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KUST Review is dedicated to publishing authoritative, reliable and accessible information about science, innovation and technology news and trends. Although we report on news from around the world, we highlight advances, innovators and topics of interest from the Middle East and North Africa region. Our mission is to spread knowledge of and enthusiasm for science and technology in the Arab world and beyond through responsible and trustworthy journalism.

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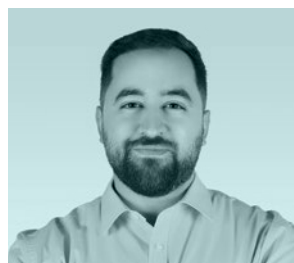
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LETTER FROM THE EDITOR

Language is how humans connect.

Other species have learned to communicate with each other, but as far as we know humans are alone in mastering cognitive language communication to share complex thoughts, feelings and concepts.

Language also helps determine how we view the world around us. It is the tool we use to build – and sometimes tear apart – civilizations. There are about 7,000 unique spoken languages in the world. Each one helps preserve the identity, history and culture of the people who speak it.

In short: Languages make us who we are and who we might become. That's why in this issue of *KUST Review* we take a closer look at the science of language and communication, not just the human languages we speak but the unspoken languages of bodies, rhythm, nature and more.

Senior science writer Jade Sterling writes about how museums are rethinking the way they communicate often complex subjects to the everyday people they serve. Writer Maggie Kinsella investigates how technology can help families better connect with non-verbal autistic children. Editor Suzanne Condie Lambert talks with a musician who translates natural processes and human DNA into music.



And our guest columnists explore how the COVID-19 epidemic interfered with how small children developed language skills.

Of course, you'll also find more of the stunning design and illustrations you've come to expect from the Middle East's premier science and technology magazine.

You'll find even more in these pages, on our website, www.KUSTReview.com, and on Facebook, Instagram, LinkedIn, TikTok and YouTube @KUSTReview.

So page, click, subscribe and follow to get the best of our coverage of science in the Middle East and around the world in English and in Arabic.

As always, be informed and stay curious.

Dr. Arif Sultan Al Hammadi
KUST Review Editor-in-Chief

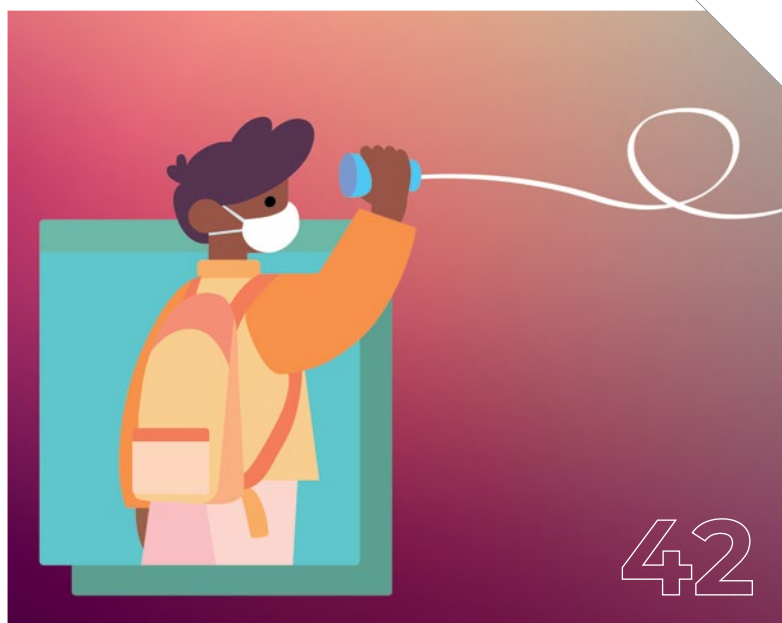
Arif Sultan Al Hammadi

IN THIS ISSUE

WE'D LIKE A **WORD**

Communication is much more than just speaking and hearing. In this issue of *KUST Review* we look deeper into why communication matters and how technology helps.

In these pages you'll read about how AI is preserving languages and cultures; why talking to aliens might be a lot harder than you might think; and how technology and art are helping us "listen" to the rhythms of nature. Our panel of experts also discusses the small things that may transform their fields – and soon.



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Language detective stories

By: Suzanne Condie Lambert

DESIGN: Rawan Chonim

Humanity gave itself a good pat on the back when the Rosetta Stone unlocked the secrets of **ancient Egyptian**. But there are still other linguistic mysteries left to solve. **Here are four:**

Rongorongo

The people who carved the giant stone heads of Easter Island also left wood tablets likely created before the arrival of Europeans. These tablets might help explain the structures' purpose. Unfortunately, few rongorongo tablets survived, and after a sharp population decline of the Rapa Nui people by the 19th century caused by European diseases and raids, no one alive could read the script. The biggest questions other than the content itself: Is rongorongo proto-writing or a complete writing system? And are the texts evidence of an independent invention of writing like that of the Chinese or the Sumerians?

The Voynich Manuscript

The handwritten manuscript, containing fantastical images and diagrams, was first documented as the possession of a 17th century Prague alchemist. It was later named after book dealer Wilfrid Voynich, who purchased it in 1912. The 250 vellum pages, however, have been carbon dated to the 15th century. Experts hypothesize that the document could be a code, a script for a natural language, a piece of fiction or even a hoax. British and American codebreakers from World Wars I and II had no luck, but Yale University, the current custodian, invites the public to have a crack.

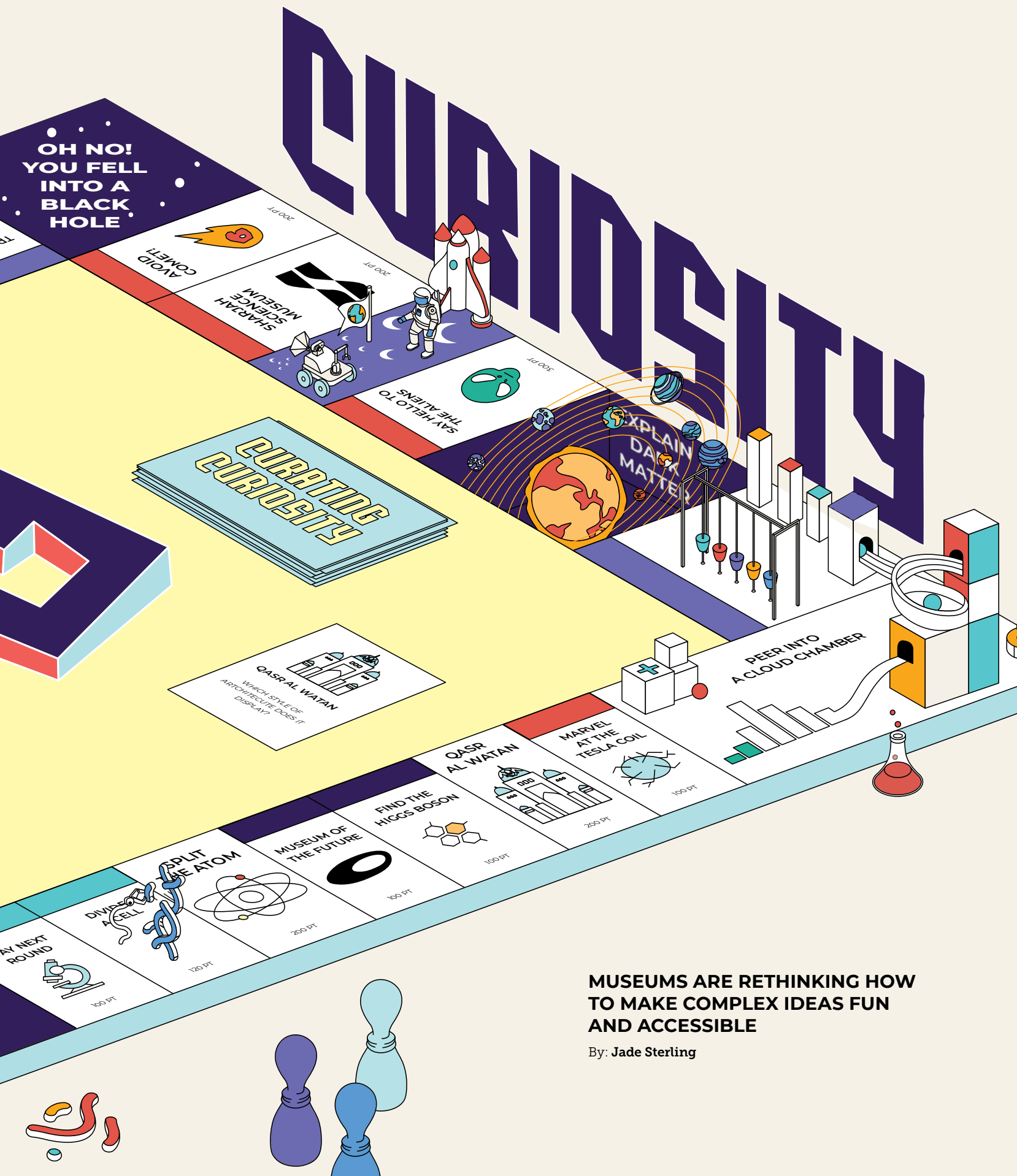
Indus Valley script

Also called Harappan, the script belonged to a civilization that spread from 3300 BCE to 1300 BCE across what is now Pakistan, northwestern India and northeast Afghanistan. About 5,000 inscribed objects such as stamp seals, pottery, bronze and copper plates, tools and weapons have been excavated since 1924. Most inscriptions are short, and there are no known bilingual inscriptions to help modern linguists solve the puzzle. The incentive to solve it is good, though: An Indian official in 2025 announced a U.S. \$1 million prize for decoding the script.

Kryptos

On the grounds of CIA headquarters in Langley, Virginia, is a sculpture by artist Jim Sanborn that contains encrypted messages. The first three have been broken since the piece was installed in 1990, but the fourth remains unsolved. A fifth message is expected to reveal itself when the other four have been broken. The sculpture is made from four large copper plates as well as water, wood, plants, red and green granite, white quartz and petrified wood. A prominent feature of the piece is a large vertical S-shaped copper screen that looks like a scroll or paper emerging from a printer.





**MUSEUMS ARE RETHINKING HOW
TO MAKE COMPLEX IDEAS FUN
AND ACCESSIBLE**

By: Jade Sterling

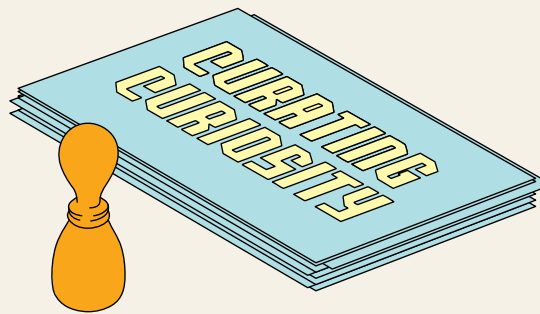
Fill a room with hundreds of pinned butterflies, and most people can admire the colors and patterns and leave having had their fill of beauty. But explaining how these patterns emerge, why butterfly wings have such luster and variability and how a species has evolved requires more thought.

Museums and science centers need to carefully consider how to get this information across to people from all backgrounds. That's where things can get tricky.

"What are museums for?" asks the UNESCO International Council of Museums' "Running a Museum: A Practical Handbook." "What is the purpose of all the efforts in collecting, restoring and displaying objects? It is certainly not merely an occupational therapy for curators or those who do research in the field. It is also not only about the pride in representing the culture of a nation or of the world's common heritage. In fact, this is undertaken in order to make the museum's knowledge and collections known to the public, to people of all ages and backgrounds, and to let them participate in knowledge and culture."

In 2012, an extensive study completed by The Museum Group noted that, "Museums, with their real artifacts, dioramas and immersive exhibitions, provide a uniquely positive environment to foster learning by young children."

While the study cites children as an example, visiting an environment with a vast collection of stories and artifacts from many cultures can enrich the minds of any age. "Learning suffuses almost every moment of our daily lives," writes David Anderson in a 2021 report to the U.K. Department for Culture,



Media and Sport. In "A Common Wealth: Museums in the Learning Age," he calls museums "universal educational institutions of immense expressive power and authority" and says they play a crucial role as public learning centers in fostering the skills of children and adults.

