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THINK

IDEAS • MALTA • RESEARCH • PEOPLE • UNIVERSITY

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L-Università
ta' Malta

"My journey
begins here."



AZARA SEIDU
UM Art Competition

#ShineAtUM





EDITORIAL

PRESERVATION

Shelley's *Frankenstein* and Hesiod's Prometheus myth highlight the dangers of unbridled advancement. For the sake of progress, something must be sacrificed. In *Frankenstein*, the tithe was Frankenstein's humanity. For Prometheus' gift of fire to humanity, he was condemned to have his liver eaten daily by an eagle. There is always a price that must be paid for our advancement.

Modernity has turned these stories into reality: virgin land sacrificed for economic growth, quality of life spent to boost GDP. But while trying to build a better society, we need to decide what is worth preserving and what can be axed for the sake of progress.

When we choose to preserve something, we are drawing an imaginary line around it to protect it from destruction. We are collectively saying that this particular object is a critical part of our identity. It is something not worth losing. Preserving it roots us.

Whether it's our artistic heritage or our cultural traditions, local researchers share how they are trying to preserve that which makes us who we are. Meanwhile, others develop new techniques to protect the environment from unsustainable practices.

Rather than viewing preservation as a hindrance to progress, preservation tempers it. It pulls back at the reigns of unbridled progress and reminds us that the past is equally as important as the future. It stops progress from turning us into monsters.

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Are you a student, staff, or researcher at the University of Malta? Would you like to contribute to **THINK** magazine? If interested, please get in touch to discuss your article on think@um.edu.mt or call +356 2340 4438

COVER STORY



PRESERVATION

Preservation implies stability. The present is formed through the layers of our past. In this graphical interpretation, Gabriel Izzo visualises several blocks and layers on top of one another, building on what came before in order to keep moving forward.

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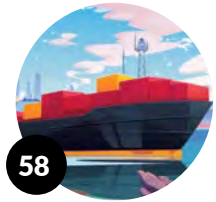
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TOOLKIT



Shimmer, Zephyr, and MySignals - Tools used by the Faculty of ICT used for Digital Health
Photos by James Moffett & Sarah Zammit



Digitising Health

Author: **Mahmud Mustafayev**

Medical diagnosis relies on data. A physician observes and analyzes a patient's vital signals to assess their condition and prescribe adequate treatment. The more accurate and reliable the data, the better the treatment. Through the use of technology, digital health allows both physicians and patients real-time access to medical data.

For the Faculty of Information and Communication Technology at the University of Malta (UM) digital health is the future of health care. In this regard, newly-procured sensors, namely the Shimmer3 ECG and MySignals, deserve attention and a deeper insight.

Dr Conrad Attard (Faculty of ICT, UM) claims that the faculty has mainly focused on activity recognition sensors such as the Zephyr and Shimmer ECG. These devices allow the team to measure the heart's electrical activity and activities such as walking. Shimmer ECG is able to measure ECG (electrocardiography) on all 4 limbs, which provides a more accurate reading. The leads are connected to the measuring site through the use of the supplied electrodes, which are attached to the skin at the desired site. The small size of the device (65 x 32 x 12mm), allows people to move freely during data collection.

The Faculty of ICT is using the Shimmer ECG for another purpose: tracking stress in the workplace – a common problem. People may not be aware of it or know when it happens until it becomes a big issue. By using controlled experiments to replicate real-life situations, these sensors allow the team to identify what causes stress and, with help of mental health professionals, develop a solution. By monitoring tensions and certain activities, sensors allow us to take actions to tackle stress at workplaces. By analysing and measuring vitals, the team is better able to understand a person's state.

According to Attard, the faculty's dauntless contribution to narrowing the existing gap in research in digital health has gained the university international recognition, allowing them to work with a larger network to perform research in this area.



Dr Conrad Attard
Photo by Sarah Zammit

'The gap and problem has been around us for a long time,' says Attard. The main reason for addressing the problem now is that there have been considerable advancements in AI and information technology. 'Thanks to funding [by the Research Innovation & Development Trust and Malta Information Technology Agency], we have been able to acquire more reliable sensors. These developments accelerate research and development in digital health.'

Education can transform the field and narrow gaps in digital health; the Faculty of Health Science and Faculty of ICT have joined forces to deliver a new study program, a 'Masters in Digital Health'. Being multidisciplinary, the course is expected to give a deeper insight into digital health. With the right tools, the future of health can become truly digital. **T**

WITHOUT BORDERS



Expanding your Horizons

Academia has long given the impression of being stuck in an ivory tower, isolated from the concerns of private enterprise and society. The global pandemic has changed that. It requires collaborative effort.

Research conducted in silos and without international collaboration is doomed to fail. Academics might be protective of their research fields or skeptical of open science policies. However, throughout the EU, there is a growing understanding of the potential impact of cross-sectoral and cross-disciplinary collaborations. It's an exciting period, and collaborations between private and public sectors have never been more sought after!

That's where Horizon Europe comes in. 'Horizon' suggests there is something out there in the great beyond; we can see it, but we can't touch it, and it's vast. New horizons suggest an openness or, in other words, letting go of borders. We are in a globalised society; tangible changes must be felt beyond the limits of the EU region.

The €95.5bn programme focuses on: Excellent Science, Global Challenges and European Industrial Competitiveness, and Innovative Europe. By focusing on these areas, the EU hopes to achieve the UN's Sustainable Development Goals and bring about a


'Horizon' suggests there is something out there in the great beyond; we can see it, but we can't touch it, and it's vast.

greener and fairer future. Engaging in international collaboration, Horizon Europe is an opportunity to work within a global community to create lasting solutions.

The Excellent Science Pillar supports frontier research projects driven by top researchers through the European Research Council. It funds fellowships for experienced researchers, doctoral training networks and exchanges through Marie Skłodowska-Curie Actions, as well as investments in world-class research infrastructures.

The Global Challenges and European Industrial Competitiveness Pillar supports research relating to societal challenges and reinforces technological and industrial capacities through clusters. It also includes the Joint Research Centre, which supports EU and national policymakers with independent scientific evidence and technical support.

Finally, the Innovative Europe Pillar aims to make Europe a frontrunner in market-creating innovation through the European Innovation Council. It helps to develop the overall EU innovation landscape through the European Institute of Innovation and Technology, which fosters integration of the knowledge triangle of education, research, and innovation.

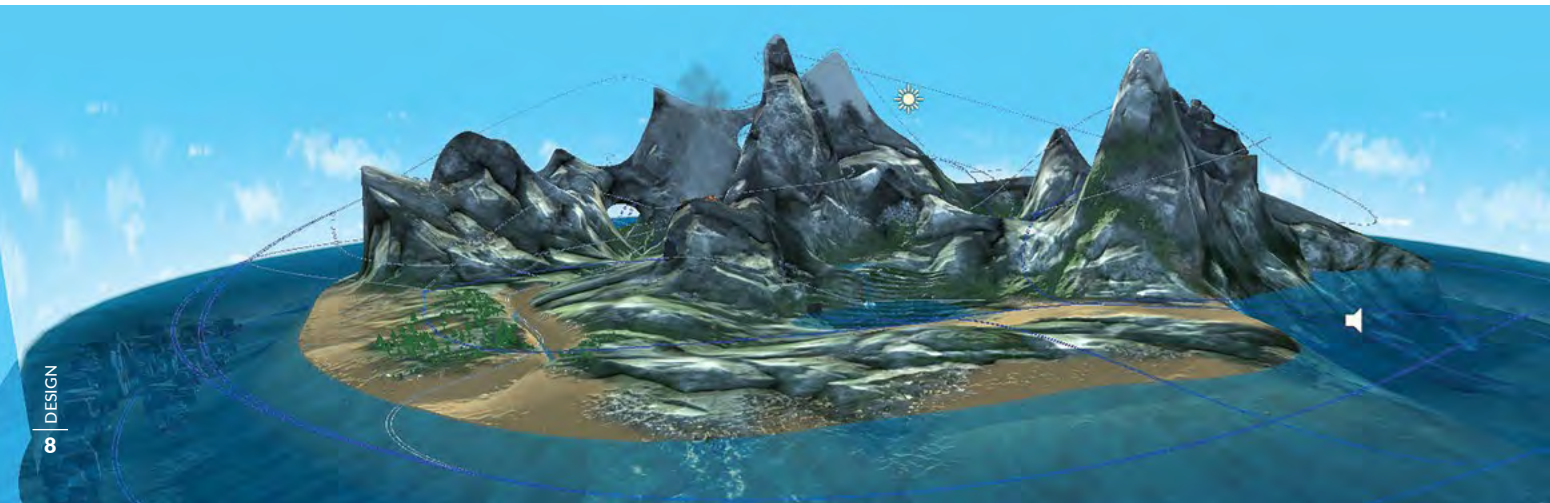
To make a lasting difference, academics and researchers need to work hand-in-hand with industry, policy-makers, and citizens. By expanding our horizons, we have the potential to transform our society. 

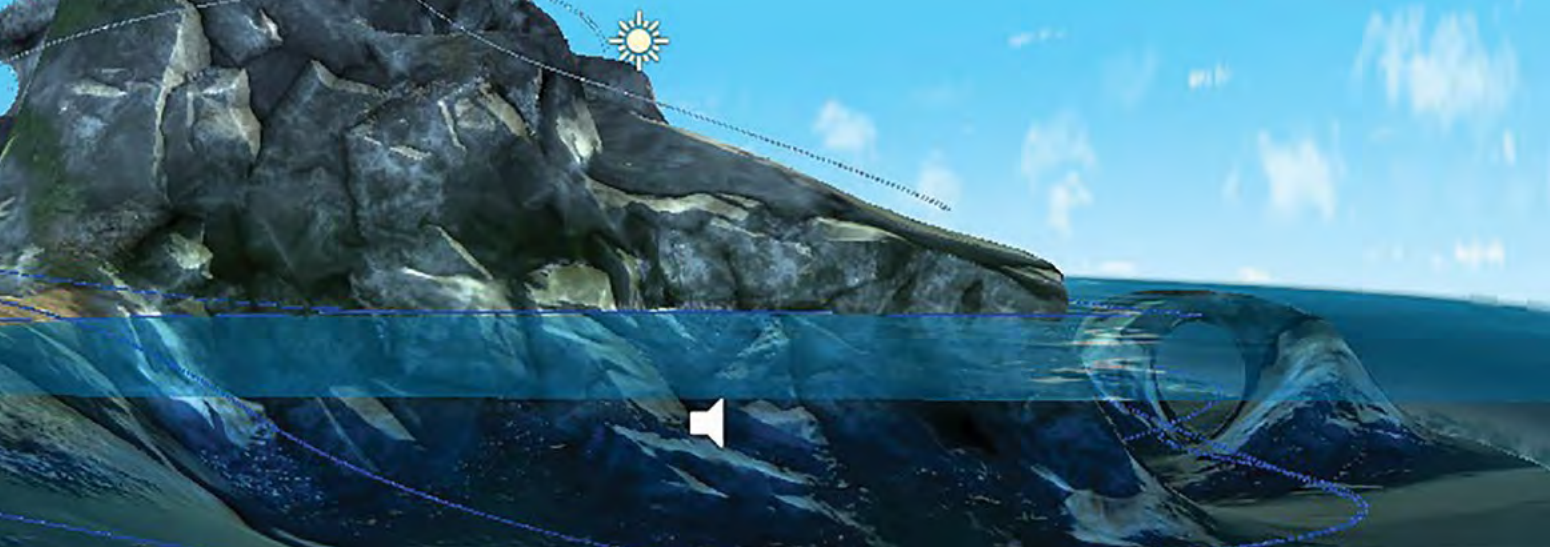
If you have a project that you feel is eligible or would like to find out more about Horizon Europe, contact the Malta Council for Science and Technology for more information. Contact George Bugeja, National Contact Point for Horizon Europe at MCST, at horizon.malta@gov.mt to learn more!

DESIGN



Various assets from the VR game MORPHEUS
Images courtesy of Fabrizio Cali





Designing a Dream

Author: Esther Sabina

Can we reduce the level of pain perception in the brain? Distraction therapy has been used by health professionals for years to help children and young people cope with painful procedures. The aim is to take the focus of the patient away from the pain and concentrate on something else instead. Books, games, music, and toys are some of the many types of distraction therapy.

By combining virtual reality and artificial intelligence, MORPHEUS aims to help child patients cope with pain during medical procedures. The project is led by Prof. Alexei Dingli from the Department of Artificial Intelligence (University of Malta), Luca Bondin, also from the Department of Artificial Intelligence, and Fabrizio Cali as Lead Designer from the Faculty of Media and Knowledge Science. Prof. Vince Briffa from the Faculty of Media and Knowledge Science supervised the project.

The researchers designed the roller coaster virtual reality game to mirror an island populated by animals. This colourful menagerie helps keep the players engaged and focused; sometimes they'll go about their normal business, and other times they'll do something unexpected like wave at you. Since hospitals are not usually equipped with high-end gaming devices, the game is built in a manner where it is accessible on a wide range of mobile devices.

To help reduce technological demands, the game incorporates the hollow face illusion. This optical illusion gives the impression that the animals are looking at you, without actually programming them to.

In the early stages of development, the team asked a sample group of children to rank their

preferred game type. Between an infinite runner game, open world game, or roller coaster, most of the children preferred the roller coaster. The game monitors the physiological data of the player in real time using a smart watch. By measuring the heart rate and its variability, the AI figures out how the patient is feeling and adjusts itself accordingly. Once you start playing the game, it reads your signals; if it notices you are not engaged enough, challenges start coming up, such as a mini shooting game. When the game senses anxiety, it adjusts itself by removing intense challenges.

MORPHEUS will be rolled out first to children who are cancer patients at the Sir Anthony Mamo Oncology Centre in Malta. Afterwards it will be introduced to Mater Dei Hospital, and eventually the application will be available for anyone to download. The Research Innovation and Development Trust (RIDT) at the University of Malta, a joint initiative between University of Malta and the Government of Malta, funded the research through investors. The project is set to be completed within three years and in three phases — evolution of the application, recapitulation of prototyping and validation of the process, and finally analysis of the application. AI will soon be helping children. **T**

MORPHEUS, a project of The University of Malta, is funded by Epic For Good Foundation.

The MORPHEUS Team would like to thank Dr Benna Chase and Ms Pamela Baldacchino from the Oncology Department for their help and advice.

Bellowing from the Rooftops

Pia Zammit



It's a topsy turvy ole world isn't it? One moment we're not allowing certain plays to be staged, the next there are journalists being locked up in a room in Castille, and before we know it, Donald Trump is banging on social media's door asking to be let back in.

But before we consider lifting *that* MAGA-shaped latch, let's talk awhile about freedom of speech and the right to speak up.

Before we were all tucked into our own homes to keep us safe from each other and The Killer Virus Which Changed Our Lives, we witnessed mass protests on our little island. Thousands of us took to the streets to combat corruption and fight for environmental issues. For some of us, it was the first time we'd seen demonstrations on such a scale in Malta. For some of us, it was the first time that we realised we had the right and duty to *speak up* for what we believe in.

The right and duty? I hear you ask.

Well, do we speak up enough in Malta? I'd contend that we don't. The way I see it is, since we've been colonised for most of our history, we haven't developed a culture of being vocal when we feel hard done by. We bow our heads and get on with things. It's more efficient that way. We don't have time. I get it. I really do. No judgement.

We're not always silent of course. We do demand that people do better on occasion. Especially when more of our green spaces are eradicated. However, time and our colonial past are not the only reasons why we're not running to the rooftops with a megaphone in hand every other week. The other reason is fear.

Fear's a big word, and I don't use it lightly. But it's a huge driving force. We fear the insults, the ridicule, the being singled out and isolated. We fear payback.

It's not unfounded fear. We've all seen what happens to some people who voice their opinion in public. We've

seen the activists isolated and torn apart on Facebook hate groups and in partisan-sanctioned memes. We've seen the harassment of anyone who tries to lend their voice to the abortion (non)debate. We've seen the slanderous lies and accusations leveled at anyone who dares raise their head above the parapet.


But we can all agree that this urgently needs to change, because we have a *right* to speak up without fear of repercussions.

It all starts with us. We need to take that first step and reach for the megaphone.

It's a vicious cycle. It seems like a paradox — the more we fear repercussions for raising our voices, the more we must speak up. It's the only way to break the cycle. It needs to be normalised. We can't leave people alone out there.

And now to duty. We need to make sure that future speaker-uppers have it easier than we do. Let's change the way we use social media. This is a big one, and it's a tricky one too! We need to make our voices heard more, but we need to make them effective. We can demand our rights and argue our point without targeting other people, without bullying, without disputing someone's opinion by insulting them. It's our duty to start a new wave of online discussions.

Debating is a wonderful skill, and when used properly, it can change the world.

Speaking up is your *right*. Speaking up right is your duty. Let's discuss! 

Further Reading:

The Shift Team (2018) Manufacturing consent: How secret online groups feed the cycles of spin. Theshiftnews.com. Retrieved 3 June 2021, from <https://theshiftnews.com/2018/05/23/manufacturing-consent-how-secret-online-groups-feed-the-cycles-of-spin/>

Nothing to see here

Julian Delia



A year after the brutal murder of Lassana Cisse in a drive-by shooting in Hal Far committed by two former AFM soldiers, the Armed Forces of Malta (AFM) declared that an internal inquiry had found no signs of racism within its ranks. Two years after Cisse's murder, which was ostensibly motivated by racial hatred given that neither of the shooters knew anything about the victim except his skin colour, the report remains a secret.

