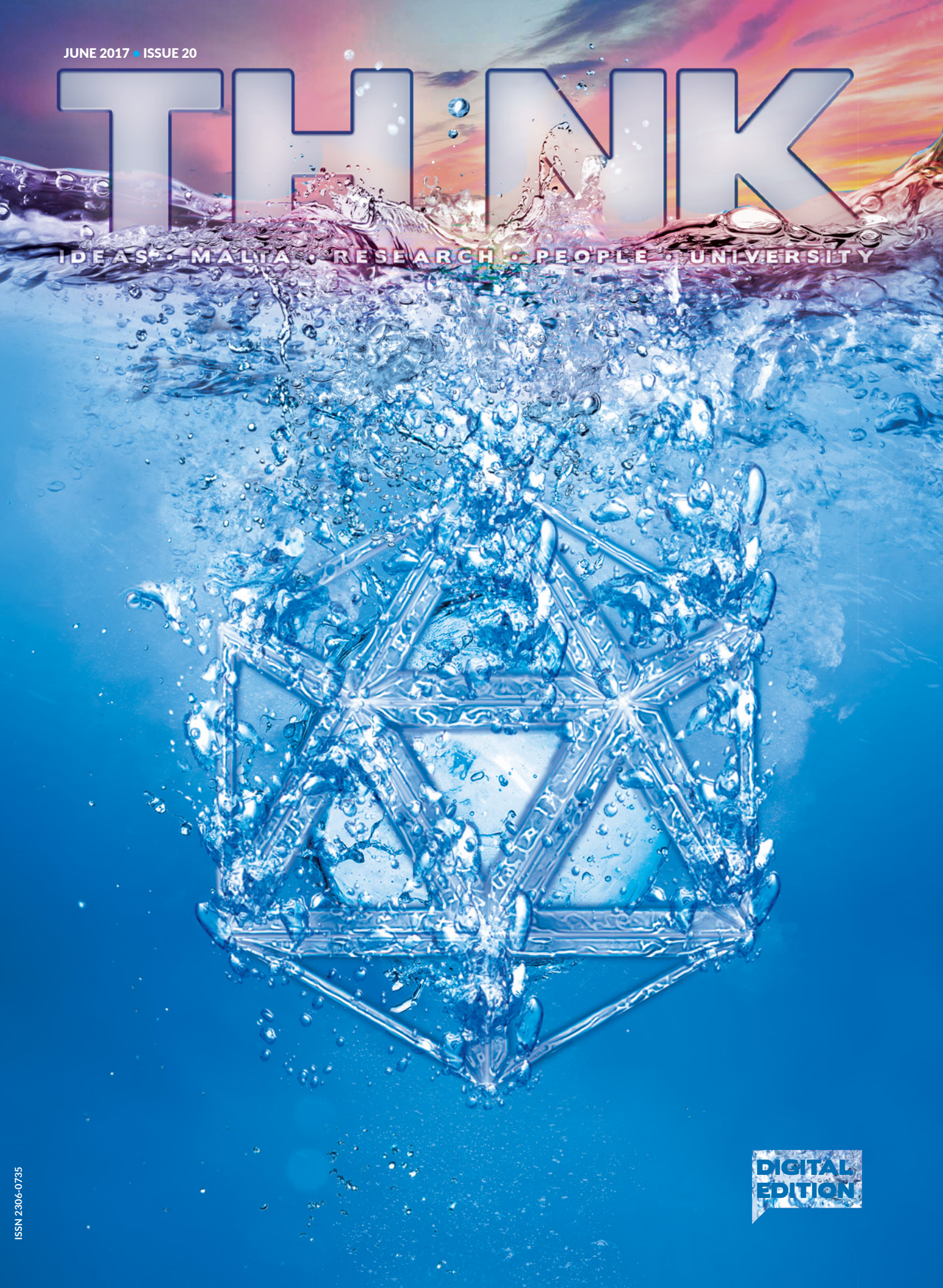
JUNE 2017 • ISSUE 20

TH:NK

IDEAS • MALTA • RESEARCH • PEOPLE • UNIVERSITY



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EDITORIAL

WATER

Thales, regarded as the father of Western Philosophy, believed water to be the original substance of all matter. At THINK, we believe that all research at the University of Malta can be linked to water. Both may be slightly overzealous in their generalisations, but this edition has a whopping 30-page special WATER Focus chock full of riveting content.

Research concerning water is multi-faceted. At least six faculties across the University of Malta (UoM) are involved. The research featured in this Focus delves into new apps (pg. 20) sharks (pg. 34), underwater historical artefacts (pg. 26), and shipping traffic (pg. 36) releasing pollution that could be seriously damaging the Maltese nation's health.

The opinion section highlights Malta's fresh water shortage (pg. 11). Despite being surrounded by water, the country has close to desert-like conditions with few taking the matter seriously. Another issue of nationwide importance is the prevalence of fake news that has finally reached Maltese shores (pg. 10).

Language is a key country identifier. Many think that Maltese is in a free fall decline, as is English, but Dr Sarah Grech holds up tablets of research that prove otherwise (pg. 40). On the philosophy of language, a playful article from the Institute of Digital Games (pg. 46) asks one to reassess the meaning of language through a game set in a surrealistic future, which sees the player become an alien chef trying to prepare the finest soup for patrons from across the galaxy.

Students are making robots, navigating underwater submarines, exhibiting art, and studying the stars (pg. 12–17). Alumni (pg. 68) and the Valletta 2018 Foundation (pg. 66) are talking about Malta's cultural landscape. To round things off, check out our To-Do list for some clever entertainment (pg. 72).

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Are you a student, staff, or researcher at the University of Malta? Would you like to contribute to THINK magazine? If interested, please get in touch to discuss your article on **think@um.edu.mt** or call **+356 2340 3451**

COVER STORY

WATER

Designed and illustrated by Roberta Scerri, the WATER cover utilises blues, pinks and yellows that harken to lazy days by the beach when the mind is left to run free, usually returning with fresh ideas and perspectives. Now at the cusp of summer, we thought the timing was perfect.

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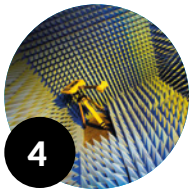

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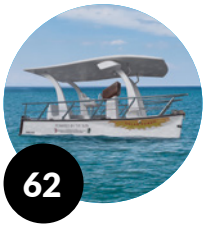
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UNIVERSITY OF MALTA
L-Università ta' Malta

RIDT

TOOLKIT

Sounds of silence

Everything in the world can emanate sound waves. These are invisible, consisting of vibrating particles in the air which can strike our eardrums, which lets humans hear. But what if you want to measure waves coming from a particular object?

An anechoic (echo-free) chamber is a heavy, metal enclosure with inner walls covered in foam wedges made from a radiation absorbent material. Any emitted sound or electromagnetic waves become trapped between these wedges until all their energy is completely absorbed. The chamber also eliminates all noise from exterior sources. Simply put, speak in an anechoic chamber, and you will hear the pure sound of your voice echo-free.

The volume of these chambers is dictated by the size of the objects as well as the frequency of the device under investigation. They can be anywhere from the size of an old television monitor to the size of an aircraft hanger.

So what are they used for?

Testing electronic devices that radiate acoustic or electromagnetic waves and mapping out radiation patterns of antennas. It's useful for systems such as satellites, radars, computers, missiles, and vehicles. Measurements aim to determine characteristics such as susceptibility, system sensitivity, effective radiated power, tracking ability, and comparability. The chambers can also be used to evaluate the effect of electromagnetic fields on human tissues, a type of experiment that has already been carried out in the University of Malta (UoM) anechoic chamber.

Manufacturers of electronic equipment are required to conduct electromagnetic compatibility and immunity testing prior to placing a device on the market. This ensures that they won't generate too much electromagnetic disturbance and will also be sufficiently immune from fields generated by other sources. Due to this new equipment, the UoM will be able to provide pre-compliance testing services to companies, which will prepare their devices for expensive compliance testing in certified laboratories, saving them a good sum of money.

QUICK SPECS

- Dimensions: 2.5m x 2.5m x 2.5m
- Weight: 2 tonnes
- Frequency: 800MHz – 18GHz
- Price: €140,000

Photos by Jean Claude Vancell

WITHOUT BORDERS

mainstream gender = mainstream funding

Dr Brenda Murphy

Research agendas change throughout the years. Historical context and economics play a distinct part in what is placed on the priority list. Presently, gender is on top. Keeping in line with the 'gender mainstreaming' policies within the EU, researchers are now being asked to put on their 'gender lens'.

For many researchers, the first response is: what does 'gender' have to do with their project and/or discipline? The reality is that gender is *the* common variable we all share. Firstly, we all have a gender. We as researchers do bring our biographies to our research, and that includes our gender. Secondly all research can be given a 'gender lens'. From architecture to engineering, theatre studies to medicine, dance to ICT—we can ask gender-focused questions about our discipline.

Horizon 2020 is the largest EU funding programme to date, providing grants to research and innovation projects in areas of basic science, industrial leadership, and societal challenges. Gender is a cross-cutting issue which is part of the funding criteria throughout the different parts of the work programme. The EU's strategy is to compel researchers to think in gendered terms about the shape and meaning of the research questions in their discipline. Researchers are also obliged to think about gender balance and roles in the structure of their teams.

The main objectives of this strategy are to close the gap between the levels of participation for women and men, and to improve scientific quality, ensuring that research products have increased societal relevance.

At the University of Malta, the Department of Gender Studies (Faculty of Social Wellbeing) wants to support any researchers who wish to put on their 'gender lens'. Our *raison d'être*, as a department, is to introduce gender into every discipline. For example, currently, we are working actively with STEAM (science, technology, engineering, art, and maths) projects to encourage a greater female uptake in traditionally male-predominated disciplines. We are also collaborating in dance, digital arts, and anthropology, and running workshops for young girls in robotics and drama.

We practice what we preach, and gender mainstreaming is integrated into our research, outreach, and activism. We work inter-departmentally with academics and stakeholders to research and publish, as well as organise events, all the while providing and receiving input concerning gendered issues. In March, in collaboration with the Gender Issues Committee, a Symposium on Gender Mainstreaming was held as one of the steps in raising awareness and flagging the need for us all to put on the essential 'gender lens'.

By adopting gender mainstreaming, the University of Malta can reveal weak spots that need to be changed. In practice, this should prompt organisational changes in structure, procedures, and cultures which are conducive to the promotion of gender equality. In turn, this will produce a space for women and men to influence, fully participate in, and benefit from working within academia.

If you are seeking to embrace gender mainstreaming, either in your research funding proposals or teaching, please contact Dr Brenda Murphy (brenda.murphy@um.edu.mt) and/or atEuropa Online: ec.europa.eu/programmes/horizon2020/en/h2020-section/promoting-gender-equality-research-and-innovation

DESIGN

(Re)diffusion

As part of his Ph.D. at the Faculty of Media and Knowledge Sciences, Department of Digital Arts (University of Malta), Matthew Galea has developed an interactive sound art piece entitled *(Re)diffusion*.

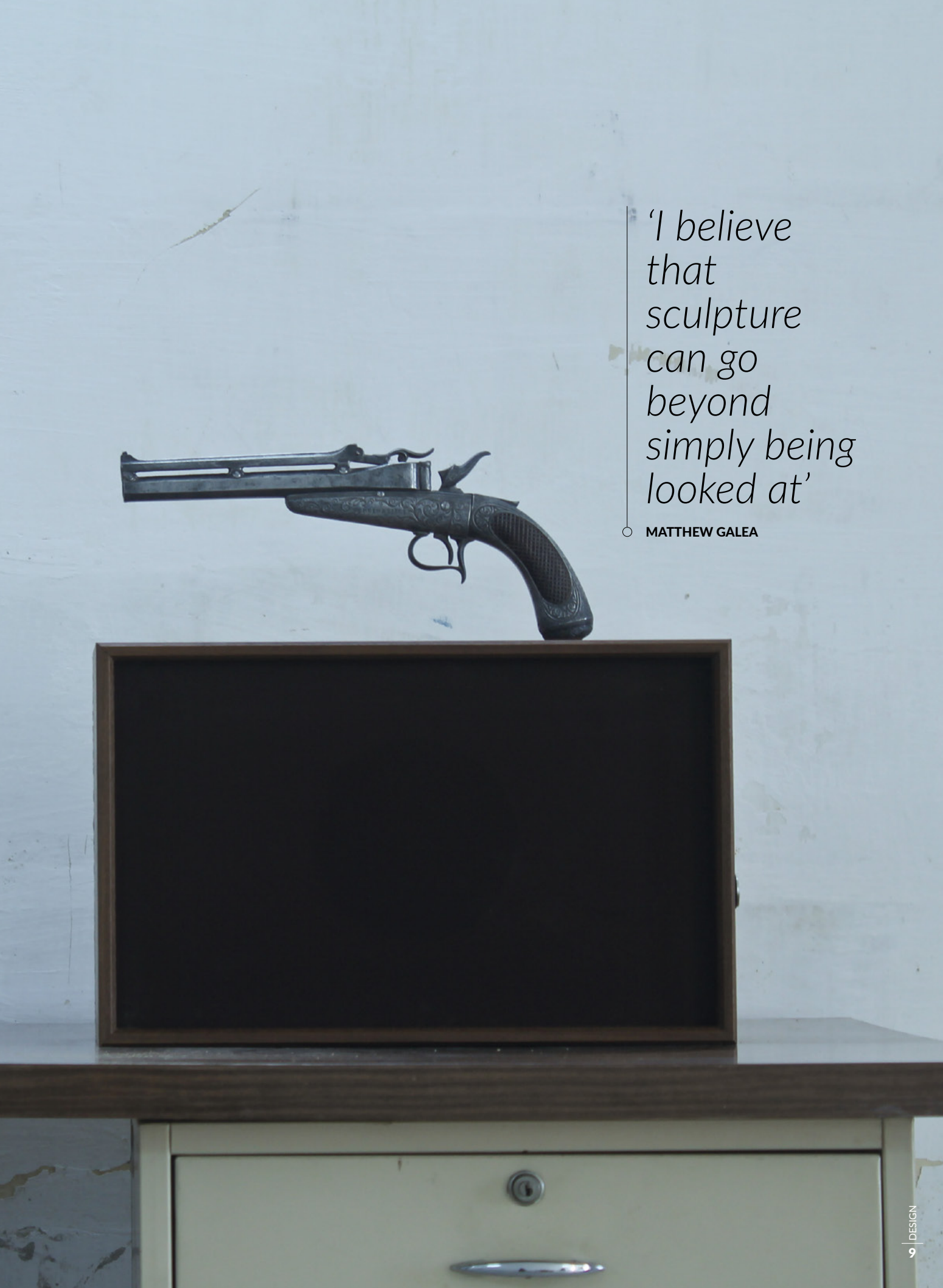
(Re)diffusion comes from *Weapons of Mass Distraction*, a series Galea has been working on which draws analogies between agents of mass communication and firearms. In language, terms like 'point' and 'shoot' are shared between the two devices, illustrating how both can be used for a positive or negative effect. 'Mass communication has been weaponised in some cases and can perhaps cause more harm than firearms,' Galea says.

Galea believes that sculpture is an intervention in society rather than matter, and that it makes use of space as an agent that connects everything: objects, sounds, and time. However, sound has long been ignored in the medium.

As Marshall McLuhan remarked, no object can be considered as purely visual, sonic, or tactile, but rather a blend of sensory stimuli. This idea of sensory ratios applies to how media comes into being. Objects moving in space or triggered on a computer, always require some kind of physical intervention that comes with visual and other sensory consequences. Similarly, sound does not exist in isolation. Sound always requires some kind of physical media to propagate it. Galea notes that whilst the human characteristic of observing things in isolation is beneficial in some areas, in an artistic context is rather pointless.

In *(Re)Diffusion*, he attempts to create a sculptural situation that has the ability to distort space and modify it in real time. 'I believe that sculpture can go beyond simply being looked at,' Galea says.

***(Re)Diffusion* will be part of IN TRANSIT, an exhibition curated by Prof. Vince Briffa, which showcases the works of emerging Maltese artists that work with digital media. The exhibition will travel to Dusseldorf (Germany) and Leeuwarden (Netherlands).**



'I believe that sculpture can go beyond simply being looked at'

MATTHEW GALEA

The Great Siege of fake information

Marc Kosciejew

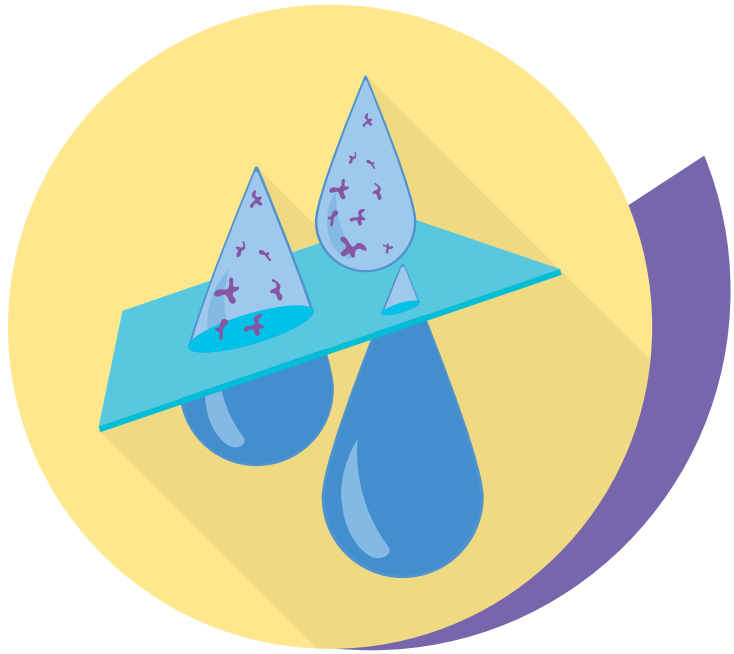
nformation is under siege.