The writers of the UNESCO International Council of Museums' handbook agree: "Continuing education for people of all ages ... can take place in museums. Education should be regarded as one of the main goals in the museum's policy."

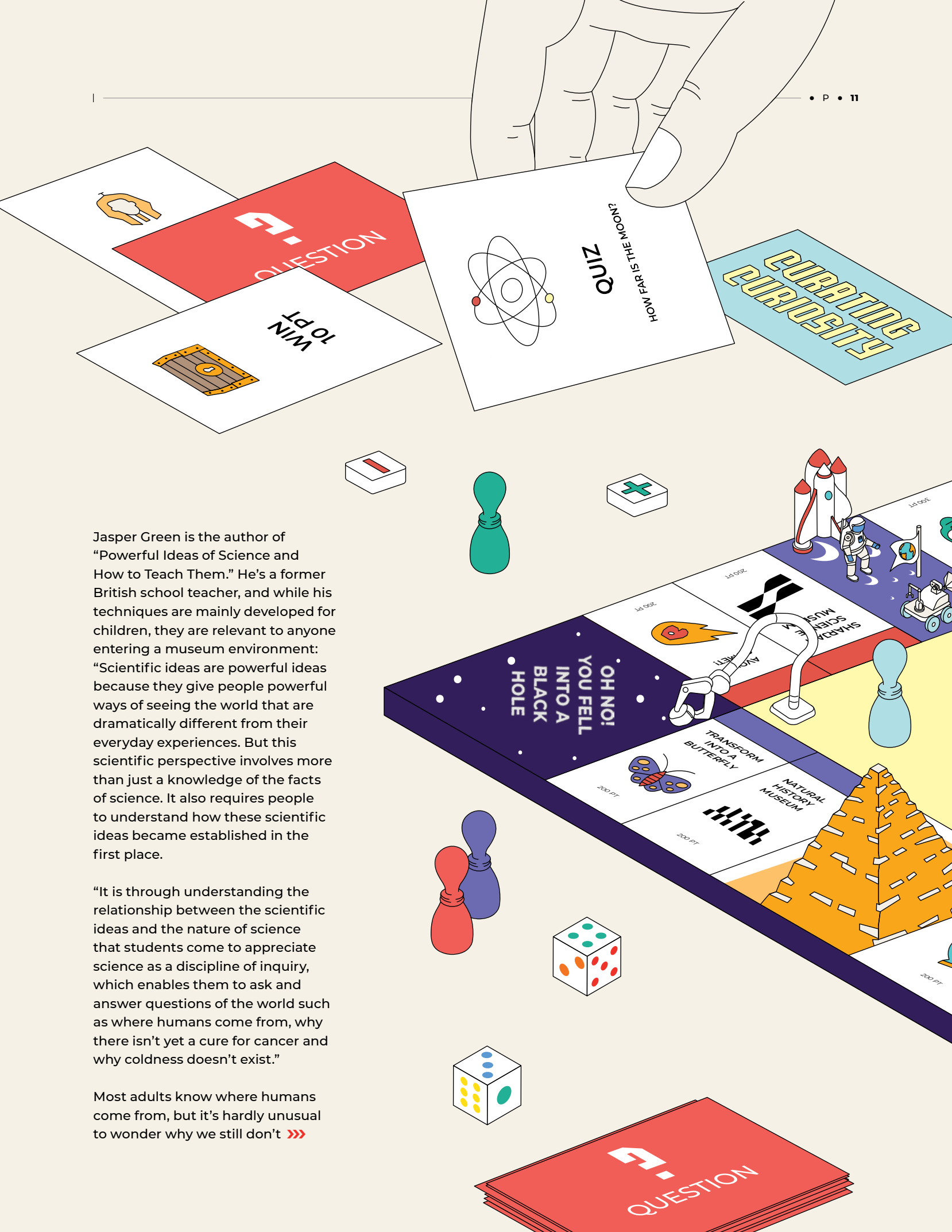
Paige Brown Jarreau, a Ph.D. in biomedical engineering, realized she loved communicating about her research just as much as (or more than) working at the lab bench. Since 2011, she's maintained the blog From the Lab Bench and advocates for science communication. Brown Jarreau says science museums are an "incredibly valuable" resource for public education and engagement: "Let's face it," she says, "there aren't many instances of high school students and members of

the general public walking into science labs on university campuses to experience science in action. But in the museum environment, museumgoers can interact with live exhibits and gaze into glass laboratories where scientists are dusting off dinosaur bones, extracting DNA from leafhopper insects, and remotely tracking bird migration across the continent."

LIFELONG LEARNING

Museums are education institutions in their own right, offering engagement through experience, and, crucially, open to all.

John Falk, professor of science education at Oregon State University, explains the role of the science museum in providing educational opportunities in the United States in particular: "There is a growing appreciation that Americans learn most of what they know about science outside of school. Institutions like science museums can play an important part in that."



Jasper Green is the author of "Powerful Ideas of Science and How to Teach Them." He's a former British school teacher, and while his techniques are mainly developed for children, they are relevant to anyone entering a museum environment: "Scientific ideas are powerful ideas because they give people powerful ways of seeing the world that are dramatically different from their everyday experiences. But this scientific perspective involves more than just a knowledge of the facts of science. It also requires people to understand how these scientific ideas became established in the first place.

"It is through understanding the relationship between the scientific ideas and the nature of science that students come to appreciate science as a discipline of inquiry, which enables them to ask and answer questions of the world such as where humans come from, why there isn't yet a cure for cancer and why coldness doesn't exist."

Most adults know where humans come from, but it's hardly unusual to wonder why we still don't >>>

“EVERYONE HAS THE RIGHT FREELY TO PARTICIPATE IN THE CULTURAL LIFE OF THE COMMUNITY, TO ENJOY THE ARTS AND TO SHARE IN SCIENTIFIC ADVANCEMENT AND ITS BENEFITS.”

Article 27 of the Universal Declaration of Human Rights



have a cure for cancer despite all the research and knowledge. The fact that there's no such thing as coldness would also appear counterintuitive to even the most rational adult: We feel cold, how can it not exist?

"Scientific ideas and practices are radically different from intuitive, everyday thinking," Green says. "And that means they can be hard to learn and tricky to teach."

Margherita Sani, a project coordinator at the Network of European Museum Organisations, says accessibility is a multifaceted concept with many dimensions: "In all cases, museums should be aware of the circumstances that impede people's participation and the full enjoyment of their collections and should make an effort to remove them, in order to promote equal access to all."

By considering the general public a key audience, researchers can generate more enthusiasm, trust and even funding for science. Science Museum Group U.K. encompasses six of the largest museums in the United Kingdom.

Central to all of them, says Beth Hawkins from Science Museum Group U.K., is helping people see that science is not just for scientists.

"We show how science is relevant and valuable for everyday life and make links between people and science. Our museums reveal stories of passion, imagination and creativity of the people who have shaped the world we live in.

Visitors can explore the social impact of science and technology through the experiences and emotions of the innovators and the users and see the breadth

and diversity of the people who use science in their work and everyday lives."

Blogger Brown Jarreau also thinks this is an opportunity for science museums to aim beyond just education to citizen-science programs: "While it's great for scientists to be able to leave jargon behind and talk to the public, I think this should be only the beginning of museum efforts to engage the public in science. Interactive museum exhibits and citizen-science projects, where community members are encouraged, for example, to bring in samples from their backgrounds for museum scientists to analyze, get a bit closer to the goals I think science centers should have in mind."

"There are many different reasons why museums and science centers are such great places for engaging people with science," Hawkins says.

"With awe-inspiring authentic objects, cutting-edge science stories, and hands-on experiences, our museums celebrate and connect the past, present and future of science and technology.

"By presenting science content in surprising and imaginative ways, our experiences expose new perspectives of science and technology to inspire all our audiences."

The surprising and the imaginative are tools of the trade for Geoff Thatcher, who designs and develops experiences for museums and attractions around the world.

In the UAE he and his team have developed concepts for Qasr al Watan, a palace turned museum, and the Warner Bros. World theme park.

For Thatcher, it's all about transforming science into an experience.

"The best science experiences are all based on simple ideas and simple stories that help you connect with science in a fun way," he tells *KUST Review*. "There's no place for a traditional, dry approach to education these days. In fact, there's never been a place for it! Think of the best teacher you ever had: They make learning more interesting and that hasn't changed. Is there a place for artifacts? Sure — they're wonderful! I want to see artifacts! But we have to figure out ways to make it more interesting. The content may be very dry and academic but it's all in the way you present it. One of the most powerful things you can do is surprise people."

ACCESSIBILITY FOR ALL ABILITIES

"Too often, text for panels, labels and captions are written by specialists for specialists, overestimating the basic knowledge of the general public," says the European museums group's Sani. "Interpretation doesn't only mean writing in clear, simple language, using an appropriate font and easy-to-read colors. It also means developing a narrative which tells about the culture that produced the objects, the contexts from which they originate, and their meaning in contemporary societies."

This is Thatcher's main point too: "In designing any exhibit, we have to figure out the story," he says. "We have to simplify science into a story and then turn that into a physical attraction. He offers the example >>>

of the Al Ain Zoo in Abu Dhabi, saying the most important thing to consider is “the enduring idea that the zoo is based upon.” For the people working at Al Ain Zoo, that enduring idea was conservation. “We simplified the story of the Al Ain Zoo down to one word: family,” Thatcher says.

“That doesn’t sound very science-y, but conservation is part of the family heritage in the UAE. Conservation is part of the legacy, and families in harmony thrive just as nature in harmony thrives. From there, we just started brainstorming. You want to find a story, an emotional takeaway, and then transform it into an experience and understanding.”

Thatcher talks about an exhibit he put together to teach energy-conservation principles. To make sure people — especially children — were able to engage with the concepts, he installed a mini golf course where each hole taught a different principle:

“Yes, you could play a round of mini golf and not learn anything, but the goal was that a child would be playing with somebody, and as they’re playing, we’re fostering conversation around science. When designing an experience, I do it with the mindset that I am providing an educator — a teacher, curator, volunteer, parent figure, big sister — with a tool that can help them teach.

“The best education happens face-to-face, and the very best education happens when a parent talks to their child in a museum exhibit about what they’ve just experienced.”

Thatcher wants to provide tools to teach in all his displays and exhibits,

not just lessons. “Think of the Tesla coil installed in many a science museum around the world,” he says. “A Tesla coil is just a light show, it’s just special effects, and you could put that to music and it would be no different to going to a rock concert: You’d learn nothing. But we provide these tools for educators to use that experience to teach.”

DUMBING SCIENCE DOWN

Monica Metzler, executive director of the Illinois Science Council, says when communicating science, few researchers speak about their actual research — this level of detail is too much for most audiences:

“Sometimes, communicating science means zooming out to get to the right level, and sometimes it means talking about a different subject entirely.”

Here she’s recalling a time when a researcher who studies depression gave a public talk about happiness, in part because people are more likely to come to an uplifting talk.

Thatcher laughs at the idea of dumbing it down: “Why is that a bad thing? We all have a different level of education — it’s not a bad thing to dumb down science so I can understand it, so a child can understand it.”

Metzler also recommends not worrying about “dumbing science down”: “All people — from mechanics to hairdressers — simplify their messages to get points across. It does not degrade science to do this,” she says. And as Thatcher points out, “dumbing down science works if it sparks curiosity.”

THE SCIENTIFIC TAKEAWAY

“The holy grail of science museums is not to provide someone all the knowledge they need, but to inspire them, to become a launching point,” says Oregon State’s Falk.

Thatcher wants the experience of his exhibits to persist long after you’ve left the museum: “My goal is at dinner, or in the car on the way home, you’re still talking about what you’ve experienced. We want people to be curious, we want them to explore, we want them to be surprised.”

