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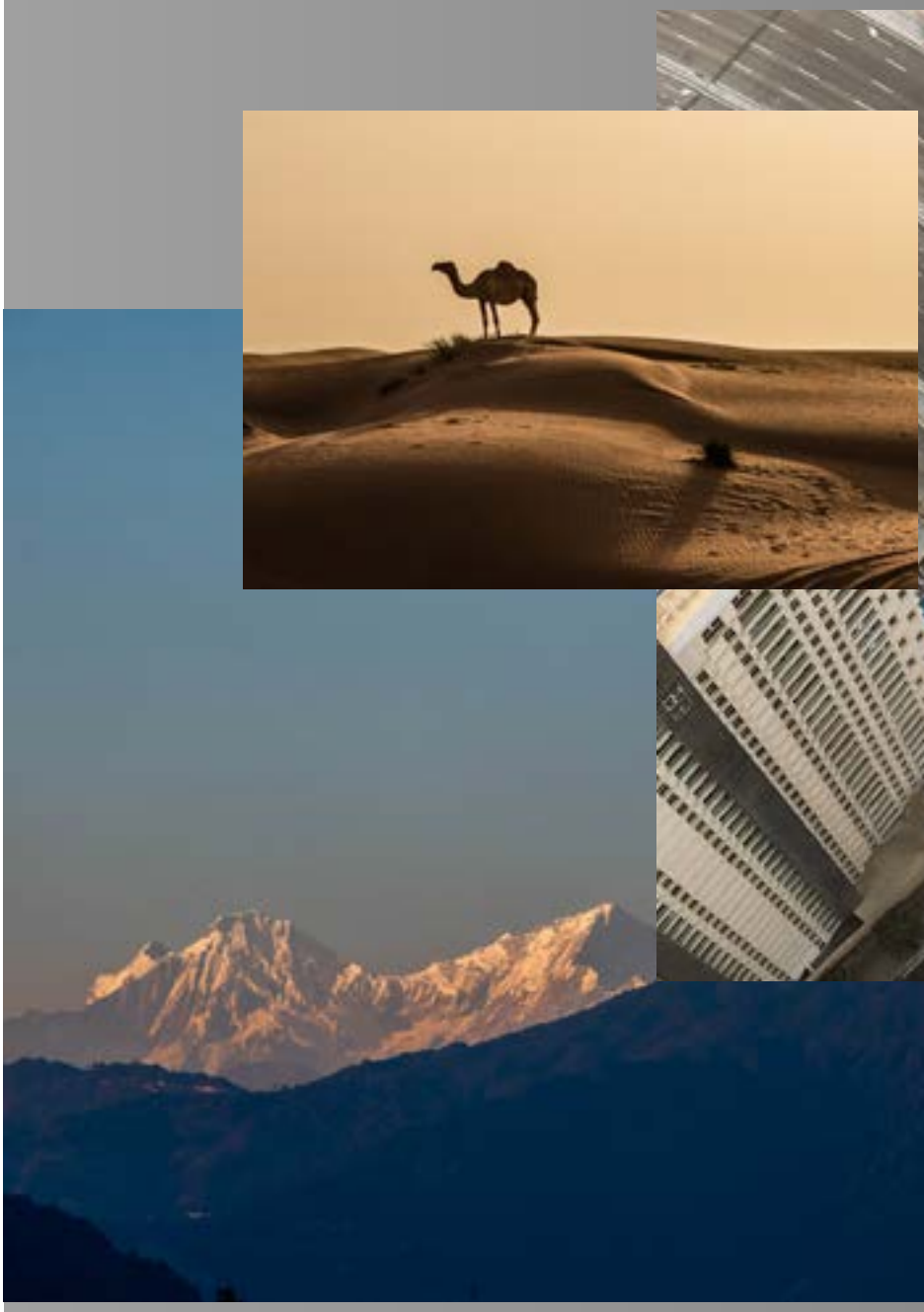
RESEARCH HIGHLIGHTS FROM NYU ABU DHABI



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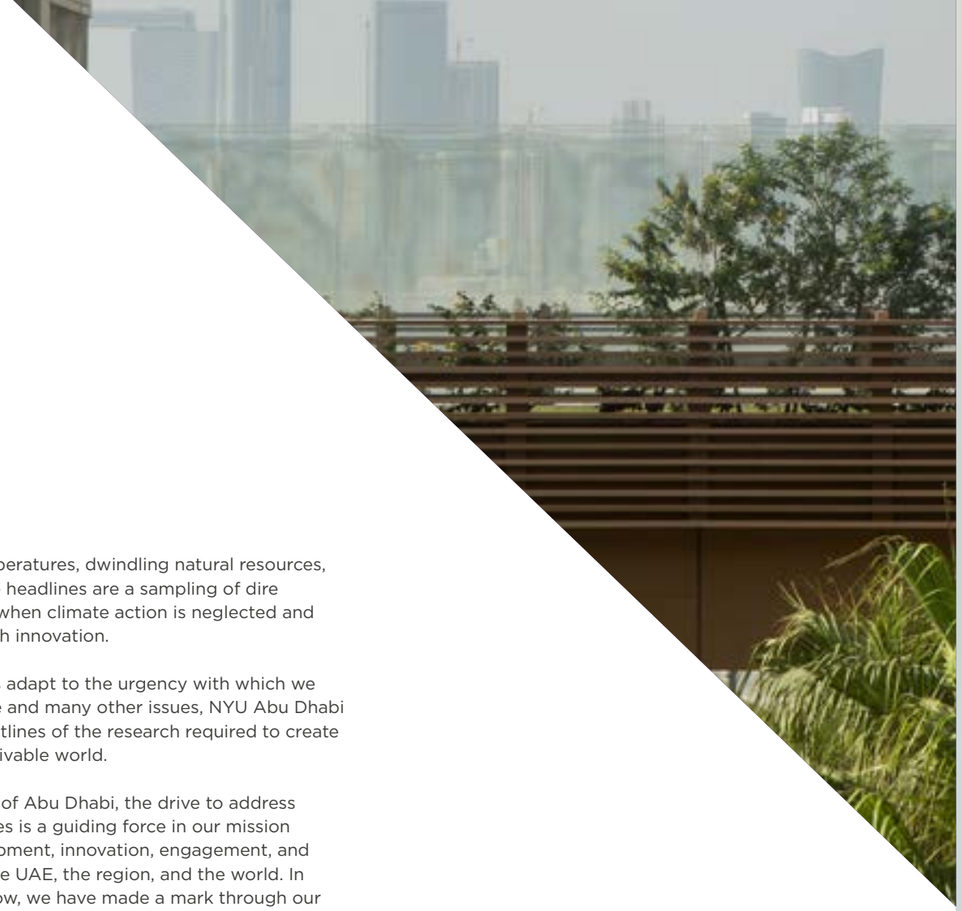


Record-breaking temperatures, dwindling natural resources, food insecurity: These headlines are a sampling of dire outcomes that occur when climate action is neglected and does not intersect with innovation.

As the world's leaders adapt to the urgency with which we need to address these and many other issues, NYU Abu Dhabi finds itself on the frontlines of the research required to create a new template for a livable world.

As a university in and of Abu Dhabi, the drive to address these global challenges is a guiding force in our mission to be a hub of development, innovation, engagement, and positive change for the UAE, the region, and the world. In our second decade now, we have made a mark through our impactful research, propelled by the curiosity, dedication, and boundless creativity of our students, faculty, and academic partners around the globe.

At NYUAD we are proud to have more than 14 research centers and labs focused on sustainability solutions and stewardship, which work on research as varied as developing pragmatic ideas for increasing the livability in our cities, to the development of supercritical CO2-based processes to create nanoscale building blocks and their self-assembly into novel materials. Beyond our labs, NYUAD is a key academic partner to the COP28 Presidency, and we have redoubled our efforts to propel not just research, but teaching and action on climate change, in the country and abroad.

The research you will learn about in this edition of Manara is a critical stepping stone towards greater positive change; it will inform our awareness and actions, impact policy, as well as change the ways industry and infrastructure organize around the principles of sustainability to create a thriving environment for generations to come.

Arlie Petters
Provost, NYU Abu Dhabi

HAPPY LITTLE ACCIDENTS

Researchers from the Smart Materials Lab and the Center for Smart Engineering Materials stumbled upon a discovery that could yield industry warping technology.

“This is one rare case, I think, where we have to thank the dust in Abu Dhabi. Without it, we would have never discovered this. Now it’s a matter of refining the research and seeing how far we can take it.”

—
Patrick Commins
Researcher, NYUAD’s Smart Materials Lab

A camera points down through a microscope at a crystal in an NYU Abu Dhabi lab. It has been set to take photographs every minute overnight to track the malleability of the hexachlorobenzene crystal. The researchers leave the lab. When they return in the morning, they are shocked by what they discover.

While piecing together photographs in a time-lapse video, Patrick Commins and Marieh B. Al-Handawi, researchers from the NYUAD’s Smart Materials Lab and the Center for Smart Engineering Materials, notice a peculiarity in the nature of foreign dust particles that accidentally found their way onto the crystals.

“They were moving. We weren’t testing for this, nor were we looking at it at all. But dust made its way onto the crystals and when we looked at the time-lapse video we saw it was moving,” said Commins.

