

SEPTEMBER 2018 • ISSUE 25

# THINK

IDEAS • MALTA • RESEARCH • PEOPLE • UNIVERSITY



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2018  
EUROPEAN CAPITAL  
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EDITORIAL

## SCIENCE

Science is a way of thinking much more than it is a body of knowledge,' said renown astronomer and communicator Carl Sagan. Science changes how one sees, interprets, and experiences the world. That concept goes far beyond the pursuit of the next paper or promotion; it touches researcher's role in society. After covering Arts and Philosophy, Think is delving into such discoveries with 27 pages dedicated to science.

Microplastics are a worldwide plague and Malta is not immune. Read how Malta is starting its battle against them (pg. 18). Other marine research is seeing how sharks can be taken from fish markets and released back into the wild (pg. 36). While a trio of researchers talk about the healthy Mediterranean lifestyle (pg. 32), another article puts the spotlight on the incredible work of three female researchers (pg. 28). Tying our focus together is an article on how the most obscure physics helped identify earthquakes (pg. 22), with another about a mobile app trying to bring the Maltese language to all (pg. 38).

Apart from this diversity of scientific research, the issue also talks about Scottish dance bringing science to new audiences (pg. 8), the rise of cyclists in Malta (pg. 10), and even how astronomy can be married to archaeology—our ancient skies. We end off the magazine by drinking sewage (pg. 68). Don't be put off and just give it a sip.

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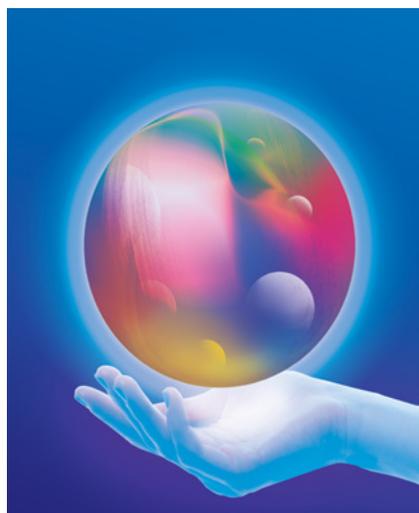


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## SCIENCE

The illustration is inspired by the aspect of 'that which is still unknown'. You don't really understand what you are looking at upon seeing the image for the first time. As you get familiarised, you start to notice the different colours, forms, and fluidity of the shape—akin to the fluidity of scientific knowledge.

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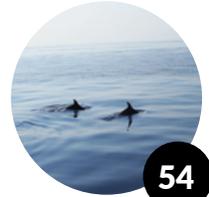


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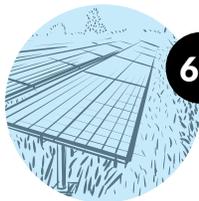
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# TOOLKIT

A close-up photograph of a white underwater drone. The image shows a propeller and motor assembly on the left side, with a white plastic housing. The drone's body is white with a dark grey or black section on the right. The background is a blurred, warm-toned light, possibly from an underwater light source.

Close-up of the  
PowerRay Underwater Drone  
Photo by James Moffett

# Underwater Eyes

**W**ater covers 70% of Earth's surface, but our oceans and seas might as well be alien planets. According to estimates, we've only explored about 5% of them so far.

Crazy depths and dangerous conditions prevent humans from venturing into the unknown simply because we would be unable to survive. However, these limitations are being overcome. Drone technology can safely explore what lurks beneath the waves, and the Physical Oceanography Research Group from the Department of Geosciences at the University of Malta (UM) are doing just that.

Enter Powervision's PowerRay Underwater Drone, an intelligent robot. It can capture real-time, high-res images beneath the sea's surface. It has a wide-angle lens and instrumentation capable of determining temperature, sea depth, and even the presence of fish. Coupled with image processing and machine learning techniques being developed by the group, the drone maps the sea floor, determining its make-up as well as identifying locations where different fish species originate.

The small, lightweight drone can travel up to 1.5m/s and is currently being tested off the coast of Malta near Bugibba. This area has already been mapped manually by divers, which means that, when ready, the drone and human maps can be compared to evaluate the drone's performance. If the AI algorithm produces accurate results, it will be used to charter unmapped regions—a first from Malta.

But its applications don't end there. The drone can also be used to monitor the condition of other expensive marine instruments which spend a lot of time underwater. Without having to put on a diving suit, it allows the team to check on deployed water temperature sensors, tide gauges, and acoustic Doppler current profilers. This helps to optimise and plan maintenance, which in turn prolongs the hardware's lifetime.

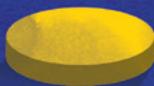
The UM team also want to use the technology to detect marine litter. They plan to identify litter 'hotspots' in order to raise awareness and organise clean-up campaigns—a valuable initiative to support vital efforts to clean up our oceans. **T**



**PowerRay Underwater Drone exploring the depths**  
*Photo by Dr Adam Gauci*

# WITHOUT BORDERS

PLAYER 1:  
READY TO  
LEARN



Can digital games form part of the answer to dwindling attention spans in the classroom? **Sara Cameron** attended the 'Playful Learning in STEM' Seminar at the MITA data centre in June to hear entrepreneur **Dr Lauri Järvillehto**'s thoughts on the matter.

**O**ur attention is constantly bombarded by the likes of mobile games, social media, Netflix, and Google. Adults are having a tough enough time focusing, let alone children sitting at their desks trying to wrap their heads around algebra and particle physics. Textbook lessons are fighting a losing battle with personalised entertainment. But there is light at the end of the tunnel. Dr Lauri Järvillehto, co-founder and chairman of Finnish startup Lighteneer, believes his team might have a solution.

Games see kids experience progressive challenges. Children, as players, use diverse problem solving abilities, then receive instant feedback, satisfaction, and a sense of achievement. To ignite that same fire for games in learning, education needs to tap into that world and harness what makes it special. The feat, Järvillehto explains, is finding balance. We need games that contextualise mathematical or scientific concepts, allowing players to master these concepts, all while being engaged and having fun. A tall order.

Gamification has the potential to ease the introduction of subjects that are normally considered complex. It can make them more approachable, allowing students to grasp the basics before undertaking formal learning to further deepen their understanding.

'Our thinking is that great learning games can work as the first spark for the love of learning in future

generations. They can convey the awe and wonder you see shining in the eyes of our scientific experts as they tell us about the wonders of particle physics,' says Järvillehto, speaking at a seminar called Playful Learning in STEM organised by the Malta Information Technology Agency and the Valletta 2018 Foundation.

But whilst digital learning is becoming all the craze, Järvillehto warns that educators should be wary of jumping on this trendy bandwagon. Technology is not a cure-all; there is no magic wand. Lighteneer aims to develop games that complement, rather than compete with, formal learning. He also believes that, even with an abundance of tech-based tools, an engaging teacher is still the best way to improve education and inspire the next generation. Games should be used as an initial spark to reel students in at the outset. 'Perhaps kids will soon grow to think about particle physics and atoms as something as cool as collecting Pokémon.' Game learning can be the key to unlocking students' potential, offering a more accessible route to developing an understanding of complex topics.

To keep up with a fast-changing digital world, we must acknowledge its challenges and adapt. Games can't solve this puzzle alone, but used in the right way, they can be a tremendously useful addition to a teacher's toolbox. **T**



**Playful Learning in STEM Seminar**  
Photo provided by MITA

# DESIGN

## Science, dance, and Scotland

**W**hat if I told you that I could explain why the sky is blue through dance? All I would need is a fiddle player, a flautist, and a guitarist. By the end of it, we would all be dancing around like particles, hopefully with a better understanding of how the world around us works.

This is exactly what neuroscientist and fiddle player Dr Lewis Hou does on a daily basis.

Sitting through a boring science class with a teacher blabbing on about how important the information is might be a scene way too familiar for all of us. The science *ceilidh* (a traditional Scottish dance) aims to combat this misconception that science is all about memorising facts. Bringing people together to better understand and represent the processes within science through interpretative dance and other arts, the *ceilidh* has been proving a fruitful way of engaging people who would normally not be interested in science or research. 'For us, that's a really important guiding principle—reaching beyond those who usually engage,' says Hou.

It all starts by bringing everyone together in one room. Researchers, musicians, and participants all get together. Researchers kick off the conversation by explaining what their work is and why it is relevant. Hou then helps the rest of the group break the scientific process down into its fundamental steps, be it photosynthesis, cell mitosis, or the lunar eclipse. The next step is translating each of the steps into a dance. And this is where everyone gets involved.

*For us, that's a really important guiding principle - reaching beyond those who usually engage.*

Thinking back on how the idea came together, Hou says his first motivation to combine dance and science came when he was playing music and calling *ceilidhs*, all while attending as many science festivals as he could. 'I realised there's a big crossover with the spirit of folk music and dance—it's all about participation and sharing. Everyone takes part even if they aren't experts—and that is what we want to achieve in science communication. We want to encourage more people to feel able to participate without being scientists.'

'Importantly, the nice thing about *ceilidh* dance is that they might be simple, but it also means that many people can join in and dance,' emphasises Hou. Back in the studio, after having understood the science and its concepts, everyone works together to create the choreography. The science merges with their artistic interpretation. It is no longer something out of reach; it is now owned by everyone in the room. 



**Dr Lewis Hou & the Science Ceilidh band**  
*Photo by Chris Scott*



# Cycling to University: motives and barriers

**Dr Marie Briguglio**

**T**his time last year, I decided to start cycling to my office at the University of Malta. Though much of my work focuses on this kind of behavioural change, I would be lying if I said that I did it for environmental or research reasons. I did it out of sheer despair: I felt like I was wasting my life, stuck in traffic for hours on end. I will also readily admit that when I started, I was not adequately prepared: I was not fit enough for it. Nor did I have the agility and speed to compete with cars while balancing on two narrow wheels. But I somehow hung in there. And somehow, before I knew it, a whole year had gone and I had never used a car to come to university—nor ever wanted to.

One of the forces that made a real difference was 'others'. While I'd long marveled at my friends and colleagues at universities overseas who cycled to work without much fanfare, it was finding a community of commuting cyclists here in Malta that really made a difference. Gathered as the 'Bicycle Advocacy Group' on Facebook, they are a new cyclist's best allies. They helped me find bike-friendly (and unfriendly) roads, plot routes ahead of time, and consoled me after bad incidents. They organise group rides. They advocate and educate. Groups on campus such as the Green Travel Plan people were also great. In the world of cycling, unlike that of driving, the more we are, the merrier it is!

The second major step in this journey was to make it increasingly easy for me to choose the bike over car. A car key always looks so easy to pick up. Instead, I prepared my bike, my bag, my helmet, and all my accessories by the door. I left some extra clothes and toiletries at work, ready when needed. I changed my days around to make them cycle-friendly, clustering meetings, avoiding heavy loads. I also made it a point to reward myself for cycling by keeping snacks handy for energy. This probably explains why I did not lose any weight despite a whole year of pedaling.

All this said, the main barrier for lots of people (and myself) is the fear of being hurt on the road. I learnt a few



**Dr Marie Briguglio**  
riding a bike on Campus  
Photo by Dr Edward Duca

practical tricks that made cycling less scary. The first is that lowering risk is entirely possible. Some times are better than others for cycling. In peak traffic, cars are moving very slowly or at a complete standstill, making it somewhat safer for you to cycle! Some roads are also better than others. With time, I found out that it is possible to use country lanes or smaller urban roads for most journeys. Where traffic is unavoidable, I stick to the middle of the lane, especially if a driver cannot safely pass while leaving a meter of space. Traffic will wait behind you (often the speed limit is 30km/hr anyway). This is even more important if there's a row of cars to your right where anyone can open a door and knock you off the bike. Thirdly, I learnt to signal large so drivers know my intent. I also learnt cycling is a mental and physical work out. You need to be completely focused and watch out for

any possible danger. Where needed, I get off my bike and cross roads on foot.

While poor public infrastructure and law enforcement remain a constraint, I gradually bought things that made the cycling life easier. My first purchase was the bicycle. I started with a basic folding bike (€200 or so). I chose a folding bike to give myself a parachute in case I got too tired and needed a lift home. The climb to Gharghur from University was nothing short of exhausting. I walked most of it for the first few weeks. Then a very attractive grant was issued for e-bikes. This changed everything: you may pedal less on an e-bike but you will certainly cycle more frequently. Later, I stuck a rack and a basket to the bike. I bought a trekking backpack (which means I sweat less), a good water bottle (which also comes in handy to wash my hands), and a helmet (even though it's not a legal obligation to

wear one). I got a high visibility vest (free from several campaigns), white and red lights and reflectors (though I'm still rather scared to cycle at night), and a mirror, which helps me see cars coming from the rear without having to turn my head and risk losing my balance. I'm still angling for a good bell, better fenders, and flat tyre-changing supplies. I eventually bought a good lock—a must.

Like other positive habits, the more you do it, the more you love it. I especially love not having to look for parking, getting to places quickly and on time, and discovering new routes. I love smiling at people, feeling younger and fitter. In hindsight, and with a rather limited sample size of one, I can see that what made it work (consciously or not) was quite in line with research: a break in habit, a combination of lower barriers, and stronger motives. **T**



# On mindfulness

**Szofia Borojevy**

In this overwhelming world of apps, chats, commercials, and instant everything, we're fighting for our attention at every turn. We sometimes barely have time to think about our decisions, often regretting what we did or what we bought a short while later.

Resurrected from old Buddhist teachings, mindfulness is being touted as the answer to the varying needs and demands of modern society. New-age 'gurus' offer courses that claim to change our life in seconds. To me, this has always sounded like a mission impossible.

Daydreaming poses a challenge for me. Ideally, it should give us the space to absorb new information and figure out potential options for future decisions and behaviour. But most of the time, programming takes over. We mentally analyse events and their effects—we worry—failing to be present.

The ability to create a mindful space in our thoughts can be developed through regular mindfulness meditation. The practice involves a lot of deep breathing, slowing down,

observing our passing thoughts, and absorbing our surroundings. There are even apps to help boost our levels of mindfulness.

While this might seem like fluff to some, studies have found clear evidence for the positive effects of such practice. Meditation has been shown to have a positive effect on well-being and emotional regulation. Some research also shines light on its therapeutic benefits for anxiety and depression.

Research shows that mindfulness gives us extraordinary insights. Those who practice regularly say that they experience the present reality to a sharper degree, absorbing small details that usually get lost. Imagine, instead of automatically reacting to your surroundings, being able to focus in the moment so that you can actually choose your next step with intention. That is power!

Personally, I found that a month of dedicated practice sharpened my attention. I started noticing small things and gestures that, before, would just pass me by. It drove the amount

of wasted time down significantly. I made better decisions. It wasn't easy to sit there with all my thoughts, but it definitely trained my mind to overcome challenging tasks.

We can all benefit from regular mindfulness practice. Go on and try it for yourself. Take a deep breath, slow down, and pause. Seize the moment. Be. 

## Further reading:

Cocoran, K. M., Farb, N., Anderson, A. & Segal, Z. V. (2010). *Mindfulness and emotion regulation: Outcomes and possible mediating mechanisms*. In A. M. Keing & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment* (pp. 339 – 355) New York: Guilford Press.

Hoffman, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). *The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review*. *Journal of Consulting and Clinical Psychology*, 78, 169 – 183. doi:10.1037/a0018555



Mnajdra temple during the Summer solstice.

Photo by Tore Lomsdalen

# The sky's role in archaeology

**Tore Lomsdalen**

In 1994, Czech poet-president Vaclav Havel wrote an article discussing the role of science in helping people understand the world around them. He also noted that in this advance of knowledge, however, something was left behind. 'We may know immeasurably more about the universe than our ancestors did, and yet it increasingly seems they knew something more essential about it than we do, something that escapes us.'

Almost all traditional cultures looked to the sky for guidance. Cosmology is what gave our ancestors their fundamental sense of where they came from, who they were, and what their role in life was. While arguably incorrect, these ideas created codes of behaviour and bestowed a sense of identity.

The cosmology of European prehistoric societies has been studied independently by archaeologists and archaeoastronomers (an interdisciplinary field between archaeology and astronomy). Despite their shared goal of shedding light on our past lives, thoughts, and ideas, the

two fields have often failed to merge, mainly due to different approaches. A clear local case is the question of the Maltese megalithic temples.

The Mnajdra South Temple on Malta predates both Stonehenge and the Egyptian pyramids. It is the oldest known site in the world that qualifies as a Neolithic device constructed to cover the path of the rising of the sun throughout a whole year. What is unfortunate is that, so far, archaeologists and archaeoastronomers have studied the site largely in isolation.

Whether the temples were built to visualise the effects of the rising sun as seen today is an open question. But with such specific and repetitive patterning, one cannot deny that the sky was an important element in the builders' understanding of the world—their cosmology.

With some exceptions, archaeologists have largely ignored, excluded, or underrated the importance of the sky in the cultural interpretation of the material record. When studying ancient communities, chronological dating and

economic concerns are often given precedence over the immaterial.

But the fault does not lie solely with disinterested archaeologists. Archaeoastronomy has often been too concerned with collecting astronomical and orientation data, neglecting the wider archaeological record, and ignoring the human element in cosmology.

We need to find a common ground. Both sides need to open themselves up to different professional perspectives and convictions and embrace alternative interpretations and possibilities. Bridging the gap between archaeology and archaeoastronomy will allow us to paint a detailed picture of past societies. And maybe it will shed light on that lost knowledge about the universe and our place in it. 

**Lomsdalen and Prof. Nicholas Vella are organising an afternoon workshop on Skyscape Archaeology as well as an open symposium on Cosmology in Archaeology. For more information, visit: [um.edu.mt/arts/classics-archaeo/newsandevents](https://um.edu.mt/arts/classics-archaeo/newsandevents)**

# STUDENTS



## Aspirin and Cancer

**Maria Azzopardi**

**A**spirin is often considered a wonder drug due to its versatile use in treating inflammation, reducing pain, and helping to prevent heart-related disease. However, there is more to it. Aspirin is actually cancer-preventive.

Studies have shown that a daily low dose of aspirin, medically prescribed for more than five years, lowers the risk of cancer-related deaths by at least 30%. So, should we all start taking aspirin on a daily basis to lower our chances of getting cancer?

No, not exactly. This is because many aspects of aspirin's cancer-preventive effects are still poorly understood. Particularly, researchers have not yet pinpointed what enables aspirin to selectively kill early-stage cancer cells and not healthy cells. This is the scope of the research currently being carried out at the Yeast Molecular Biology and Biotechnology Laboratory (headed by Prof. Rena Balzan).

The secret behind aspirin's tendency to kill certain cells but not others seems to lie in the physiology of the exposed cells. Aspirin exploits the natural differences between healthy and cancerous cells to eliminate malignant cells before they can take over.