For Hawkins, from Science Museum Group U.K., museums are great places for science engagement because the best exhibits encourage people to talk science:

“We design our experiences to get visitors talking, to share their ideas and opinions about science with us and each other, in and beyond our museums. We invite our visitors to tell us their own ‘science stories’ from their lives and local communities. By helping more people to see that museums are places where they feel welcome and can enjoy themselves, we hope we will promote a lifelong connection with science and culture.”

Tilly Blythe, head of collections and principal curator at the Science Museum U.K., gets the last word:

“Science is embedded in the world around us, and only by seeing science as part of our broader culture can we begin to understand and interpret it in the rich and multifaceted way it deserves.” ●

ILLUSTRATIONS: Abjad Design



Human interests

By: **Suzanne Condie Lambert**

Daniël van Tonder and the team that designed the Body Museum at Khalifa University had an unusual challenge: Make the plastinated displays of real human bodies and body parts accessible while honoring the donors' dignity.

Depending on the viewer, it could be "walking either into a horror house or into a fantastic body exploration," van Tonder says.

In the end, the team chose to use simple language suitable for school groups, curious community members or visiting medical students explaining the systems that work together to support human life and let the bodies speak for themselves.

"I think the main message is just to know what's going on and how to care for (the body) and make you more aware that you need to pay attention to these individual structures," van Tonder says.

Details: bodymuseum.ku.ac.ae

BRIDGING THE SILENCE

Tech helps non-verbal people communicate

By: Maggie Kinsella

PHOTOS: Envato
DESIGN: Abjad Design



Billy is a non-verbal 3-year-old with autism spectrum disorder (ASD). When Mom and Dad try to brush his teeth, he bites them. When they try to get him dressed, he kicks and punches. Billy is obviously unhappy, but what is he trying to say?

This scenario is all too familiar for many families learning to communicate with non-verbal members, but there is help: researchers like Ralf Schlosser.

Schlosser, assistant dean of research in the School of Clinical and Rehabilitation Sciences at Northeastern University, has spent his career researching augmentative and alternative communication (AAC) for those with severe speech, language and literacy difficulties. He specializes in helping children on the autism spectrum.

He believes families play an imperative role in developing communications technology. "Sometimes families may have an advantage over clinicians or teachers in that they are likely very familiar with their child's idiosyncratic communicative behaviors such as gestures or vocalizations and have the ability to 'read' these and respond appropriately. As a result, it may sometimes feel unnecessary to use an AAC system," he says.

But families aren't always together, and their methods may not work outside the home. These coping methods might, in fact, even hinder the child's ability to communicate beyond the family circle. This is where technology can help.

Family involvement

Oliver Wendt of Purdue University emphasizes that family and user feedback are critical in AAC development. "You can no longer

develop AAC technology without it," he says. AAC development involves co-design with direct input from users and stakeholders, usability input from families and therapists and assessments of tech used during interventions. Comments about an app's usability, like "the interface needs to be simpler" or "it was a lot to navigate," are crucial. "You need this type of feedback to fine-tune the app and ensure uptake within the community," Wendt says.

From a design perspective, technology for verbally challenged individuals isn't a one-size-fits-all solution because each person's challenges are different.

"Technology opens the doors to interact with other individuals. Use of speech output along with interaction efficiencies is going a long way to make communication possible in schools, at work and in the community," Schlosser tells *KUST Review*.

Another vital tool, Schlosser says: the "written gloss." In a symbol-based AAC app or device, there are graphic symbols like an image representing the concept "drink" or "hungry" next to a corresponding word or phrase. This helps clarify the symbol's meaning, aids in language learning and helps communication partners understand the user's message.

He says speech-generating devices and tablets with AAC-specific apps allow individuals to talk using speech, digitized and/or synthetic. Tech also offers efficiency in word retrieval, whether singular or combined into a sentence.

One such tool is GoTalkNow. GoTalkNow is a comprehensive, iPad-compatible AAC app based on the Project CORE research from the University of North Carolina's

Center for Literacy and Disability Studies. It includes core vocabulary — a collection of most of the words that make up typical daily communication that the user can customize by creating and adding pages. For those with literacy challenges, the app also includes symbols, the option to use images from the users' cameras and a built-in internet-image search.

"Record video modeling sequences to pair instruction with communication. Play music to heighten interest. Choose text-to-speech or recorded audio for message content. Jump to any communication page, even from a different communication book. Add auditory cues to allow both auditory and visual scanning. Select automatic or step scanning, adjust scanning speed, and group buttons together by row or column for more efficient scanning," the website advertises.

Skills required

Schlosser says many AAC tools require additional skill sets. Users must depend on traditional writing and spelling or understand the graphic symbols used to represent concepts. They also need to understand the tool's functionality and learn to use the program during interactions.

Schlosser says there are obstacles for end users. These include the facts that applications don't always meet all of an individual's communication needs and vocabulary selection can further overburden already busy support professionals.

"Vocabulary selection in AAC for AAC applications and speech-generating devices is generally a time-consuming process, and school-based speech-language pathologists have little time >>>

given their caseloads," Schlosser says. But it appears that AI and machine learning can help alleviate some of these issues.

A recent paper by Schlosser, Mauricio de Fontana and Christina Yu, the developers of the QuickPic AAC app that uses AI image analysis to lay out vocabulary, explores two algorithms (ChatGPT-3.5 and NLP-AAC) and found that ChatGPT-3.5 provided more relevant and accurate vocabulary. The app analyzes an image of an activity and produces relevant words represented by picture communication symbols and organizes them in left-to-right categories in this order: subject, verb, attribute, object.

"This allows creating the displays on the fly or just in time, a process that was previously unimaginable. Just-in-time supports have various cognitive advantages for the learner and allow instructors to capitalize on teachable moments. Within minutes, the clinician can then customize the display as needed," Schlosser says.

A future for wearables

Schlosser's research has recently crossed 10,000 citations (uncommon within his field). It reflects long-term influence across research, and he is excited about what AI will bring to the table in the future. The research has only scratched the surface of its impact on AAC.

He sees many opportunities for wearable technologies and has done some small studies in this area, including tools like smart watches. Researchers were concerned the watches' small size might be an issue, but the individuals in the study all responded well, he says. Another study included remote visual interventions like photos, video or text, in real-time, to assist a learner.

Schlosser also says measuring physiological responses like heart rates could also help manage anxiety and support communication. Wendt cautions that smart watches are still too expensive for many users, but he is enthusiastic about other wearables. People on the autism spectrum with verbal challenges also frequently experience sensory impairments, so the possibilities are endless as the wearables field moves away from watches and toward tech that could be directly woven into clothing, he says.

Help from AI

And as with most industries around the globe, AI will further individual targeted tech design for AAC.

"Diagnostics and prognosis will be more effective through AI. AI can compare the communication profile of a user with data from a plethora of other users with similar conditions. This will help to determine how severely someone is involved and what the prognosis/outlook is," Wendt says.

"Future AAC applications may be able to predict what vocabulary is needed by a user and then create that content right on the spot."

Innovations in AR and VR in tandem with AI will only further tech development in this space, as devices become smaller and more user-friendly, they become more cost-effective. "This will allow users to learn and interact in completely new environments that allow new opportunities to learn and grow," he tells *KUST Review*.

KU Autism study

With the increasing diagnoses of autism spectrum disorder around the world comes a desperation to understand its origins. While experts believe causation is multifaceted, researchers at Khalifa University led by Hamdan Hamdan and collaborators including Fakhri IVF Fertility Center and Baylor College of Medicine are studying the condition's genetic components.

The team has identified seven novel mutations in autistic children within the UAE population using next-generation sequencing. "The investigation aims to uncover the roles of these novel genes as well as the complex mechanistic pathways involved in ASD using advanced techniques, such as CRISPR-Cas9 gene editing and BioID," Hamdan says.

The CRISPR-Cas9 gene editing and BioID protein mapping individually have their challenges, but in combination could help identify how mutations contribute to autism and brain development. The team hopes that identifying mutations specific to the Emirati population may contribute to personalized, targeted therapies and offer important findings for global ASD research, highlighting the importance of population-specific studies in understanding the full spectrum of genetic variations associated with autism. ●





English, Arabic and mixing the two

By: **Suzanne Condie Lambert**

Spend a few minutes in nearly any public space in the United Arab Emirates and you'll hear multiple languages.

About 200 nationalities are represented in the Gulf country, and nearly 100 languages are used. English is the common tongue for most offices, stores and services. Modern Standard Arabic is the UAE's official language.

Emiratis commonly use the Khaleeji dialect at home. And even foreign-language-speaking expats tend to sprinkle Arabic words like "yalla" (hurry up) and "khalas" (finished) into their conversations.

How and why Emiratis switch between English and Arabic

interested a team from Zayed University, which surveyed 100 Emirati university students.

It found that English tends to be the primary language of education, online communication and public life.

But there isn't always a clear line between the languages.

"This kind of study is important because it gives a clear indication of how our society is evolving, how culture may be impacted and whether intervention is needed to preserve the Arabic language and Emirati dialect," says Khalifa University's Ahmed AlDhanhani, who studies social media in the local dialect to monitor public sentiment. He was not involved in the study.

"While English is essential, especially in a diverse country like the UAE where nationals need it to communicate across communities, there's also a growing need to safeguard our local culture and language.

"With today's openness, the internet, foreign entertainment and social media, maintaining the use of Arabic and the Emirati dialect is more challenging than ever. I think the biggest challenge is convincing the younger generation that holding onto their language, dialect and culture matters.

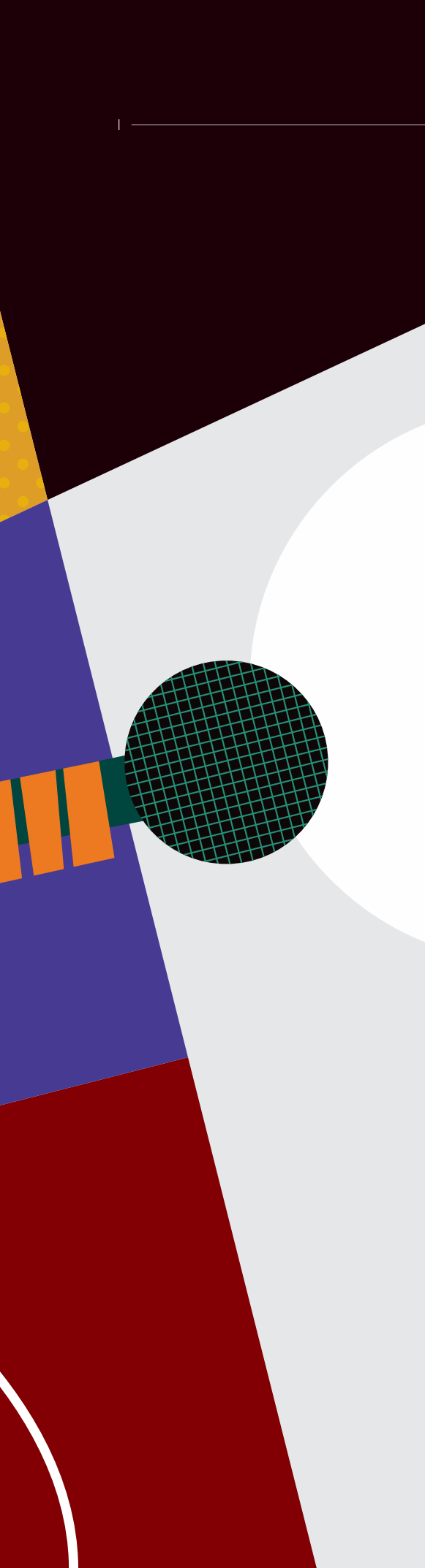
"Some may see the shift as natural progress, but in my view, that mindset risks losing an important part of our identity," AlDhanhani says.

The students often mixed English and Arabic in such forms of linguistic hybridity as translanguaging (moving fluidly between languages) and Arabizi (the chat alphabet using Latin script and Western numbers for digital communications).

Most participants said mixing languages felt natural. But a third expressed discomfort with the practice, saying it sounded unprofessional, threatened their culture or evoked colonization. The study authors, however, suggest that education could benefit from encouraging translanguaging.

