if technology allowed us to map our entire brain? What if we could upload ourselves into an online world to live forever once our body wears down? Would that be a genius piece of technology or a beehive of unethical practices?

Popular media has been filled with eerie futurism stemming from our present-day ubiquitous technology. *Black Mirror*, a British anthology television series with often dystopian episodes, has explored the concept of recreating human consciousness in the digital realm in several episodes ('Be Right Back', 'White Christmas', and 'San Junipero'). Similarly, *Altered Carbon*, an American cyberpunk television series based on Richard Morgan's novels, delves into the notion of transferring consciousness from body to body – or sleeves. But even half a decade ago, Daniel F. Galouye's 1964 novel, *Simulacron-3*, toyed with the idea of a virtual city whose digital inhabitants have their own consciousness, unaware that they are only electronic impulses – with the exception of one individual.

The concept of digital immortality has fascinated humans for long enough that some are convinced we are on the verge of achieving it due to our immense technological development. But has digital immortality really become viable?

CREATING AI PROFILES

'From a technological point of view, it is possible up to a certain point,' Dr Vanessa Camilleri tells **THINK** magazine. Camilleri, who is a Senior Lecturer in Artificial Intelligence at the Faculty of Information and Communication Technology at the UM, explains that we can create AI-powered profiles of people for manipulated footage or chatbot discussions. But digitalising someone in their entirety remains a stretch too far.

Today, AI can assist in creating digitally manipulated footage of facial appearance and voices, known as deepfakes, through deep generative methods. This technology enables anyone to impersonate a country's leader or a celebrity,

Dr Vanessa Camilleri
Photo by James Moffett

perhaps reciting a poem from *The Little Prince* by Antoine de Saint-Exupéry at best – or spread hateful messages or disinformation at worst. As large language models (LLMs), such as ChatGPT or Microsoft's Copilot, evolve and generative AI improves by the day, it is possible to create digital avatars of existing people. These avatars use big chunks of their verbal and non-verbal output from videos and written records to carry out limited conversations with their digital copies. To a certain degree, this can be considered a form of digital immortality. We could create a chatbot of Albert Einstein and speak with it, which would be fun and Einstein-like, but would certainly not be the scientist himself.

NO DIGITAL AFTERLIFE – FOR NOW?

But can we hook up the human brain to a computer and create a copy of it in ones and zeros so someone could live in a virtual, digital world? 'I think we are nowhere near that,' Camilleri says. 'I would not even try to suppose how it could work out from a technological perspective. Thoughts and emotions are so profound and complex. We understand more about the brain by the day, but we understand so little about how thoughts and emotions are formed in the brain. How are we supposed to create a digital copy of something we do not yet fully understand?' Camilleri says.