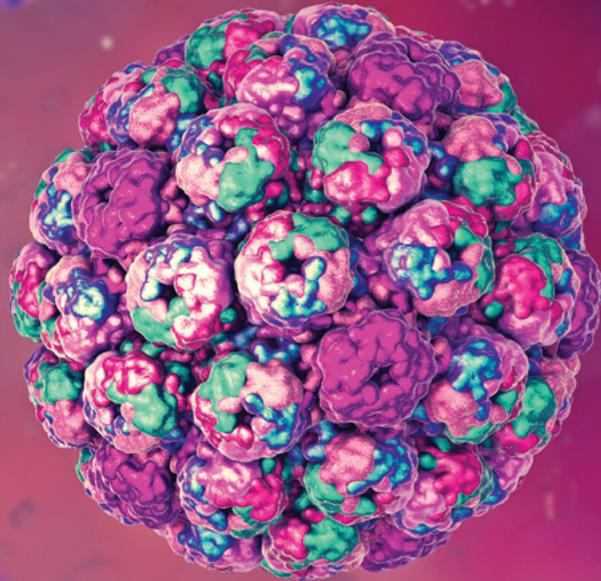
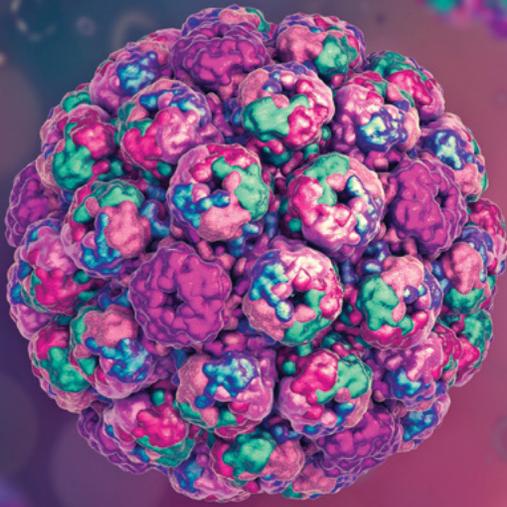
Oxygen, if transformed into 'Reactive Oxygen Species', is known to cause DNA mutations that can

lead to cancer. Through this research, we studied mutated yeast cells which are a relevant model of early-stage cancer cells due to their low tolerance to oxygen-associated stress. We then identified genes in these mutant yeasts which are affected by aspirin.

One of aspirin's targets is a key metabolite required for the production of energy-rich compounds vital for cell survival. We found that aspirin creates a shortage of this metabolite in mutated yeast cells, causing them to run out of energy and die.

This implies that early-stage human cancer cells may suffer a similar fate and, more importantly, partly explains how aspirin prevents tumour formation. Such knowledge may prove useful in the development of novel anti-cancer treatments. **T**

**This research was carried out as part of Project "R&I-2015-001", financed by the Malta Council for Science & Technology through the R&I Technology Development Programme. This research is being carried out as part of Azzopardi's Ph.D. project at the Centre for Molecular Medicine & Biobanking and the Department of Physiology & Biochemistry, University of Malta**



## Blood in the brain

### Kirsty Sant

**A**rtificial intelligence (AI) has now made its way into the medical world. But it's not as scary as it sounds. Most forms of AI are simply programs which have been developed to carry out very specific tasks—and they do them very well.

As part of my final-year project, I used AI to develop a program that can diagnose different types of brain haemorrhages. Brain haemorrhages are life-or-death situations where blood vessels in the brain burst and bleed into surrounding tissues, killing brain cells. Speed is key in preventing long-term brain damage, but treatment options depend on the size and location of the haemorrhage. This is when computerised tomography, or CT scans, come in.

Using X-rays, CT scans can image the brain in seconds. Last year, John Napier (another final-year project student) created an AI system to detect brain haemorrhages from CT scans. Building on this, I (under the supervision of Prof. Ing. Carl James Debono, Dr Paul Bezzina, and Dr Francis Zarb) developed a system to take the output from Napier's system and further analyse the intensity, shape, and texture of haemorrhages to identify them as one of three types.

The AI was trained on 24 pre-classified CT scans. By presenting the scan image to the artificial neural network along with the answer, the system can take on the information and learn. This process trains it to become familiar with the types of haemorrhage. Two different structures of artificial neural network were used with 220 variants each—resulting in 440 variants being used to train and test the model.

Then it was time to test this system. Six scans were given as unknowns and the network successfully classified over 88% of the haemorrhages using only three of the 440 variants.

The purpose of this system is to verify radiologists' diagnoses. However, we hope to develop it to diagnose haemorrhages, which would help treat patients faster. The system can be adapted to other illnesses—CT scans are commonly used to image the abdomen and chest. The applications, and life-saving potential, are endless. 

This research was carried out as part of a Bachelor's degree in Computer Engineering at the Faculty of ICT, University of Malta





## SCIENCE

Science is a reflection of humanity's understanding of the world. It breeds knowledge while changing society. Are recent shifts for better or worse? Only time will tell but what we can say so far is that the researchers at

the University of Malta have noble intentions in their contributions—to move our planet towards a healthier, brighter future. Our focus touches on a plethora of scientific topics, from quantum physics for detecting earthquakes, to good eats and baby sharks.



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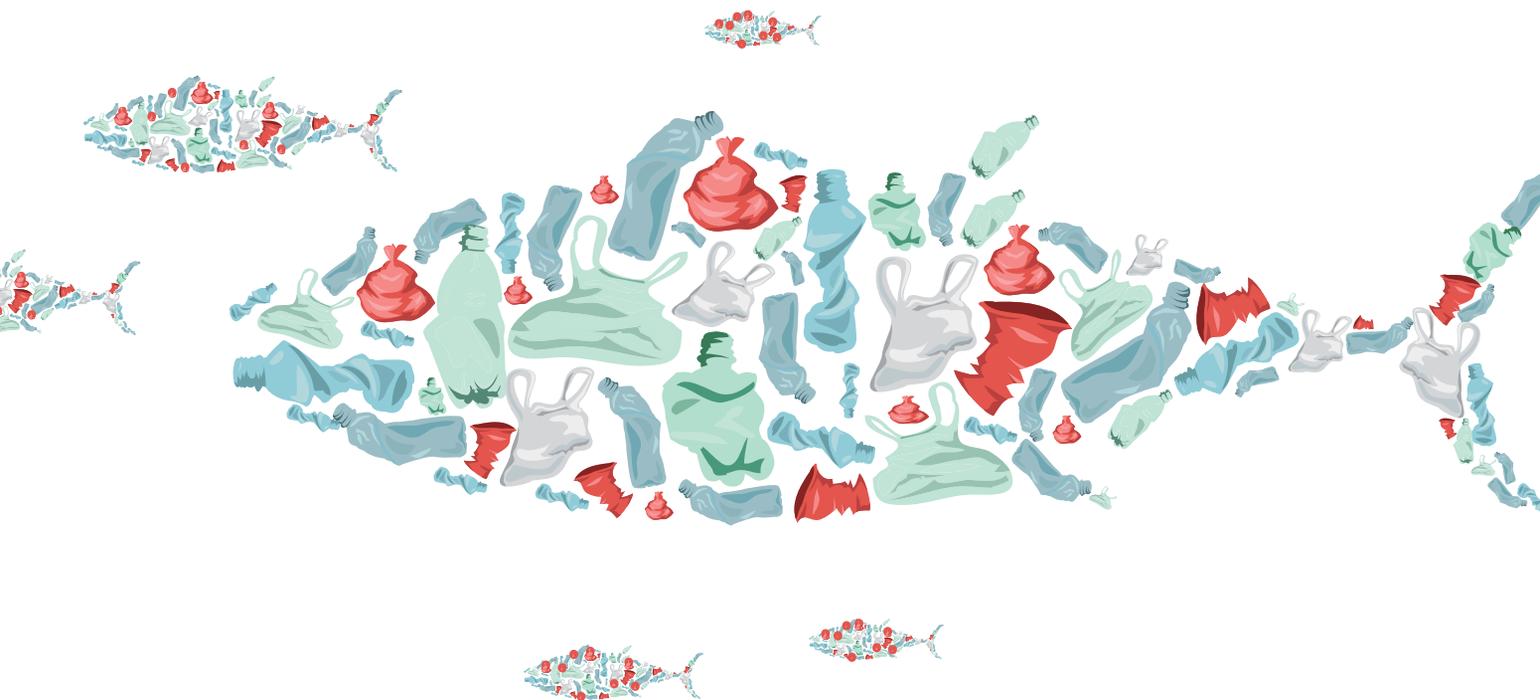
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# THE P FACTOR





*In the challenge of keeping our seas clean, plastics FAIL. And yet, during the last decade, we produced more of it than in the last 100 years combined. **Dr Adam Gauci** writes about his team's efforts to categorise the microplastics from Malta's beaches and how those efforts will contribute towards the war on plastic.*

Plastic is convenient. It's cheap, versatile, and useful. The trouble is that it never goes away. While plastic is recyclable and can be reused in the form of lesser quality plastic, it can never be completely eliminated. Instead, it breaks down into smaller and smaller fragments, called microplastics, that stay in the sea. The only way they are ever removed is if fish eat them—coloured ones look especially tasty—or if they enter some orifice of ours while we're enjoying our summer sun on the beach. Next time you're sunbathing, sift your hand through the first five centimetres of sand and count all the small, smooth, rounded plastic fragments you pick up—that's the stuff we're talking about.

A whole movement has started taking shape in recent years, raising awareness about the damage plastics are causing. If you've never received a Facebook invite to join a clean-up

campaign, you're following the wrong friends. However, there are so many questions that need answers.

What's the source of these fragments, the land or the sea? Are there more fragments closer to the waterline? At which depth in the sand and water will you stop finding them? What can their number, size, shape, and colour tell us about the way they move through the environment? All this informs our understanding of microplastics. With this information, we can identify whether their prevalence increases or decreases on a seasonal or yearly basis. It also helps target campaigns, since some areas need cleaning more urgently than others.

Characterisation of plastic is an important first step in this journey. We need to extract and define parameters for the microplastics found within specific volumes of sand from specific beach locations. Needless to say, the going is slow. So

far, there is no universal methodology researchers follow for analysing isolated microplastics. When classifying pieces of plastic based on colour, something as simple as lighting can affect results. Subjectivity also plays a big role—what appears red to one person can be pink to another. There is a high bias from the interpretation of human observers, which needs to be resolved. Reducing human bias is where computers and image processing techniques come in.

Using cameras, we capture high-resolution images of the particles and submit them to computers, which run image processing techniques to automatically characterise the plastic pieces. Not only does this save time, it removes the subjectivity, allowing us to make accurate spatial and temporal comparisons.

Our shovels, sieves, hats, and flip-flops were out from August to November. We collected samples from Riviera Bay, ➤

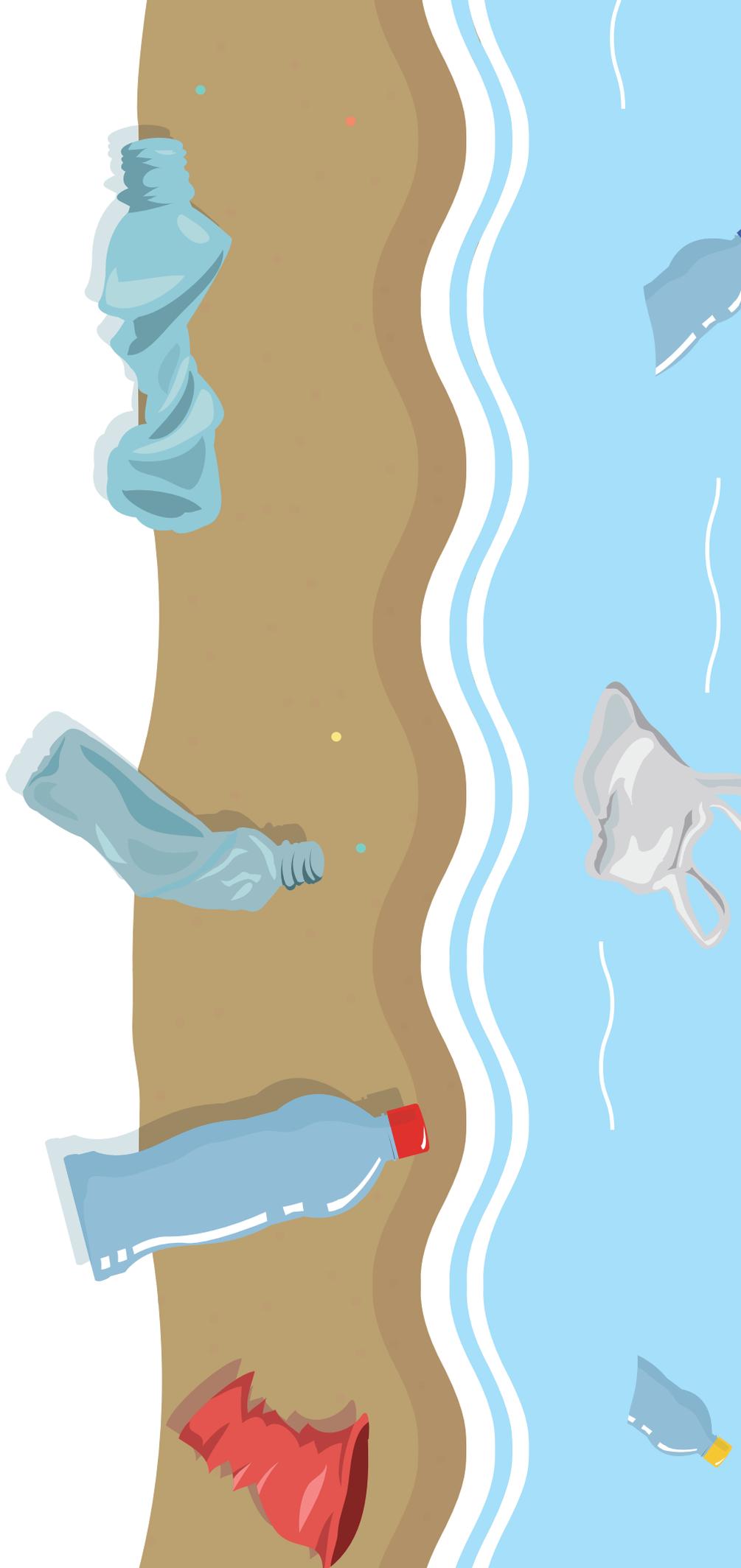
Golden Bay, Ghadira Bay, and Pretty Bay. Apart from being our favourite beaches, these locations also cover the four corners of Malta. They are exposed to wind and waves from different directions, which means that we can correlate the total number of extracted microplastics with the meteorological and sea conditions before and on the days of fieldwork to determine how natural phenomena affect the concentration of microplastic particles.

We visited each beach eight times. At every location, we sampled six different stations by sifting a consistent volume of sand to extract microplastics and other debris. We recorded GPS

*As it stands, what we know is that the most polluted beaches are Riviera Bay and Golden Bay.*

coordinates to ensure that data was collected from the exact same spot each time and soon learned that asking tourists to reposition their sunburnt selves out of the way is really uncomfortable. Asking a local, even more so. A few awkward encounters later, we shifted our sampling schedule to very early in the morning, before swimmers arrived and prior to beach cleaning by the authorities.

In the lab, a calcium chloride based solution helped us separate the microplastics from other debris. Once dry, we could scan the samples at high resolution. Following hours of coding, we created an algorithm that could run on all the data collected. We designed





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

## THE TEAM

There is no fairy tale behind the setting up of the team. People with different backgrounds, research interests, and (allegedly) superpowers got together to improve the way we parameterise microplastics. I, Dr Adam Gauci (Physical Oceanography Research Group, Department of Geosciences), discussed the topic with John Montebello (Institute of Earth Systems). Prof. Alan Deidun was roped in because of his previous experience on a similar project some months before. Dr John Abela (Department of Computer Information Systems, Faculty of ICT) helped with developing the algorithm. Prof. Victor Axiaq (Biology Department) was also involved for his long-standing work on the same thematic. The inclusion of Prof. Francois Galgani from IFREMER (*Institut Français de Recherche pour l'Exploitation de la Mer*) was sacrosanct in view of his research profile on microplastics.

the programme to automatically generate charts for our interpretation.

The implemented software is about as intelligent as a three-year-old. An adaptive thresholding method gives us a binary image. Morphological methods then fill in the gaps to create a solid image. The programme basically mimics human paint-by-numbers. The second step is like a connect-the-dots exercise, identifying and drawing rubber bands (i.e. outlines) around each particle. With this, the algorithm builds a mathematical model of each microplastic particle, from which it can compute roughness as well as the lengths of its major and minor axes. The red, green, and blue intensities of the pixels enclosed within each boundary are compared against a table to determine whether the particle is black, blue, brown, green, grey, orange, pink, purple, red, white, or yellow.

We already know that the algorithm performs very well compared to the output emerging from human observation, but a more comprehensive validation process is underway.

As it stands, what we know is that the most polluted beaches are Riviera Bay and Golden Bay. Both have a north-west aspect, which matches the direction of the prevailing winds reaching the Maltese Islands. Preliminary results suggest that high microplastic counts in these locations could be due to these locations being exposed to a lot of wind and wave action. However, contribution from human visitors cannot be discounted. The results clearly indicate that 66.63% of the isolated particles (that is, a total of 7133 microplastic fragments) are smooth and either grey or white. This might mean that most of the particles collected from the four beaches are pre-production pellets (nurdles which have not yet been moulded into a plastic

item). These pellets are occasionally lost from industrial facilities during the production process or from carriers during transit and are highly mobile given their small size, easily transported from land into the sea.

As a team, we are on a journey that will serve to quantify Malta's microplastic problem as well as highlight how dangerous and widespread microplastics are. This study adds to the movement attempting to claw us out of the hole we've dug ourselves into and reverse the damage plastic has been wreaking on our natural habitat for the last decades. We hope that next time you're on a beach running your fingers through the sand (and, inevitably, the microplastics in it) you will also remember your role in all this. At that point, ask yourself: What will my contribution to the solution be? 