Misinformation, disinformation, and fake news are everywhere, blurring people's understanding of what is real and what isn't. Indeed, false information is metastasising, bringing about dangerous new terms such as 'alternative facts'. Facilitated by the Internet and social media, it is influencing news, politics, scholarship, and public discourse. It is changing how many people perceive, interpret, and understand the world.

Information literacy is the toolkit needed for this dire problem, and it starts with the successful identification of fake stories. Hitting share is easy, which is why damaging information is propagated so easily. How do you find reliable information outlets? Take a moment to consider the source. Look into the website, its agenda, and its legitimacy. The author should be analysed similarly. Beyond these measures, make sure to read beyond the headline and first few paragraphs. Take in the whole story. Is this satire? Is it written in jest? Make sure that personal biases aren't clouding judgement. Consult an expert if needed.

The second part of information literacy is self-reflection. Be aware of psychological biases during searching, such as how questions are framed, how easily information needs are satisfied, how results affect perceptions, and how other factors influence searching; in other words, consider your thinking processes and adjust the search accordingly. Contextualise the information to help better understand the information's purpose, motivation, and bias. Finally, compare, corroborate, and cross reference with various sources. Do a deeper search if needed.

Online content is available everywhere, but we need to be smart about what we choose to consume and share. Adopting these approaches can help us break this alarming and intensifying siege on legitimate information and not only restore order, but save ourselves from a potentially very dangerous rabbit hole. T



When desalination is the only option left

The Malta Water Association

The Water Services Corporation (WSC) has recently announced that it will construct a Seawater Reverse Osmosis Plant at Ħondoq ir-Rummien in Gozo. To the casual observer, having a reverse osmosis plant on the island might seem like a necessary and commendable way of ensuring an adequate and independent water supply. However, Gozo has been meeting its water demands efficiently through a groundwater polishing plant since 2005, importing just 20% of its water from the Ċirkewwa reverse osmosis plant, a facility that is not being used to capacity. So a pertinent question arises: why is a reverse osmosis plant being considered?

The only official justification provided for the plant is a necessity to 'improve water quality'. This seems to be an admission of failure in the management of Gozo's groundwater, and the Gozo polishing plant's inability to treat groundwater to the required standard.

The reality is that illegal groundwater extraction in Gozo, as in Malta, is believed to be at the same level as WSC's own extraction, pushing totals well beyond the aquifers' sustainable limits. This over-extraction is leading to very high chloride levels, forming a detrimental combination with high nitrate levels from over-fertilisation in agriculture. As a result, the existing polishing plant is no longer able to meet EU drinking water standards at cost-effective prices.

Now, rather than dealing with the rampant, unsustainable extraction of groundwater and creating a holistic plan for the management of our aquifers, the country's water authorities are geared towards slapping a band-aid on the problem. Their solution: ignore the abuse of groundwater and increase desalination capacity. However, desalination is far from the miracle cure.

It is important to point out that production of fresh water by reverse osmosis costs six to eight times that of groundwater. We should also severely question the decision to push forward with a desalination project in the absence of a strategic national water plan.

In one of the most water-poor countries in the world, a total lack of management and planning is seeing the islands hurtle towards total reliance on fossil fuel-dependent seawater desalination. There is little incentive to collect, safeguard, and make sustainable use of rain and groundwater. The Maldives islands are a bitter lesson we must learn from.

In the Maldives, over-exploitation of the aquifers in the small, water-poor islands led to reliance on desalination and a severe water crisis in December 2014 when a fire broke out in their largest reverse osmosis plant. With no other water supply, bottled water had to be flown in from India. Malta does not want to be in this situation.

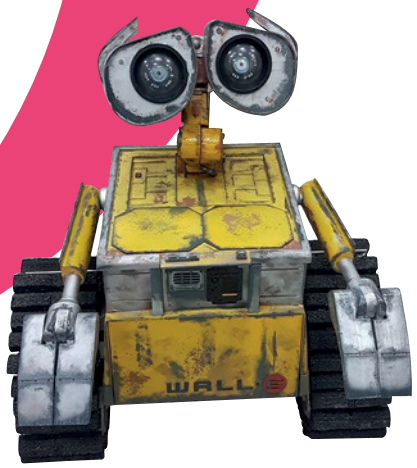
Water sustainability is an area that needs urgent attention from government bodies. It also needs the support of citizens who will ultimately be the ones to suffer the dire consequences of the current situation. A local water plan and an agricultural plan for Malta and Gozo are both still missing and long overdue.

For more information visit:
www.facebook.com/groups/MaltaWaterAssociation/
info@maltawaterassociation.org

STUDENTS

Wall-E: Ta-dah!

Edward Cachia, Owen Attard, Matthew Tanti, and Enrico Aquilina



Think sci-fi, think robots. Whether benevolent, benign, or bloodthirsty, these artificially-intelligent automatons have long captured our imagination. However, thanks to recent advances in mechanical and programming technology, it looks like they are set to break the bonds of fiction.

The Department of AI (Faculty of ICT, University of Malta) is currently in the process of introducing Robotics and Automation into its programs, and starting from October 2017, they will offer the first modules at both Undergrad and Postgrad level. In advance of this, students are being tasked with some interesting robotics projects.

Edward Cachia, Owen Attard, Matthew Tanti, and Enrico Aquilina (supervised by Prof. Alexei Dingli, Dr Claudia Borg, James Catania, and George Camilleri) came together to help build a full-size replica of Wall-E, the Disney-Pixar film's eponymous lead.

The team was split into three groups, each researching and planning individual parts of the robot. The aim was to exactly replicate the movement and aesthetics of the movie character.

The Wall-E robot is granted movement through a track drive, similar to that of a tank. Being underneath the rest of the robot, this part bears most of the load and pressures from the moving parts, which is why research into the best materials and gearing ratios was required to make it rigid and able to withstand abuse during motion.

Above the track drive sits the body, its aesthetic appearance concealing all the hardware required to make Wall-E work. When researching materials, the team took into account the need to balance sturdiness with lightness, ultimately deciding on medium-density fiberboard. The arms were split into two main parts: the lower arm and the hands. The latter were created using 3D printing, to make them light and precise. Expanded polystyrene was used for the lower part of the arm, as it is both robust and low-weight. To facilitate arm rotation, servo motors were incorporated with metal gears, providing durability.

Wall-E made his first appearance at the Malta Robotics Olympiad 2017, where thousands of people flocked to greet him.

Wall-E's personality is created by the emotional expression achieved by moving his head and neck. Great consideration was taken in choosing head materials in order to keep them light enough for smooth movement. Servo motors are used to provide the head with human-like motion in all directions and also to raise and lower the eyebrows, providing expressions. The lightest materials possible were chosen for the head, such as plastic and acrylic glass.

Wall-E made his first appearance at the Malta Robotics Olympiad 2017, where thousands of people flocked to greet him. Who knows which friendly robot will have the honour of greeting the curious crowd next year? T

Understanding gravity to understand the Universe

Gabriel Farrugia

For a primate species clinging to a speck of dust in an incomprehensibly vast universe, curiosity has seen humans discover a great deal about how it all works. However, there are still mysteries that the cosmos is reluctant to relinquish, one of which is gravity.

The most accurate theory describing gravitational attraction is general relativity, developed by Albert Einstein in 1915. Unlike Isaac Newton, Einstein did not describe gravity as a force, but rather a manifestation of the curvature of spacetime, thought of as a stretchable and squeezable fabric that is distorted by matter. However, his theory does not fully explain phenomena such as the accelerating expansion of the Universe and inconsistent orbital speeds of stars within galaxies.

So, is Einstein wrong?

More reasonably, the theory is incomplete. To fill in those blanks, Gabriel Farrugia (supervised by Dr Jackson Levi Said, Institute of Space Sciences and Astronomy, University of Malta) is investigating alternative theories of gravity.

His focus is on teleparallel gravity, in which spacetime is twisted rather than curved. This is a new description that can be used to construct more general theories and models. As part of his research, Farrugia investigated whether a particular extension of teleparallelism can describe the evolution of large-scale structures like galaxy formation with current observational data.

In this model, the effect of gravity is not only dependent on the torsion being produced but on the type of material gravitating. Although it has been concluded that the model is not sound unless special circumstances are considered, this is not a negative result. It serves to restrict the number of possible valid theories and ultimately help find the true theoretical description of gravitation.

The phenomena these theories try to explain are unlikely to directly affect our lives. Yet, understanding them will not only broaden our repertoire of knowledge, but helps us develop better technologies.

Thanks to Newton, humanity was able to determine the periods of planets around the Sun that helped build the first rockets and satellites. Thanks to Einstein, the Global Positioning System (GPS) became a reality. Given the importance of these technologies to our current lifestyles, who knows what technological revolutions such research will make possible?

This research was carried out as part of a Ph.D. in Cosmology, Institute of Space Sciences and Astronomy, University of Malta.

Paving the way for underwater explorations

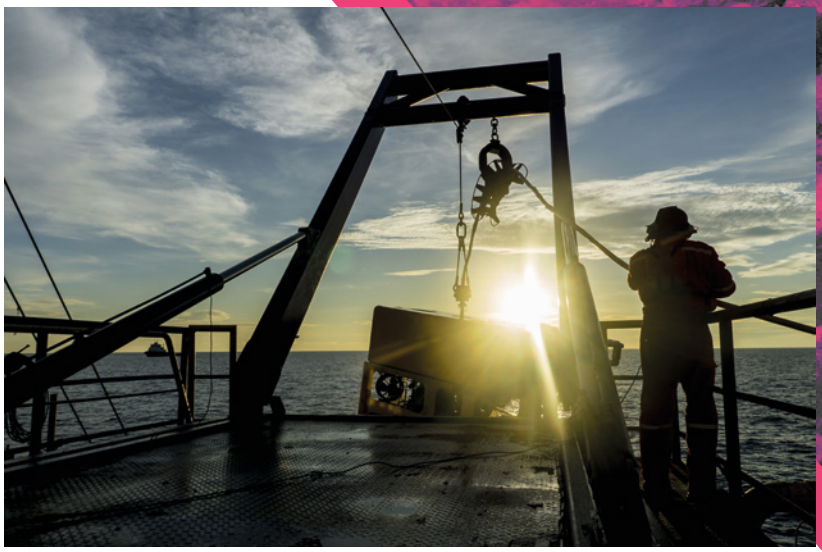
Rachel Cauchi

Nearly two-thirds of the Earth is covered in water. Yet we know more about the surface of the moon and Mars than we do of our own ocean floor.

Humans have an understandable fear of water and desire to remain safe on land. The oceans are formidable places requiring sophisticated equipment. Even more dangerous is exploring uncharted areas.

Remotely Operated Underwater Vehicles (ROVs) overcome the problems humans face remaining underwater. They are used for manual and autonomous missions which would see commands issued by a human pilot. I (supervised by Dr Ing. Brian Zammit and Dr Ing. Marc Anthony Azzopardi) have initiated the design process that will eventually see the Department of Electronic Systems (Faculty of Engineering, University of Malta) doing exactly that.

In order to be able to develop autonomous systems for the ROV in the near future, I started from the mathematical models that are required to predict the physical behaviour of the vehicle in a simulated underwater environment. I also conducted a series of experiments to characterise the behaviour of the underwater propulsion system in terms of generated thrust versus motor speeds, which gives an indication of the generated thrust for variable speed commands



sent by the pilot. In addition, I then determined the design of the electronic hardware required to provide robust communications between the pilot and the ROV. This process helped to create a suitable system for bench-testing the developed communications link.

The most vital communication for an ROV to work properly is promptly receiving commands from the pilot to the ROV. After the commands are interpreted by the onboard processors, the ROV's motion will be controlled by adjusting thrusters. The same physical link will be used to transfer data from the various underwater sensors back to the pilot ground-station. This data will include vehicle-related information such as attitude, speed, and orientation together with mission-related information such as live video streaming. All the data will be transferred using a single fibre-optic tether cable that provides the required high transmission bandwidths whilst reducing problems associated with copper cables, such as their increased weight.

This project is the start of the development of the University's own ROV, which will lead to safe underwater exploration becoming reality, making yet another step forward in satisfying humanity's desire of exploring the unknown.

This research is being carried out as part of a B.Eng. (Hons) in Electrical and Electronics Engineering at the Faculty of Engineering, University of Malta.

MAKS MFA Digital Arts

From the MFA in Digital Arts students at the Faculty of Media and Knowledge Sciences, this selection of works showcases how art can turn into research in varied areas, from the concept of re-appropriating gaze to the creation of false memories through photography and much more.

Gabrielle Agius

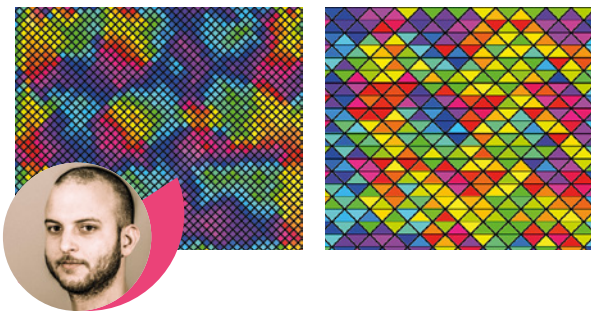
Wait with me

My research is an investigation of the perception and experience of time as one waits. The wait is typically characterised by the absence of stimuli which are able to distract one from the current condition. The project seeks to develop this emptiness by creating a space which reflects the temporal suspension.

David Falzon

The Adventures of Memories with Trash and the Three Bears of the Sixties

My research delves into the reinterpretation of meaning present in Robert Crumb's comix by means of the cut-up technique. The methodology allows for sampling of comics which best portray the shortcomings of the American dream. The cut up technique is therefore used to manipulate form and eventually alter meaning. Hence the fragmentation process can be perceived as a chaotic reinterpretation of a dystopia.



Jean Paul Migneco

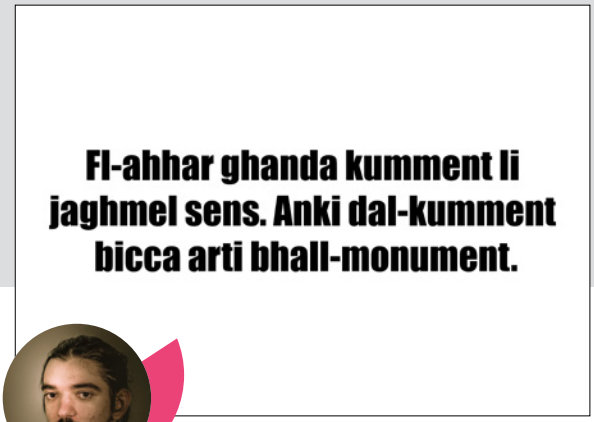
Reinterpretation of Landscape Topography

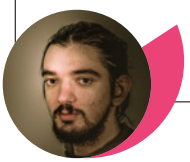
My project involves extracting three-dimensional coordinates of land terrain and converting them to a red, green and blue (RGB) colour space in order to achieve colours that correspond with elevations of the terrain. The colours that are generated through this process are manipulated in order to obtain chromo-stereoscopic patterns. These are intended to reinterpret colour-field and landscape artworks that are known for displaying illusions of depth through the aid of specific colour applications.

Lisa Formosa

Truthful Inexactness

Photographs can be an illustration of the story of one's life, but, they can also distort memories. The project takes on the form of personal photographs which are able to blend into one's existing memories or alternatively create false ones.





Matthew Schembri

7-9-15-22-1-14-14 4-5-13-1-18-20-9-14-15

This project, entitled ARTMENTS (2017), aims to explore the relationship between online comments on contemporary public art, both in the local and international context. ARTMENTS aspires to present this form of artistic commentary as an art in itself through the technique of recontextualization and, eventually, public recirculation.

Annalise Schembri

Il-Kixxiefa

My work deals with the re-appropriation of the gaze and challenges the positions held by the viewer and the viewed and their respective gender associations. The project explores the concepts of stereotypes, voyeurism, and surveillance by means of a satirical interactive installation and performance piece. Ultimately, my work comments on the juxtaposition of power between the seer and the seen from a feminist perspective.

John Ambrogio

Terpsichore in XML

My work involves a practice-led project to digitally record, archive, and preserve traditional flamenco and contemporary dance as practised by Maltese dance companies. A pragmatic research methodology including personal involvement is used to film, photograph, and textually document a series of practice sessions in dance studios and the public performances of local dance companies.

WATER

Water is simple: just three atoms. Those two hydrogens bonded to a central oxygen gave planet Earth a rich ecosystem, capable of sustaining a kaleidoscope of life forms.