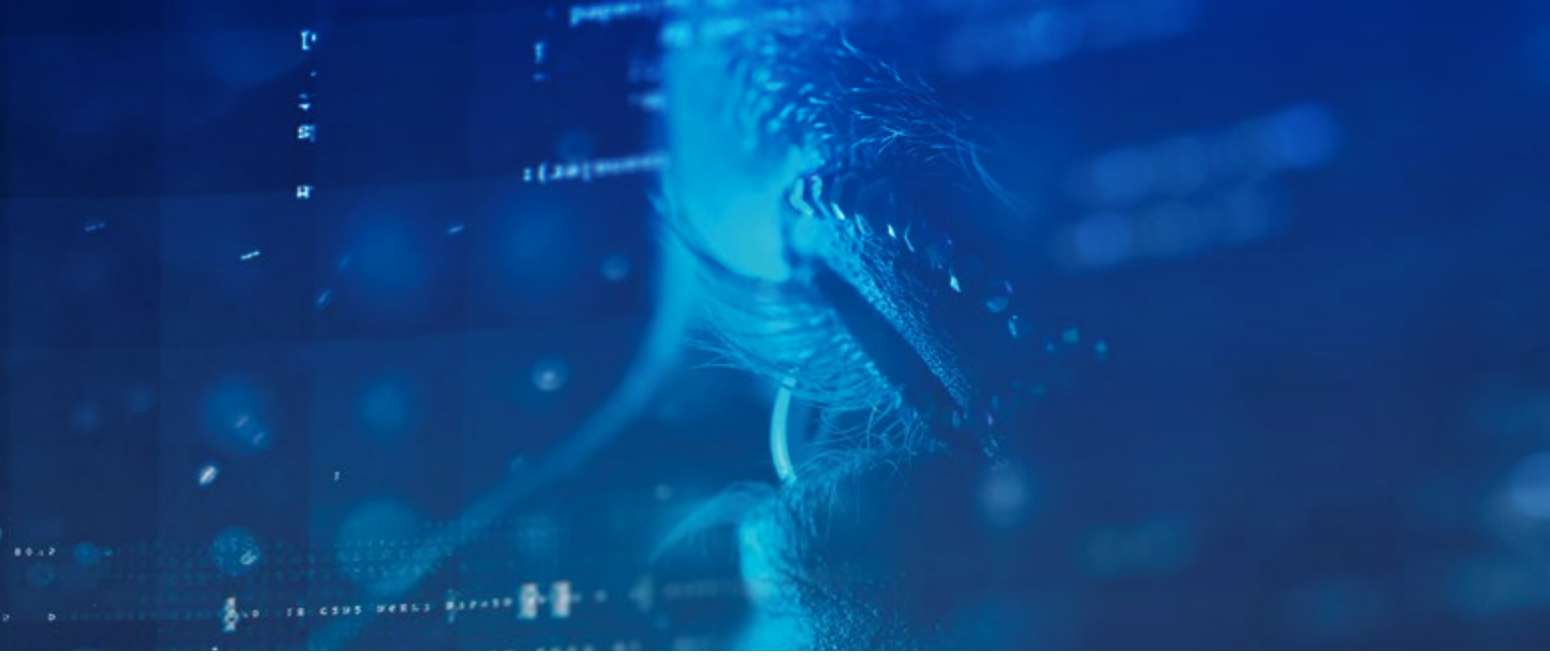
To upload someone to a digital realm, beyond recreating their thoughts and emotions, we would essentially need to capture and encapsulate their mind and soul. 'We are in a thought experiment,' François Zammit, philosophy casual lecturer at UM and Principal Subject Area Officer at MATSEC, says. 'Let us argue that the mind is data. Data can be replicated and transferred. But a counterargument to this will be that this is a reductionist understanding (an approach saying that we can best explain something by breaking it down and reducing

François Zammit
Photo by James Moffett

it to a simple physical phenomenon) of what the mind is. Embodiment plays an essential role in our life,' Zammit adds.

Zammit argues we simply have no identity without our bodies. From a phenomenological perspective, we experience the world as embodied beings. 'We're not just mind. We're a mind and a body – that is how we experience our world. That is what gives us an identity,' he adds.

Humans have invented and developed technology to track brain activity. CT (computed tomography) takes a fast series of X-ray pictures, while MRI (magnetic resonance imaging) uses strong magnetic fields to take such pictures. With such non-invasive technologies to inquire about the mind, we can see the brain light up in activity when a subject feels emotions. However, we do not know what actually happens under the



hood. We see activities taking place here and there, but we do not know how the brain runs these processes. As an everyday example, we could think about using a remote control for our television set. As non-engineers, we understand that we can make our TV louder or quieter if we press the volume buttons. But we do not know how the remote control directs the TV. Brain researchers are in a similar situation.

If our knowledge of the brain was sufficient and our computing power allowed for true digital immortality, which would mean recreating someone in a digital world, the ethical repercussions of such a scenario would be worrying.

ETHICAL BEEHIVE

'Hypothetically speaking, let us say a loved one has signed an agreement to be digitally immortalised when dying. Such a scenario would profoundly affect the grieving process,' Camilleri says. 'Traditionally, humans evolved accepting that somebody, in their physical form, ceases to exist upon death. Grieving would move to a new plane if the deceased person lives on a hard disk. Also, we must consider the trauma of the person transferring to the digital. How can they process the death of their physical form and their encasement to a virtual world – becoming essentially bits and bytes?'

The ethical conundrums get even more profound for third parties. 'What will the moral responsibilities of the people who are maintaining these digital personas be? How about the right to privacy, freedom of expression, and property rights?' Camilleri ponders. What happens in case of an electrical fault or a natural disaster destroying a part of a server park? How can a company running the technology that keeps the digital versions of personas alive compensate for the loss of data – lives in this case? How about hackers getting into the digital realm to intercept knowledge and data from particular digital individuals to abuse that information in the world of the living?

'We have also ethical-political aspects to consider,' Zammit says. 'Generally, people who have financial means have better access to technology. Are we going to have a new form of inequality where people who have access to immortality are people of financial status? What about certain politicians? Let us suppose an authoritarian state where the ruler becomes digitally immortal and they keep running the country for eternity. What are the ethical implications of that?' Zammit adds.