# Accidental science

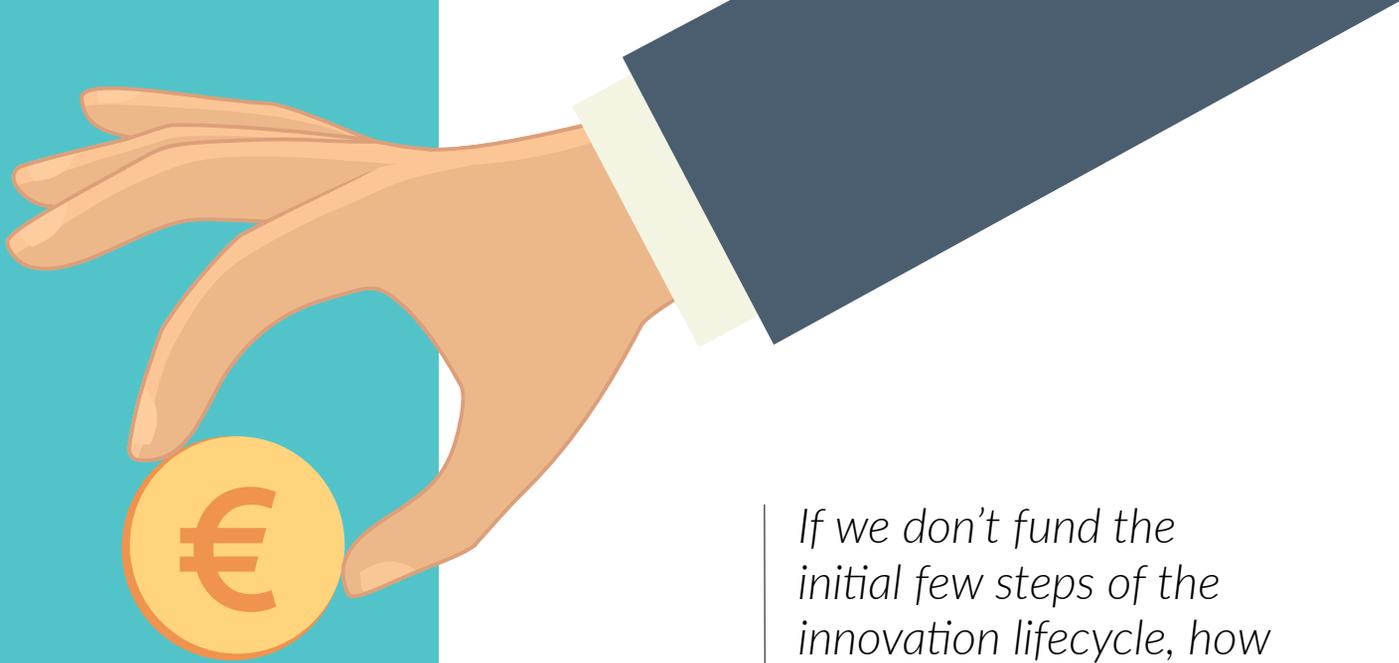
*Do scientists need to have a clear end-goal before they dive down the research rabbit hole? Sara Cameron speaks to Dr André Xuereb about the winding journey that led to the unintended discovery of a new way to detect earthquakes.*

Some of science's greatest accomplishments were achieved when no one was looking with a purpose. When studying a petri dish of bacterial cultures, Alexander Fleming had no intention of discovering penicillin, and yet he changed the course of human history. Henri Becquerel was trying to make the most of dwindling sunlight to expose photographic plates using uranium when he stumbled upon radioactivity. A chance encounter between a chocolate bar in Percy Spencer's pocket and the radar machine that melted it sparked the invention of the household microwave.

One would think that with this track record of coincidental breakthroughs, the field of science and research would continue to flourish by embracing curiosity and experimentation. But as interest piques and funding avenues pop up for researchers, there has been a shift in mindset.

Money changes things. And while it does allow people to work hard and answer more questions, it has also fostered expectations from stakeholders. Investors want fast results that will improve their business or product. We, the end-user, want to see our lives changed, one discovery at a time. We're no longer satisfied with research for research's sake. At least for the most part.

Quantum physicist Dr André Xuereb (Faculty of Science, University of Malta) is all too aware of this issue and its effects on scientific progress. Xuereb explains scientists' frustration: 'A lot of funding, in Malta and elsewhere, is dedicated to bringing mature ideas to the market, but that is the tip of the iceberg. There is an entire innovation lifecycle that must be funded and sustained for good ideas to develop and eventually become technologies. The starting point is often an outlandish idea, and eventually, sometimes by accident, great new technologies are born,' he says. ➔



*If we don't fund the initial few steps of the innovation lifecycle, how will we ever develop new technologies?*



## **STARTING POINTS**

Over the past few years, Xuereb has been exploring new possibilities in quantum mechanics.

The field of quantum mechanics attempts to explain the behaviour of atoms and what makes them. Its mathematical principles show that atoms and other particles can exist in states beyond what can be described by the physics of the ordinary objects that surround us. For example, quantum theorems that show objects existing in two places at once offer a scientific basis for teleportation.

*Star Trek* fans know exactly what we're talking about, but for those rolling their eyes, the reality is that many things in our everyday lives wouldn't exist without at least some understanding of quantum physics. Our computers, phones, GPS navigation, digital cameras, LED TV screens, and lasers are all products of the quantum revolution.

Another technology that has changed the way we live and work is modern telecommunications technology. When you pick up your phone to message a friend overseas, call a loved one, or email a colleague, telecoms networks spanning the earth carry the data across continents and under oceans through thousands of kilometres of optical fibres.

The 96-kilometre submarine telecommunication link between Malta and Sicily was Xuereb's focus in 2015. He organised a team of European experts to begin investigating the potential for building a quantum link between the two countries.

The Austrian, Italian, and Maltese trio were particularly interested in a strange property called

'entanglement.' This is a curious property of quantum objects that can be created in pairs of photons, connecting them together. This entanglement can be distributed by giving one of these photons to a friend and keeping the other for yourself, establishing a quantum link between you and this friend—an invisible quantum 'wire,' so to speak.

Through this connection, you and your friend can send data faster than over ordinary connections; by modifying the state of the photon at your end, you can instantly affect the state of your friend's photon, no matter how far apart you are in the universe. Using quantum links such as these, all manner of feats can be performed, including super-secure communications. 'We wanted to demonstrate that

quantum entanglement can be distributed using a 100km-long, established telecoms link, using what was already available, with no laboratory facilities in sight,' explains Xuereb. His team also wanted to demonstrate that entanglement using polarisation of light was possible. Previously it was thought impossible in submarine conditions, even though it has some very technologically convenient properties.

Two years and several complex experiments later, Xuereb and his team have indeed proven the possibility of quantum communications over submarine telecommunication networks. And with one question answered, a slew more lifted their heads.

The Italian subteam, led by Davide Calonico (Istituto Nazionale di

Ricerca Metrologica, INRIM), now turned their attention to a different set of questions for the Malta-Sicily telecommunication network.

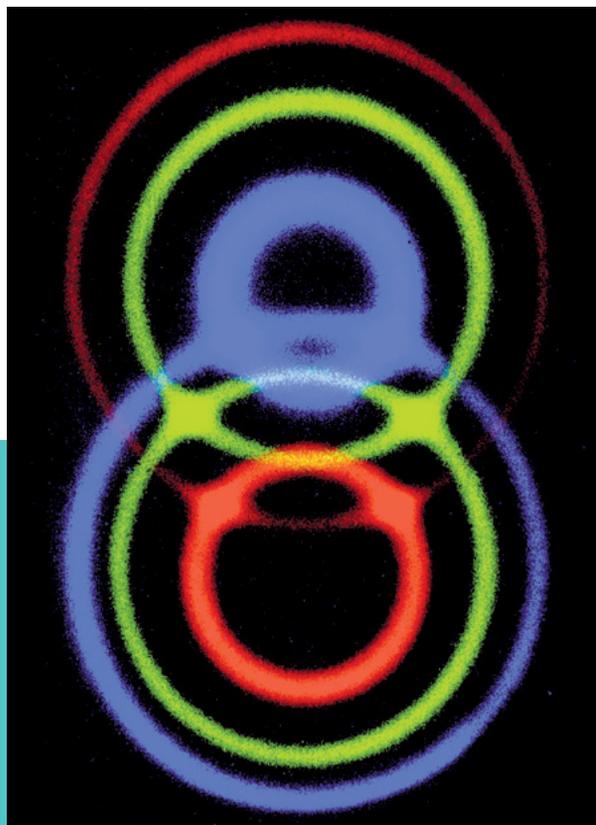
### **MORE TO COME...**

Atomic clocks keep the world ticking by providing precise timekeeping for GPS navigation, internet synchronisation, banking transactions, and particle science experiments. In all these activities, exact timing is essential.

These extremely accurate clocks use atomic oscillations as a frequency reference, giving them an average error of only one second every 100 million years. Connecting the world's atomic clocks would create an international common time base, which would allow people to better synchronise their activities, even over vast distances. For example, bank >



**Dr André Xuereb**  
Photo by Dr Edward Duca



**How entangled photons came to be**  
Photo courtesy of the Institute for Quantum Optics & Quantum Information, Vienna

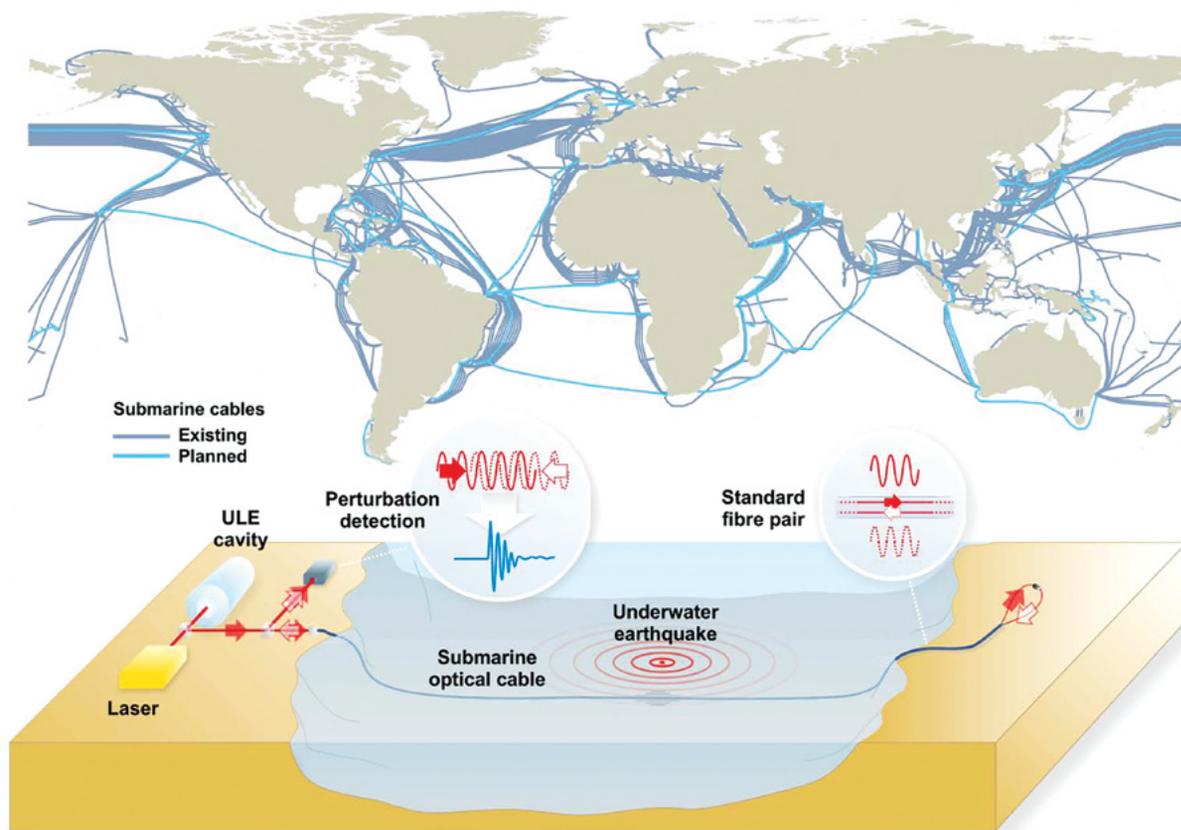


Diagram illustrating how even the smallest underwater seismic waves can be detected.  
Image courtesy of Science Magazine

*The starting point is often an outlandish idea, and eventually, sometimes by accident, great new technologies are born.*

transactions and trading could happen much faster than they do at present.

This can't be done by bouncing signals off of spaceborne satellites, since tiny changes in the atmosphere or in satellite orbits can ruin the signal. This is where the fibre-optic network comes back into the picture. Researchers have recently been looking at the

telecoms network as a way to make this synchronisation possible. Scientists can use an ultra-stable laser to shine a reference beam along these fibres. Monitoring the optical path and the phase of the optical signal of the beam can then allow them to compare and synchronise the clocks at both ends.

Whilst Calonico and his team were testing this idea on the submarine network between Malta and Sicily, a few thousand kilometres away, meteorology expert Dr Giuseppe Marra was monitoring an 80km link in England. On October 2016, everything changed. One night, he noticed some noise in his data. Unable to attribute the noise to misbehaving equipment or a monitoring malfunction, his gut told him to turn to the news from his home country, Italy. There, he saw that the town of Amatrice had been devastated by an earthquake of 5.9 magnitude.

Further testing confirmed that the waveforms Marra saw in the fibre data matched those recorded by the British Geological Survey during the earthquake. His system even recorded quakes as far away as New Zealand, Mexico and Japan. This was huge news.

In simple terms, the seismic waves from an earthquake tremor cause a series of very slight expansions and contractions in fibre-optic cables, which in turn modify the phase of the cable's reference beam. These tiny disturbances can be captured by specialised measurement tools at the ends of the cable, capable of detecting changes on the scale of femtoseconds: a millionth of a billionth of a second.

The majority of seismometers are land-based and so small that earthquakes more than a few hundred kilometres from the coast go undetected. Conventional

seismometers designed to monitor the seabed are expensive and don't usually monitor underwater seismic activity in real time. Telecoms networks could offer a solution that would allow us to observe and understand seismic activity in the world's vast oceans. They would open up a new window through which to observe the processes taking place underneath Earth's surface, teaching us more about how our planet works. In future, it may even make it possible to detect large earthquakes that cause untold devastation earlier.

The beauty of this discovery is that the infrastructure already exists. No new work is needed. All that is required is to set up lasers at either end of these cables, using up a tiny portion of a cable's bandwidth without interfering with its use.

## THREADS COMING TOGETHER

Marra got together with Xuereb and Calonico, who were already working

on the undersea network between Malta and Sicily, to conduct some initial tests. The underwater trial, published in the world-leading journal *Science* this year along with the terrestrial results, was able to detect a weak tremor of 3.4 magnitude off Malta's coast. Its epicentre was 89km from the cable's nearest point, which reinforced the idea that cables can be used as a global seismic detector. 'We would be able to monitor in real time tiny vibrations all over the planet. This would turn the existing network into a microphone for the Earth,' Xuereb explains.

The system hasn't been tested on an ocean cable. An interesting target would be a cable that crosses the mid-Atlantic ridge, where the drifting of Eurasian and African tectonic plates creates an area of high seismic activity. Based on the results so far and on conservative assumptions, trials are being planned for the near future on a larger scale, which will give us a better idea of the possibilities.

## FURTHER DOWN THE RABBIT HOLE...

In many ways, it is understandable that agencies that fund science favour smaller, more goal-driven research programmes. They seek tangible results in a timely manner to reap quick rewards. But as this story goes to show, a change in mentality is needed.

'If we don't fund the initial few steps of the innovation lifecycle, how will we ever develop new technologies? This is a problem that affects scientists from many countries and comes from a mismatch in timescales. A year is a long time in politics, but a decade is often a short time in science,' Xuereb comments.

Innovation has to start from somewhere, and it often starts from ideas which may have no apparent relevance to our everyday lives. We need to support researchers by keeping an open mind to unknown long-term possibilities—or the world might not only miss the next earthquake but also the next life-changing discovery. 





Women in  
science,  
*do it  
with art*

*STEM subjects tend to intimidate, seeming inaccessible to the untrained eye. **Dr Vanessa Camilleri, Dr Marie Briguglio, and Prof. Cristiana Sebu** speak to **Becky Catrin Jones** about how they are challenging preconceptions by combining science and art at Science in the City, Malta's national science festival.*

It's 2018. We live in a world where saliva samples sent out from the comfort of our own homes return to us with a sprawling outline of our ancestry and where some of the biggest social media influencers are robots. Despite this progress, utter the word 'scientist' and the outdated image of men in white lab coats still abound.

When advances in STEM (Science, Technology, Engineering, Mathematics) direct almost every aspect of life, why is it that so many still switch off the minute we mention science?

Researchers haven't always had the best PR. In films and TV, science is often portrayed as a foreign language, gibberish to most. Real life is not always that much better, with some researchers needing to carry a jargon-busting dictionary around to translate what they study. To improve its reputation, we need a more creative approach that can break these stereotypes and bring science to the masses in a way that doesn't send people running for the hills.

Science in the City (SitC), Malta's science and arts festival, is the perfect opportunity for researchers at the University of Malta (UM) to bring their research to citizens in a way that doesn't need subtitles.

Professor Cristiana Sebu (Department of Mathematics, UM) joined UM only three years ago, but has already made a firm mark. With a background in Applied Mathematics, she moved to the university as an Associate Professor,

setting up a new course stream for undergraduate students in Biomathematics. Sebu's interests lie in the practical applications of mathematics, particularly in biology, and in exploring how mathematics underpins essentially everything in life. 'The links between mathematics and biology are strong,' Sebu asserts. 'We need to be able to make predictions and apply mathematical modelling to understand complex and intertwined biological systems such as signalling pathways in the body or ecosystems in the environment.'

That said, Sebu is still very aware that her love for mathematics is not often shared by the wider world. The word 'mathematics', however applied it might be, still strikes fear into the hearts of many. In an effort to counter this reaction and replace it with a more positive one, Sebu is joining the myriad of researchers at SitC and adding music to the mix.

'Maths provides the building blocks and the structure of music,' says Sebu. 'Debussy, Mozart, Beethoven, and so many more used a mathematical pattern known as the Fibonacci Series in their scores.' The Fibonacci sequence is an infinite pattern of numbers where the next number is the sum of the two previous ones, going from 1, to 1, 2, 3, 5, 8, where  $(1+1) = 2$ ,  $(1+2) = 3$ , and so on. This sequence is closely related to what's known as the Golden Ratio, an infinite number which can be found in so many examples throughout nature, from the composition of bee colonies to the shape of seashells and the patterns in sunflower seeds. 



**Dr Vanessa Camilleri**

*Debussy, Mozart, Beethoven, and so many more used a mathematical pattern known as the Fibonacci Series in their scores.*

To highlight this elegance, Sebu has teamed up with jazz composer Diccon Cooper. The performance, entitled 'Jazzing the Golden Ratio', will feature presentations of the Golden Ratio in art, the environment, and the human body, accompanied by Fibonacci-inspired jazz music specially commissioned for the festival. Sebu herself will also be there, sharing her thoughts about the significance of this pattern in the world around us. 'People see arts and science at odds, but the two are very much embedded in each other,' Sebu states. 'Hopefully we'll be able to demonstrate the beauty of mathematics at Science in the City this year.'

The significance of this connection between arts and science is a notion shared by Dr Vanessa Camilleri (Faculty of ICT, UM). After working on a project

combining Artificial Intelligence (AI) with behavioural studies at Coventry University, Camilleri found a niche research environment using immersive technology and design to influence our decisions and behaviours. Returning to the UM, she worked on a Virtual Reality (VR) headset allowing teachers to experience what it might be like for a child with autism in a classroom.

'Unless you experience something, it's very difficult to reach a deep level of empathy,' Camilleri said of the idea behind the project. 'We wanted to give [teachers] the opportunity to build new memories through VR, and help them understand the needs of the child in greater detail.'

