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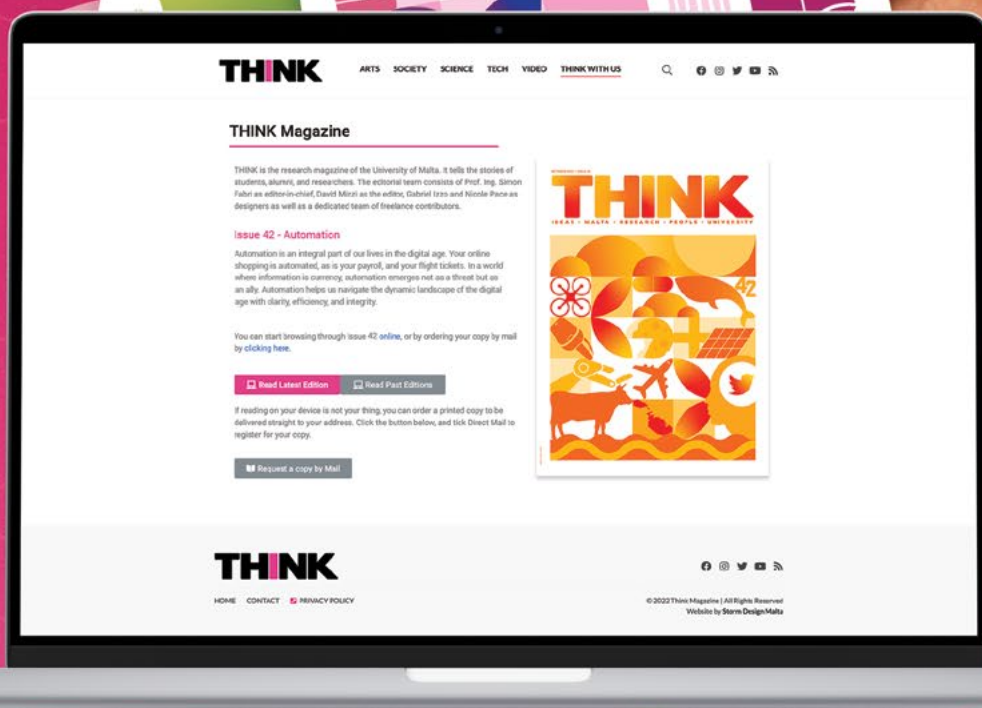
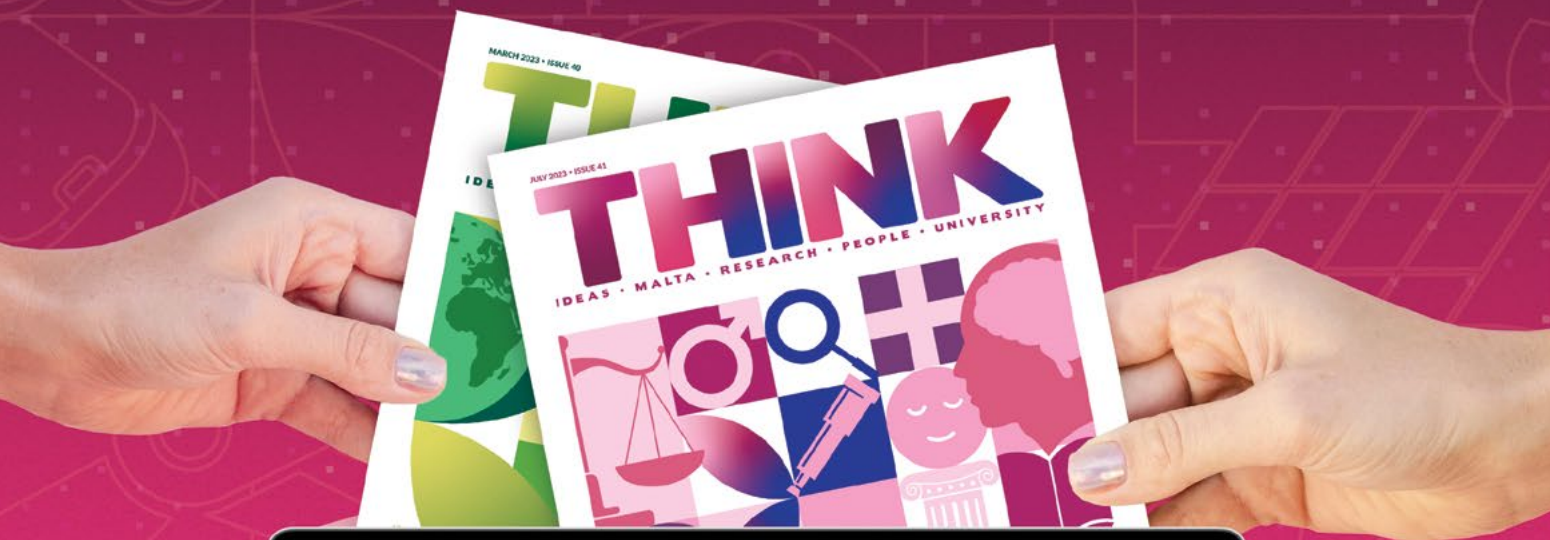
THINK

EDITION

UM RESEARCH EXPO 2023



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editorial

UMRE23

The first edition of the University Research Expo 2023 (UMRE23) was a resounding success, showcasing the wealth of research at the University of Malta. Research, unfortunately, often goes unnoticed or unappreciated by society at large, sometimes even by those tasked with shaping the research landscape. We believe that UMRE23 changed that to some extent. It allowed our university researchers and academics to share their work, network together, and celebrate their achievements. UMRE23 also included the Doctoral School Symposium, highlighting the promising research of our doctoral students.

For over a decade, **THINK** has been a platform for our researchers to share their insights and discoveries. Now, it proudly features a select sample of the exceptional work from UMRE23 in this special edition!

Research is the cornerstone of progress and innovation. UMRE23 and **THINK** Magazine demonstrate our commitment to nurturing a vibrant research culture at the University of Malta. They inspire us to address global challenges and shape a brighter future.

As we celebrate UMRE23 and this special edition of **THINK** Magazine, we look forward with optimism. Our researchers will continue pushing boundaries, uncovering remarkable discoveries, and contributing their innovations. The University of Malta remains dedicated to making a lasting impact on society and the global community through research, innovation, and knowledge.

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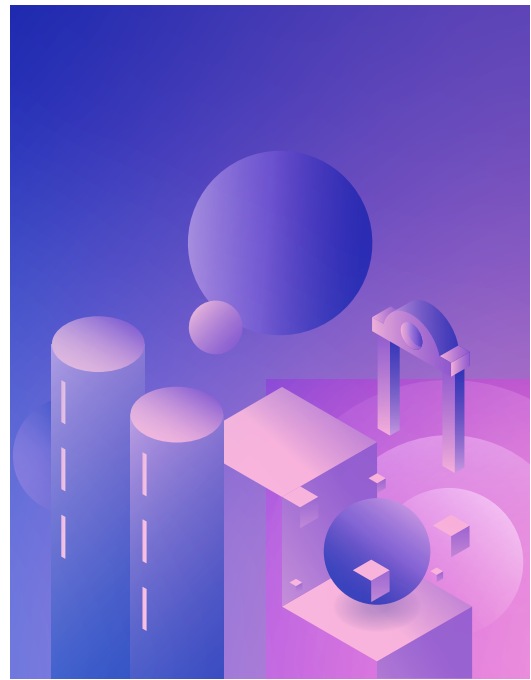
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**L-Università
ta' Malta**

cover



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

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Education, Humanities and Law





Climatic, Landscape, *and* Ecological Perspectives *on* Maltese Prehistory

Author: Timothy Alden





*It took the work of pioneering archaeologists like Temi Zammit to deduce that the Maltese megalithic temples were some of the oldest free-standing buildings in the world. Since then, generations of archaeologists have celebrated Malta's remarkable archaeological record, yet the exact timing, character, and environmental context of the changes in Maltese prehistory have remained unclear. A new generation of archaeologists, such as **Dr Huw Groucutt**, are re-examining Malta's prehistoric heritage and bringing modern scientific methods and technology to the table.*

Picture the ancient Maltese landscape, shimmering golden under the sun, with majestic stone structures unique to the islands peering over the horizon. The land, though beautiful, has its challenges – a place where rainfall is a luxury and the semi-arid climate poses survival challenges. While Malta's temples continue to hold mysteries that have captivated and puzzled people for generations, archaeologists such as Dr Huw Groucutt (Department of Classics and Archaeology) are now asking questions seldom asked before. How did early settlers survive in Malta through the various periods of prehistory?

CLIMATE AND THE COLLAPSE OF CIVILISATIONS

While we know that early Maltese settlers faced a semi-arid climate, detailed information about the historical climate and the ancient environment of the Maltese Islands is limited. We don't really know the exact conditions in which people lived from one year to another. However, we do know that 4200 years ago (around 2200 BC), both Malta and the world were struck by what is known as the 4.2 ka event. Often labelled a 'global megadrought,' the event caused significant climatic variations for over a century. It is often attributed with contributing to the collapse of civilisations such as Ancient Egypt and Mesopotamia.


In the Mediterranean, the 4.2 ka event resulted in drought in some areas but increased precipitation in others. While some areas experienced societal collapses, others like

Phoenician city-states Tyre, Sidon, and Byblos were able to adapt and fill the vacuum. The varying reactions of these civilisations emphasise that societal response to environmental changes is not deterministic. Resilience and vulnerability play crucial roles. Some civilisations were able to successfully practise climate adaptation and prosper. In looking to Malta and Gozo during this period, modern scientific methods offer hope of increased insights into how people adapted to the 4.2 ka event and other climatic upheavals over the millennia.

THE END OF MALTA'S TEMPLE PERIOD

Among Malta's most captivating chapters, the Temple Period spanned from approximately 5.8 to 4.2 thousand years ago. This epoch, hallmarked by its impressive megalithic temples, set Malta apart, with some structures like Tarxien, Ħaġar Qim, and Mnajdra standing as timeless testaments to the era.

However, as one draws closer to the 4.2 ka event, a discernible decrease is observed in both precipitation levels and Malta's archaeological footprint. The subsequent era presents a palpable void in archaeological evidence, hinting at the possibility of Malta mostly being deserted during this phase.

'Recent research has delved into the period bridging the Temple Period and the Bronze Age. What emerged was a narrative of persistent dryness, with little evidence for a significant human presence. The late Temple Period, spanning at least 200–300 years, showed a society under duress. There was evidence of 



**Excavation of local sites
in collaboration with
IslandLab.
Image courtesy of
Dr Huw Groucutt**

increasing enamel hypoplasia in human remains, for example. These are distinctive lines in teeth, stemming from malnutrition experienced in infancy,' Groucutt explains.

He goes on to state that sites like the Xagħra Circle began to show mounting indications of this nutritional strain. By collating and interpreting all the available data from various researchers, he managed to piece together a story of decline, with fewer burials alongside escalating health issues. It suggests that during these dry spells, Malta was becoming an increasingly challenging place to inhabit.

EARLY AGRICULTURE

When early settlers first arrived in Malta, the islands presented a mix of vegetation types and would have contained abundant animals such as deer. Deer bones have been found at various sites, suggesting that hunting supplemented people's diet long after a farming lifestyle developed. By also looking at evidence such as pollen samples, we are able to get a clearer idea of what kind of crops people were able to grow in Malta, as well as changes over time in natural vegetation. These include the staples of wheat, barley, lentils, and peas. Farming efforts were also accompanied by animal husbandry, as early settlers managed herds of sheep, goats, cattle,

and pigs. One element Groucutt is working on is trying to determine whether there were people in Malta before farmers arrived around 7500 years ago.

One of the characteristic challenges faced in Malta and Gozo even today is soil erosion. Groucutt hopes that modern science will shed further light on how people adapted to it, building on existing evidence that material such as charcoal may have been used in some sites in Malta to enrich the soil. Indeed, evidence from Ġgantija indicates that soil manuring might have been practised there. Groucutt points out, 'There are hints of people deliberately improving soil with charcoal in Malta. Today, people sometimes use seaweed as a fertiliser, and perhaps locally, people were also doing it in prehistory. Did early settlers modify the landscape too and carry out terracing works as we do today with rubble walls? Some of the oldest walls we know about go back to the Punic period. There probably was a lot of terracing at that time. But we do not yet know if it stretches farther back.'

He also refers to evidence of water storage as another key strategy for early settler adaptation. Numerous archaeological sites reveal the ingenious ways ancient settlers harnessed and stored water, highlighting their foresight and adaptability in the face of water scarcity. The Misqa Tanks, situated near the Mnajdra and Ғaġar Qim temples, are hewn out of a relatively impermeable rock and stand distinctively apart from Bronze Age and Roman



Dr Huw Groucutt (left) and Prof. Eleanor Scerri (right) after a hard day of digging. Image courtesy of Dr Huw Groucutt

cisterns in both size and design, hinting at their possible Neolithic age. Another water storage site is to be found at the Ħal Saflieni hypogeum, which features a vast cistern. Basins were strategically positioned to collect water seeping from natural fissures. Temples like Tas-Silġ and Tarxien further attest to the prevalence of water storage facilities. The location of temples such as Ġgantija also seems to be linked to the previous presence of natural springs, now largely vanished.

STONE TOOLS AND TRADE

A fascinating aspect of Groucutt's research revolves around stone tools, an area previously little explored in Malta. He is now doing surveys to try and understand what kind of rocks are available in Malta that can be used for toolmaking, as we know people used to import obsidian and other rocks from areas such as Sicily. However, without knowing what is really available locally, it is hard to know what was imported and what was not. Flint, for example, only occurs naturally in small parts of the Maltese Islands, and it is of quite poor quality. However, this poor quality is perhaps a reason that more stone tools have not been identified, as they may have been harder to recognise. As well as flint, limestone was used to make stone tools, and these can be a particular challenge to distinguish as human-made. Groucutt

explains how, 'there is an ongoing debate about how isolated the Maltese Islands really were. My impression is that they were pretty isolated. The fact that the temples only exist in Malta suggests it was a unique and distinctive society without much connection to other areas. In cases where we do have materials that did not originate locally, because they are in small quantities, they could have ended up here practically by accident, rather than recognise a pattern of trade. It's an incredible story, how people survived and thrived in this isolated place.'

LOOKING AHEAD AT THE PAST

Groucutt states that he and his colleagues are collaborating extensively with the Superintendence of Cultural Heritage and Heritage Malta to try and ensure that archaeology keeps up with the pace of construction in Malta, as many sites are identified during building projects. While this presents a challenge, he is also optimistic that modern scientific methods, such as isotope analysis and radiocarbon dating, along with further excavations, will shed new light on Malta's past and help to answer the questions surrounding how people adapted to survive.

Furthermore, he states that as people have been so focused on the temples, there is a lot of scope to try and understand Malta during other periods and in the ▶



**Dr Huw Groucutt excavating a Maltese prehistoric site.
Image courtesy of IslandLab**

'...there is an ongoing debate about how isolated the Maltese Islands really were. My impression is that they were pretty isolated. The fact that the temples only exist in Malta suggests it was a unique and distinctive society without much connection to other areas. In cases where we do have materials that did not originate locally, because they are in small quantities, they could have ended up here practically by accident, rather than recognise a pattern of trade. It's an incredible story, how people survived and thrived in this isolated place.'

landscape more widely, away from the famous temples. Periods such as the Bronze Age are currently poorly understood. This period would see the first boats with sails in Malta, as before that, early settlers were probably using simple paddled canoes. It is for this reason that further excavations are being carried out, especially as many of the well-known major archaeological sites in Malta have already been disturbed and cleared. There are also major questions about what Malta was like before the Neolithic and whether people might have been here before they were farmers.