To this day, Malta's public does not know what questions were asked of 300 members of the AFM, nor the content of their answers; we just know the official narrative put forward by the Ministry for Home Affairs. The public was told that the soldiers interviewed denied any knowledge of racist sentiment among their colleagues, and that no affiliations with extremist groups bearing such ideologies were reported.

The problem is that, both before and after Cisse's murder, several other authorities that have no keen, obvious interest in exonerating themselves have reported racist incidents.


In March 2021, the Council of Europe's torture committee delegation, forced to make its way to the island after humanitarian NGOs were denied access to detention centres 'due to COVID regulations', decried our detention system as inhumane, arbitrary, and illegal. Problems with systemic racism extend beyond the AFM; detention centre officers have been repeatedly singled out for their cruel mistreatment of migrants who desperately land on our shores. A May report published by the office of the United Nations High Commissioner for Human Rights features interviews with asylum seekers in Malta, one of whom claimed that guards urged suicidal migrants to 'go ahead and kill themselves'.

Malta's government has repeatedly defended its horrifying regime of detaining and dehumanising migrants, with additional obstacles for those who manage to obtain a residency and find work. It is clear that our authorities have failed to build a humane system that prioritises lives over populism, or over hard-line stances designed to strong-arm the

EU into better burden-sharing. Unless our approach changes, we risk facing a mass graveyard at the bottom of our seas.

A resolution to the migration problems faced by Malta and other EU member states requires multi-layered approaches over the course of generations. Issues directly related to systemic racism in the country need to be tackled through better social education, community outreach programs, and by de-platforming racist policies to instead promote solidarity and inclusion.

The road to resolving migration is a long one, and it begins with acknowledging that the Western world directly profits from instability in the African continent. This profiteering leads to the exploitation of natural resources as well as the displacement of migrants, who leave their country and end up boosting European economies with cheap labour. Over \$41 billion in wealth is extracted from the African continent every year via tax evasion, illegal resource extraction, and questionable debt-financing practices.

In reality, there are many hidden horrors within our institutions and in the countries of origin where migrants come from that need to be seen, and there is even more to do in terms of properly inquiring as to how things have gone so wrong. The independent investigation of our army and security institutions is just the tip of the iceberg. 

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STUDENTS



Send in the Drones

Benjamin Farrugia & Andrea Gerada



Design is a transformation process. The idea is to transform problems into solutions through creative design thinking. With guidance from Dr Lawrence Farrugia, Daniela Quacinella, and Dr Sarah Pulé, we (Benjamin Farrugia and Andrea Gerada) have researched and designed a conceptual product-service which could revolutionise the marine fire rescue industry using drone technology.

Fires do not wait for help to arrive; delays cause fires to amplify. According to our research, it seems that drones and smart technology are already being put to good use to fight both bushfires and urban fires, but not marine fires.

Water is not used to combat fire on ships as it can flood and sink them. Meanwhile, employing chemicals to fight fires at sea only leads to more environmental pollution. It goes without saying that a ship is not a building. Marine firefighting is different!

Our smart marine firefighting service model, Coast Guardian, explores the concept of using sound to suppress fire at sea. This builds upon the work of two engineers from George Mason University who have prototyped acoustic suppression. This type of technology allows us to quickly respond to and fight marine fires while avoiding chemicals which are toxic to the marine environment.

Coast Guardian would use a specialised drone equipped with acoustic flame suppression capabilities. The drone would be stationed on a vessel within Maltese territorial waters and find fires through mobile and GPS technology. The rescue drone would include temporary lifesaving equipment, such as inflatable lifebuoy sausages that automatically inflate when they touch seawater. By equipping the drone with adequate sensors and artificial intelligence, it would be able to avoid any collisions and detect fire severity to update other rescue services.

Malta is an international maritime centre, with a big chance of sea accidents. There is a long list of articles reporting deaths and injuries due to boat fires. A smart marine fire rescue service would be incredibly beneficial to prevent accidents such as what happened last year in Kalkara and the Mġarr Gozo marina. Reducing fire extinguishing delays could help strengthen the island's reputation as a maritime authority. Who knows, perhaps by 2030 drones will be saving lives with sound. **T**

This research was carried out as part of the Bachelor of Science in Technical Design and Technology course programme, Faculty of Education, University of Malta.



Commuters, Ahoy!

Marthese Cini

Travel time studies are important for transport geographers, especially on island archipelagos. Small islands like Gozo depend on outside links for their infrastructure. My (Marthese Cini) research study focused on Gozitan commuters working in Malta and the recent discussions on 'connecting' the islands. Specifically, I studied whether a ferry or a tunnel would be more suitable for their needs.

Travelling is central to our lives. It's needed to work, shop, and visit friends or family. Travel is commonly seen as a burden that takes time and money. People's travelling behaviour is important to consider. It can help identify and understand which mode of transport commuters use the most and why, as well as the reasons behind certain destination choices. To decide on their mode of travel, commuters consider the distance of the trip and its purpose, travel time, safety, perceived comfort, service quality, and other factors. Gozitans

that commute to Malta for work are classified as extreme commuters.

My research showed that the average Gozitan commutes around 4 hours per day. For daily commuters, that's 20 hours per week. In European countries such as Sweden, the Netherlands, and France, as well as the United Kingdom and Switzerland, commuters who face long trips (more than two hours, minimum three times per week) total between 5 and 10% of the commuting population. Gozitans are commuting longer than most of Europe!

There are few publicly available studies about Gozitans' concerns over travel time and their attitude on infrastructural changes. In my research, I sent a questionnaire survey to 350 Gozitan commuters. The majority of commuters were against the building of the proposed tunnel (63.7%) and were in favour of a fast ferry service between Valletta (in Malta) and Gozo (65.7%). If a tunnel was built, participants felt that Gozo

would lose its character and identity. The fast ferry service was popular with Gozitans who worked in or near Valletta. Commuters were also satisfied with the addition of the fourth ferry, since this considerably improved the existing ferry service.

This research can help inform decision makers. By taking various considerations, economic, social, and environmental into account, it becomes easier to develop a strategic solution that addresses Gozitan concerns. Should we look at the short to medium term gains of implementing a faster ferry service, or should we look at the longer term costs and benefits of constructing an underwater tunnel? The answer isn't simple, but it requires research to answer. **T**

This research was carried out as part of the Master's Degree Programme in Geography at the Faculty of Arts, University of Malta under the supervision of Prof. Maria Attard.





PRESERVATION

Preservation is the act of maintaining or protecting something. We take a look at the research that preserves our artistic, cultural, or linguistic

heritage. Other researchers are examining new ways to maintain our environment and our shared, collective knowledge.



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Revealing the techniques behind a Renaissance sculpture

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**Close-up of Antonio Gagini's
Madonna and Child
Photo by James Moffett & Sarah Zammit**

Uncovering History

Author: Caroline Curmi

*Commissioned over half a millennium ago, Antonello Gagini's Madonna and Child has been silently standing tall in a Franciscan church in Rabat for the past five centuries. Little was known about the Renaissance sculpture, but a recent study is tracing the statue's history. **Caroline Curmi** speaks to art historian **Dr Charlene Vella** and University of Malta student **Jamie Farrugia** about their findings.*

When one directs their thoughts to local religious iconography, the Maltese Islands' opulent and resplendent Baroque churches undoubtedly come to mind first. Indeed, the many prime examples scattered across the islands coupled with Malta's fascination with the Baroque have unwittingly caused several other major art periods to be cast aside in public memory. 'The Renaissance in Malta is often overlooked,' University of Malta Art History lecturer Dr Charlene Vella confirms, insisting that such works 'deserve scholarly attention' too.

The Knights of St John were the largest commissioners of baroque art in Malta, filling it with many masterpieces, but Vella draws attention to other surviving artworks which predate their time. Examples include two Antonio de Saliba paintings and Antonello Gagini's *Madonna and Child* – all housed at the Church of Santa Maria di Gesù in Rabat, Malta. The church is a great source of fascination and inspiration for Vella and

has featured in her own master's and doctoral studies: 'It has a wonderful history, an intriguing cloister of artefacts,' she says. Indeed, over the past decade Vella has supported and secured funding for the study and conservation of Renaissance paintings across Malta. Her latest study has seen a natural progression into sculpture.

Gagini's *Madonna and Child* was commissioned on 23rd February 1504. The statue was delivered a few months later around June, in time for the Corpus Christi feast. There is no documentation that sheds light on the way the mammoth statue – whose weight exceeds 380kgs – was transported from Valletta's Grand Harbour to Rabat: 'It must have been the Maltese Franciscan Observants who handled this, but there are no records of it,' Vella muses.

The study was funded by the Majjistral Action Group Foundation under the LEADER Programme 2014-2020. It was after the diagnostic testing, conservation, restoration, and 3D scanning of the statue. Its findings were analysed and supplemented further by University of Malta art >



Photo by James Moffett & Sarah Zammit



'The presence of so much gilding was probably paired with a beautiful bright azurite blue which has since been completely lost'

history student Jamie Farrugia's BA dissertation research, which merged scientific study with art history to obtain a deeper understanding of the commission. 'The sculpture was analysed from a visual and stylistic perspective and compared to Sicilian counterparts to assess its success as a Renaissance work within Gagini's oeuvre,' Farrugia explains.

Farrugia's research saw her analyse pigment profiles extracted from the statue since much of this has been lost through the centuries. Through this, she was able to '[...] connect them to [her] art history research, while proposing hypothetical 2D-reconstructions of the *Madonna and Child* as it may have looked in 1504.'

PRESERVED IN PAINT

Dr Davide Melica (Consulenza e Diagnostica per il Restauro e la Conservazione) carried out the scientific testing to extract pigments from the statue followed by an identification test.

A total of six samples of approximately 1mm² were removed from the Virgin and Child's hair and dress; the latter had a layer of repainted brownish pigment as well as a yellow wax. Various areas from the left-side of the Virgin's mantle also display repainting interventions in red and yellow hues. They found that the statue had at least 2 instances of later intervention through repainting or wax applications.

'In one stratigraphic layer – that is, layered materials over a period of time – at least two individual repaintings have been identified,' Farrugia explains.

Some original paint residue was located in a green layer of verderame (or verdigris) present in certain areas on the Virgin and Child's heads, and as floral patterns on the Virgin's dress. 'This is indicative of Antonello Gagini's use of an old technique used by masters,' Farrugia explains, who goes on to highlight the sculptor's methodology: 'The verderame (pigment) was mixed with linseed oil and painted onto the marble surface, and then the gilding was applied onto it, where the verderame would act as a mordant for the gold,' she says. She elaborates that while on first viewing, the statue appears white to the naked eye, the presence of the verderame confirms that gilding was present wherever the green layer was found. This means that both the Virgin and the Child's hair, as well as the sizable floral patterns adorning the mantle were completely gilded. While the Virgin and Child's eyebrows may also have been gilded, there

Jamie Farrugia, Dr Charlene Vella
& Dr Davide Melica
Photo by James Moffett & Sarah Zammit



QUICK THINK

1. Following the placing of Gagini's Madonna and Child in the Church of Santa Maria di Gesù, the religious home became more commonly known as Ta' Giezu, a derivation of the statue's name.
2. Tests carried out include the use of stereoscopic microscopy, optical microscopy with polarized reflected light, staining tests, FT-IR infrared spectroscopy, and X-Ray fluorescence spectroscopy (XRF).
3. MUŻA is Malta's National Art Museum. It is located at the Auberge D'Italie in Merchants Street, Valletta.


is a higher probability that they were painted in a natural ochre. Within the inner sides of the drapery folds, very light traces of possible azurite were identified. 'The presence of so much gilding was probably paired with a beautiful bright azurite blue which has since been completely lost,' Farrugia says, a speculation based on her readings of original documentation of Sicilian sculptures of the time.

Such a stunning hue is not the only thing lost from the statue. Its octagonal marble pedestal – carved in relief and portraying the Stigmatization of St Francis on the front, as well as two half-length images of St Paul and St Francis – was moved to the National Collection in 1911. Today, it is exhibited at Valletta's MUŻA arts museum. 'All the figures on the pedestal have been defaced, probably intentionally, at an unknown period in the past,' Vella explains, adding that the pedestal carries the artist's signature.

A hole in the Child's hand can also be observed, which Vella confirms could have once held a flower or a bird. Detailing the meaning behind such iconography, Vella refers to the 1515 Renaissance altarpiece by Messinese artist Antonio de Saliba portraying the Madonna and Child with Angels. There, the Virgin is depicted holding a flower and a bird, specifically a goldfinch. 'The red flower in question is a passiflora, often associated with Christ's Passion, and the goldfinch – a small bird with a splash of red on its head – is known to make its nest from thorns, and therefore

another link to Christ's passion and crucifixion. The same could possibly have appeared on the Gagini sculpture,' Vella explains. 'This means that even when we see an image of the young mother and her infant son, there is a lot that prefigures Christ's suffering and death for humanity's salvation which is typical of Renaissance iconography.'

Over 500 years' worth of history are preserved in the statue's multiple layers. It is a unique and precious historical and artistic artefact which deserves preservation. Although it is not the oldest Renaissance specimen found on the island (the earlier example is believed to be a holy water stoup in Gharb by Antonello Gagini's father, Domenico, dated to 1474), Gagini's Madonna and Child predates the arrival of the Knights of St John. These facts make the statue vital to preserve. Today's studies offer insight into the Renaissance era in Malta, and hopefully, they will act as a catalyst for more in-depth research to better appreciate Malta's Renaissance past.

Now completed, the sculpture has been settled back into its place in the Ta' Ġiezu church in Rabat, where it can be appreciated by the public. Speaking about her time on the project, Farrugia highlights the excitement that comes from uncovering the layers of history which had previously been left unstudied. 'Confirming the true visual identity of the work based on factual pigment samples is truly ground-breaking.' 





Revisiting Cultural Traditions with Open Eyes

Author: Nicholas Gambin

Nicholas Gambin analyses Maltese cultural traditions that have stopped, remained, rebirthed, or changed in some way in today's society.

Cultural changes do not happen in the blink of an eye; they happen gradually. World wars, globalisation, and advancements in technology have continued to push societies forward and cause irreversible changes. Old traditions have either stopped, continued, adapted, or been replaced by new ones.

Throughout our lifetime, we frequently consume our culture passively and without even knowing. When we walk through the cobbled streets, we hardly spare a thought for the culture hidden beneath our feet. However, Malta's rich culture and traditions surround us in unexpected ways.

Guido Lanfranco's book *Drawwriet u Tradizzjonijiet Maltin* acts as an excellent starting point to delve into some of Malta's cultural traditions. This, paired with the insights of Dr Michael Spagnol (Head of Department, Department of Maltese, University of Malta), offers us a glimpse into what this Mediterranean island has to offer.

FOOD - ŻEPPOLI

Lanfranco writes that sweet shops have been making this dessert since the 19th Century. In terms of origin, Spagnol explains that this food is typical of South Italy, who refer to it as *zeppole* in places like Naples, Catanzaro, Reggio Calabria, and Sicily. Malta has had a long cultural relationship with Italy. The link is not surprising.

Although *zeppoli* were usually eaten exclusively on the 19th March, nowadays, you can buy them from pastry shops in the weeks leading up to St. Joseph's Day. Spagnol comments that 'because Maltese people seem to have such a connection with traditional dishes, they continue adapting these traditions and sometimes create new ones altogether.' Another example of this is the *qagħaq tal-ghasel*, which are sweet pastry rings filled with treacle (not honey, even though *ghasel* in Maltese means honey). These were originally made around Christmas time but are now produced all year ▶



Il-Ġostru competitor gets close to the flag

round. More recently, *figolli*, the Easter pastry filled with almond meal, has been transformed into smaller bite-sized versions called *figollini*. If you are a foodie, then you can definitely explore the culture of Malta through its food.

ACTIVITIES - IL-ĠOSTRA

Imagine a time before the Internet, when people had to actually go outside and invent ways to pass the time. One such activity is *Il-Ġostru*, which you might have seen photos of shared all over social media. The game is believed to be derived from the Neapolitan game of the Cockaigne pole. It involves someone crawling along a greased pole fixed at an angle while trying to grab flags; entertainingly, most participants fall into the sea. This used to be a popular activity for men during village feasts. The flags also hold religious meaning, with a blue and white one dedicated to St Mary, a yellow and white one for the Vatican, and the Belgian tricolour for St Julian, who is believed to have been born in the Belgian town of Ath in 7AD.

Il-Ġostru was organised in summer, when falling into the water is refreshing rather than shocking. Now, it's organised in villages close to the water, like Msida, Balluta, and St Julians. The game wasn't always played over water. Spagnol mentions a similar event, the *kukkanja*, which used to take place during Carnival. The pole was vertical instead of sloping horizontally, with people trying to climb up the greased pole to reach the prizes hanging from the

top. These prizes included cured meats and wine. The pole laying horizontally makes the game slightly easier (and safer), so one can imagine why this alteration was made.

Images of this activity have made their way onto Reuters' Images of the Day, snapped by Maltese photojournalist Darrin Zammit Lupi.

SUPERSTITION - THE EYE OF THE LUZZU

Tradition and superstition often come hand in hand. From breaking a mirror giving you seven years of bad luck, to Ancient Greeks fearing that a storm was caused by angry gods. When human beings cannot understand something, they create myths and superstitions to give it meaning. Whether these are based on truth or fact is a discussion for another article.