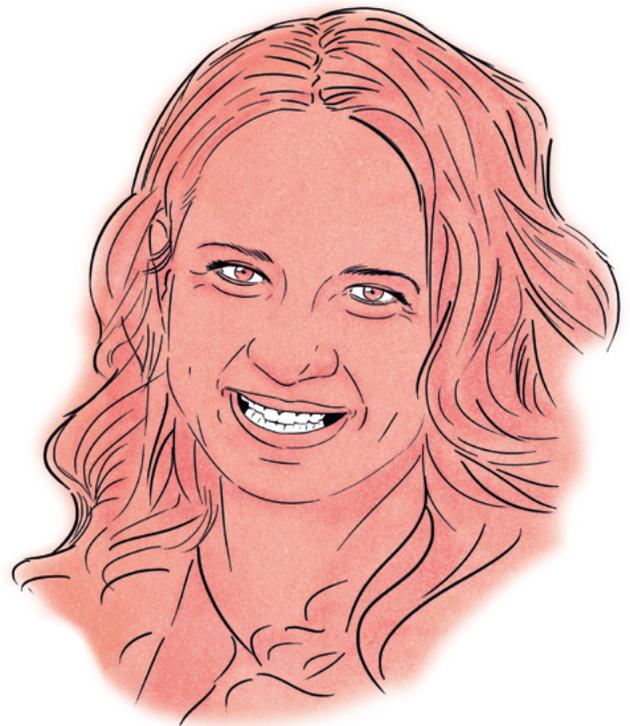
For SitC this year, Camilleri is taking a different approach. The VR headsets are having the night off, and attendees will need nothing but their smartphones

to see science brought to life in artistic form. Using Alternative Reality (AR) methods, she's collaborating with artists Matthew Attard and Matthew Galea to bring a fourth Triton to the fountain for one night only through a project funded by Valletta 2018. By downloading the smartphone app, attendees will see the new fountain brought to life through their phones. In the build-up to the festival, the artists are using eye-motion tracking and heat mapping sensors on volunteers to see which bits of the current statue draw their attention. This is then translated into the final depiction, making the fourth Triton as eye-catching as the current three.

Lecturer Dr Marie Briguglio (Faculty of Economics, Management & Accountancy, UM) is also hoping to use art to bring her subject to life, albeit in a more sober manner. As a behavioural



Prof. Cristiana Sebu



Dr Marie Briguglio

economist, Briguglio's focus is on a population's impact on environment and how we can police this. In particular, at SitC, she wishes to convey the 'Tragedy of the Commons'—the notion that free or common assets such as public space or air are likely to be exploited by the masses due to sense of entitlement combined with lack of responsibility.

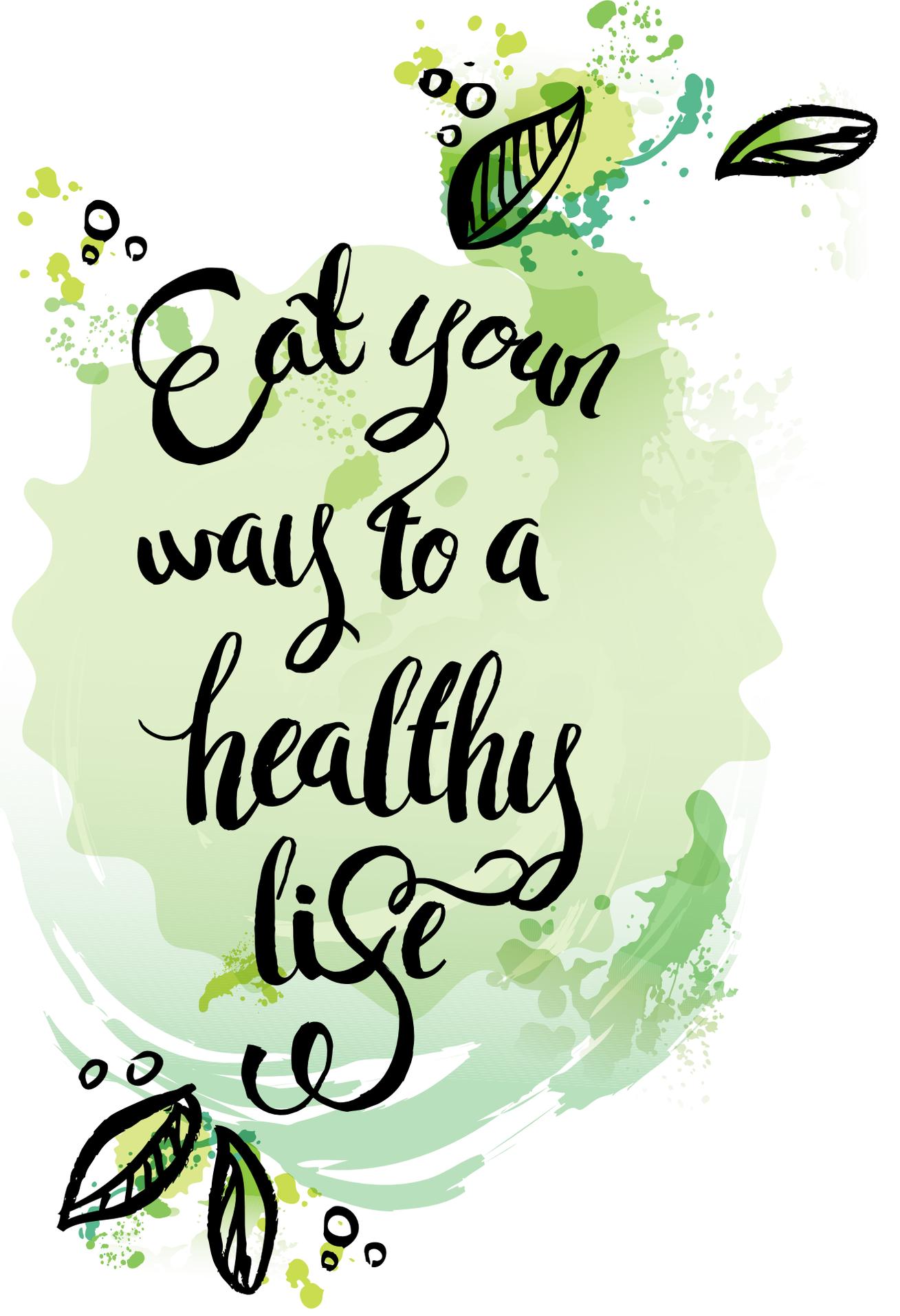
To do this, Briguglio recruited the expertise of Steve Bonello, a cartoonist with a political bent. 'Working out how best to design environmental regulation underpins much of the research I am involved in. But it's also very evident in many of the cartoons Steve draws,' says Briguglio. 'I soon realized that there was enough material to write a book.' And so they did, combining the work of faculty with cartoons to produce the comic *The Art of Polluting*.

Home truths about how we personally damage the world we live in might not make for easy reading, but Briguglio hopes the fusion between arts and science will make this message easier to swallow. 'It is intended to bring to light research on environmental pressures, status, and responses in a manner that is accessible and also fun.' The book itself will be displayed as part of a larger instalment titled *No Man's Land*, which will include a live action play, more detailed research, and even a free tree-planting stall.

Putting research on the main stage is no new concept to any of these three, and this year's SitC is certainly not their first venture into science communication. The projects they've put forward have all stemmed from previous public engagement ideas. Camilleri worked with the same

artists on an AR feature about Greek Mythology, and she regularly translates her research for mass media. A science communication event, *Go For Research*, which was spearheaded by the Faculty of Science and Directorate of Curriculum Management and aimed at the Junior Science Olympiads was where Sebu's idea for highlighting the beauty of mathematics was born.

The passion for their subjects is infectious in all three researchers. Each one listed the prospect of inspiring their audience as their top goal for the festival. Shaking up science communication by presenting it in a way we wouldn't expect, through musical maths, theatrical economics, and artistic AI, provides an opportunity for researchers and citizens alike to see science through a new lens. One where progress seems brighter and kinder. 



Eat your  
way to a  
healthy  
life



*With growing evidence showing that our eating habits affect not only our waistline, but our physical and mental health, should we all be turning to the Mediterranean diet to live longer, healthier lives? **Prof. Giuseppe Di Giovanni, Prof. Christian Scerri, and Dr Paulino Schembri** write.*

The saying 'You are what you eat' is often bandied about, but just how much does the food we eat affect us?

Tons of research has shown that overeating and an unbalanced diet increase the risk of diabetes and cardiovascular diseases. Half of all cancers are preventable by adopting a healthy lifestyle, following a balanced diet, and reducing environmental pollution. People who consume too much sugar and fat are also more likely to suffer from mental health issues.

Excess sugar harms the brain by promoting inflammation and oxidative stress: stress which causes breaks and base damage in our DNA. Our ongoing research at the Department of Physiology and Biochemistry at the University of Malta, together with the Department of International Studies, correlates high sugar consumption with impaired brain function and a deterioration in symptoms of mood disorders such as depression. We also agree that diet plays a role in the development of dementia.

So, what is a 'healthy' diet? We would say the answer is simple: lots of fresh, unprocessed, nutrient-dense foods. And

the good news? The Mediterranean diet is a favourite among scientists in the field.

Much like its people, the Mediterranean diet is a fusion of cultures. Every region adds its own twist; however, they're all bound by common features. Key ingredients include extra virgin olive oil as the principal source of fat, a ton of vegetables (including leafy greens), and fresh fruits to substitute sugary desserts and highly processed snacks. Cereals and fibre are also on the menu, with wholegrain staples being the preferred option. More good stuff includes nuts, seeds, and legumes. Consumed more moderately are fish, seafood, poultry, dairy, red wine, and eggs, with red meat, processed meats, and sweets being at the bottom of the pile.

Our kitchens are full of colour, enticing flavour, and the delicious aroma of a plethora of herbs. The typical Mediterranean diet (which doesn't include some traditional Maltese dishes, such as pastizzi, imqaret, and timpana) is what will maintain strong, healthy minds and bodies.

So, with this knowledge, why do people continue with unhealthy eating habits? It seems we are hardwired to crave sugar and fat. Our brain still 



## FOODIE WORKSHOP

If you're looking to take control of your health and its correlation to the Mediterranean diet then join We are What We Eat, a three day programme taking place in October that includes talks by our three foodie scientists, cooking sessions, and a day-trip to Sicily to visit organic fields. Link: <http://bit.ly/EatFoodMed>

**Top:**  
The correct definition of a healthy and clean Mediterranean diet

**Above, left to right:**  
Dr Paulino Schembri,  
Prof. Giuseppe Di Giovanni,  
and Prof. Christian Scerri

*Photo by James Moffett*

works the same way as that of our ancestors; it interprets sweet food as a signal for energy and bitter food (like vegetables) as a warning sign of potentially poisonous plants. However, these innate habits can be rewired to suit our modern lives.

We already see that the childhood preference for high salt and sugar decreases with age. Repeated exposure to less salty or lower fat food can retrain adults to beat their cravings too. While sweet and bitter preferences are harder to shift, neuroscience may finally provide the switch everyone is avidly awaiting. One day we may crave broccoli more than that huge packet of crisps with a side of chocolate ice-cream. Imagine that!

But could the Mediterranean diet be a Trojan Horse? While fruit and

*One day we may  
crave broccoli  
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ice-cream.*

vegetables contain large quantities of antioxidants, which can prevent oxidative stress (one of the main cancer-causing culprits), it is also true that produce is increasingly exposed to pollutants from various sources: water, air, and fertiliser and pesticide use. The International

Agency for Research on Cancer, part of the World Health Organisation, has classified outdoor air pollution as a cancer-causing agent. All of these pollutants affect the food chain, both through direct application of pollutants on food, as well as indirectly through irrigation and sea water.

Water is routinely contaminated by traffic, industrial discharges, and fireworks. Nitrogen, though essential for plant growth, can be very dangerous, seeping into groundwater and having a direct effect on fruit and vegetables as well as the humans that eat them. Clearly we must ensure that the food in our markets is clean and free from harmful substances. To do this, farmers, consumers, and politicians need to be better educated. **T**





# SAVING SHARK BABIES

Sharks are a vital part of marine ecology, keeping everything beneath them in the food chain in check. But they're being caught and consumed at an alarming rate, and people aren't even realising it. **Randel Kreitsberg** writes about Sharklab Malta founder **Greg Nowell's** work in raising awareness and preserving these fantastic creatures.

'I'll pick you up at 2.45,'

Greg says casually.

'AM?'

'Yes,' he smiles.

There is a one hour gap, between three and four in the morning, before the Pixkerija (fish market) in Marsa opens to the public. This is the time when fishermen arrive with their catch, but their clients, chefs and managers of Maltese restaurants, have yet to appear.

It is also when Greg Nowell, founder of the Sharklab Malta elasmobranch conservation group, and a small crowd of volunteers inspect the shelves and boxes of fresh catch. They're looking for two local catshark species—nursehounds and lesser spotted catsharks—so they can cut them open and save the viable eggs still inside the females in the hopes of releasing them back into the wild.

## AN ENGLISHMAN'S LIVING ROOM

Greg Nowell is a diver whose 'regular' job involves electronics quality auditing and building renovation works. In 2011, while at a local fish market, Greg noticed something unusual. One of the catsharks on sale had an egg protruding from it. 'I took it out, and it looked intact. I could see there

was something inside,' he says. He decided to put the egg in an aquarium to see what would happen, and while the shark pup inside developed successfully over the course of a few weeks, it eventually died before the two month mark. Looking back, Nowell can confidently say now that it had everything to do with temperature.

'Originally, we didn't know all the parameters we needed to develop the eggs. Temperature was the big eureka moment. Most of the eggs collected during the year's early months started to develop nicely, but after some time most of them simply stopped – until we installed the cooling system! Now if we have an egg that starts to develop, it has a 95% chance of making back into the sea,' Nowell says proudly.

It took two years to successfully release the first market-sourced shark pup. Nowell released the baby himself. 'I don't know if it was saltwater in my mask or tears—it was beautiful!' More than 280 shark babies have been released into our seas since then.

## MOVING ON

Today, a lot has changed. The Sharklab team and volunteers proactively check all the egg-laying shark species in fish markets before they're sold. The shark pup

aquariums have also moved out of Nowell's living room and into tanks in the Malta National Aquarium, where citizens can learn and foster an appreciation for them.

While the initial plan for our interview was to go to the fish market and save the eggs still alive in the female sharks, a storm put an end to those plans. The fishermen couldn't go out to sea, so we made our way to the Malta National Aquarium instead.

The aquarium looks different from others I have visited over the years. Yes, there are some tropical species and colourful Japanese Koi Carps, but the majority of species there are local. This includes 20 to 30 cm nursehound pups and their empty egg-cases. It immediately strikes me that the focus of the aquarium is conservation and education, rather than the display of pretty fish.

Sharklab science officer Lydia Koehler praises the national aquarium for their support. She emphasises that with the help of the national aquarium, other countries are following suit and scavenging viable eggs from caught female sharks. Currently, there is a Sharklab in Bosnia Herzegovina, founded with Sharklab Malta, as well as activities in Spain and Greece, which are making strides. 'In

Spain they have a lot of Blackmouth Catsharks,' Koehler says. 'They had their first release couple of weeks ago.'

## WHAT CAN WE DO?

'A major part of what Sharklab Malta does is raise awareness and educate people,' Koehler says. 'And we have seen a change amongst younger people, appreciating the animals for what they are.' But there are challenges too. 'There is a generational gap,' she notes. 'Some older people don't go into the water because there could be sharks in it. They are still very afraid of them.'

At the same time, shark is still a popular menu item with locals and tourists, which is why populations are heavily exploited in Malta. Koehler says that the volume of catches is astounding. 'The first few times you go to the fish market, you don't actually realise how many sharks they bring back. That was one thing that really shocked me. Especially for the small

spotted catsharks. They come in boxes of 40 to 60 individual sharks. Once we saw them bring in 40 boxes in one day.'

Koehler says that most people don't even know they are consuming shark. 'Traditional Maltese fish soup, *aljotta*, often has several different species of shark in it,' she says. 'The issue is people don't call them sharks—they call it fish soup. If you ask people whether or not they eat shark, their reply is: no, we don't. But if you ask: do you eat *mazzola*? The reply is yes. They don't know sharks are used in it,' Koehler says, joking then that we should give up *mazzola* for good.

But there is more to Sharklab than the sharks themselves, Nowell notes. Towards the end of our trip to the aquarium, he highlights the need for better ecosystem management. 'The animals, as fascinating as they are, live in an environment,' he says. That itself deserves attention.

'Plastic is a major issue for all marine life, and if you start affecting

any part of it, you're affecting sharks,' Nowell says. 'We also need to be knowledgeable about the species we're consuming. Overexploitation of fish species because we like to eat them has a direct impact on sharks, because they can get caught accidentally as bycatch.' Being apex predators, sharks have a critical role in maintaining the species below them in the food chain. They remove the weak and sick individuals, all while keeping competitors balanced to ensure species diversity. Sharks are essential for ocean health, and they have to be protected.

There is much to be done. And there are lots of opportunities to get started, as Nowell and his volunteers have clearly shown by empowering themselves and taking action. But as with every environmental issue, larger numbers make the loudest noise. And so it always boils down to a very simple question: Do we care enough to add our voices to the call? **T**

Baby sharks at the Malta National Aquarium  
Photo courtesy of Malta National Aquarium

# MALTESE FOR ALL



*What would you do if you were stripped of your words? If speech simply didn't come to you? **Sylvan Abela** writes about MaltAAC, an Augmentative and Alternative Communication App for the Maltese Language.*

In 2016, education minister Hon. Evarist Bartolo faced calls to remove Maltese O-levels as a prerequisite for autistic youths to enter the University of Malta. The Maltese language has a reputation for being quite a tough one to master, and a cross section of parents, politicians, and educators felt that people with language difficulties were being held back in their personal and educational goals. The idea sparked hefty debate throughout the Maltese community, with many expressing their concern that making the Maltese language an optional subject to study would be another nail in its coffin.

Linguist Dr Sarah Grech (Centre for English Language Proficiency) says Maltese is no different from any other language to learn. What it suffers from is a lack of resources when it comes to mastering it. 'Television, cinema, games, books, apps—there are so many choices when it comes to absorbing the English language. The same cannot be said for Maltese,' she says. Thankfully, this situation is changing.

## IDENTIFYING TALKING POINTS

Most children naturally convert thoughts into word sequences and couple these to the necessary muscle movements to speak. However, there are others who are unable to translate their thoughts into audible words, creating the need for an alternative means of communication. Enter Augmentative and

Alternative Communication (AAC), which is any method of communication that serves to aid or function as an alternative to speech.

Common examples of AAC systems include gestures, facial expressions, and communication boards with visuals that correspond to different words. AAC has proven to be crucial for children who suffer from communication impairments due to cognitive issues such as autism, or motor impairments like cerebral palsy. Over the past 40 years, this field of research has evolved with the noble aim of developing more convenient and accessible AAC solutions for children. But there are challenges.