The more we explore the idea of complete digital immortality, the more problematic it becomes, especially considering that humans are aware of their mortality. Someone's perspective on death inevitably shapes their life. The fact that we have an expiry date gives meaning to our mundane, everyday tasks.

For the sake of this article, let us assume that genuine digital immortality would mean that after our body dies, we can live on forever in a digital realm – no ethical strings attached. That would mean humans defy the most basic law of nature, the cycle of life, a phenomenon that everything adheres to, animals, plants – and in the long, long run, our universe too. Would it do humans good if we went against those rules?

'I am quite a strong advocate of balance in nature,' Camilleri says. 'Living creatures have a lifecycle; they are born and they die. This is what we, as humans, have been used to. I do believe that tampering with this lifecycle is not going to be good for people. I believe people are used to this cycle. Breaking this cycle, remoulding it into a straight line so one is born and then keeps going forever, will not benefit humanity,' Camilleri concludes.

Exclusive:

Metsola's Road from Sunday Lunch Politics to European Parliament Presidency

Author: **Christian Keszthelyi**

Roberta Metsola *took the helm of the European Union's core decision-making body after a political career characterised by dedication and leadership prowess. With a year-long experience of being the President of the European Parliament, Metsola, a UM alumna, talks to* **THINK** *magazine about the oft bumpy road to the prestigious role.*

Metsola comes from a family with no direct political party involvement and from a tiny country with a native population of around 500 thousand, where the majority of people hold personal ties to the representatives of a largely bipartisan system. Like any other family, hers would participate in casual political discussions during Sunday lunches. But then, Malta brought the topic of potential European Union (EU) membership to the table

Opposite:

The President of the European Parliament Roberta Metsola in Gozo

Image courtesy of Marieclaire Grima

Right:

The President of the European Parliament Roberta Metsola at the European Parliament

Image courtesy of the European Parliament

in the early 2000s. At the time, Metsola was studying at UM and felt the urge to be part of this dialogue.

'This is where I started becoming politically active. I joined a student organisation at the university, and we started working to convince people to vote "yes" [for joining the EU] in the referendum. This was the first time I immersed myself in the political arena,' Metsola tells **THINK** in an exclusive interview about her career. One activity led to another, as she participated in debates, gave speeches, and was eventually asked by the Partit Nazzjonalista (PN), the Nationalist Party, to run for the European Parliament election. 'My sixth form and university days, along with my various encounters, had helped me shape my idea of what politics is like, what the priorities should be, and how to engage with people. It gave me a taste of what was to come. It was not always easy, but it certainly was worth it,' she says.

A professional career is studded with challenges in every vertical. Politics is no exception. Metsola put the adage – you only fail if you stop trying – into action. It took her a decade of work to get elected as a Member of the European Parliament (MEP). 'I remember knocking on doors with my two toddlers by my side, trying to convince people why they should vote for me to represent them. I did not get elected, twice, but I persevered and, in the end, was elected as one of the first Maltese female MEPs,' she says.

During her early political journey as a youth, Metsola was involved with the European Democrat Students (EDS), the official student organisation of the European People's Party (EPP), and later she joined the European Youth Forum (YFJ). Experiences at these organisations had a profound impact.

'Being a member of both EDS and YFJ was incredibly important for me in different ways. These experiences taught me immensely, but if I had to underline two main things, I would say that coming from the smallest member state should never hold us back from reaching our aspirations. And that it is crucial to build bridges and prioritise every single person. Working hand-in-hand with people from different political backgrounds is vital to achieving goals that will benefit society,' Metsola says.

ENTER THE NEW PRESIDENT

Her involvement with politics was largely sparked by the ambition and aspiration of the Maltese and Gozitan people to become EU members. Her family's support – who needed much convincing from her side – and then Prime Minister Lawrence Gonzi's encouragement, made her contest the European Parliamentary elections. In 2013, she became an MEP from Malta, a role warranted by her commitment to public service and her active involvement within the PN. In November 2020, she assumed the

role of the First Vice-President of the European Parliament under President David Sassoli. The spotlight shone on her with the tragic death of Sassoli. On 18 January 2022, she was elected the European Parliament's President, after a historic election in turbulent times. Her victory marked several significant milestones. She became the youngest-ever President of the European Parliament, the first Maltese person to hold this prestigious office, and the first woman to hold the title since 2002.

'Being the first Maltese to become the President of the European Parliament is a responsibility that I carry out on behalf of the Maltese people who trusted me with their vote,' Metsola says. Following a tough campaign of meeting MEPs, listening to how they wanted to reform the European Parliament, and convincing them to choose Metsola as a representative, she assumed the position at the peak of an overwhelming, emotional moment.