Maltese seaside villages, such as Marsaxlokk, Marsaskala, or St Paul's Bay, are dotted with brightly coloured fishing boats called *luzzu*. This type of boat can be traced back to the ancient Phoenicians, and their stable, sturdy, and reliable nature meant that they could be used in both good and bad weather. However, one of the most striking features of the *luzzu* is the two painted or carved-out eyes that stare directly into your soul.

The concept of the 'evil eye' is widespread across Mediterranean cultures, such as the Turkish Nazar eye-shaped amulet, the Italian *cornicello* (designed to ward off the evil eye), and the hand-shaped Hamsa talisman found



Zeppoli



Eye of the luzzu

in West Asia. The eyes on the *luzzu* are probably linked to the Eye of Horus or Osiris, which was the Phoenicians' god of protection from evil. For the Phoenicians, the eye was a symbol of protection and good health, so the eyes were painted onto their boats to protect the fishermen from any harm while at sea. With no modern weather reporting technology, fishermen turned to superstition to give them hope and protect them on their journeys.

PERFORMANCES - QARĊILLA

Lanfranco tells us that the *Qarċilla* tradition dates back to the 18th Century, around the time of the Maltese linguist Giovanni Pietro Francesco Agius de Soldanis, who wrote the first lexicon and systematic grammar of the Maltese language. Since the Catholic Church was so strong throughout Maltese history, people were brought up to be very religious and obedient. Carnival was the one time a year when people could have some fun and disobey.

The *Qarċilla*, sometimes called a Maltese wedding or 'iż-żwieġ la Maltija', was a farce or popular drama enacted in village streets during Carnival. Two men would dress up as the groom and notary. On his head, the groom would wear a *figolla* in the shape of a woman and decorated to look like a bride. The notary would then recite a fake and comedic marriage contract invented on the spot, which usually included political and social satire, sexual innuendos, and swearing. People would listen and cheer,



Dr Michael Spagnol
Photo by James Moffett

and once his speech was over, the actors would cut up the *figolla* into pieces and share it with the audience.

One of the best known *Qarċilla* is the one written by Mgr Felic Demarco for Carnival in 1760. What is quite interesting about this tradition is that, although it seemed to have stopped and been lost to history, it actually had a rebirth back in 2014. Over the last few years, Maltese writers like Trevor Zahra, Immanuel Mifsud, and Leanne Ellul have been commissioned to write their own version of a *Qarċilla*, which is then staged and performed by citizens. The tradition is finding a new life in today's society.

For a culture to exist, it needs people. It is people who create traditions, keep them alive, or preserve them, be it through lived experiences, speaking to people like Spagnol, or documenting them as Lanfranco did with his book. To appreciate our culture, we need to learn about it. Written records help us preserve these traditions and allow culture to grow and develop. **T**

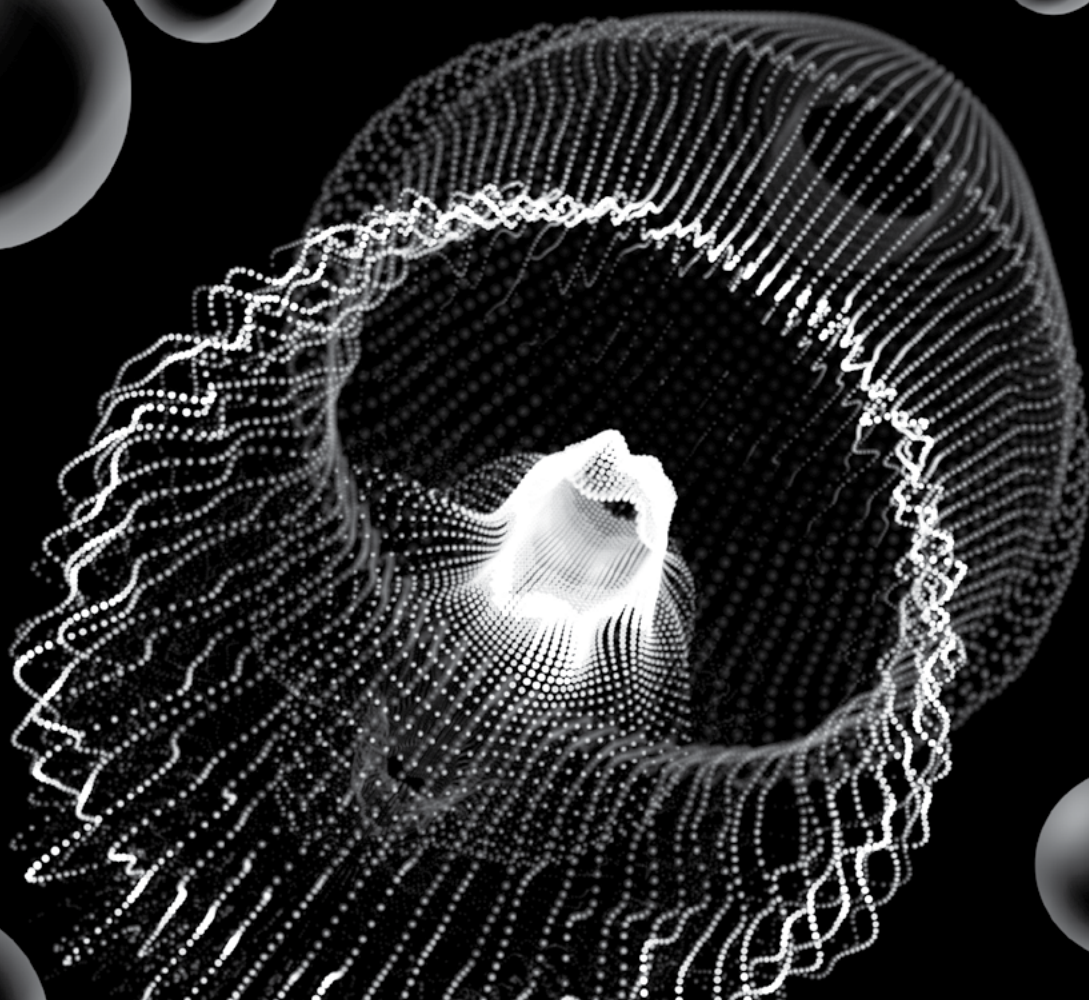
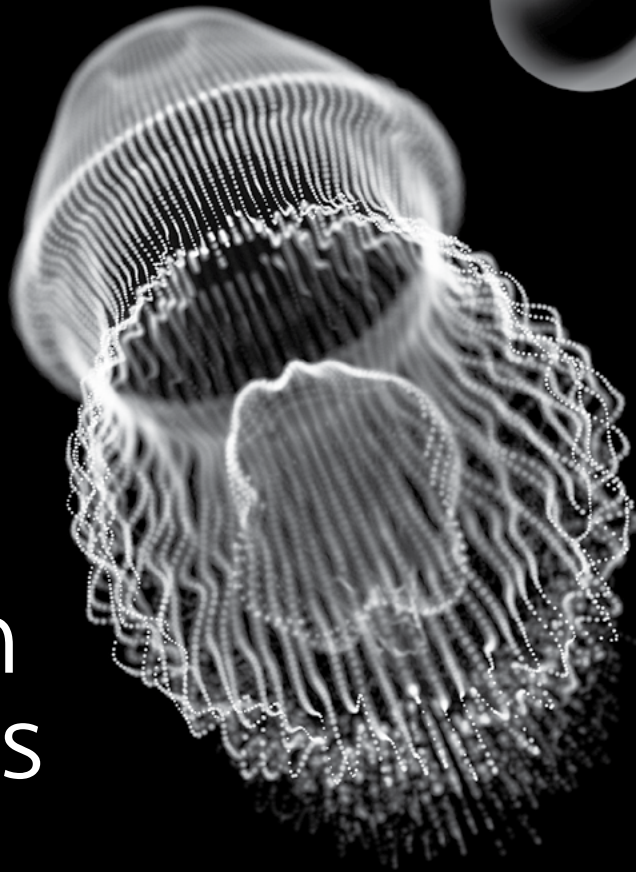
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Juggling Jellyfish:

How AI can improve citizen science projects





Author: Becky Catrin Jones

One of the largest citizen science projects in Malta, *Spot the Jellyfish* has helped record many interesting discoveries about marine life. But as the project grows, the team must expand their technology to cope with the influx of data. **Prof. Alan Deidun, Prof. John Abela, and Dr Adam Gauci** speak to **Becky Catrin Jones** about their latest developments.

For Prof. Alan Deidun, there is no such thing as a slow day. As the lead scientist on one of the longest running citizen science projects in Malta, *Spot the Jellyfish*, every day brings the ping of a new notification, a recent sighting, or a call to engage with the community about the multitude of species in Maltese waters.

Spot the Jellyfish was born over 10 years ago with an invitation to citizens and tourists to add a side of marine biology research to their day at the seaside. Beachgoers, divers, and water sport fanatics are encouraged to document the details of any jellyfish sightings (or lack thereof) on the *Spot the Jellyfish* website and social media pages, along with photos.

The campaign has been hugely popular, with more than 4,000 verified reports to date. And the results at

such a scale allowed the team an insight into the more subtle nuances of jellyfish appearances and movements around the Mediterranean. The team have produced a massive number of scientific papers based on the images, recording unusual sightings or how the trends of jellyfish appearances are changing over time.

'Ninety percent of jellyfish sightings in the Mediterranean come to us,' remarks Deidun about the project's success. There is no doubt that this is thanks to his efforts engaging people on social media and chatting to community groups.

IN TOO DEEP

The project is running into some major challenges. There are more people than ever reporting jellyfish sightings all around the coasts of Malta and Gozo — averaging to one jellyfish sighting a day.

The problem is that most submissions are not through the dedicated website but through the *Spot the Jellyfish* social media pages or personal messages. All these submissions must then be manually uploaded to the website. Deidun was under pressure to keep on top of all the submissions.

'Each submission needs to be validated, which obviously takes a lot of time,' Deidun remarks of the process. It was time that the project branched out in a new direction. Was there a way that he could speed up this system?

THE POWER OF AI

Enter Dr Adam Gauci and Prof. John Abela from the Department of Computer Information Systems at the University of Malta. Gauci, a PhD student of Abela at the time, was sitting in the Department of Geosciences alongside Deidun while



Dr Adam Gauci (left) and Prof. Alan Deidun
Photo by James Moffett

working on his studies. Gauci and Deidun had worked together before on cross-disciplinary projects, and it seemed that this could be another great opportunity to merge paths. 'It was certainly a case of 'right place, right time!' Gauci says.

Using Gauci's background in artificial intelligence (AI) and under the supervision of Abela, maybe they could find a way to build an algorithm that could identify and record the jellyfish, without needing extra, human expert validation?

'First, we focused on the five most commonly reported jellyfish,' Gauci recalls. These five species: the mauve stinger (*Pelagia noctiluca*), fried egg jellyfish (*Cotylorhiza tuberculata*), box jellyfish (*Carybdea marsupialis*), by-the-wind sailor (*Velella velella*), and salps (*Salpidae*) made up the bulk of submissions from around the island and had the greatest number of clear images. Taking 1,000 images, each one labelled with the jellyfish species in the photo, they began training a tailor-designed Convolution Neural Network (CNN) to recognise individual features.

Neural networks are computer algorithms that can learn by processing information. By feeding data into the network, the algorithm can start to recognise patterns, which can then be applied to new information. The more data used to train the algorithm, the more accurate it can become.

To be able to correctly identify a jellyfish, the team needed a selection of training pictures that captured each species in a variety of locations, positions, and conditions. This was no mean feat. Photos taken from the beach might not be in short supply, but they needed a balance of images from above

and below the water and with different lighting to develop a robust algorithm ready for this challenge. Often, while the jellyfish was the focus of the image, it did not occupy the whole frame. In these cases, the algorithm also needed to be able to pick out the jellyfish amongst the sea of blue pixels.

THE FOURTH INDUSTRIAL REVOLUTION

The team managed to produce a highly accurate algorithm capable of recognising these five most common jellyfish with a lot of hard work and plenty of citizens' jellyfish pictures. 'The idea is to put this on the website, so that people can upload their own photos, and the algorithm will tell them what it is straight away,' Gauci says. Not only will it confirm the jellyfish species, but it can provide links to more information, such as how to treat a potential sting. Geotagging, inherent within digital images, also means that the team can see exactly where the photo was taken, helping to accurately pinpoint the jellyfish's location.

As more images are collected, the team hopes to expand the number of jellyfish that can be automatically classified by the algorithm. A sister project, Spot the Alien Fish, is also set to benefit from some AI – although the team still needs to find enough clear images to train the network. Gauci hopes that the system will be turned into a smartphone app to allow citizens to instantly verify the jellyfish species in front of them.

'We're in the midst of the fourth industrial revolution,' Deidun says. 'This is a great example of how smart systems and AI can be used for citizen science purposes.'




Prof. John Abela
Photo courtesy of Prof. John Abela

FOCUS ON THE FUTURE

Freeing up this validation time means that Deidun and his team can focus their research on jellyfish movements and population fluctuations. This is important when monitoring invasive jellyfish species in Maltese waters. While only five such species have been recorded in Malta so far, their impact can be devastating – destroying habitats for native species or interfering with aquaculture systems. In some cases, large blooms of jellyfish have even shut down power stations.

Deidun and his colleagues map jellyfish trends to predict the types and numbers of jellyfish throughout the year. With over 10 years of data under their belt, they have plenty of experience in understanding how changing seasons and temperatures might affect the species found in the seas. 'We are sitting on datasets that are really valuable,' says Deidun.

The Spot the Jellyfish website has helped the team record really rare events that would easily have been missed by a single research group. Just this year, thanks to lockdown jellyfish spotters making the most of their time at the beach, the team received reports of a very rare jellyfish bloom which had not been seen around Malta since 2012. The bloom only lasted one week, but thanks to the vigilance of the spotters, they were able to record it and hope to publish a paper documenting it later in the year.

'This is the beauty of this system,' says Deidun. 'To keep track of such events, you really need an army of citizen scientists.' And luckily enough, it seems like he has one. 



Chemistry Gets a Green Makeover

Author: Emma Clarke


*Can big pharma be sustainable? **Prof. Giovanna Bosica** and her team are trying to find out. This is no easy task, but step by step, they are reimagining what the field could look like.*

The pharmaceutical industry has gotten itself a bad reputation. Through mass waste generation, toxic chemical use, and natural resource exploitation, large-scale chemical production is notorious for leaving a hefty mark on the environment. Until now, the industry has been pretty much unregulated, but growing pressure is forcing the field to clean up its act. It might be long overdue, but chemistry is finally getting a new look.

Figuring out how to make this industry environmentally friendly is no simple task. Many production lines were originally designed with no consideration of their environmental impact, and changing them is expensive. Similarly, a lot of reactions were developed at a time where scientists were simply unaware of how toxic a chemical can be. All of this means that the chemical industry needs a complete environmental makeover, which is where researchers like Prof. Giovanna Bosica (Faculty of Science, University of Malta) come in. Reaction by reaction, Bosica

At the core of green chemistry is sustainability: the idea that we should meet the needs of the current generation without compromising those of future generations.

and her team are reimagining what their field could look like. 'It's a new philosophy,' she explains, 'This kind of chemistry is the future.'

Bosica's research is part of a growing movement called 'green chemistry' which has emerged over the last 25 years. At the core of green chemistry is sustainability: the idea that we should meet the needs 



Prof. Giovanna Bosica
Photo by James Moffett

of the current generation without compromising those of future generations. When Bosica and her team design experiments, they don't only consider efficiency but also the environmental consequences of the processes involved. Bosica sees the movement as a kind of gradual revolution. 'It's about changing mindsets,' she says, 'and mindsets change slowly.'

HOW DOES IT WORK?

We can think of Bosica's work as a kind of chemical renovation business. With her team, she researches chemical reactions which have been performed in the same way for decades and gives them an upgrade for the modern world. Once they have figured out how to give the process an overhaul, the researchers collaborate with pharmaceutical companies and other academics to pass on the knowledge. The ultimate aim is that various industries will take on these cleaner, greener approaches and that everyone will benefit. Some companies, such as Monsanto, DuPont, and Pfizer have already begun implementing green chemistry principles.