For the Maltese Islands, water is part of the fabric of our community. It is present in our everyday existence, from the scarcity of fresh water that still haunts us, to the Mediterranean sea used by shipping companies worldwide. The opportunities for research are endless.

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Glider South: exploring the sea south of Malta
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KAPTAN ON BOARD

Meet the mobile app that's making the sea safer for sailors and citizens alike. ***Prof. Aldo Drago*** *writes.*

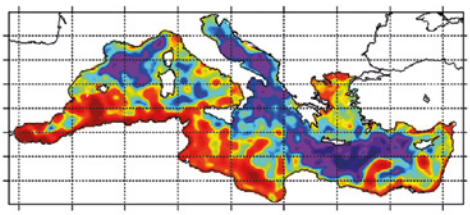
Ahead of departing on voyages at sea, mariners, fishermen, and leisure craft owners need to plan and make journeys that are as safe and efficient as possible. This means they are always in search of the latest and most accurate data on weather and marine conditions. But how to obtain this information?

Well, now there's an app for that! Seafarers navigating around or close to the Maltese islands and southern Sicily now have an on-board digital assistant called KAPTAN, Maltese for 'Captain'. The app brings key data to personal smartphones, using real-time marine and weather prediction services to provide high-resolution local data. With just a few clicks, users have interactive spatial maps at their fingertips, giving them details on prevailing conditions at sea, as well as short term past and forecast information.

KAPTAN was developed within the CALYPSO project, an Italia-Malta cross-border cooperation initiative led by the Physical Oceanography Research Group (Department of Geosciences, Faculty of Science, University of Malta [UoM]). The face of the app was designed by THINK, a local digital agency and web design company. The service integrates observations from the CALYPSO HF radar network, which consists of four CODAR SeaSonde installations on the northern Maltese and southern Sicilian shores. Satellite observations are added to high resolution weather and marine numerical models run by the UoM team specifically for the Malta-Sicily Channel. This yields a full suite of very local meteo-marine reporting and complements other weather forecasts and local weather stations. What makes KAPTAN different is that the app provides maps and point data showing the dynamic structures of the atmosphere, variability in sea surface currents, temperature, and waves, and shows how all of these evolve in space and with time. The user can get the specific data they need when they need it.

KAPTAN looks set to make a splash. The app's data is useful for many at sea. This is the key added value of KAPTAN: making data easily and freely available not only to researchers, public authorities, and environmental agencies, but also to other citizens. KAPTAN is a service that will make travel at sea safer and more comfortable.

The free phone app can be downloaded on Android and iOS devices or viewed on the web at www.capemalta.net/calypso/kaptan



Map showing sea level topography

DID YOU KNOW?

The ocean, like the atmosphere, is a fundamentally turbulent system. Its motion is characterised by meandering streams and many small-scale circulations in the form of mesoscale eddies. These are dynamic, rotating structures of water that are continuously evolving in time and space, influencing the 'weather' of the sea. Although only the surface expression of mesoscale eddies is visible in satellite images of the sea surface (observing height or temperature), they are in fact 3D structures that reach down into the pycnocline where water density increases rapidly with depth. In the Mediterranean, the sizes of these eddies are around 10 to 20 kilometres, or four times smaller than in the oceans, and much smaller than the atmospheric high and low pressure systems normally seen on weather maps.

GLIDER SOUTH

Exploring the sea south of Malta

To map pristine areas in the Mediterranean, CAMPE is going where no glider has gone before. ***Prof. Aldo Drago*** *writes.*

CAMPE spends most of its life in the sea. CAMPE is the name of a sea glider deployed on April 23rd. For the next two months, the immense volume of water south of the Maltese Islands will be its home. With the ability to dive repeatedly down to depths of 1000m, this torpedo-like vehicle carries a payload of sensors to sound the sea uninterrupted as it steers its way autonomously through the water, sending signals and data to a land station by satellite communication every time it surfaces. The result? A massive collection of data in quasi-real time that sheds light on the vast expanse of water yet unexplored just south of Malta's home shores.

CAMPE forms part of the French SLOCUM glider fleet at the Centre National de la Recherche Scientifique (CNRS) in La Seyne-sur-Mer. Through a JERICO-NEXT Trans-National Access activity called GLIDER South, the University of Malta's Physical Oceanography Research Group are conducting this data acquisition expedition in the sea between Malta and the Gulf of Sirte. At the moment this stretch of sea is practically unexplored, and the project aims to rupture the great lack of knowledge about this immense volume of water which divides the Mediterranean Sea in two halves.

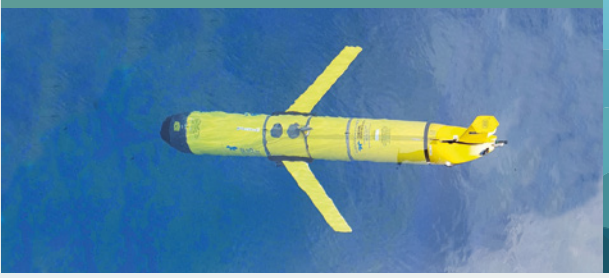
The Armed Forces of Malta supported the deployment of the sea

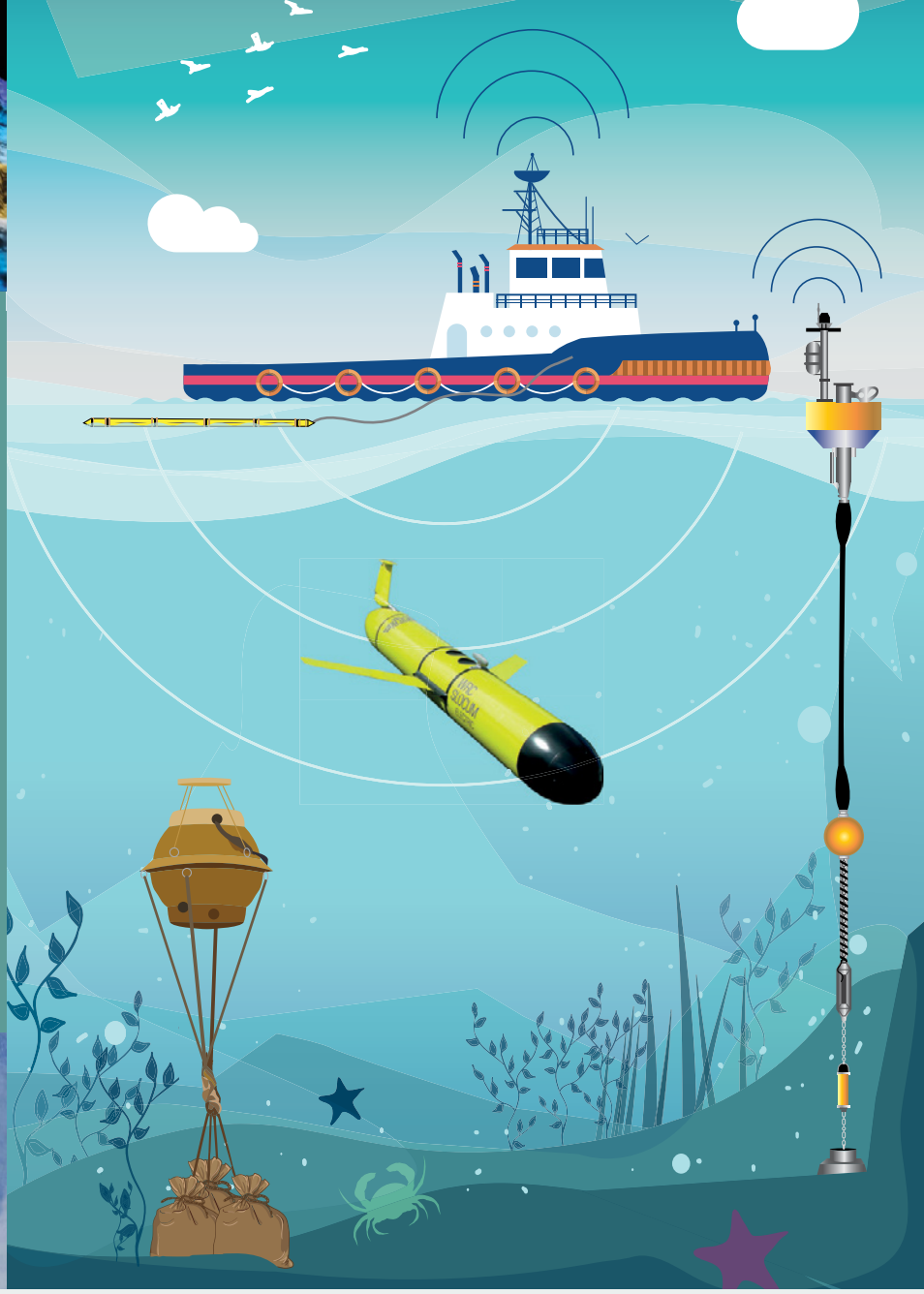
MEET THE TEAM

Prof. Aldo Drago coordinates the Physical Oceanography Research Group (Department of Geosciences, Faculty of Science, University of Malta). Dr Adam Gauci and Dr Anthony Galea handle field expeditions and technical execution of the research. Prof. Alan Deidun provides expertise in marine biology and environmental management. Audrey Zammit, Raisa Galea DeGiovanni, and Tiziana Micallef support the research team. The Armed Forces of Malta support the team through provision of boats and crew for equipment deployment.

DID YOU KNOW?

The bottom of the sea joining Sicily to Malta is relatively shallow (100m on average) and forms a step-like platform, known as the continental shelf, beyond which the sea bed drops down consistently to much greater depths. The Maltese Islands lie at the edge of this shelf, looking like the top of a mountain emerging out of the sea. This explains why the sea is so deep less than a mile away from the sturdy Dingli Cliffs on the south-western shores of Malta. Astounding underwater topographies make the Maltese Islands so unique not only on land, but also under the sea!





glider. The glider slid down into the sea from a rigid-hulled inflatable boat launched from the patrol boat. With a payload of multidisciplinary sensors, it performs vertical profiles of physical and biogeochemical parameters during each dive, gathering data on pressure, conductivity, temperature, fluorescence, dissolved oxygen, nitrates, and optical backscattering. Integrating these profiles along the path followed by the glider creates 2D vertical maps outlining the changing conditions from the water's surface to the seabed, and exhibiting the spatial variability with depth and distance.

Sea gliders are a new generation technology platform for marine observations. Since the glider can be controlled remotely, it can adapt to the changing needs of the mission. Sampling paths can be reset, and the glider can be redirected to measure the most important areas. The next step in this journey is for the research team to integrate glider observations with satellite and numerical model data, linking and superposing data types acquired by different observational platforms with diverse temporal and spatial representations.

AN EYE ON THE SEA

Continuous measurement and analysis of marine conditions in real time is allowing local users to better understand the short and long-term implications of the changing sea.

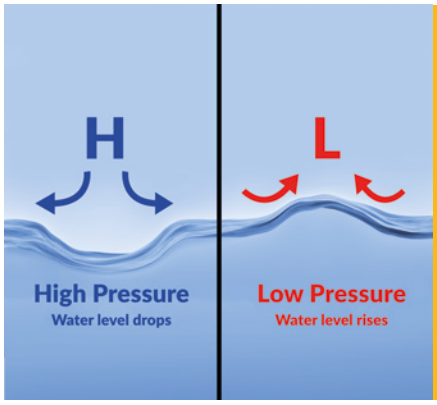
***Prof. Aldo Drago** writes.*

Every good decision is an informed one.

For that to be possible, data is essential.

When Malta was under British rule, the Armed Forces handled the gathering of marine data and its dissemination to ships and stakeholders through the British Hydrographic Office. They were responsible for safe entry and exit of large ships in our harbours. They aided in search and rescue missions. Then came Maltese independence. With that, the British left, and so did their expertise, leaving behind a devastating massive lacuna.

Since the early 90s, the Physical Oceanography Unit, now established as the Physical Oceanography Research Group (Department of



DID YOU KNOW?

The sea surface reacts rapidly to changes in atmospheric pressure, falling by approximately one centimeter with every pressure increase of one millibar and increasing at the same rate when the air pressure is relieved. A moving atmospheric low pressure cyclone bulges up the sea beneath it, leading to sea surges (rapid sea level rise) at the coasts during storms. Higher sea levels often restrain water runoff from reaching the sea leading to coastal flooding. We have all experienced this at Msida!

Geosciences, Faculty of Science, University of Malta [UoM]), has endeavoured to fill this gap.

The first ever digital sea level station in Mellieħa Bay and the meteo station in Ramla Bay were set up in 1993 and 1994 respectively. Data was collected in delayed mode by storing it in high-capacity data loggers on site, accessing it for viewing and processing in retrospect every couple of weeks. Advances in telemetry subsequently made it possible to receive data directly from the system of sensors on a station to a dedicated University server by a dial-up bundled transfer of data packs. Such an installation was set up in 2001 at Portomaso, delivering sea level, sea temperature, and atmospheric pressure with updates every hour—slow by today's standards.

The 2010 upgrade now allows the station to deliver fast data streams to the control and processing centre at the UoM, where it is automatically quality controlled while publishing, within moments, over dedicated web servers. Sea level updates are received every 15 seconds and shared within the MedGLOSS regional monitoring network, contributing to the first phase of a Mediterranean tsunami early detection system. The system also monitors for seiching events (a standing wave) that can be hazardous to movement of ships and their berthing in harbours. The accumulation of long-term sea level data sets are then useful to determine trends and indicators of climatic changes, and essential to determine the impact of saltwater intrusions in aquifers.

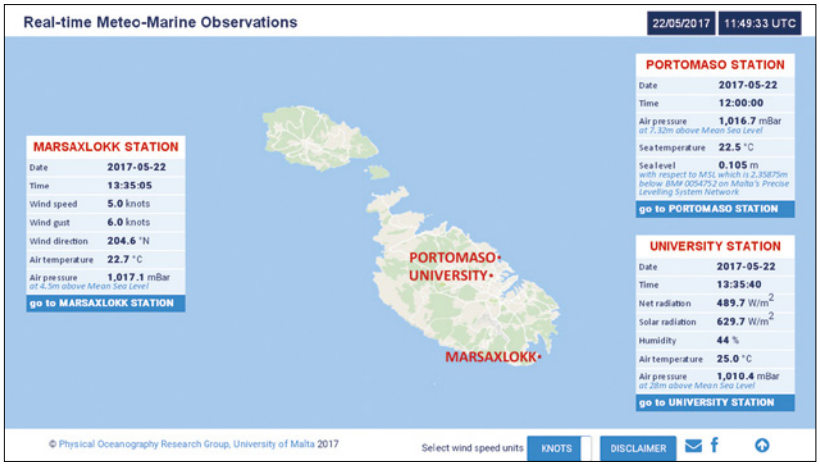
Today, the number of monitoring stations has increased. The tip of the breakwater at the sea entrance of Marsaxlokk harbour boasts one. The University campus is home to another. They both serve to provide early warnings of adverse atmospheric conditions, especially for port operations and the safer navigation of ships into and out of the port.

A website has now been set up that can deliver this information free of charge as an online service.

This information is delivered in real time and free of charge as an online service on a dedicated web interface. User-friendly displays and plainly presented data makes this useful to both professional and casual users.

Current plans are to continue adding more of these stations working around the clock. In collaboration with Transport Malta, other stations in the Grand Harbour, Ċirkewwa, Mġarr, and possibly southern Sicily will join the network, providing an extended service and targeting more users.

http://ioi.research.um.edu.mt/WeatherStations



HISTORY
BENEATH
THE BLUE

Many would say that Malta's rich history is evident for all to see. From Mdina to Mnajdra, much of the island's past is present and tangible in our everyday lives. But what heritage is still hidden? ***Dr Timmy Gambin*** *writes about the efforts made to bring to light the history beneath the waves.*

For a nation with a surface area of 360km^2, Malta has a disproportionately large concentration of heritage sites. Occupation and probable continuous habitation over the past 7,500 years have left an indelible mark on our islandscape. Unsurprisingly, much of Malta's history is inextricably connected to the sea—a link manifested in the unique harbor structures, our art and folklore.

It can be hard to imagine how much of Maltese maritime history is actually on the seabed. Hard because when one looks out to sea, all that is visible is a vast blue—a surface impenetrable to most. Indeed, even standard SCUBA divers do not quite comprehend the potential for underwater cultural heritage that lies in waters beyond the 50m contour.

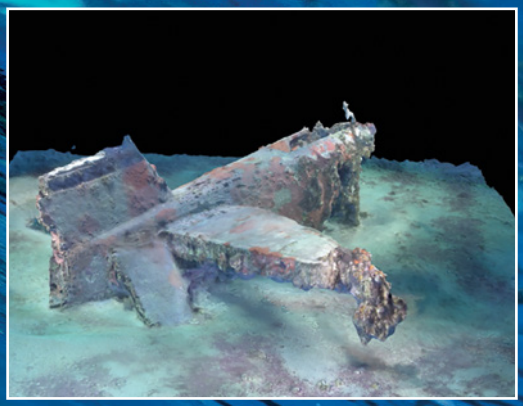
Another reality many are not aware of is the sheer vastness of seabed for which Malta is responsible. Within its 12 nautical mile territorial waters, Malta has over 3,000km^2 of seafloor—nearly 10 times the land area. Although one cannot expect to have similar concentrations of cultural heritage on the seabed as are present on land—the potential is huge.