The main limitation of AAC systems is their communication rate. While most people communicate their thoughts effortlessly, converting ideas into words in a matter of milliseconds, AAC users type letters in a text box or choose pictures from a visual array to construct sentences. In practice, while a child may speak at a rate of 130 to 200 words per minute, AAC users reach rates below 10 words per minute. It is easy to understand why this can be immensely frustrating for AAC users. Thankfully, solutions are on the horizon. Numerous studies have shown that by implementing next word prediction functionality in high-tech AAC systems, the same technology that lets your phone predict what word you will use next, communication rates can be improved 🗣️

significantly. AAC developments in the Maltese language are very limited and no complete high-tech AAC system exists. Our team has risen to the task to tread new ground.

Under the supervision of Dr Ing. Owen Casha, myself (Sylvan Abela, Department of Microelectronics and Nanoelectronics, Faculty of ICT) and Dr May Agius from the Access to Communication and Technology Unit (ACTU, the agency responsible for assessing individuals for AAC solutions and research) joined forces to create a mobile AAC app that would allow children with communication impairments to communicate in Maltese, all while reducing the amount of effort they require to do so and improving their communication rate.

The app owes its inception to SPEECHIE, a project working on a toy

that supports language development in preschool children (See **THINK** issue 24, pg 30). Dr Daniela Gatt, a member of the SPEECHIE consortium, introduced Casha to Agius, who emphasised the urgent need for an AAC app tailored to Maltese children.

At the time, the ACTU team were continuously dedicating resources and effort to customising existing AAC apps originally designed for English. However, this proved problematic due to English being a Germanic language and Maltese being semitic.

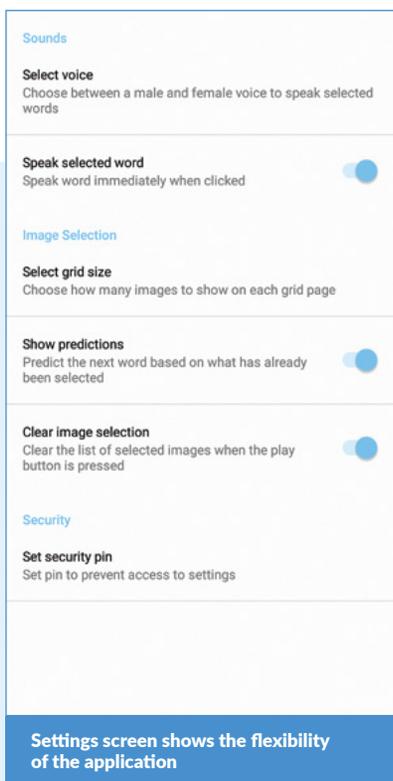
In early June 2017, faced with the selection of a final project for my degree, the development of a mobile AAC app stood out from the list of project proposals. Its potential to have a positive impact on people's lives made it an unmissable opportunity to give back to the community. I requested

a meeting with Casha and Agius without giving it a second thought.

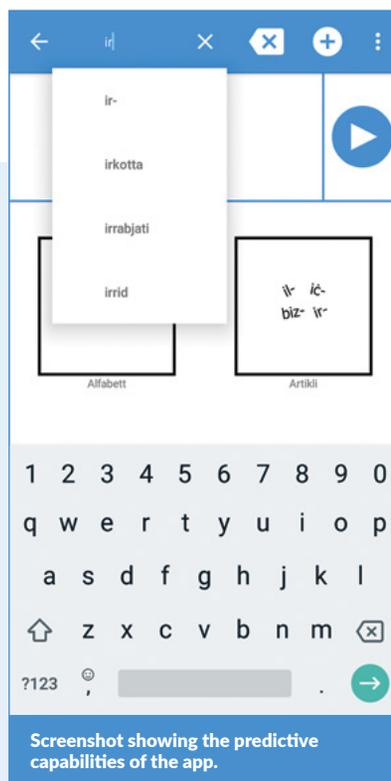
There, we discussed how we could combine the engineering and rehabilitative disciplines to produce a practical and beneficial AAC solution for Maltese children. This initial meeting ultimately paved the way for the birth of MaltAAC, the first AAC app specifically designed for the Maltese language.

## DIGGING OUR HEELS IN

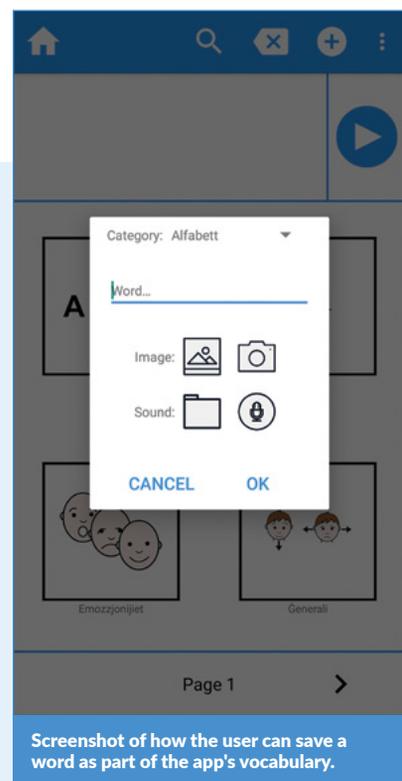
Work on the MaltAAC project began with a sit-down at the ACTU, where Agius ran us through the prevailing AAC technologies and identified the essential features that comprise a high-tech AAC system. Dedicated speech generating devices (SGDs) were, and still are, considered to be the most appropriate high-tech AAC systems, 



Settings screen shows the flexibility of the application

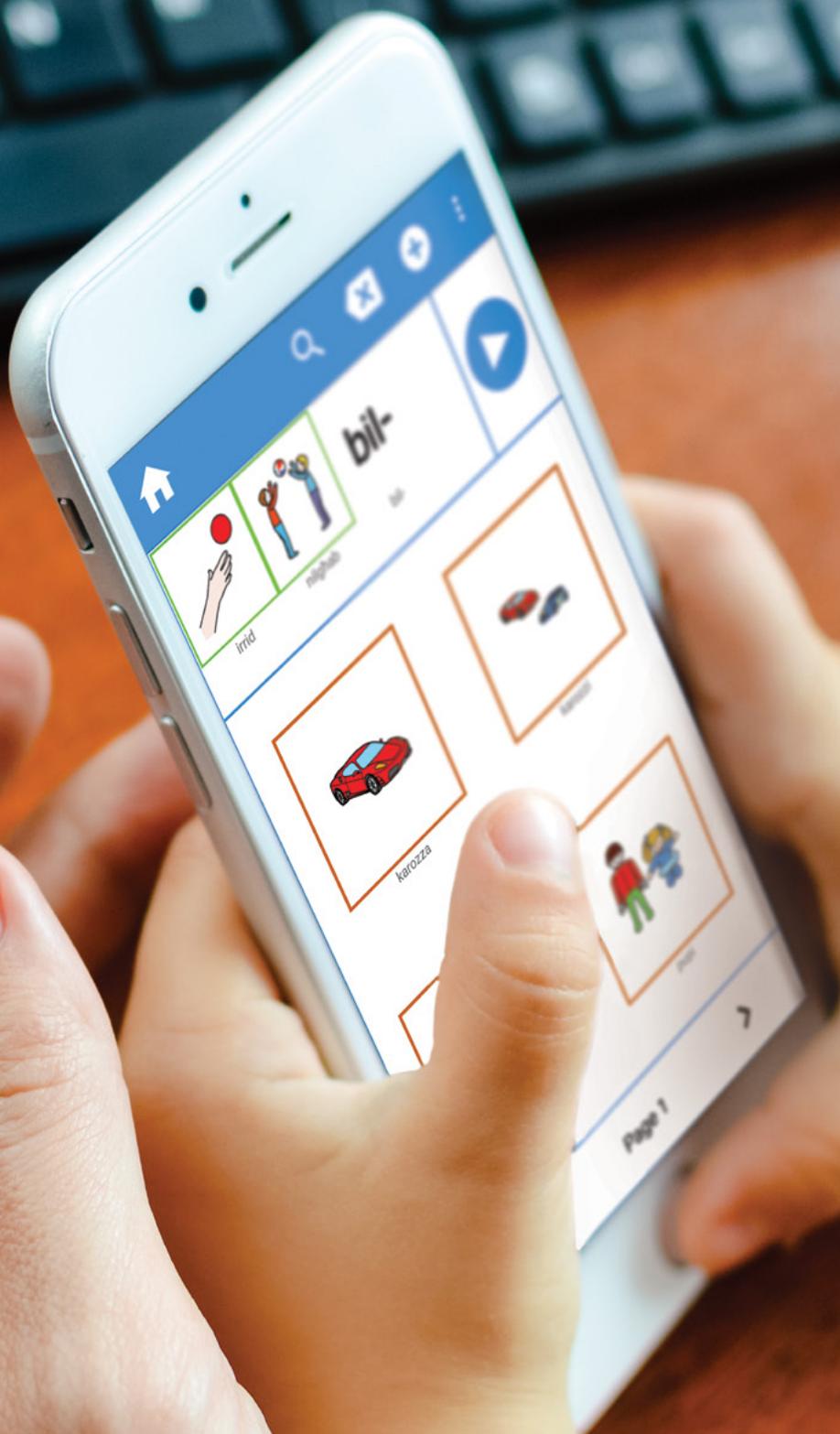
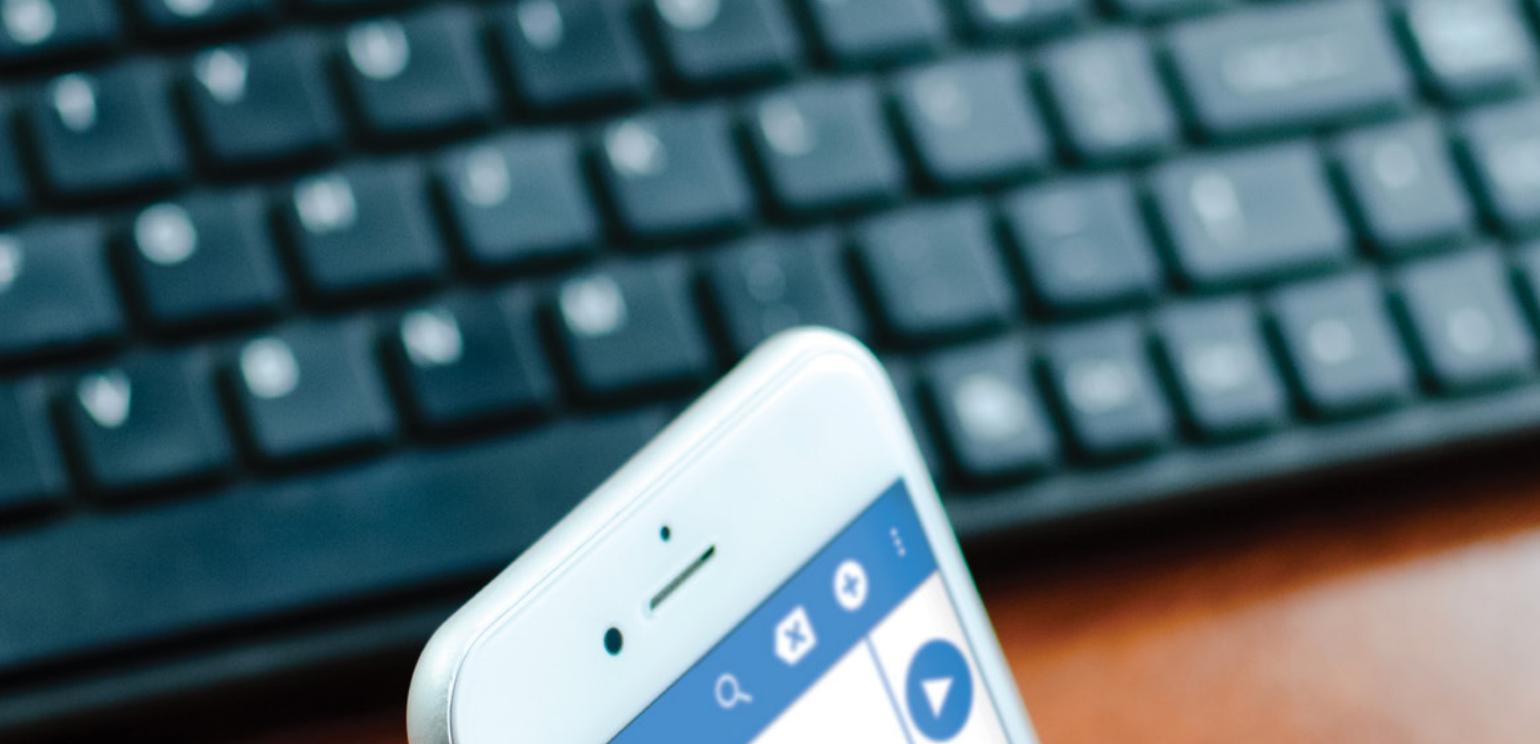


Screenshot showing the predictive capabilities of the app.



Screenshot of how the user can save a word as part of the app's vocabulary.

All images courtesy of Maltese AAC App





**Dr Ing. Owen Casha**  
Photo by James Moffett



**Dr May Agius**  
Photo by James Moffett



**Sylvan Abela**

*[The app's] potential to have a positive impact on people's lives made it an unmissable opportunity to give back to the community.*

and for some people, no other AAC solution suffices.

Unfortunately, SGDs come with extremely high price tags, ranging from €3,000 to €15,000. To improve accessibility and affordability, we decided to use a smart device. The next choice we needed to make was the operating system. When deciding between Android and iOS, it came down to market share. In

Malta, Android holds the lion's share with 70% of users, all while being a lot cheaper than Apple devices.

The app features a symbol-based user interface (UI) which looks a lot like the layout used in most high-tech AAC systems intended for children. Primarily, users tap images to input their thoughts. They also have the option to type should they wish to. The image grid is the main component of the UI, which users can resize based on their needs and abilities. This symbol-based system makes the task easier for children, as it helps them visualise the words. We tried to reduce their communication effort even further by using the Fitzgerald Key to colour-code each symbol based on the word's grammatical role. So nouns are orange, verbs are green, adjectives/adverbs are blue, and social words are pink.

The next step we had to tackle was integration of speech into the app. However, a Maltese text-to-speech

engine for the Android platform does not yet exist, so we had to manually record the audio ourselves. Desperate for the project's success, I turned to my beloved girlfriend, Nicole Fsadni, for support. At that point, she was well-accustomed to hearing about the project and didn't hesitate to help. Nicole and I scheduled an appointment at the University of Malta's radio station, Campus FM, and recorded the speech using its state-of-the-art equipment, ensuring that the speech the app generated was the best it could be.

### **MORE TO IT THAN MEETS THE EYE**

But MaltAAC goes beyond translating image-tapping into speech. It enables users to add, remove, and edit words in the app's dictionary according to preference. Children's caretakers can protect app features with a security PIN. In addition, they can monitor the child's progress, back up their



### The MaltaAAC project was designed with children in mind

AAC profile to the cloud, and lock the device for sole use with the AAC app. To reduce the effort of the child when communicating and improve their communication rate, we implemented a smoothed trigram language model, which generates a list of the most probable next words each time the user selects a new word. The trigram model was most suitable not only because of its ability to provide accurate predictions, but also because of its short training time and low memory consumption, which are essential for swift performance in mobile apps.

After developing the app, we tested it. We identified bugs and measured the language model's accuracy. It passed both tests, so we moved to the black-box testing stage.

At this point, we ran MaltaAAC through its paces. The app was handed over to three occupational therapists, two speech therapists, and two learning support educators working

at ACTU, all of whom took it out into the field. These specialists make use of AAC technologies on a daily basis to assist children in their communication needs and therefore could properly evaluate the app. A month later, they came back full of positive experiences and gave us invaluable feedback.

Our next move will be to improve the UI in line with the recommendations made by the AAC specialists. Among other things, they suggested switching the position of certain grid elements and changing the interface to a darker colour to improve the visual contrast. We are also working on a Maltese text-to-speech engine, which would replace our home-made voice recordings with synthesised speech. Now MaltaAAC has been published on the Google Play Store, and we will eventually start working on an iOS implementation of the app. Undeniably, a laborious journey lies ahead, but the time is ripe to capitalise

on the momentum of this project's success and ride it to the finish line.

### WATCH THIS SPACE

The MaltaAAC project is nothing if not a solid step forward in promoting the use of the Maltese language while providing an accessible solution to Maltese children with complex communication needs. However, in addition to assisting native speakers, MaltaAAC can be taken a step further to serve as linguistic first aid to immigrants arriving in Malta. In this scenario, the app can be used to facilitate their communication and support their integration into Maltese society.

The MaltaAAC project was sparked by the will to help the vulnerable in our society. From one group, children, we now realise that the app has the potential to help many more groups in our community. We hope to continue giving people the tools they need to help them connect with those around them. **T**



# *Sustaining mobilisation:*

← what will it take?

*You can't watch Blue Planet and not feel a pang of guilt for the plastic straw in your drink. But what does it truly take to mobilise people and encourage more sustainable behaviour? **Kirsty Callan** talks to **Dr Vincent Caruana**.*

**W**e're finally living in a world where environmentalism is a sexy topic. Everywhere you look, it's vegan-this, plastic-free-that. And it's wonderful. Public awareness of the impact we are having on our planet is on the rise, and yet, according to Eurostat, Malta still registered the European Union's highest increase in carbon dioxide emissions from energy use in 2017.

Researcher Dr Vincent Caruana (Centre for Environmental Education and Research, University of Malta [UM]), believes the crises we are facing can be summed up in one double challenge: the eradication of poverty and the preservation of the environment. By simplifying the issue, it is turned into a single problem rather than many overwhelming issues, highlighting the interconnectedness of the challenges we face, be they social, economic, or environmental.

Taking Nepal and Bangladesh as examples, both have suffered devastating floods. Some point to large-scale deforestation by logging companies and

agricultural businesses, as well as locals using the forests' resources. Some environmentalists point to the population and blame them, saying that the increasing use of the forest by locals places burdens on the region's resources, suggesting that their activities are the current major source of environmental problems. But that creates a scenario where the victims of poverty are blamed for trying to alleviate their own poverty. Meanwhile, the reality is that the wealthiest one-fifth of humanity consumes so much more than the rest of the world, leaving the rest hungry.

In his classes, Caruana runs his students through a similar thought experiment. Who is most to blame for these problems? International institutions such as the United Nations, national governments, transnational corporations, or consumers? Some argue that it is greedy transnational corporations, out to make a quick buck while ignoring environmental impacts. Some retort, saying that corporations are bound by economy to maximise profits. Others would point their fingers at the consumers who choose 



to buy from dirty companies instead of the most ethically sourced. 'Of course, there is no correct answer,' Caruana states. 'There is no single solution. We need thousands of solutions working in parallel. Literally. The interconnectedness of it all requires both governments and civil society to commit time and effort.'

### GETTING TO THE CRUX

Caruana's doctoral research identifies the influences that lead people to engage in responsible sustainable behaviour and hones in on ways to sensitise and mobilise sustained civic action.