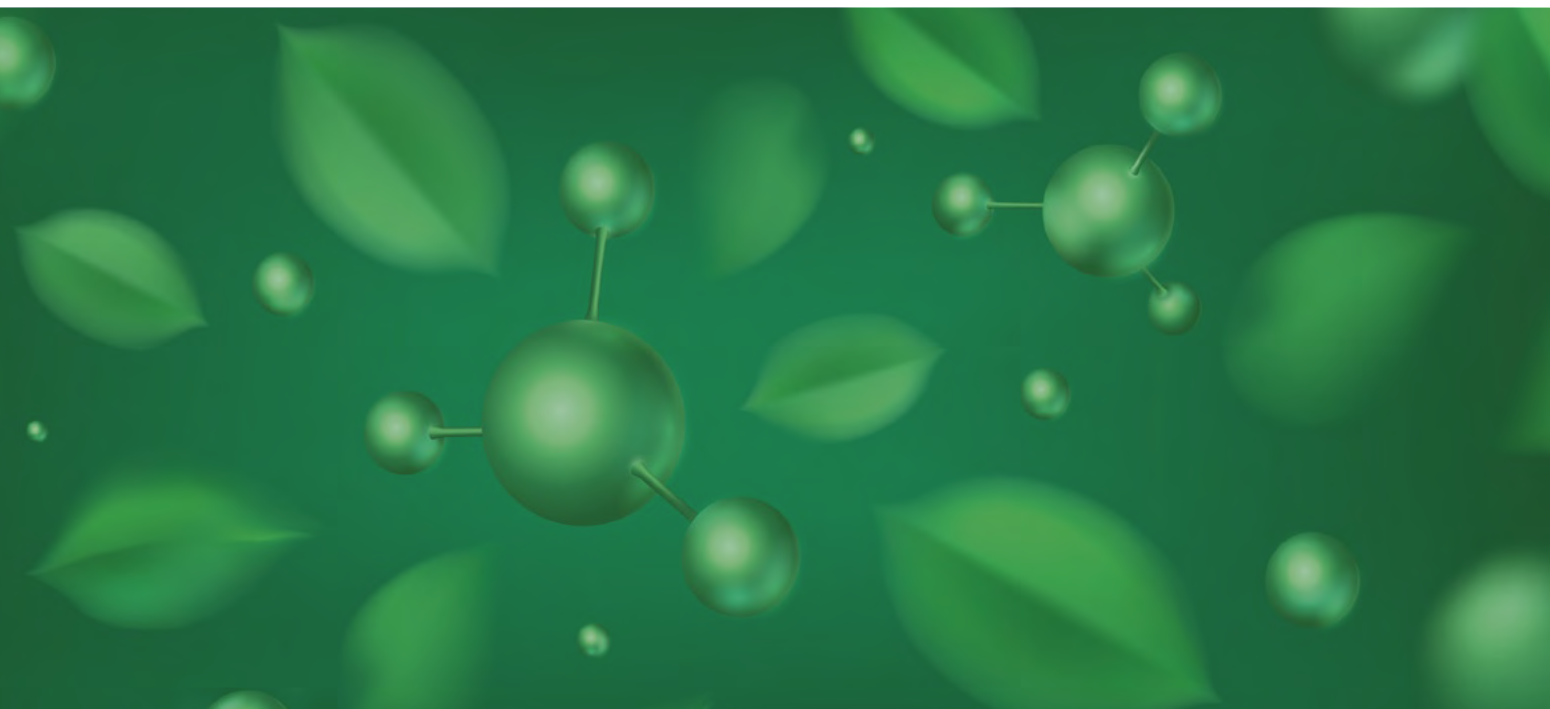
The potential of the research is far reaching and has many applications, but the work always begins with a researcher in a lab. With each new experiment, the team learns more about how techniques can be improved. But where do you start if you want to renovate a chemical reaction?

In many ways, chemistry is like cooking. There are the ingredients that you start off with, some more toxic than others, then there are the waste products, and ultimately, the final dish. Green chemistry uses a set of principles to make the recipe as safe and efficient as possible while also trying to maximise the portion sizes that you get from those ingredients. The key difference is that you probably shouldn't ingest anything you find lying around in the lab fridge, and also that people get angry if you have a glass of wine while you work.

REDUCE, REUSE, RECYCLE

One of Bosica's main priorities is reducing the amount of waste that a chemical reaction generates. To do this, she looks closely at the process and sees if it can be done in fewer steps. In the same way that a 'one-pot' recipe saves you from cooking each ingredient separately, a one-pot chemical reaction allows you to complete more steps of the process in one go. 'If you're just one scientist in a research lab, the difference might seem small,' says Bosica, 'but to a pharmaceutical company performing these reactions on a massive scale, cutting out steps can save a lot of waste.'

The technical term for one-pot chemistry is a multicomponent reaction, and this strategy is a key focus of Bosica's research. The team tries to use 'ingredients' that are safe and readily available and keep the processes simple. If a



process has a high 'atom economy', which essentially means that most of the ingredients end up in the final dish, that's another sign that you've designed an eco-friendly reaction.


Another thing you can do is make sure you're using recyclable utensils. Chemicals often make use of catalysts, molecular tools which help to speed up your cooking, or reaction. Currently many industries use something called a homogeneous catalyst. These are often toxic and only work for one reaction – a bit like using a new knife every time you cut vegetables. Part of Bosica's work is to investigate catalysts which work well but can be used repeatedly, saving huge amounts of waste as well as the disposal cost of the chemical equivalent of many large knives. The task is not simple, because the catalyst has to be highly productive and cost-effective if pharmaceutical companies are to be persuaded to adopt the process.

HOW CAN GREEN CHEMISTRY RESEARCH CREATE CHANGE?

By combining these principles, Bosica and her team are gradually bringing reduce, reuse, and recycle to the lab. They work on chemical processes which have a huge range of potential applications, and Bosica hopes that through industrial collaborations she can begin to see her work in action, transforming the chemistry that we use in our day-to-day lives.

Some of these potential applications are already in the works. Recently, Bosica sent a selection of chemical products to a biology lab, where they will be tested on human cells to see if they can stop cancerous tumours. If the products are effective and can be used cost-effectively, there is the potential to develop ecologically friendly drugs from this research.

The field of green chemistry is still small, though it is growing. In 2019 Bosica attended the first ever conference in China. Though change is slow, she is optimistic and has found that the pharmaceutical companies she approaches are open to the idea. She has managed to secure funding for various projects, though she notes that 'with more resources one can always do more'.

The work of Bosica and other green chemists is paving the way for future scientists to change how we live. The importance of this cannot be underestimated. In the words of Nobel Laureate Professor Ryoji Noyori, "Green Chemistry" is not just a mere catch phrase; it is the key to the survival of humanity.' 

Further Reading:
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Preserved in Plastic

Archives help preserve the past. Modern archives are dependent on technology. What happens when the technology used to store the past becomes obsolete? Will this information be lost forever at the next update?

Author: David Mizzi

Do you remember that old school project you had saved on a floppy disk? Using something like a floppy disk to store information is great, but only if you have a floppy disk reader. Finding one today is a tall order; that school project could be lost to time.

Future generations will be able to see our culture only if they have the right technological tools. Our 'modern' hard drives will eventually go the way of the dodo (or floppy, in this case), resulting in a digital dark age.

Digital isn't as permanent as we think. Digital formats can become corrupted, degraded by bit rot, or obsolete. Future generations may find it difficult or impossible to retrieve electronic documents and multimedia because they don't have the technology to retrieve it any more.

But what if there were a way to permanently preserve works of art, without the risk of technology making them obsolete?

PRESERVED IN PLASTIC

Julia Galea, an MA graduate from the department of Digital Arts at the University of Malta, has an idea to 'future-proof' an artwork with the technology available

today. Most current recorded formats depend on some kind of playback equipment (floppy disks require floppy drives; SD cards require appropriate readers). These tend to become obsolete very quickly. We cannot assume that future generations will have the means to process and understand our archives.

Galea's research has found a way to turn the imperishability of plastic into a time capsule. The ingenuity of her research is bringing an art object, such as an image, into the physical space. Enter the plastic slides.

These 3D-printed reliefs fit in the palm of your hand and depict the recorded artwork when held up to the light. Through 3D printing, these slides effectively create mechanical reproductions of digital artworks and, as a happy side effect, produce a physical archive.

While materials such as magnetic tape already exist and are able to record and reproduce a wide range of formats, they need equipment to recover. As Julia puts it, 'assuming the sun stays in the sky, the plastic slides should always be capable of reproducing the image.'

Plastic's long lifespan has led to widespread environmental degradation, but it's that same property that Galea uses. Plastic slides are practically



Artworks rendered in plastic slides



Julia Galea and Dr Clive Zammit
Photo by James Moffett



3D printed plastic slides in relief

imperishable. 'The idea of creating these plastic slides was to use a material that theoretically could outlive any current material utilised for recording images.'

To develop these slides, Galea used three-dimensional rendering, printing, scanning, and computer-automated translation of data. The body of work created throughout this research was constructed and developed on 3D rendering software and various 3D printers. Through a semi-automated process, the 3D rendering software analysed a flat image by pinpointing a tonal value range and printing out the image (in relief) as a plastic slide.

Galea's research was first met with skepticism, being seen as creating a solution to a problem that will never exist. Technology is quickly being superseded, and many digital artworks have already been lost. Unless current archives keep up, a lot more art and history will be lost.

THE ARCHIVE OF THE FUTURE

Dr Clive Zammit (Faculty of Media & Knowledge Sciences, University of Malta), Galea's supervisor, points out that, 'The more technologically advanced we are, the more vulnerable to obsolescence we become'. He refers to philosopher Jacques Derrida, who points out

the inherent tension within the archive. On the one hand, it is a means of preserving the past, yet it needs to continuously advance for archives to remain relevant.

Technology also embodies this tension. It allows for a greater quantity of ideas and data to be stored as the technology advances. But it also leaves a trail of loss, as earlier mediums become obsolete.

The use of plastic opens up issues around the sustainability behind art, museums, and archives. All of these aspects need to consider sustainability to be future-proof. Besides the practical and artistic applications behind these plastic slides, they also invite us to reconsider sustainability by viewing plastic as a solution to a problem.

Future archives might have entire wings dedicated to hand-held slides, each one carefully catalogued and made from recycled plastic without the need for any sophisticated equipment to read. These slides could easily survive any technological disaster. The very act of holding something against the light is intuitive.

Not to mention the beautiful irony behind using the very thing that is destroying the future to preserve the past. Perhaps plastic might preserve art (and your old school project!) for future generations. **T**

Peeling Away the Layers of Time

Author: James Moffett

THINK takes a trip to explore research and archaeological work taking place at Borġ in-Nadur, overseen by Heritage Malta, which will see the Neolithic site freed from modern-day debris and accumulated material to show the original prehistoric structure in all its glory.

The mass of stones at the top of a hill overlooking Malta's seaside town of Birżebbuġa looks like another natural feature of the local landscape. Upon a closer glimpse, the rugged shapes transform into a coherent and visible structure.

Borġ in-Nadur, literally translated as 'the mound of stone at the lookout place', boasts a remarkable characteristic. Extensive research over the years has revealed that the site once served both as a Megalithic structure ground and, later on during the Bronze Age, as a village and fortification.

Preserving our natural heritage often involves peeling away the layers of time. Modern-day rubble and debris litter Borġ in-Nadur, one of Malta's lesser-known prehistoric sites. Without proper care, this refuse can damage the site and complicate the way we interpret these ancient ruins.

THINK's James Moffett meets up with Katya Stroud and Dr Josef Caruana (Senior Curator and Curator, respectively, with Heritage Malta) to see how they handle these re-excavations.

Stroud and Caruana are leading a team of researchers and archaeologists to conduct conservation works at Borġ in-Nadur. Many of the original excavations around Megalithic sites on the island took place between the 1920s and 40s. They were subsequently left open to

the public or ignored. From photographs taken during these past excavations, the team was able to assess the site and find contrasting differences between past and present. 'We realised there was an accumulation of material which does not feature in the photographs taken during the original excavation,' states Dr Caruana.

PEELING AWAY THE PRESENT

With this in mind, the team decided to remove the unwanted material that had accumulated over time in order to better read and understand the site. By selecting three different sections around Borġ in-Nadur, the team started comparing the present-day remains with the black and white photographs to determine what had changed over time and to ensure that whatever was being removed was modern.

Wind-blown dust, sand, debris, and even abandoned bird nests accrue over time. 'This is something that occurs naturally in archaeological sites,' says Stroud. Borġ in-Nadur is surrounded by fields, and several rubble stones — unrelated to the original remains — have ended up within the area itself. If a site is not looked after and not cleared from time to time, such undesirable material will pile up. Reversing this process is one of the primary aims ➤



Katya Stroud



Dr Josef Caruana



Removing unwanted material that accumulated over time
Photos courtesy of Dr Josef Caruana and Heritage Malta





Such areas provide evidence of how these ancient people used to relate with the natural landscape around them and how they used to understand it.

undertaken by Heritage Malta. 'Partly it's a re-excavation,' remarks Stroud. 'We are rediscovering what there was.' Unlike the builders of the Tarxien Temples, when Bronze Age settlers in Borġ in-Nadur began construction on a village, they did so by removing the items left by the previous users rather than burying them. To this end, any evidence of what came before is scarce.

Although the site itself is not included in the UNESCO World Heritage list, Borġ in-Nadur has equal relevance to other sites around Malta and Gozo. 'It adds another piece to the whole story,' explains Stroud. 'These sites mark the birth of monumental architecture. It provides us with Neolithic evidence in Malta and the impact the beginning of agriculture had on communities and how culture affected society.'

The geographical position of Borġ in-Nadur is similar to several other sites on the Maltese islands; typically, with the sea on one side and land on the other. This relationship between the land and the sea appears to have

been an important element in deciding where these sites were built during the Neolithic period. Such areas provide evidence of how these ancient people used to relate with the natural landscape around them and how they used to understand it. Borġ in-Nadur is particular in that it overlooks the sea and rests upon a promontory, flanked by a valley upon each side. As Caruana puts it, 'this is a strong indication of a lot of activity in that landscape.'

A FUTURE FOR OUR PAST?

A side project involving Heritage Malta called FRAGSUS, led by the University of Malta and the Universities of Cambridge and Belfast, analysed pollen samples taken from one of these valleys. Both oak and pine species were present, while barley was also cultivated in both the Neolithic and Bronze age. Evidence also suggests that grapes were cultivated for a short period around 2,500 BC. These results gave a picture of the vegetation growing during the Neolithic and Bronze Ages. The mystery puzzles put forward by



the passing of time are being solved step-by-step, as we learn more about these structures from thousands of years ago. 'Ironically, the picture we have nowadays of Borġ in-Nadur is significantly more complete than other more well-known sites,' states Caruana.

Associate Professor Nicholas Vella (Department of Classics & Archaeology, University of Malta) has been researching the site throughout the years with his colleague Professor Davide Tanasi (University of South Florida, US). 'We were able to identify an earlier fortification wall, throw new light on the date and sequence of the hut remains, identify some of the rock-cut silos where dry food was stored, and present a comprehensive catalogue of the finds that had never been properly published.' Now they can be.

Archaeologists now have descriptions of all the pottery, stone objects, and animal bones, as well as land and marine molluscs that were retrieved. The research was able to place the Borġ in-Nadur site within context at both local and regional levels. 'In fact,' continues Vella, 'the

Maltese appear to have capitalised on their knowledge of seafaring in the Sicily-Malta channel and may have served as pilots for maritime traffic that connected the eastern and western halves of the Mediterranean.'

Future work on the Borġ in-Nadur site looks promising. Plans are in place to analyse two mounds of rock within the megalithic structure, which are not visible in the original excavation photographs and might be due to a more recent intervention. Once the mounds are dug up and the team is certain they can be removed, the site will be more legible, and the relationship with the surrounding environment better understood. This will also allow improvement on the understanding of the site and its place in Malta's history.

One of the pitfalls in archaeology is when the narrative of the site starts to change. 'The most important thing for us was not to create false narratives. It's a problem of dissociation: when the site's history is separated from reality,' said Caruana. With this in mind, the removal of modern accumulation

is paramount. Once the site is clear of debris, the possibility of academic reinterpretation can happen.

According to Stroud, this was the first phase in a three-stage plan. The works undertaken at Borġ in-Nadur confirmed that certain areas contained modern accretions. Through the fieldwork, the team identified conservation interventions. The next step forward will be to carry out these interventions and remove the modern additions from the area. She explains, 'Once modern additions are removed, you can start to see and experience the spaces a step closer to what was originally intended.'

Prying through the folds of time, the works taking place at Borġ in-Nadur offer glimpses of undiscovered knowledge and their place and relevance in our island's history. Providing a comparable example, Vella says: 'In archaeology, it's not the beauty of the pottery piece alone that is relevant, but the context within which it was found. That makes all the difference. History is written from context.' 



Author: **Andrew Firbank**

*Satellite observation helps us understand our environment down on the ground. From tracking ocean currents to studying sinkholes, the applications are endless as long as the technology can keep up. Andrew Firbank speaks with **Dr Ing. Reuben Farrugia** and **Dr Ing. Gianluca Valentino** (Faculty of ICT, University of Malta), who are making sure that it does.*

Step outside tonight, and look up at the sky. Our planet is part of a cosmic stage, stunning in its complexity. It's easy to picture our ancestors, long ago, appreciating the same scene. Only it wasn't. These days, you're more likely to spot a satellite flashing overhead than catch a shooting star.

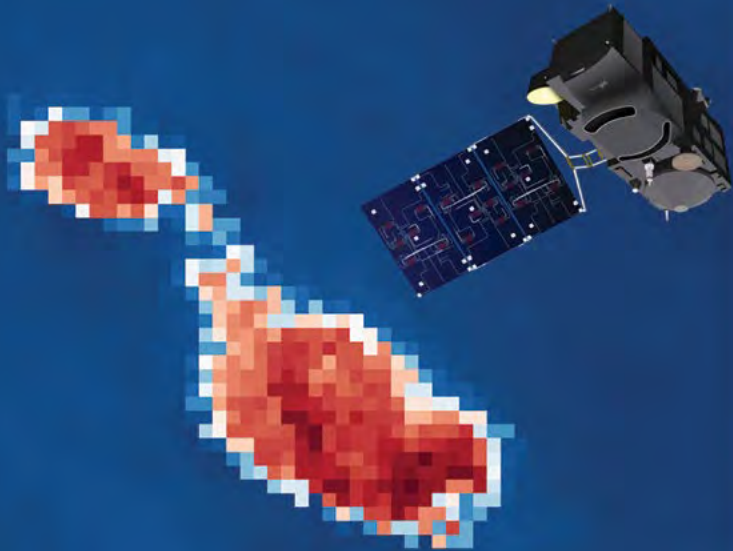
At some point in our journey, we graduated from looking up to looking down. This new field of science, Earth observation, uses satellites to study our planet's surface. Satellite remote sensors can detect surface temperatures, identify materials, and even spot different plant species. Every year, more satellites are launched to better track and map the world. But their image resolutions are still lacking. Back on the ground, researchers must perfect techniques to clarify their findings. If satellites are our eyes in the sky, then researchers are the opticians.