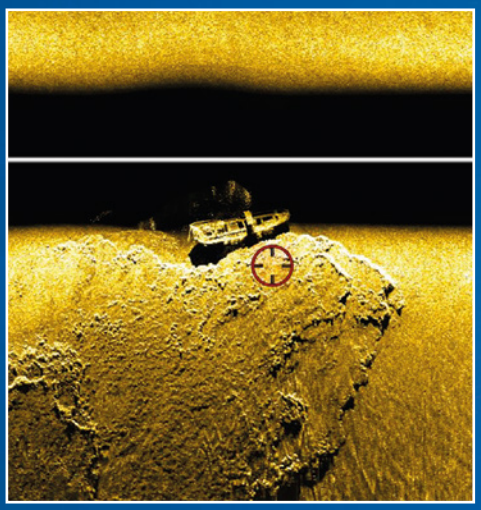
Within its 12 nautical mile territorial waters, Malta has over 3,000km^2 of seafloor—nearly 10 times the land area.

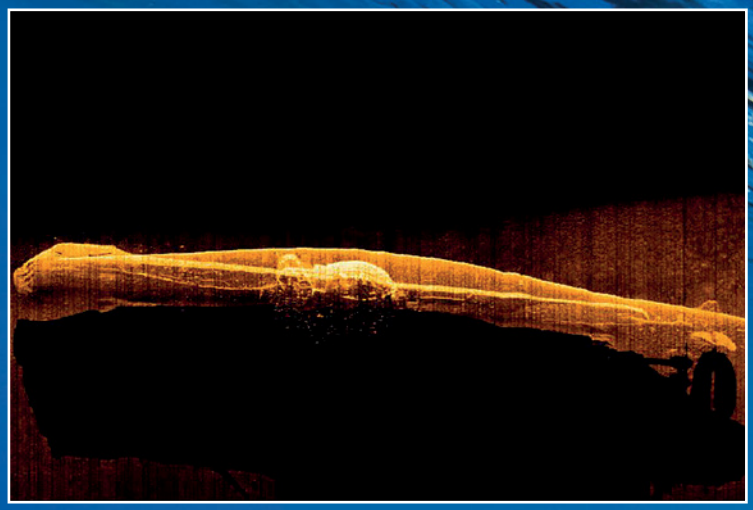
To better understand our underwater cultural heritage, it was deemed essential to explore the seabed around the Maltese islands. The guiding principle behind this initiative is: 'to manage, one needs to know'. But where does one begin?

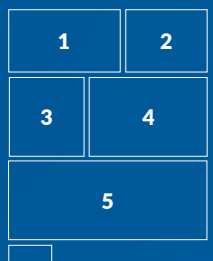
We developed a 3M approach which is currently being implemented to break down what may seem to be an overwhelming task.

The first stage, or M, of this long-term strategy is mapping the seabed. With the support of the Planning Authority, the University of Malta (UoM) has been systematically surveying the seabed using a side scan sonar system. The system (owned and deployed by the UoM) is towed, but for the past three seasons we have had the use of an Automated Underwater vehicle (AUV). The latter is extremely time-efficient, especially in deep waters. What we set out to do, year after year, is map an area of seabed that was previously unexplored. We 'fly' the sonar along a regular pattern that is predetermined using specialised planning software. Each survey block consists of about 25km^2, taking between two and five days to complete. This variation is determined by a number of factors, including whether a towed system is deployed or whether we run a survey using an AUV. Once collected, sonar data are stitched using specialised software that produces geo-referenced images of the seabed. In-depth inspection of these datasets permits



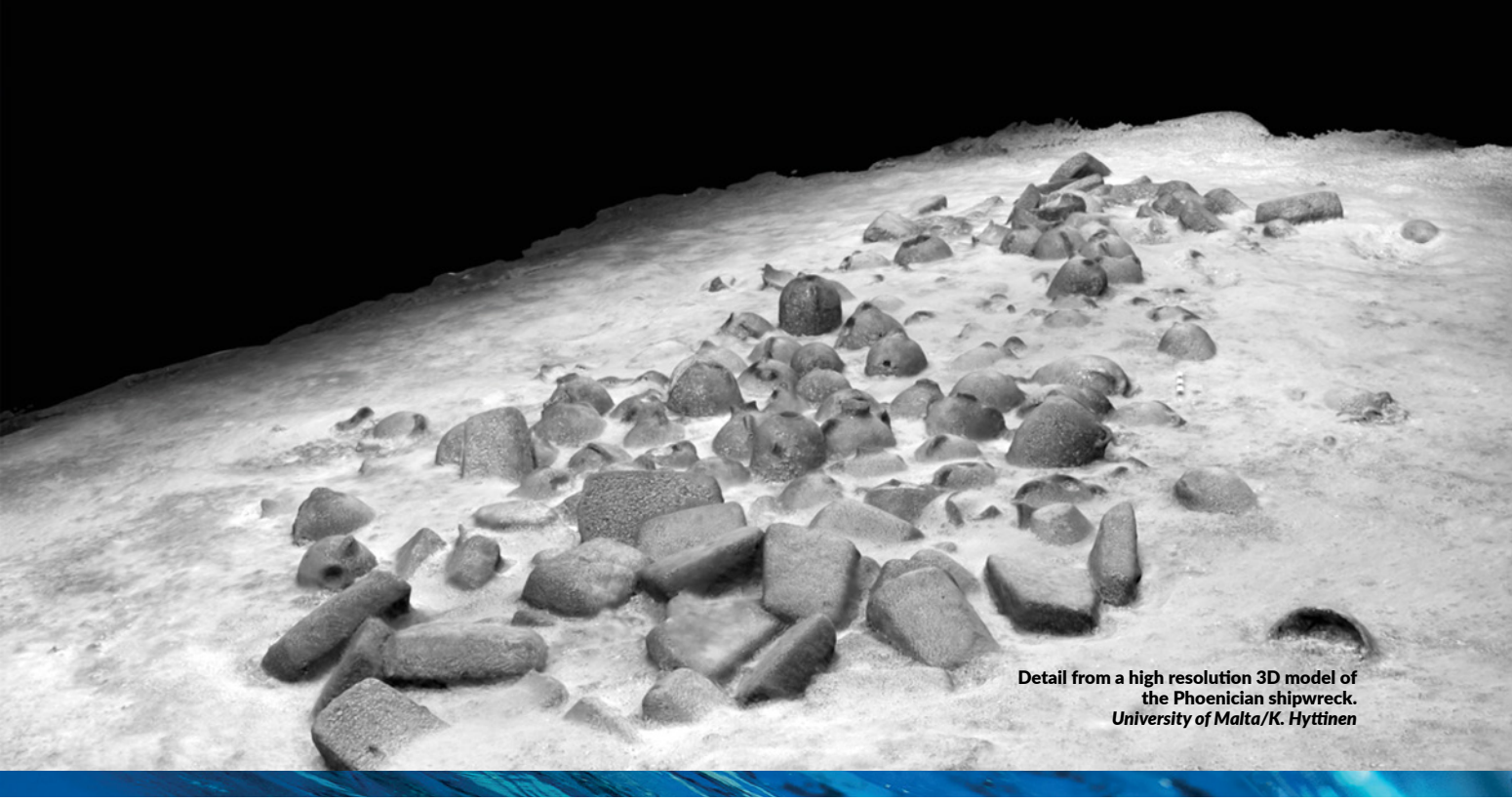




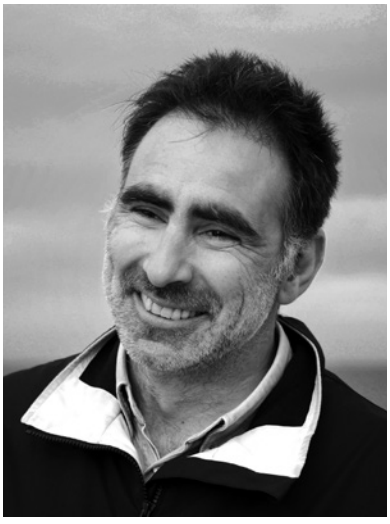


1. Divers filming remains of a crashed aircraft. *Photo by T. Gambin.*
2. 3D rendition of WWII aircraft remains on seabed. *Photo by K. Hyttinen.*
3. Sonar image of shipwreck.
4. High Resolution sonar image of submarine on seabed.
5. High resolution photomosaic of German Schnellboot. *Photo by J. Wood.*
6. Areas surveyed around the Maltese Islands.

All photos courtesy of University of Malta



Detail from a high resolution 3D model of the Phoenician shipwreck.
University of Malta/K. Hyttinen



Dr Timmy Gambin

The ultimate aim is for Malta's underwater cultural heritage to be elevated in status and to match the importance of land sites.

us to identify interesting anomalies (or targets) and prepare these as lists.

It is only once this information is in hand that decisions and plans can be made to proceed with the second M: management. The plan's next steps are dictated by the targets present in the area of study and the resources available. What is crucial at this stage is the identification of the target, its typology, and its state of preservation. On the basis of this information, it will be far easier to decide on the level of attention to dedicate to each site.

Another factor considered is that of threat. Threats can stem from activities such as fishing, ship anchors, looting, or even damage through natural processes. Once these aspects are determined, we then proceed with further in-depth studies. Such studies include visual inspections, further recording through photography and video, as well as very high-resolution 3D modelling. These help build a comprehensive picture of the site.

Since June 2015 we have collaborated with colleagues from Finland and have developed a low-cost 3D modelling process that is very cost effective. Using 4K video footage, thousands of photographs are subsequently used to create an accurate and scaled 3D model. These models provide yardsticks for the determination of site preservation as well as for the colonisation of these archaeological sites by marine life. Furthermore, periodic visits to these sites enable us to monitor the site formation processes.

The third and final M is monitoring. We are now working in close collaboration with various entities, both locally and overseas, to develop methods and tools for the monitoring of Malta's underwater cultural heritage. One system being explored is the use of European satellites to act as a sentinel for any illicit activity.

Many of Malta's submerged cultural assets remain undetected on the seabed. However, large stretches of seabed have already been mapped with numerous sites currently being investigated. The ultimate aim is for Malta's underwater cultural heritage to be elevated in status and to match the importance of land sites. The sea has many stories to tell, and we are working hard to share them.

University Maritime Platform

CONNECTING PROFESSIONALS

The University Maritime Platform, a dedicated space for all those interested in the sea and the work happening around it. ***Prof. Claire De Marco*** *writes.*

Malta's strategic position in the Mediterranean Sea has impacted its history, culture, and economy. It has also given birth to a vast maritime industry, covering a plethora of areas—legal, environmental, engineering, marine, archaeology, and geology, to name only a few. Identifying this, the government has prioritised the maritime sector. However, it has also recognised that a more integrated approach between stakeholders is required to adopt a strategy for the development of new and improved services on our islands.

While essential to the industrial sector, this unified strategy should not be limited to it, but extended beyond, into academia. The University of Malta (UoM) has a critical capacity to develop new technologies, to empower a new generation of scientists, professionals and industrialists, and to create maritime-related services and jobs. The UoM meets these challenges by providing a framework for research and innovation, allowing many academics within their respective faculties to meticulously work on their own areas of interest. Being that the UoM is a multidisciplinary institution with many faculties, institutes, and centres, academics would be vaguely aware of the persons working and researching within the maritime area, but details can be missed. Complementary expertise may also exist within the UoM that, if not referenced, may result in the duplication of work.

To address this, a dedicated platform was created with focus on the maritime theme. The University Maritime Platform was officially launched in March 2017.

The platform not only facilitates collaboration between UoM entities and individual academics, but also allows the maritime industry, both local and international, a common point of entrance for maritime enquiries at the UoM, promoting cooperation between clusters, centres, programmes, networks, and individuals with similar purpose and scope.

GETTING CONNECTED

Research and innovation is a fundamental pillar of a university. The UoM's framework for academics, departments and research groups involves entities such as the Knowledge Transfer Office, the Research Support Services Directorate, and

Academics would be vaguely aware of the persons working and researching within the maritime area, but details can be missed.

Project Support, all of whom work in tandem to provide not just information on potential opportunities at hand and avenues for exchange of expertise, but hands-on guidance for funding applications. The platform will work alongside these groups, according to the platform's scope, to aid those involved in maritime activity.

The second pillar is education, training, and development. The UoM already hosts many academic marine-related programmes and individual study units covering a wide range of disciplines. A database of these is being compiled with the collaborating university entities which will allow interested parties to follow the courses either in their entirety or selected individual units. For those external to the UoM, this will ease the process of finding a suitable maritime programme by making relevant information easier to find and utilise. Short course training programmes are also to be included, creating possibilities for training, work placements, and educational and research scholarships. This education and training empowers a new generation of the workforce to have an effective impact on the maritime sector, by providing the necessary skills, knowledge, and expertise for graduates to become effective contributors to the maritime industry

Even at these early stages of the platform's development, academic members have been registering: a clear indication that it addresses a present need for connection and communication among peers.

both locally and internationally.

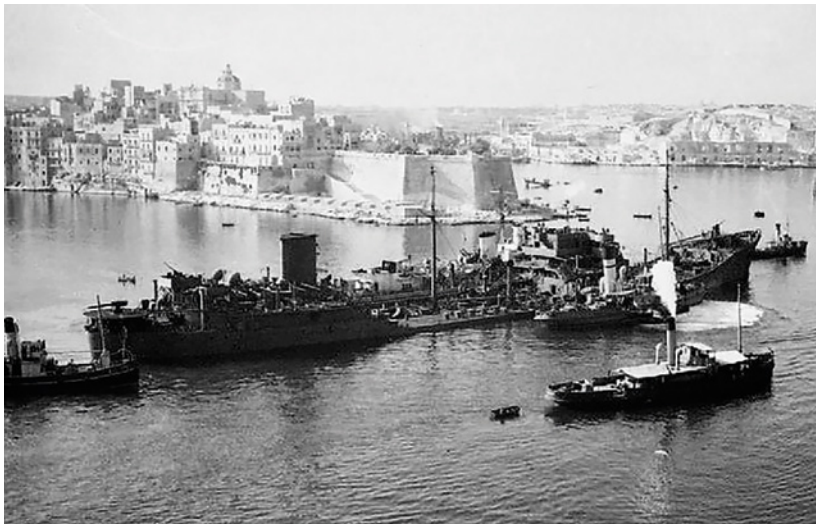
Even at this early stage of the platform's development, academic members have been registering: a clear indication that it addresses a present need for connection and communication among peers.

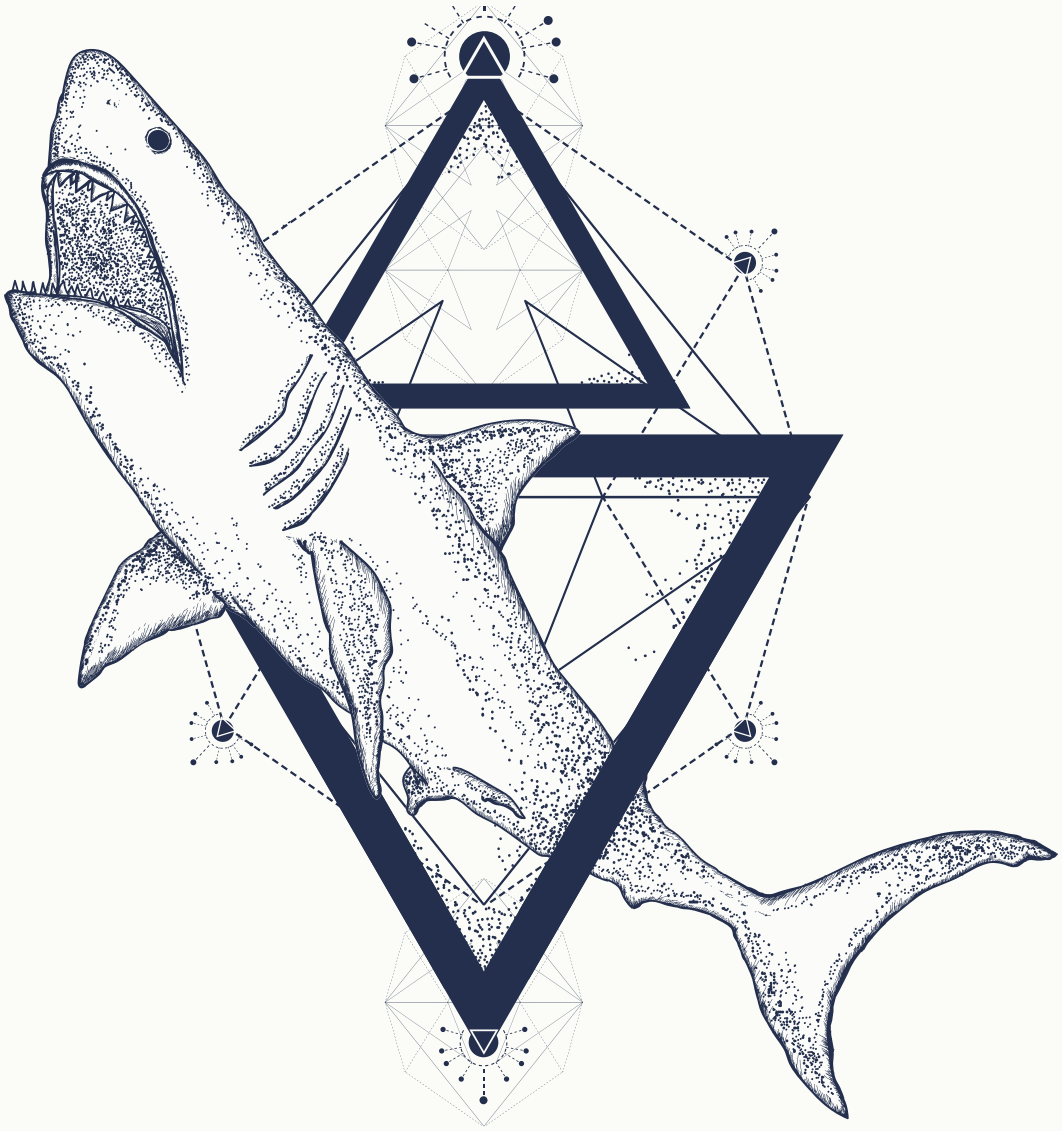
The next step in the platform's evolution is to set up focus groups, containing committee and academic members from the platform, together with non-university experts from the industry. Events will be planned, enabling members and external groups to meet and learn more about each other, providing much-needed networking opportunities, as well as showcasing the UoM's potential to attract groups, persons, and industry players who may also be willing to support the platform in any possible way.