"The grassroots mixing of languages, as seen in the study findings, could be viewed as a counter-discourse to rigid 'English only' expectations in English-medium universities and policies advocating 'pure and separate' language use," the authors say. "Especially in today's globalized world, the idea of 'language purity' is unsustainable as well as undesirable." ●





NATURE'S CONDUCTOR

Sam Nester explores the language of plants, earthquakes and human DNA

By: Suzanne Condie Lambert

Australian-born musician, composer and Fulbright Scholar Sam Nester has made a career for himself collaborating with scientists to turn natural patterns into sound.

He spoke with us about that work, which includes a residency with a U.S. National Park in Hawaii making music from earthquakes; using lie-detector-style technology to “listen” to plants; and, more recently, two projects as an artist-in-residence with New York University Abu Dhabi creating sound art from DNA and the Arabian Gulf’s coral reefs.

Nester and *KUST Review* started out talking about a project with a big purse and creative freedom. “That’s the dream of every artist,” Nester says.

| Q: Do you get that often?

Sometimes. I get that more and more now. Sometimes it’s, “Here’s some money, we want you to do something.” And there’s other times where it’s like, “We want this thing and let’s work on it together,” so there’s already a basis for something.

And sometimes, like in Abu Dhabi, they say, “Here is what we do, what we research, what we study, the things that interest us, and you come in and do whatever it is you want to do. Hopefully some of that will be together.”

| Q: How did your work with NYUAD start? Were you talking to faculty to find out what they were doing or did you just come in with the concept and then figure out how to make it happen?

The genome thing (“Transposon”) is one of two big projects that we worked on. The other is to do with coral reefs in the Arabian Gulf.



I get to invent an instrument that the plant will ‘play,’ but I don’t invent sheet music for it.” — Sam Nester

Right now I have a hydrophone – an underwater device with microphones – in the Arabian Gulf recording the soundscapes of the coral reefs. John Burt, a very well-known marine biologist, and I have started what is essentially the first soundscape study in the region.

We record the sound of those coral reefs and how the acoustics of them change depending on the time of the year and the heat stress. Burt can also add that as a data point in research and look at the study of how the sound of those reefs determine health for the reef itself and everything that lives on or around the reef.

In addition to that, as a sound artist and a musician, I’m listening to those things. And we’re collecting plastic from the Gulf and working with engineers at NYU to reconstitute it into discs.

We’re basically making the equivalent of vinyl discs out of ocean plastic and I’m cutting into them the sounds of these dying coral reefs, essentially the last sounds of these coral reefs encoded into the material that’s choking them.

| Q: How do you see an exhibit for that working?

There will be publications and hopefully these records will have an installation coming out. But for both of these projects, the genome one and the coral reefs project, NYU hosted their first artist-in-residence.

That happened to be me. It was new for them to have an artist in residence in the sciences.

I presented my work and basically went around to all the labs meeting scientists. The general project is with Stéphane Boissinot, the director of the Center of Genomics. His interest is in transposable elements.

What I wanted to do is find a way of turning the genome into sound. Boissinot’s focus is on the elements in genomics, repetitive things that also change.

We started looking at that and playing around with the ideas of converting genomic information into musical parameters and then building with biomathematicians a code that would allow us to feed in any genetic information.

It will churn out a MIDI file. That could be a piece of music and also a light installation.

| Q: So it’s like turning a genome into sheet music?

Yeah! Yeah. We can turn it into sheet music right now and I can go perform it. But I was also looking at turning it into sound and doing it in really scientific ways. I’m using digital software because we can have things that are played exactly for the length as they exist in the genome.

It’s also a way of saving data in sound, which we can then turn back

into data. And it's also a way for scientists to be able to look at their own work in different ways.

We can start to hear patterns in things and of course there's this idea of the art-science collaboration – looking at things that are being researched and ways artists think about things.

Hopefully we come up with something that's interesting for both disciplines.

|Q: You've done other work where you're converting natural patterns into sound. With "Arcadia," the interactive sound and light installation based on the biorhythms of plants, you have different site-specific installations. Is there a difference in the sound that you're getting from plants from different ecosystems?

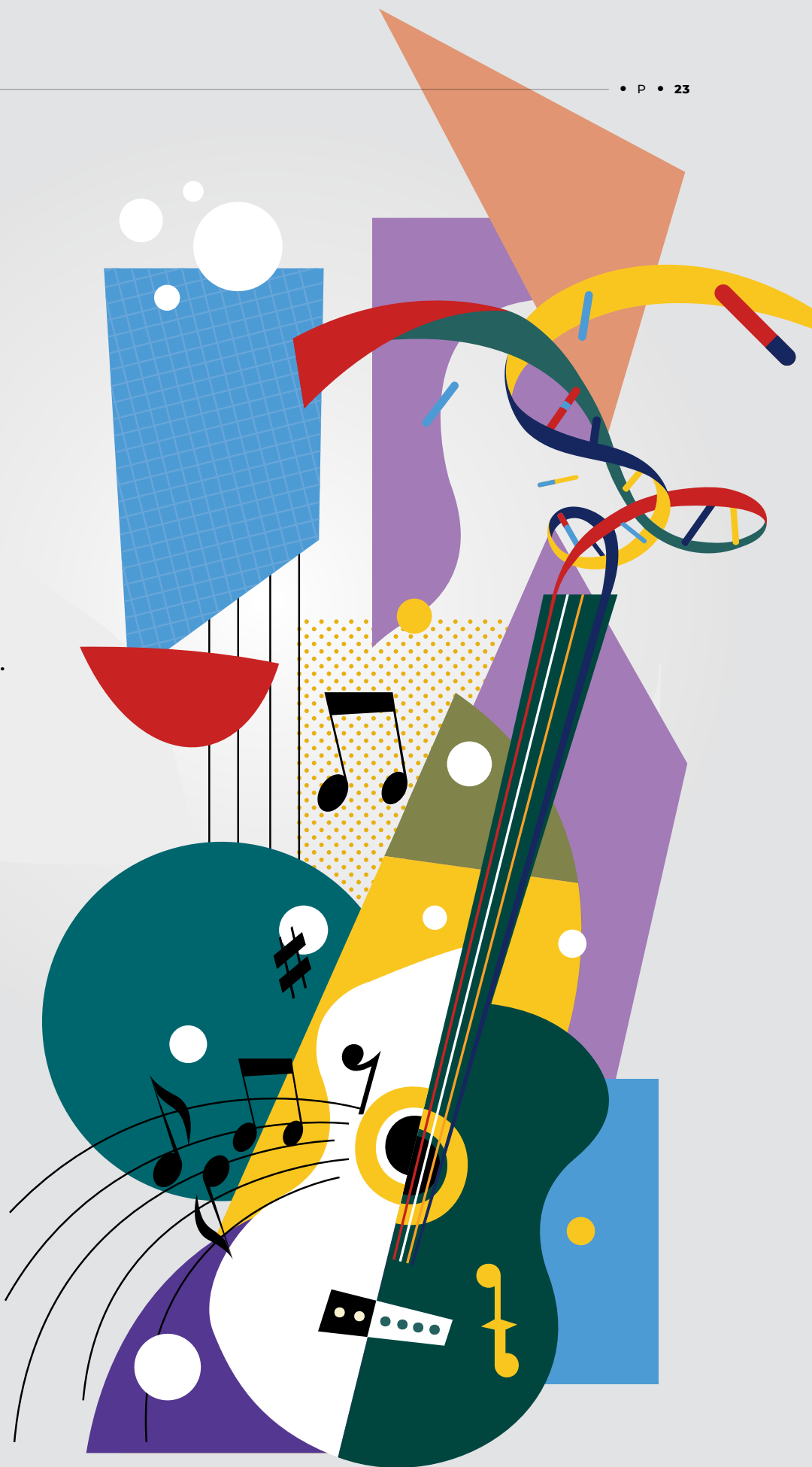
It is but maybe not the way we think about it. With "Arcadia" what it's doing is registering changes in conductivity between two points in a plant. Essentially it's a lie detector.

Those changes from one plant to another plant or ecosystem plant to ecosystem plant are different because of the frequency at which those conductivity changes occur, how strong they are and how conductive on the scale it is.

That's to do with a whole bunch of things. One of them is the change of water in an individual system.

It changes with patterns of day, night, time of the year or whether it's going through photosynthesis. Those have a lot to do with health.

I was just in a desert in China in Inner Mongolia doing something with "Arcadia." If the plant is healthy, the technology works relatively consistently. >>>





It does change from place to place but it's not like one plant sounds like a chainsaw and another sounds like a piano.

That's more my decision. I get to invent an instrument what the plant will "play," but I don't invent sheet music for it.

That was one of the big ways in which I can connect to scientists. One of the things I've done in the last eight years or so is collaborate with research scientists.

"Arcadia" was in no way a science project. I just wanted to make something that would make us think a little bit more about the rate at which things happen in plants. There are a whole bunch of biological processes in plants.

How can I convert that into something that will give wonder or awe? There's such an active part (of plant life) that we don't see. Years ago I had an installation at George Mason University of Virginia. It was designed for a year in a greenhouse

where scientists were researching medicinal and native plants. The scientists asked me if we can save the data.

So I showed them how the information came out as data, how it came out as Musical Instrument Digital Interface (MIDI).

It's basically what John Burt is looking at with coral reefs, even though that's acoustic recordings, the actual sounds of fish, shrimp, crabs and whatever lives on the reefs.

We're looking at how those acoustic patterns change depending on time of day, night or season.

The scientists at George Mason asked to see, to observe how that conductivity changes with other parameters they were looking at.

In the end they accepted it and decided maybe they could learn something from art. Which never happens. From there more and more things have happened like

working with the U.S. National Parks and scientists with the U.S. Geological Survey to turn earthquake data into sound.

| Q: What does earthquake data sound like?

It's really beautiful and interesting.

I was the artist-in-residence for Volcanoes National Park on the Big Island in Hawaii. I was collecting earthquake data, the same thing we're doing with the genome project.

I say it's the same thing, but the projects are obviously very different. The idea is the same – taking the data itself and converting three-and-a-half weeks of earthquakes into sound, into a playable score.

Earthquakes are happening all the time, not just the ones you feel. It was an idea that came from being there. I felt an earthquake, looked it up and realized there were tens of them before and hundreds happening after in the same place.

Of course, we don't feel them day to day, but it's fascinating because all of them are contributing to the shape and size of Hawaii and also the placement of our continents.

The project "Rifts" was amplifying something we didn't hear into a way that you could maybe understand that there is so much hidden natural rhythm. That's a lot of what I look at. I amplify the hidden rhythms in nature.

So I created this piece and when you hear the instruments that are playing and how loud they're playing and how long they're playing, each relating specifically to an earthquake and to the positioning we have in the data.

| Q: Is there a rhythm in nature that you really want to explore next?

Yeah, there are a couple of things I'm interested in. I have a commission for a new piece for live performance in Houston, Texas, at a cistern.

There's a 15-million-gallon cistern (underground water storage tank). Other than the live performance, I'm looking at creating a light installation controlled by parameters of water data. Most of it is what I'm looking at with Antarctic ice melts.

Other natural rhythms I'm interested in are moonquakes, which I only learned about about a year ago. I want to see if I can convert the quaking of the moon into a piece of music.

| Q: Say you're at one of your installations. What is the best feedback you can overhear?

The feedback I like is not necessarily "I like it" or "I dislike it," but does it make people ask more questions.

"Arcadia" is the same thing: "What is happening?" or "I wonder what my houseplant sounds like?" That's the thing that's amazing.

| Q: And now with the genome project it's "What does my genetic code sound like?"

The best feedback is the audience thinking about their fears or excitement for the future. But also the way they connect those questions and thoughts that are already bouncing around. They're all connected, of course, but there's no narrative.