Here, Dr Ing. Reuben Farrugia and Dr Ing. Gianluca Valentino, together with their team at the Faculty of ICT, University of Malta, found their niche. It started when Malta announced its first ever National Space Policy in 2017. 'We immediately realised that we could apply our expertise to solve problems in satellite Earth observation,' recalls Farrugia during our remote call.

They are both younger than you'd expect, given what they've achieved. Amicable and sharp, they beam when we explore the countless applications of their work.

Their first Earth observation project, SAT-FIRE, sprung from a chat with Dr Anthony Galea (Faculty of Science, University of Malta). He was creating Maltese marine current forecasts to aid local divers, search and rescue teams, and coastal monitoring. To do so, he needed frequent sea surface temperature maps from satellite remote sensors, but the images he could source had a resolution too low for Malta's coastline. This was the first taste of a recurring problem in Maltese Earth observation. Most satellites can't provide a resolution high enough for a country this small. Luckily, Farrugia and Valentino were uniquely positioned to solve this issue.

'Our team's background is in computer vision, image processing, and machine learning,' explains Valentino. 'These are techniques to help exploit and obtain information from images.' With low-resolution data stunting Earth observation in Malta, they saw how useful their skills would be. 'I had worked with CCTV cameras to better identify faces,' Farrugia adds, 'I focused on de-noising images and increasing their resolution. There are lots of types of satellite sensors: radar, optical, thermal, etc., and we wanted to improve their resolution too.'



Satellites such as Sentinel 3 (left) orbit the Earth daily. That helps provide a frequent forecast, but what if they could also match the resolution of Satellite Landsat 8 (right)?

Farrugia and Valentino knew that if they could find one satellite capable of taking images precise enough for Malta, then they could use its data to enhance all the other low resolution satellites. For SAT-FIRE, the satellite they needed was Landsat 8. Orbiting our planet every 16 days, it was too infrequent for Galea's marine current forecasts. But that was overcome. A team of researchers led by Farrugia and Valentino created a neural network that learned to replicate Landsat 8's quality using daily low-resolution data from another satellite, Sentinel 3. This model was trained using hundreds of Landsat-8 and Sentinel-3 images, and now the neural network can improve resolutions by itself, producing exquisite images from dated data. Dr David Lloyd, a post-doc hired to work on the SAT-FIRE project, developed the deep learning model, while Aaron Abela worked on multi-resolution registration algorithms for his master's thesis. In the validation of the hydrodynamical model used for the marine current forecasts, Dr Galea was aided by Ms Ioanna Thoma, who also did a master's thesis on this topic.

Next came SATINET. For this project, our Maltese researchers teamed up with CNES, the French space agency, to map Earth's surface in 3D. Working with their colleague Prof. Johann Briffa, they designed an algorithm that could combine multiple images taken by a satellite into one 3D picture. 'You can capture a scene from two cameras at two different angles, where each camera is like an eye, and estimate the depth,' explains Farrugia. 'Satellites are the same. They take a picture

of the earth, move a bit, take another, move a bit more, take another, and so on. Each picture is like adding another eye.' They employed AI technology to eliminate any objects in motion, like cars or clouds, for a crisper image. The results are the highest accuracy 3D maps ever produced by a satellite. With this tech, CNES hopes to map 95% of the Earth's surface in 3D by 2025. The CNES collaboration also allowed master's student Tharen Abela to spend a 6-month internship at CESBIO, the Centre d'Etudes Spatiales de la Biosphere, to conduct research on forest cover mapping using satellite imagery.

Farrugia, Valentino, and Briffa are still breaking barriers in Earth observation research today. Their WARM-EO project, like its predecessor SAT-FIRE, is refining low resolution satellite data to map land surface temperatures in Malta. Evaporation cools down fields, so the team, which also includes post-doctoral researcher Dr Mang Chen, hopes to estimate agricultural water usage in Malta to aid conservation efforts. Meanwhile, the Coastal-SAGE project, led by the same team, is underway to monitor and predict landslides on the Maltese coast. Satellite radar sensors can map cliff-side structures and show where landslides are most likely to happen next, helping prevent catastrophes.

Although created with specific goals in mind, the scope for all of these projects is limited only by our creativity. Another possible application is using SAT-FIRE's temperature-tracking technology to spot illegal sewage dumping into the sea. You might not want to picture it, but sewage is noticeably warmer than seawater. ➔



Malta has an arid climate and limited land. WARM-EO will produce high resolution satellite temperature maps to help track water usage in Malta's fields.

Likewise, Coastal-SAGE has been designed to track landslides on Malta's coast, but the same technology could be used to respond to several natural disasters. Before long, it could help map how volcanoes change as they erupt, or changes in the Earth's surface following earthquakes. 'This has been done for 20 or 30 years,' Valentino clarifies, 'but the resolutions were much poorer back then. For large events, this was not such an issue, but for small events, you need better resolutions and less noise.' Their work produces the detail needed for localised events like sinkholes and ground fissures, and it will inevitably aid larger catastrophes too. This

would boost emergency response systems. Safe access routes to victims could be sourced with precision from satellites to better guide ground exploration.

Throughout their journey, our researchers have enhanced satellite data to account for Malta's tiny size. Larger countries make good use of low resolution satellite mapping, but the Maltese islands require something more refined. Once this resolution barrier is broken, then Malta can also shine a brighter light on the rest of the world. There are plenty of other small nations and regions in need of this technology. Farrugia and Valentino's team is stepping up to deliver. [T](#)



With the right tech, satellites can eliminate cloud cover and other moving objects, producing crisp pictures of the Earth's surface.

Project #1: SAT-FIRE | Remote sensor: Temperature

The spark: Dr Anthony Galea (Department of Geosciences) was creating Maltese marine current forecasts. For this, he needed satellite remote sensors to map the surface temperatures of seawater. He had access to data from two satellites:

	Sentinel 3	Landsat 8
Earth orbit frequency (<i>days</i>)	2 - 3	16
Image resolution (<i>per pixel</i>)	1Km	100m

For a timely forecast, you need satellites that orbit the Earth at a high frequency. Sentinel 3 seems ideal. But for a coastal region as small as Malta's, a resolution of 1km per pixel can't provide the detail needed. Sea would blur with land, distorting any results.

Neural networks: Valentino and Farrugia needed to create a model that used Landsat 8's high-resolution data to sharpen Sentinel 3's more frequent images. Here, Farrugia's background came into play. From his experience in super-resolution, he knew it was possible to train a neural network to match low- and high-resolution images. Every 16 days, the two satellites capture the same scene at the same time, allowing a dataset of low- and high-resolution image pairs to be built. With practice, the neural network learnt to transform the low-quality images into high-resolution ones. SAT-FIRE was the first project in which this technique was attempted on satellite sea surface temperature data, and the results were excellent.

Status: Complete.

Project #2: SATINET | Remote sensor: Optical

The spark: A trip to France. Valentino and Farrugia won a grant offered by CNES (Centre National d'Études Spatiales, the French space agency) and MCST (Malta Council of Science & Technology). Partly for networking and education, it was also to find a common goal in Earth observation. Arriving in Toulouse, the researchers discovered that CNES was hoping to map 90% of the Earth's surface in 3D by 2025. They offered to help.

A new dimension: Satellites can take multiple images of the Earth's surface in quick succession, like the 'burst' mode on a camera. CNES wanted software

that could combine these photographs into one 3D image. Luckily, Valentino, Farrugia, and their colleague Prof. Johann Briffa had experience working on this with traditional cameras. By capturing many images and weaving them together, a 3D map can be produced. Not as simple as it sounds – whilst the satellite travels, the Earth's surface isn't static. They employed deep learning and AI technology to create a programme that could eliminate any objects in motion, e.g. vehicles and clouds. The results are the most advanced 3D maps ever produced by a satellite, accurate to within $\pm 1m$ 74% of the time.

Status: Complete.



Project #3: WARM-EO | Remote sensor: Temperature

The spark: The Maltese Energy and Water Agency saw that NASA was using satellite remote temperature sensors to estimate water usage in US agriculture. Evaporation lowers temperature readings, so we can estimate the volume of water used in a given field or on a given crop. With Malta's arid climate and lack of fresh water, this knowledge would be invaluable for water conservation. Unfortunately, the resolution used by NASA's satellites is 500 m. That may work well in the sprawling plains of Nebraska, but here in Malta, you could probably fit 10 farms into an area that size — plus a handful of buildings and a motorway.

Ultra HD: Valentino, Farrugia, and Briffa found access to a satellite providing 10m resolution, but even that isn't precise enough for Malta's fields. They are now applying the same super-resolution technique they used for SAT-FIRE to see if they can achieve an even better image. To do this, they purchased a handful of images from a satellite capable of 3m resolution. If they can train a neural network to replicate that excellent resolution, then they could recreate it with the freely available 10m data. As well as lessening the project's financial burden, it would be a major step towards accessibility and affordability in Earth observation around the globe.

Status: On-going.

Project #4: Coastal-SAGE | Remote sensor: Radar

The spark: Slow-moving coastal landslides: a Maltese phenomenon. The Public Works Department within the Ministry for Transport, Infrastructure and Capital Projects deals with the damage from rockfall and landslides in Malta. These events help define our coastline, but they endanger lives as well as infrastructure. Right now, the best way to tackle them is to respond to disasters once they have occurred. Valentino, Farrugia, and Briffa are trying to help the Ministry to predict them, preventing any avoidable damage in the first place. Dr Sebastiano D'Amico and Emanuele Colica, geoscientists at the University of Malta, are helping them gather ground-truth data, such as Digital Elevation Models, using drones.

Landslides: Satellite remote sensors can shoot down radar waves. When these waves hit an object on the Earth's surface and bounce back, their characteristics (amplitude and phase) can reveal not only the placement of the object, but even what type of material it is. Successive measurements over time reveal information about changes, such as subsidence and uplifting, that occur to the Earth's surface. This can show which cliffs are eroding quickest in Malta by tracking their movement downhill. It can reveal which soil patches are weakening, and therefore which boulder lying precariously might start rolling next.

Status: On-going.



Dr Ing. Gianluca Valentino (far left) and Dr Ing. Reuben Farrugia (far right) with the SAT-FIRE team. They are helping many researchers to access quality satellite data.

All photos courtesy of Dr Ing. Gianluca Valentino

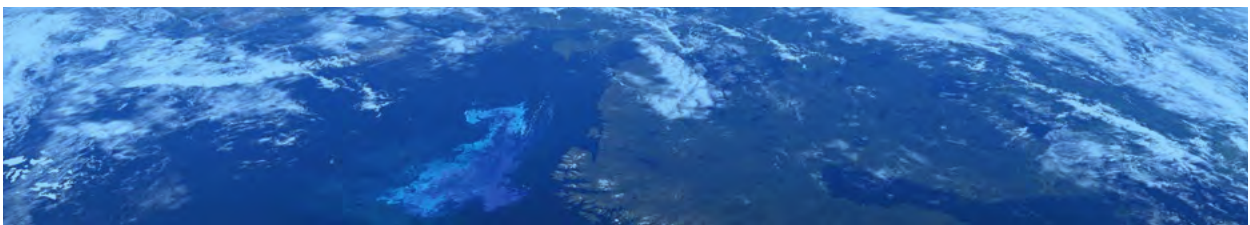
Acknowledgments

Project SAT-FIRE is financed by the Malta Council for Science and Technology, for and on behalf of the Foundation for Science and Technology, through the Space Research Fund.

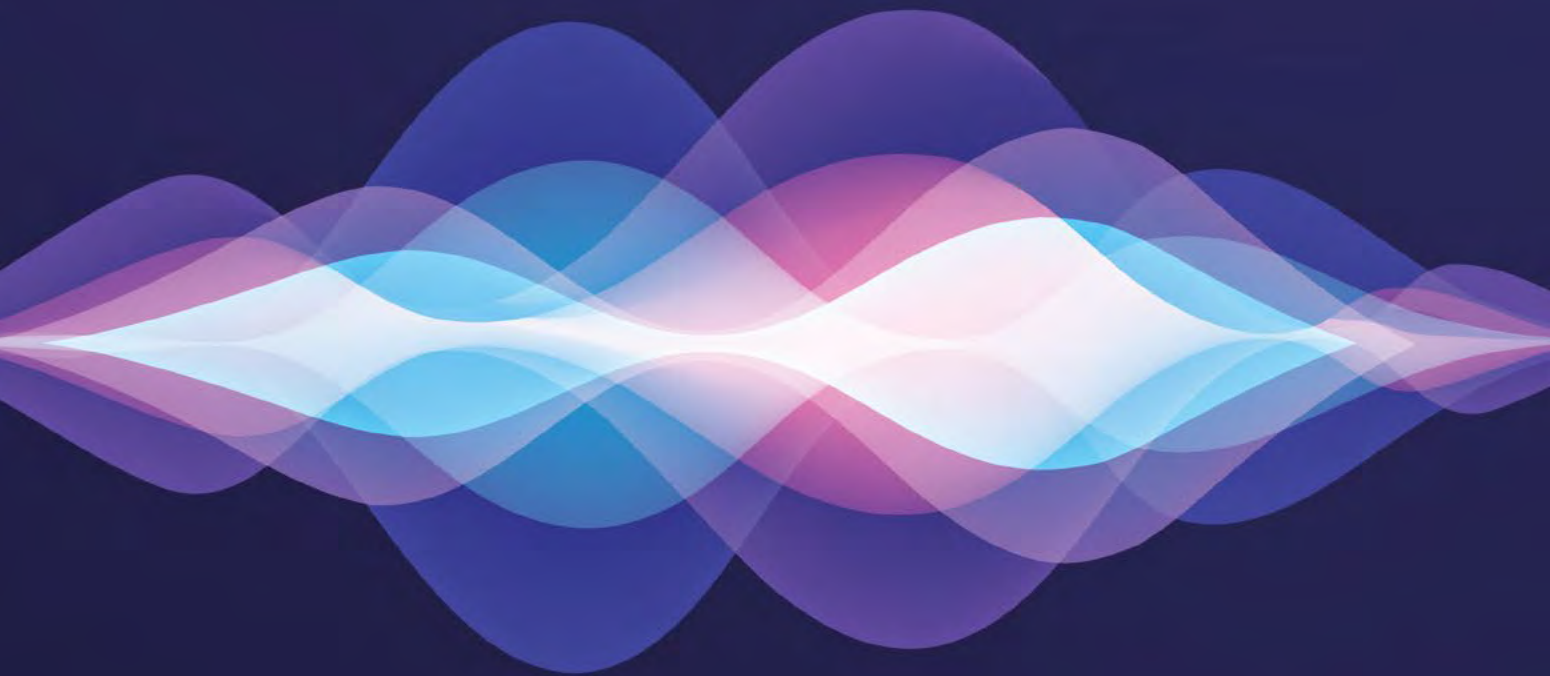
Project Coastal-SAGE is financed by the Malta Council for Science and Technology, for and on behalf of the Foundation for Science and Technology, through the Space Research Fund.

Project WARM-EO is financed by the Malta Council for Science and Technology, for and on behalf of the Foundation for Science and Technology, through the Space Research Fund.

Project SATINET is financed by the Malta Council of Science & Technology, for and on behalf of the Foundation for Science and Technology, through the MCST-CNES Space Bilateral Fund.



Virtual Assistants: 21st Century Towers of Babel?





Author: **Christian Keszthelyi**

*Virtual assistants, such as Alexa or Siri, are gaining popularity and becoming our new family members. But these technologies are often designed with English in mind. How can we teach our virtual assistants other languages, such as Maltese? **THINK**'s **Christian Keszthelyi** speaks with **Prof. Patrizia Paggio**, **Prof. Ray Fabri**, and **Prof. Albert Gatt** from the Institute of Linguistics and Language Technology (University of Malta) to find out more.*

As we mope around, bothered by the silence of our condo, we just need to say 'play music' and our handy virtual assistant should immediately boom our favourite tunes through the speakers.


In a fraction of a second, hundreds of signals blitz through the electric circuits of your virtual assistant when we command it to play music. 'We need to differentiate between two parts: the application functionality, such as being able to interact with iTunes, and the natural language processing parts, which are closely related and interdependent,' says Patrizia Paggio, Professor at the Institute of Linguistics and Language Technology at the University of Malta (LLT), as we are unpacking the underlying mechanism.

'When you say "play music", the same sound waves that hit your ear are the ones that hit your device's microphone. This continuous waveform is chopped up into portions that correspond to discrete sounds so they are

individually identified,' says Albert Gatt, Associate Professor at the LLT, going further into detail.