The platform will be made successful by university and industry-wide combined effort, contribution, and collaboration. Surmounting these challenges will secure the platform as a recognised member forming part of a coordinated network of universities, maritime centres, institutes, enterprises and innovative players.

Communication between all entities is the recipe for success, and maintaining a portal for discussion and dissemination of knowledge is paramount. With this dialogue, the platform can be used as a point of reference, information, and expertise and also be in a position to influence maritime policy with respect to relevant national and international initiatives and programmes.

www.um.edu.mt/platform/maritime
maritime.platform@um.edu.mt





ONCE UPON A TIME WE HAD

Sharks

Human beings may be adversely affecting biodiversity, but can we be a help as well as a hindrance? ***Greg Nowell*** *writes.*

Marine life once thrived in the waters surrounding the Maltese islands, sharks included. But that is no longer the reality we see today. So, what happened? Where have all the fish gone? How can we bring them back?

The word shark typically conjures up images of a large, dangerous, sharp-toothed animal with more interest in causing harm than good. In reality, of the 35 species historically or currently documented in Malta, only one fits part of that description and even then, it would still prefer to have nothing to do with us humans.

The simple truth is that humans have hunted sharks for food and killed them for sport, all without considering potential consequences. Regrettably then, we have removed a key factor in maintaining a healthy, diverse, and balanced marine ecosystem around the Maltese islands.

Despite only some sharks being classed as top predators, all play a crucial role in maintaining a healthy marine ecosystem by feeding on a huge variety of marine species. Some target the injured and sick, in turn keeping their prey populations healthy. By targeting sharks, the balance is destroyed.

So what can we do to change things back to how they should be? In truth, this will be very difficult for a number of reasons. Sharks are cartilaginous fishes and differ greatly from bony fish since they are very slow to mature and only produce few offspring—on average, maturity can take between eight and 15 years. Overfishing has also contributed to the drop in numbers. Without food, no predatory animal is likely to re-establish itself in areas it once used to frequent.

To make a significant change, we must stop abusing the waters around our islands. Proper regulations and enforcement are essential, together with a long-term practical plan. Current safe areas need to be expanded and safeguarded to provide a real refuge where marine life can flourish.

Once upon a time sharks roamed freely: plentiful and uninhibited by the misunderstandings of the human animal. If we want a healthy, diverse, rich sea around our islands, we need to reduce exploitation and welcome them back.

Stuck in the middle with fumes

When it comes to emissions, ships are like floating power stations. So what damage can they do? ***Cassi Camilleri*** *talks to* ***Prof. Raymond Ellul and his team*** *at the Giordan lighthouse to obtain the answers.*

Since the 1960s heavy fuel oil (HFO) has reigned supreme as the king of maritime fuels. It was efficient and cheap; its use spread far and wide. International shipping boomed on its success. Even today, this industry handles 90% of the world's trade volume. For many, HFO is the lifeblood of the maritime shipping industry. But it has a dark side...

Its high sulphur content (3.5%) and damaging byproducts, including soot, aerosols, sulphur dioxide, nitrous oxides, and ozone makes HFO a carcinogenic nightmare. Emission expert James Corbett (University of Delaware) calculates that about 60,000 people worldwide die annually due to the toxic fumes emitted by ships. He also notes that the majority of those deaths come from the coastlines of Europe, East Asia, and South Asia.

Malta's political arena continues to light up with debate around cleaner energy. Following the last round of elections in 2013, the current government oversaw a shift in energy production, away from coal and oil. Now, with the Delimara power plant in action, the country largely runs on gas, but the HFO problem in shipping failed to even be mentioned.

When considering how the relatively narrow gap between Sicily and Gozo receives a quarter of all the world's ships passing through, and how the vast majority of them still use HFO, it would seem like a conversation worth having. A team of experts based in a scenic lighthouse in Gozo would certainly agree.

GETTING A READING

The Giordan Lighthouse (University of Malta - Gozo Campus) is one of the very few still functioning lighthouses in Malta. It is on all the tourist maps out there. But to atmospheric physicist Prof. Raymond Ellul and his team, it is much more than a tourist attraction.

Since the 90s, the lighthouse has played a crucial role in identifying the pollutants around the Maltese Islands. Before then, there was no knowledge or data collected on the subject. 'It was a black box,' says Ellul, 'so even the tiniest of steps was a leap.'

The outfit started with just three instruments, each of them focussed on different molecules; ozone, sulphur dioxide, and carbon monoxide.

Now, with the Delimara power plant in action, the country largely runs on gas, but the HFO problem in shipping failed to even be mentioned.

WRF

The Weather Research and Forecasting Model (WRF) is a numerical weather prediction system used for both forecasting and atmospheric research projects. A computer model simulates the atmosphere and predicts changes within it. The WRF works through two cores: a data assimilation system and software architecture that allows for parallel computation.

The WRF will allow Ellul and the team to run simulations based on observational data from the Giordan Lighthouse. WRF-Chem is a version of WRF that also simultaneously simulates the emission, turbulent mixing, transport, transformation, and fate of trace gases and aerosols.

One big tanker that passes by the Maltese Islands has an engine of about 80 megawatts. A Maltese power station outputs a maximum of 450 megawatts. So a tanker is a fifth of that. But we get 200 ships of that size passing by Malta like that going through every day.

Since then, vast upgrades have been made thanks to some well placed funds. Now their repertoire includes analysers for nitrous oxide and aerosols. Aiding the cause are Automatic Identification Systems (AIS) which are now a must on ships thanks to the International Maritime Organization (IMO). This device allows for position tracking and collision avoidance, but its data can also be used for research purposes. By combining it with STEAM, a complex mathematical model borrowed from Finland that assesses Ship Traffic Emissions, the team have now calculated the speed ships are travelling at, the amount of fuel they are using, and the volume of exhaust fumes they are emitting.

Assessing a 200km by 200km square around Malta, environmental Engineers Dr Ing. Francelle Azzopardi and doctoral student Martin Saliba explain how 1,774,448 ship data points, showing 84,500 ship movements, were detected in that box in 2015 alone.

To put things into perspective, Ellul provided a quick analogy: 'One big tanker that passes by has an engine of about 80 megawatts. A Maltese power station outputs a maximum of 450 megawatts. So a tanker is a fifth of that. But we get 200 ships of that size passing by Malta like that going through every day! It's like having a couple of hundred mini-power stations going past every day,' emitting sulphur dioxide and everything else a power station would emit. 'We've done away with the heavy fuel oil power station, but we still have the ships. We still have big problems,' he reiterates.

The reality is that kilotonnes of fumes are coming over Malta from ships going through the Mediterranean. According to the latest estimates from the group, the 200km square surrounding the country is suffering '50.9 kilotonnes of nitrous oxide, 30.3 kilotonnes of sulphur dioxide, three kilotonnes of carbon monoxide, along with a devastating 2080 kilotonnes of carbon dioxide,' says Saliba, also the Senior Technical Officer at Giordan.

> *We've done away with the heavy fuel oil power station, but we still have ships. We still have big problems.*

The solution? Declare the Mediterranean a Sulphur Emission Control Area (SECA).

FINDING ALTERNATIVES

Currently, ships and other marine vehicles are free to use whatever fuel they want in international waters; they're only required to switch to less harmful fuels when docking in particular European ports. This makes HFO the choice of most thanks to its low price point compared to distilled fuels.

'The only way to change this,' says Ellul, 'is for Mediterranean countries, including those in North Africa, to come together and declare the Mediterranean a SECA.'

SECAs are sea areas where stricter controls are established to lower the level of airborne emissions. Widespread concerns about air pollution have led to the successful adoption of SECA standards in a number of places, including the Baltic Sea and the North Sea. SECAs set the sulfur limit in fuel at 0.1%; normally it is a whopping 3.5%.

'The trouble is that maritime transport is big business, and many countries are making a lot of money out of it,' says Ellul, 'including Malta.' Our islands alone have four bunkering

areas where ships anchor to refuel and trade fuel. These areas are located just five kilometres from the Maltese coastline. Malta, much like Cyprus, also brings in hefty revenue from ship registration fees. This makes our own government hesitant to move on the issue. Having 23 countries agree to a solution will be a very big challenge.

Ellul believes that the move to restrict heavy fuel oil and sulphur emissions 'can only be achieved through Brussels.' 'This is an international situation. You have to have France, Italy, Malta, and all the states in the Eastern Mediterranean agreeing. Their ships would have to switch to either diesel oil, which is a lot cleaner because it doesn't have sulphur, or liquified natural gas (LNG) which can reduce carbon dioxide and nitrous oxide emissions by 25%, and completely eliminate SO_2.' The catch? 'It will cost them a lot more,' Ellul says. But if the Baltics can do it, why can't we?

THREE STEPS AHEAD

While the STEAM predictions may be as good as gold for some, the team has laid out an entire journey that will make the data bulletproof. Saliba says that the next step is to obtain the ship's tracks from STEAM and put them through another model called WRF-Chem to analyse the dispersion of ship's pollution across Malta. Saliba expects harbour and shore towns to be receiving the brunt of it, but in total Ellul estimates that we are 'benefitting' from about 20% to 30% of the fumes measured.

The results from WRF-Chem will then be compared to actual observations at the Giordan lighthouse. 'From a technical point of view, this will be absolute proof as to what is happening,' says Ellul.

Taking things a step further, the team will then work with medical experts to try to see if there is a link between the dispersion of exhaust emissions and locations and rates of disease and adverse health effects. The approach will help determine exactly how many people are suffering because of these toxic fumes.

'In terms of pollution, these ships are doing more damage than traffic. Traffic pollution doesn't contain these levels of sulphur,' Ellul says. And yet most are unaware of the danger. We might not be able to do anything about natural pollutants like Etna and dust events from Africa, but we can do something about the ships. T

From top to bottom: Prof. Raymond Ellul, Dr Ing. Francelle Azzopardi, Martin Saliba and Dr David Munao

IS-SERKIN

In Malta, diversity in language is both sought after and shunned. Some embrace change as creative and interesting, others admonish it as 'incorrect'. ***Dr Sarah Grech*** *dives into this paradox and wonders if a shift in perception can help see our languages flourish.*

They say variety is the spice of life. Cliche? Maybe. But also very true—especially when it comes to language. To understand this variation, linguists regularly adopt a nonjudgmental approach, leaving behind the idea of something being said or written incorrectly, focusing on finding out how it is actually used in the real world. This approach, defined as descriptivist, not only helps identify predictable patterns of language use in the unlikeliest of linguistic encounters, but also encourages an appreciation for the rich forms of self-expression present in individuals everywhere.

However, as a linguist working in Malta, I face a strange conundrum. On one hand, Malta's linguistic wealth is plainly evident in anything from the witty and totally irreverent Għana (Maltese folk music) that is still alive and well, to my young children's ability to recognise Maltese, English and Italian on their cereal boxes at breakfast. On the other hand, there is a palpable concern that some vital linguistic skills are being eroded, or lost completely, putting students and job-seekers at risk.

It would be easy to dismiss these concerns as idle complaints. Yet, it would be a cultural tragedy to enforce rigid rules and regulations that would stifle the ability to tell stories or sing songs in a mashup of languages. A new solution is needed.

Multilingualism has been a solid part of the local cultural heritage. As Joseph M. Brincat notes in his book *Maltese and Other Languages*, Maltese has co-existed with a succession of other languages for hundreds of years, the latest being English, the current trending global language. Given this background, one would think that Malta's exposure to so many different languages would make it open to variety. However, I often encounter resistance to the idea. This is followed by anxious concern or outright condemnation of perceived diversions from a norm.

A small consolation is that we are not alone in our concerns. The worry that standards in language are falling is such a familiar one that linguists Milroy and Milroy gave it a term of its own, the 'complaint tradition'. Local evidence of this can be found in the drawn-out threads of irate comments following local

media coverage of anything vaguely language-related connected with education or employment. Because of this, a linguist's attraction to diversity and variation in language must be tempered by an appreciation that some sectors of society benefit from a stricter approach. This is where sensitivity to context is applied when implementing rules. While a society benefits from being multilingual, it also benefits from the freedom to shape languages and create variants when needed.

In Malta, as elsewhere, students need good exam results to progress through the educational system and move on to a rewarding job. Brincat documents an increase in students taking English and Maltese language and literature exams. That increase is coupled to a steady trend of healthy grades in both Maltese and English.

Exams are the most popular form of assessment but are they the best measure of performance? Exams can only give a close-up snapshot of linguistic ability, which is why it is limiting to focus on them and strategies to pass them, at the expense of broader linguistic dexterity. The nurturing of linguistic ability must go beyond school walls, having widespread support from an entire society if it is to carry us through life.

Dr Sarah Grech

Maltese citizens tend to be quick to complain, but less forthcoming with concrete directions. For example,

The range of possible options is particularly true for English, which is now used in so many diverse ways that some linguists refer to it in the plural—'Englishes'.

what do we do with the sometimes alarmist views that poor writing skills are costing employees their jobs, when it is not clear what the parameters for good writing skills are in such contexts? Does good writing simply mean correct and clever sentence structures? Should we aim for elegance of expression and some smooth rhetoric? The range of possible options is particularly true for English, which is now used in so many diverse ways that some linguists refer to it in the plural—'Englishes'. Should we use British English, where Malta gets its English from in the first place? American English, perhaps the most prestigious, at the moment, at least among teenagers? How about Maltese English, oh wait, is that not just bad English?

As a linguist, I might suggest reserving judgment for a moment, until we can identify what works, what doesn't, and in which contexts. Sometimes a job might require linguistic acrobatics: a teacher might need to really inspire her students with some poetic language; a lawyer could really persuade a case with some well-chosen words. Equally, language sometimes just has to be good enough to get a message across clearly.

This is not to say that we simply need to understand each other, as that too, would be limiting. But diversities are key, and just as we are all bilingual to varying degrees, we are all sensitive to different social contexts which require a range of linguistic abilities. It is this linguistic dexterity which we want to nurture and the norms which need to be determined not just by teachers or by employers, but by an informed and sensitive society.

FURTHER READING

- Joseph M. Brincat (2011), Maltese and other languages: A linguistic History of Malta
- James Milroy and Lesley Milroy (1985), Authority in language: Investigating language prescription and standardisation. London: Routledge & Kegan Paul.

Cycling for Research

As the ALIVE Charity Foundation gets ready for the next edition of the RE/MAX ALIVE Cycling Challenge for Cancer, Chairperson ***Nicky Camilleri*** *tells us why, year after year, they continue donating funds towards cancer research.*
Words by ***Iggy Fenech*** *for RIDT.*

Every year for the past four years, dozens of cyclists have committed themselves to training for 16 weeks, cycling over 1,000km in just one, and raising a minimum of €2,400 which is donated to cancer research. These cyclists are leaving behind a legacy.

'This has always been a very personal matter to me,' says co-founder and chairperson of the ALIVE Charity Foundation, Nicky Camilleri. 'Nineteen years ago, I watched my mother succumb to cancer, and since then, I've lost many friends and relatives to the illness. It wasn't until some six years ago, while cycling with my friend Miriam, that I decided to do something meaningful with my life and give back to society at large.'

That was the moment the ALIVE Charity Foundation was born, and within a week Nicky and Miriam—who today still form part of the strong four-person committee—had already recruited three other cyclists. This number would grow to 35 by the time the first 'ALIVE Cycling Challenge for Cancer' took place, where the team cycled from London to Paris via Brussels.

Over the past four editions, the Foundation has donated over €300,000 to the University of Malta's Research, Innovation, and Development Trust (RIDT), money that has so far funded four Ph.D. students—two in breast cancer and two in brain tumours and leukemia. On top of this, ALIVE has also funded an indoor and outdoor play area at the Oncology Department within Mater Dei Hospital.