Caruana is quick to note that there are a plethora of barriers—social, economic, and political—which prevent people moving towards sustainability. What surprised him was that more personal barriers, such as frustration, hopelessness, and dealing with disappointments, also pose a problem. 'This is a significant point, considering that environmental circles are often concerned with reaching out towards the unconverted rather than supporting the converted,' he explains. In other words, we have to continue to motivate those who are already on the right path to ensure they don't become demoralised.

Looking to understand how people can take control of processes that affect their lives, Caruana conducted four case studies. Among them were an intentional community in Malta and a Fair-Trade network in Egypt. 'The power of case studies lies in their ability to reframe and critically challenge core beliefs that are now taken for granted, like how a municipality, church organisation, and a trade organisation ought to act,' he says.

Caruana believes that education on sustainable development (ESD) lies at the heart of it all—and he is not alone. In 2015, representatives from 193 countries gathered in New York to sign off on the 2030 Agenda for Sustainable Development. At the opening ceremony of the summit, Ban Ki-moon referred to the the Agenda outlined as 'a to-do list for people and planet'. One goal focuses on education, which includes the aim to 'ensure all learners acquire knowledge and skills needed to promote sustainable development by 2030.'

In Malta, ESD is established as a cross-curricular theme within the National Curriculum Framework. However, 'in practice, it is still in the process of being concretely translated across schools and within subjects,' Caruana notes. He also highlights the



**Dr Vincent Caruana**  
Photo by James Moffett

need for adults to be educated too, so that this cultural shift can truly happen; however, he is quick to follow up the notion with its own weakness. For years, adult ESD has remained 'locked within ideologies which have caused many of our contemporary environmental problems.' We need a complete overhaul of our outlook. Increased emphasis on recycling is a positive; however, what would be better is if we could reduce the amount of waste we are creating in the first place. This is but one example. 'As long as ESD remains

## Who is most to blame for these problems? International institutions such as the United Nations, national governments, transnational corporations, or consumers?

stuck within the same thinking that is creating the double challenge, there can be little progress,' says Caruana.

### **CLEARING THE SLATE**

Back in 2001, Caruana co-founded Malta's Fair-Trade movement. 'Faced with the continuous realisation of an unfair world trade system, and seeing first hand through my voluntary work how such a system creates poverty, my friends and I wanted to be proactive and part of a solution,' he states. 'The path forward was not chartered for us. We started off passionately, then with each step, we finally arrived to setting up a fair trade shop and an ongoing educational programme. Rather than complain, we have within us the power to create new solutions.'

This philosophy is at the core of what Caruana is doing now. 'The current model needs to be challenged, and we do have the power within us to create new ways of thinking. We need a shift from thinking in terms of economic growth to growth in wellbeing,' he says. Referring to the United Nations Conference on Environment and Development in 1992, Caruana says they had it right. 'A country's ability to develop more sustainably depends on the capacity of its people and institutions to understand complex

environmental choices.' We need real leaders, not token ones, who inspire, embrace and support citizens in their actions, and create new spaces for dialogue. 'Both Civil Society Organisations and local institutions can be a positive force towards sustainable solutions at a local level.'

### **GETTING TOUGH**

This mission is a beastly mountain. The reality is that there are major hurdles standing in the way of a paradigm shift that would see Malta's people acting more sustainably. Beyond personal barriers, Caruana's research reveals the vulnerability of local processes: 'In Malta, a change in government results in a change in priorities (and support).' Every five years, the system is shaken by an election that brings with it new agendas and philosophies. 'Stability in environmental issues and processes is essential,' he notes. Caruana also points out the fragility of civil societies' human resources.

The solution, Caruana suggests, is 'to create stronger links between governments, politicians, organisations, and citizens, both for research and to build a network of adult educators.' This was highlighted in his Fair Trade case study where success

was highly dependent on the level and consistency of engagement at both a local level with producers and with their partners in the west.

It is clear that good leadership is key. To help address this issue, he has created an Erasmus+ project called PEERMENT with the aim of coming up with a new model of mentoring and peer-mentoring for ESD. It involves about 20 education specialists as teacher trainers and senior mentors and about 50 teacher mentees.

'We have to invest in leadership,' says Caruana. 'We need to focus on social learning and empowering institutions and organisations to work together and become innovative co-creators of new ways of thinking. In an ever-changing world, this is a challenge for educators to embrace with passion and urgency.'

Circling back to the double challenge, it is clear that no one project will be able to comprehensively solve the issues we are facing as a global society. But 'we have to stop waiting for permission,' says Caruana. 'The beauty of the emerging paradigm lies in the reality that we don't need permission to change outmoded mind-sets that no longer serve us.' And this will be crucial in the road ahead. **T**



# Luzzu TRUTHS

Strolling along Malta's coast, you'll be mesmerised by the rainbow of traditional fishing boats ambling on the water—that and all the eyes ogling at you from their bows. **Katre Tatrik** takes a closer look at the hidden meaning behind the luzzu's colours.

The Maltese *luzzu* dates back to the time of the ancient Phoenicians. For generations, Maltese fishermen have painted them in a kaleidoscope of bright colours, turning them into a national icon. But is there rhyme or reason to the hues they choose?

Lifelong fishermen, brothers Charles (62) and Carmelo (70) from Marsaxlokk, paint their *luzzus* twice a year in bold blues, reds, and yellows. It's no easy task, requiring thorough cleaning and six layers of paint. Despite their dedication, Charles and Carmelo, like many others, are largely unaware of the hidden meanings the colours on their boats carry. 'They're all the same,' Carmelo says. 'It's just for beauty.' Charles adds that 'these boats have always looked the way they look.'

But in 2016, Prof. Anthony Aquilina from the University of Malta embarked on a project that would uncover more. 'Contrary to what you have been told, there is a lot of meaning in the way our traditional boats are painted,' he explains. Aquilina edited and published *The Boats of Malta - The Art of the Fisherman*, written by world-famous anthropologist Desmond Morris.

Morris resided in Malta for six years in the 1970s, visiting each of the fishing villages on the islands. During his stay, he sketched some 400 of the 700 traditional boats anchored in the

coastal villages. He wrote: 'to visit a Maltese fishing village is like entering a huge, open-air art exhibition.'

Summing up Morris' work, Aquilina says that 'even in a small country, you can see the difference between one locality and another. But at the same time, there is the individual stamp of the fisherman, of that particular person.'

Morris' main findings show

To visit a Maltese fishing village is like entering a huge, open-air art exhibition

that some traditional rules come into play when choosing the colour palette for a *luzzu*.

Whilst reddish brown or maroon was typically painted on the lower half of the boat to mark the waterline, the locality of a boat's owner could be identified by the colour of its *mustaċċ*. The *mustaċċ* is the band above the lower half of the boat, shaped like a moustache, which gives the feature its name. A red *mustaċċ* would indicate that the boat came from St Paul's Bay, for example. A lemon yellow indicated a boat from

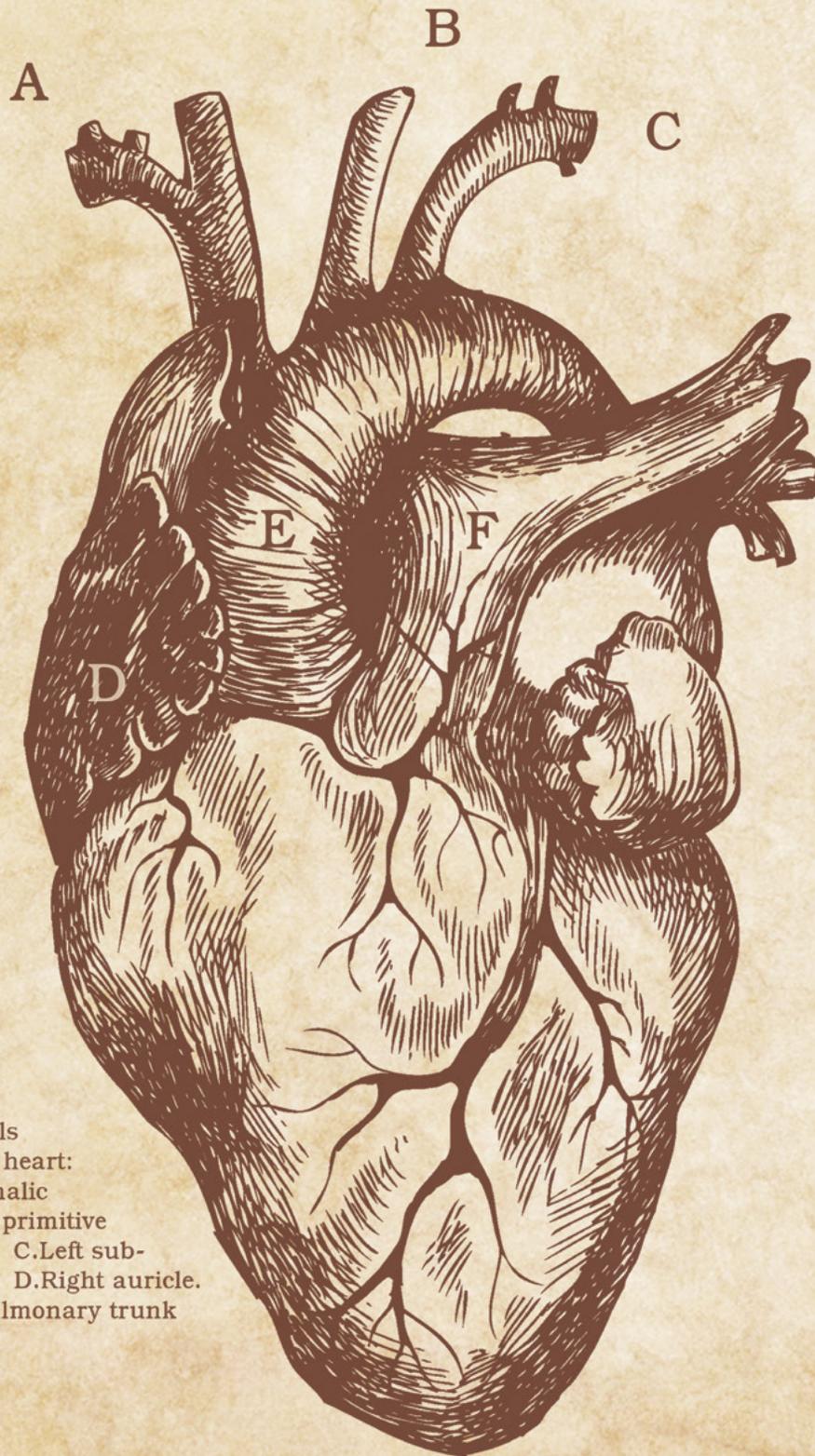
Msida or St Julian's, whilst an ochre yellow one would identify the boat as hailing from the Marsaxlokk and Marsascala area. When a *mustaċċ* was painted black, it denoted mourning for a death in the family.

In addition to colours, decorations also send a message. In more than half of *luzzus*, signature eyes are painted on the bow or the stern—symbols of protection for fishermen out at sea. Where the eyes are not seen, other symbols such as a rising sun, a Maltese cross, fish, shooting stars, or lions are painted on. The gangway, usually varnished brown, can be heavily decorated or engraved with symbols of the sea and the island: shells, mermaids, birds, flowers. Religious insignia are common too, with doves, olivebranches, and lambs often making an appearance.

Political or religious influences also come into play where a *luzzu*'s name is concerned. During the time we spent in Marsaxlokk, we saw *San Mikiel* (Saint Michael the Archangel, patron saint of Isla), *John F. Kennedy*, and *Ben Hur*.

Even if Charles and Carmelo couldn't tell us what the *luzzu*'s colours mean, their dedication to tradition is undeniable. Before we left, they said they were fearful that this part of Malta's heritage may fade away as featureless carbon-fibre boats wade in. I hope they're wrong. **T**

# IDEA



## heart

A muscular organ which is the propelling agent of the blood in the body, situated in the thorax of vertebrate animals

Fig 1. Human heart:

A.brachiocephalic artery. B.Left primitive cartoid artery. C.Left sub-clavian artery D.Right auricle. E.Aorta, F.Pulmonary trunk

# English for medicine: Bridging worlds

You come to Malta to attend Medical School, and you end up in an English class. **Nicola Kirkpatrick** talks to **Dr Isabel Stabile**, **Omar N'Shea**, and **Edward Wilkinson** about the often unappreciated value of the University of Malta's Medical Foundation Programme and its impact on international medical students' lives.

A sea of blank faces stared him down. Omar N'Shea had asked his students a question, but no reply came. None of them wanted to be there. The University of Malta's Medical Foundation Programme (MFP) aims to equip high school graduates with less than 13 years of formal education with the skills they need to enter Medical or Dentistry school. But its focus on academic English is what receives the most ire. N'Shea, one of the programme coordinators, understands. 'They don't see the value initially. They think to themselves: 'I didn't travel thousands of miles away to sit in an English class. No, I want to study medicine.' The frustration is understandable,' he nods.

But when so many international students were struggling with the medical course due to language and communication difficulties, something clearly had to be done.

Looking back at the challenges she was facing when the Medical School opened its doors to international students, Director of Studies Professor Isabel Stabile notes the discrepancy

in language skills. What was expected was quite distinct from the reality of the situation. 'What is interesting about our student body is that their spoken level of English is really high,' says N'Shea, 'but their written level of English needs work to keep up with the demands of an academic course.'

English Programme Coordinator and tutor Edward Wilkinson agrees, highlighting that 'resources were lacking. Teaching exercises and materials were sourced online and everyone did the best they could. But a gap quickly emerged as far as Medical English was concerned.' Stabile further clarifies, 'Most books available were aimed at teaching doctors and nurses bedside manner and care for patients, but there was little to none out there that focused on academic medical English.'

With this philosophy in mind, Stabile, N'Shea, and Wilkinson joined forces to develop a series of books called Academic Medical English for Pathway/Foundation Programmes. These books provided a framework for students to deal with the language in which scientific subjects are taught. The material improves their academic literacy in ways important to medical students, equipping ▶



*With students communicating more, isolation is less of an issue and this is immensely beneficial.*

them with skills such as reviewing research papers, writing reflective essays, and answering essay questions.

The book was 'born out of the needs of these students and the medical program,' says N'Shea. 'The concept is to present to the students the core skills required by the medicine and surgery degrees, so that students become aware of the differences between using English as a lingua franca and using English within the framework of academic literacy.' To enable this, the team included topics to reflect those covered in the science classes that students attend throughout the course. 'So if they're doing pulmonary topics in science classes,' N'Shea says, 'then they're discussing them in English classes too. We used the science as a framework for our English lessons, and that was essential. Rather than teaching two disciplines with no dialogue, we created a bridge.'

This approach saw immediate shifts in perception. Dr Hussein Alibrahim, now a house officer in Kuwait, says his primary and secondary education was all in Arabic, and the foundation course, where English and science stood side by side, 'was an advantage and a necessity. Skimming carefully through an article, identifying keywords, summarising, criticising, asking questions, and looking for the right answers are all skills that I learned for the first time in the foundation course and are skills I still use today,' he added.



**Prof. Isabel Stabile**



**Omar N'Shea**



**Edward Wilkinson**

But the programme was not only useful for medical school. Alibrahim noted how it changed his day-to-day life as well. It taught him important lessons on punctuality and work ethic. 'If you don't learn [these things in foundation school] then maybe you're in the wrong place,' he notes.

With time, the team refined the course. After looking into the discrepancy between spoken and written levels of English, N'Shea and Wilkinson determined that the most probable reason behind it was a lack of reading by the students. Due to this, reading is now a core element of the course and is based on science topics to keep students' interest piqued.

Now that the coursework has been implemented, positive results can already be seen. Students are so ready and raring to go that 'sometimes they even want to take over the sessions,' says N'Shea. 'A student came up to me in class one time and asked to explain a concept to the others. It was such a dramatic shift.' This has made it a joy to be in class, he adds, saying that 'it became an active classroom. Students are totally immersed now.' He feels that, through this course, the students are empowered 'because they feel

they can bring into the classroom all the things they know from science, but explore them through language.' This way, 'English is presented as a skill set to enable them to better achieve their goal in the career path of choice. It makes English less of an extra subject and more of a tool,' he adds.

N'Shea, Wilkinson, and Stabile all agree that they will continue to perfect the programme. Currently in the works is a coursebook dedicated to developing listening skills. It will concentrate on areas such as note writing and identifying and differentiating words even when people speak with different accents. However, before the 'listening book' (as they fondly call it) is released, we will see the 'reading book', which will provide scientific passages for the students to read and be assessed on. All editions of this book will have the added bonus of a teacher's book, meaning that the coursework can be taught by any teacher around the world, even if their knowledge of science is lacking.

With students communicating more, isolation is less of an issue and this is immensely beneficial. 'We have to remember the dramatic shift that these students are going through,'

Stabile says. 'They're moving country, dealing with culture shock, all while fending for themselves for the first time in their lives, an adjustment local students do not need to make.' This, along with the pressure that comes with a course you only get one chance to pass, is significant.

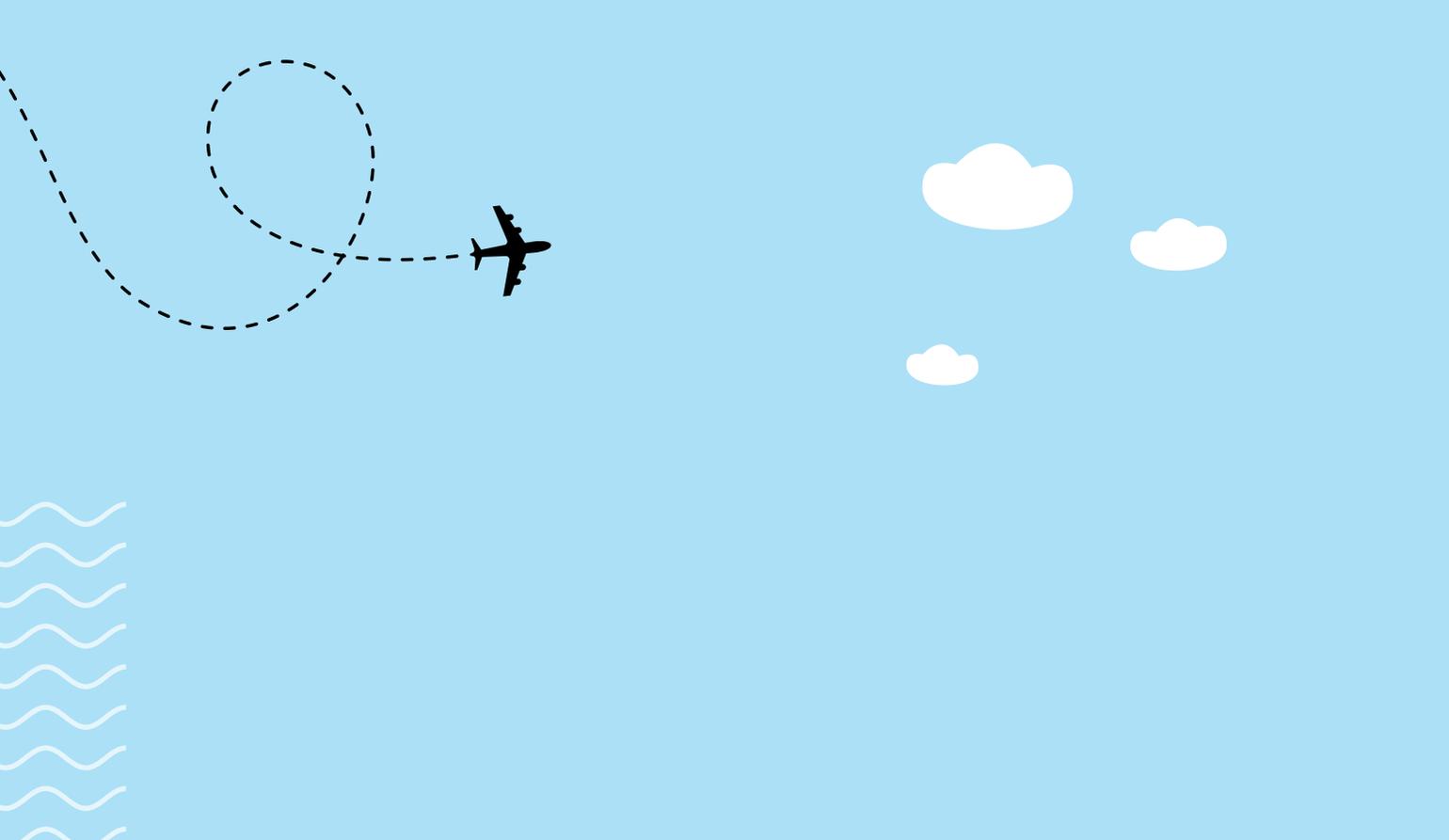
The fruit of their hard work is evident. According to research conducted by the team, between 2008 and 2015, 86% of MFP graduates progressed through Medical School. Moreover, the proportion of MFP students who repeat Year 1 of their medical degree is only 8.2% compared with 8.8% for EU (mostly British) students between 2014 and 2017. They also found that MFP students who started in 2010 and graduated medical school in 2015 achieved the same average grade over the whole five years as did local students in that cohort.