This is followed by a process of assembling the most likely sequence of words corresponding to the speech input, which eventually ends in the virtual assistant understanding the command. Understanding involves overcoming ambiguity, as variations in language use are always present. Gatt mentions Jimi Hendrix's famous line, 'Excuse me while I kiss the sky' that is often interpreted as 'Excuse me while I kiss this guy'. Such foul play always needs to be factored into the process.

In order for software to understand speech, systems need to be trained on large databases of spoken and written language, which allow the system to learn the relevant patterns in the sound and text they are exposed to. 'As the system is learning, it is trying to make increasingly abstract representations of the input – the sound in this case – in order to enable the mapping of this input to the output: the transcribed text in this scenario,' Gatt clarifies further. ▶



The idea is that such a model acquires a significant amount of linguistic knowledge, which can be exploited by 'fine-tuning' the model on other tasks, such as understanding commands.

Ongoing research is trying to explore how the transcription phase can be omitted and how to go directly from speech to recognition. These models are still being researched and need to be improved. Today's systems require a multi-stage process since they first transcribe the spoken input then carry out the order.

CONTEXT REIGNS

Besides recognition, the virtual assistant needs dialogue management. This enables it to respond to our linguistic cue, even if we have very limited exchanges. 'These systems can request clarifications or look things up for you. Therefore, they need to be enabled not just to map your speech commands via text to some action, but also, if necessary, they have to be able to produce an appropriate response, such as "What do you feel like listening to right now?"' Gatt says. That is the scope of pragmatics, the ability to behave appropriately when using language. Systems need to understand the context of the linguistic exchange, but it is not always easy.

'Things can get tricky here. The appropriate response depends on the expertise of the user: a child versus an adult, for example. Or, what happens if users fill the systems with inappropriate linguistic exclamations, and they learn to behave like that?' Gatt further explores the challenges. Inappropriate language, such as swearing, can get recorded in the digital fabric of the virtual assistant, and they may swear back at unwitting others.

Any form of artificial intelligence relies heavily on big data to build models with lots of parameters. 'At the moment, the idea is that the more data you have, the more likely you are to get a good system,' Gatt says, but there are issues with data quality.

SPEAKING MANY TONGUES

The English language has had the most significant developments for speech recognition software and virtual assistants. The approach cuts off anyone who does not speak English: around 6-7 billion people. The main bottleneck is having enough data to

teach virtual assistants new languages. English is the most used language on the Internet (although Mandarin Chinese is a very close competitor), so naturally, English is the most developed language. Data reigns supreme.

Solutions exist. Pre-training can make a system learn a new language faster. Current systems often rely on large, pre-trained language models, which can also be multilingual. These models are exposed to huge quantities of data from multilingual sources, such as Wikipedia. The idea is that such a model acquires a significant amount of linguistic knowledge, which can be exploited by 'fine-tuning' the model on other tasks, such as understanding commands. The same strategy has very recently started being used for speech recognition.

THE LOCAL CHALLENGE

How do we teach these virtual assistants to understand Maltese? A large dataset in the target language is needed. Gatt worked on the first automatic speech recognition system for the Maltese language



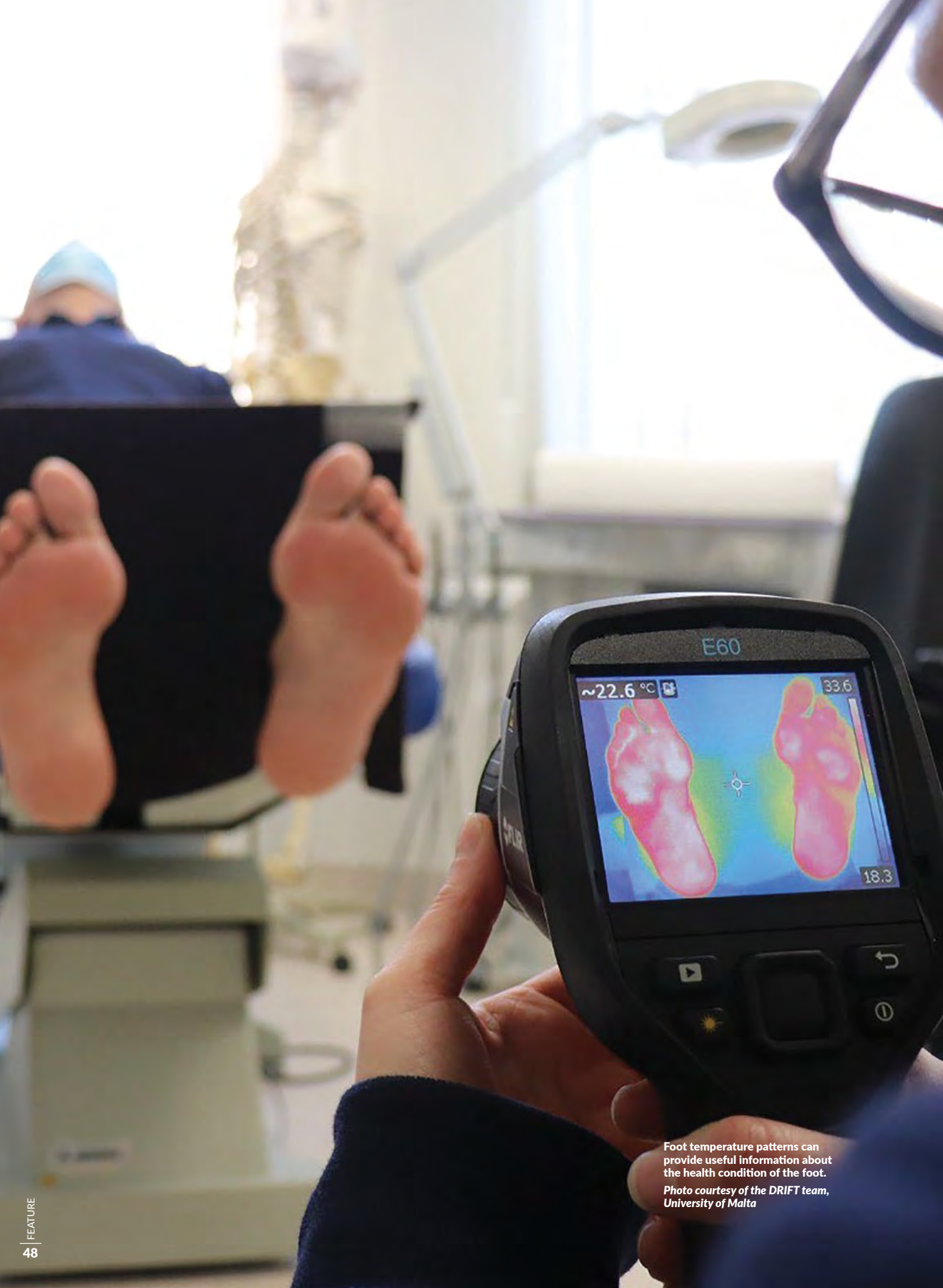
called MASRI (Maltese Automatic Speech Recognition). Now there are 90 hours of transcribed Maltese language data. 'With this data, we can create half-decent models that are good for experimental purposes but not for commercial use in devices,' Gatt explains. This can be complemented by pre-training and fine-tuning.

Some bumps exist down the road. 'Another problem is commercial interest. In Malta, the potential audience is not large enough to spark the curiosity of companies,' Paggio says.

The Internet of Things market is predicted to boom soon, fueled by worldwide 5G connectivity. With such a high level of connectedness, data input will exponentially grow, and virtual assistants, as well as their underlying ecosystems, may soon reach stellar levels of intelligence. As we are equipping devices with artificial intelligence, let's make sure that we hand over our best cognisance to these devices. While it is still open for debate whether we are born with preconceived ideas or not, artificial intelligence starts with a tabula rasa and will reproduce our knowledge and biases. **T**

The Institute of Linguistics and Language Technology at the University of Malta offers its students a B.A. in Linguistics and a B.Sc. in Human Language Technology, covering linguistics (how language works) and language technology (how language can be realised in computers). While the courses emphasise the importance of theory, students have the opportunity to engage in practical projects in small groups, as well as undertake industrial placements for the B.Sc. in order to apply their knowledge to real-world tasks.

Apart from undergraduate courses, the institute also offers M.A., M.Sc., and Ph.D. courses in both areas and is currently designing a new taught master's in the Language Sciences. Ray Fabri, chair of the institute, comments that studies carried out show that students who graduate from the institute find jobs and new opportunities on completion of their studies. Specifically, in the area of language technology, fields range from artificial intelligence to software design and development.



Foot temperature patterns can provide useful information about the health condition of the foot.
Photo courtesy of the DRIFT team, University of Malta

Smart insoles for diabetic patient monitoring

Local researchers from the DRIFT (Dense Recording of In-Shoe Foot Temperatures) project team are investigating foot health in patients with diabetes. In collaboration with Mater Dei Hospital, researchers are developing smart insoles, a system with embedded thermal sensors that measure foot temperatures. **THINK** got in touch with **Chiara Modestini**, podiatrist and researcher with DRIFT, to find out more.

The Covid-19 pandemic disrupted various outpatient and primary health care services locally. Health professionals were only able to attend to urgent cases, and only after a risk assessment was determined over the phone. Restrictive measures were implemented to curb the spread of the virus, and people were advised to remain indoors unless absolutely necessary. Fear and anxiety has kept many from setting foot in a hospital or clinic, even in an emergency situation. Combining this with back-logged appointments and health care professionals falling ill, the result is a strained healthcare system.

A NEW TYPE OF HEALTHCARE

Since the Covid-19 outbreak, novel approaches such as telemedicine and virtual consultations have been implemented locally. Telemedicine refers to the practice of caring for patients remotely through telephone or video chat. However, when virtual consultations are not sufficient, other approaches are needed.

Researchers at the University of Malta (UM) in collaboration with Mater Dei Hospital are currently developing smart insoles with embedded thermal sensors

that interact with the sole of the foot. The Dense Recording of In-Shoe Foot Temperatures (DRIFT) Project is led by Dr Stephen Mizzi (Department of Podiatry, UM), Dr Owen Falzon (Centre for Biomedical Cybernetics, UM), and Prof. Kevin Cassar (Department of Surgery, Mater Dei). Together with the rest of the team, they have developed insoles that are able to detect temperature changes in a patient's feet.

This information is provided in real time to both the user and clinician, allowing the clinician to monitor the patient's progress. The technology could overcome the challenging self-care practices diabetics need in their daily routine.

DRIFT AND DIABETES

Providing care for people living with diabetes is extremely crucial in these challenging times, especially when having foot-related complications places them in a high-risk category. When glucose levels are not controlled, complications may arise. For instance, damage to the foot's nerves and blood vessels would cause sensory loss and poor circulation. Of all the complications of diabetes, those involving the feet have normally required substantial face-to-face patient visits to healthcare clinics for screenings and treatments, such as checking circulation ➤



These smart insoles are able to provide wearers with peace of mind, knowing that even though they may not be able to access frequent physical podiatric healthcare, their podiatrist will still be able to monitor and intervene.

and nerve status and treating ulcers. If the patient is not checked by a medical professional or themselves, then major foot complications such as ulcers and limb loss can occur.

In September 2019 the DRIFT project team ran a survey on 300 diabetic patients. The study found that 37% of diabetic patients visit a podiatrist approximately six times a year or more. These numbers have dropped significantly over the last few months due to the global pandemic. Low visitation numbers are problematic since only 48% of patients living with diabetes check their feet every day, 55% do not check their feet after performing physical exercise, and 52% are not aware of skin injuries during exercise. Patients need a way to check their feet.

Non-ulcer diabetics (diabetics that do not have ulcerations in their feet) benefit from walking. It helps to better control glucose levels and improves blood flow to the feet. However, exercise can also harm diabetic patients. During walking, friction between the sole of the foot and the inside of the shoe may pose a major threat on the lower limbs, especially in diabetics with poor circulation or loss of sensation, as they are more susceptible to skin breakdown and ulceration. This is where the smart insoles truly shine.

BRIDGING THE GAP BETWEEN SELF-CARE AND HEALTH CARE

The smart insoles being developed can be used at all times during daily activities. These smart insoles are able to provide wearers with peace of mind, knowing that even though they may not be able to access frequent physical podiatric

healthcare, their podiatrist will still be able to monitor and intervene. Patients will be able to exercise safely as advised by their health care professionals, knowing that if at any point they are in danger, they will be alerted through an app on their phone, helping them to immediately stop their ongoing activity.

The smart insoles should transform diabetes patients' lives. It helps clinics devise better care to prevent injury and reduce the number of ulcerations and amputations. Most importantly, it will eliminate fear from the equation and allow patients to feel safe — so important in these times. This novel approach will bring a paradigm shift in diabetic foot care, bridging self-care and health care. **T**

Chiara Modestini is a podiatrist and researcher forming part of the DRIFT project, together with Tiziana Mifsud. The project is funded by the Malta Council for Science & Technology (MCST), for and on behalf of the Foundation for Science and Technology, through the Fusion: R&I Technology Development Programme.

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Implementation of EU Law in Malta

Author: John Crossan


*Upon accession into the European Union (EU), Malta vowed to incorporate the entire body of European Union law (known as the *acquis*) into its legal system. It has been one of the fastest member states to do so, but has it been done properly? **THINK** magazine interviews **Dr Jelena Agranovska** and **Dr Ivan Sammut** (Faculty of Laws, University of Malta).*

It is sad how EU legislation is seen as a foreign interference, especially after 17 years of membership,' laments European and Comparative Law lecturer Dr Jelena Agranovska (Faculty of Laws, University of Malta). Malta joined the EU 17 years ago and agreed to implement EU legislation, mostly as directives (goals set by the European Union which member states must achieve). These laws effectively override national law. This principle, known as primacy, states that if EU law and national law conflict, EU law wins. All nations wishing to be part of the Union must accept this or walk away.

Making rules for 27 different legal systems isn't easy, especially 27 systems that have evolved over decades or, in some cases, centuries. Member states vary widely in their legal traditions, and what works in one country doesn't necessarily work in another. But how do you create laws that work in Germany, Finland, and Malta? Laws cannot simply be 'plugged' into a different nation. In order for EU law to work in all member states, this law needs to reign supreme, otherwise, loopholes emerge. *The Implementation and Enforcement of European Union Law in Small Member*

States, A Case Study of Malta, aims to increase the transparency and understanding of this complex legal order and codify some of the complicated dynamics that emerge when Maltese law comes into contact with that of the EU.

In great detail, the book attempts to highlight how some laws have essentially been 'copied and pasted over their original placeholders with the goal of satisfying the European Commission rather than any local legal tradition,' as Dr Ivan Sammut (Department of European and Comparative Law, University of Malta) comments. This has been partly the result of the limited resources of the Maltese legislative branch: Parliament. On 20 February, Agranovska and Sammut's book became the first publication on European Union Law in Malta since the country's accession. 'There's nothing written on Maltese and EU law with an international audience in mind,' explains Sammut when talking about why they wrote the book. The book aims to shine a light on 'Malta as a model system for smaller member states to transpose legislation into domestic law' and could guide other nations like Montenegro, who are trying to join the EU in the coming years. ➔



Malta's legal system combines elements of both civil and common law systems, forming a 'hybrid' structure. Hybrid systems or 'mixed jurisdictions' are found throughout the world.

HISTORY OF MALTESE LAW

With tightly knit connections to continental Europe, the Maltese Civil Code was heavily influenced, along with most European countries, by Roman civil law and carries many of the legal traditions that are still present today. The dominance of Roman civil law in the EU can be attributed to the legal traditions of its six founding members: France, Germany, Italy, Belgium, the Netherlands, and Luxembourg, known then as the European Coal and Steel Community.

Malta was also influenced by the British legal system after they arrived on the Islands in 1800. Unlike most European states, the UK has its own distinctly unique set of rules known as common law, which places importance on precedent and takes into account what decisions have been made in the past, unlike Roman civil law, which, instead places importance on the written word of the law. Having been colonised by the UK for 150 years, Malta assimilated some of Britain's legal traditions.

Malta's legal system combines elements of both civil and common law systems, forming a 'hybrid' structure. Hybrid systems or 'mixed jurisdictions' are found throughout the world. Former British colonies, like South Africa and Cyprus, often have this relatively rare blend of common law and civil law. After joining the EU in 2004, Malta began implementing EU law into national law, turning Malta

into 'a microcosm of hybrid legal traditions, much like in Cyprus,' says Sammut. 'They are both hybrid systems with nothing in common, other than being hybrid systems.'

A COMPLICATED SIZE

'Size doesn't matter...' explains Sammut, '...when it comes to transposing EU law into national law.' Due to its small size, Malta does not have the resources of bigger countries to go through EU legislation with a fine-toothed comb. Instead, directives sent by the EU are 'copied and pasted into national legislation without much thought about how the directive is assimilated into the national legal order'. This can cause problems when national law and proposed directives cannot exist together without much scrutiny, legal costs, and investment of time and resources, of which Malta has relatively few.

Size is a double-edged sword. 'It is easier to transpose the law [due to its small size and centralised government], but on the other hand, the quality of the transposition may affect Malta's populace in the future when it comes to effective implementation and enforcement,' explains Agranovska. 'The lack of negotiation, brainstorming, deliberation, and debate that may be present in bigger countries such as Germany may be missing in Malta, affecting the quality of the transposition of laws.' This may also affect the time in which directives are implemented. In recent cases, Malta has been issued



Dr Jelena Agranovska
Photo by James Moffett



Dr Ivan Sammut
Photo by James Moffett

formal warnings about not fully implementing directives, such as the EU drinking water directive and more recently, the directive on victim's rights. In the long run, Malta's citizens could suffer and lag behind the rest of Europe.