Observed for the first time, the researchers found the width of small grooves, or channels across the crystalline surface, was widening over the length of the experiment. This was due to the hexachlorobenzene crystal’s natural inclination to sublime, or the process of going from a solid state to a gas state much in the manner of dry ice.

This chemical phenomenon combined with water’s physical tendency to move from flat surfaces towards corners meant that water particles found in the grooves on the crystal’s surface were not only moving across the channels but also pushing particles along with it.

“This phenomenon has been observed in nature; plants use similar processes to move water upwards. But this had never been discovered on surfaces of crystals, and this has opened up a range of options for us,” said Al-Handawi.

The observation prompted an investigation and a momentary pause on their initial experiment. Upon closer inspection, the researchers discovered a previously unseen physical phenomenon that not only had immense use-case potential but resulted in a notable research publication.

Autonomous water flow has previously been achieved utilizing either surface chemical modifications or precisely fabricated microchannels, or on highly specialized surfaces of natural systems such as some plants or insects.

—
Left, Patrick Commins
Right, Marieh B. Al-Handawi

The findings from this new study hold the potential to guide the development of new technologies to utilize naturally occurring and omnipresent sources of aerial water such as dew and fog, currently used only by some desert plants and animals for survival.

The new research builds on the understanding of water collection mechanisms of such biological structures, while it presents a fundamentally different mechanism for water transportation.

The researchers are looking at stabilizing the process further. The potential could be industry defining for the improvement of solar energy and water harvesting.

Cleaning and maximizing exposure to sun rays is a big challenge for solar panels, especially in regions of the world where dust is frequent. Commins and Al-Handawi’s research could offer a cost-saving solution that is not only autonomous but consumes little to no water.

“This is one rare case, I think, where we have to thank the dust in Abu Dhabi. Without it, we would have never discovered this. Now it’s a matter of refining the research and seeing how far we can take it,” said Commins.

“This phenomenon has been observed in nature; plants use similar processes to move water upwards. But this had never been discovered on surfaces of crystals, and this has opened up a range of options for us.”

—
Marieh B. Al-Handawi
Researcher, NYUAD’s Smart Materials Lab

NYU ABU DHABI

These Walls Could Talk

Artist Vikram Divecha aims to create a global archive of salvaged walls for a new art destination and research hub, ***building the world's first multi-cultural city through the ages.***

The demolition site is a flurry of activity, with construction workers and heavy machinery moving around in a carefully orchestrated dance. Gradually, the dust begins to settle, the drilling slows to a halt, and a sense of eerie stillness pervades the scene.

At the heart of the destruction stands a 6.5-tonne internal wall, slated to be the only part of the former family home that will remain intact after the demolition is complete. As the wall begins to move, the workers hold their breath, their eyes trained on every tiny shift and tremble. Despite its enormous weight and size, the wall seems to glide effortlessly through the air, lifted by the cranes as if weightless.

Back on solid ground, Vikram Divecha, assistant professor of art and art history, breathes a sigh of relief, watching intently as the wall is carefully removed from the site in Abu Dhabi's Al Danah neighborhood, perfectly preserved and ready to become the centerpiece of his new exhibition – and a new area of global research.

Divecha has a tendency to bring out the hidden or the overlooked. His artistic process involves finding invisible systems and highlighting them in new, abstract ways. His latest work was inspired by the UAE itself, as the Beirut-born, Mumbai-raised artist searched for studio space and materials in the UAE's abandoned buildings.

"When I walk into these buildings that are going to be demolished, I often come across two or three unique walls that completely blow my mind," said Divecha. "These walls are literally witnesses of time where people leave behind imprints of their culture. I want to extract entire walls and explore that memory and nostalgia, but I also want to move beyond that, and that's what I'm exploring right now."

The extraction in Abu Dhabi in October 2022 was the first artifact for *Wall House*, an ambitious undertaking that Divecha hopes will eventually feature 400 walls and facades from around the world, creating an architectural archive and art destination in the UAE.

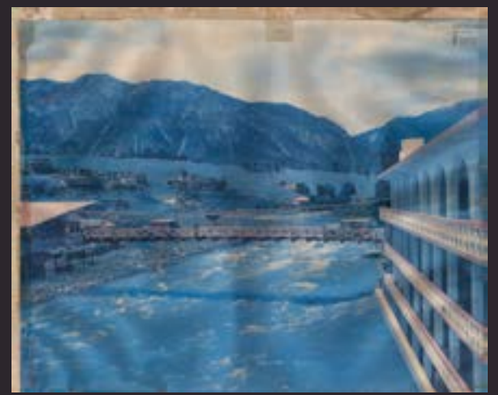
— Vikram Divecha
Assistant Professor of Art and Art History

— Extract 1 (Plot NO: C144, Sector: E18_03, Zone: Al Danah, Abu Dhabi, UAE)

"What I imagine creating is one address, the only address in the world built from hundreds of addresses," said Divecha. "I imagine it as a timeline of contemporary civilization. We're walking through apartments and memories, neighborhoods and cultures, looking at interior and exterior walls, from private to public and back again."

Measuring four meters in height, three meters in width and 1.5 meters in depth, the inaugural wall was taken from the living room of a Pakistani family and displays decorative images of their hometown in north Pakistan's Swat District.

Demolition of the building was paused for a week to extract the wall, under the instruction of Abu Dhabi Municipality and Abu Dhabi Department of Culture and Tourism. *Wall House* is the latest in a long line of Divecha's projects covering time, value, and labor, though it may be his most ambitious yet – as a professor as well as an artist.



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Top Left - Wall to be extracted from Plot No: C144, Sector: E18_03, Zone: Al Danah, Abu Dhabi, UAE

Top Right - Plot No: C144, Sector: E18_03, Zone: Al Danah, Abu Dhabi, UAE

Bottom Left - Poster detail from wall

"This is the first step in a much bigger vision," said Divecha. "I want to turn this first wall into my pilot and use it to show what a wall can be. There are three parts to the project. The first is this big art destination, the second is an architectural archive, and the third is a vehicle for global research."

Currently, Divecha is discussing the possibility of installing the wall at NYUAD. He believes it can transcend art to be studied by students of history, engineering, anthropology, urban studies, social sciences, performance arts, and architecture.

"In terms of research, my students can start with the migrants from Pakistan," he said. "The focus then moves to the UAE and the history of the building itself and the people that lived there before, perhaps moving from a Bedouin to an urban lifestyle."

"The history of the wall could then be translated into a theater set that explores the different stories and lives lived, or we can look at the architectural history of the UAE and influences from other parts of the world. Even the ethernet wires allow us to consider the connection with families back home."

Recently, Divecha exhibited a small-scale version of what *Wall House* could look like, as part of Louvre Abu Dhabi's second *Art Here* exhibition, under the theme "ICON. ICONIC" curated by Reem Fadda, curator and art historian.

As well as building a model version of his *Wall House* vision, Divecha also displayed a video showing the extraction of the Abu Dhabi wall, which was mounted onto a metal frame before being sliced out with a concrete saw and maneuvered out of the rubble by crane.

Eventually, Divecha hopes to extract walls from across the world, starting with Kerala, Egypt, and Kenya, and eventually assembling enough artistic and academic material to build a syllabus that facilitates student capstone projects.

"I hope to create this template of how a wall can become a focus for different disciplines," he said. "Then it becomes owned by this completely new community that becomes everyone's work, rather than just mine."

—
Top - Wall after extraction at demolition site

Bottom - Video Still. Extract 1 (Plot No: C144, Sector: E18_03, Zone: Al Danah, Abu Dhabi, UAE)

"I don't have all the answers right now but I'm trying to build momentum. I can envision it and trigger it in some form, but eventually, it will take on a life of its own."

—
Vikram Divecha
Assistant Professor of Art and Art History

PROTECTING TRANSPORTATION NETWORKS AGAINST CLIMATE CHANGE

Rising sea levels and the increasing rate of climate change induced natural disasters require an urban planning retrofit that protects key roads in the UAE.

“There are different scenarios, one where you protect nothing. The other way, protect everything, and a range of scenarios in the middle. What matters is what particular roads to protect, because in an urban area you’re looking at a network.”

—

Samer Madanat
Dean of Engineering

Studying the results of the overnight supercomputer calculation, Dean of Engineering Samer Madanat observes data that necessitates a call to action to protect the UAE from natural disasters.