'We are currently excavating some fantastic sites in collaboration with a European Research Council Funded project called IslandLab, led by Prof. Eleanor Scerri. This project looks at ecology over very long time scales, including studying things like the bones of mini-hippos in Għar Dalam, and tries to understand the impacts people had on landscapes and ecosystems over time.

In spite of so much archaeology already being done, there is still so much to do. For every time period, there is so much more which modern scientific methods and international practices can bring to light,' says Groucutt.

Early settlers in Malta and Gozo present a unique narrative on how ancient societies responded to climatic shifts, especially challenging phenomena such as droughts. It is not yet clear if there was an unbroken line between early settlers and the Bronze Age populations which came after, but in understanding the challenges and sacrifices made then, we can better comprehend the profound effects of a changing climate which we are facing today. Perhaps we can draw a parallel to the difficulties of the 4.2 ka event and recognise the need to truly rise to the challenge of climate change. Archaeology allows us to learn from the Maltese Islands the best way to survive challenges. 📖

How do you learn? Do you absorb information best in a quiet space, reading from a book? Or do you need to fuel your imagination with visual media? Perhaps you need to be in a busy space, interacting with others, or trying things yourself to get to grips with new ideas? Every person will have a different answer. These will sometimes be radically different, perhaps the difference between an organised classroom and a natural space. But those differences may also be as subtle as different temperatures, seating arrangements, or even lighting. People may need slightly more or slightly less effort to be productive or need to spend slightly more or slightly less time on a task to fully engage with it. The complexity of context is endless.

All these contexts – and many more besides – are ‘modes’ of learning. You have likely identified the modes through which you learn best; they may have even changed over time. But for many of you, and for this writer, these modes weren’t necessarily something you only found in school, even in cases where you had the best, hard-working teachers. Dr George Cremona is working to empower teachers, students, and policy-makers specifically, by raising awareness of how frequently we use ‘multimodal’ methods. Cremona aims to help them discover new modes in turn.

‘Explaining multimodality is part of my everyday challenge,’ says Cremona, especially as academic interest increases in the subject. ‘Gunter Kress, a linguist and semiotician, defines modes as a channel through which communication can happen. Sigrid Norris (a linguist and professor at the Auckland University of Technology) elaborates on the subject: superordinate modes such as the text of this article are the most obvious channel through which communication is happening,’ Cremona says. But there are also subordinate modes. He explains, ‘In this article, they may be the font, the font size, the layout, the images which accompany it. Even our language, reading from left to right, or where we read the article is in itself a text made

up of a variety of modes, therefore multimodal.’ Another superordinate mode such as spoken conversation is just as complex, in part due to intricate subordinate modes of tone and body language, accompanying gestures, gaze, or even the colours of our clothes while speaking.

DR GEORGE CREMONA

Since 2009, Cremona has been a member of UM’s Faculty of Education, which is concerned with teacher education, and he is currently a senior lecturer. He is the programme coordinator for German as a Foreign Language and is also the Media Literacy coordinator. ‘Before then, I was a secondary school teacher. To be honest, when I saw the post at UM, I had mixed feelings. Teaching at a secondary school level and learning from colleagues and students made me very happy.’ After starting the post at UM, ‘I was happily settled in but immediately missed being in schools. My theory is that as a teacher-educator, I cannot teach how to teach if I lose contact with the classrooms. Schools change so quickly; publications are important but need to



Dr George Cremona with linguist and semiotician Gunther Kress (right). Gunther Kress was the original proponent of multimodality.

be connected to the grassroots. To bridge my work at university with this belief, and to bridge it with my calling to teaching, I launched the Multimodal Encounters research project, which at its core, adopts a multimodal socio-semiotic theoretical framework.'

MULTIMODAL ENCOUNTERS

There are two aims for the Multimodal Encounters project. 'First, we want to ask what the benefits and challenges of educators and learners are when multimodal texts are used as pedagogical tools. Second, based on the outcome of the first question, what suggestions can we make?' This 'we' includes educators, learners, school administrators, policy-makers, and parents (and more besides), as Multimodal Encounters is a fundamentally collaborative effort. 'I do not go to schools to impose. Teachers are already doing sterling work and all they can to teach, with a very packed schedule. With limited time and the resources they have at hand, teachers are working miracles.' Instead, suggestions are built collectively, rather than being top-down advice, which respects and reflects the unique modes of each space. Then the suggestions can be implemented.

Multimodal Encounters will not add extra stuff to the already very intense syllabus, but instead

engages with existing academic necessities, tailoring teaching and activities to students' individual needs. Finally, another collaborative discussion will take place after the ideas have been tested in classes, leading to refined versions of multimodal activities which teachers may continue to

implement. 'I particularly love to see teachers taking over as we implement this approach. This is teacher empowerment!'

One example of a multimodal approach is to take a conventional students' textbook and engage with it via different modes. 'Students can draw rather than write about ▶



Multimodal activities in Maltese schools
Photo by Clint Scerri Harkins



Dr George Cremona brings multimodal activities to Filipino classrooms

Top: Dr George Cremona promoting his recent book *Bilkemm jitwemmnu!* on his weekly educational radio show airing on Calypso Radio 101.8

Bottom: The radio show was awarded best radio production in Malta by the National Institute of Journalism

the contents, they can roleplay the examples used in the textbook, changing their classroom's layout or their outfits to create a performance.' Popular interests, which might include football or Eurovision, can contribute interesting modes to lessons, which in this case, could include anything from visual aids to songs or physical activities. Something as dry as learning grammatical prepositions can be made accessible to many different ways of learning. Employing popular cartoons in younger classes has already resulted in massively increased engagement.

The same results were achieved in some older classes after it was discovered that students were interested in graffiti, which opened the door for self-expression through art. A yet more ambitious experiment involved engaging with Malta's beloved children's book, *Il-Ktieb tal-Fenek l-Aħmar* written by Trevor Zahra, with new modes largely suggested by students. This culminated in an inter-school musical play, a superordinate mode rich with subordinate modes that engaged a huge variety of different interests. 'We try to encourage students and teachers to recognise that they have potential, to see they can be proactive designers of modal "texts" such as these, instead of passive receptors of learning.'

MODES BEYOND MALTA


This project started in Malta and Gozo across all education levels, with the majority of schools reaching out to the project after hearing of it. After outreach via international conferences, blind peer-reviewed journals, and books, Multimodal Encounters began to receive invites from elsewhere. 'We have collaborated with schools and educational institutions across Europe: Sweden, Italy, Switzerland, Germany, and Ukraine.' In 2019, Cremona felt it was time to look further afield, beginning a collaboration with institutions in the Philippines. Multimodality has educational potential beyond conventional schooling, through the internet, television, and radio. 'Fortunately, I have a weekly educational radio program on Calypso Radio 101.8.





Various initiatives undertaken with educational institutions across Europe and Asia

This has become a multimodal show, with a production ethos that focuses not only on the superordinate mode of speech but on subordinate modes such as setting.' Apart from achieving the title of most-followed Sunday evening radio programme in Malta by the latest three consecutive Broadcasting Authority surveys, the show was also awarded the best radio production in Malta by the National Institute of Journalism on three separate years. Cremona sees this as more of an award for multimodality than an award for himself.

Multimodality is a new understanding of an old reality. In essence, it is a term for the incredibly nuanced way we each absorb information. Our 'communications' with the world are unique and subjective but, as Cremona stresses, are all the more valuable for it. As Gunter Kress frequently told him, any perspective based on reasoning which respects other perspectives is equally valid. Multimodal Encounters is proving that. In whichever mode this approach is applied, it's getting results. 

Dr Cremona's new Maltese-language book on this subject, *Bilkemm jitwemmu!*, is now available.

Further Reading:

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SUMMONING A GLOBAL GUARDIAN TO HALT THE ECOLOGICAL CRISIS

Author: **Christian Keszthelyi**



Humanity faces an ecological crisis. It is urgent and complex. It has several characteristics and an in-built inertia, which makes it even tougher to address, as the effects may only dawn on us in the coming decades. There is no simple solution. But setting up a global guardian issuing binding agreements may help.

THINK goes on a thought experiment for a better future.

While the past half-century has witnessed numerous global efforts under the United Nations to address ecological issues, they often suffer from a fundamental limitation – they are generally non-binding, insufficiently ambitious, or binding only on consenting parties. The absence of effective binding agreements and a lack of urgency have hindered the world's collective response to this pressing matter. Dr Roberto Debono (a Ph.D. candidate from the Department of Philosophy) recognises this gap and proposes an innovative solution: the creation of a 'global guardian.' This concept forms the cornerstone of his research, which seeks to redefine the global political landscape and enhance our ability to combat the ecological crisis effectively.

The four key principles outlined by Debono for effective global governance are: sufficiency, subsidiarity, democracy, and solidarity. These four principles would help secure the legitimacy and effectiveness of such a global guardian. He is also proposing a legal framework for the creation of a global guardian to ensure all countries step back and take responsibility for reducing our global ecological footprint.

A GLOBAL GUARDIAN

Sufficiency narrows the scope of the global guardian to issues exclusively related to ecological sustainability. Subsidiarity supports multi-layered global governance, where decisions are taken at the hierarchically lowest possible levels. Democracy ensures that the international process is owned by the member states. Solidarity evokes a duty to assist societies that do not manage to keep pace with the ecological transformation. More importantly, it imparts a sense of collectively addressing

shared adversity, where the fate of one people is tied to the fate of everyone.

Debono argues that observance of these four principles should allay fears of a constitutionally-limited and legally coercive global authority, secure the global guardian's legitimacy, and safeguard the global guardian's mission to steer humanity towards ecological sustainability. But how did we get here?

'As I dove into economics for my research, I found that ecological economists, among others, argue we cannot have limitless economic growth. This argument has been around for more than half a century, since at least the Club of Rome's 1972 publication *The Limits to Growth*,' Debono tells **THINK**.

A competitive, state-based, international political system fuels economic growth, which underpins an individual country's geopolitical performance. Political leaders worldwide are often appointed or expected by the populace to support economic growth. But as the economy grows, it often takes up ecological space, essential for humans to live a sustainable and quality life.

A UTOPIAN PRINCIPLE

But what is the ecological crisis in reality? 'Humanity is at a turning point. We must ensure that we do not push Earth into a transition to Hothouse Earth, where the planet could become uninhabitable for humans. We are also experiencing a sixth mass extinction event. The last such, the fifth mass extinction event, happened 65 million years ago to the dinosaurs. The sixth mass extinction event is seeing rates of biodiversity loss that undermine our livelihoods as part of the biosphere,' Debono says.

All four principles Debono proposes should be observed to secure good global governance. But this may irk people who could easily see such an entity as



a 'totalitarian monster on feet of clay'. Debono insists we can design a global guardian and introduce checks and balances to ensure it does not trump national liberty and self-determination.

'My proposal is a utopian one. But it is a realistic utopian proposal: an imagined reality based on observed reality. In addition to securing a safe operating ecological space and to apportioning available ecological space justly among states worldwide, the global guardian must ensure that the global ecological transformation is temporally just. It must give people time to adjust to the ecological space attributed to them and will probably require some countries to lower their material living standards,' Debono explains.

With the coming into existence of a global guardian, each member state would receive ecological entitlements. Such entitlements include carbon credits and should not be tradable on the global market, Debono says. 'I argue that carbon accounting should happen where it is enjoyed and has an effect, such as a positive effect on material standard of living. Practically, it means that the client, the consumer country, shall start shopping from greener companies,' he adds.

POLITICAL INTERESTS

But do we need all countries of the world to sign up for the idea of a global guardian? What happens to stray countries that may not be interested?

'There will be countries who do not sign up. But I believe once you have a sufficient number of states agreeing to and binding themselves to the idea, others will start joining too. Still, non-member countries will need to honour their respective ecological space.


On the principle of no harm, member countries can legitimately interfere in the affairs of non-member countries if the latter undermine global ecological sustainability,' Debono said.

But how can you oblige countries unwilling to sign up for the idea of a global guardian? 'My argument is this: If you are a citizen of a country, you are obliged to honour the law. If you are not a citizen and you are in that country — you are still obliged to honour the law, even if you do not sign up for citizenship,' Debono says.

He believes his proposal can work as long as the global guardian enjoys sufficient legitimacy by most countries worldwide. He returns to the classical definition of liberty: you are free to do as you will so long you do not harm others.

'If you have a few countries polluting and therefore infringing the mutually accepted principles, the global guardian will be justified in intervening economically or militarily in the same way that the international community is legitimately entitled in intervening in the affairs of a state if it constitutes a threat to international peace,' Debono says. He argues that his concept is not entirely new and is prefigured by the practices of entities such as the European Union, the United Nations, and the North Atlantic Treaty Organisation (NATO).

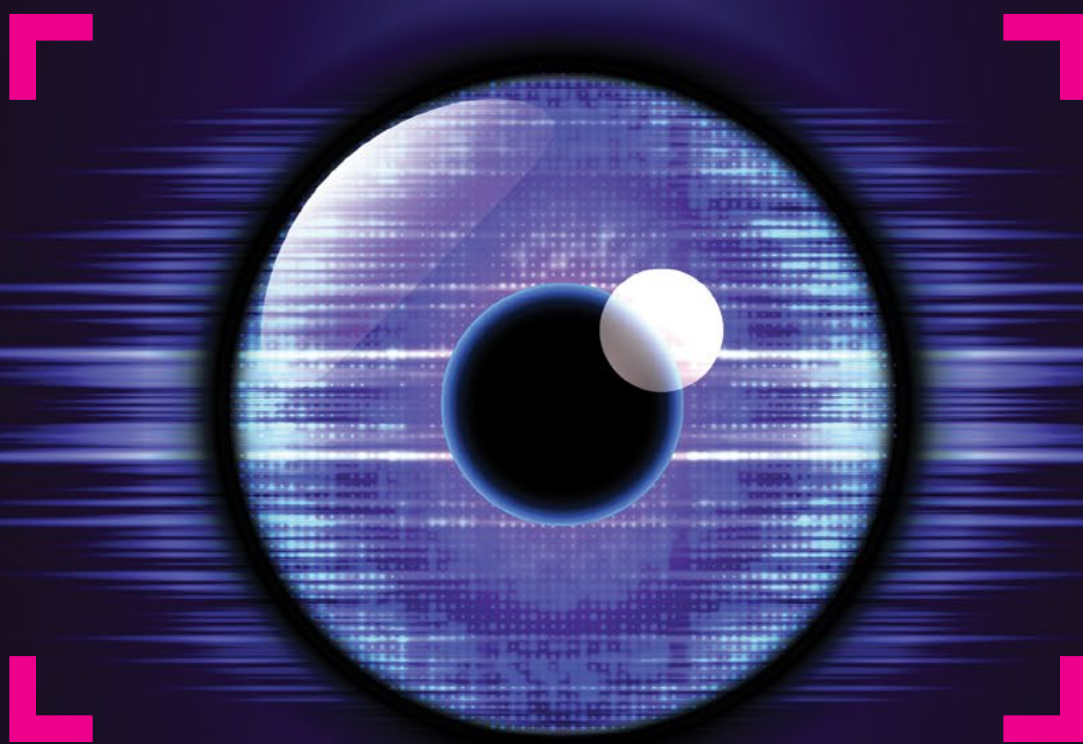
Debono argues that the most critical and powerful point of entry for such an entity would be via the most influential players in the world. He believes a ripple effect would reach other countries if world powers come together to launch such an initiative and the most powerful states sign up.