Laws designed to protect citizens can harm them. This has been shown with the potential minimum wage legislation proposed by the EU Commission as reported by MaltaToday in March 2021. The Commission suggested a 'mandatory threshold of decency' which would mean tying the minimum wage in Malta to average minimum wages across the EU. Malta's minimum wage could suddenly double or triple, leading to unemployment and inflation. Discussions are needed to implement directives simultaneously in each state while taking into account a state's unique conditions.

GOING FORWARD

Over half of Malta's population approve of the EU, the highest percentage in Europe according to a recent study by the European Commission. In 2018, 93% of the population of Malta felt that they benefited from the European Union. As previously stated, not all directives sent by the EU have been implemented correctly – and some not at all; however, Malta is still mostly in line with its commitments. This has been a great success story according to Agranovska and Sammut's study. Asked about the potential of the book, Agranovska hopes that 'it will

give birth to more quantitative research being done in particular areas to see how EU law is implemented in reality, as there are areas of law that have not been explored, such as environmental law, as an example of poor compliance'.

The Faculty of Laws is working on another volume on the EU Internal Market. Sammut and Agranovska are also working on the Jean Monnet Project, which explores how the migrant crisis affects the future of the integration process by examining the transit and destination countries within the free trade area. **T**

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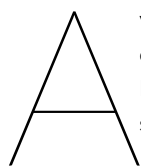
IDEA



Hibernating Humans

Author: Christian Keszthelyi

*As lockdowns spread worldwide and grounded planes crippled international tourism, humanity cut the environment some long-awaited slack. With the climate change debate heating up (proportionally to the planet's temperatures), **THINK** investigates what would happen if humanity's only chance to preserve our planet is a yearly 3-month lockdown?*



year ago, being advised against leaving our homes would have sounded surreal. Restricting socialisation would have sounded outright dystopian.

When the coronavirus pandemic started its spread in 2020, we quickly learnt that humanity, with the exception of a noisy minority in denial, can instantly make drastic changes to habits and behaviour. Lockdowns kicked in, transport ebbed, and the planet breathed.

Scientists found that during the spring of 2020, the human carbon footprint in the Northern Hemisphere softened to a level not seen in decades. The reason? Pandemic restrictions were the strictest ever.

Despite all the gain, the researchers warned that there may be a trade-off.

NORMALISING THE EXTREME

The restrictions that jolted change in our behaviour arrived gradually. Wearing masks, sanitising hands, keeping social distance, and converting handshakes into awkward elbow bumps have become commonplace.

'The behaviour is changing, and that is the process of normalisation,' philosophy researcher Francois Zammit tells **THINK**. He pinpoints that the coronavirus pandemic has created an interesting social experiment. 'These aspects and behaviours that we exhibit today, in normal circumstances would seem extreme or radical.

[...] From the coronavirus experience we can extract a social consideration: how long does it take to normalise a behaviour which was considered abnormal or extreme?'

Quite quickly it turns out. These 'abnormal' behaviours became normal in less than a year, even if various cultures have reacted differently to the coronavirus pandemic. In Malta, it is fair to say that we have lost physical contact. Large gatherings such as family reunions have become rarer. Maltese residents overall have approached Covid-19 restrictions in a very disciplined manner, which Zammit says roots from a culture that is fearful of crises. This has been boosted by factors such as different leaders and social institutions sending the same message, the Maltese tendency of closely following the instructions of the leaders of their identity groups like political leaders, as well as the society being small and tightly knit, where leaders and decision makers are close to citizens.

How would the social contract change, however, if this lockdown recurred annually to help the environment?

'When we talk about the social contract, we mean that people follow unwritten rules and norms so that you can live in a society and community. It is always present between human beings,' Zammit says.

Instating an annual lockdown would include another element to the social contract: the environment. It is an element that is not directly there today. 'In western society, the idea is that humans control the environment. >



Francois Zammit
Photo by James Moffett



Dr Marie Briguglio
Photo by James Moffett

Whereas in this hypothetical situation, it would mean that humans cannot control the environment.'

For this scenario to work, governments, businesses, and economies would need to unite and order a worldwide lockdown. We would need a global initiative. If there were a single country that said no to this lockdown, it would attract people over, gaining economic advantage. How would our economies need to change?

SEASONALITY TO HELP PLANNING

Covid brought an abrupt change to globalisation. It made us realise how vulnerable our supply chain is, and how the international free flow of goods and services, a mechanism that we take for granted, can be disrupted. While economies were shaken by the coronavirus pandemic's unexpected nature, a planned annual lockdown would pan out differently.

'When anything becomes predictable, like a recurring lockdown, it could create similar behavioural patterns as other seasonal issues. The economy would

plan around that. Businesses would start to encourage staff to take their leave around the time of the lockdown so they would not lose productive hours,' senior lecturer Dr Marie Briguglio (Department of Economics, FEMA, University of Malta), tells **THINK**. The shock factor would soften, say compared to the coronavirus outbreak, as it would now be a predictable lockdown. 'It could even become a normal part of the business calendar.'

Briguglio compares the hypothetical scenario to a low tourism season. A drop in temperature in winter leads to a drop in tourists. 'The industry forecasts that there will not be much traffic in January and February, for instance, and that tourism would pick up after,' she says.


Certain practices may bleed out of the lock down period. For example, working from home may become a preferred option even if we do not have to worry about contracting the coronavirus. Briguglio says she expects that working from home will remain viable with businesses partially opting for it. She admits that employees need to meet physically, but a home office scenario

could be better for deep working (tasks that require concentration and minimal distractions). Office spaces may need redesigning to add more community spaces for team working. Working hubs would encourage these interactions, with people able to work in groups without being tied to a particular office.

'Even though working from home may become a norm, it is unlikely that it will take place 100% of the time. It is more likely that it will be a hybrid. [...] There have been too many benefits to working from home, I doubt the pre-Covid working model will come back fully.'

Nevertheless, she notes that a lockdown may not automatically leave the environment better off. Granted, changes in transport caused pollution to drop. But working from home also consumes electricity, water, and other resources, which can harm the environment.

Another problem is competition. Unless the recurring lockdown takes place all over the world at the same time, lockdown countries could lose their competitive advantage. 'The



We have yet to see whether humanity has learnt its lesson from this extraordinary scenario. There are changes that will only fossilise in the long run.

effects on globalisation would depend on whether it is unilateral or happens everywhere. If it is all countries doing the same thing, nothing changes. It is a constraint on the free market, but it creates room for other activities such as postal orders and deliveries,' she adds. Some elements of globalisation would be suppressed, but if all countries do it and the lockdown becomes predictable, economies would be able to plan and prepare accordingly.

The unexpected shock of Covid-19 has pushed economies into a severe slump. But there is a silver lining, and the economist is optimistic about the future. 'As the vaccine starts winning over viral spread, unless something else goes wrong such as pandemics becoming the new normal, we should start to see economic recovery by this year,' Briguglio says.

THE FUTURE IS BRIGHT

We have yet to see whether humanity has learnt its lesson from this extraordinary scenario. There are changes that will only fossilise in the long run.

The pandemic has made one thing certain: We need more public spaces. 'Households are smaller than in previous years. People are more likely to live in apartments with no garden. They need public spaces. However, they have been privatised and taken over by businesses. The building spree in Malta has left people feeling like there is no space,' Zammit says. He believes that policy needs to change for the betterment of mental health and people's happiness.

Once vaccination reaches herd immunity, normality should return, yet we may never go back where we were. 'I do not think we will go back to 100% normal as it used to be before the pandemic. Especially for children and teenagers, I am afraid, their lives have been affected,' Zammit says. 'We are in a paradoxical situation. Earlier, we would need to restrict children's screen time. Suddenly, screen time has grown exponentially, as children are being educated remotely.'

Remote learning may lead to youth being less able to socialise face to face. Some young people may be worse off because of missing out on their

education due to lack of resources or support. Not everyone can afford a laptop for every child. In a decade from now, it is highly possible that we will be talking about them as the Covid Generation, and they will have their own characteristics and behaviours, similarly to Baby Boomers or Millennials.

Would a pre-planned, yearly lockdown address climate change? Probably not. The implications it would have on the economy, the way we work, and the social contract are far-reaching. But it does show us how intimately we need to consider the environment. Without it, our health, work, and well-being all suffer. Without significant improvements, the lessons we could have learnt from Covid will be lost. **T**

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START UP



Sniffing out pollution at sea

Author: **Antónia Ribeiro**

The maritime industry is one of the largest producers of greenhouse gas emissions. While newly introduced legislation helps control this hazard, it has significantly increased the burden for Port State and environmental authorities.

Antónia Ribeiro interviews **Nicky Borg**, the founder of local start-up *Marine Hound*, to discover how their original smart buoys can help solve the problem.

It is Monday morning. You sit at your desk, going through your tasks, working towards someone else's dream. For some of us, this is ideal.

Either because our dreams align with the boss' or because our life goals are detached from our work life, we are happy to work towards someone else's goals. But for Nicky Borg, the founder of *Marine Hound*, it wasn't good enough. Dreaming of a project of his own, Nicky waited for the right moment to start his own adventure. When COVID-19 hit, he saw the perfect opportunity.

For Nicky, his new project needed to involve three things: managing a team, working towards innovation, and business development. He found the perfect match when a previous

client, Ismo Kauppinen (founder and CEO of *Gasera Ltd*), presented him with a challenge he couldn't refuse: a project still in the womb that would need a holistic approach. It included everything Nicky was looking for, and it offered an extra topping: working on a project from its creation, building something from the ground up.

All the way in Finland, *Gasera* had been focusing on a novel technology: a set of sensors capable of measuring gas emissions with lab-grade accuracy and high sensitivity. Nicky's job was to add a new dimension to the technology, adapting it to a new, profitable context. As Nicky figured out, this technology could become really handy in the maritime industry.



ANSWERING EMERGING NEEDS

In 2020 a new legislation from the International Maritime Organization (IMO) came into action. As Nicky explains, 'IMO2020 MARPOL Annex VI obliges Port State Authorities to monitor, report, and enforce illegal shipping emissions'. When burned, shipping fuel produces nefarious gases; Carbon Dioxide (CO₂), Sulphur Oxides (SO_x) and Nitrogen Oxides (NO_x). These gases aggravate global warming, contribute to acid rain, and deteriorate air quality, affecting people's health. For example, both SO_x and NO_x are linked to an increase in pulmonary, respiratory, and

cardiovascular diseases. The situation is particularly worrisome in cities with an economy dependent on big ports, such as the Harbour Area in Malta.


The law mandates that fuel's sulphur content must be lower than 0.5% or, in some cases, 0.1%. Determining which boats are abiding by the rules can be quite a burden for Port State Authorities, and testing every single boat that arrives in a given day is both time consuming and expensive.

Marine Hound's sensor-based technology aids authorities in determining which boats should be tested for sulphur content. 'Our system is similar to the trained dog used by police officers to sniff for narcotics or explosives in a

busy airport', Nicky explains. By 'sniffing out' excess gas emissions, it allows authorities to concentrate their search to specific boats.

MORE THAN THE SUM OF ITS PARTS

So Nicky figured out where to apply the sensor, but he now faced a new challenge: how to adapt the technology to real-life necessities. Even more consequential, he needed to figure out how to make it stand out in the market.

Consider this: boats burn fuel when off at sea. If the sensor is to detect unlawful gas emissions, it needs to be in similar locations. Basically, it needs to float. Due to its 

Just like a sniffing dog at the airport, Marine Hound's technology detects an area with high emissions and identifies the ships inside that area.

small size and low power consumption, the sensor can be incorporated in buoys and happily float around in international waters, harbours, or shipways. Easily chargeable, the sensor can stay at sea for long periods of time. Solar panels are enough to recharge the battery any time it's needed.

The buoys have another amazing feature: by connecting to the internet, they can triangulate a ship's general location through weather and ship location data. If a vessel burning too



Nicky Borg
Photo by Sarah Zammit

much sulphur is detected, the authorities will know in real-time the emission levels and the boats in the signalled area.

Just like a sniffing dog at the airport, Marine Hound's technology detects an area with high emissions and identifies the ships inside that area. It is then up to the Port State Authorities to determine the individual boat responsible for the CO₂, SO_x, and NO_x emissions.

The icing on this cake is the choice of materials for the buoys. Nicky wants to use recyclable materials to make the technology as green as possible without increasing the price. The ultimate goal is to create a low-cost, green technology with high benefits.

Manufacturing on a small island with space issues is complicated. As the supplier, Ismo's company in Finland will continue to manufacture the sensors. In Malta, the sensors will be integrated into a larger system and installed on the smart buoys.

The project meets a real and urgent need in a highly lucrative market. It's already won the Maritime Seed Award (MarSA) from the National Government Budget and the University of Malta. The fund, disbursed by Transport Malta, helps promising ideas become commercial.

The award helped this business to start up and test out ideas. Raising the capital from private investors can be an arduous task, and the fund allowed Nicky to focus on the business.

NEXT STEPS

Marine Hound has gone through its ideation phase. They identified the needs of the market and applied their technology to solve them. Now it is time to tackle the nits and grits of the business world.



Nicky is looking for investors and, more importantly, connections. The smart buoy answers a current need of the market – the legislation came out only a year ago, after all. The quicker they can commercialise, the larger the market share they can obtain. But the maritime industry lives out of connections, and acquiring customers can be hard without them. Word of mouth is one of the main ways trustful connections are built. Marine Hound is looking to partner with companies already collaborating with the maritime industry to help build these trusting relationships and scale up faster.

If everything goes according to plan, Nicky would expect to be servicing over 30% of the market in the next five years. He admits this is highly ambitious, but it's not impossible. Nicky's strategy is to acquire more people for his team – a collaborative effort between people with different expertise would accelerate the whole process.

TIPS ON HOW TO KEEP AFLOAT

This is a valuable lesson Nicky took from venturing into start-ups: know when to ask for help. 'You get a lot of doubts. Am I thinking the right way? Is my strategy good?' he says. Consulting with the right people, with proper experience and knowledge, is fundamental at every step of the project. Besides professors at the University of Malta and potential customers (such as Transport Malta), Nicky also consults with suppliers, maritime experts, and companies that already provide digital services to the maritime industry.

How to know if you are getting solid advice? Firstly, listen to experts in the field. Their specialised knowledge can be invaluable. Secondly, talk to people who are approachable, willing to help, and recommended by others. Finally, you'll want to find people who suggest solutions.

Surrounding yourself with these kinds of people allows for an enriching experience, both for you and your start-up.

With other start-up projects in his past, Nicky's experience has left him with a lot of good advice. As an engineer, technology dominated his life. Fascinated by the potential of a certain project, he would try to push it to the market without realising a key factor: just because his creation answered a personal need didn't mean it would solve other people's problems. As he puts it: to start a business, you need to study the market and consider its needs. You need to solve its problems better than your competitors. The technology is secondary.

A Master's in Knowledge-based Entrepreneurship, delivered by the Centre for Entrepreneurship and Business Incubation, offered Nicky the skills and mentorship he needed to be able to venture into the deep waters of the business world. Receiving the feedback and tools from the program helped him develop the confidence needed to start his own enterprise.

Marine Hound still has some miles to swim. Acquiring investors and building lasting partnerships takes time, and the technology is a current necessity. Yet, by applying an innovative technology to such a particular market, the start-up shows why transferring knowledge from lab to life is key for society. Although a business isn't always smooth sailing, Marine Hound has a worthy goal to keep it afloat. **T**

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LAB TO LIFE



Charging into the fast lane!

Author: **Sam Shingles**

Road transportation makes up to 20% of all global emissions. Electric cars are one of the many ways we can help the environment. But there are a few features that electric cars are lacking. **THINK**'s gets in touch with **Dr Robert Camilleri** (Institute of Aerospace Technologies, University of Malta) to find out how they plan to lead the way!

In this busy world, the human race is constantly on the go, and technology has had to keep up! Items like our phones and laptops are constantly being used, from work to entertainment purposes. Research has had to develop batteries that can keep up with this 24/7 lifestyle. In today's world, some of the latest phones on the market can be charged halfway in just 30 minutes. But what about larger electrical devices, say, electric vehicles?

Typically it takes around 8-14 hours to fully charge an electrical vehicle, possibly longer for larger cars. As much as we all want to do our bit to tackle climate change, this charge time is a drawback, especially when compared to the few minutes it takes to fully fuel a petrol car.

However, this might be about to change. To find out more, we sat down and talked about all things battery with Dr Robert Camilleri,

lecturer within the Institute of Aerospace Technologies (University of Malta) and the principal investigator on the NEVAC (Novel Evaporative Cooled Technology) research project.

HOW DOES FAST CHARGING WORK?

Before we can understand how fast charging works, we need to see how batteries function. A battery is a device that stores energy in chemical form and converts it into electrical energy. There are two ends, each made of different metals: the anode and the cathode. In between these two points is a chemical called the electrolyte that allows electrons to flow through a separator and generate electricity when the battery is attached to a device.