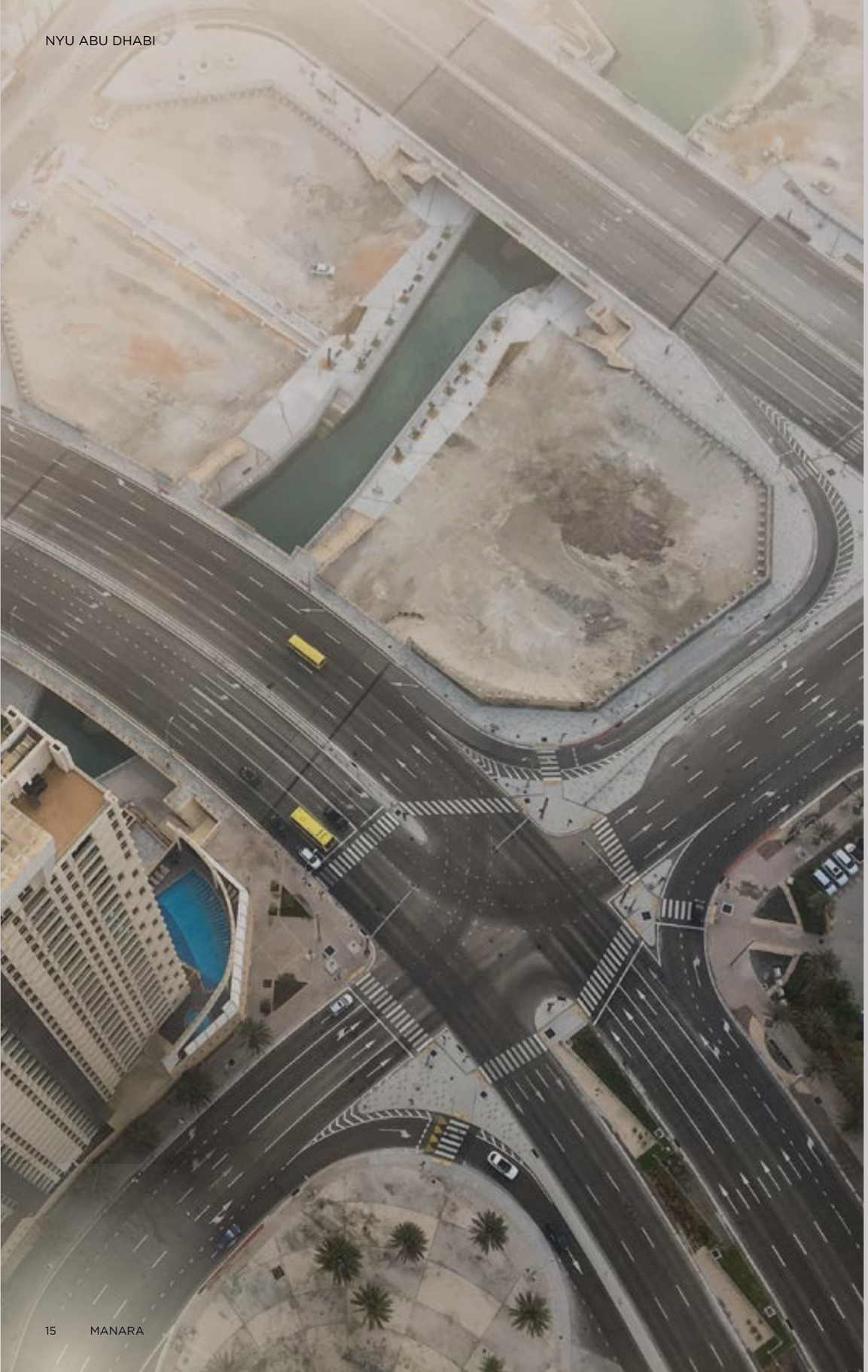
Climate change-induced extreme weather events and rising sea levels are presenting a risk to the transportation networks in the UAE. Madanat and his team of researchers are predicting the rate and frequency of flooding, or inundation, on the roads in Abu Dhabi. By using computational models and combining them with traffic simulations gathered from data on road usage by residents in the emirate, the dean of engineering is able to illustrate simulations and scenarios that can help the country implement plans to mitigate transportation disruptions.

Madanat, who has been researching this topic since his time at UC Berkeley, in the San Francisco Bay Area, through a grant from the US National Science Foundation, is taking a holistic approach. By taking these prediction models of sea level rise and overlaying them on a digital elevation map of Abu Dhabi, he can identify specific roads that are at risk of inundation from extreme weather events from tides in a future where the sea level is higher than it is today.

According to Madanat and his team’s calculations, scenarios whereby key roads in the UAE are to be inundated are expected to increase in frequency – and in fact they are already beginning to disrupt networks today.

In 2019, roads in Fujairah and Sharjah were closed due to high waves breaching the barriers as the result of a particularly strong cyclone, an extreme weather event that is predicted to become increasingly more destructive as a result of climate change.

“If it’s not a recurring event like that one, there’s no big deal. However, with the rise in sea level this will become an issue. In fact, it may lead to situations where the Corniche will be unusable for half the day when you have the high tide, and that leads to a major disruption to the transportation network,” he said.



In a city like Abu Dhabi, where the main mode of transportation is the automobile, this leads to rerouting that adds to the congestion of the roads that have not been inundated. Furthermore, Abu Dhabi being an island is particularly vulnerable to these events. According to Madanat's research, of the four bridges that lead to Abu Dhabi – Al Maqta Bridge, Mussafah Bridge, Sheikh Zayed Bridge, and Sheikh Khalifa Bridge - the approaches to all but one of these key roads are at risk of disruption from inundation.

Madanat and his team take this data two steps further. Based on these predictions and scenarios of high-risk areas being inundated, he applies these disruptions to traffic models and road usage to see how that adds stress to the overall transportation network. In other words, he sees how flooding can add to people's commutes, and their accessibility.

He does this by using data provided to him by the Department of Municipalities and Transport on road frequency use and traffic data. They run simulations on traffic models to see what scenarios make certain roads inaccessible and see how traffic patterns change in the city. In his models, the scenarios vary from manageable, such as adding more time to residents' commutes through detour, to extreme, where they cannot reach their desired destinations.

Certain conditions would block individuals in Abu Dhabi from access to roads. Schools, work, deliveries, hospitals, and almost every aspect of a city would be thrown off-kilter.

The other, and more extreme but possible scenario, is a situation whereby flooding is so extreme that it would cut off the entirety of Abu Dhabi city from the mainland.

As of the UN's last report, mitigation as a policy is no longer sufficient and the world is currently on a trajectory of sea levels rising by up to 0.5 meters in the next 30 years. Sea level rise is not a possibility but a certainty.

With an eye to helping inform an urban planning retrofit, Madanat and his team offer adaptive solutions to these events.

"There are different scenarios, one where you protect nothing. The other way, protect everything, and a range of scenarios in the middle. What matters is what particular roads to protect, because in an urban area you're looking at a network," he said.

He gave the example of a scenario where an event causes inundation in the roads leading to Sheikh Khalifa Bridge. In that scenario, to go from Abu Dhabi city to Saadiyat means that drivers need to go all the way through Yas Island to get to Saadiyat turning their 30-minute drive into one that would require almost an hour to complete.

The research goes a step further. Madanat and his team offer several solutions to the relevant authorities in their future planning. Beyond just making suggestions as to what roads are the most important to protect, they also offer different mitigation options.

The maximalist approach is to create sea walls, which Madanat says are the most effective although not visually appealing. The next most effective method is building levees, essentially raised land next to bodies of water that serve as a sort of 'speed bump' for incoming waves or rising sea levels.

The last suggestion, which is visually the most appealing but not as effective, is increasing the "roughness" or texture of the coast. This would be various types of vegetation planted on the coastline that slows down the encroachment of seawater.

Some combination of these scenarios is, Madanat says, the best approach. He is working with the Abu Dhabi City Municipality to develop these scenarios and work on recommendations for future urban planning in the emirate. He has also been given access to future plans for transportation networks so that Abu Dhabi can plan ahead.

Madanat's research team is composed of Aaron CH Chow, Alain Tcheukam Siwe, Ilia Papakonstantinou, and Jiayun Sun, who is currently at the US National Renewable Energy Lab. The team is also working with the Ministry of Energy and Infrastructure of the UAE to help them devise inundation mitigation plans based on sea level rise projections at the federal level.

NYU ABU DHABI

THE HOPES AND HAZARDS OF AFRICA'S DIGITAL REVOLUTION

Through his work on sub-Saharan African countries, Luca Maria Pesando is discovering how digital technology is reshaping the social fabric and norms.

"In many households, in Zambia, Kenya, and Ghana, gender norms are rooted very much in favor of men, and perhaps a woman in possession of a phone could be seen as a threat, increasing her risk of domestic violence. That woman may have access to support or a shelter through her phone, but can she get to it? There are lots of variables here."

Luca Maria Pesando
Associate Professor of Social Research and Public Policy

These days, we take our own use of technology, the internet, and mobile phones for granted. But in more impoverished countries, it might have bigger implications.

"I think the big gamechanger was COVID," says NYU Abu Dhabi's Associate Professor of Social Research and Public Policy Luca Maria Pesando. "The role that technology had during the pandemic, even in low-income African countries, with mobile phones, the internet, laptops, and tablets becoming essential to help people stay in touch, or keep up with their child's education, we're now seeing how that adoption continues to have major repercussions."

Pesando, who started his position at NYUAD in August 2022, has long been fascinated with the social demographics of a variety of different cultures and countries, but has mainly focused on sub Saharan Africa which, according to the World Bank, is where more than half of the world's extreme poor reside.

"I have a personal interest, as I spent a lot of time in Africa growing up," he says. "My father was an eye surgeon who founded a hospital in Kenya, so I would travel there with my sister, and we would help out at schools and meet with African households. Eventually, I was able to combine this with my passion for statistical and econometric analysis, and look at sociological changes in families and schools in resource deprived contexts."

The various social norms and cultural practices of African countries react differently in the presence of digital technology. This, he says, influences the manner in which society evolves and provides the example of African women with phones being better informed about childbirth and access to various health services. Pesando asks whether this digital transformation creates a whole new era of empowerment or disruption.

Pesando talks of the UN's Sustainable Development Goals (SDGs), and how technology is cited as a means to accelerate gender equality. This continued adoption in sub Saharan African countries could potentially mean big changes in societies approving of marriage and childbirth for women at a very young age. He is looking at the schooling of children and working on a series of projects supported by the Jacobs Foundation in Switzerland.