While the concept of a global guardian certainly has its merits, especially in the wake of climate disasters such as wildfires, temperature increases, and rising sea levels, could such climate action work? Is the world ready for a global guardian? Time will tell. 

Architecture and STEM



Transforming Internet Access for People with Disabilities



Author: **Inês Ventura**

In the digital era, where Zoom, email, and social media platforms prevail, communication has never been easier. For some of us, even if we are in different parts of the world, daily communication is no longer an issue. Unfortunately, for individuals with disabilities, this is not always the case. A team of local researchers is exploring ways to facilitate access to the internet and all that it affords, including communication, work, and entertainment.



Dr Chris Porter

For individuals with vision or hearing impairments, communication can be a challenge. While various assistive technologies such as screen readers and artificial intelligence-based tools have been developed to overcome these challenges, there is still room for improvement. Furthermore, there are other situations that can make communication even more challenging, and this is the case for people with severe motor impairments, including locked-in individuals.

In a nutshell, this rare condition results in complete paralysis, where all voluntary muscles except those controlling eye movements cease to function. Despite their immobility, these individuals remain conscious and able to understand their surroundings. They can remember, imagine, perceive, and process information, but they lack voluntary speech and bodily expressions.

'How are you supposed to live when your body can perceive but

can no longer respond? How would people know inside the immobile body you are still alive?' writes Jean-Dominique Bauby in his memoir, *The Diving Bell and the Butterfly*.

On 5 December 1995, Jean-Dominique Bauby, then editor of the French magazine *Elle*, suffered a massive stroke that left him quadriplegic and mute. In his memoir, Bauby shared his experience of loneliness and powerlessness as a locked-in individual. He communicated by blinking his left eyelid to select letters and form words, sentences, and a narrative, one blink at a time.

ENHANCING INTERNET ACCESSIBILITY WITH CACTUS

Reading Bauby's memoir inspired Dr Chris Porter, a researcher and senior lecturer at the Faculty of ICT, UM. Bauby's story illuminated the challenges faced by locked-in individuals and their need for enhanced communication. Porter embarked on his work in assistive

technology to explore how technology could assist people living with such conditions.

'We are currently developing two different projects that address accessibility for people with severe motor impairments,' explains the researcher. The first project, named CACTUS, involves the development of a novel web browser that is designed to be primarily operated via eye-tracking devices. This technology detects a person's presence and tracks their gaze in real time, providing unrestricted access to the internet. With this technology, users can perform various online tasks, from sending emails to browsing and shopping.

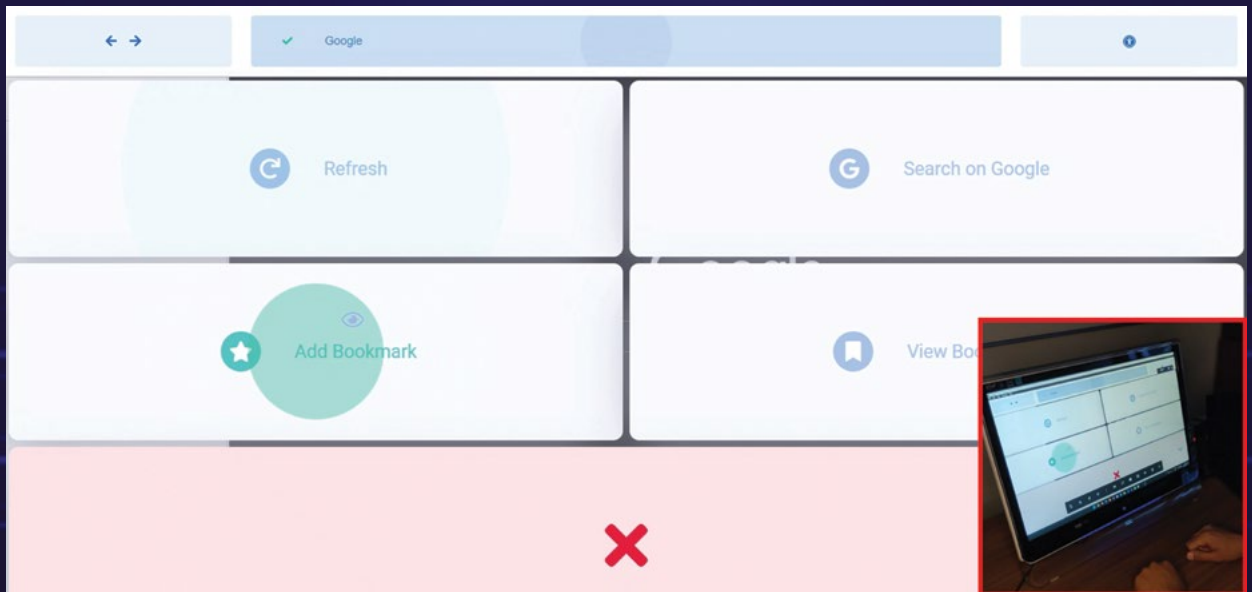
'The idea is to enable people to browse as efficiently as possible, depending on their capabilities, even if they cannot use a mouse, keyboard, touch screen, or even their voice,' Porter elaborates. They are also creating a multimodal approach, allowing people with some residual motor function to use alternative devices, such as adaptive switches, to

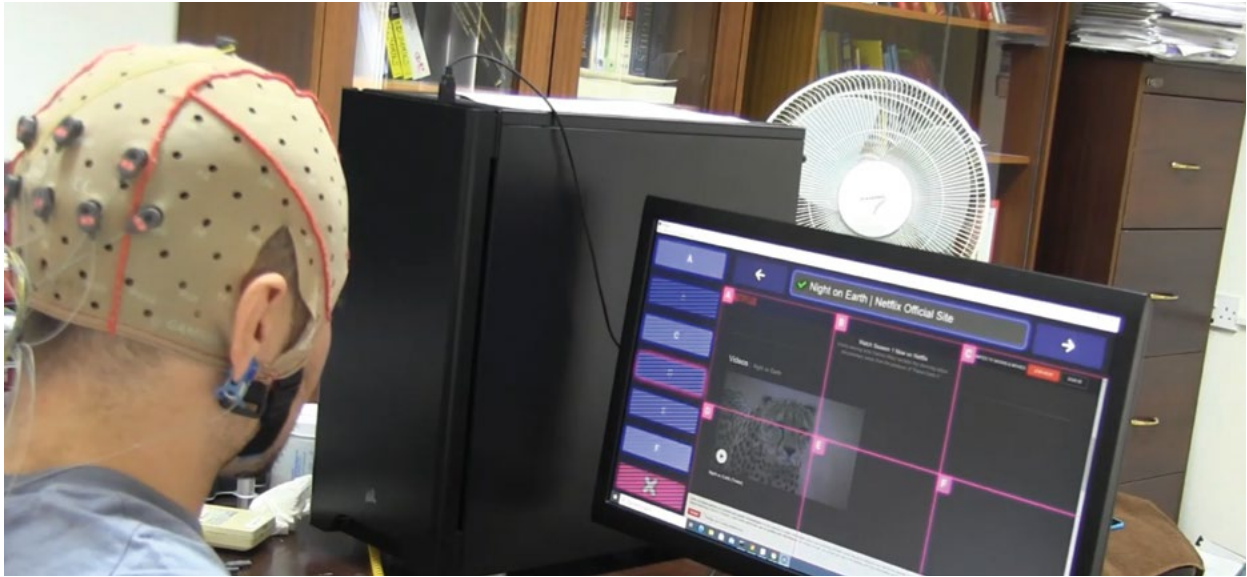
Top: HCI Lab
within the Faculty of ICT,
University of Malta

Centre: CACTUS browser – a user
accessing common browser
functionality

Bottom: CACTUS browser – a user
interacting with a navigation
region on a website

Images courtesy of
Dr Chris Porter





BOGGLE browser – a user selecting a link on a page
Photo by Alison Camilleri

expedite the process. For example, if an individual has some hand movement, a custom switch can be adopted for quicker selections.

THE POTENTIAL BOGGLES THE MIND

While CACTUS addresses the needs of individuals who can use eye trackers, there are others who cannot. Porter's second project, BOGGLE, targets these individuals with distinct needs by using brain signals. This project is being carried out in collaboration with Dr Tracey Camilleri, a senior lecturer with the Department of Systems & Control Engineering at the Faculty of Engineering, UM.

'We are focusing our attention on brain-computer interaction (BCI) based on Steady State Visually Evoked Potentials. When you focus your attention on a visual stimulus, such as a button flickering at a specific frequency, a portion of your brain responds to it in a predictable manner. This is a well-known neuronal response, which we can capture and interpret to determine the person's intentions,' Porter


explains. By measuring brain activity, the BCI browser can recognise which command the individual is looking at and wants to activate.

Despite being in an early stage, the researchers have observed encouraging results from a recent study. Participants were able to access the internet and carry out a number of common tasks, including searching and watching videos. Although brain-computer interaction is typically slow, BOGGLE offers significant improvements in terms of browsing freedom, classification accuracy, and speed over existing technologies.

'Assistive technologies can be incredibly expensive. Even with best-of-breed assistive technologies, they can't be of much help if they're not affordable,' Porter emphasises. The team at UM is working to minimise barriers to entry by building their own assistive technologies using low-cost hardware while also open sourcing code for others to use and build upon.

'This kind of technology can be frustrating, but it can also be

life-changing. We're ensuring that people with severe motor disabilities can harness the power of technology to live better, fuller lives,' Porter concludes.

In a world where communication is increasingly digital, these remarkable innovations are breaking down barriers for individuals with disabilities. As CACTUS and BOGGLE pave the way for enhanced accessibility and independence, they signify the unyielding human spirit and determination to harness technology for the betterment of all. With open-source solutions and a commitment to affordability, the UM's research team is lighting the path towards a brighter, more inclusive future, where technology serves as a bridge, not a barrier, to a life well-lived. 

CACTUS is funded by the MCST Fusion R&I: Research Excellence Programme 2023.

BOGGLE is funded by the UM Research Excellence Fund 2024-2025

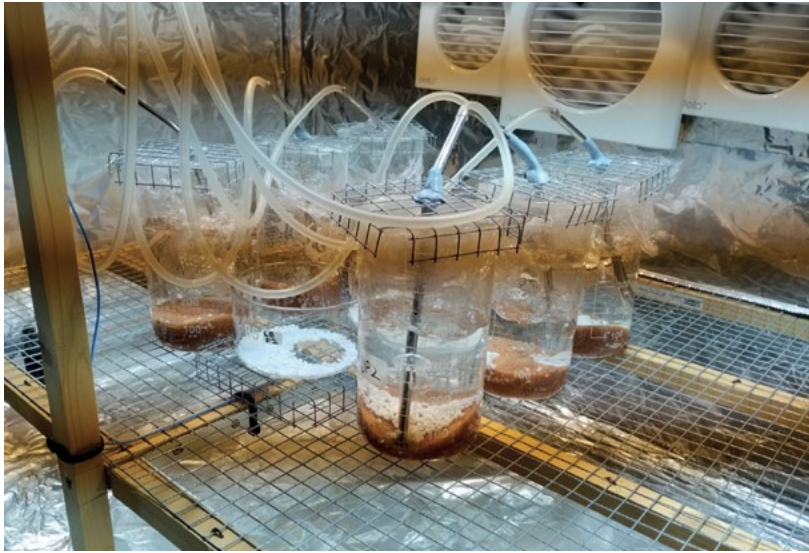
AGEING PLASTICS

A Microscopic Threat in Our Global Environment?

*Plastics are now an essential part of our modern lives, offering unmatched convenience and versatility. They're ubiquitous, from everyday household items to cutting-edge technology. However, this convenience comes at an ecological cost: the widespread presence of plastics in our environment and their transformation into tiny, nearly invisible particles called micro and nanoplastics. **THINK** magazine sits down with **Dr Sophie Briffa** to delve into the ageing of plastics and the possible health and environmental effects of micro and nanoplastics.*

Author: **Andrea Cuschieri**





Environmental ageing of micro/nano-plastics
Image courtesy of Dr Sophie Briffa

Microplastics are typically defined as plastic particles measuring less than 5mm in size, roughly the length of a grain of rice. In contrast, nanoplastics are even smaller, often measuring 100 times thinner than a human hair. However, the exact size distinctions between microplastics and nanoplastics can vary, contributing to ambiguity in terminology, especially concerning safety regulations in different regions.

One of the significant challenges scientists face when dealing with these minuscule plastics is the limited knowledge surrounding their potential harms. 'There is so much we don't know about the harmful effects of micro and nanoplastics, especially their toxicity effects on humans,' explains Dr Sophie Briffa, lecturer at the Faculty of Engineering, UM. The human body's ability to interact with and respond to particles of such diminutive dimensions remains a subject of ongoing research.

However, detecting and quantifying micro and nanoplastics poses a formidable challenge. Their small size and organic nature make them elusive in environmental samples. To complicate matters further, current technology has limitations. For instance, the detection of nanoplastics in bottled water is constrained by the equipment's ability to identify particles smaller than a certain threshold, similar to searching for a needle in a barn full of haystacks.

HOW UM RESEARCHERS ARE STUDYING AGEING TINY PLASTICS

Getting a grasp on how these tiny plastics break down, or age, is vital. It helps us understand what to look for when trying to detect these minuscule

plastics. One such approach involves replicating plastics' degradation under environmental conditions, for example, in seawater.

Dr Briffa and her team conducted experiments to simulate the ageing of a specific plastic, polyethylene terephthalate (PET), within a controlled environment. Thanks to the controlled environment, they could closely observe how these plastics gradually transformed into nanoplastics over time.

Here, the researchers selected PET pellets, a commonly used plastic in various consumer products. These PET pellets were exposed to extended periods of UV radiation, mimicking the effects of sunlight, inside a specially designed weathering chamber filled with water columns to simulate seawater conditions. The initial observations have yielded fascinating insights into the plastic's ageing process. Within a relatively short period of 100 days, the researchers observed changes to the microplastics and were able to detect nanoplastics within the water column.

Research into the ageing of plastics conducted by Dr Briffa and her team is part of a broader effort to shed light on the environmental ageing of plastics. One of the key takeaways from their ongoing study is that plastic ageing indeed leads to transformations, even within a relatively short time frame. Although the research focused on PET, it opens up a plethora of questions about how other types of plastics may behave under similar conditions. Given the vast diversity in the chemical composition among plastics, the extent and nature of their transformations remain uncertain.

Studying tiny plastics presents a range of challenges. The tools scientists use to detect and measure them



Dr Sophie Briffa
*Photo courtesy of Francesca Attard
(iCreatemotion studio)*

have limitations. Traditional microscopes struggle to see particles of this minuscule size, and although special stains like Nile Red (a dye used to enhance the visibility of molecules as it fluoresces) can help make them visible, these methods are not without their limitations.