'I understood the immense responsibility of that outcome. This was a big result for women worldwide, particularly in Malta. The main message was that a young woman from Gżira could do it, and so can you,' Metsola says. Gżira is a tiny town of 1.5 square kilometres, housing a bit more than ten thousand people. Metsola's success in taking such a prominent position stands as a memento that glass ceilings can be shattered and as a testament to women taking political action in a field that has been traditionally characterised by men. It is also an inspirational tale for a tiny nation geographically isolated from the European continent in the middle of the Mediterranean, burdened by colonial history woven into the social fabric of Maltese and Gozitans.

Now steering the ship with many eyes on her voyage, what are Metsola's main objectives in the role? 'My goals for my term in office have been simple: getting people closer to the European Union and getting out of our post-pandemic recovery period to regain our vibrant union,' she says. As if cutting through the uncharted waters of the pandemic's aftermath was not enough, Russia's war on Ukraine in the bloc's immediate periphery has complicated geopolitical and global economic matters. 'But it has been a clear reminder that we could not take our values for granted, and I believe that we have made steady progress in getting people closer to the European Union. Europe is about all of us standing up for one another, bringing people close, defending everything our mothers and fathers worked so hard for after years of wars and conflicts. We must work towards this vision by leaving egos aside and applying the principles that have provided Europe with so much prosperity while adapting to today's issues,' Metsola says.

TIME FOR THE YOUTH IN POLITICS

An increasingly polarised atmosphere on both sides of the Atlantic calls for active political action. Politics globally needs youth involvement and their fresh and ubiquitous perspective, more than ever – a hard feat in a world where the young seem apolitical, nurturing a general apathy towards ageing, talking heads. A lot needs to be done. But what do our communities need in these times?

'If I can sum it up in a few words, I would say: ask, think critically, vote, and contest. Do not give up on politics. I am always ready to discuss where they think we could have done better as their representatives. But voting is crucial. It allows us to make our voices heard. Ultimately, I also want to see more youth involved in the political process, including idea generation, campaigning, and implementation. I want to see more young people running for local, general, and European elections, speaking about how they believe the country, the EU, or their locality can improve. There should

Opposite:

The President of the European Parliament Roberta Metsola with the President of Ukraine Volodymyr Zelenskyy, in Kyiv

Image courtesy of the European Parliament

Right:

The President of the European Parliament Roberta Metsola with students at the University of Malta

Image courtesy of Martin Agius

never be an empty space in politics. If the right people do not step up, that space will still get filled,' Metsola says.

Politics is a hard venue to navigate. Considering the tough competition, women need to rise above the traditional binary masculine versus feminine personality trait debate and courageously participate in politics. It is everyone's game now. 'Unfortunately, the reality is that women don't have it easy. Society imposes a lot of pressure, expectations, and barriers for women to get into the political world. That did not stop me. I believed in my abilities. I believed in what I was campaigning for and did not let anything hold me back. At the same time, the European Parliament understands that it also needs to do its part in removing any discriminatory barriers. That is why it is introducing new legislation such as the "Women on Boards" and "Equal Pay for Equal Work" directives. But for us to be successful in this, what we really need is a paradigm shift in thinking and culture. As women, we must constantly answer questions about being mothers and how we support the family. I think this needs to change,' Metsola says.

Women need more role models, especially in leadership roles – not only in politics but also across the board. 'I am proud of the European Parliament's work to instil change. Despite the challenges, women in leadership positions have transformed the world. Women in business, women in STEM, women in education, women in the arts and journalism. They have broken barriers and disposed of taboos in history's dustbin,' she says.

DESIRING CONSTRUCTIVE, HEALTHY DIALOGUE

Metsola insists dialogue must remain ripe with the topics mentioned above, especially making women's contributions to society more visible. 'I would not be here today if it was not for the resilient Maltese and Gozitan women who had to endure for so long to make my path towards becoming an MEP and President of the European Parliament possible. And I want to repay that going forward. Every time we fall – whether in politics or life, we all do – we are pulled back up by another woman who has been through it all before us. And that is my appeal when I speak to young girls across our union: we must pull each other up,' Metsola says.

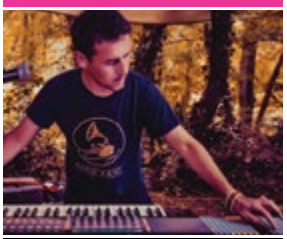
Universities are the perfect arenas for discussions, leading debates, and inspiring change. 'Our university should be an idea-sharing hub and a playground for continuous discussion. It can lead by example by ensuring women with the required credentials are promoted to leadership positions and given the prominence they deserve. Educational institutions can organise campaigns, and serve as a breeding ground for new politicians. There are a lot of things we can do,' Metsola says.