"We're looking at the effect of digital technology on narrowing the inequality in terms of education during COVID, accessing classes for remote learning. But also, how might it exacerbate inequalities for those not digitally connected? I'd love to convince telecommunications companies and international organizations to develop cheaper data plans, so that more people in poorer countries can take advantage, as it appears to be something that impacts in a beneficial way."

In the past, Pesando has worked with the World Bank and UNICEF and a number of other academic organizations, examining how digital technology is shaping societal demographics in Latin America, Europe, USA, and Asia. Could his move to Abu Dhabi tempt him to study this region as well? "I'd love to," he admits. "It's so multicultural and there are so many population dynamics at play. I would even love to see a center for population studies, focusing on the dynamics of demographic change in the Middle East, as there are lots of interesting implications."

ENGINEERING INSIGHT INTO MENTAL HEALTH

Tuka Alhanai's curiosity and self-starter nature have driven her through an illustrious career bolstered by support networks and mentorship.

Diagnosing depression is a complicated endeavor that requires health professionals to detect responses of individuals to questions and observe lifestyle changes. It is life-saving work that Assistant Professor of Computer Engineering Tuka Alhanai believes can be substantially enhanced through machine learning models.

Alhanai works on the interface of human and computational machinery to build algorithms that can help measure subjective elements of human behavior. Her research has shown the potential of using machine learning systems to quantify formerly immeasurable human qualities such as determining the characteristics of a group of people that form a successful team or the elements of an idea that lead to a hit in the marketplace.

It s work that she began while conducting her PhD at the Massachusetts Institute of Technology (MIT). In her thesis she explored the use of speech to automatically detect the presence of cognitive impairment due to dementia and Alzheimer s disease in individuals, a heavily underutilized biomarker that may help in the early diagnosis of the 10 million yearly cases of the debilitating syndrome.

"A lot of the time, especially when you're conducting research or working in a cutting-edge field, there is no textbook on how to progress, and that's where I find mentors to be important."

—

Tuka Alhanai
Assistant Professor
of Computer Engineering

Her research has garnered much attention and piqued the interest of her academic circles, but it also has been recognized for its potentially impactful use cases. Bill Gates, co-founder of Microsoft and co-chair of the Bill & Melinda Gates Foundation, even highlighted on his personal blog the research that Alhanai had worked on with colleagues at MIT, Boston University, and the Framingham Heart Study.

Building upon her success, Alhanai co-founded the machine-learning consultancy company, Ghamut Corporation, in 2016 to utilize her technical experience to solve business challenges across a variety of industries. For her entrepreneurial and translational work, she received awards from MIT and a Small Business Innovation Research grant from the US National Science Foundation. She continues to share learnings from these industrial experiences through her teaching and student mentorship activities at NYUAD.

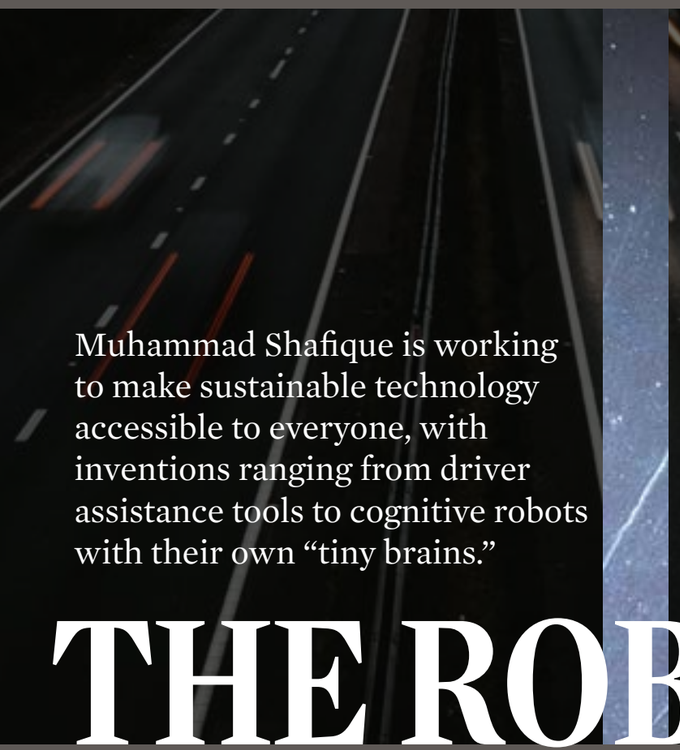
Alhanai's drive and curiosity towards becoming a master of computer engineering has been present since she was an undergraduate at the Petroleum Institute in the UAE. The Emirati's self-starter nature and dedication to excellence allowed her to sustain an academically rigorous and demanding career, but it's her stalwart belief in the importance of mentorship and learning from others that allowed her to excel.

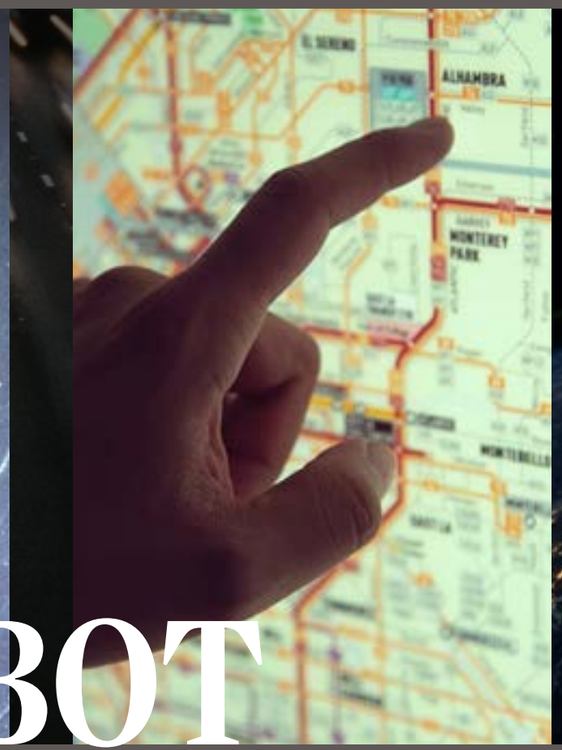
"Finding mentors, relying on a network of colleagues and professionals to help guide me through these challenges is a key component of my career. A lot of the time, especially when you're conducting research or working in a cutting-edge field, there is no textbook on how to progress, and that's where I find mentors to be important," she said.

As a computer engineer, Alhanai continues to build and utilize her network of colleagues, former educators, and family members to help guide her through her work.

As a professor, she now finds herself in a position to give back in the mentorship cycle. Her Lab for Computer-Human Intelligence has hosted over 25 high-school, undergraduate, and full-time researchers. Several student research assistants have pursued top industrial positions (Palantir, Noon, Goldman Sachs) while others have gone on to continue their post-graduate education, with one even conducting a PhD at the University of Oxford, motivated by research they worked on in Alhanai's lab.

"It's probably the single most important thing, ask for advice, work with others. Having an opportunity to be mentored by colleagues at NYUAD, and helping students and other researchers I work with is an amazing experience that is really key to the academic world," she said.





Muhammad Shafique is working to make sustainable technology accessible to everyone, with inventions ranging from driver assistance tools to cognitive robots with their own "tiny brains."

THE ROBOT REVOLUTION

"We don't want a cyber-dominant society, we want a society where these autonomous agents work with us to make the world ***b bgvwgt pıbeg f qt gvgtÁqpg.****"*

The bustling city streets are alive with activity, the hum of robots blending seamlessly with the chatter of humans. The small, sleek machines scurry about on their assigned tasks, their "tiny brains" allowing them to learn and adapt with every encounter and experience.

It sounds like a scene from a sci-fi film, but this is what the future will look like according to Professor of Engineering Muhammad Shafique, whose groundbreaking research into brain-inspired computing and AI technology could bring this vision to a swift reality.

AI and machine learning have proliferated in our daily lives in almost every application already," said Shafique. "We have wearables that are monitoring our daily lives, health diagnostics in our smart watches, autonomous vehicles, and traffic control systems. My research is all about bringing intelligence to real-world systems.

Enabling future intelligent technologies and cognitive systems that care for humanity and the ecosystem in an energy-efficient and secure way is the key focus of Shafique's eBRAIN lab at NYU Abu Dhabi. Shafique and his research team have been extensively investigating innovative foundations for next-generation AI systems that make technology safe, secure, and sustainable across every sector.

Shafique's goal is to create accessible tech that can be used by everyone, regardless of income or location. His assistive robotics are designed to help and facilitate human life, while enabling AI-based intelligent functions on smartphones and mobile devices for different applications like healthcare and autonomous driving assistance.

"Nowadays the average person has four to five electronic devices and we're talking about putting a very small electronic brain inside these components to enable intelligent technologies in 80 to 90 percent of computing devices in the world," he said. "The robots and autonomous vehicles are to be used for people, with people, and we want to make it safe, secure, and accessible to everyone.

One such smartphone system that Shafique and his students are currently developing is an advanced driver assistance tool that will make getting behind the wheel safer than ever before. The tool aims to detect danger in the most adverse weather conditions, recognizing oncoming vehicles during heavy fog, a leading cause of multiple-car pileups in the UAE. Currently, the system is being tested using scenarios in the virtual world, though Shafique hopes to progress to real-life driving situations soon.