Secondary batteries, such as lithium-ion batteries, can do this process reversibly; i.e. their chemical reactions can be reversed by applying ▶

an electrical current to the cell. This regenerates the original chemical reactions so they can be used, recharged, and used again multiple times. However the charging process is associated with a speed (or rate) at which the battery cell can do this process safely. Fast charging requires that a higher current is pushed into the battery cell, thus making the reaction faster (hence fast charging). Since this conversion is not 100% efficient, charging often generates heat. Therefore, one of the major limitations of fast charging is thermal management of the battery.

As Camilleri explains, 'when batteries have a high current pushed through them, they generate a significant amount of heat. If this is not dissipated, the battery temperature increases. Beyond a certain temperature threshold, there is a risk of batteries experiencing what is known as *thermal runaway*.' Thermal runaway is when the batteries experience a chain reaction in which more energy is released. This causes the electrolyte to break down into flammable gasses, which eventually catch fire or explode.

SWEATING THOSE BATTERIES

NEVAC uses *evaporative cooling* as the thermal management system. This cooling system uses the concept that every liquid has a unique boiling point, and once this temperature is reached, the liquid turns into gas. The process of turning the liquid into gas requires a lot of heat and energy. NEVAC takes advantage of this principle, making it able to absorb a large amount of heat, which prevents the battery cells from overheating.

The system is designed so the electric batteries sit in a pool of dielectric liquid (one that is safe for electronics) that boils at 35°, the comfort temperature for lithium-ion batteries. When the batteries have a high current passed through them, they heat up. The heat is absorbed by the liquid, causing it to reach its boiling point and evaporate into gas, effectively transporting the heat away from the batteries. The battery system is sealed to prevent loss of the coolant in its liquid or gaseous state. The gas is then condensed back into its liquid form, ensuring that the system is self-sustaining.

NEVAC has two advantages, Camilleri says: 'One: we are able to extract a lot of heat when a high current is pushed through the battery. This enables the possibility of fast charging without suffering from battery overheating, and two: the liquid always boils at the same temperature, therefore despite the battery being made



Dr Robert Camilleri
Photo by James Moffett

of thousands of cells, they will all be maintained at the same temperature. Keeping the gas within the system was very important and was easier said than done!

Camilleri and his team have proved that with the NEVAC design batteries can stay cool whilst fast charging. The team has demonstrated that the system prevents thermal runaway. ABERTAX, a manufacturer for advanced battery accessories and project partner, have developed a technology demonstrator for independent review in Germany. The team are now in the process of patenting key features of the technology and hope that they can attract the interest of car manufacturers. The key question is, will we be seeing this tech in commercial electric vehicles soon? Camilleri is optimistic, 'I'm very hopeful. We've just concluded the NEVAC project (3 years!). We have successfully proved the concept and built a technology demonstrator. The results are very promising. I believe there is a real opportunity to maximise on the findings made. The dream is for this to be in a Tesla car one day!'

NEVAC (R&I-2016-002-V) is financed by the Malta Council for Science & Technology, for and on behalf of the Foundation for Science and Technology through the FUSION: R&I Technology Development Programme.



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FICTION

WHITER THAN THE DEVIL

Written by
Melissa Mawdsley

The voices in my head tell me that I'm a bad person. They tell me I've done bad things. Bad things to good people. They say I'm stupid and crazy. That I'm not good enough to be outside with the rest of the world. Well... they may be right. I don't know what I'm doing and I don't know what I'm saying. But I'm bad. I know that. They told me. The voices. They told me I'm bad, so I know I'm bad. I need to get them out. Just make them go away. The voices. They drive me insane. Always talking, talking, talking. They make me SCREAM!

I've been in this cage for too long. This cage of steel and concrete and wood and rust. It's all rust. It's been rusting for years now, just like me. I've been rusting for years too. The voices have made me rust. They've made me doubt myself. I think that I'm crazy. But it's just the voices. But I'm the voices. Am I the voices? Are the voices me? Do they control me, or do I control them? No, I don't control them. They control them. The bad men. The ones who wear white. White is the devil's colour. They're worse than the devil. At least the devil wouldn't lock me in here and beat me over and over and over again. That's what they do. They've locked me in my own mind. And now I'll never escape.

'Escape. I'll never escape. How can I escape my own mind? I know! I know! No you don't. Yes I do. I'll eat myself from the inside then there won't be any of me left. That's stupid. No it's not. Yes it is. You're right. My mind is eating me up already. Bye, liver. Bye, spine. Bye, lungs. Bye, heart. Bye, mind. They say I'm dangerous. The white-clothed men. That's why I'm in here. Who am I dangerous to? Myself? You? Them? Well, maybe. But maybe not.

'I know they watch me. They watch me constantly. On their screens in their safety rooms. What do I have in my room? A disgusting old mattress. A toilet that hasn't been cleaned for years. A camera. Look at me, camera. I'm talking to you. To the bad people who watch me – listen here. I will spit on your graves and watch you burn in hell. I will beat you and lock you up as you've done to me. I will cut you up and eat you, bit by bit. You hear me? I'll do it. I'LL DO IT. I'LL DO IT. I'LL DO IT!

'They're outside my door. The white men. I can hear them. Talking about me. I'll do it this time. I will. I'll fight back. I've sharpened my nails. Look. I'll scratch their eyes out. I'll do it. Shhh, they're coming.

'GO TO HELL! NO NO NO. DON'T TAKE ME AWAY. DON'T TAKE ME. I HATE YOU. JUST KILL ME—'

With that, the screen blackened. Their eyes were frozen to the bulky screen, which had darkened completely in an instant.

'Woah,' said Tommy with astonishment.

Aly didn't reply. She couldn't. Her mouth was taped shut; physically, she couldn't utter a sound. After a pregnant pause, Tommy turned his flashlight towards Aly to make sure she was still there. Apart from her pupils quickly constricting in an effort to protect her eyes from the blinding light, her whole body was frozen.

'Alyyyyy, hellooooo,' Tommy whispered while shaking Aly's arm from side to side. As if a trance had suddenly been broken – or akin to how the young girl was awoken from her sleep at the touch of her lover's lips on hers – Aly, in a much less elegant way, jerked out of her own enchantment.



'Yeah, creepy,' she murmured.

Walking down the half-broken steps leading to the deserted front yard, Aly looked down at the tape in her hand, fondling it. The moonlight allowed her to see its scars, and she wondered how, after all these years, it still played.

'Als, look,' the voice from behind her breathed. She turned around and was immediately attracted to the light coming from Tommy's phone. As she peered in, he began reciting, 'The Concetta Ramos Hospital for the Criminally Insane in Oregon shut down in 1953, after rumours of severe patient abuse led to the suicide of owner James Acosta'

He took a slight pause for dramatic effect and looked up at the moulding walls, which were full of profane graffiti. He moved closer to examine the façade and noticed what looked like the leftovers of a sign barely hanging on, connecting the remaining letters with those that were stolen by the winds and shifty kids with ladders, to complete the name of the institution that he was currently reading about on Wikipedia.

'The institution was said to lock patients up in enclosed rooms, and nurses known as the "white men" due to their all-white clothing would, according to Acosta's suicide letter, attempt to "beat the devil out of their sick minds". Some patients were also put through severe psychosurgery, which left many of them unable to perform basic bodily functions, sources claim. After Acosta's sudden death, the nurses and other workers moved away, and the residents of the institution were left locked in their rooms. Due to bad publicity, no one cared to take over the hospital, and the patients all died as a result of severe malnourishment and dehydration.'

The two youths looked at each other in disbelief. They didn't seem to care about the building which, as a midnight adventure, they had been sneaking into. But now, having seen that tape and reading about the horrid lives and deaths of those poor people, the shivers that crawled up their spines seemed endless.

'Today, the hospital has become an attraction site for all those interested in ghost stories,' the webpage continued, 'as countless fan pages, blogs, and magazine articles have dedicated posts to the phantasmagorical sights and sounds which have been seen and heard by hundreds of prowling onlookers. Some say that the patients' screams for liberation are still heard to this very day, whilst others have seen men, women, and children roaming around the hospital grounds, almost invisible-like. "Could these anecdotes be true, or are they resultant of our fantasy-filled contemporary society, which craves to fill our necessity for the imaginary?" critic Stephen Baldwin questions.'

Tommy locked the screen and put his phone in his pocket. They both stood there, flabbergasted, at a complete loss for words.

'That's horrible,' Aly whispered, 'that poor woman. Those poor people. How could they have just left them all there to die? What is wrong with people?' Silence reigned between the two once again until Tommy broke it a few minutes later, asking Aly for the name of the woman they had seen on the tape. She looked down at it once again and turned it over to reveal a strip of white tape on its side with large, cursive writing. 'Madelaine Rose,' she told him.

'Yes?' it hissed. **T**



Making Maltese Visible

Author: **Martina Borg**

*It's hard to imagine Maltese literature leaving a mark on the global stage. We might assume that there simply isn't enough interest. But in a world that's so increasingly globalised, is it fair to assume that a language that represents such a melting pot of identities has nothing to offer to the wider cultural market? The UK-based micro publisher Praspas Press, spearheaded by **Kat Storage** and **Jen Calleja**, is setting out to disprove that assumption.*

In September 2013 Kat Storage boarded a flight to the UK and embarked on an adventure with a suitcase full of hopes and dreams. As an avid reader and book lover, she was determined to learn all she could about the publishing industry and bring a little slice of it back to Malta. After a few detours and a couple of chance encounters, University of Malta (UM) alumna Kat Storage and Jen Calleja merged their determination and views to found Praspas Press in 2020.

'I met Jen when she was chairing an English PEN event which centred around Literature in Translation, and we started talking and bonding over our Maltese surnames,' she laughed. 'We also discussed our views on bilingualism and translation, and we realised we hold many common views,' she said.

'We kept in touch, and it quickly became clear that we both wanted to do something about the lack of Maltese works (in translation or otherwise) available on the UK market,' she said.


The pair decided they wanted to do what they could to bridge the gap between Maltese writers and the UK publishing industry. They took their inspiration from other small presses championing similar works including Fitzcarraldo Press, Tilted Axis, Prototype, Lolli Editions, and Les Fugitives. These small presses highlight diverse and intersectional voices that are often ignored by bigger companies, mainly because niche audiences do not usually generate high returns. Storage and Calleja noticed that recently translated works had found a receptive market in the UK. The press then sought support from the Malta National Book Council, which provided them with funding for their first publication: an anthology

of Maltese writing which will include poetry, fiction, and nonfiction to be published in October 2021. Their second project, also planned for 2021 and also part-funded by the Malta National Book Council, will be an English translation of Lorraine Vella's short story collection, *mill-bieb 'il ġewwa*, published in the UK as *What will it take for me to leave*.

PUBLISHING FROM ISLAND TO ISLAND

Storage began to develop an interest in publishing back in her days as an English Undergraduate student at the University of Malta. During this time, she was instrumental in setting up DESA - The Department of English Students Association.

'DESA is still one of my proudest achievements and my first baby,' she laughed, looking back on the research into student organisation mandates and applications. 'I always enjoyed doing something new. I like to challenge myself and create something, especially if it doesn't already exist, and set it free in the world,' she added, explaining that the student organisation had continued to thrive and grow since she left university. 'I eventually also started editing for *Insite*, a student-run magazine, which helped me to get a job in magazine publishing.'

After completing an MA with the UM's English Department in 2009, she started working for Network Publications' *Circle* magazine, ultimately taking on the magazine's editorship. This role provided her with contacts in the local industry, and further stoked her interest in editorial work, but she decided to take her interest in publishing 

Jen Calleja and Kat Storage (right)
Photo by Robin Silas



further and read for an MA in Publishing at Oxford Brookes University after hearing a talk about the course at UM.

'I had always hoped to use my knowledge of the UK publishing industry to create something locally or to address the lack of Maltese publishing in the global market,' she said, looking back on the various statements she wrote as an applicant to the course.

Ultimately the MA led Storage to an internship at the esteemed publisher Faber & Faber, and that internship led to a four and half-year employment at the company spanning various departments from Rights, to Marketing, and Editorial. The experience equipped her with a well-rounded knowledge of some of the key processes for UK book publishing.

'During this time, I learned a lot about the various departments in publishing, and I also realised how complex the industry actually is. No matter how much experience I already had, it was like starting from scratch,' she explained, adding that the learning curve delayed her plans to contribute to the local publishing scene.

'I ultimately took a step away from the industry to reignite my passion for creating something new for Maltese creators,' she said of her decision to leave Faber and take up a position at Gunter Piekarski, an independent Graphic Design Studio.

Although she is clearly no stranger to breaking new ground, Storage explained that working at the four-person operation has helped her to build the confidence to rely on her own resources and pushed her to start something of her own during last year's lockdown.

With an infectious enthusiasm, Storage went on to explain that the project has worked so far because of a clear sense of partnership and respect that has allowed Jen and Kat to blend their experience seamlessly.

'We both bring something different to the table. I have always read and loved Maltese books as well as having contacts in the Maltese book scene. Jen, on the other hand, doesn't read Maltese herself, but her formidable work as an author, editor, and literary translator from German into English has been widely praised, and she was shortlisted for the Man Booker International Prize 2019, so her opinion in reading the works in translation will be invaluable to give us a more objective view of the work.'

WHAT'S IN A NAME?

One of the most striking things about the company is perhaps its name; a playful word that is largely untranslatable into English, yet instantly evocative to Maltese speakers. In fact, the word is a nod to one of Kat's childhood favourites, Charles Casha's *Il-Praspar ta Fra Mudest*.

'We went through so many potential names for the press, ranging from sea-related terms to the classic pen and quill metaphors,' she explained with a giggle.

Storace goes on to explain how she hopes this kind of collaboration will be a winning formula to identify and launch Maltese writers into a more global market. Their aim as a publisher isn't to dominate UK markets, but rather to serve as a springboard for local talent. In fact, that was the logic behind choosing an anthology as a first publication. Their call to action led to a whopping 200 submissions being sent in, from poetry to non fiction, as well as fiction pieces including genre fiction and extracts from larger works.

'It was hard to whittle down the selection, but we finally settled on sixteen pieces. The sheer volume of impressive pieces submitted makes me truly hopeful that we will be able to publish another anthology next year, but this is all readership and funding dependent,' she said.


SHARING MALTESE LITERATURE

In its first year, Praspas is hoping to raise its profile, both in the local scene by participating in literary events such as the Malta Book Festival this November, as well as in the UK publishing scene, through hand-selling their books to indie bookshops and online, as well as marketing the books with agents and other publishers.

'We hope to have a strong enough following to prepare a second anthology, and we would like to work with even more local talent such as designers for any future work,' she said.

It's hard not to root for such a hopeful enterprise. Being unable to share your most formative reading experiences simply because of a language barrier can be quite frustrating! We went on to discuss some of the works that ignited a desire to be shared amongst international friends. Storace also reflected on influential works like the poetry of Maria Grech Ganado, Loranne Vella, Marie Gion, and Alex Vella Gera among others.

'If there was one work that truly made me want to share Maltese literature, it has to be Alex Vella Gera's seminal *Is-Sriep Reġġhu Saru Velenużi*. I devoured that book, and at the time that it was published, I remember wishing I could share it with my UK based publishing friends.' Thankfully Vella Gera's work has resonated so strongly with local audiences that it has inspired a film version and a translation, but it is precisely the reach of works that encapsulate Maltese history, identity, and language issues that Praspas Press aims to enhance.

As we wrapped up our chat, Kat stressed that Praspas really hopes to continue growing and to involve as much Maltese talent as possible. So much of contemporary Maltese writing reflects our island nation's unique identity, history, and influences. If Praspas grows, Maltese literature might start shaping global cultures, inspiring others outside of this tiny island in the Mediterranean. 



TO-DO LIST

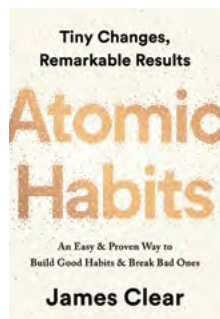
PODCAST



50 Things That Made The Modern Economy - BBC World Service

Released weekly — **Tim Harford** tells fascinating tales of the origins of inventions and innovations that have helped create the modern world.

BOOK



Atomic Habits - An Easy & Proven Way to Build Good Habits & Break Bad Ones

Award-winning self-help book that helps break down difficult, complex goals in one's life into simple, achievable steps.

MOVIE



13th

This thought-provoking movie looks at the American system of incarceration after the 13th amendment (1865), especially its effects on people of colour.

YOUTUBE CHANNEL

Periodic Videos

This series highlights some of the cooler parts of chemistry and is charmingly presented by academics from the University of Nottingham, UK.



TV



Love, Death & Robots

There is something fascinating about the animated short films by **David Fischer**, **Tim Miller** and **Jennifer Miller**. With 26 short films, there's enough to please everyone; each story uses a different genre from horror steampunk to odd comedy.

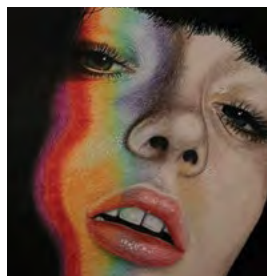
MUSIC

Wyvern Lingo

Bursting with lush, vocal harmonies and an eclectic mix of soundscapes, this group from Ireland have just released their new album **Awake You Lie**, recorded in Berlin.



INSTAGRAM



lucyaliceart

From cutesy illustrations of mice and ducklings to dashing portraits from Money Heist, Lucy's work will put a smile on your face!



L-Università
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"Take the leap."



JULIA CAUCHI
UM Art Competition

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