Another challenge is the complex organic background of the environment. In nature, plastics coexist with various other organic materials, making it challenging to isolate and identify nanoplastics accurately. The intricacies of working within this organic matrix necessitate innovative solutions and refined techniques for accurate detection and quantification.

THE JOURNEY TO GREENER PLASTICS: HOW UNDERSTANDING AGEING MAKES A DIFFERENCE

Ongoing research into plastic ageing is just the beginning. To fully understand how different plastics age and transform in various conditions, future studies must broaden their scope. This includes investigating other commonly used plastics like polystyrene, polypropylene, and biodegradable polymers, each of which may exhibit unique ageing characteristics, affecting their environmental impact.

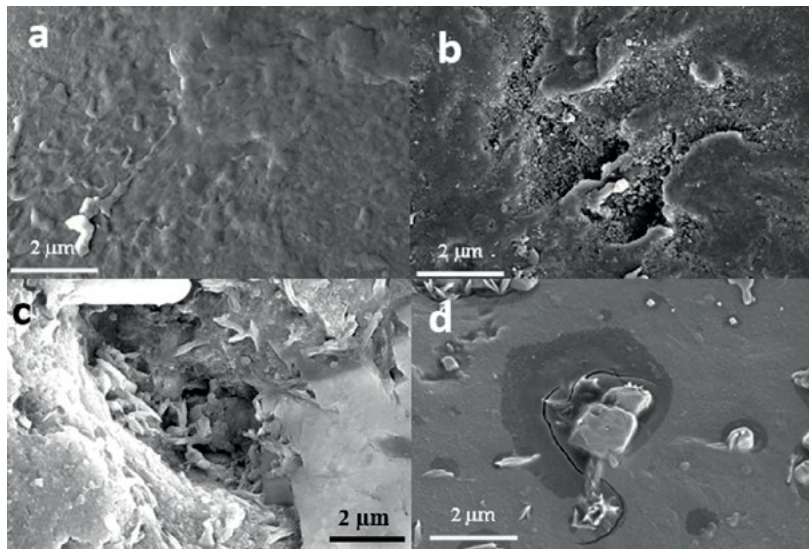
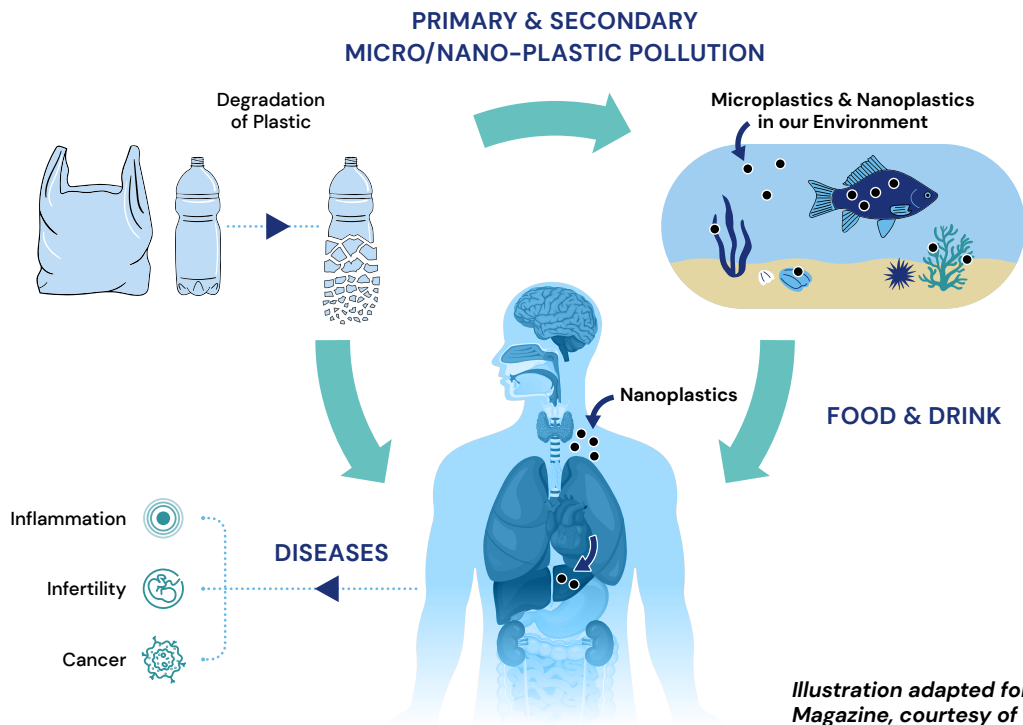
Research should also consider a wider range of environmental factors such as UV exposure, temperature

changes, and different aquatic environments to get a more detailed understanding of plastic behaviour and promote eco-friendly practices.

Understanding how plastics change over time is crucial for reducing their environmental impact. As our understanding of plastic ageing grows, we can influence how plastic products are made. Knowledge about durability and long-term effects can drive innovation, leading to more eco-friendly materials and production methods. Addressing plastic's environmental impact requires collaboration between governments, industries, and individuals. Companies must reduce plastic waste, adopt sustainable practices, and explore alternatives. Consumers, armed with information, can make informed choices, and awareness campaigns can promote responsible plastic use. By supporting eco-friendly products, consumers are demanding corporate responsibility and a greener future.

As our knowledge of plastic ageing grows, it can influence policy making, impacting initiatives like the Sustainable Development Goals and the European Green Deal, which aim to reduce plastic use and protect the environment. This knowledge empowers individuals to advocate for responsible practices, influencing regulations and corporate behavior to work towards a more sustainable future. **T**

TACKLING THE ENVIRONMENTAL PROBLEM OF MICRO/NANO-PLASTICS (MNPs)



Relevant experience:

- Set-up development
- Organic Characterisation (Raman and microscopy)
- Understanding NM behaviour in the environment

Results:

- Weathering chamber successfully designed
- Physical and chemical changes noted
- Microplastics were detected in the liquid column
- Complexity of dynamic ageing environmental processes

Image courtesy of Jack Galea

Understanding the Technology of Malta's Oil-Based Wall Paintings for Conservation

Author: **Elena Said**

*Oil-based painting on stone is the most common painting technique used to decorate churches and historical palaces in Malta. Unfortunately, such paintings face several conservation challenges. **THINK** explores **Dr Roberta De Angelis'** research into the intricate chemistry of these artworks and her quest to understand the processes of degradation, which in turn informs decisions when it comes to their restoration.*

The most common wall painting technique in Malta, dating back to at least the 17th century, is oil-based painting. Oil-based painting, which typically involves colour pigments mixed with a drying oil such as linseed, allows for deep and vibrant colours to adorn local churches and palaces. However, due to humidity, moisture, temperature changes, and a host of other issues, these magnificent works of art can deteriorate. Conserving and restoring them entails a systematic, multidisciplinary approach.

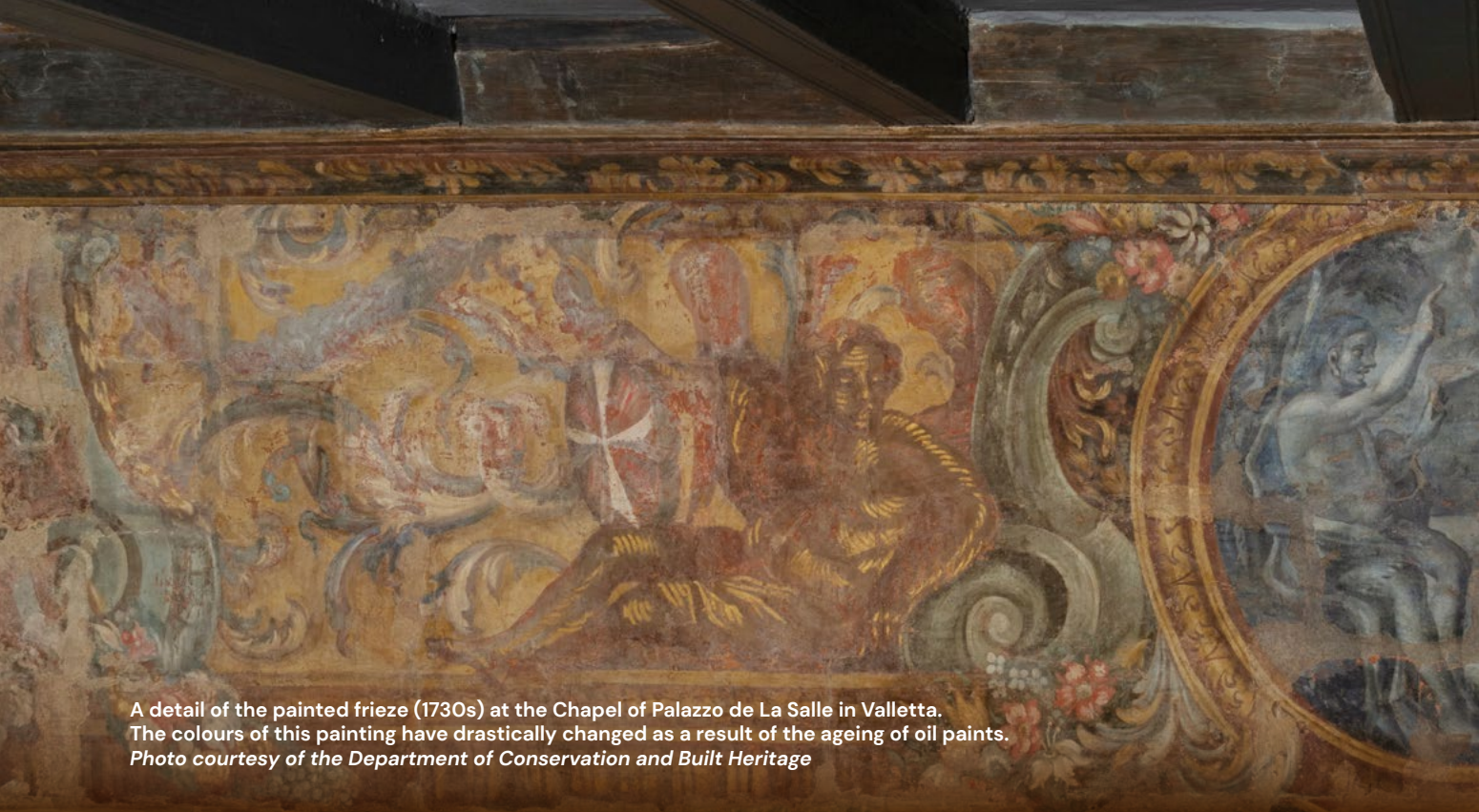
Upon her arrival in Malta in 1999, Dr Roberta De Angelis, a paintings conservator and a Lecturer in the Department of Conservation and Built Heritage, was captivated by the deteriorating oil-based wall paintings present on the islands.

Her M.Phil. research on oil painting on stone sparked her curiosity about the specific types of degradation associated with this technique, which led her to focus

her Ph.D. research on the technology of Baroque wall paintings in Malta. She specifically explored the materials used and their implications for conservation, moving beyond the typical issues (such as the gradual peeling or flaking of paint layers) found in paintings due to salts and Malta's marine environment.

A DISTINCT TECHNIQUE

The choice of oil-based painting on stone in Malta, although still unclear, can be attributed to a combination of local traditions and material availability. While lime-based painting (also known as *fresco*, where pigments are mixed with water and applied directly to wet lime plaster on the wall) was prevalent in Italy, in Malta, this technique was seldom used, and then primarily by Italian artists, who had to modify it and adapt it to the local scenario. 'Some researchers have suggested that local materials were not suitable for traditional fresco techniques,' explains De Angelis. ▶



A detail of the painted frieze (1730s) at the Chapel of Palazzo de La Salle in Valletta. The colours of this painting have drastically changed as a result of the ageing of oil paints. Photo courtesy of the Department of Conservation and Built Heritage

One case in point is Mattia Preti, who used fresco in Italy but in Malta preferred oil-based painting directly on stone. This technique allowed him to incorporate the natural stone colour into his compositions. Oil painting on stone provided artists with a versatile palette, offering a broader range of pigments for self-expression. In contrast, fresco painting relies on specific pigments and demands swift execution, while oil allows for corrections and greater artistic freedom.

Oil paints are, and remain, chemically reactive over time, leading to changes in the appearance of paintings such as changes in colour, the formation of crusts, and surface haziness. While oil degradation on canvas paintings is well-researched, the way oil paints interact with a stone substrate is not well studied.

By comparing a set of 19 oil-based wall paintings present in Malta, De Angelis was able to understand the extent of chemical degradation in these paintings and the changes they underwent over time. Some of the paintings studied by De Angelis include two from different periods at Palazzo de La Salle in Valletta, the Choir painted by Mattia Preti at the Mdina Cathedral, wall paintings found at the Jesuit Church in Valletta, and those at the Inquisitor's Palace in Vittoriosa.

LOOKING BEYOND THE SURFACE

In order to study these paintings without damaging them, non-invasive techniques are used. These include visual examination by trained experts, digital

microscopy, and specialised photographic techniques such as near-infrared reflected imaging and ultraviolet-induced luminescence, as well as X-ray fluorescence.

These methods provide insights into surface conditions. However, to fully characterise the layers and materials within the painting, invasive sampling is necessary, typically involving the removal of a very small (c. 1mm) fragment. Non-invasive methods allow researchers to locate where to take samples with minimal damage.

The sample is embedded in a resin block and carefully sliced to examine all painting layers under a microscope. This allows researchers to understand the painting build-up and its chemical composition, also by resorting to a range of instrumental techniques.

'Understanding the chemical composition and degradation of paintings provides essential guidance for the restoration process. Every painting exhibits unique characteristics in its construction and material composition. While some paintings may share common traits or can be grouped into classes, conservation strategies must be tailored accordingly,' she explains.

Decisions made in the conservation process depend on important factors. One key factor is understanding the original materials of the painting and their properties, since these inform what can and cannot be done during a conservation treatment to avoid damaging the artwork. Conservation treatments are not risk-free. Additionally, conservators



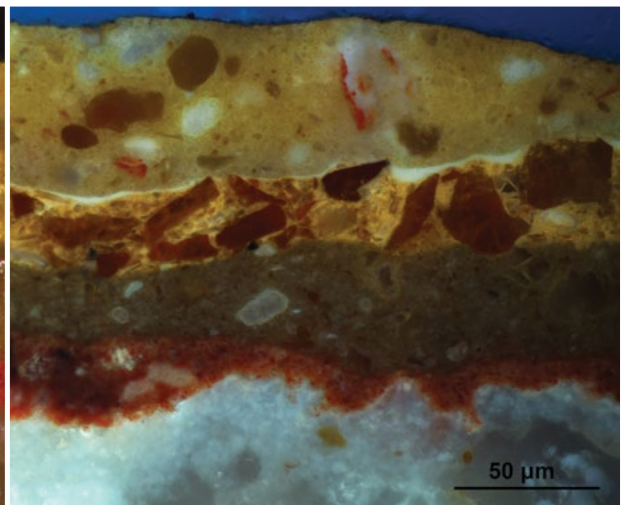
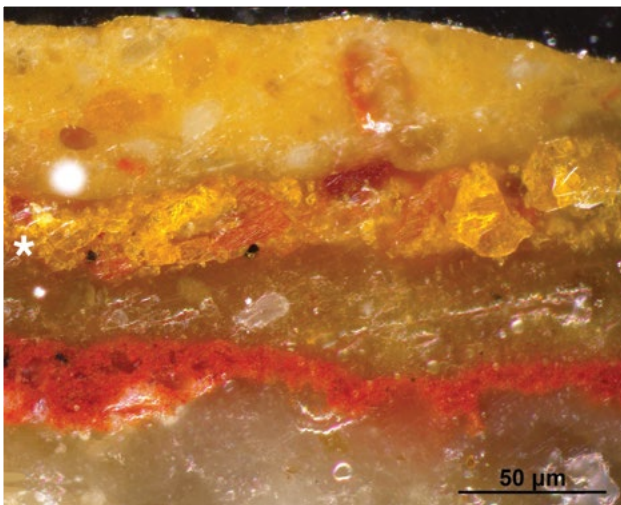
One of the lunettes of the Chapel of St Joseph at the Jesuit Church in Valletta and a detail showing the versatility in paint texture typical of oil paints
Photo courtesy of Dr Roberta De Angelis



Top: One of the angels of the frieze at Palazzo de La Salle. The flesh colour has altered to greyish brown where it was originally intended to appear bright yellow and imitate a gold sculpture. This alteration is typical of a pigment called orpiment (left) and is caused by light.