Another ongoing project involves four-legged robots commonly used to explore disaster zones. As well as increasing their speed and efficiency, Shafique is working on developing their robust design and defenses against cyber attacks that can hack into the machines and use them maliciously.

Healthcare is also a priority for Shafique and his students, and a new multimillion-dollar AI project could potentially reduce miscarriages in pregnant women. The Moore4Medical EU Project in collaboration with Philips Healthcare aims to develop an intelligent handheld ultrasound device that will allow expectant mothers to monitor their pregnancy from home.

"With the help of these devices, we can perform various AI-based analysis functions, such as segmenting the fetus and analyzing their anatomical features to identify any potential anomalies," said Shafique. "This empowers women to monitor their pregnancy and seek medical help before emergencies can arise.

"I've seen a lot of cases where everything has appeared fine in ultrasounds but on the day of delivery there are complications. My goal is to advance this technology at NYU Abu Dhabi and build our own in-house intellectual property to make this care available to mothers-to-be everywhere.

Elsewhere in the healthcare field, the lab's Edge AI for Medical Image Processing tool aims to analyze X-ray images and other diagnostics on a laptop, a tablet, or even a mobile phone.

"Typically, only hospital doctors can run these complex image diagnostics on high-end servers in hospitals, but this technology could allow medics to travel to remote towns and villages in rural areas like South Asia and Africa where they don't have sufficient resources or internet bandwidth," said Shafique. "These small devices can take care of medical image analysis very quickly and hopefully save lives.

As well as the human effect of his research, Shafique is firmly focused on environmental impact and aims to harness power for his tech from natural resources like sun and wind. By building zero-power devices that consume the same amount of power they generate, he hopes to significantly reduce his carbon footprint and leverage eco devices that propel the agriculture, automotive, and industrial sectors into the future.

As the technology continues to progress and learn, Shafique is confident that it will begin to think and act more independently. But he's not losing any sleep over the "robot revolution.

"There are checks on the cognition of machines because we cannot afford these systems to be 100 percent as intelligent or out of control as humans, because we have morals which you cannot simply program for such machines," said Shafique. "My ultimate goal is to make technology that can help people, not replace them.

NYU ABU DHABI

Uncovering the Secrets of the Gulf Ecosystem

Just two years in, NYU Abu Dhabi's Arabian Center for Climate and Environmental Sciences is already discovering fascinating new data about the region.

When he's not talking numbers with a roomful of students, Associate Professor of Mathematics Francesco Paparella is busy in a different role, heading up NYU Abu Dhabi's Arabian Center for Climate and Environmental Sciences (ACCESS). Established in 2022, the Center is building the observational and modeling capacity to effectively monitor the climate and environment of the Arabian Peninsula and the Gulf region. And it has already made a number of important discoveries.

For Paparella, the establishment of such a program was necessary due to a lack of modeling and data relevant to the Gulf. As the founder of ACCESS, the applied mathematician hopes for an increased research focus on the region in a global context.

"If you look at scientific literature, there are more studies on Antarctica than there are of this region. There are reasons, of course. Historically, it s always really difficult to obtain the right permissions from different countries, and the region was once very under-developed. That s now changed, so it s important to devote resources to find out what s happening environmentally.

"To address the climate crisis, we need a holistic approach, one that brings everyone together and commits to change that can safeguard both the natural environment and the wellbeing of human societies."

Francesco Paparella
Associate Professor
of Mathematics

Paparella talks about satellites often used to measure conditions around the world, collecting data on the temperature and salinity of water, for example, but explains that their radiometric models are calibrated for locations very different to the Arabian Gulf.

To solve this issue, he is looking at working on a drone that has 144 spectral channels, as opposed to the 8-12 of most satellites, and that operates closer to the ground than a satellite. This drone had its maiden flight recently with resounding success and it will continue to collect data with the aim of delivering findings within two years.

The drone, which takes off vertically, has a highly efficient design that allows it to cover a lot of ground. It is equipped with a hyperspectral imaging camera, pointing downwards, which analyzes a wide spectrum of light, and can determine how much plankton is in the water, for example, just by looking at how green it is.

The Center also counts other professors and researchers among its members, including technicians and biologists, helping Paparella find the answers to unusual questions. "We wanted to understand why and when the corals bleach in the Gulf, which happens elsewhere when the water temperatures are too high," he said. "But the temperatures in the Gulf get so high, coral found in the rest of the world under these conditions could not survive. This was an observation from John Burt, associate professor of biology, who is also a member of ACCESS. He discovered a symbiotic algae that is more heat-resistant than the equivalent found outside the Gulf, specific to this region, providing the coral with nourishment, ensuring it remained alive.

Developing regional models, rather than relying on the global ones, is important when considering factors like precipitation, which is strongly affected here by the presence of small geographical features such as the Hajar mountains, and is often triggered by the passage of moist air from the Indian Ocean.

Francesco Paparella
Aassociate Professor of Mathematics

Some of the work involved in creating these models has even led to accidental discoveries. “One is shallow water hypoxia, a lack of oxygen observed occasionally in the coastal waters of Abu Dhabi. That was completely unexpected,” said Paparella.

The team was analyzing the water temperature of a coral reef, and the instruments happened to include an oxygen indicator. On summer nights, they found that oxygen in the water would drop below two micrograms per liter, which is a major threshold and if sustained, would kill all the fish and most aquatic life. The observation has triggered an investigation into the reasons behind the hypoxia and has resulted in another research stream for the Center.

You can sense the excitement when Paparella talks about his work, and describes how the information could prove useful. The Center s holistic approach to analyzing data and modeling is allowing the team of researchers to discover natural anomalies that can form the basis for pivotal climate change research. In so many instances, Paparella describes analyses that are sparking more questions than answers – a telltale sign that they have hit a valuable research vein.

Analyzing phytoplankton, the base of the food chain, has value to fisheries, for example. Or there is a bloom in Abu Dhabi lagoon, close to Yas Marina, with cells that produce a neurotoxin. The quantities aren’t enough to harm people swimming or drinking the water, but they can accumulate in fish and shellfish, so this needs to be observed. We’re monitoring the lagoon to keep an eye on the situation.

In these eco-sensitive times, and ahead of the UAE hosting COP28, detailed information and modeling concerning the Gulf, which has previously been lacking, could assist governments and inspire others to take action, particularly as countries in the region become more developed, with increasing levels of farming and industry, and the impact that might have.

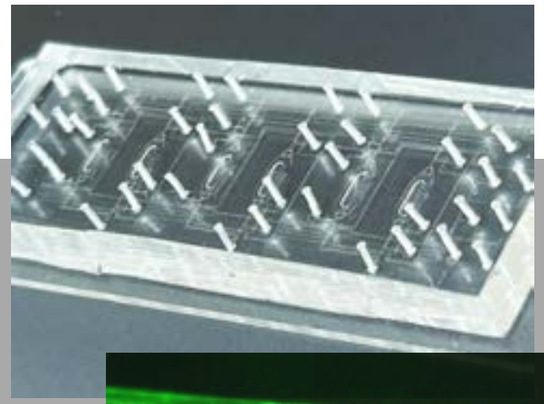
Paparella and his team have an ongoing collaboration with the Ministry of Climate Change and Environment. As members of the Climate Change Research Network they help the Ministry contextualize the Intergovernmental Panel on Climate Change findings to the UAE and the Gulf region, and to cope with the uncertainties in the climate projections. The team were involved in COP27 in Sharm el Sheikh and will be attending COP28 in the UAE.

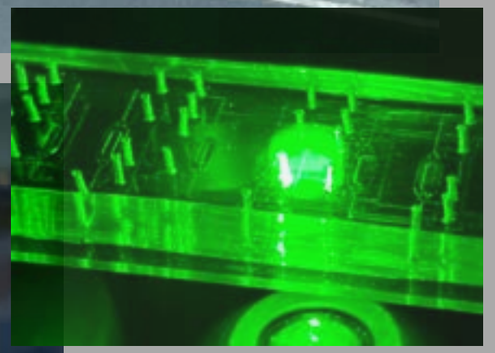
“To address the climate crisis, we need a holistic approach, one that brings everyone together and commits to change that can safeguard both the natural environment and the wellbeing of human societies. One depends on the other: just as we can’t have a prosperous, happy society in a wrecked natural environment, likewise we can’t have the resources to study and preserve the environment unless we live in an affluent society. I believe that the UAE is leading in this positive, effective attitude towards solving the climate crisis,” said Paparella.

NYU ABU DHABI

BODIES ON A CHIP

Revolutionary biotechnology research is flipping the narrative on animal testing **by using research into human cells to save endangered animals.**





"It's quite ambitious but I'm motivated to make something new that can change the course of nature," says Kamei. "Some of the most beautiful creatures on our planet are in danger of extinction and if they disappear, they will be gone forever. The challenge is to defend these endangered animals and save species before it's too late."

Seven-year-old Kenichiro Kamei sits cross-legged on the tatami mat of his bedroom in Tokyo, his small fingers hovering over a set of action figures. Before long, the entire figure is dismantled, ready to be carefully reconstructed, with each piece slotting perfectly together – only better. The skill was one that Kamei would carry with him into adulthood and apply to his work in the field of biotechnology, only this time, it is the human body that he is remodelling.

Now, as a micro-engineer at NYU Abu Dhabi, Associate Professor Kamei uses the same precision and attention to detail to create devices that mimic the human body. He dissects human cells, examining each part and how it interacts with other biological functions. He then reconstructs the cells on a silicon-rubber chip, designing intricate channels and troughs that allow for complex interactions.