The best part is when they ask questions that are not necessarily about the art anymore. The best feedback is when they start to take that and ask questions about other parts of life or existence. It tells me I'm on the right path. ●



العلوم
التكنولوجيا
الهندسة
الرياضيات

Science
Technology
Engineering
Mathematics

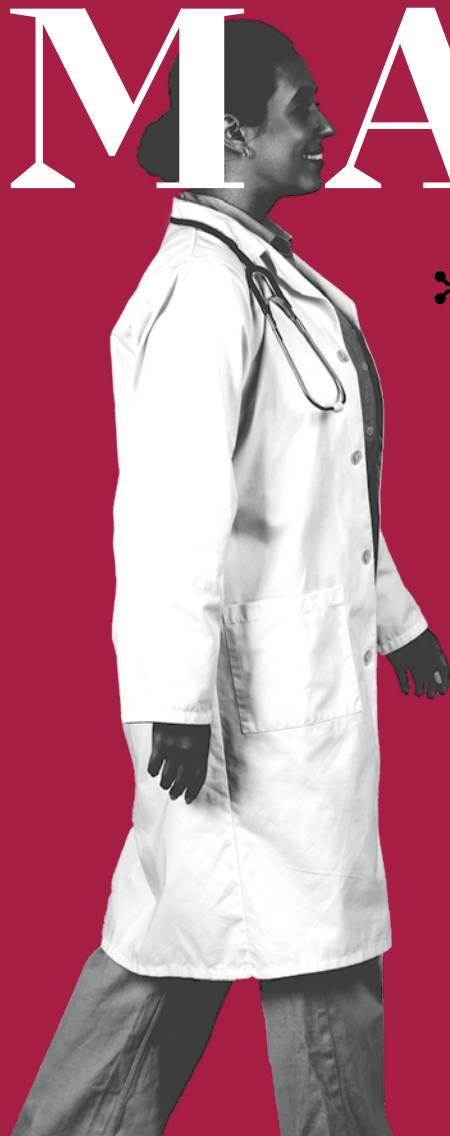
WHY SCIENTISTS, ENGINEERS AND
TECH LEADERS **NEED STRONGER**
BRAND NARRATIVES

By: Alwaleed Osman
DESIGN: Abjad Design

MAKING



STEM
SPEAK



In an era when ideas travel faster than ever and public perception can shape the future of innovation, technical expertise alone is no longer enough for success in the world of science, technology, engineering and mathematics (STEM).

Whether you're an academic researcher, an engineer launching new technologies, or a leader steering a tech organization, your reputation is one of your most valuable — and vulnerable — assets.

For too long, STEM fields have treated reputation management and strategic communication as peripheral concerns, often reserved for companies' public relations teams or the occasional research press release.

But the reality is changing. Innovation now sits at the crossroads of public discourse, policy influence, ethical scrutiny and investment priorities.

Whether it's artificial intelligence reshaping global economies, biotechnology advancing at breakneck speed, or engineering breakthroughs redefining sustainability, STEM professionals today are not only creators — they are also communicators.

This shift raises an important question: If your work is set to change the world, how are you telling that story?

Public relations is about far more than managing crisis headlines or polishing resumes.

It's about shaping your professional identity and controlling the narrative before others define it for you.

In today's highly networked environment, credibility is built through clear, consistent and human-centered storytelling.

Complex ideas often fail to resonate, not because they lack value, but because the audience lacks access to them. A well-crafted brand narrative — whether personal or organizational — can bridge this gap.

Consider the most influential scientific voices of the past century.

Names like Carl Sagan, Jane Goodall and Neil deGrasse Tyson come to mind not just because of their scientific contributions, but because of their ability to communicate ideas in relatable, emotionally compelling ways.

Today's STEM landscape is even more demanding, requiring experts to navigate traditional media, social platforms, podcasts, and panel stages. Each offers an opportunity not just to educate, but to build trust and authority.

Trust, in fact, is the cornerstone of reputation, especially in a time when misinformation spreads as quickly as facts.

Whether advocating for policy changes, seeking research funding, or leading high-stakes technology projects, professionals who invest in their reputation are more likely to attract collaborators, secure investment and influence meaningful change.

A strong reputation doesn't emerge by accident; it's the result of intentional narrative building, thoughtful media engagement and a willingness to be visible and accessible to diverse audiences.



ALWALEED OSMAN is a strategic communications consultant and has a bachelor's degree in engineering from Khalifa University.

In essence, reputation is the new currency for the STEM leader. The stronger your narrative, the greater your ability to shape outcomes for your work, your organization and your industry.

By adopting communications strategies long embraced by marketers and brand builders, STEM professionals can amplify their impact and ensure their innovations don't just exist but thrive in the public imagination.

In a world increasingly defined by science and technology, the voices and faces behind the breakthroughs must be as strong and clear as the discoveries themselves. ●

SPREADING THE WORD FROM THE GRAVE

Tech helps **restore** and **preserve** dead and dying languages

By: Jade Sterling

Kangaroo is not an English word.

It comes from a language called Guugu Yimithirr, and there are only 775 people left who can speak it.

In the millennia before the British arrived, Australian Aboriginal languages thrived: Around 300 languages made Australia one of the most linguistically diverse places in the world. Now, all but 13 of them are considered "highly endangered."



7000
LANGUAGES

Worldwide, there are approximately 7,000 languages still alive and kicking. However, nearly 97 percent of the world's people speak 4 percent of the world's languages. On the other hand, **an estimated 96 percent of those 7,000 languages are spoken by just 3 percent of the world's people.**



96%
LANGUAGES

Languages are dying all over the world. But this is not a hopeless situation. People everywhere are working to document and archive the languages running out of native speakers. They are making dictionaries, recording stories and translating histories.

Even if these documentation efforts end up sat in a museum collection, their existence means someone in the future with an interest in learning the language could access the information.

The last native speaker of Cornish, or Kernewek, died in 1777 (although the last reported person to have "full knowledge of a traditional form of Cornish" was John Davey, who died in 1891). Either way, the language was dormant for at least 100 years. Yet in 2009, Cornish was removed from UNESCO's list of extinct languages.

A community push

The process started as a scholarly enterprise, but online-learning programs, community initiatives, apps and cultural attention have helped Kernewek flourish again. The Cornish Language Office estimates there are now about 400 advanced speakers and 2,000 conversational. Many thousands more have at least some knowledge of the language.

With today's digital technology, safely storing this information and turning it into computer-assisted language learning (CALL) applications is easier than ever.

When we think about "technology," we often think high-tech: the VR headsets, the artificial intelligence, the reams of binary a la "The Matrix."

But digital technologies include **audio and video conferencing, language-learning apps and even the now practically vintage CD-ROM.**

We're talking computers, not abstract, nebulous, futuristic technology. One of the first initiatives was a computer-based communications system called Te Wahapu (The Estuary), created in 1990 to revitalize the Maori language in New Zealand.

Leoki (Powerful Voice) is an electronic bulletin board system established in 1993 in the Hawaiian Indigenous language to "provide online support for Hawaiian language use in immersion schools and the broader community." >>>



3%
PEOPLE

Other Indigenous voices

In Alaska, the Lower Kuskokwim School District produced a bilingual CD-ROM in English and Yup'ik for the traditional story "How the Crane Got Blue Eyes."

A version of Windows 8 is available in Cherokee, a Native American language, and an Android app allows speakers to text using its 85 letters.

The Diyari blog was launched in 2013 to "present news and stories about Diyari language and culture." The language is from Lake Eyre in South Australia.

While not regularly updated, the website serves as a resource teaching the language and supporting language revitalization.

Archive Nepal is a digital repository of images, videos, journals, books and documents aiming to "encourage the understanding of Nepal's rich history and culture." Nepali may have more than 17 million speakers, but of the 123 other languages of Nepal, at least 24 are considered "endangered." As of 2021, three had just one speaker left.

As David Harrison, co-founder of the Living Tongues Institute for Endangered Languages, told the BBC: "No culture has a monopoly on human genius, and we never know where the next brilliant idea may come from. **We lose ancient knowledge if we lose languages.**"

The Living Tongues Institute developed the Enduring Voices Project, a "multimedia dictionary-builder for under-represented languages," with the National

Geographic Society. The project aims to document endangered languages and prevent language extinction.

When invited, **the project assists Indigenous communities in their efforts to revitalize and maintain their threatened languages.** And, through its efforts, a language called Koro was discovered in India in 2008.

Candace Kaleimamoowahinekapu Galla is a Native Hawaiian professor at the University of British Columbia. She says within the past two decades there has been increased interest in how technology supports language-revitalization and -reclamation efforts.

"In this culturally diverse world, it is difficult to imagine the survival of Indigenous languages in the 21st century without the intervention of digital technology," Galla says.

"Technology encompasses a wide range of artifacts, methods, systems, tools and practices, including everything from wax cylinder recordings to digital audio recordings, email to chat, video recordings to interactive audio video conferencing, and/or surfing the internet to playing interactive computer games.

"As existing technologies are reinvented and new technologies emerge, additional domains for language use surface."

Monica Ward, dean of teaching and learning at Dublin City University and a pioneer of the use of CALL in education, says digital technology has created new domains for languages to exist, allowing learners and speakers to engage in or at least feel that the language is a necessary part of their Indigenous well-being and the contemporary world:

"Community members may be proud to see their language on a computer, and it may help to dispel some of the notions about the language, especially among the younger members of the community that the language is 'just for the old people' and 'cannot be part of the modern world.'"

A need to act fast

There's a sense of urgency here. **It is estimated that every three months, a language dies**, and most linguists believe that 50 percent of the world's remaining languages will be gone by 2100.

At least 100 of those have only a handful of speakers left. Part of maintaining a language is using it: Without practice, even a native language will begin to slip from your mind. "Many of the world's languages do not have a writing system: They are purely oral," Ward says. "Another of the most basic

potential constraints is that the language may never have been previously documented.

"Some languages may have been partially documented (like in the case of the Barngarla language), and while this existing documentation can be a good starting point, sometimes it can cause confusion, especially if the quality and correctness of the content are not of a high standard.

"If the language has never previously been documented, it is extremely difficult to develop language-learning materials."

Galla recognizes that technology creates a double-edged sword: "Due to the increase of technology use among Native youth (in Native American communities), cultural teaching and oral traditions have decreased tremendously, inhibiting intergenerational language transfer."

However, among those same Native American communities, social media use has become more influential and visible, with young people sharing stories or videos online, giving voice to their Indigenous identities. This includes their languages.

"In the 21st century, Indigenous languages no longer exist in isolation, but rather are supported by a multitude of technologies," Galla says. "Digital technology creates environments for language learners and speakers, allows for the creation and sharing of language materials, permits greater access to the language, and more importantly, expands the realm of communication." ●

GRAPHICS: Anas Albounni, KUST Review.
IMAGES: Shutterstock, Unsplash

ON THE CUSP

A few of the endangered, threatened, vulnerable and at-risk languages in the MENA region:



Al-Sayyid Bedouin Sign Language

Fewer than 150 native signers in a small settlement in the Negev Desert.

OO||> ||||xspəakəy

Ghadames

About 4,000 speakers worldwide. The language originated in Libya.

ЖН. ISHΘQ.

Taznatit

An estimated 40,000 speak this Algerian language.

†97Y8

Mehri

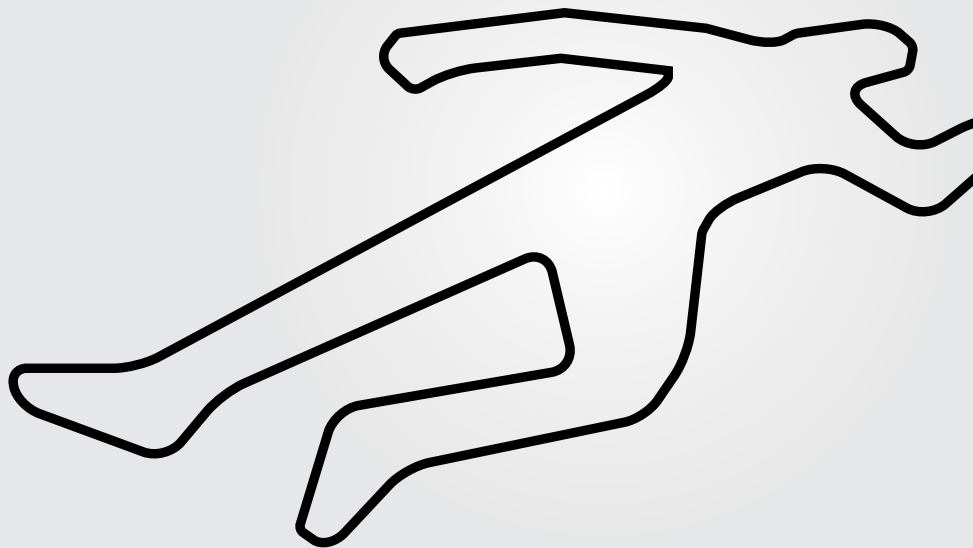
About 100,000 native speakers. It is spoken in Yemen and Oman.