'While treatment and proper care are both important factors in the fight against cancer, it is through research that we can aim to advance our knowledge of the disease, which allows us to give better diagnoses and treatments,' Nicky adds. 'This investment is building research capacity through opportunities for young scientists to join the research community, and any advancements or breakthroughs that come from that could benefit anyone whose life is touched by cancer.'

In the coming weeks Nicky, on behalf of the ALIVE Charity Foundation and together with the University of Malta's Rector, will launch the Cancer Research Programme, which will be helping researchers to directly obtain funding towards cancer research.

With just a few weeks to go before this year's 50-strong team of cyclists take on the challenge of cycling from Copenhagen in Denmark to Warsaw in Poland, the Foundation has already raised a substantial sum through the cyclists and corporate sponsors. Moreover, ALIVE has also teamed up with Malta's first crowd-funding platform, ZAAR.com.mt, to raise at least another €100,000 for cancer research. At the time of writing, over €70,000 has already been raised.

As Nicky points out, the name of the charity outlines the inspiration behind its projects: 'Many of us take a lot of things for granted, and we don't take care of ourselves or our health. Yet, when we suffer from an illness, we all wish we would have done things differently. That's why the most important thing in life is to remember to live because only then are we truly alive!' T

For more information about the RE/MAX ALIVE2017 Cycling Challenge: www.alivecharity.com

YOU DON'T KNOW WHAT SOUP IS

Digital Game as Philosophical Artefact

A philosopher's job is to delve into life's big questions. But as the world and its technologies evolve, discussing ideas is no longer the only way to do this. ***Jasper Schellekens*** *interviews* ***Dr Stefano Gualeni****, who believes games can be used to question philosophies.*

In the early days, storytelling played a big part in philosophy. In the Allegory of the Cave, Plato exhibited the difference between the perception of reality and its true form with the use of fire and shadows.

Experiments followed. Wittgenstein's thought experiment—about a beetle in a box which no one can see but you—is meant to demonstrate that our use of language and its functionality is not affected by the fact that, ultimately, we do not know what is in one another's box.

Now, however, there is a new game in town.

Lecturer and game designer Dr Stefano Gualeni believes digital games can be used as instruments to craft and communicate philosophical ideas and frameworks. The medium allows players to actively negotiate the hypotheses presented to them in a virtual space. It also allows the game designer to experiment with fantastical situations and alternate rules of physics like teleportation. In addition, with the progressive diffusion of digital media—social media in particular—more philosophical questions are bound to arise with regard to our interaction with new technology, such as its use in constant commercial exploitation. Where a thought experiment relies on imagination, a digital game can impose the rules of a thought experiment more vividly.

THE GAME

Digital game *Something Something Soup Something* (funded by Maltco Lotteries and designed by Dr Gualeni) is a philosophical artefact, an interactive thought experiment questioning the unreliability and relativity of language and humans' methods of communication.

The reality is that, despite our best efforts for precision in communication, humans are still faced with ultimately indefinite, shifting concepts. Basically, the idea is that nobody really quite knows what 'soup' is and that trying to define it precisely might be an impossible task.

In the game, humanity has invented teleportation and immediately put it to work by outsourcing menial labour to aliens willing to work for lower wages. Your job, as the player, is to serve soup to the patrons of your restaurant. Seems simple, right? Wrong. As the manager, you must ensure that the aliens working for you have actually understood what they are supposed to produce. What you have decided to serve your patrons will determine your definition of 'soup', and you will soon realise that

PLATO'S ALLEGORY OF THE CAVE

In The Republic written ca. 380 BCE, Plato uses the allegory of the cave to describe the effect of education on our perception. The shadows seen on the cave wall are the prisoners' reality, however, a change of perception, through education, would allow the prisoners to perceive the true form of reality: the object actually casting the manufactured reality of the shadows seen by the prisoners.

the concept of 'soup' is shifting, influenced by culture and personal experiences.

What you have chosen to serve as 'soup' is different from what other players have chosen to serve. So why does your choice differ from the others' if we all know what soup is? Your understanding of soup diverges from theirs, despite using the same language and the same word.

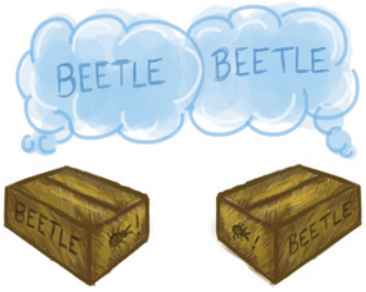
An important core of the game is that it is based on research into what people from varying backgrounds perceive as soup. Soup has many facets: sometimes 'soup' is hot, sometimes cold, sometimes sweet, sometimes savory. To illustrate with a somewhat extreme example, coffee shares many characteristics with 'soup' as it is hot, liquid, and occasionally served in a cup, but it is not really 'soup', is it?

BEYOND THE GAMEPLAY

On top of being a philosophical game about definitions, or lack thereof, *Something Something Soup Something* also highlights the relationship people have with technology. In a way, it adds a different dimension of philosophical questioning by having the player interact with the results of the continuous dispersal of technology and the philosophical questions that technology raises—in this case, the ethics and morality of humanity having invented a miraculous teleporter and immediately setting it to use in exploiting aliens as cheap labour.

By playing the game, the player is effectively co-authoring the game's philosophical concepts.

The video game draws the player into the argument to question their understanding of soup but then leads them to something more. Even the most avid soup fan may question whether it is worth creating an entire game to dispute our understanding



WITTGENSTEIN'S BEETLE

In his 1953 book *Philosophical Investigations*, Wittgenstein uses a thought experiment to clarify the concept of subjective experience, such as the concept of pain. It proposes that you imagine everyone has something called a 'beetle' in a box. People can only see inside their own box and can never see what is in anyone else's. Despite this limitation, people can still have meaningful discussions about 'beetles' despite never actually knowing what is in others' boxes

By playing the game, the player is effectively co-authoring the game's philosophical concepts.

***Something Something Soup Something* screenshot**

of soup, but the underlying truth is much deeper than that. Most people believe that we live in a world where everyone understands what words mean. But that assumption seems to be very flawed from the outset. So if we actually misunderstand each other on such simple concepts as 'soup', imagine how badly we misunderstand each other on more complex matters like democracy, freedom, or justice. The implications are very real and very telling.

Now, given that *Something Something Soup Something* has many game-like elements, the defining question still remains: is it really a game?

***Virtual Worlds as Philosophical Tools* is a published academic book on the use of digital games as instruments for philosophical examination written by Dr Gualeni. It tackles questions such as: who are we in simulated worlds? Will experiencing worlds that are not 'actual' change our ways of structuring thought? Can virtual worlds open up new possibilities to philosophise? Play the game at http://soup.gua-le-ni.com**

Isabelle Kniestedt and Johnathan Harrington

MEET THE STUDENTS

The game was designed by Dr Gualeni with the involvement of the Institute of Digital Games, which was featured among the Princeton Review's top 25 graduate schools for game design, and two of its students.

Johnathan Harrington is a Masters student whose thesis deals with applying prototype theory on digital games. Prototype theory is a method of graded categorisation in cognitive science where some of the categories are more important than others. For example, how people use the word soup instead of more specific recipes like minestrone or chicken soup. Johnathan was responsible for the research behind the concept of soup which was critical to its validity as a philosophical artefact, hence the game. As Johnathan put it, 'If we are arguing that the concept of soup is fuzzy, we have to be very careful that we're not subjecting the user to our idea of soup, but rather to a more culturally bound idea of soup'. It is often tempting to stray from the data to make more interesting game design, so he ensured the fidelity of the game design to the data by running focus groups asking people what soup is and using this data in the game.

Isabelle Kniestedt is the game artist and programmer. Using the game's narrative elements, she wanted to give the impression of a disused and repurposed kitchen. The teleporter had, after all, made the kitchen obsolete, as the actual preparation had been outsourced to aliens. The game interface is relatively simple and her main challenge was making sure it ran smoothly on the web. This meant compromising on detail. Isabelle explained, 'By working with lighting and using textures with a 'painterly' feel to them we can make the room look convincing in a sort of 'stylised' realism, without having to show a lot of detail'. In terms of programming, Isabelle made a sketch of the underlying system and the various components such as: the creation of noise on a line, the ability for the player to move a cursor up and down, and finally the recombination of various parts to create one model representing a soup that is delivered into the teleporter.

THROUGH THE VR GLASS

As societies evolve and take in a greater number of distinct cultures, histories, and traditions, the ability to empathise with each other becomes vital, for all our sakes. In an effort to get as close as possible to seeing life through another's eyes, researchers from the University of Malta are creating a virtual reality experience that allows users to step into someone else's shoes.

Words by ***Dr Vanessa Camilleri****.*

From a young age we are often taught that if we want to understand someone else's perspective, we must first *walk a mile in their shoes*. This ability to place ourselves in another's position is what we call empathy. This component of emotional intelligence is known to increase prosocial behaviour and reduce individualistic traits, meaning that it can lead to a better quality of life where practiced, whether at home, in the workplace, or any other environment.

Empathy is particularly important in the classroom, where comfort and a sense of belonging can improve the engagement and learning prospects of children from different backgrounds. To promote the inclusion of migrant children, teachers and pupils need to understand how different growing up from another cultural perspective can be. This made us question—is there a technology that can be exploited to elicit empathy by allowing users to walk in other people's shoes, albeit temporarily?

As it turns out, there is. Virtual reality.

GOING DOWN THE RABBIT HOLE

At the University of Malta, our inter-faculty initiative between the Department of Artificial Intelligence at Faculty of ICT and the Department of Digital Arts at the Faculty of Media and Knowledge Sciences is now developing a VR experience to understand how migrant children perceive daily life at school. The project, titled '*If you aren't experiencing it, you're not understanding it!*', places the participating teachers in the virtual point-of-view of children coming from migrant backgrounds. We use seamless implementation of footage and sound in VR technology together with a strong narrative to create an immersive experience. We think of immersion as the degree to which a VR system projects sensory stimuli in users, that are matching, vivid, and interactive.

The collaboration was born from the realisation that creating a VR experience requires various expertise including story writing, narrative building, audiovisual techniques, and photography, as well as technical development of the actual VR app. The group was comprised of four research students under the supervision of four academics, sharing knowledge and resources.

HOW DOES IT WORK?

This technology will see teachers transported into a virtual world by wearing a visual display headset supported by a surround-sound system that provides three-dimensional audio stimulation. The ability to experience their surroundings through multiple senses will provide context to the occurrence, whilst interactions with virtual people will create a sense of presence built around the illusions of space, self-embodiment, and physical interaction.

The experiences that are triggered and then projected depend on the context of the scenario in which the virtual child finds themselves. What the participant sees and hears in the 360-degree

The ability to experience their surroundings through multiple senses will provide context to the occurrence, whilst interactions with virtual people will create a sense of presence built around the illusions of space, self-embodiment, project such as this one and physical interaction.

immersive experience is taken from the perspective of a child negotiating daily school encounters, whilst also carrying mental and emotional baggage due to experiences arising from family interactions and narratives. These narratives are shown as a series of flashbacks triggered by what we may consider to be trivial actions or behaviours, but which may carry deeper meaning to those coming from different cultural backgrounds.

A LONG JOURNEY

Developing a project such as this one doesn't come without hurdles. Our researchers not only had to deal with the technical development aspect of a VR experience, but with integrating audio in a way that augments the visual experiences being projected. When choosing equipment, both budget limitations and technological capabilities were taken into account. The equipment needed to be unobtrusive, yet powerful enough to capture high-quality footage and pristine three-dimensional sound: both paramount for the success of this project. We ultimately decided on a Samsung Gear 360 camera, a binaural mic, Samsung Gear VR headset, and Samsung Phones. Filming in 3D involves novel challenges, from the way the camera has to project motion without enhancing the motion sickness of first-time VR users, to the filming techniques used for a 360-degree projection on a small VR screen.

Responses included participants falling on the floor, jumping in water, giggling and touching empty air, as they reached out to the children they were seeing in the virtual world.

Once the footage was collected, the Unity game engine was used to develop the software required to digitally represent the teaching environment. However, recreating life experiences as though they were a reflection of the user's perceived reality and achieving a sense of presence inside the virtual reality means VR must go beyond mere technology-induced immersion. To do this, we began by identifying scenes that would provide insight into the life experiences of migrant children. The script was written to support the narrative, which needed to unfold in a way that would ensure a seamless experience for the teacher immersed within it. Actors were recruited, and a school granted help, support, and the use of its premises for filming of the classroom scenes. We couldn't have done this without the assistance of the Lija-Balzan-Iklin Primary School, St Theresa's College.

Involving children and children's perspectives meant that ethics was one of the major challenges involved in the project. To solve this problem, we chose to collect data from third-country national adults who volunteered to share some of their life perspective and may have had experience in Maltese schools. We decided on this option for data collection as we believe that children may not yet have the necessary insights to communicate their feelings and emotions in a way that can be accurately represented in the VR experience. Communication was essential, and for this project we enlisted the support and help of the Foundation for Shelter and Support to Migrants to assist in interviewing and data collection.

WHAT NOW?

This experience, currently in its beta phase, has been tested with around 300 people from all walks of life and ages ranging from six and 60. Among the initial test volunteers were those coming from migrant backgrounds. The experience was well received by all who tried it, and their varying reactions were enlightening.

During the stormy scene, where the users on top of a rough sea were surrounded by thunder and lightning, several of the younger individuals tried to jump into the water. A Czech woman let out a tiny scream as the floor gave way to ocean, and her hands floundered in the attempt to get her bearings in this new virtual world. In a VR classroom scene, users were giggling and touching empty air as they tried to touch the digital schoolchildren. Some individuals did not immediately realise the scale of the simulation. As it dawned on them that they could look all around as in real life, they began spinning to see behind them, and then in a full circle. Initial reactions such as uneasy excitement are all very normal responses to a first venture into a virtual world, though it is surprising how many returning users tend to be carried away by virtual reality. This suggests that the narrative element of this VR technology would be strong and immersive.

Our next step is to investigate the effects that such experiences have on participants' real world behaviour. Do they become more empathic? In this phase, we plan to evaluate the human-computer interaction strengths and identify weaknesses when working with the teacher target group. This will be done by expanding our inter-faculty collaboration to include the Department for Inclusion and Access to Learning at the Faculty of Education.

Once proven effective, investment, research, and development of this technology could see it put to service in evoking empathy in many different social situations, from schools to the workplace and beyond. Furthermore, its power need not be limited to one particular society, culture or target group. VR could be the key to addressing multiculturalism's issues of assimilation and integration, promoting understanding and acceptance between different groups of people, and ultimately maintaining civility and cohesion throughout society.

The Foundation for Shelter and Support to Migrants strives for the integration of migrants through support services, education, research, capacity building, and advocacy.
http://fsmmalta.org , 2017

DESIGNING THE FACTORY OF THE FUTURE

With consumer demand reaching new highs, automation in industry is essential. ***Dr Ing. Emmanuel Francalanza*** *writes about his contribution to streamlining the complex factory design process for contemporary engineers.*

From smartphones, to smartwatches, smart cars to smart houses, intelligent technology is inescapable. Busier people have made efficiency a valuable currency and thus the 'Internet of Things' (IoT), and its plethora of connected devices, has become a necessary part of everyday life. The application of this model goes way beyond the regular consumer, however. To keep up with demand and the public's seemingly insatiable thirst for new and more varied products, factories are being upgraded too. Thus, we now have the 'Industrial Internet of Things' (IIoT). The 'things' being controlled on the factory floor are the machines, robots and systems carrying out a variety of manufacturing processes that transform raw materials into the products sent out to market. Due to their impact on operations, these technologies have brought about the 4th Industrial Revolution—Industry 4.0.

OLD NEWS

The idea of highly automated factories may come across as very contemporary: however, the reality is that they have existed for decades. This transition began towards the late 80s early 90s with the development of computer integrated manufacturing (CIM). The CIM approach advocated the design and development of manufacturing systems and underlying control systems to integrate different machines and have them work together. Companies such as Lego made use of these technologies to continue producing in countries such as Norway where human labour wages are extremely high.