Known as reverse biotechnology, Kamei's work has the potential to revolutionize medical research. While traditional lab experiments are often isolated and static, Kamei's "bodies on a chip" contains an interconnected system of channels, valves, and pumps that can replicate the complex interactions of living systems.

Kamei's work goes beyond humans to adapt "bodies on a chip" to eradicate diseases in endangered animal species. His ultimate goal is to create whole animals on these chips, an ambitious feat that could change the face of science as we know it.

"It's quite ambitious but I'm motivated to make something new that can change the course of nature," says Kamei. "Some of the most beautiful creatures on our planet are in danger of extinction and if they disappear, they will be gone forever. The challenge is to defend these endangered animals and save species before it's too late."

Kamei constructs his custom microfluidic chips using a laser cutter and a 3D printer. Each chip contains six interconnected chambers and microchannels, into which he introduces different types of cell tissue. By utilizing pneumatic micropumps navigated by a controller, he can establish circulation within the chip.

The technology enables him to examine the effectiveness and potential side effects of new medications, develop tailored treatments for patients based on their specific cell cultures, and enhance our comprehension of the underlying mechanisms of various diseases.

The success of these experiments hinges on an extensive supply of diverse cells, which would not have been possible without the groundbreaking research of Shinya Yamanaka. Yamanaka, a stem cell scientist at Caltech was awarded the Nobel Prize in Physiology or Medicine in 2012 for his pioneering development of induced pluripotent stem (iPS) cells.

In a nutshell, iPS cells can be reprogrammed into any other cell type in the body, enabling scientists to prepare whatever tissues or organs they need. These "blank canvas" cells become sperm and egg cells for fertility treatments, cancerous cells for pharmaceutical trials, or even brain cells for neuroscience.

Humans, of course, are not the only species that suffer from disease. As well as alleviating the need for lab animals, iPS cells and chip technologies can accelerate the development of new medical treatments for the animal kingdom too, helping to save species at risk of extinction.

Currently, Kamei is working on iPS cell research to protect Grevy's zebra, of which only 2,000 remain in the wild, as well as golden eagles, whose numbers have also dwindled in recent years. In the future, he hopes to work with white rhinos, of which 16,000 are thought to remain globally.

By obtaining just a strand of hair or a drop of blood from high-risk animals, micro-engineers can isolate their iPS cells and use these to develop unique, reliable, inexpensive and highly effective experimental models to develop life-saving drugs. It is a research area that will potentially revolutionize animal conservation and Kamei is at the forefront of that research.

"Up until recently, the 'body on a chip' was only suitable for humans and human healthcare but now we are trying to adapt it as a way of saving endangered species," said Kamei. "These animals can experience unknown diseases that are harbored in nature but we're not sure why. Our approach is to try to establish iPS cells from the animals and study how diseases happened and then establish new drugs and treatments to save them using a similar chip system."

For Kamei, the sky's the limit, and he hopes to one day take his research into outer space.

"Eventually humans and animals will both go to space, and we need to investigate how such an extreme environment is influencing human healthcare and animal healthcare," he said. "My ultimate dream is to take the iPS cell system into space and see how it reacts in that environment. That's the bigger picture for me."

CONTROLLED EXPLOSIONS: ENGINEERING'S NEXT WAVE OF ENERGY EFFICIENCY

Je Ir Ryu, assistant professor of mechanical engineering, is knocking on the door of a new breakthrough in energy efficiency.

Je Ir Ryu
Assistant Professor of
Mechanical Engineering

Je Ir Ryu holds up the palm of his hand in his recently occupied NYU Abu Dhabi office, points at it and says: "the entire energy conversion rate of the United States could be achieved in a space this big if we could just figure it out.

He's talking about harnessing the incredible power of detonation or, in engineering terms, supersonic flame propagation and what could be the next generation of rocket propulsion systems.

This is a realm of physical phenomena that is still academically unwieldy and difficult to control, but one that Ryu and his research group are working on solving.

"If we understood the phenomenon, it would create a totally different world of physics," he said.

Put simply, Ryu is trying to understand and harness the energy output created from shockwaves emitted from breaking the sound barrier. This is no easy task, as the chaotic nature of the phenomenon makes controlling that immense energy output in a contained system problematic.

However, the potential of this breakthrough would not only change rocket systems, but also the way we harness energy. Traditional rocket and combustion energy systems require a high degree of pressurization, which is typically done in compressors.

However in supersonic flame propagation, the shockwaves already create the highly pressurized environment needed for energy output by virtue of the physical phenomenon of breaking the sound barrier. This would completely negate the need for compressors, which are large and cumbersome, and would create a system that is significantly more energy and space-efficient.

Through computational simulation that measures the physics of rockets and propulsion systems, Ryu is researching various methods of optimizing engineering mechanics involved in rockets and engines, including supersonic phenomena but also more applicable systems such as optimizing nuclear energy in rockets and as an energy source.

"You can do this all experimentally, you can build these components and change the variables. But it's very expensive if something goes wrong."

—
Je Ir Ryu
Assistant Professor of
Mechanical Engineering

Ryu, who was recently hired as an assistant professor of mechanical engineering, researches a number of propulsion systems, which is the most common method used for rockets. Through computational techniques he is looking at understanding the physical phenomenon to better understand propulsion systems and further optimize that work.

An example is space rocket propulsion. By exploring different energy systems, mainly nuclear and combustion, he looks to simulate the operation of a space rocket as it journeys to planets.

"You can do this all experimentally, you can build these components and change the variables. But it s very expensive if something goes wrong," he said.

Through his calculations and simulations, different variables in any given propulsion system – from rockets to car engines – can be manipulated to illustrate the best possible builds and quantities when it comes to building a propulsion system.

It can also be an extremely cost-saving and efficient way to know why things go wrong. "Failure is a good thing in engineering research. If I failed in this case, that means I can understand more about the systems,"he said.

Before joining NYUAD, Ryu was a postdoctoral fellow at the US Army Research Laboratory and Argonne National Laboratory. He also works with Hyundai in South Korea to begin uncovering the mysteries of how to harness the incredible potential of quantum computers to better understand physical properties.

Today his work continues with Hyundai and the US Army but he is also hoping that his research will aid in the UAE's space ambitions – a childhood dream of his.

"It s silly, and it s common. But when I was a kid, I watched Apollo 13 and I was completely fascinated by the space engineers. So this led me down this path. It s special to know that my research can contribute to national space ambitions, big companies' technology breakthroughs, and also fulfill a childhood dream of mine.

OUT OF THIS WORLD

Thunder and nanosatellites collide in an innovative mission to study terrestrial gamma ray flashes.

As the Earth silently rotates beneath them, a team of Japanese astronauts from the International Space Station skillfully operate a robotic arm poised to deploy a groundbreaking nanosatellite into the void.

Back on solid ground, a group of students from NYU Abu Dhabi watch in anticipation, their months of diligent labor hinging on the outcome. The team fastidiously designed and crafted the nanosatellite, leaving nothing to chance. As it is liberated into orbit, the students hold their breath, only to erupt in celebration as it hurtles into the darkness.

The nanosatellite, called Light-1, was a collaboration between students from NYUAD and Khalifa University, designed to study charged particles known as terrestrial gamma ray flashes (TGF) that are released above thunderstorms and pose a risk to aircraft passengers and crew.

The deployment in February 2022 marked a crucial milestone for the NYUAD students and their teacher, Francesco Arneodo, professor of physics at NYUAD's Center for Astro, Particle and Planetary Physics.

Now, more than a year on from launch, the group is almost ready to announce their findings after the nanosatellite completed its mission.

"Some people hypothesize that gamma rays are responsible for civil aircraft disasters in recent years, though that is complete speculation."

Francesco Arneodo
Professor of Physics

Francesco Arneodo
Professor of Physics

"We expected it to last for about six months, so it stayed in space for a lot longer than we hoped. We are still analyzing the data and the satellite didn't work 100 percent to our specifications, but it did gather some valuable information, and we are going to publish a paper very soon," said Arneodo.

Part of a joint effort by the UAE Space Agency and Bahrain's National Space Science Agency, the nanosatellite measured the potency and duration of TGFs, and the source of these flashes. With only a few missions previously launched to study TGFs, the data collected by Light-1 is invaluable in improving our understanding of this natural phenomenon.

"To my knowledge, the project was the first scientific Earth satellite to come from the UAE, and possibly the entire Gulf area," said Arneodo. "It was initiated and partly led by students, and it was the first time we'd done anything like that, so for it to be a success was incredible."

Although analysis is ongoing, Arneodo and his team were able to make some interesting observations from Light-1, including measuring the South Atlantic Anomaly, which is an area east of Argentina where the Earth's magnetic field shows some fascinating irregularities.

"Satellites flying in this area get to see a lot more charged particles, like the electrons and protons of cosmic rays and typically they're flooded with data," said Arneodo. "It was nice to be able to clearly see this anomaly and we have a nice picture where this bright spot of high radiation intensity is visible on the map of the Earth."

TGFs are extremely powerful and can endanger aircraft passengers, exposing them to the equivalent of 400 chest X-rays in just one flash. They also interfere with aircraft electronics and could put passengers and crew at risk. The terrestrial flashes were accidentally discovered by space scientists at NASA in 1992 when carrying out studies about cosmic gamma-ray flashes, which occur outside Earth's atmosphere.