Bottom: Images taken under a microscope of a paint sample under visible light and UV-induced luminescence respectively, showing the original bright yellow paint layer (*) of the angels in an area protected from light.

Photos courtesy of Dr Roberta De Angelis





A conservator at work cleaning the painted frieze at the Chapel of Palazzo de La Salle, Valletta.
Photo courtesy of the Department of Conservation and Built Heritage

need to be cautious when dealing with crust-like formations. These might look like salt crusts at first, but they can actually come from the paint itself as a result of chemical degradation processes. This means conservators have to be careful in handling them, as they are part of the original artwork.

STROKES OF CHANGE

The chemical reactivity of oil paintings, characterised by changes in colour and shifts in paint properties, profoundly impacts how we perceive and appreciate these works of art. It is essential to recognise that appearances can sometimes be deceiving. 'This perspective enhances the appreciation of artworks and reveals that what may appear as unattractive or unimportant is, in fact, an integral part of the artwork,' clarifies De Angelis.

Such an example is the case of one of the paintings at Palazzo de La Salle. While the touches of gold stand out, the figure of an angel has gradually turned brown and appears flattened over time. This transformation is due to the yellow pigment present, which has faded and no longer retains its original colour.

Distinguishing between original and non-original crusts and assessing their suitability for removal can be a complex undertaking. Paint degradation and transformation can manifest haziness in the form of a white or brownish crust that is inherent to the painting.

'These materials, often meticulously applied by artists, hold significant historical value, even in purely decorative paintings, and need to be preserved,' notes De Angelis. Some paints may become sensitive to water as a result of paint degradation processes, potentially leading conservators to adopt the wrong approach.

Dr De Angelis' research illuminates a crucial aspect for conservators and art enthusiasts alike. It underscores that changes in colour, while noticeable, are not flaws but rather an inherent and natural part of the painting's life cycle. This evolving colour palette doesn't signify aesthetic issues; it reflects the artwork's own journey. Recognising and embracing these transformations as integral to the art's evolution enhances our understanding of these intricate compositions and their historical significance, deepening our appreciation of these invaluable artworks. **T**

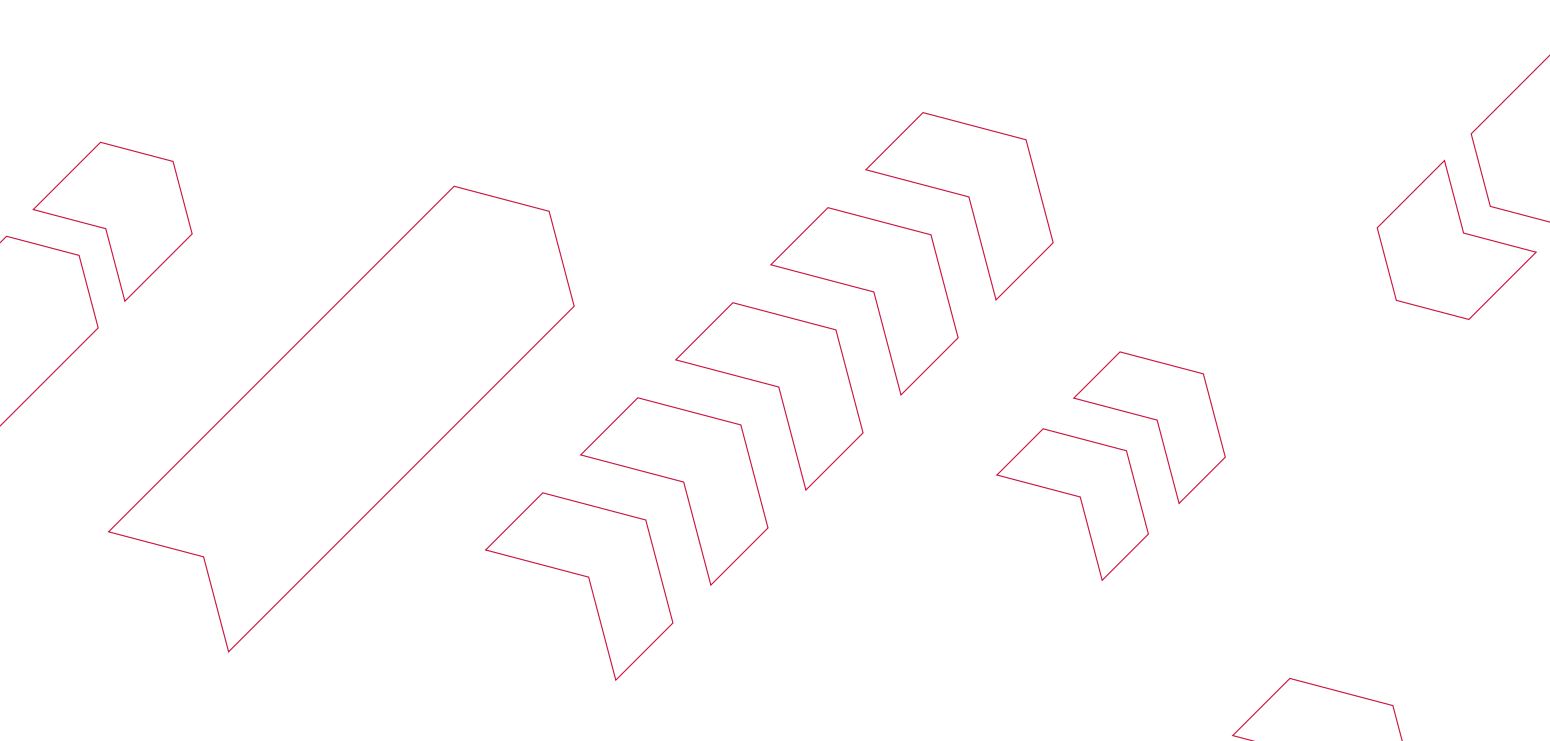
WALKING THE FUTURE

PREMIER'S SMART
PROSTHETIC
INNOVATIONS



Author: **Andrea Cuschieri**





*Prostheses allow amputees to regain mobility and embrace life after limb loss. However, modern prostheses are rather austere and expensive, posing challenges for accessibility and affordability. **Project PREMIER** is developing a smart prosthesis to address these challenges.*

In today's society, amputations are increasingly common, with individuals requiring amputations due to traumatic events or diseases such as diabetes and bone infections. Lower limb amputations, in particular, have seen a steady rise in numbers compared to upper limb amputations. This growing prevalence of amputations has ushered in a pressing need for innovative solutions, specifically, the development of smart above-knee prostheses. These aim to provide amputees with sufficient movement to perform routine activities while remaining affordable, aesthetically pleasing, and user friendly.

In response to this need, Project PREMIER has been initiated to pioneer ground-breaking research to improve the quality of life for above-knee amputees. **THINK**

sat down with Nicholas Patiniott, a Ph.D. candidate and research support officer forming part of the PREMIER project. The team is led by principal investigator Prof. Ing. Jonathan C. Borg from the Department of Industrial and Manufacturing Engineering.

UNDERSTANDING THE NEEDS OF AMPUTEES

Amputees face a myriad of challenges that evolve as they progress through various stages of recovery and adaptation. Initially, regardless of age or gender, the first challenge is often simply regaining the ability to walk. Standard prostheses allow for this simple functionality, albeit in rather spartan fashion, and they are typically designed with a limited lifespan and only cater to basic

functionalities. 'Everyday tasks like standing, sitting, or ascending stairs become Herculean feats, demanding extensive effort and patience,' explains Patiniott.

As amputees recover, they may aspire to enhance their posture, gain more stability, or even engage in activities like running. Unfortunately, prostheses are costly: a cost that dramatically increases as the prosthesis becomes more advanced in terms of functionality and aesthetics. Such financial constraints often leave amputees restricted in their pursuit of an improved quality of life.

MEETING AMPUTEES' UNIQUE NEEDS

The above-knee prosthesis developed by PREMIER transcends mere mechanical limb replacement; it represents a realm of smart



Some team members of Project PREMIER with the smart above-knee prosthesis. From left to right: Prof. Ing. Jonathan C. Borg, Mr Nicholas Patiniott, Prof. Alfred Gatt. Photo by James Moffett

applications with profound potential. These applications, while seamlessly monitoring user health beyond the prosthesis, have the capacity to revolutionise amputees' lives.

The smart PREMIER prosthesis makes use of sensors and AI algorithms that can detect potential issues, for example, excessive pressure on the stump arising from an imperfect 'socket' that can lead to ulcers and, eventually, muscle atrophy. Such pressure sensing can enable automatic and swift reporting to both the amputee as well as the prosthetist to enable them to take timely action to prevent discomfort.

Modularity is a fundamental aspect of PREMIER's design philosophy, breaking down the prosthesis into interchangeable components. This modularisation

is supported through the in-house manufacturing processes available within the Faculty of Engineering, thus allowing the replacement of specific parts, leading to reduced cost, reduced waste, and increased sustainability, without compromising on quality.

Furthermore, the project emphasises the emotional well-being of amputees, acknowledging that a prosthesis is not just a medical tool but a vital part of one's identity, advocating for aesthetic appeal, customisation, and positive impacts on self-esteem and social integration.

Central to PREMIER's pioneering approach is the creation of a digital twin of the prosthesis as part of an innovative product-service system (PSS). This PSS is a game-changing development that deserves special attention. This digital replica

provides clinicians and users with invaluable real-time insights into the prosthesis' performance. Perhaps most notably, it drastically diminishes the need for frequent clinic visits. This innovation isn't just about convenience; it's a profound shift in how amputees interact with their prosthetic devices and healthcare providers. By offering continuous performance monitoring, the digital twin empowers amputees to take more control over their prosthetic experience and overall health. It's a transformative leap forward in prosthetic care, enhancing not only accessibility but also the user's sense of agency and well-being.

Developing smart above-knee prostheses presents persistent challenges that the team is determined to conquer. Weight management is a crucial issue, ▶



Smart above-knee prosthesis developed by Project PREMIER
Photos by James Moffett

as finding the right balance between a prosthesis that's not too heavy to impede mobility and not too light to compromise stability requires meticulous engineering and design efforts. Environmental factors like the weather, particularly wind, can also impact the prosthesis' performance. Ensuring precise alignment of the prosthesis with the wearer's body is another intricate challenge addressed by the project, aiming to prevent discomfort and maintain a natural gait.

ONE SMALL STEP FOR PREMIER TOWARDS ONE GIANT LEAP FOR MANKIND

A smart product, such as PREMIER's above-knee prosthesis, is aimed at supporting both the amputee as well as their healthcare professionals. PREMIER is contributing to the concept of a smart prosthesis service system that will enable future research and refinement, becoming smarter, more adaptable, and more cost-effective. As this technology

matures, it is likely to transcend above-knee prostheses to address a wider array of limb-loss scenarios, including upper limb amputations. Furthermore, the integration of predictive and adaptive features into prosthetic devices has the potential to revolutionise healthcare by aiding preventive medicine, injury rehabilitation, and geriatric care, ultimately enhancing the well-being of diverse patient populations.

The PREMIER project's mission encompasses more than just engineering and technology; it embraces the holistic care of amputees. Consequently, it may serve as an inspiration for a shift in the healthcare paradigm, promoting a more patient-centric approach that emphasises the emotional and psychological aspects of rehabilitation. In summary, the PREMIER project's legacy extends far into the future, promising innovation, accessibility, and a brighter outlook for those grappling with limb loss and the broader healthcare industry. **T**

Disclaimer: The smart above-knee prosthesis discussed in this text, developed as part of the research project PREMIER, is not currently in production. The PREMIER prosthesis represents a visionary concept and functional prototype that will contribute to the future of prosthetic technology and related healthcare services. As with any research project, further work is necessary before such solutions become commercially available and approved by relevant authorities.

Funded through ERDF.01.124 as part of Project PREMIER – Development of a Low-Cost Product-Service System for a Smart and Modular, Emotionally Pleasing Above-Knee Prosthesis.

The PREMIER project is led by Prof. Ing. Jonathan C. Borg. Project members include: Nicholas Patiniott, Dr Emmanuel Francalanza, Dr Joseph P. Zammit, Dr Pierre C. Vella, Prof. Alfred Gatt, and Prof. Kristin Paetzold-Byhain at the Technical University of Dresden.

Life Sciences and Medicine





Protecting White Matter:

The Key to Preserving Brain Function after Injury

Author: **Antónia Ribeiro**

The destruction of white matter in the brain, which can occur during a stroke, is an irreversible process that can cause serious cognitive decline. While unravelling the effect of drugs that may protect against white matter injury, new research at the University of Malta is giving hope to people at higher risk of strokes.

The brain is a marvellously complicated organ. It oversees all our bodily functions and controls our perception of the world. Yet, it is also highly sensitive. Heavy impacts, infections, or intoxication can lead to alterations in the brain that deal great damage.