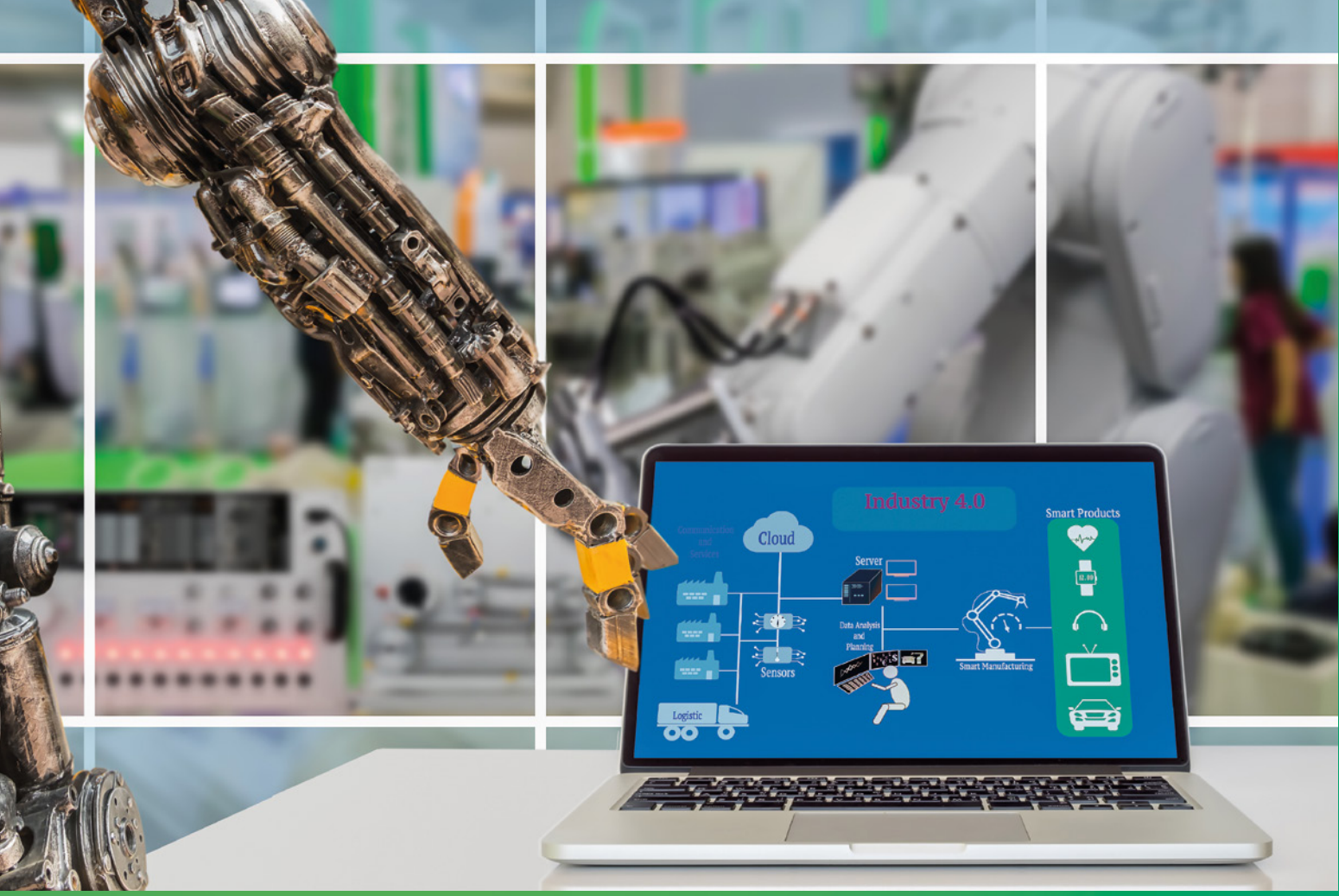
In recent years affordable IIoT technologies have seen the

development of new business models that allow companies to sustainably implement fully automated systems. But the task is easier said than done. In designing factories which implement Industry 4.0 technologies, engineers must take into consideration a vast array of moving parts: interaction between machines, interaction between machines and human operators, changing business strategies. Big data has also changed the game, forcing engineers to wrap their heads around massive quantities of information. Long story short, the engineer needs to be a robot themselves to complete the task of designing a modern factory.

APPROACHING SOLUTIONS

To address these challenges, I (Dr Ing Emmanuel Francalanza, Department of Industrial and Manufacturing Engineering at the University of Malta) proposed, implemented, and evaluated an artificial intelligence (AI) based digital factory design tool, nicknamed 'FactDES'. This initiative supports the implementation of smart factories through the use of virtual environments and representations that supplement the real manufacturing activities across the factory life cycle.

There are two different approaches to providing such AI support: artificially replicating human cognition in AI to automate the design tasks, and developing intelligent design assistants. Given the problems with replication and the difficulties that arise from making decisions based on uncertain data or information, researchers wisely opted for the concept of an intelligent assistant. Intelligent design assistants can learn from past design experiences and carry out semi-automated tasks.



The intelligent design assistant provides explanations for its reasoning and acts as a colleague to the engineer designing the factory. The working philosophy is therefore to complement the engineer's own natural skills rather than replace them. Whilst providing the required support, the intelligent design assistant leaves the engineer with the final decision making, control, and responsibility, allowing humans to utilise their innate ingenuity to solve the ultimate problems.

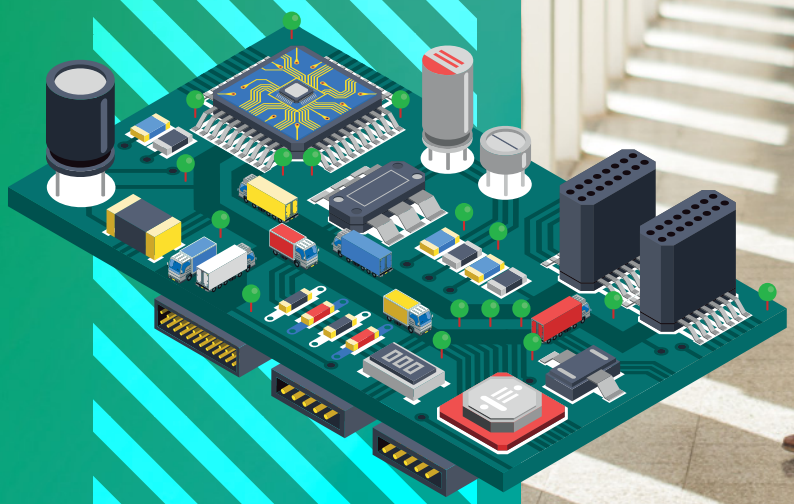
NOT PLAIN SAILING

While the concept of an intelligent assistant was the solution to one problem, actualising that solution posed its own set of issues. Developing the Human-System Interface (HS-I) for the intelligent assistant proved to be among the biggest challenges.

Engineers cannot continuously be presented with large amounts of information to process. Only information which is of high relevance to the task and decisions being made needs to be presented to the stakeholders, otherwise there is the risk of information overload. To avoid this, an MIT-developed approach called 'Just In Time Information Retrieval' (JITIR) was implemented. The JITIR approach filters information, recommending what is needed at the right time to proceed with the design in a non-intrusive manner. From the results of the evaluation, this approach was greatly appreciated by the stakeholders who assessed this tool.

The encouraging results obtained from this research evaluation have shown that the digital factory tool, and the design approach framework on which it is based, meet their goals and are useful in practice. This result can lead the way for the development and integration of such knowledge-based decision-making approaches within state-of-the-art digital factory tools.

However, implementing these new Industry 4.0 models will influence society, and that too needs to be taken into account. As has been recently discussed at the World Economic Forum (WEF) in Davos, unemployment may increase, whilst wages for low skilled workers and their rights will be attacked. In February 2017 renowned inventor and entrepreneur Elon Musk also sounded a 'warning' about the future of manufacturing operations and hinted towards the introduction of a universal basic income as a result of automation in manufacturing. Elon Musk is very familiar with the implications of such intelligent factories since Tesla's very own Gigafactory, currently under construction in Nevada, US, employs such technologies. Likewise, Bill Gates



Dr Ing. Emmanuel Francalanza. *Photo by Jean Claude Vancell*

Whilst providing the required support, the intelligent design assistant leaves the engineer with the final decision making, control, and responsibility, allowing humans to utilise their innate ingenuity to solve the ultimate problems.

has also recently suggested that governments should tax companies' use of robots who are taking human jobs, as a way to at least temporarily slow the spread of automation and to fund other types of employment. Industry 4.0 brings new meanings for the concepts of manufacturing work, availability, and flexibility. The question many are asking is: will this revolution lead to intelligent systems and robots taking over all manufacturing activities? The implications will be vast and people need to be protected. At all costs, we need to avoid the dire scenarios propagated by pop culture, but it would be cool to have our own Sonny leading a factory. T

START-UP

Thinking in 3D

In 2013 two diving buddies attempted to build a watch. Less than five years later, they have created and commercialised a solution to a fundamental problem with a budding and disruptive technology. Here is the story of Thought3D, from diving deep to making waves.
Words by ***Sam Stanfield****.*

Humans have been granted the power to take an abstract thought and transform it into a physical object in mere minutes. Not by magic, but by 3D printing technology.

Layer by layer, computer controlled printers can now create complex items of almost any shape, including moving parts. As the process becomes simpler and more easily accessible, invention, customisation, repair, and replacement have the potential to drastically change consumer culture. Advanced equipment and printing materials will see breakthroughs in medical treatments and humanitarian projects. 3D printing is allowing innovation on all frontiers.

In Malta, one name is making its way to the forefront of this young and growing industry. Attempting to solve problems creators were facing, Edward Borg and Dr Keith M. Azzopardi took their 'if you can think it, you can develop it in three dimensions' attitude and started their company, Thought3D.

The University of Malta (UoM) brought Borg and Azzopardi together in 2009, reading for degrees in electronic engineering and metamaterials respectively. Hangouts and parties ensued, but a true friendship solidified when the pair signed up to a scuba diving course.

Mutual interests in inventing, building, and testing saw them sharing all sorts of ideas. But it was in places like Ċirkewwa, while submerged beneath the waves, that the dangers inherent in diving truly established a solid sense of cooperation, reliance, and trust between the two—vital for starting a business. With that, they were ready to take the next step and get one of their many ideas off the ground.

SAFETY FIRST

In the summer of 2013, the ambitious pair picked what appeared to be the obvious choice. 'We both like diving, we both know the risks involved, let's develop a watch which also acts as a safety device,' they proposed. Before they had even acquired any funding, they began developing a prototype. As such, all they had to work with were hand tools such as drill presses and grinders. Unwilling to be defeated, they explored other manufacturing machinery, which led them to 3D printing, which changed their lives.

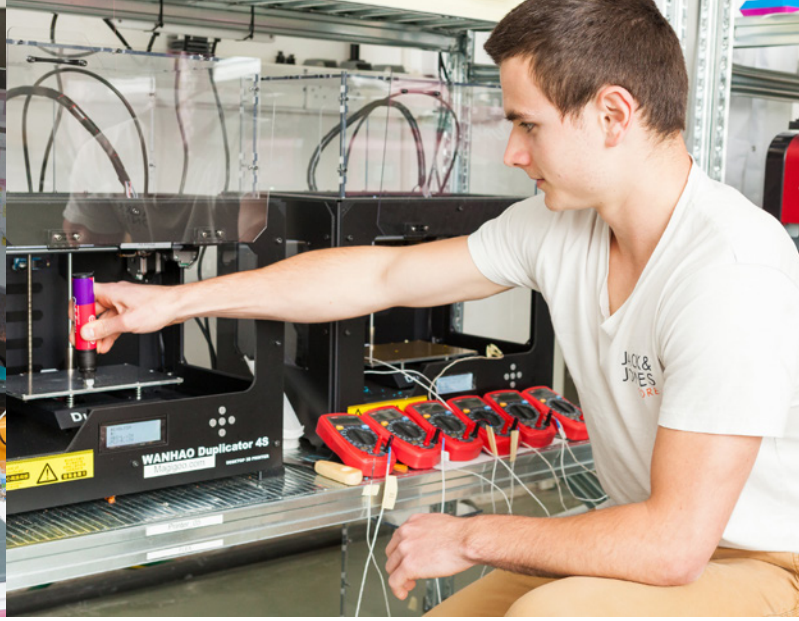
'We both like diving, we both know the risks involved, let's develop a watch which also acts as a safety device' they proposed.

3D printing is a technology ideal for prototyping thanks to its speed, relative simplicity, and inexpensiveness. Azzopardi already had some familiarity with the technique because it was used in the Metamaterials lab (Faculty of Science) during his time at the UoM. To cut costs, they decided to build their own printers.

At the time, 3D printing for the public was in its early days and, as with most nascent technologies, quite expensive. For example, fused deposition modelling, the most common technique amongst beginners, involves pulling a plastic filament into the machine, melting it, and then depositing the viscous liquid onto the build plate to harden. The cost of these raw filaments used to be approximately €40 per kilo, making quite a dent in the builder's budget, especially if the print were to fail. Azzopardi and Borg realised that they could reduce the amount spent on materials by an order of magnitude, using raw pellets rather than filament. To do this, they engineered their own version of a printing part called an extruder that would fit on a desk and allow these pellets to be melted and pushed through the printing nozzle using a simple drill screw.

While this invention's build costs turned out to be too high to justify sales, the innovative project impressed Ben McClure and Prof. Saviour Zammit at the UoM's business incubator, TAKEOFF. The team was accepted into the incubation program. With this success under their belts, they now had a space to work in.

Edward Borg and Dr Keith M. Azzopardi



Andrei 'Andy' Linnas and Hugo Pinson

Realising that they wanted to help inventors and businesses by offering 3D printing services, they bought two new printers. As their proficiencies grew, they designed and printed a quadrocopter that could be disassembled and used as a platform to teach programming, coding, and electronics to the younger generation. This little project turned into the ideal submission when an opportunity arose. The Malta Communications Authority (MCA) had partnered with TAKEOFF, offering support to local start-ups in the development of innovative business ideas. Now having registered their company as Thought3D, it was time for their first official pitch.

A JAR OF GOO

Mentored by Andrei 'Andy' Linnas, then a manager at TAKEOFF, they got through to the finals of the MCA/TAKEOFF competition, but fell short of winning the funding. Despite the setback, the team had learnt a lot. They realised that they had too many ideas on the go at once. They needed to focus, or drown in their ambition. With their small team, they needed to dedicate their time, energy, and resources wisely. But with so many ideas, what should they concentrate on? A timely visit helped answer this question.

The Knowledge Transfer Office (KTO) received a phone call from the Dutch embassy. Saswitha de Kok, a representative of 3D printer manufacturer Leapfrog, wanted to visit the UoM and meet anyone making advances in their industry. Cue Thought3D. Borg and Azzopardi showed her round their lab, exhibiting a selection of their best work: the extruder, printer prototype, and quadrocopter. However, when they mentioned an innocuous Nutella jar full of goo, her interest piqued.

Having started offering 3D printing services to clients, the duo soon got stuck on a common problem. As the printer works, its unfixed product tends to migrate across the surface, or peel up from it, wasting a lot of plastic in the process. At first, they were babysitting the machine for the duration of the print, but this 'solution' was impossible to sustain. They turned to other available adhesives, to no avail. Sprays stuck in printer parts, tapes proved tricky to apply and troublesome to remove. Other options either wore away too quickly or were not safe to work with. The team had to overcome this issue, or stop providing services outright.

They needed to focus, or drown in their ambition.

After many rounds of testing and trials, they developed an answer to their problem—a special adhesive. This wonder glue could be applied to the print surface to help the object stick when the surface is hot, and be released after it cools down. This was the substance kept in that chocolate spread container and they named it Magigoo.

TO EUROPE AND BEYOND

Magigoo became their focus. They were determined to plunge into production, and quickly. In April 2015 Borg and Azzopardi were able to apply for the TAKEOFF Seed Funding Award (TOSFA), and employing their previous pitching skills, they won! With the €15.5k, they focused on three aspects: setting up their minimum viable manufacturing, optimising their branding and packaging, and launching their first product. Their intention of launching at the TCT 3D printing show in the United Kingdom at the beginning of October meant that they only had one month to complete all those tasks. They had to work hard and smart. Rather than outsourcing production or buying off

the shelf, they bought second hand equipment at a fraction of the cost, then repurposed it to fit the new production processes necessary for large batches. Even when EU standards almost prevented them from shipping Magigoo to most of Europe, the team rallied and redesigned the formulation. Thought3D took all this in stride.

By the time the TCT show arrived, Thought3D were ready. Knowing that their start-up stand would be very small, they were ready to employ intelligent tactics to maximise interactions. 'Before the show we emailed other companies telling them we were going to be there and that we'd like to meet them. We told them about our product and that we'd like to exchange samples,' explains Borg, 'We also visited literally each and every other stand,' he continues. Networking in the industry was key to being nominated for the Best Emerging Company award. 'We also shifted our distribution strategy thanks to that show,' remembers Borg. 'We realised there was more pull from manufacturers and resellers, rather than directly from home customers. For us, it made sense, since through sellers we would increase the volumes we sell.'

Success in 2015 didn't stop at the TCT show. Thought3D went on to acquire further seed funding from Malta Enterprise called Business Start. They also reeled in numerous awards: the Malta Innovation Award for Best Technological Innovation, a WIPO Intellectual Property Enterprise Trophy, and were finalists of the MCA's Best Tech Start-up Award.

The cherry on the cake came in the form of a new addition to the team. Linnas decided to change from mentor to team member, so in 2016 Linnas joined Thought3D. His experienced input also saw them working with new partners; Ganado Advocates assisted them with the legal legwork, while BRNDWGN helped them create a strong visual identity and a responsive website.

The future was bright for this not-so-little start up.

FROM STARTING UP TO SPREADING OUT

At the beginning of 2017 Thought3D graduated from the TAKEOFF business incubator, moving their offices out of UoM and into the Kordin Business Incubation Centre. They are now closing their first seed fund. They are continuing to establish their brand and make the industry aware of them and what they represent. 'Regarding distribution' says Linnas, 'we are already present in almost all EU countries and in 3D printing related online shops. We're also selling Magigoo from our web shop directly to customers, or to countries that are not yet represented. We can do that because we have no restrictions for transportation of this product. You can even take it onto an aeroplane, no problem!'

Continuing to broaden their horizons, the guys have struck a deal with Amazon US, who will be importing Magigoo directly from Malta. They are now aiming to create a product line by varying the adhesive's formulations to provide the best performance according to the 3D printing material.