Currently, the way that TGFs are generated in thunderstorms is not completely clear, and Arneodo hopes that further study will be able to pinpoint effective ways of managing the harmful radiation they emit.

"It's interesting to study them because people on an aircraft are not protected from that amount of radiation," said Arneodo. "It may be harmful to the aircraft itself, as well as the people on board."

"When there is a huge amount of radiation interfering with the electronics of an aircraft, this might cause malfunctioning. Some people hypothesize that gamma rays are responsible for civil aircraft disasters in recent years, though that is complete speculation."

Regardless of what the data eventually reveals, the impact that the mission has already had on the region, the scientific field of study, and the students themselves is remarkable. And, for Arneodo, the first nanosatellite is just the beginning.

"It was a massive success from the point of view of training my group of students," he said. "There's also a scientific impact where we can essentially increase the knowledge about a natural phenomenon. Finally, it shows what we can do as a university. With research like this, we can become an authority on space satellites and an entity that people can trust to be active in other space projects."

NYU ABU DHABI

UNDERREPRESENTED CLIMATE CATASTROPHE IN THE HIMALAYAS RISKS LIVES OF 2.5 BILLION

An interdisciplinary initiative at NYU Abu Dhabi spotlights how the Himalayan climate hotspot is jeopardizing the water supply for a quarter of humanity.

As the climate crisis worsens, the Himalayan water supply, which serves as a lifeline to several countries including India, Pakistan, and China, is under threat. Importantly, the scramble for uninterrupted access to ample fresh-water sources is exacerbating geopolitical disputes within Asia and eroding interstate cooperation.

NYU Abu Dhabi's Geopolitics and Ecology of Himalayan Water Project (GEHW) was founded to both study and raise awareness on this underreported crisis that threatens the stability and livelihood of 2.5 billion people. After all, the 15,000 Himalayan glaciers supply the water of Asia's major rivers, including the Ganges, Yangtze, and Yellow River.

The Himalayan Water Project was designed as a teaching lab that forges interdisciplinary connections and draws parallels across a wide range of human-environment problems.

The Project, born during the pandemic, originated after a Zoom call between Global Distinguished Professor Sophia Kalantzakos, Kunda Dixit, publisher of the *Nepali Times*, and NYUAD alumni working in sustainability.

It was clear that although the Himalayan hotspot constitutes a major security threat to global stability, it has been egregiously overlooked. The initiative spotlights the urgency of the problem, raises awareness, produces and showcases research, and brings together a network of experts to foster momentum for policy action.

"We hope that this project offers a salient example of how finding inclusive and equitable solutions to the climate crisis requires new, more open-minded, and interdisciplinary thinking to guide us forward and take action."

—
Sophia Kalantzakos
Global Distinguished Professor

Himalayan glaciers are melting at an unprecedented rate. Forming more than 200 lakes in a precarious seismic region. Any glacial lake outburst flood (GLOF) could wreak havoc downstream forming an inland tsunami that would "wipe out entire areas" of these densely populated countries.

The Himalaya-Hindu Kush mountain ranges also act as a gigantic sponge that stores water, but this ground water reservoir is being depleted, making springs and streams go dry. This enormous mountain range serves as a weather-maker, trapping the monsoon's atmospheric rivers.

"The region is facing the perfect storm that is causing instability in many already fragile states and could result in both intrastate conflict and interstate competition leading to violence. This is a crisis of gigantic proportions," Kalantzakos said.

Tense diplomatic relations between the largest countries of the region - India, China, and Pakistan — compound the problem as they share water supplies and are racing to control and dam them, recognizing the looming catastrophe ahead.

The Himalayan Water Project is an Arts and Humanities-led initiative which in the world of climate change research, is a rarity. Kalantzakos emphasizes that tackling the climate crisis necessitates innovative interdisciplinary thinking.

"The scientists have given us the necessary information, but attempting to solve the problem solely through technology and engineering will fail. It represents siloed thinking when we need a holistic approach," she said.

"The Arts and Humanities are about understanding the world we live in conceptually. They pose the big existential questions and help explain the logic behind the pathways we have thus far taken. They question humanity's choices and propose new ways to think about the future. Once we establish what we are trying to accomplish, what is the equation we are solving for, then the sciences can offer us the information necessary to guide us."

This is what she calls reversing the order of the process. A key aim for the initiative is to provide space for the plethora of societal voices and for different kinds of knowledge production to come together. GEHW has organized webinars and conferences, recorded podcasts, written op-eds and articles, developed a library of resources, and devoted much attention to experiential learning and knowledge sharing. Educating the next generation of leaders and instilling them with a sense of purpose to tackle the climate crisis is a top priority.

During J-Term 2023, NYUAD students traveled to Nepal as scholars to research and experience first-hand the complex challenges facing the region. But Kalantzakos and Dixit also felt that students should have the opportunity to "fall in love with the Himalayas," in order to better understand what is at stake.

"We designed the classes to be interdisciplinary, so we not only incorporated geopolitics, media, science, history, but also curated a program that awakened the senses. In Kathmandu, we organized a conference of leading seismologists, artists, and policy-makers, but students also photographed, painted, trekked, tasted traditional food, bird-watched and marveled at seeing the mountains reveal themselves every afternoon after the pollution cleared to offer spectacular views of the glistening peaks," Kalantzakos said.

"We hope that this project offers a salient example of how finding inclusive and equitable solutions to the climate crisis requires new, more open-minded, and interdisciplinary thinking to guide us forward and take action," she said.

“In one class, I even organized a pretend Arabic wedding, with a band and dancing, to help students build their familiarity.”

—

Nasser Isleem
Senior Lecturer of Arabic

NO LONGER LOST IN TRANSLATION

Non-Arabic speakers making efforts to learn the language that can help bridge the cultural divide.

If you win an award for Teaching Innovation, as Senior Lecturer of Arabic Nasser Isleem did for NYU Abu Dhabi in 2021, then you know you must be doing something right. Out of all the accolades Isleem has won throughout his career for teaching Arabic to students, this one seems particularly special.

“It’s the first time anyone from Arts and Humanities has won this award,” he says.

Isleem’s career is full of firsts, writing textbooks that explore new ways of teaching the Arabic language and culture. “I’ve authored maybe 15 or 16 books now, I forget the exact number,” he laughs. “There are storybooks for children, and books I’m able to teach in my classes. One that gained publicity a few years ago was *Ramsah*, the first modern standard language textbook for the Emirati dialect.”

Exploring the language from various angles is at the heart of Isleem’s research. Currently, he is working on a book that explores Quranic Arabic – the first work that really explores the language of the Quran from a linguistics perspective. A central aim of the book is to simplify the language to the extent that students can absorb the meaning.

Isleem tackles the Arabic language from a range of perspectives in his teachings and his books. Often he will attribute it to a particular subject, such as the Quran, or Arabic films, artwork and music, or teach a specific dialect, such as Jordanian, Egyptian, Emirati, Levantine, or his native Palestinian. Some books are supplied with audio and video content, and suggest roleplaying to aid learning.

In particular, Isleem sees his work as helping to raise the awareness of Arabic traditions among those who might be unfamiliar. “When I taught in the US, I found this very important,” he says. “Particularly when I celebrated Ramadan with my family, it seemed unusual to a lot of people. I would organize gatherings, so students, professors, and neighbors could come to my house and celebrate with us. In one class, I even organized a pretend Arabic wedding, with a band and dancing, to help students build their familiarity.”

This approach has extended to his teachings at NYUAD. “In 2014, I established a programme with the Office of Global Education, where I take students who have finished three semesters of Modern Standard Arabic, and they live with an Emirati family for a short period, immersing themselves in the culture,” he says. “At first, it was difficult to find families willing to take part, welcoming a student into their home, so we built it slowly, and now it is easier to recruit host families. It became so popular, and we haven’t had a single bad experience, with so much generosity and willingness to learn.”

In his classes, Isleem invites guest speakers from all corners of Arabic society, old and young, with museum visits and field trips, and he even arranges for students to play basketball with the UAE national team. Isleem has also set up a number of online resources for instructors and those learning Arabic at any level.

In a career of firsts, what might this Arabic language expert be planning next? “I hope the Quranic Arabic project will become a series,” he said. “The volume I’m working on now is for intermediates, but I’d like to share my approach with novices and children. I have two granddaughters living in the US, and the eldest is just one. So by the time she starts reading, I’d love to have that ready for her.”

EVERYDAY LIFE IN THE SPECTACULAR CITY: Making Home in Dubai

Rana AlMutawa's ethnographic research challenges the perception of Dubai as a "superficial" and "alienating" city, exploring how it fosters meaning and belonging in unexpected places.

Dubai is a city that captures the world's attention. With its iconic hotels, sprawling shopping malls, and ambitious feats of architecture, it has become a symbol of modernity and luxury that has attracted a huge population of expats. But with the headlines come preconceptions, and the city – which is home to over 200 nationalities – often gets a rough ride for its "superficiality."

For Assistant Professor of Social Research and Public Policy at NYU Abu Dhabi Rana AlMutawa, the "fake debate" is one that urgently needs addressing. Her upcoming book *Everyday Life in the Spectacular City: Making Home in Dubai* is set to challenge the way people think of Dubai, and help locals and residents find meaning in the city's so-called superficial spaces.