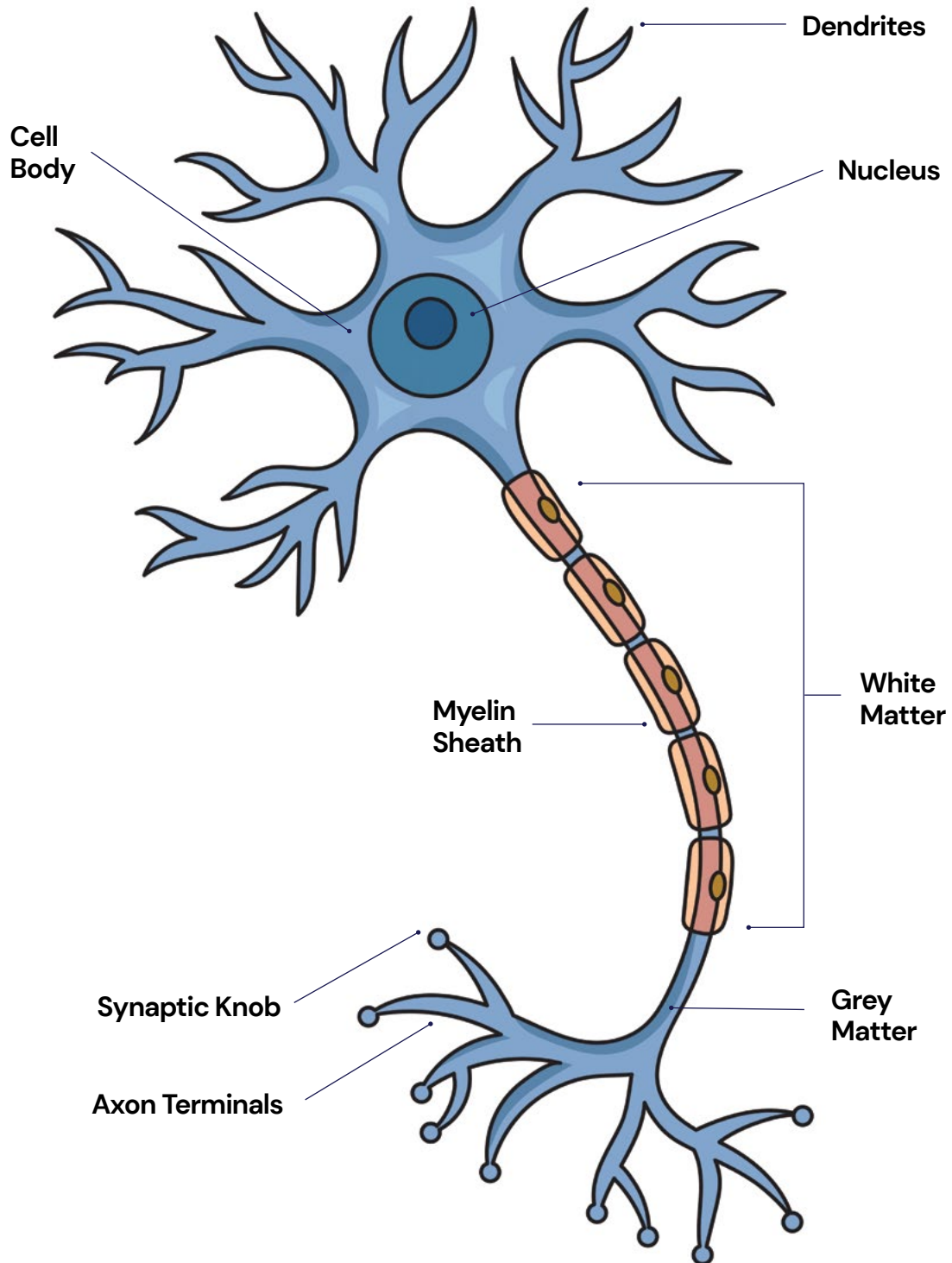
Look at strokes, for example. They are either caused by an obstruction of the brain's blood supply, which deprives it of oxygen and nutrients (a phenomenon called ischemia), or by the rupture of a blood vessel supplying the brain (referred to as a haemorrhagic stroke). In both cases, this can lead to the destruction of neurons and affect a person's ability to speak, move, and think. Or consider diabetic patients, prone to periods of extremely high (hyperglycemia) or extremely low (hypoglycemia) blood sugar; both conditions can also trigger neuronal death.

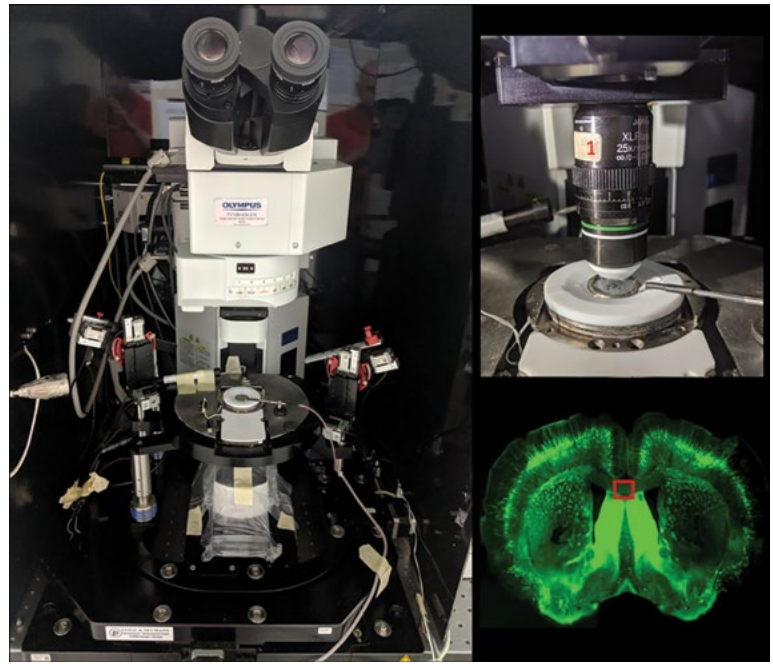
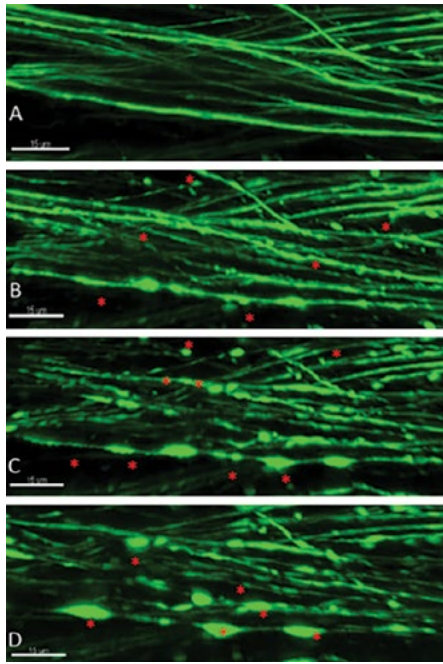
Neurons are specialised cells which are responsible for transmitting information throughout the body, allowing us to think, feel, move, and respond to our environment. When neurons die, it's like losing a part of our communication network. Neurons cannot easily be replaced, so finding a way to protect them is crucial.

WHITE AND GREY MATTER

Neurons are an important part of the brain, which can be divided into white matter and grey matter. 'Grey matter includes the cell bodies of neurons, which work similarly to the CPU in a computer,' explains Dr Christian Zammit, a researcher at the Laboratory for the Study of Neurological Disorders, Faculty of Medicine & Surgery, UM, and a lecturer at the Department of Anatomy of the same faculty. Grey matter is the area where information is processed, while white

Neuron Structure



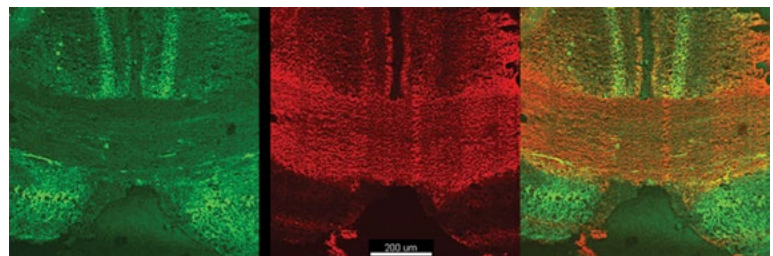


Top left: Visual showing progressive axonal injury

Top right: Two-photon microscopy

Bottom: Neuronal profiles in green and myelin stained in red

Images by Dr Christian Zammit



matter is made up of axons: extensions from the cell bodies of neurons that work as connection wires.

In addition to neurons, there is another group of cells that make up the brain, known as glial cells, which act as 'helper cells' to adjacent neurons. One particular cell type is called the oligodendrocyte, and its function is to cover the axons with an insulating layer that helps the electrical message travel quicker, known as the myelin sheath.

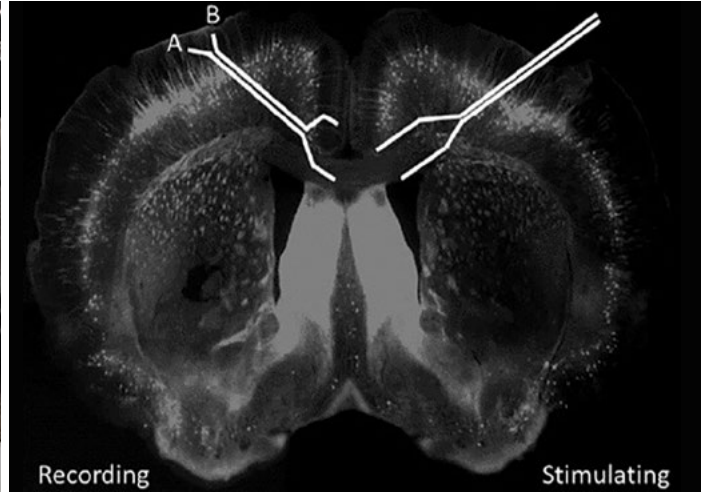
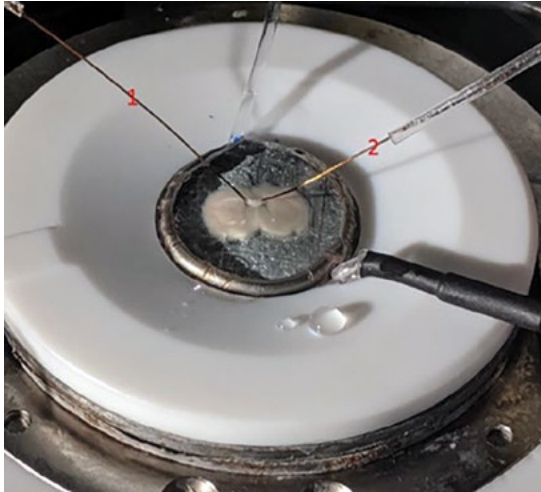
Led by Prof. Mario Valentino, the group at the Laboratory for the Study of Neurological Disorders where Zammit works is trying to protect white matter components during periods of hypoglycemia and ischemia to hopefully limit brain damage. Zammit guided **THINK** through their research.

The group is studying two drugs that target different components in white matter. The first drug, QNZ-46, blocks specific receptors present on the myelin sheaths of axons that are usually activated by the neurotransmitter glutamate. During ischemia and hypoglycemia, an excess of glutamate floods the

spaces outside the cells in the brain. This glutamate binds to specific receptors in the surrounding cells and initiates a cascade of events that ultimately may lead to cell death. This process is called excitotoxicity.

Imagine that receptors are like doors and glutamate is the key. When glutamate is inserted in the keyhole, the door opens, and people are let in. QNZ is a master key that fits the keyhole usually used by glutamate, but instead of opening the door, it locks it. This prevents glutamate from binding to the myelin sheath and limits neuronal death.

The second drug (CP-465,022) acts on oligodendrocytes, which when damaged via excitotoxicity, are weakened in their ability to produce myelin sheaths. Valentino's group is trying to stop glutamate from binding to oligodendrocytes during ischemia and hypoglycemia. While QNZ-46 locks the 'doors' on the myelin sheaths, CP-456,022 guards the entry into the oligodendrocytes. The group hopes that by protecting oligodendrocytes – and consequently the myelin sheath – the drug will help limit neuronal death. ➤



The above images show how electrodes are placed to measure axonal electrical conductivity
 Images by Dr Christian Zammit

Zammit, in collaboration with a research group based in Plymouth University (led by Prof. Robert Fern, Associate Dean-Research, Faculty of Health, Plymouth University) has already shown that QNZ-46 protects neurons during ischemia. The group in Malta is now assessing how the two drugs act together when the brain is deprived of glucose.

EVALUATING NEURONS' STRUCTURE AND FUNCTION

Studying the mechanisms that lead to neuronal injury when the brain is deprived of oxygen and glucose is a challenge in its own right. To do so, the group uses genetically modified mice. For this particular research project, they extract their brains, slice them, and keep each section in a special solution that mimics the fluid that surrounds our brains. With this method, the brain slices are kept alive for up to 7 hours and react to stimuli just as if they were still a whole brain inside the head of a mouse.

As Zammit explains, he can remove glucose (the energy source of neurons) from the solution, creating an environment that mimics the human brain during periods of hypoglycaemia. In addition, he can also replace the oxygen in the solution by displacing it with nitrogen

to create an ischemic-like environment. Then, he can assess how the injured brain slices react to the drugs.

To determine whether the drugs are effective in protecting the neurons, Zammit and his colleagues need to assess both the structure and function of these cells. For this particular research project, two different types of genetically modified mice are used: one type produces fluorescent proteins in neurons, the other in oligodendrocytes. By utilising a special type of microscopy known as multi-photon microscopy, the researchers can visualise these fluorescent proteins in real time, thus enabling them to establish whether the cells are healthy or not. In addition, they can also add colourful tags to specific proteins they are interested in (a technique known as immunocytochemistry) to obtain more information about the health status of these cells.

Axons possess a remarkable property: the ability to transmit information from one part of the brain to the other via electrical impulses. Researchers determine whether a neuron is still functioning or not by checking if the axons are still conducting electricity. To do so, they insert two pairs of electrodes in two places along a bundle of axons and measure the

In his research, Zammit has found that neurons lose their structural integrity and their ability to transmit electrical signals when there is a low level of glucose. But if brain slices are treated with the two drugs, either alone or in combination, there is a good level of protection to neurons during prolonged periods of low glucose supply.

electrical current between them. Healthy neurons are able to transmit a constant electrical signal.

In his research, Zammit has found that neurons lose their structural integrity and their ability to transmit electrical signals when there is a low level of glucose. But if brain slices are treated with the two drugs, either alone or in combination, there is a good level of protection to neurons during prolonged periods of low glucose supply.

To consolidate their findings, the group now has to prove specifically how these two drugs protect neurons, without technically acting on them. Their hypothesis is that protecting the nerve insulation (myelin sheath: QNZ-46) and the neighbouring helper cell (oligodendrocyte: CP-465,022) offers secondary protection to the neurons.

So far, it seems like the drugs Zammit is studying can protect against brain damage. Even more exciting, when used together, they increase each other's effects.

A LONG ROAD BEFORE GETTING TO MARKET

As demonstrated by previous research, these two drugs are full of advantages. They target specific types of receptors found in the myelin sheath and on oligodendrocyte, decreasing the possibility of side effects.

Additionally, they cross the blood-brain barrier (BBB), a crucial aspect for the potential future drug development process, since the effectiveness of a drug doesn't matter if it cannot enter the brain through the BBB.

QNZ-46 and CP-465,022 are proving to be effective at dampening stroke-induced damage, yet, as Zammit puts it, 'translating something that is effective in rodents into human use is a long way.' There is a long process to bring drugs to market. The chemical formulations used by the research group will have to be adapted by pharmaceutical companies into actual medicines that can be given to patients and tested for safety and effectiveness in humans. If developed, these drugs could potentially be given to patients who are at a significant risk of developing a stroke in order to limit neuronal damage. **T**

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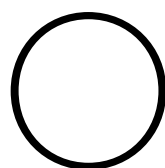


SMALL FISH, BIG POTENTIAL

Using Zebrafish to Identify
Novel Drug Targets

Author: **Ines Ventura**

*Osteoporosis is a silent disease that weakens our bones. While developing a suitable treatment is quite challenging, a team of local researchers have found a novel way to tackle this issue. Dive into **Prof. Formosa's** research, which uses fish to find treatments!*



osteoporosis, the most common type of bone disorder, affects more than 200 million people worldwide. That means that 2.5% of the population has a medical condition where bone mass is lost at an alarming rate, weakening the bone structure and making them more susceptible to fragility fractures. This metabolic bone disease is particularly prevalent in the elderly population and in women after menopause, explains Prof. Melissa Formosa, a Maltese researcher and a Faculty of Health Sciences professor. 'It's a silent disease in the sense that a person might be affected and not even know that they have osteoporosis until a fracture occurs. This is one of the worst outcomes of having osteoporosis – it can be your hip bone, your wrist, or even your spine,' she explains.