SOURCE: University of Illinois Urbana-Champaign

SAY IT [REDACTED] LIKE YOU DIDN'T MEAN [REDACTED] IT

Forensic linguistics — LLMs, crime and the power of words

By: Maggie Kinsella



Robert Leonard was teaching linguistics at Hofstra University when an unexpected career shift walked through the door.

The Pennsylvania State Crime Squad was investigating a murder. All the squad had was two letters sent by a self-proclaimed killer.

The investigators needed an expert in sociolinguistics — how language varies across dialects, individuals and situations. Leonard says he and his colleagues can extract a

lot of information based on these observances. In this case, there were a couple of giveaways: The letters were very different.

One was typed and complicated, the other scrawled and basic, and Leonard determined that odd misspellings used in only the last half of the letter were intentional.

But it was the subject's use of rhetorical devices that was the clincher. A rhetorical device is something writers might use to make their prose memorable,

powerful or persuasive. You see them every day in advertisements, speeches and regular conversation.

For example: saying something twice to make it stick.

The device the writer unknowingly added to the letters was the repeated use of the same word, once linked to emotion and again to violence.

"It was such a rare rhetorical device it was as if he'd left behind his own signature," says Leonard, who heads

the Hofstra linguistics department. This observation was key to putting a guilty individual in jail for life.

It convinced a judge to allow a search warrant for all the writings of the main suspect – the victim's husband.

While Leonard often contributes to murder cases, his field also covers such issues as legal translation, legal compositions, forensic voice comparison and authorship attribution. Now technology is making things easier.

For example, Harry Potter author J.K. Rowling was recently discovered to have written a crime novel, "The Cuckoo's Calling," under the pen name Robert Galbraith.

An anonymous tip led Patrick Juola of Duquesne University to uncover the ruse using software he developed. Juola and Leonard often work cases together.

Machine learning tools analyzed adjacent words, character sequences, common words, etc., and compared the stylistic outcomes in another Rowling novel and several other authors' novels in the same genre.

It took only 30 minutes to determine the author. Though this instance isn't urgent, many cases are — like disputes over song lyrics or trademark infringement, where millions of dollars and market perceptions are at stake.

Leonard says in these trademark intellectual-property cases, a sight, sound and meaning analysis is conducted. How language is used worldwide often determines the outcome.

The analysis determines things like: How common is it? How confusing

is it? What's its history? He uses the example of an airline and a hotel with the same name. The airline might claim that when people think about this name, they think of air travel, not about the hotel, so the hotel shouldn't be allowed to use it.

The word, however, is common. It's used for a plumbing company, a dental insurance company and countless others.

"Even though the sight and the sound are the same, the meanings are so dispersed over the English language that you can't really claim that the people in the attacked trademark are going to be confused and think it's the larger trademark," says Leonard, who helped Apple defend its App Store trademark against Microsoft and Amazon.

Authorship these days is often determined by large language models (LLMs).

And Leonard's expertise has helped to advance this with the development of Flint AI. Leonard is a shareholder.

The difference between his technology and that of his colleague that determined authorship of the Rowling novel: Leonard's FlintAI contains reason and explainability codes, which he says is imperative when it comes to the law.

"In American and other common-law jurisprudence, you always must be cross-examined, for very good reason. But as one guy once said, you can't cross-examine a black box — nobody knows why it works. With us, you can."

Understanding why it works is essential, but it's difficult, Leonard says. >>>

ROCK STARS OF SCIENCE

Before he was a rock star in linguistic forensics, **Robert Leonard** was... a rock star.

As a founding member of Sha Na Na, Leonard sang lead vocals on "Teen Angel" when the doo-wop band opened for Jimi Hendrix at Woodstock in 1969. But Leonard left the group after two years to pursue academics.

He isn't the only rocker in a lab coat. A few others:

Dexter Holland, The Offspring: The punk rocker took a 20-year break from his Ph.D. program in biology to pursue music before earning his degree at the University of Southern California. How's that for "a sucker with no self-esteem"?

Brian May, Queen: No. 26 on Rolling Stone's list of 100 Greatest Guitarists of All Time has a Ph.D. in physics. He is co-author of "Bang! – The Complete History of the Universe" and "The Cosmic Tourist".

Gregg Graffin, Bad Religion: Another punker with a Ph.D., Graffin is an evolutionary biologist who taught at UCLA and Cornell.

Milo Aukerman, The Descendants: The punk band's first studio album was called "Milo Goes to College" because Aukerman, well, went to college. He has a Ph.D. in biochemistry.●

With all of the nuances of language and the extreme level of detail required to pass between the linguists and what Leonard says are the best programmers and coders, creating such technology has been complicated.

"Our Flint AI is the only one I know that can do this and explain it — that can actually pass the Daubert and Frye standards in the courts," he says.



The Flint AI system was picked up by one of the intelligence agencies, for which Leonard is a senior consultant.



As the use of LLMs like ChatGPT, Gemini and Claude accelerates in industries world-wide, sometimes it takes human understanding to reveal deception, and, in some cases, save lives.

Leonard emphasizes that while technology can analyze linguistic patterns, frequencies and structures at scale, it is limited when it comes to understanding context, nuance and — most importantly — intent behind language.

"It can't impute intentions to anybody. It just can't see that a mismatch is intentional."

Intent requires human judgment, cultural awareness and sometimes psychological insight that machines are unable to replicate, he says.

Hence, forensic linguists, with their expertise in deciphering meaning and purpose in communication, will remain indispensable, even as LLMs become more advanced. ●



Once upon a Time

Without technology, some cases would take years or even decades to extrapolate precise data, if at all.

Linguists used to rifle through thousands of pages looking for the information a computer can now spit out. If machine learning was around in the early half of the 20th century, projects linguists spent much of their careers working on could have been one of thousands, rather than one case that became their life's work.

One such case is the authorship identification of the Federalist Papers, 85 essays written by James Madison, Alexander Hamilton and John Jay under the pen name "Publius" between 1787 and 1788.

The documents were intended to grow public support for the ratification of the United States Constitution. Most of the papers' authors were undisputed, thanks to a list made by Hamilton, but 12 remained unknown.

Previously, there was no way to know which author wrote which of the unattributed essays. A couple of linguists decided to tackle the problem in 1941.

Statisticians Frederick Mosteller and David Wallace began, with the help of their wives, by counting sentence length, which turned out to be unrevealing.

"After a time, we had counted all sentence lengths for the book. When we assembled the results for the known papers the average lengths for Hamilton and Madison were 34.55 and 34.59 (words), respectively — a complete disaster because these averages are practically identical and so could not distinguish authors," Mosteller said.

Counting nouns, adjectives and special rules showed no significant result either.

"The writings of Hamilton and Madison are difficult to tell apart because both authors were masters of the popular Spectator style of writing — complicated and oratorical," Mosteller said.

The project seemed like an impossible task and the two statisticians would at times be separated by life events.

But when computers entered the scene they were able to determine that the 12 disputed papers were written by James Madison.

The entire process, on and off, spanned over two decades and finally concluded in 1964 upon publication of their book, "Inference and Disputed Authorship: The Federalist."



WE HEAR YOU

Tech gives animal communication a much-needed voice

By: **Maggie Kinsella**

Sound ecologist Bernie Krause has been recording the natural world for more than 55 years. With a Ph.D. in bioacoustics and feathers in his cap that include contributions to the film “Apocalypse Now” and a record deal with Warner Bros., he was the first to propose in the early 1980s that the sounds of a healthy ecosystem function in highly structured organization.

Within his library of 5,000 hours of data lies significant information on the health of an estimated 70 percent of the original habitats recorded. Nicolas Mathevon, professor of neurosciences and animal behavior at the University of Saint-Etienne and author of “Voices of Nature: How and Why Animals Communicate,” says discoveries in animal acoustic communications in recent decades have been ample.

Much of this is due to a surge in technological development.

What tech?

Krause’s original observations involved spectrograms: visual patterns of how sound frequencies change over time.

Now, technology can monitor and analyze these animals, habitats and ecosystems analysis far beyond the capabilities of a spectrogram.

As Mathevon says, “Our understanding of animal acoustic communications has always evolved alongside the development of techniques: the tape recorder, the computer, mathematical advances in signal analysis, etc.” Now AI is becoming an indispensable tool, he adds.

While remote acoustic sensors and underwater recorders are transforming data-collection techniques, Mathevon says machine-learning tools are enhancing the field in a variety of

ways: wading through enormous volumes of data, yes, but also analyzing soundscapes to keep tabs on species and ecosystems.

Why listen?

“This complexity of information carried by animal vocalizations opens the door to targeted and effective conservation strategies, where the analysis of sound recordings informs decision-makers in relevant ways,” Mathevon tells *KUST Review*.

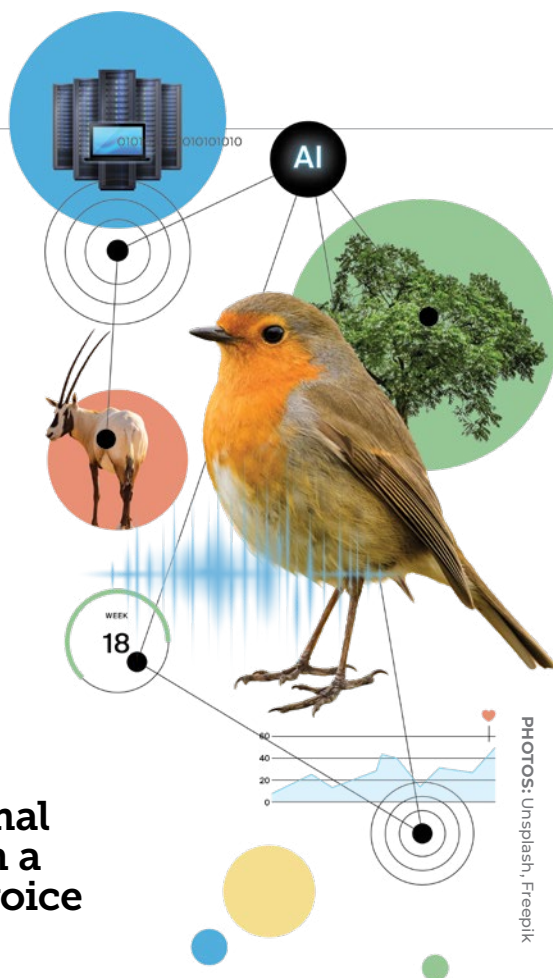
Data also provides information that might warn of potential extinctions. This allows for strategic conservation planning.

Monitoring environments remotely and non-invasively is the preferred approach, and rather than relying on battery-operated devices, Mathevon believes broadscale, solar-powered e-solutions with remote, real-time transmitted data aren’t far off.

“We will have systems where field recorders send recordings in real time to storage and computing centers. In the future, we will better utilize the information contained in animal vocalizations, and soundscape analysis will provide increasingly precise indications about the state of animals (reproductive stage, nature of social relationships, health status, etc.) and, on a larger scale, that of ecosystems,” Mathevon says.