That said, all this work is not just about grades. Stabile says the team's intentions go beyond seeing students pass exams. What they want to do is to 'place them on a trajectory for success.' And that is definitely a goal they are achieving, one year at a time. 

# START UP

*Chasing the White Whale:*

*the pursuit of sustainable  
tourism in Malta*



*EcoMarine Malta's boat tours are leading the way in environmentally sustainable tourism around the Maltese Islands. Founder **Patrizia Patti** talks to **Edward Thomas** about how economic success doesn't need to be sacrificed in order to protect nature.*

A quarter of Malta's GDP comes from the tourism industry. It accounts for €2 billion annually and shows no sign of slowing down. Tourist expenditure went up by 13.9% from 2016 to 2017 alone. It constitutes one in every seven jobs in the local economy and maintains a close link to development: better hotels, improved roads, more diverse shops and restaurants. Beyond the economic benefits, tourism promotes and celebrates local customs, food, traditions, and festivals, creating a sense of civic pride.

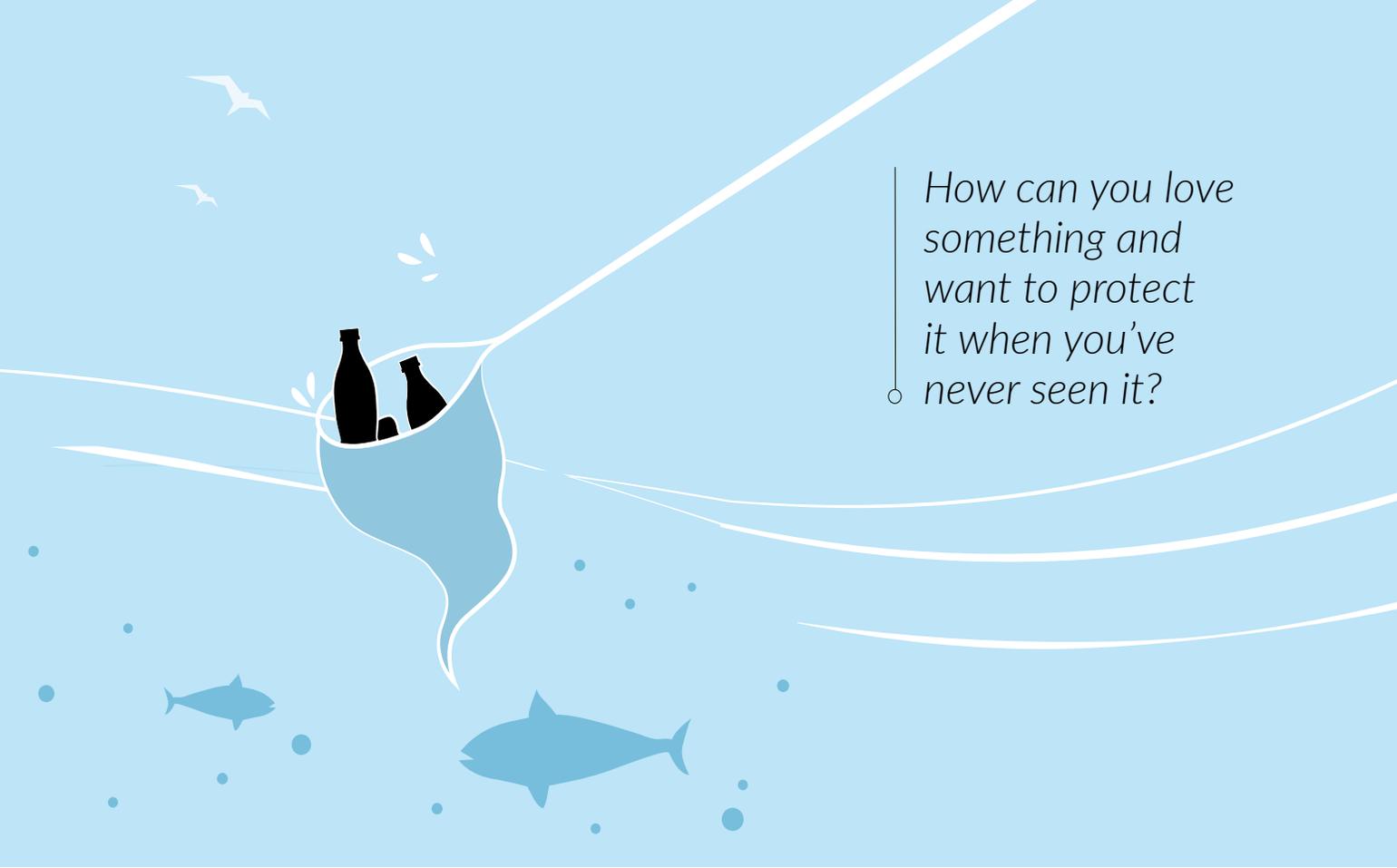
However, there are concerns. In July and August, Malta, Gozo, and Comino are covered by thousands of holiday-makers flocking in. This is not only a burden on already strained island resources and infrastructure including water, waste management, and traffic congestion, but it pushes many coastal habitats and aquatic ecosystems to the breaking point, with drastic impacts on local biodiversity.

Marine biologist Patrizia Patti laments how 'people go with speed boats to Comino carrying beers, drinking, throwing bottles into the sea, playing loud music... it disturbs everything.' If larger

tour companies made a small effort to be more responsible, it could have a large effect, she says. 'Even a simple announcement on a microphone, reminding people they are in a protected area and to behave in a certain way, advising people to respect nature, would help. It's only a small reminder but it would help a lot.' Always looking to lead by example, and to show that small actions can have a great impact, Patti set up EcoMarine Malta. The start up organises responsible boat tours around the island, where the international code of conduct is followed and people can experience the joy of encountering dolphins, turtles, and seabirds in their natural habitat.

### **FACE TO FACE**

Patti says their goal is to establish profound personal connections between people and the sea in the hopes that it will change behaviour. She has been passionate about marine biology since the age of 17, when she first encountered a dolphin. That happened during a school trip to an aquarium. She says 'it was exciting because it was the first time I saw a dolphin, but it was terrible seeing it trapped' 🐬



*How can you love something and want to protect it when you've never seen it?*

in a small tank. It made me so sad.' The emotional response was strong enough to move Patti to tears. 'It was at that point I decided I wanted to become a marine biologist. I wanted to help.'

Patti went on to study the ecology of sperm whales in the Ligurian Sea before travelling far and wide, gaining experience working with marine mammals in Canada, the Maldives, and the Red Sea. In 2013, she co-founded Costa Balenae Whale and Nature Watching in Italy, a company, like Eco Marine Malta, which strongly focuses on bringing humans closer to marine wildlife, forming lasting memories that inspire them to consider their environmental impact and educating both children and adults about the natural biodiversity of the Mediterranean Sea.

Seeing these animals and experiencing their natural environment first hand is vital to establishing an emotional bond. This is what then engages people and inspires them to change their behaviour. 'How can

you love something and want to protect it when you've never seen it?' Patti questions. By opening local and tourists' eyes to the majesty of indigenous species, EcoMarine Malta create compassion and motivate people to take responsibility for the environment too. They also chip away at the sense of helplessness many feel when it comes to 'actually making a difference.' EcoMarine Malta provide education and information for their passengers to follow. Patti, who leads the tours herself, goes into how they can enjoy Malta's beaches responsibly and sustainably, empowering them to take ownership for their actions and decisions before it's too late.

### **MONEY PROBLEMS**

It's not always been plain sailing for EcoMarine Malta and their boat trips. Patti firmly believes that environmental conservation can be a tool to increase economic growth and employment in Malta. 'Even if we act like an NGO, we decided to be a private company

because we want to create job places and grow and be able to provide the best service possible,' Patti says. But not everyone agrees. Patti has received plenty of push back from others in the field as she lobbies for best practices to be enforced around the islands.

Some views are severely narrow and short-sighted, rooted in the belief that any sort of restriction of operations is bad, even if inspired by respect and protection for the natural resources they use. 'People have to understand that a protected area is to enjoy for a long time. Maybe not now, maybe for one or two years you have to be careful, you can't do everything you want to do. But after those two years, you can enjoy a new beautiful area, rich in life,' explains Patti. Setting up EcoMarine Malta as a for-profit enterprise to prove these people wrong, however, has led to another kettle of fish. Because they're not an NGO, applying for sponsorship and funding is a major challenge. Potential benefactors 🎯



**This photo:**  
Viewing dolphins in their natural environment

**Below, left photo:**  
Sailing in search of marine life on board the EcoMarine Malta boat

**Below, right photo:**  
Patrizia Patti, founder of EcoMarine Malta

**Bottom photo:**  
Filming the dolphins swimming by the side of the boat

*Photos by Amanda Mathieson*





*With an army of environmentalists in the making, Patti hopes they will take over her role in the future.*

often dismiss collaboration, telling Patti that the company should be able to support its own endeavours.

This lack of support saw EcoMarine Malta having to rent boats from various charter companies, a massive expense. Externally renting a boat brought with it uncertainty and inflexibility. Last-minute dropouts or weather changes forced them to cancel tours and lose a lot of money. 'The boat rental still had to be paid for,' she says. But things are looking up. EcoMarine Malta purchased their own boat this summer, and Patti is working hard on getting all the permits in place to have it out on the water as soon as possible. 'Now we will be able to plan our own routes and diversify the tours we offer. At the moment, we have six tours available to choose from, including a sunset tour when marine life is at its most active,' she smiles.

## GET THEM YOUNG

2018 might be EcoMarine Malta's first full summer season, but that doesn't stop Patti from dreaming big about their future. She and her team want to do more outreach and education and are working on offering a series of courses for students aged between 10 and 16 years old. These children will be able to participate in a day of hands-on classroom activities, discovering and learning about sustainability and the ecosystem of the Mediterranean, followed by a boat trip to implement their new

knowledge, observing and identifying the variety of wildlife and nature surrounding them and their island.

'We hope to inspire a whole new generation of marine biologists and environmental scientists,' Patti says.

With an army of environmentalists in the making, Patti hopes they will take over her role in the future. That would allow her to refocus on a passion she is itching to pick up again: searching for evidence of sperm whales in the Mediterranean surrounding the Maltese Islands. Her eyes light up as she admits to me, 'I love outreach, but my personal dream is to spot sperm whales in Malta.' Researchers know that juvenile and female sperm whales in the Atlantic remain in warm waters while the males migrate to the poles to feed, but movements and social dynamics of pods in the Mediterranean are still unclear.

Looking forward, Patti is working hard to establish networks with other entities and NGOs who share the same vision. EcoMarine Malta already collaborates with the likes of Birdlife Malta and has been involved with beach 'Clean Up' projects in the past year. Patti asserts that despite everything, 'the Maltese public and tourists are some of the most enthusiastic and passionate people we've worked with so far. It's great to see people of all ages and backgrounds, coming together to work on a common goal.'

'Everyone can contribute different things, and together, it adds up to make a big difference.' Patti is keen to encourage people to help in whatever way they can. To cooperate with others and not feel overwhelmed or alone in their efforts. 'It's not possible to do it alone. We need to work together, holistically, caring about the land, sea, and air, to protect the island's environment. **T**

For more information visit:  
[ecomarinemalta.com.mt](http://ecomarinemalta.com.mt)

### Further reading:

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# LAB TO LIFE

## GREEN HEAT, GREEN POWER

*At face value, renewable energy seems the smartest choice for a cleaner tomorrow. But when green energy cannot be stored, what do we do during scorching summer afternoons and cold winter nights? **Cassi Camilleri** speaks to **Prof. Joseph Cilia** and his team to find out more about the innovative solution they are developing.*

The movement towards sustainability has been ramping up over decades. Now, it feels like it has reached fever pitch. Headlines are hogged by the latest scary statistic on air, land, or sea pollution. People are rallying, demanding that new measures be implemented to reduce waste and clean up our streets. Despite this call, real advances on these issues always manage to find themselves obstructed by seemingly 'rational' arguments.

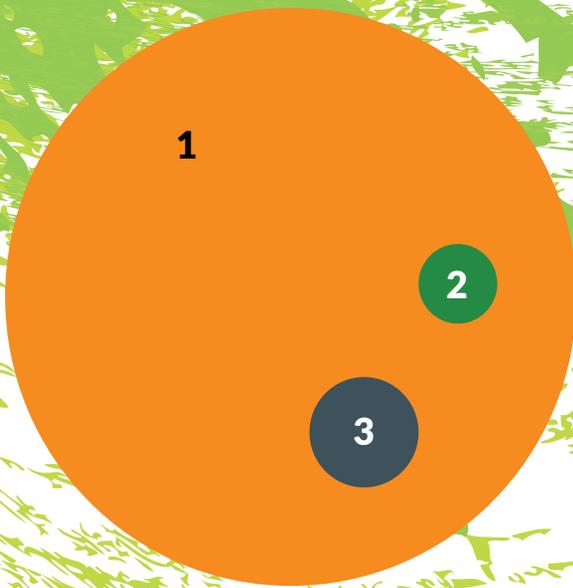
For one, renewable energy isn't as reliable and cheap as fossil fuels. Overhauling the status quo is expensive and requires significant effort, both of which make people frown. Solar power depends on the sun, wind power depends on wind, both of which are

quite unpredictable. But while this is true, it shouldn't even be considered an issue. We live in a country on the receiving end of 550,000 GWh of solar energy annually, while we need only 3,484 GWh to cover all energy consumption. Let that sink in.

Of course, I hear your concerns about the quantity of solar panels needed to harvest that energy—Malta is so small and built up. But in reality, only 28% of our island is built up, and just 7% of the remaining land would be required to meet the total energy demand.

So yes. There are solutions to our energy woes. And those solutions need to be combined to create the best results.

Thanks to support from Abertax Kemtronics and MCST (Malta Council for Science and Technology),



**Comparing energy use in Malta with total solar energy available**

**On diagram:**

- 1 - Solar energy available: 550,000 GWh/year
- 2 - Electrical consumption: 2,300 GWh/year
- 3 - Total Energy consumption: 3,484 GWh/year



**Comparison of land required for 100% PV energy**

**On diagram:**

- 1 - Maltese islands total area: 314km<sup>2</sup>
- 2 - PV area required for total energy demand: 21km<sup>2</sup>
- 3 - PV area required for 100% electrical energy demand: 14km<sup>2</sup>
- 4 - Built-up area: 90km<sup>2</sup>

Prof. Joseph Cilia and his team of researchers (Department of Industrial Electrical Power Conversion, University of Malta [UM]) have found that houses with a normal-sized photovoltaic system can supply more than 100% of the total energy they need during summer. During winter, that figure falls to 50%. To manage this drop, energy can be supplied through other sources. Enter the Micro-CHP.

A small combined heat and power (CHP) machine provides seasonal energy in two forms: electrical and thermal. It consists of a standard internal combustion engine coupled with a generator that produces electrical energy. The thermal energy resulting from the engine and exhaust is then recovered using water heat exchangers and reused to heat the house and domestic water.

While similar systems already exist, most are geared towards industrial applications. The rest cost, on average, around €15,000—pricing a

large cross-section of society out. The system Cilia and his team have developed makes use of a grid PV system, combined with battery energy storage, a heating and cooling heat pump load, a CHP machine, and LED lighting. It is also an easy-to-install, plug-and-play solution that fits into your current setup, as opposed to a complex installation that would force everything to change with it. By the end of it, the team's CHP will cost the consumer around €8,000.

Their study of Maltese households showed that in a typical medium-sized household, energy needs vary substantially. The energy fluctuations for a typical Maltese household are usually about 500 kWhr between the summer and winter seasons. In this case, storing this energy in a battery is not feasible. What is feasible is simply making more efficient use of the LPG gas tank that most people already have and use at home. If one wants to be renewable, one

can also use ethanol or methanol to operate the CHP, which, if used in combination with a heat pump, can easily reach an efficiency of 150% to 180% in heating mode.

Added to this, the team's system is unique compared to others on the market. It is connected directly to the main electricity supply, tapping into it whenever the system needs support, while not using mains electricity when enough energy is being produced by the system itself.

The system is scalable due to the plug-and-play concept the system is based on. It can be upgraded as more and more savings are made on electricity bills. 'The idea is to provide a cost-effective solution that even low-income households can afford,' says Cilia. This can not only trigger a widespread use of energy generation and storage for domestic use, but also turn consumers into suppliers of their own energy needs. Gone are the days of being dependent on the grid. **T**

# Kidney Stakes



A small team of scientists at the University of Malta is trying to determine what causes children to be born with serious kidney defects. **Laura Bonnici** speaks to **Prof. Alex Felice, Dr Valerie Said Conti, Esther Zammit,** and **Alan Curry** to find out more about this ground-breaking programme.

'd sell a kidney for that!'

Most of us have been guilty of using this expression when faced with something desirable.

But do we fully appreciate the real value of what we are offering before the words escape our lips?

Kidneys are our body's official waste disposal system, filtering out toxic build-up from our blood, which can poison us if left unchecked. With kidney failure posing such a threat, renal research has become an ongoing global goal.