And we gravely need universities to endorse critical thinking and civil discourse. Information exchange is reshaping due to online channels facilitating the rampant, toxic spread of misinformation. We must nurture constructive public dialogue among voting citizens; it must come from political leaders. 'We need to be careful. We need to debate arguments, not people. We must respect people's intelligence and sustain a high level of debate,' Metsola says.

We need politics that break out of the partisan mould and flow along the lines of action to build a better future for every generation. 'The politics of hate belongs in the past. We must stand tall in front of those forces who prey on people's fear to sow division,' she says. Metsola believes the younger generation understands that right or wrong has no political affiliations. 'They know that we can disagree without hating each other. That we are a community above all. I am hopeful that change is coming, generations are shifting, and this old way will simply not cut it anymore,' Metsola concludes.

to-do list

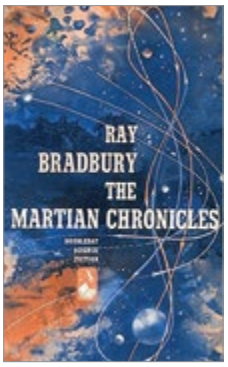
music



Hugo Kant

A multi-instrumentalist from France, Hugo Kant started his solo project in 2011. Finding inspiration in his eclectic musical background such as classic rock, classical music, acid jazz, progressive 70's rock bands and more recent styles like trip-hop and downtempo his music focuses on listeners' immersion and deep, full ambience that tries to take the listeners onto a musical journey.

book



The Martian Chronicles

The Martian Chronicles is a science fiction fix-up novel, published in 1950, by American writer *Ray Bradbury* that chronicles the exploration and settlement of Mars, the home of indigenous Martians, by Americans leaving a troubled Earth that is eventually devastated by nuclear war.

videogame

RimWorld

A sci-fi colony sim driven by an intelligent AI storyteller. Fans of Dwarf Fortress will love this game as will anyone who enjoys seeing everything built burn around them. War criminals, cannibals, and psychopaths will also be pleased.

film

Ghost in the Shell

In this 1995 adult animated neo-noir cyberpunk thriller film, a cyborg policewoman and her partner hunt a mysterious and powerful hacker called the Puppet Master.

Brian's Corner

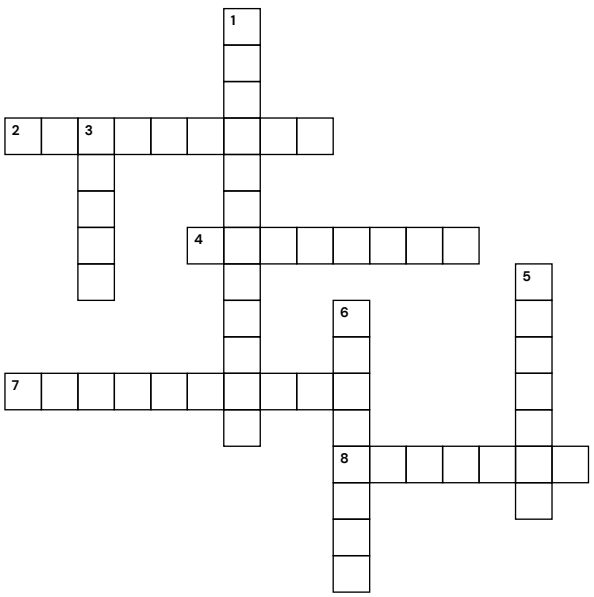
Crossword Puzzle

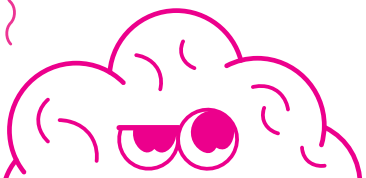
Across

2. Chilled hibernation for space travel.
4. Artificial intelligence for deceptive videos.
7. Virtual imitation of reality.
8. Human-like machine, often depicted in science fiction.

Down

1. Animals without a backbone.
3. Microscopic fermenter in bread and beer.
5. Elusive creature of folklore.
6. Flexible limb of certain sea creatures.





THINK Edition 42 Crossword Answers

Across: 3. Abyss, 4. Towel, 5. Cavity, 6. Contraception **Down:** 1. Geopolitics, 2. Offal, 4. Tripe, 5. Curd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