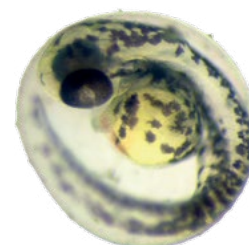
Osteoporosis can be caused by a variety of factors (including environmental and genetic

factors) which affect the rate of bone formation and resorption – two processes that help maintain bone integrity. Bones are not static; they are constantly being renewed through the remodelling cycle. Through this cycle, old bone is removed by osteoclasts and replaced by new, healthier bone thanks to osteoblasts. If the bone is damaged, such as due to a microcrack, bone remodelling becomes necessary to repair the damage. In this process, minerals, hormones, and elements are released, contributing to the proper functioning of the body. When these systems falter, osteoporosis occurs.

'Imagine: in a hip fracture, the person might need to have a hip replacement in order to be able to treat it,' elaborates the researcher. 'Sometimes the bone might be so fragile that even if they have corrective metal pins inserted, it still might not heal properly. And if you're already at an advanced age, it will be incredibly difficult to recover from that.' Although rare, ➤



From left to right:
Dr Sherif Suleiman (UM), Ms Margherita Muscat (UM), Prof. Melissa Formosa (UM), Ms Natalia Panasiak (AquaBiotech Limited), Mr Matthew Camilleri (UM)
Photo by James Moffett



Zebrafish embryo at 2 days post-fertilisation
Image courtesy of Prof. Melissa Formosa

early-onset osteoporosis in children and young adults is becoming increasingly evident, resulting in a significant fracture history at a very young age. The treatment options that are currently available might not always be suitable or effective for everyone; hence, adopting a 'one size fits all' approach is not possible.

SOMETHING FISHY

Osteoporosis medication is grouped into two categories: antiresorptive agents (which inhibit bone resorption) and osteoanabolic agents (which promote bone formation). While several antiresorptive agents are currently available on the market, very few osteoanabolic agents have been developed thus far, prompting researchers to focus their attention on such drugs, which can simultaneously increase bone mass and strength. But how can a fish impact this research field and improve the available treatments for this specific disease?

Zebrafish is a common model organism used in biomedical research. This is because they have a high fecundity rate (how quickly they produce offspring), which enables researchers to have a lot of animals to work with very quickly. On top of that, they also develop quickly, have regenerative capabilities (they can even regrow parts of their own heart!), and are transparent at early life stages. This allows researchers to see the effect

of different drugs on internal organs without having to sacrifice them. But most importantly for this problem, as Formosa explains: '90% of human disease-related genes are present in zebrafish.' To test the effect of potentially beneficial drugs or compounds, they are simply added to the water in which the fish swim, and several tests are performed to establish the outcome.

But how can you use zebrafish to develop osteoporosis drugs against defective human genes? In a nutshell, researchers use a genetic engineering technique called CRISPR to de-activate specific genes in the fish, mimicking the effects of osteoporosis. That way, if you administer a drug that leads to an increase in bone mass in those fish, you can expect the same effect in humans and find a valuable new treatment option.

PROJECT ZeEBRA

This is where the idea for the ZeEBRA project came about. Formosa started using this animal as a translational model species for studying osteoporosis in her post-doctoral studies in the Netherlands, and since then, her passion has been developing novel drugs to help people afflicted with this disease. On-going since 2021, the ZeEBRA project is currently at a crucial stage: finding which compounds to test and their optimum concentration (the dose that maximises the response while simultaneously minimising the likelihood of toxicity).



Zebrafish housing tanks in a recirculating setup
Photo by James Moffett




Adult zebrafish having prominent horizontal blue stripes on each side of their bodies
Photo by James Moffett

'We are not only testing drugs available on the market,' emphasises Formosa. 'We are also screening for small molecules that target a particular pathway and even natural compounds.' Why? Natural compounds can be used as a supplement (something that can be given to susceptible individuals) to increase bone mass and prevent the development of osteoporosis.

'For the optimal drug concentration, we test different doses, and then we look at the fish morphology. We use a list of scoring mechanisms to do that,' describes Formosa. A detection and tracking system is also used to record animal activity following drug exposure. To understand the impact of bone morphology in swimming for example, researchers give the fish several stimuli and record their response. The next stage is to test the effect on their animal model. Comparing the results with a control (an animal without the disease), they will be able to understand the effect of the compounds that they are testing and their potential as a new treatment for osteoporosis.

To develop all this, the team had to accomplish a very difficult task first: establishing their own animal facility. 'I'm very proud of the system that we developed. Not only do we have a recirculating water system, capable of maintaining all the relevant parameters (pH, temperature, ions), we are also breeding our own fish,' highlights Formosa enthusiastically. And understandably so, since ZeEBRA can now provide a platform for other researchers and institutes to use this model animal to test a variety

of ideas! 'Eventually, we will also start holding training schools, where we can teach individuals about zebrafish husbandry and how to apply this model system to their own work by having hands-on practical work,' concludes Formosa.

At first glance, the humble zebrafish seems to be more suited for an aquarium rather than a lab. However, the ZeEBRA research team has managed to harness the remarkable abilities of the zebrafish to develop osteoporosis treatments. Perhaps in the future, these aquatic allies will become as ubiquitous as lab rats when it comes to bone disease treatments and research in general! 

The ZeEBRA Project (R&I-2019-018) is a R&I Technology Development Programme (TDP) funded by the Malta Council for Science and Technology (MCST) for and on behalf of the Foundation for Science and Technology. The project is a collaborative effort between researchers from the University of Malta (including Professor Melissa Formosa, Ms Margherita Muscat, Dr Sherif Suleiman and Mr Matthew Camilleri), AquaBioTech Limited (Project Partner), and the Department of Animal Physiology and Ecology at Radboud University, Nijmegen, The Netherlands (Project Collaborator). More information on the ZeEBRA project can be found at: um.edu.mt/r/projects/zeebra

Social and Behavioural Sciences



The Importance of Being Ethical: Language Choice for Research Matters

Author: **Christian Keszthelyi**

As English has become the de facto lingua franca of research papers, interviews often occur using this language. However, there may be ethical implications when data collection involves non-native English speakers.

THINK magazine explores the topic with **Dr Natalie Schembri**, Senior Lecturer at the Institute of Linguistics and Language Technology, UM.





Dr Natalie Schembri, a linguist, has always been interested in language – specifically, how people use languages when participating in research for qualitative (chiefly interview-based) and quantitative (for the most part corpus-based) approaches to data collection.

English is the primary language of research publishing; this ensures an international appeal. As a result, given that research is published in English, this language is often used between interviewers and interviewees for data collection. However, for non-native speakers of English, such an environment may hinder the expression of thought.

'When you have an interview, there is a language choice for both the interviewer and the interviewee. This language choice is obviously motivated. For our recent research, we were interested to see how the choice of language happens: whether the interviewer or the interviewee proposes it. If the interview is not conducted in the native language of the interviewees, are they allowed to code-switch? These are all essential points of focus to investigate the ethical effects of language choice,' Schembri says.

Her research reflects an intriguing aspect of research. It is vital to acknowledge that if an interview is conducted in English and the interviewee's linguistic proficiency is not up to scratch, it may affect the



validity of the collected data. This can create a problem that appears during the data collection phase but is endemic to the whole research process.



Dr Natalie Schembri
Photo by James Moffett

TIME AND MONEY

'Furthermore, when research is carried out in the interviewee's first language instead of English, other problems may arise. For example, the choice of examples may lead to data deculturalisation, because less culturally-specific examples are easier to translate,' says Schembri. These and other problems related to translation of data may encourage researchers to select people who are proficient in the English language, which may lead to the exclusion of informants who may be more appropriate for the research agenda at hand. In such a scenario, the question of representativeness arises.

'Researchers have to assess each situation individually. Along this road, ethical issues emerge,' she adds. But these choices do not happen in a vacuum. Researchers are always bound by pressing constraints. The two most dominant pressures they face are time and money. Both affect data collection. On the one hand, research must be published as quickly as possible to ensure the data does not become outdated. On the other hand, as financing is often an issue, human resources are usually insufficient. As a result, it is highly likely that conducting an interview in the native language of the interviewee, transcribing the interview, and then translating that evidence into English (making sure that the translation is culturally apt) would involve ➤



'I think this is where our research brings value to the community. It raises awareness of these underlying ethical issues and helps researchers approach the process with more cognisance to ensure the research is as ethical as it can be and the collected data is as representative as it can be.'

a time and human resource burden the researcher cannot afford. So what can a researcher do, then?

'I think this is where our research brings value to the community. It raises awareness of these underlying ethical issues and helps researchers approach the process with more cognisance to ensure the research is as ethical as it can be and the collected data is as representative as it can be,' Schembri says.

FAIRLY LOCAL

Schembri's research takes on an even more exciting flavour in Malta. As set in the constitution, Maltese is the native language, and English is also an official language. However, language proficiency in English, and to some extent Maltese, ranges over a wide spectrum.

'What you get is not a homogeneous phenomenon. You cannot make a generic statement about the status of Maltese and English. Their first and second language status varies a great deal. There are several factors affecting this. Geography is one – where you live on the island – as it affects the status of Maltese and English and the interplay between these two languages,' she says.


Bilingualism has many definitions. In Malta, what typically happens is that certain functions are taken

over by one language while another covers other functions. In Malta, the roles of these two languages are fluid and can vary from one individual to another.

'It is a very bilingual country we live in, as we use both languages in whatever way suits us best, depending on our upbringing and proficiency at the end of the day,' she says. In such an environment, the ethical issues of the selected language for research are even more prominent. And the role of the interviewer is even more critical.

Suppose the interview is being conducted in English and this is the language the interviewee has less proficiency in. In that case, the interviewer can always help them speak their mind with follow-up questions or encourage them to code-switch to their native language briefly to explain their ideas.

Despite these difficulties, however, researchers are doing a good job navigating such challenging terrain.

'Now, I see more awareness of ethical issues in general, so awareness must rise relating to language-based power play, too. Once there is awareness, you do not have to formulate rules. Interviewees will code-switch, and the interviewers will facilitate an environment where ethical issues are kept in check. Creating this awareness is a positive move forward – that is what we want to achieve,' she concludes. 

REVIVING *the*
GHONNELLA
with PROJECT
TRACtion
(Tradition in Action)

Author: **Catherine Camilleri**





Traditional outfits paint a picture of an older time, and through each stitch, every piece of fabric, and every colourful design embedded in the garment, they hold the beliefs, history, and heritage of a unique place and time in our world. But how can traditional costumes be revived and revamped to fit contemporary styles and modern cultures?

Project TRACtion (Tradition in Action) aims to share the relevance and importance of traditional costumes with the international community. UM, the University of Helsinki, and Atlantic Technological University (ATU) St Angelas College in Sligo, Ireland have embarked on a two-year journey to preserve their national heritage and encourage creative thinking and interpretation of how traditional outfits could be adapted for the contemporary world.

Each institution will focus on a particular garment that acts as a living manifestation of their country's traditions and culture. At the University of Helsinki, the focus will be on the colourfully embroidered designs of traditional Finnish folk costumes, whilst ATU St Angelas College will study the delicate varieties of lace that embellish Ireland's traditional clothing. Here in Malta, Dr Lorraine Portelli, senior lecturer in the Faculty of Education, and her team are leading the TRACtion project and aim to bring one of Malta's most treasured cultural garments back to the forefront: the għonnella.

THE GĦONNELLA

The għonnella is a garment that epitomises Malta's heritage and history. This traditional headdress framed the faces of Maltese women from as early as the 16th century, though the

exact origins of the għonnella remain a mystery. The wide-brimmed cape of the għonnella has a rich history in Maltese folklore; from a covering of religious piety to a protective garment that warded off unwanted advances from occupying French troops, there are numerous legends about the għonnella that reflect Malta's history.

Worn over the head like a shawl or cloak, the għonnella was stiffened with cardboard and whalebone. It was particularly effective in capturing the cool breezes of the Maltese Islands during summers. The garment encompassed almost all of the wearer's body, leaving just the wearer's face to be seen. The large, round frame and silky fabric of the għonnella would be effortlessly handled and manoeuvred by the women who would wear them.

The għonnella was a common staple in Maltese society up until the mid-20th century and was so popular that it was worn by most women on the island. However, following World War II, Malta began to modernise, and the għonnella fell out of popularity, disappearing almost entirely from the streets of Malta by the 1970s.

Today, the għonnella lives only in memory and photographs and in legends and stories that have persisted for generations. However, its intricate design and historical relevance make the għonnella an invaluable element of the past that inspires and informs the present and future of Maltese fashion and design. ➤



The lead project coordinator of TRACtion, Dr Lorraine Portelli, during a research visit on the Ghonnella at Casa Rocca Piccola, Valletta
Image courtesy of Project TRACtion

REINTRODUCING THE GĦONNELLA

With the aim of bringing more awareness to the ghonnella, Project TRACtion will hold various events and initiatives where the ghonnella can be appreciated on a deeper and more creative level. These events will target different audiences, from younger students, to fashion designers and instructors, to anyone around the globe who wants to learn about the ghonnella's unique history. Participants will be able to explore the textures, textiles, and fabrics used to form these costumes, with a detailed focus on creation, interpretation, and innovation.

Online workshops will also be held, where people from different backgrounds can learn about the ghonnella, its construction, and its importance to Malta. To make the ghonnella even more accessible, digitised scans and a 3D virtual mannequin will be available online for people outside our islands to learn about Malta's most distinctive and traditional garment. Through these collaborations, the ghonnella will be introduced to new audiences, and Maltese fashion and heritage will be revitalised and projected on a global scale.

Project TRACtion will also help introduce the ghonnella to younger generations by visiting three Maltese schools and teaching students about the heritage and history of the garment. Students, regardless of gender, can even try on a ghonnella and experience what it is like to wear, walk, and live in this garment. After students have learned about the unique history of the ghonnella, a competition will be held where students can create their own interpretation of the ghonnella, connecting with the past while thinking creatively to assemble


their own ideas of how the ghonnella would be constructed in modern times.

Students will be encouraged to think sustainably, using different media, fabrics, textiles, and materials to construct their innovations. An exhibition will also take place in June 2024 at the Inquisitor's Palace in Birgu, which will showcase these creative deconstructions and interpretations of the ghonnella. Through this competition and exhibition, the ghonnella will be reintroduced to the Maltese public and transformed in a way that reflects contemporary culture while still drawing inspiration from the past.