In the years since they met, the communication and problem-solving skills that kept these diving buddies safe under the sea have also allowed them to ascend from bromantic beginnings to running an internationally recognised business. They began their entrepreneurial journey wet behind the ears, but by sticking with it and going with the flow, they kept their heads above water. T

Etienne Camilleri showing off a 3D printed guitar

LAB TO LIFE

CATAMARANS GO SOLAR

Despite their many drawbacks, fossil fuels maintain a toxic hold as the world's primary energy source. To release ourselves, we need innovative approaches to sourcing and managing energy. At the University of Malta, researchers have designed a solar powered catamaran that uses smart-charging and battery management to efficiently utilise renewable energy. The project aims to serve as inspiration to usher in a future of environmentally friendly vehicles.
Words by ***Diane Cassar.***

Our globalised economies demand distribution. Commodities and cargo can be flown and driven, but it is shipping that carries 90% of international trade. This worldwide transport network runs on fossil fuels—frightening volumes of it. Effectively, fossil fuels make contemporary economic growth and development possible. But with fuel prices fluctuating viciously and environmental impacts sending shivers down spines, the issues cannot be ignored forever.

The transport sector accounts for nearly one-quarter of global energy-related carbon dioxide emissions. In turn, maritime transport is responsible for about 2.5% of global emissions and is expected to increase by 50% to 250% by 2050, a worrying thought when considering its dependence on oil and internal combustion engines. The problems associated with these are common knowledge but no less devastating to the marine environment. Unpleasant noises and smells have a negative impact on both wildlife and the experience of those on the boats, particularly in the tourism sector, and the high fuel consumption and operational cost can make journeys financially unfeasible.

To mitigate these major worldwide concerns, researchers are developing alternative energy sources, such as solar, wind, and hydro energy. However, while the concept of using renewable energy and electric methods of propulsion on land has been progressing quite rapidly over the past decade, the adoption of these technologies for marine applications is proving much slower for various reasons. One particularly salient aspect of this task is energy storage: a valuable asset for vehicles travelling over long distances and far from established sources of fuel.

A team of engineers (from the Department for Industrial Electric Power Conversion, Faculty of Engineering, University of Malta) has been studying the exploitation of renewable energy and energy storage for small vessels on short trips. The result is a cutting-edge electric catamaran powered by battery energy storage in conjunction with photovoltaic (PV) panels and fuel cell technology.

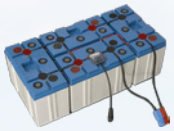
This custom-made catamaran needs to be environmentally friendly and provide performance comparable to an equivalent fuel-powered vessel. The five metre prototype is capable of carrying seven passengers and has successfully tested through a number of sea trials. The final trials are planned for the coming months.

Malta is bestowed with the EU's highest intensity of solar radiation—perfect for photovoltaic panels.

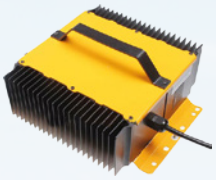
SOLAR CHARGING

GRID INVERTER

CONTROL PANEL & AUTOPILOT



BATTERY BANKS



GRID CHARGING

FUEL CELL

ELECTRIC OUTBOARD MOTOR

Malta is bestowed with the EU's highest intensity of solar radiation—perfect for PV panels. The high amount of electricity that PV panels in Malta can generate makes solar ideal for the islands to achieve carbon-neutral transport. PV systems comprised of flexible panels have been integrated in the solar catamaran's roof and are used to charge the on-board battery. Secondary power is provided by a fuel cell which runs on methanol. The electric motor that operates the catamaran has a number of environmental advantages when compared to an internal combustion engine. It is proven to leave

An online battery management system is used to optimise the performance of the energy generation, storage and propulsion system of the catamaran, ensuring reliability.

a much smaller carbon footprint than a fossil fuel engine. It does not pollute the water either, since it doesn't emit any exhaust gases nor release any oil or unburned fuel into the water that harms the sea. Moreover, electric motors do not produce any unpleasant smells during operation and are much quieter than comparable combustion engines. A solar-powered catamaran is ideal for port areas, leading to cleaner air and less noise pollution

Electric sea transport has several environmental benefits and lower running costs. Yet, its uptake is hindered by the scarcity of commercially available solutions. Existing options lack adaptability to meet the requirements of catamaran owners ,and they incur high investment and maintenance costs in order to ensure reliable performance and a reasonable battery lifetime. The solar catamaran wants to solve these problems and develop a cost-effective solution for the conversion of fuel to electric-powered vessels that can be replicated on a local level. An online battery management system is used to optimise the performance of the energy generation, storage, and propulsion system of the catamaran, ensuring reliability. This remote monitoring and control over the vessel's batteries helps to keep their charge within a safe and useful window of operation and increase the batteries' lifetime, thus reducing maintenance costs. The system also allows for the application of smart charging, through which the user can charge different onboard technologies before the vessel embarks on planned trips, and can also sell electricity to the grid while the vessel is berthed and not in use. This feature makes the boat more cost-effective.

Turning the solar catamaran into a viable product for the market can have a huge impact on Malta and beyond. It will help develop green transport, reduce the carbon footprint, and perhaps create a new market for Malta to offer worldwide.

The solar catamaran prototype can serve as a showcase and inspiration for electric-powered transport in our harbours, proving that it's possible to design and execute a cost-effective system which is both environmentally friendly and reliable. The project can be replicated through the conversion from fuel engines to electric motors for small vessels operating in the Grand Harbour area, as well as for short trips to Blue Grotto and the island of Comino, and for round trips around Malta. This can be very beneficial for the tourism industry, making these trips more attractive by eliminating exhaust gases and significantly reducing noise. The serene atmosphere we would all love to have on our sea is not a reality yet. But it could be...

Audience matters

Valletta 2018 in collaboration with Arts Council Malta

Knowing who your customers are is a fundamental part of starting and operating any kind of business. After all, if you don't know who you're targeting and what their needs and interests are, how can you know how best to serve and engage with them?

The concept is logical—and yet most cultural operators in Malta would agree that their artistic programming is often carried out with a restricted view of their audiences. While arts organisations often recognise the need to grow and develop audiences, approaches that place these same audiences at the centre of their thinking are not always present. This results in decision-making based solely on 'gut feeling' assumptions and possibly haphazard investment, with the producers and commissioners behind each artistic endeavour often unable to predict potential success. More importantly, this could limit the ability to assess risk and determine financial feasibility.

The latter is in fact one of the most troubling aspects of arts programming. While government grants can go some way towards helping the realisation of artistic projects, they are meant to be a stepping stone to private investment. But the lack of data on the scene and its audience means cultural operators will inevitably have to shoulder all the risk. Understandably reluctant to step into this scenario, potential investors back out. Artists are left stranded. The creative economy suffers.

Arts Council Malta and the National Statistics Office in collaboration with the Valletta 2018 Foundation have carried out the third edition of the Culture Participation Survey. A primary aim was to obtain a better picture of cultural life in Malta and how it is consumed. Using data collected in November 2016, the survey takes a value-based approach to cultural participation, leading to response data that can be used to segment audiences by attitudes and preferences, and categorise them into distinct demographic and psychographic profiles. This edition of the survey is also particularly notable for the emphasis it places on digital cultural engagement, which featured far less prominently in the 2011 edition. The survey findings will be published in June.

'For Arts Council Malta, the survey is a tool for policy-making, to understand how people engage in cultural activities and obtain insight into what motivates and hinders such engagement, enabling us to tailor policy initiatives that widen access to the arts,' says Adrian Debattista, Research Associate at Arts Council Malta. 'It can also be used as a shared knowledge base for artistic programmers and artists themselves to inform their audience development strategies, for academics and researchers who want data to refer to, and for people involved in arts marketing and fundraising who can, for instance, present potential sponsors with concrete figures in terms of the target audience, increasing the likelihood of a successful sponsorship.'

Artists and audiences alike will benefit from such a vivid and detailed picture of the Maltese public's tastes, interests, and methods of cultural consumption. Such an aggregated view of cultural participation means operators will be less solely dependent on their subjective perception of their audiences—and more aware of how the audiences perceive them in return.

Artists and audiences alike will benefit from such a vivid and detailed picture of the Maltese public's tastes, interests and methods of cultural consumption.

The Culture Participation Survey seminar will be held on 21 June 2017 at the Valletta Campus Theatre, Valletta. Registrations are currently open by sending an email on fundinfo@artscouncilmalta.org. The publications will also be available for free download from www.artscouncilmalta.org after the seminar. The Culture Participation Survey forms part of Arts Council Malta's Create2020 Research programme and the ongoing Valletta 2018 Evaluation & Monitoring research into the impacts of the European Capital of Culture title. The Culture Participation Survey expands on the annual Valletta Participation Survey, which investigates cultural participation in activities in Valletta.

Art initiates life

*While **Lisa Gwen Baldacchino** never specifically aspired to any of her roles at Malta's Creative Europe Desk and beyond, she has always known her heart belongs in the creative sector. She speaks to **Veronica Stivala** about how it all started with panto, Seurat, and* Cats: The Musical.

A light oak front door is framed by the bright hues of a magenta bougainvillea. An ageing iron door, painted white, is adorned with art deco glass patterns. A pale turquoise front door sits poised between two symmetrical windows, an imposing white balcony perched above. These are just some of the beautiful photos that form part of the collection of MaltaDoors, a whimsical social media project started by Lisa Gwen Baldacchino, but which has gained quite a steady following.

It comes as no surprise that she works in the arts. Her studies and career path have always followed this cultural line. To speak to Lisa is to speak to someone who not only loves the arts, specifically visual art, but to an individual who works tirelessly to see the discipline given due prominence in Malta. Appropriately then, Lisa is currently Head of the Creative Europe Desk in Malta, hosted within the Culture Directorate. Creative Europe is an EU programme which supports European cinema and the cultural and creative sectors through funding opportunities and organises events to bring the works to the public and give them due exposure.

One part of Lisa's multi-faceted role sees her travel several times a year for official meetings to discuss policy and programme updates and collaborations. Her organisation also organises several events such as the Creative Europe Malta Desk Meeting and the Young Audience Film Day throughout the year to promote the programme and its funding schemes. 'The job is demanding, yet challenging, and I'm happy to be kept on my toes,' she confides.

Interestingly, Lisa admits that none of the roles she has held were roles she ever specifically aspired to. 'My aspiration,' she asserts, 'has always been to work in the creative sector—which is where my heart belongs and the only sector I feel strongly passionate about.'

To truly understand Lisa's relationship with the arts is to go back to her childhood. 'I have my mother to thank,' reveals Lisa. She was surrounded by books and paintings at home since the day she was born. From a very early age she was watching pantos and performances, attending rehearsals with her mother. 'Then there were the travels,' she muses. 'I clearly remember being mesmerised

Photo by Ritty Tacsum

Photo by Ritty Tacsum

by Seurat and the modern art section at the National Gallery. When you're but a few feet tall, those paintings seem larger than life, and I was easily transported into the folds and layers of the works. The trip to London when I was five left a deep impression. I watched ballets, musicals—*Cats* being an all-time favourite. I visited places like the Barbican, which in hindsight might have contributed to my great love for Brutalist architecture.'

Years later, Lisa went on to read for a B.A. (Hons) in History of Art at the University of Malta. She followed that up with a stint as sub-editor and features writer at the *Times of Malta*, which served to set incredibly strong foundations for her career ahead. 'I learnt so much,' she recalls, 'I never realised how well I could work against a deadline, nor how much I enjoyed writing and reacting to the happenings around me.' These little epiphanies came in useful when she jumped into an M.A. in Cultural Heritage Management.

Lisa's Master's thesis explored the idea of having a permanent contemporary art space for Malta. Titled 'Setting up a Modern/Contemporary Art Space in Malta', Lisa explored the concept of having a permanent exhibition space in Malta. Indeed this issue remains a sorely-felt need. Several years have elapsed since her study, and while public infrastructure projects are in the pipeline, they remain distinctly elusive. This said, Lisa doesn't think this limitation should stop artists in their tracks. 'Exhibitions do not require strict museum or gallery spaces, just like bands and performers do not require stages or theatres,' she says. Looking to the near future, she would like to see more pop-up spaces and galleries; 'artists need to organise themselves, they need to start working together and set up artist-led spaces and organisations where strength not only lies in numbers but also in the diversity of the collective.'

But the lacunae don't end there. Lisa does not mince her words when she addresses the gaps in higher education: 'We need courses for arts managers and for tomorrow's curators; courses on art writing and art criticism among others—it's useless creating infrastructural projects when we do not have the human resources, the expertise required to drive those spaces forward. We have to do away with the 'learn on the job' mentality, and foster an environment of specialisation.' This is not to say that Lisa doesn't believe in reaching beyond the bounds of one's 'specialisation'.

Lisa has a number of projects outside of her work at the Creative Europe Desk. She is presently curating a touring show of visual artist Ritty Tacsum's work in Brussels and working on an upcoming Bank of Valletta retrospective of artist Anton Calleja.

It is consuming, it will leave you breathless, but every project is so rewarding—it will ensure that you sleep and wake up with a smile on your face.

Of this exciting portfolio, Lisa explains how her highlight is most definitely the collaboration with the artist/s and the relationship that often evolves as a consequence. 'Through much creative dialogue and engagement, one feeds off the other, and to a certain extent, I feel like I become enmeshed in the process and layers of the artwork.' She confides how the difficult part is gaining the artist's trust. 'When I started out, 10 years ago, it was hard to be taken seriously. And although that aspect has dissolved, I still find that many artists like the 'idea' or notion of having a curator yet don't really understand what the role entails.'

One of her own babies is MaltaDoors, a whimsical photography project based on social media, seeing her capture pretty, local facades she comes across.

'I just love making sense of all the chaos,' she comments. 'Plus, I love playing local tourist, every day, always. I love exploring every little nook and cranny of this tiny island, which even after 30-something years in this world, I'll admit to finding quite magical. Mine is almost a need to frame and isolate the most stunning details around me. Most of us just rush from one thing to another and in the process, we end up missing so much. This is my attempt to focus attention on those impeccable and perfect portions of the life surrounding us.'

Lisa goes on to reveal she wants to do something more with these doors: 'I want to tell the story of the empty house, of the broken family, of the crazy cat village lady. Theirs are the stories I am interested in. The doors are an excuse—they are mere thresholds, entrances and exits, all at once creating opportunity yet providing obstacle.' Since starting this project, she has made countless new friends and acquaintances from all over the world, some of whom have connected precisely because they wanted to tell their story.

So who is Lisa when she's not working on any of her projects? Lisa laughs when she admits how she enjoys being at home, and actually enjoys cleaning, gardening and talking to her plants, and giving her cats Perry and Ginny some well-deserved attention. 'I take pride in my space, and I made sure to surround myself with things that make me feel good, that remind me of the places I have been and the many special people who have shared or who share my life.'

When asked about her aspirations for the future, Lisa admits that while from the outside, it would appear that she is constantly involved in arts projects, she feels the needs to actually be creating, to be more engaged in creative outlets. Rather than focusing solely on supporting artists, she wants to be more involved creatively herself: 'I don't want to keep holding back; I want to engage.'

Lisa's advice to someone pursuing a career in the arts world is to 'go for it.' While she warns that you must be prepared to make sacrifices, be prepared to volunteer or work for free, at least at the beginning and until you build your CV, she points out how the sector is a dynamic one, which is constantly evolving; there is no chance of getting comfortable or bored when you work in or for the arts. 'It is consuming, it will leave you breathless, but every project is so rewarding—it will ensure that you sleep and wake up with a smile on your face. But you must really want it, and at times you need to be aggressive in your approach, because there are more than a few hungry sharks out there.'

MALTADOORS

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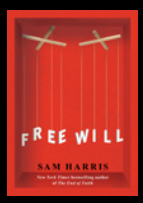
Photos by Lisa Gwen Baldacchino

TO-DO LIST

MOVIE

Ex-Machina explores concepts of consciousness and artificial intelligence, as a young programmer takes part in the ultimate Turing test against the most advanced humanoid robot in a clever and claustrophobic thriller.

BOOK



In his book ***Free Will***, philosopher and neuroscientist Sam Harris reasons that the titular phenomenon is but an illusion, and that realising this will help us make better decisions in areas such as politics, law, religion, relationships, and morality.

MUSIC

The motivational harmonies and powerful lyrics of ***Believer*** by Imagine Dragons explore how suffering can be used to learn, grow, and inspire self-confidence.

TV

Set in a fully colonised solar system 300 years into the future, ***The Expanse*** is a heart-pounding drama that tackles technology, politics, and interstellar class warfare.

YOUTUBE CHANNEL

We love seeing creative ways to express scientific concepts, and Canadian rapper and playwright (or, the world's first and only peer-reviewed rapper) ***Baba Brinkman*** does this beautifully through hip-hop.

PODCAST

StarTalk Radio
Astrophysicist Neil deGrasse Tyson invites celebrity, scientist, and comedian co-hosts to discuss space, science, and pop culture.

INSTAGRAM

If you want to see what goes on in intricate and awe-inspiring marine ecosystems, or learn about the conservation efforts to maintain them, then check out the ***National Oceanic and Atmospheric Administration (NOAA) Fisheries***.

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