"There's a lot of literature that talks about how Dubai is alienating and isolating because it is spectacular and rapidly changing," said AlMutawa. "People say it's a neoliberal city that is built to generate profit. But people also build relationships with the city and form belonging and meaning in places that are often considered to be alienating."

A Dubai-raised Emirati who has lived in London, New York, and Tokyo, AlMutawa has a unique perspective of life in her home emirate. Her research was inspired by her own experience of Dubai, though she embarked on her ethnography as part of her PhD thesis at the University of Oxford in 2017.

NYU ABU DHABI

"People look at New York and say it's cosmopolitan and globalized but when they come to Dubai, they say there's no culture precisely because of that cosmopolitanism and globalization. When diversity exists in a place like Dubai it's seen as inauthentic."

—
Rana AlMutawa
Assistant Professor of Social Research and Public Policy

Since then, the project has evolved as an urban ethnography of middle-class citizens and long-term residents in Dubai, which is due to be released in January 2024. While analyzing Dubai's residents, the book investigates the city itself, exploring how its perceived inauthenticity marks it as inferior to its global counterparts. In her research, AlMutawa points out the contradictions that occur when describing Dubai.

"Cities like New York are contrasted with cities like Dubai, with New York being depicted as more authentic and Dubai as superficial," she said. "People look at New York and say it's cosmopolitan and globalized but when they come to Dubai, they say there's no culture precisely because of that cosmopolitanism and globalization. When diversity exists in a place like Dubai it's seen as inauthentic."

AlMutawa explores integration and segregation extensively in her book, investigating how immigrants create a sense of home and belonging both by accepting and rejecting new cultures. Each chapter examines themes of authenticity, belonging,
and agency.

"One theory is that Emiratis feel alienated in their own city because there are so many foreigners that they no longer feel a sense of home," said AlMutawa. "I've read literature that says Emiratis aren't happy about the way the city is progressing and I've heard comments in everyday life, but the reality is much more complex than that."

"What I'm trying to show is that people's experiences of the city are multi-dimensional and their feelings are complex and contradictory," she said.

Now, with the book in its final stages, AlMutawa is hoping that the perception of the UAE will evolve, both abroad and closer to home.

"I want to challenge these ideas of authenticity and superficiality because there is a lot tied to them," she said. "Certain regions of the world become associated with inferiority or superiority depending on whether they are deemed authentic or not."

"Even within Dubai, there are people who go to art spaces or grassroots events and look down at these neoliberal spaces such as shopping malls. I'm trying to challenge these ideas of what is authentic and what is fake and what is meaningful and what's not."

In the future, AlMutawa believes that whatever happens, Dubai residents will find a way to relate to their city, whether that means posing in a shopping mall or drinking tea in a majlis.

"I think people will always find ways to find meaning in their communities and everyday lives no matter what their environment is," she said. "The way they go about it will change but that's the thing that will always remain constant."

Solving the Riddles of Space and Time

From explaining how asteroids orbit Jupiter to free-floating planets and a twin Earth, Nikolaos Georgakarakos is uncovering the secrets of the Solar System and beyond.

"I helped to develop a mathematical framework a few years back that identified so-called 'Habitable Zones' in five known exoplanet systems with two stars, between 2,764 and 5,933 light years from Earth, potentially capable of supporting life."

"They want answers, explanations. Astronomy is something that gets people excited."

Nikolaos Georgakarakos
Research Associate

While most of the world's media debates whether or not man will set foot on Mars, or if billionaires will ever colonize outer space, academics such as Nikolaos Georgakarakos work tirelessly behind the scenes, answering the space questions we didn't know we needed answers to.

As a research associate at NYU Abu Dhabi, Georgakarakos was recently part of a project concerning two of Jupiter s asteroid swarms which had baffled scientists for years. "They couldn't work out why there was a significant difference in the numbers of asteroids between the two groups," Georgakarakos explains. "Both orbit Jupiter as it orbits the sun, in near-identical pathways.

In a paper published in the journal *Astronomy & Astrophysics,* Georgakarakos and an international team of scientists explain why one swarm has about 1.6 times the asteroids of the other, and possibly different evolution paths for each. "I joined the project rather late, but it is well related to the work I did in my PhD and in the years that followed," says Georgakarakos. "I come from a mathematics and physics background, but became very interested in astronomy. My PhD explored the three-body problem, and the dynamics resulting from three 'bodies' interacting with one another, such as the Sun, the Earth, and the Moon. I applied my theories to Jupiter and its asteroid swarms, helping to explain this asymmetry.

Georgakarakos says that attending seminars and conferences all over the world, giving talks and meeting colleagues, inevitably led to collaborating in projects such as this, which involve peers from the US, Japan, and China. "I like to see where I'm able to use my knowledge, and you become inspired by different problems," he says.

More space-related confusion looks set to be resolved as part of another upcoming paper concerning free-floating planets. "The formation of planetary systems can be quite violent, with planets forming, colliding, and being expelled, traveling from one system to the next," he said.

With his theoretical work, Georgakarakos describes the large number of simulations required to arrive at the mechanisms designed to present an explanation and commends the computational processing power on offer at NYUAD. Maybe his work will even reveal the location of a possible twin Earth. "I helped to develop a mathematical framework a few years back that identified so-called 'Habitable Zones' in five known exoplanet systems with two stars, between 2,764 and 5,933 light years from Earth, potentially capable of supporting life," Georgakarakos explains.

"Liquid water, important for life as we know it, could persist on the surface of a planet in these zones. Scientists have only identified giant exoplanets in these systems so far, but it s possible that smaller, Earth-like planets might exist.

Georgakarakos plans to contribute to more papers and mechanisms and hopefully solve even more galactic mysteries. "It s very interesting to people," he says. "They want answers, explanations. Astronomy is something that gets people excited.

THE WORLD'S CHANGING TECHNOLOGICAL LANDSCAPE

For NYU Abu Dhabi's Associate Professor of Computer Science, Azza Abouzied, it is about navigating more data and battling misinformation.

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Technology advances at such a rate these days, that even when she first joined NYU Abu Dhabi in 2013, associate professor of computer science Azza Abouzied was looking at a very different digital landscape.

"Lately, I've been focused on building tools that help people make decisions with data," she says. "Just this morning, I was discussing with my team about how we can help people mitigate or respond to disinformation online. How should they react? Should they block the user or ignore the post? These kinds of decisions are supported by the tools we're making, based on the data available from similar posts in the past, and the scenarios and behaviors that developed."

Decision-making tools can help in other circumstances too. "Say you wanted to buy stocks," Abouzied continues. "To a certain degree, based on company history or market circumstances, these tools can predict the stocks that might rise in the future, sifting through lots of different data, presenting a combination of predictions."

In terms of where end users can find the tools created by Abouzied and her team, there is no limit to where her work will crop up next. "With a lot of our systems, we offer them as open-source software, so anyone can find and integrate our tools," she says. "Some companies may approach us directly, or we might demonstrate how a collaborative decision-making tool has been helpful in certain scenarios, such as renting out properties, showing it to a company that wants to help people make restaurant bookings, for example."

Abouzied was even able to offer these tools as part of the UAE's response to COVID-19. "We collaborated with the Department of Health, and if you think back to that time, you had lockdowns and periods of wearing masks," she says. "How do you control all of that while ramping up the vaccine distribution? What actions can you take? It's similar in many ways to the stock portfolio optimization problem, weighing up the variables and comparing different approaches. We provided the tools, and hosted training workshops to show how policymakers can benefit."

As technology becomes more advanced, does it actually increase the amount of data available, making the ability to handle and make use of it more challenging? Abouzied agrees. "More data can make decisions harder to arrive at, and more complex for lots of people," she says. "But often data plays into these predictive models, and more of it means more accurate forecasts. The problem is that options are increasing too. You might want to predict the financial performance of tech companies, for example, which can happen if you have data related to them, but you might also need to consider start-ups, for which data is scarce. Data can give us a good idea of behaviors, but there's uncertainty in situations where we have little information to work with."

Keeping up with technological trends and developments, and the social media platforms and software that people are using, is another ongoing challenge. "ChatGPT is something we've been discussing a lot lately," says Abouzied. "It can frame arguments in a way that is very convincing, not rigid or templated, which makes it a powerful tool in terms of spreading disinformation, and a person's ability to spot it and react to it."

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But while Abouzied is keen to support a person's own decision-making process, she does not see digital tools as a replacement for that. "It's about making data-driven decisions from good models, with good predictions, and feeling confident about what these tools are telling you," she explains. "And there's no doubt that it can be useful".

"Data can help someone decide where in Abu Dhabi they should live, based on affordability, how likely the price in that area will increase or decrease, and help them better plan. And with the government and city planners, what will growth be like in the next five years or 10 years, based on different factors? I'm involved with the Center for Interacting Urban Networks at NYU Abu Dhabi, looking at the main challenges facing the city, and how we can use our research, current trends and recent data, to make decisions."

In addition to offering predictions, the tools can offer worst-case scenarios, and suggest what might happen in those circumstances. "If you're trying to rent out a property, it can be frustrating to get a simplified plan from an agent, rather than a whole list of scenarios and ideas you can interact with, and then adjust and make changes to them based on the seasons or major events," Abouzied adds. "You might be able to attract new customers, or set the price differently, achieving more profit. The big thing for me is being able to make the best decisions possible, and building the tools and interfaces to enable that."