Even though the ghonnella exists now only in museums, galleries, paintings, and scarce pictures, Project TRACtion has brought this representation of Maltese history back to the forefront, allowing global society to get a glimpse of our past and the chance to transform the ghonnella to fit the taste and talent of the present. Through Project TRACtion, the ghonnella lives on, and the unique reconstructions birthed from this initiative will shine a light on the progression of Malta while connecting us to our rich heritage. 📖

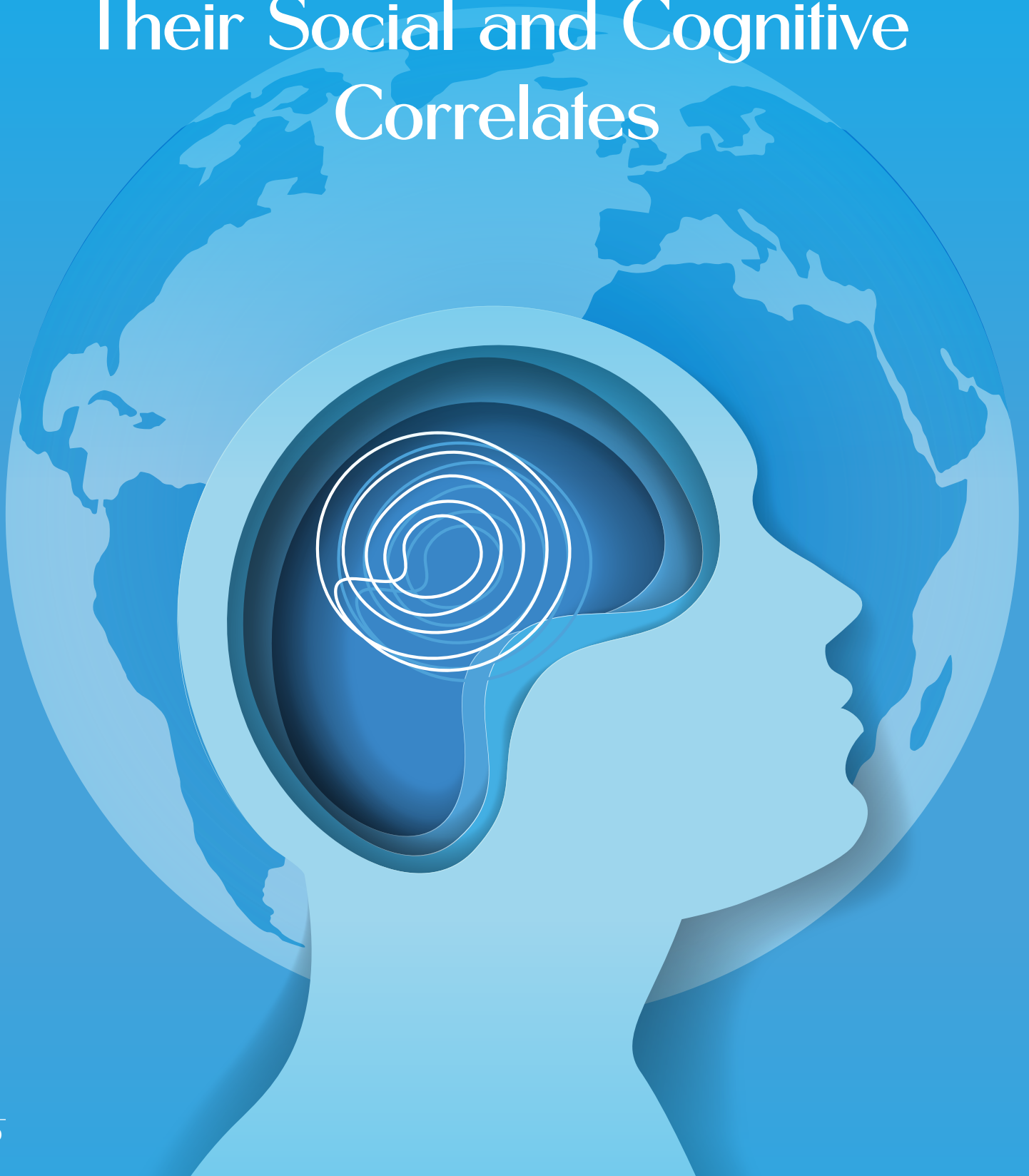
Project TRACtion – Tradition in Action, Grant Agreement 101099726 – CREA-CULT-2022-COOP is funded by the European Union

Tradition In Action | **TRACtion**



Project TRACtion has brought this representation of Maltese history back to the forefront, allowing global society to get a glimpse of our past and the chance to transform the għonnella to fit the taste and talent of the present.

Our Worldviews and Their Social and Cognitive Correlates



Author: **Jonathan Firbank**

*How does the way we think shape how we view the world around us, and how is this reflected in our behaviour? **Rebekah Mifsud** is a UM researcher crossing disciplinary boundaries to investigate these questions. She speaks with **Jonathan Firbank** about her results.*

In this age of global communication, every point of view can have an impact. However, this hasn't created a utopian 'marketplace of ideas', where the best ideas naturally triumph as we communicate freely. Instead, public discourse has become polarised as different worldviews clash. Now, more than ever, it is vital we understand each other. This does not just entail knowing each other's beliefs, but also why we believe them.

Rebekah Mifsud is a researcher in UM's Department of Cognitive Sciences. Along with Professors Gordon Sammut and Noellie Brockdorff, Mifsud is investigating five distinct worldviews, defined as Localised, Orthodox, Pragmatist, Reward, and Survivor.

'Prof. Sammut developed the idea of worldviews, and together with Prof. Brockdorff, I sought to investigate them from a cognitive science point of view,' explains Mifsud, in order to 'determine whether differences in our cognition – the way we acquire knowledge and understanding through thought, experience, and the senses – predispose us to particular worldviews over others.' The team found evidence that variations in our

cognitive processes predispose us to these worldviews by influencing our relationship with the world around us.

FIVE WAYS TO VIEW THE WORLD

Mifsud's article, 'Worldviews and the role of social values that underlie them', provides definitions for these five worldviews.

The Localised worldview involves the desire to fix problems or address social issues. 'These people are all about helping society,' says Mifsud. 'They're inclusive and want to make society a better place.'

The Orthodox worldview seeks to preserve the status quo and is perhaps the worldview we are most aware of. Conservatism is widely understood to be a powerful social force. 'These are avid rule followers and also tend to be the most religious.'

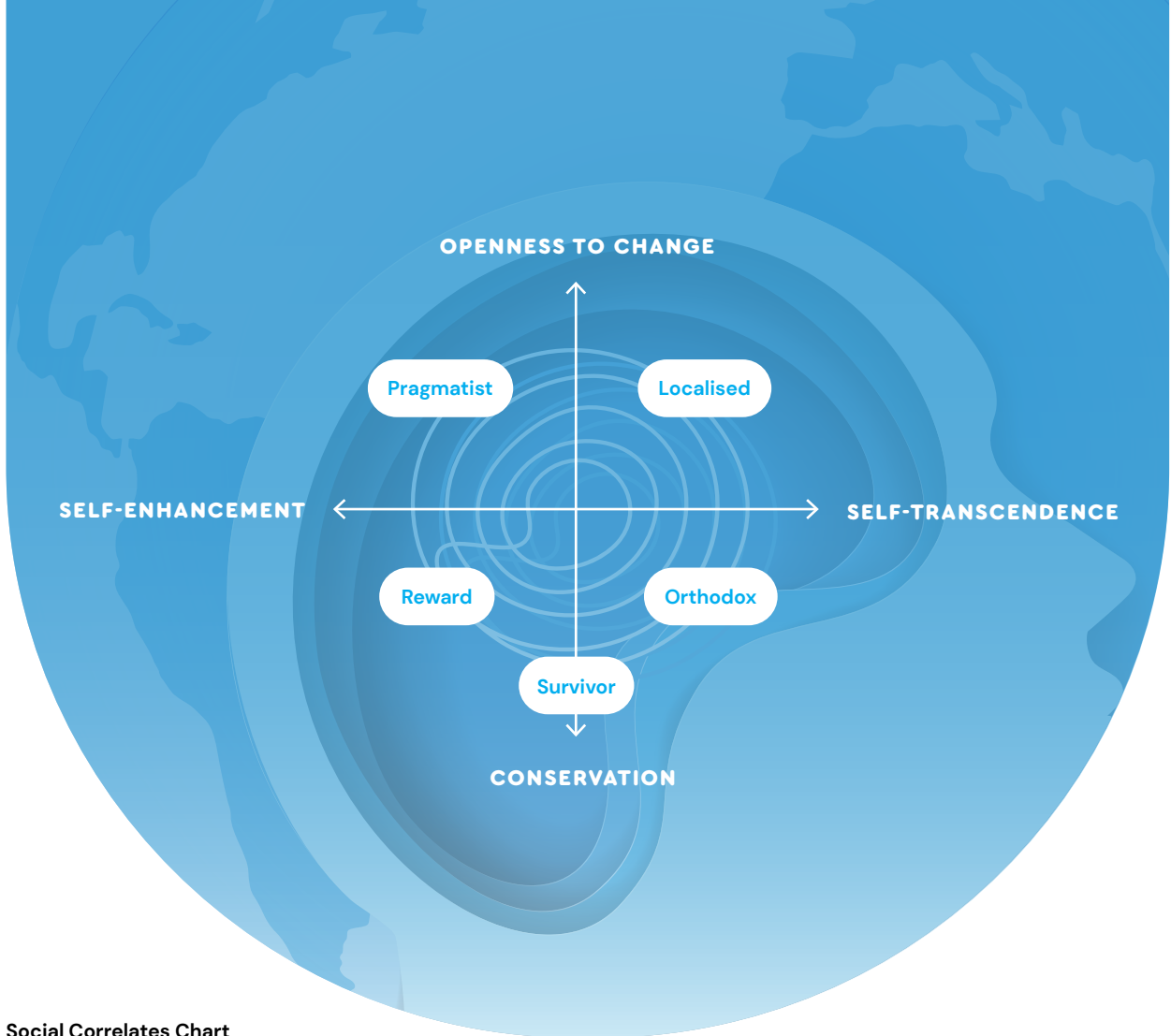
Conversely, a Pragmatist worldview might facilitate bending rules. It is protective and revolves around self-interest: that is, one's 'own interest as well as that of their loved ones.'

The Reward worldview centres around determination to work hard to obtain a desired goal. 'These are the go getters. The sky is the limit for these people.'

This contrasts with the Survivor worldview, which involves fatalism, distrust in others, and the need to overcome adversity. 'I tend to think of these as the opposite of those with a Reward worldview. These guys are quite passive and tend to have a negative view of the world.'

But what predisposes us to having these contrasting worldviews? 'The thing with worldviews is that they are quite abstract and generalised, so hypothesising cognitive correlates – (that is, the mental processes that accompany these worldviews) – is a challenging undertaking. In cognitive science, generalised beliefs such as worldviews have not been explored that much.'

'We have done this by first examining the relationship between worldviews and values.' The values Mifsud used are: 'openness to change versus conservation and self-transcendence versus self-enhancement,' as defined by Prof. Shalom Schwartz. Each of the five worldviews have a relationship with these values that is distinct from the other four. 'Identifying the underlying value correlates of worldviews makes the concept of worldviews a little bit more tangible. Therefore, linking it to cognition ➤



Social Correlates Chart

makes it a more manageable prospect,' explains Mifsud.

A DIFFERENT WAY OF THINKING ABOUT DIFFERENT WAYS OF THINKING

'Worldviews are thought to function in a way that allows us to adapt to changing circumstances.' Mifsud's work proposes a link between worldviews and our ability to self-regulate, 'moreover, I proposed that the relationship between worldviews and values can help us predict such a link.' Self-regulation is the goal-oriented management of thoughts, feelings, and behaviour through executive functions. 'Put very simply: executive functions are like the boss of the brain,' facilitating planning and decision making.

Executive functions are split into three processes: 'inhibitory control, cognitive flexibility, and working memory capacity... Inhibitory control describes the ability to resist impulses, helping you stop and think before you act.' Mifsud's work indicates inhibitory control is stronger in those with Orthodox, Reward, and Survivor worldviews, who each follow rules for very different reasons. It is less pronounced in those with Localised and Pragmatist worldviews, who have more cognitive flexibility.

'Cognitive flexibility refers to the ability to adapt thought and behaviour. It helps you attend to and switch between different tasks.' This is more pronounced in those with flexible, independent Localised and Pragmatist worldviews.

'Lastly, working memory capacity is like the workspace of the brain, a "landing bay" in which you hold and manipulate information for a brief amount of time.' In Mifsud's research, it was important to control for working memory differences because it is strongly related to inhibitory control and cognitive flexibility.

People with some of these worldviews are similar to each other in their predisposition to conservation or openness to change, as also evidenced in self-regulatory abilities. However, they are different in their predisposition to 'self-transcendence' or 'self-enhancement'.

Self-transcendence might take the form of charity or unreciprocated kindness, common in those with Localised or Orthodox

worldviews. Self-enhancement, on the other hand, is a desire for self-improvement or power, found in those with Pragmatist or Reward worldviews. Those with Survivor worldviews stand alone in having little inclination to self-transcend or self-enhance.

AN ORTHODOX EXAMPLE

'Let's take someone with an Orthodox worldview,' continues Mifsud. 'Our study found this worldview to be linked to the values of self-transcendence and conservation.' Mifsud found that people demonstrating 'better inhibitory control ability are more likely to hold an Orthodox worldview than any other. This is a big finding in itself because it shows that certain cognitive processes link to beliefs about ourselves and the world around us.'


Additionally, 'I also found that cognitively inflexible individuals are most likely to hold an Orthodox worldview.' Understanding worldviews can 'help us navigate certain social debates. In a previous study, we showed that those with an Orthodox worldview are less receptive to the idea of recreational cannabis.' By referring to 'findings linking inhibitory control and cognitive flexibility to the Orthodox worldview, we may understand why.'

'Strong inhibitory control often corresponds to the ability to adhere to rules and societal standards. However, when a new policy is under consideration, individuals

must be willing to consider new perspectives or alternate viewpoints to form a judgement. Those who lack cognitive flexibility, such as those with an Orthodox worldview, might struggle with this. Consequently, this struggle might contribute to a lack of support for certain policies if they seemingly go against existing norms.'

WHAT NEXT?

Mifsud considers the investigation between worldviews and values an essential preliminary step for the much bigger investigation that follows. 'My wish is that at some point in the future, I investigate whether electrophysiological brain activity can be linked to worldviews. This would complete a full circle of bridging the social realm to cognitive processes and ultimately to the physical brain itself.'

This would bring us yet closer to 'understanding how our social interactions are influenced by our cognitive processes and, in turn, by the biological workings of our brains.' Understanding this may prove a prerequisite to adequately understanding society. The implications are profound. 

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At the University of Malta Research Expo 2024, UM researchers can showcase their research activities to the wider UM community, facilitate the sharing and cross-pollination of ideas, and celebrate their successes thus far! It also incorporates the traditional Doctoral School Symposium – allowing us to also celebrate the up-and-coming research of doctoral students.

Submit your application and join us!



APPLICATION DEADLINE

Scan the QR code to submit
your abstract by **29 February 2024**

SAVE THE DATE

📅 29 May 2024

📍 Mediterranean Conference
Centre, Valletta

FEATURED KEYNOTE SPEAKERS

ROBIN A. NELSON

Professor Emeritus of Theatre, Intermedial Performance and Practice Research
Royal Central School of Speech and Drama, University of London, UK

KANNAN PASHUPATHY

Former Director of Global Engineering at Google Products and
Engineering, and current Board Member at Solidaridad





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Research Expo
2023

THINK