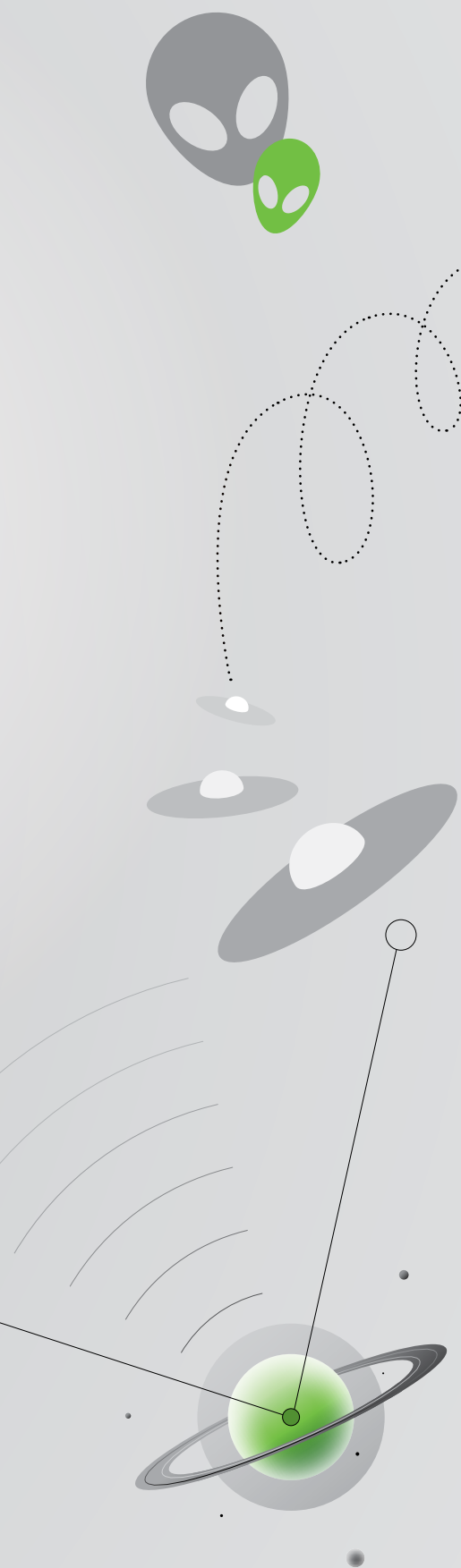
Is tech the only solution?

While AI and machine learning are enhancing the field of bioacoustics, impacting policy and shedding light on the status of species and the environment, Mathevon says without the important metadata humans provide, like observations and labeling of vocalizations, these technologies will teach us very little. ●





If there is alien life out there in the great unknown reaches of space, **we're going to need an enormous bridge.**



There's a big slab of rock standing in the British Museum. It's a 1-foot-thick piece of granodiorite, weighing almost a ton, and it's the only reason we know what ancient Egyptian hieroglyphics stand for.

The Rosetta Stone is testament to humanity's ability to bridge even the most daunting language gap.

"Many of us want to believe that extraterrestrial creatures can talk to us, that perhaps they are even living among us, as UFO fans believe," Daniel Roberto Altschuler Stern, professor of physics at Universidad de Puerto Rico, writes.

"It would be fascinating if it were true, a more than extraordinary discovery, the answer to an eternal question. There is possibly a deep psychological motive in this desire to know if we are alone in this huge universe, and the need to believe in something beyond our limited world, in space and time."

Let's put aside for a moment the question of if there even is life out there (I want to believe!) and whether they come in peace.

Where and how we look is the purview of someone else's research, whether we've already met them is Area 51's business, and quite whose leader we'd take them to, who can say? If we did catch wind of an alien species, how on earth would we go about communicating with them?



DROP US A LINE

Fernando Ballesteros authored "E.T. Talk." He's also head of instrumentation of the Astronomical Observatory at the University of Valencia.

He says it is likely that the first emission we detect coming from an extraterrestrial civilization won't be an intentional message of hope and longing sent deep into the cosmos, but "the equivalent of a radio or television show emitted for their own use, escaping unnoticed from their planet into space."

Ballesteros says it would be unintelligible, a truly random collection of signals that we may mistake for any number of random cosmic noises received by radio telescopes on Earth every day.

Celestial bodies emit lots of radio frequencies; identifying if a string of radio blips is a message or a random happenstance is an active scientific pursuit.

David Whitehouse, author of "The Alien Perspective," says alien contact could come in many guises, either instantaneously or gradually.

"Perhaps it will be something so obviously artificial and unhuman that it immediately shows itself to be the mark of an alien intelligence — a signal or an artifact of some sort. Perhaps it will be a dawning realization that something already in plain sight can be interpreted differently, revealing a previously unappreciated design or interference." >>>

Most scientists believe it will be an artificial radio signal coming from space. In 1959 Vanna and Giuseppe Cocconi were a husband-and-wife team working at Cornell University in New York.

They proposed that gamma rays were a promising method for interstellar signaling. Gamma rays are electromagnetic radiation much more powerful than light and are rare in the cosmos: They'd be easy to spot. However, when discussing their thoughts with Philip Morrison, another Cornell professor and member of the Manhattan Project, he pointed out that gamma rays are rather difficult to generate and detect.

It might be better to look at radio waves. Radio waves are low-energy, easy to produce and receive, and can travel the vast distances of the universe virtually unaffected. More than 60 years later, radio waves remain the preferred means of communication with aliens.

"If SETI (the Search for Extra-Terrestrial Intelligence) produces results, and we manage to detect signals from other civilizations in the galaxy, we will have a problem," Ballesteros says. "Could we understand the signal? Even if this signal were designed by our galactic neighbors to be easily decipherable, could we, nonetheless, understand anything? If we sent a radio signal to any completely alien civilization, could they understand it?"



HOW (OUR) LANGUAGES WORK

You've probably heard a picture is worth a thousand words, but human language is not to be underestimated for the sheer volume a single word can convey. In "E.T. Talk," Ballesteros uses this example: the word "whales."

Did you imagine two whales, or three, or countless? Were they blue, grey, killer? Real or cartoonish?

Human languages are symbolic: We use words to represent ideas. Language is a means of information exchange, and words codify this information. Whether we hear them or read them, the word is decoded by the brain to make sense of it, transmitting a concept from one brain to another.

This sounds rudimentary but is extraordinarily powerful: We can share abstract information and concepts to describe events or objects without needing them in front of us. We can generate an infinite number of thoughts or ideas from a finite number of words.

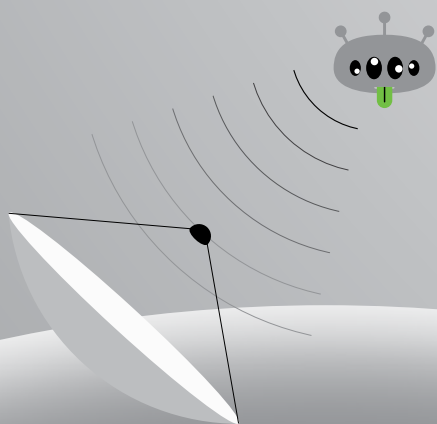


"Is it necessary to have a symbolic language to be intelligent?" Ballesteros asks. "Or is it possible to be intelligent by thinking in terms of concepts or visual images? Are words the only possible mechanism of articulating an exchange of information among intelligent beings?"

Language alone assumes that all alien species use sound to communicate. Even on Earth, ants use chemical communication, bees dance, sharks sense electrical impulses, cephalopods change color and moles send vibrations through the ground.

Humans can communicate full sentences through the quirk of an eyebrow; what if alien language is all in the specific tilt of a tail?

Maybe alien communication is alien in every sense of the word. To a creature communicating with electrical signals or vibrations, our weird sounds are just as strange.





His findings have been challenged by both economists and linguists. But there are many other fascinating findings of cross-linguistic differences in cognition, as Lera Boroditsky, cognitive scientist at University of California-San Diego, puts it:

Or, in other words: "Are many alien organisms likely to be individually conscious in ways we would recognize? Almost certainly. Can some species develop analogs to culture and high-order technology? Less likely, but still fairly probable. If so, will we be able to communicate with them? Only on a basic level, and only with profound difficulty." >>>



We come in
peas!

ALTERNATIVE COMMUNICATION

We can't even just take picture books. A human child can look at an image of a dog and recognize the image represents a dog. An alien might not be able to do this.

First, we're assuming the alien even uses light for vision. What if they're echolocators, like dolphins or bats?

Second, it might not be as complex as a different cultural worldview. What if there are no dogs on this new planet? No pets at all? No photographs even? It's hard to imagine an intelligent species without dexterity, but what if they have no way of drawing, no illustrative ability?

Mathematics! If an alien civilization has emerged in our universe, it must be constrained by the same universal laws of physics. However, the speed of light may be universal, but the units to describe it are not.

299,742,458 METERS PER SECOND

The meter is a unit of length developed in France in 1791 as one ten-millionth of the distance from the equator to the North Pole. The second is an approximation of the Earth's rotational rate. Both are arbitrary units as far as an alien species occupying a completely different planet is concerned.

Pi is a mathematical constant. There is no arguing with pi. Even alien circles will have to conform. Both us and them having circles is no basis for intellectual conversation.

Circles and the speed of light might open the door for communication, but what would we even talk about? With the potential for enormously different, entirely incomprehensible cultures and social norms, where should we even begin to understand each other?

Wallace puts it best:
"Understanding alien systems of learned heritage transmission and their role in astrobiological processes would be a profound intellectual challenge, far more daunting than the still-unmet difficulties of understanding different cultures and their shifting norms within human populations."

MAYBE IT'S THE JOURNEY

If all of this is a “profound intellectual challenge,” as Wallace calls it, why do we expect a non-human intelligent being would fare any better?

Humanity has sent the equivalent of a seafaring message in a bottle out into the vast cosmos, hurtling across the universe as the golden plates on Pioneer 10 and Pioneer 11 and the golden records on Voyagers 1 and 2.

We’re putting the burden of translation on an alien civilization, asking them to do the intellectual heavy work.

But, says Ballesteros, there’s no expectation at all. He says their real function is to satisfy our humanity:

“Nobody believes these spacecraft will be intercepted in the future, given how immensely vast and empty interstellar space is, and how incredibly low are the probabilities that they could reach any planet, not to mention one inhabited by a civilization. In fact, the real addressee of these messages is humanity.

“Their real function is to stimulate the human spirit of exploration, to make us believe that it is possible to contact other civilizations in our galaxy,” Ballesteros says.

“There is something deeply human in the mere fact of attempting this communication, in leaving this everlasting footprint for posterity.

“Up to a point, this fills our yearning for immortality. It says, ‘Humanity was here.’” ●

IMAGES: Shutterstock, Unsplash
GRAPHICS: Anas Albounni, KUST Review

5 MOVIES

about talking to **aliens**



Arrival

2016 • PG-13 • 1h 56m

A human linguist races to decipher strange visual symbols that look a lot like coffee rings before human nations go to war in this meditation on the relationship between language and perception.



Contact

1997 • PG • 2h 30m

A scientist searching for proof of extraterrestrial life does the math to discover data embedded in a signal from space that might be the key to first contact.



E.T. The Extraterrestrial

1982 • PG • 1h 55m

When a boy named Elliott finds a lost alien botanist hiding in the shed, he learns that the universal language is love. And also candy.



Close Encounters of the Third Kind

1977 • PG • 2h 18m

Lights and musical notes open up the lines of communication after a UFO lands, either a masterstroke of interspecies connections or one heck of a piece of viral marketing for a rave.



The Day the Earth Stood Still

1951 • G • 1h 32m

Alien ambassador Klaatu has an ultimatum for the people of Earth who wage war and pollute the planet. They’d be wise to listen.

Pandemic still
impacts language
development in children

Kids, Covid & Communication

By: Binu George and
Naja Omer Sherief



ILLUSTRATIONS: Abjad Design



The COVID-19 pandemic

presented significant challenges for child development, especially in language-acquisition and communication skills.

Parents started to notice the impact of social isolation after the first few months and as the COVID threat waned. Pediatric and speech therapy clinics also noted familiar milestones missing among toddlers and didn't see the change in skills and behaviors expected among older kids.

Some of the ways COVID impacted children's language, cognition and communication:

Lack of exposure to diverse vocabularies:

Children who encounter a variety of vocabularies and sentence structures create a strong mental lexicon to use in many contexts. However during COVID time, this exposure was limited. A study by Jovana Pejovic et al found that COVID-19-related changes had a negative impact on early language skills, such as word segmentation, word learning and lexical development, as well as on overall language and communication.