A team of scientists from the University of Malta is currently honing in on what may cause children to be born with 'CAKUT', or Congenital Anomalies of the Kidney and Urinary Tract.

With between three and six cases recorded per 1000 live births worldwide, CAKUT is the most common cause of end-stage kidney disease in children. Since early identification of these anomalies may reduce kidney damage later in life, the LifeCycle Malta Foundation has raised funds for a renal research programme which targets CAKUT and its causes.

'We know that a number of children are born with a kidney defect, but in many cases, we are not sure why,' explains the programme's principal investigator, Dr Valerie Said Conti. 'There are many factors that can affect the development of the kidney, both genetic and environmental. We are trying to understand those influences so that we can carry out preventative strategies, diagnose issues earlier, and target personal therapeutic interventions.'

For this team of renal researchers, the first three years of initial research has been the first step in a far longer journey. 'We hope to contribute our data to the international literature pool,' continues Prof. Alex Felice, consultant and supervisor on the programme. 'We will need a massive amount of data to create a robust theory with which to progress. We hope that our findings regarding CAKUT will be useful when we come to the stage of creating new interventions.'

It's an end-game that has kept the small team focused as they approach the programme's expected completion date this year. Having had to start literally from scratch, they collected

biological samples from patients with a range of kidney diseases, including CAKUT, nephrotic syndrome, and Bartter syndrome. This allowed them to build the renal disease collection at the Malta BioBank, a vital storehouse for scientists.

'For research projects like this, you see what material is available and you work with it,' explains Said Conti. 'A big part of it so far has been sourcing the samples from families attending the clinic with their formal consent for the material to be used in this project. We are hugely grateful to those who accepted to take part in the research. Without them, it would have been impossible.'

This project has set the groundwork for renal research in Malta to continue. 'Without funding, projects such as this one simply could not exist,' Said Conti remarks of the €100,000 donation LifeCycle Malta Foundation made to RIDT. 'It enabled us to employ a full-time Research Support Officer, involve other laboratories,

*A number of children are born with a kidney defect, but, in many cases, we are not sure why.*

attend international meetings to share insights, perform ultrasound tests, and invest in 'Next Generation DNA Sequencing', genetic technology that maps out genes, revolutionising our world.' But there is much more to come.

The Founder of the LifeCycle Malta Foundation, Personal Fitness Consultant Alan Curry, agrees. 'Renal failure is an ever-increasing problem with figures going up every year, and LifeCycle is the only NGO that is actively supporting renal patients and their families in Malta. Our annual LifeCycle Challenge, which this year is routed from Dubai to Oman, aims to raise €150,000. It's a huge responsibility, but we are sure that, by funding research programmes such as this, we will significantly improve the lives of kidney patients.' 



# Grassroot legacy

**Valletta 2018 Foundation**



*Capitals of Culture want legacy. Wrocław 2016 established a microgrant system for small operators that is still in place. Aarhus 2017 combined qualitative and quantitative methods to evaluate a city's cultural sustainability. Valletta 2018 wants to leave behind a vibrant grassroots movement actively shaping the country's cultural policy. **Rachel Baldacchino** speaks to **Szilvia Nagy** to find out how this is possible...*

A European Capital of Culture (ECoC) title brings with it a set of ideals. We imagine something of a utopia for organisations of all shapes, sizes, and stature with collaboration across all levels of the creative community. But as massive infrastructural development takes off, and public funding for large projects wades in, it is easy to see how the grassroots movements of a city can often be left behind with plenty of ideas to spare but no clout to see them through.

The cultural communities of Zsolnay Factory in Pécs are a case in point. Pécs in Hungary was crowned ECoC in 2010, winning the title largely due to a thriving grassroots culture around Zsolnay—a disintegrating, post-industrial tile factory that organically transformed into a fully functioning exhibition space with its own advanced artist residency programme. The ECoC delivered Zsolnay Factory its own university, theatre, and museum, but the NGOs that first ran it were gradually pushed out. Pécs is one example, but this seems to be a shared experience among many small organisations as they struggle to find their way around big cultural projects like the ECoC.

The problem with wiping out grassroots movements is that you're left with an institutional-cum-corporate takeover of a city's

creative sectors. In other words, the creative industry becomes a servant to its wanting political mother—the neoliberal dream. If so, why is collective action missing from such an emerging scene? This issue will be discussed at the Valletta 2018 Foundation's annual conference under the moderation of Szilvia Nagy. A visual and cultural anthropologist with a background in political science, Nagy is teaming up with the V18 research team to develop possible solutions for Malta.

Nagy is part of the Local Operators Platform (LOCOP), a research network that focuses on supporting the grassroots scene of designated Capitals of Culture. The idea for LOCOP was born in 2010, an unintentional offshoot of Nagy's research in the field of cultural policy. Nagy found that cultural workers from past ECoCs had trouble finding a voice within the larger structures that dominate a Capital of Culture. Many described attempting to operate in an ECoC without any form of guidance and support as 'traumatic.' Some even left the city when the ECoC was over.

LOCOP was established to bring together cultural workers from past, ongoing, and future Capitals of Culture to talk about what can go wrong and share their experiences, Nagy explains. 'On the basis of such discussions, we then create methods of intervening in the larger system in a 

*The creative sector is not just about art production. It is also about reciprocity, representation, claiming rights, naming, and collaboration as a way of getting things done.*

way that turns what seems to be an insurmountable problem into one that can be tackled.' The idea is to recenter the Capital of Culture around the notion of cultural sustainability. 'The local operators of a city are the main stakeholders of the Capital of Culture project. When the year is over and the Foundation's offices close down,

these people will still be there, so we need to make sure that they not only survive, but that they are empowered!

Nagy, who is based in Essen, has been to Malta three times this year to work with local self-organised groups in a series of workshops hosted by the Valletta 2018 Foundation. The workshops

brought together a wide span of local operators, ranging from visual artists, writers, and curators, to members of homeless shelters, environmental action groups, and small business associations. Nagy armed these representatives with what she calls 'a pro-active policy making tool'.

Nagy's tool consists of a step-by-step guide for bottom-up policy-making. In Malta, she trained participants to map out their problems against a set of nine questions. They listed their goals, pinpointed those who could help achieve them, and identified where to start on that journey. This thought exercise trained participants to identify



**Top:**  
Szilvia Nagy

**Left:**  
Evening event discussion organised by Valletta 2018  
Photo supplied by Valletta 2018



**Discussion during a focus group session**  
*Photo supplied by Valletta 2018*



**Close-up of the plans for the Grassroot Legacy**  
*Photo supplied by Valletta 2018*

stakeholders and partners and analyse their specific interests and power. It is important to understand what these different groups need to hear from grassroots movements, Nagy noted. 'The creative sector is not just about art production. It is also about reciprocity, representation, claiming rights, naming, and collaboration as a way of getting things done. So it is crucial to know how to deliver your message and to whom,' she adds.

A concern raised during these workshops was the lack of genuine consultation with civil society regarding public spatial planning. To engage with this question, participants mapped the current

state of participatory practices in Malta. Then they identified potential opportunities to participate in planning processes through digital technologies such as GIS platforms. Another issue that came up was the struggle of evaluating the real-world impact of art-oriented grassroots projects. Given that real-world outcomes are inherently difficult to quantify, participants shifted their focus to optimal programme design, planning the project in a way that leads to a desired outcome. This meant identifying the various disciplines, contemporary issues, and communities they want to see represented in a project and

making sure that the programme works to bring these facets in.

These thinking strategies, says Nagy, are like 'learning to walk on a rocky path. Participants learn how to locate the steps that are missing. They can then decide to proceed on their own, but it is still good to know what can emanate from guidance' and use that to build a legacy they can be proud of. **T**

**Szilvia Nagy will host a workshop on proactive policy making for local groups during the conference 'Sharing the Legacy', which is hosted by the Valletta 2018 Foundation in October 2018**

~~WATER~~



SEWAGE WORKS

Water is our number one resource. It not only sustains life, but also supports the economy and its development. And yet, water is taken for granted. **Kirsty Callan** talks to **Marco Cremona**, the man behind the revolutionary water treatment solution that promised to reduce Maltese hotels' water use by 85%.

Malta is an island surrounded by sea. Malta is also almost a desert. It has less than 1,000m<sup>3</sup> of water per inhabitant, the generally accepted limit to sustain agriculture and life.

So why do we insist on using an immensely expensive process (reverse osmosis) to turn all the water we consume (an average of over 100 liters per day) into high-quality, potable drinking water when we only actually drink about two liters of it, at most?

This question baffled celebrated hydrologist Marco Cremona for a very long time. 'We are making that extra effort to produce very good-quality water, which comes at a high cost since we don't have very abundant water supplies, and people don't drink it. Where is the sense in all of this?' His contribution to the solution was the HOTER system, a membrane-based process that turns hotels' waste water into water that matches the hotel's water quality demands. The system can reduce the hotel's reliance on external water by up to 85%. But quite recently, the Maltese Food Safety Commission denied him a licence over fears of unknown compounds that have not, as

of yet, been discovered and cannot be tested as being present in the water.

## BACKSTORY

Cremona's career in water sprang up during his course in mechanical engineering at the University of Malta (UM). 'I am now a water treatment engineer because of a fourth-year design project,' he says. The project saw him designing a solar-powered reverse osmosis plant, an endeavour

*With sewage being 99.9% pure water, why are we simply throwing it away?*

which required him to reach out to people in the water treatment industry. A different project could have led him down a different path, he admits, 'things do happen by chance.' However, what followed from there was a very deliberate set of decisions.

Following graduation, he went on to work with a local water treatment company, but an opportunity soon

presented itself. In 1995, there was a one-time master's at UM in hydrology—the study of water in all its aspects. He took the leap, quit his job, and jumped back into his studies.

This shift brought further changes. Cremona became an activist. This passion stemmed from being part of the team that carried out the first environmental impact assessment in Malta. Cremona started to volunteer with a number of NGOs, voicing his concerns about water and the islands' environment.

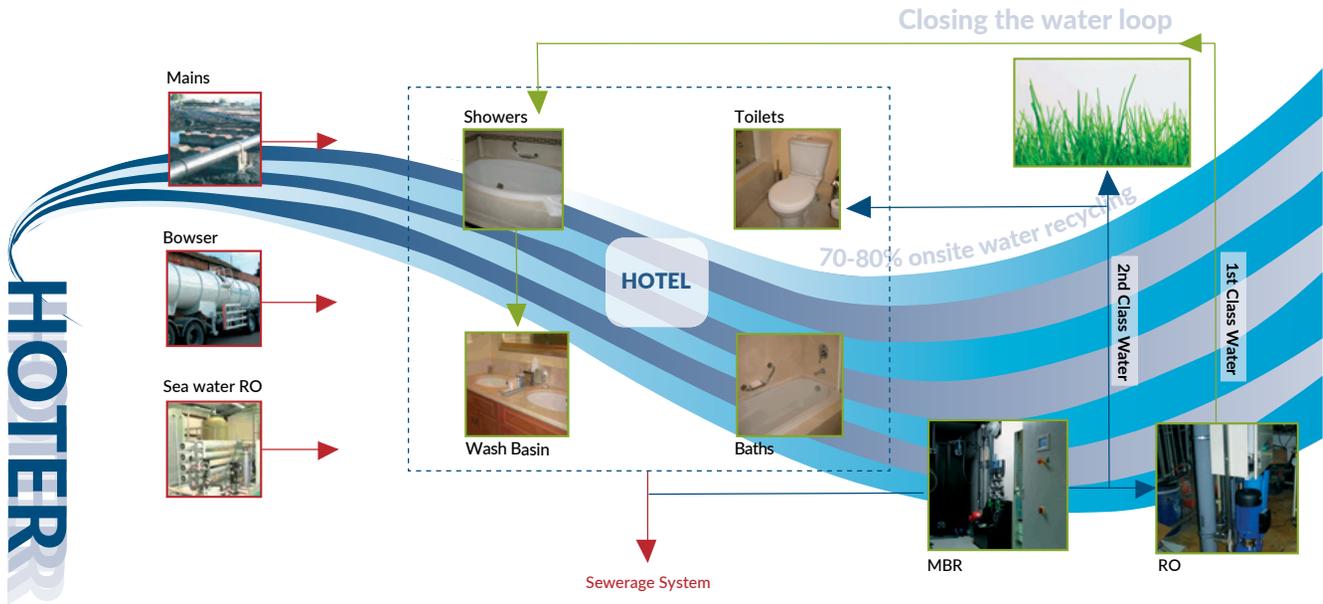
'Malta is a country with very limited resources, which means that we should be more diligent and more careful about how to make these resources last longer. You do that by being efficient, having long-term policies, recycling... a number of measures,' Cremona states.

In 2002, 'I took the plunge and started doing my own thing.' And he hasn't looked back.

For the last 16 years, Cremona has been self-employed, using his water expertise and engineering background to provide consultancy, products, and equipment to anyone related to water, be that beverage companies, hotels, or government. In this time, he has also had stints working on development projects

**HOTER:** Development of an innovative wastewater recycling process for hotels/ large commercial buildings / isolated communities for environmental protection and cost recovery

**Closing the water loop: 70 - 80% on site water recycling**



abroad, including Sri Lanka in 2005, following the devastating tsunami.

## ALL OVER THE WORLD

The HOTER system began with an idea: What if a building or business could have its own water recycling treatment plant?

'Whatever I dream, I can carry out a few calculations, then build something,' Cremona says, alluding to how his engineering background came into play when working on this idea. Hotels proved to be the prime example, with Malta's economy geared so much toward tourism and the hospitality industry. With sewage being 99.9% pure water, why are we simply throwing it away? 'With each flush, we are effectively flushing away as much as 10 kilogrammes of quality drinking water, simply to transport a few grams of contaminants,' Cremona laments.

With HOTER, the sewage is first converted into second-class water, which can be used to flush toilets and for gardening. The excess receives further treatment at a second plant, bringing it to drinking-quality level, primarily for use in showers. With

this system, each drop of water can be used as many as 20 times before it leaves the system. Groundbreaking.

The HOTER project was applauded and embraced the world over.

It was featured on news channels all over the globe: BBC, France 24, Al Jazeera, and others. It was nominated for the 2010 Stockholm Water Prize, and ranked as one of the three finalists for the best green business idea in Europe in 2009's prestigious CNBC/Allianz awards. Cremona was even awarded a Republic Day's honour in December 2014 for his outstanding achievements in the water sector in Malta and internationally. Then, stumbling blocks.

In 2013, the Maltese Health Council stated that use of Marco's recycled water was not permitted for human consumption. This was despite the fact that the system had been through several tests which proved the water produced by HOTER conformed to and even exceeded the standards of the EU Directive and Maltese laws.

The final blow came from the Food Safety Commission, which refused to grant the project a license. It stated

concern about the possible presence of 'pathogens and other chemicals that may have a harmful effect on human health,' adding that current safety standards were insufficient. They also brought up the worry that the system could have 'adverse effects on the tourism industry' due to the risk involved in implementing such a system.

Cremona says that the whole experience was disappointing. 'Unfortunately, I have given up on the idea because I have been labouring to get a permit to use the water locally for more than seven years now. I think it is too advanced for its age,' he states. But there is still hope. When asked if he sees a future for the HOTER system, Cremona still has faith in his work. But he believes it will not call Malta home. 'It will happen,' he says. 'But I am now at an age where I can't give up everything else and just follow this project. I'm willing to collaborate and not keep the idea to myself. I'd like to see it developed. I believe this is the way we will manage water in the future!'

Having been contacted by others who believe the idea has potential, it seems like only a matter of time



Marco Cremona

*Can you drink sewage? The instinct would be no—but in the right place and with the right technology, you can.*

before we see the system implemented somewhere in the world.

### HOPE NEVER DIES

While the HOTER project may have an uncertain future, Cremona

is still working hard to communicate the importance of sustainable development. He is currently working on a game designed to bring that message to children.

Developed in collaboration with Prof. Alexiei Dingli (Faculty of ICT, UM), the game takes users back to when Malta was first inhabited. The goal is to survive and increase the population whilst sustainably managing resources.

The idea for the game, which has already won the Malta Innovation Award despite still being in development, came from Cremona's frustrations at repeating the same story over and over without receiving enough attention. 'I thought it would help if I created something visual, if I could help them imagine a Malta in which they made the right decisions,' he says.

Motivated by his strong sense of fairness above anything else, Cremona says, 'I think that what we are doing today is quite unfair on future generations. We are using water reserves that have accumulated over centuries as if there is no tomorrow. It has to change.' Cremona recounts, 'I remember in my teens there wasn't enough water in the country,' speaking of times when tap water was only available on certain days of the week and water even had to be shipped in from Sicily.

'While I can fully appreciate the benefits of reverse osmosis

technology, strategically it is very dangerous to put all our eggs in one basket,' says Cremona. This is why he continually advocates for the safeguarding of groundwater, Malta's only substantial freshwater resource.

While water consumption is not as sexy as saving turtles, it needs people's attention. And it needs it now. 'Pumping too much water is helping to grow fresh produce in summer. But it's crazy to try and grow anything in the Maltese summer when the value of the water is more than that of the product. But it would upset people if I was to suggest restrictions.'

Our conversation ends with a call to action for all the young people out there. Cremona asks them to be active. 'First observe, then question, and if you aren't satisfied with the reply, then try to do something about it.' Using his own example, he makes the point that there is no such thing as a stupid question. 'Can you drink sewage? The instinct would be no—but in the right place and with the right technology, you can.'

Change is within our grasp. **T**

**HOTER project was developed in partnership with SUSTech Consulting, Island Hotels Group, ttz Bremerhaven, the Government of Malta Department of Public Health and the MCST Research & Innovation Programme 2006.**

# TO-DO LIST

## MUSIC



British indie three-piece **Amber Run** have been on loop in the office for a while now—to the chagrin of some. Singer Joshua Keogh's raw vocals really jive with the introspective harmonies of their latest EP **The Assembly**.

## BOOK



Pixar is an institution synonymous with creativity and storytelling. But every company has to start somewhere, right? **Creativity Inc.** by **Ed Catmull** is the perfect read for nerdy / filmy / creative types with big dreams.

## MOVIE



**Hereditary** really does get under your skin in a way no horror film has done in a while. Toni Colette's casting is epic, and you'll be crying in the living room at midnight for reasons you can't explain—just like the characters.

## YOUTUBE CHANNEL



**Matt D'Avella**. He's the filmmaker behind the documentary **Minimalism**. His channel is all about building your brand and business in a sustainable way.



## PODCAST



There's a group of scientists (and comedians) who come together with one question each that the rest of the team have to answer. Fun and shenanigans ensue. It's called **A Piece of String**.



## TV



A couple of foodies have joined the summer intern team here at **THINK**. And so, the Netflix original **Chef's Table** has made it to the list this quarter. Entrepreneurial spirit meets mouthwatering gorgeousness. What's not to love?

## INSTAGRAM



**The Cloud Appreciation Society**. Even their tag line is awesome: "Look up, marvel at the ephemeral beauty, and live life with your head in the clouds!" Yes, please.



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