Increased screen time and distance learning:

Children spent too much time on iPads and TV, and they did not get opportunities to engage in the spontaneous unstructured play necessary for social-skill development. Children with hearing impairment were particularly affected by "Zoom fatigue". Difficulties interpreting nonverbal cues, poor audio quality and audiovisual dyssynchrony contributed to increased listening effort.

Less parental engagement and stress:

According to a study cited in *Early Childhood Research Quarterly*, caregivers who engage in frequent, varied and interactive language exchanges create an enriched linguistic environment fostering children's language growth. More parents working from home and handling childcare meant less time for direct connections with their children, which raised stress and lowered linguistic input.

Impact of mask-wearing:

We rely on integrating auditory and visual information to perceive speech. This integration was difficult when masks were worn and articulatory movements were not seen. It was challenging to understand spoken language. Use of masks also degrades the speech signal, serving as a low pass filter by attenuating high frequencies spoken by the wearer. Also young children show a preference for the speaker's mouth rather than other areas of the face.

Naja Omer Sherief, a speech and language pathologist (SLP), experienced how COVID-19 affected some young children. She notes how virtual learning and limited peer interaction weakened their capacity to recognize social signs, such as taking turns, facial expressions, tone, personal space and understanding boundaries. Additionally, children who use augmentative and alternative communication (AAC) devices didn't have many opportunities to practice with them outside of their homes, which affected their learning, vocabulary usage and participation.

Prevention is better than cure. Recognizing the requirements of appropriate and sufficient stimuli during the first three years of life is paramount. Developmental skills such as speech are a result of interactions with immediate and extended family as well as community members, hence these opportunities are a must.

Addressing these gaps requires strategies that prioritize children's social engagement, language exposure and positive supportive interactions.

It is essential that educators, SLPs, audiologists and caretakers acknowledge these challenges and provide support systems to help children recover and improve their communication abilities.

Binu George is a neurodevelopmental pediatrician and manager at UAE mental-health platform Sakina.

Naja Omer Sherief is a speech and language pathologist at Sakina. ●





A matter of ethics

LLMs present privacy, bias and equity issues

By: Suzanne Condie Lambert

DESIGN : Abjad Design
PHOTO: Shutterstock,
Unsplash, Freepik

Large language models, or LLMs, have become a staple of modern life. The machine learning technology powers the chatbot that helps you shop for car insurance to the autocorrect that messes up your text messages.

But giving computers the ability to interpret, manipulate and comprehend human language creates ethical and privacy issues for consumers, cultures and nations.

Jessica Scopacasa, co-founder and CMO of Olive Gaea in Dubai, sees a growing interest in ethical issues among her customers. The company uses the tech to make sense of unstructured data to enable decarbonization efforts.

"One thing that's come up often with clients is data privacy," Scopacasa says. "Many have asked that (LLMs) don't take their data outside of their cloud or on-premise environments, and we've addressed this. ... Data stays where they need it to stay."

Mohamed Elsonbaty, an AI trainer and consultant and founder of SciComm-AI, is optimistic about AI, predicting that it will soon be an essential office skill like using the internet. But he has concerns about laws and policies keeping up with evolving technology as well as inequality in data protection.

He cites a recent email offering him the choice to block Meta AI from using his data for training a new model. "Because I live in (Europe) within this legal framework I can opt out of this. But other people, maybe in Egypt, cannot do that because there is no legal framework about the use of the data. And this is very, very alarming."

Then there is the inherent bias in models that are trained with a Western perspective. Elsonbaty says he could see the bias when he used

AI to explain quantum physics to an 8-year-old Egyptian student.

"One of the analogies it used there was, 'Think of quantum computers as a super fast computer. Like a super camel, faster than the fastest camel.' And I think this is alarming because this is a Western perception of how to address people in the Middle East. Because in Egypt we don't have a lot of camels.

"In Saudi Arabia, they have a lot of camels. In the Emirates, they have a lot of camels. It's a major thing. In Egypt I only see camels in the zoo or near the pyramids. So I would say this analogy actually doesn't work."

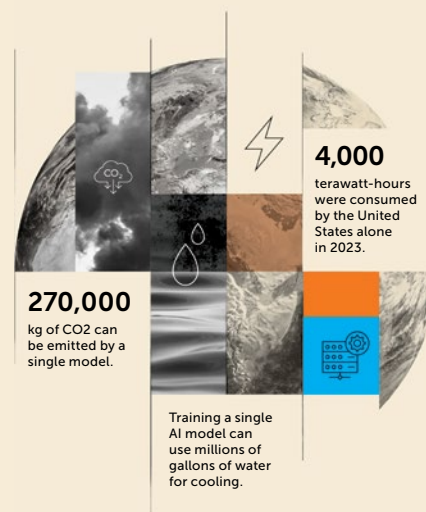
Khalifa University's Khaled Salah also emphasizes the risks of hallucinations – when the LLM produces text that is factually wrong or outright nonsense. "The tool is powerful, but it still needs implementation of rail guarding, filtering and fact checking to make sure the output is accurate," he says.

But is it sustainable?

Generative AI has a high environmental cost. Training a model alone can consume millions of gallons of water to cool the hardware, according to a team from the University of California-Riverside and the University of Texas-Arlington. And a University of Massachusetts-Amherst team finds that training just one model can produce more than 270,000 kilograms of CO₂, the equivalent of 125 round-trip flights between New York and Beijing.

MIT researchers warn that this "relentless demand" for computational power is expected to range between 620 and 1,050 terawatt hours worldwide in 2026. By comparison, the United States alone consumed about 4,000 terawatt hours in 2023, per Statista.

Environmental footprint of training intelligence models

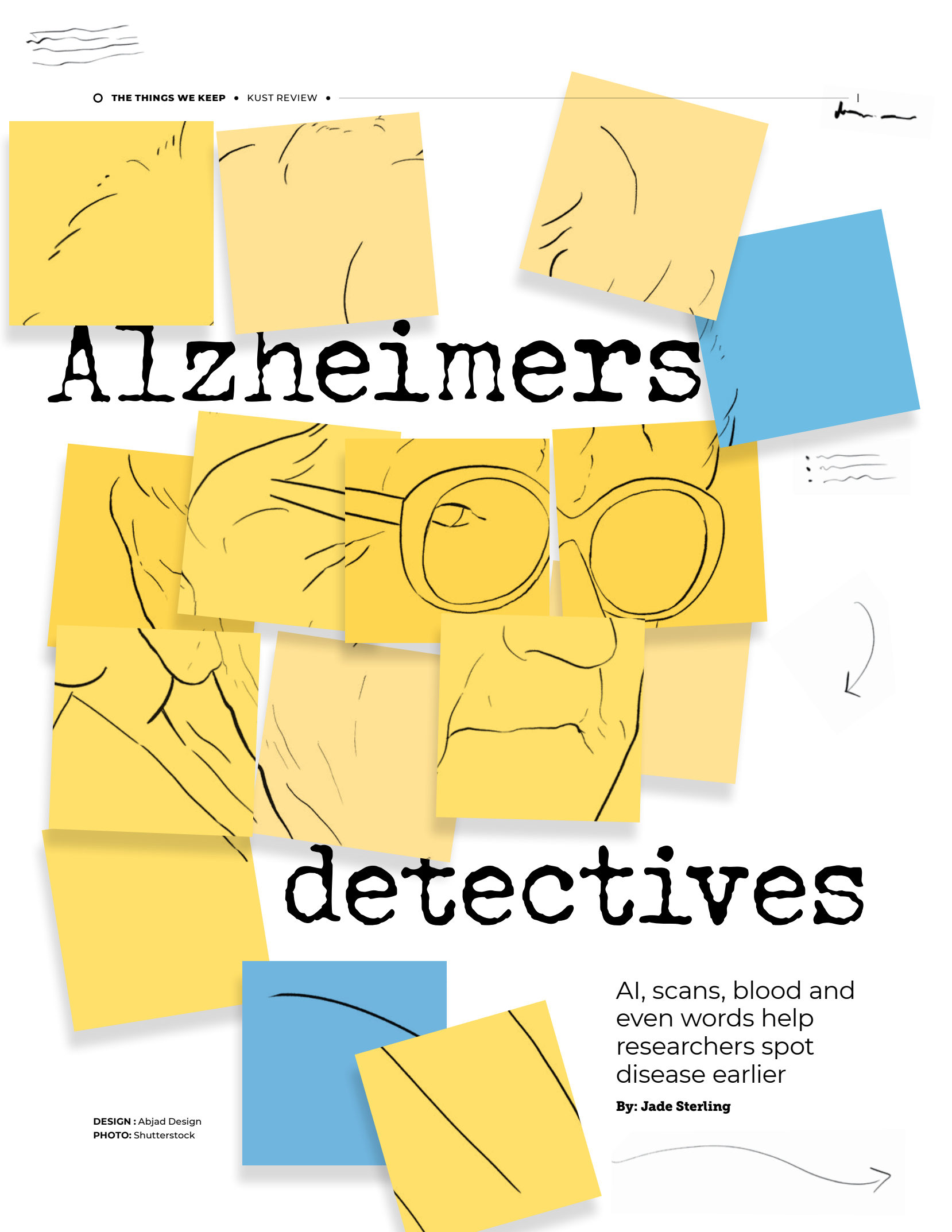


SOURCE: Statista

AI trainer Elsonbaty spells out the dilemma: "If you decide to stop using AI, sooner or later you will be left behind. So this is a kind of a hard moral choice between what could I do and how that will impact me or impact the future of the next generations or the future of the planet."

Researchers and industry leaders, however, have ideas on mitigating the damage. A few:

- Make high performance and power efficiency a major component in the design of future AI applications.
- Increase transparency and comprehensive reporting of AI's water footprint.
- Continue to improve data center power and cooling infrastructures.
- Enlist legal experts, industry leaders, researchers and policymakers to develop strategies reducing harm. ○



Alzheimers

detectives

AI, scans, blood and even words help researchers spot disease earlier

By: Jade Sterling

DESIGN : Abjad Design
PHOTO: Shutterstock



The Alzheimer's Association defines dementia as a general term for loss of memory, language, problem-solving and other thinking abilities that are severe enough to interfere with daily life. Alzheimer's disease is the most common cause of dementia, accounting for 60 to 80 percent of cases.

Currently, diagnosing neurodegenerative diseases like Alzheimer's relies heavily on clinical intuition, subjective symptom assessments and neuroimaging techniques. However, symptoms such as memory loss, tremors and cognitive decline are often subtle in the early stages and may overlap with normal aging. This diagnostic uncertainty delays interventions that could slow disease progression.

Research at Khalifa University is aiming to help diagnose neurodegenerative diseases as soon as possible, using artificial intelligence techniques and approaches as well as making the old-school approach more accessible.

AI and MRI: A powerful pair

Hasan Al Marzouqi is developing an artificial intelligence system to leverage brain scans in detecting early warning signs for Alzheimer's disease. His work builds on studies using positron emission tomography (PET) scans and machine learning.

PET scans measure the levels of glucose in the brain — the more active a cell, the more glucose it uses. As brain cells become diseased and die, they use less and eventually no glucose. However, because Alzheimer's disease is a slow, progressive disorder, the

changes in glucose levels are subtle. Enter machine learning, able to more reliably read PET scans to help diagnose early stage Alzheimer's.

PET scans are not broadly available — they're a powerful tool, but expensive and require specialist facilities and expertise. Al Marzouqi applies the machine learning to MRI scans instead.

His research divides the brain into 138 anatomically relevant regions of interest. By analyzing each of these regions separately, the model can pinpoint the areas most affected by Alzheimer's and provide a clearer picture of disease progression.

"By identifying which brain regions contribute most to its predictions, the model aligns with existing knowledge about Alzheimer's pathology," Al Marzouqi explains. "For example, the hippocampus and amygdala, both of which play critical roles in memory and emotion, were among the top predictive regions highlighted by the system. This interpretability means that doctors and clinicians can use the AI model not just for classification but also to better understand disease progression in individual patients for diagnosis and care."

Leontios Hadjileontiadis is also using MRI to help diagnose Alzheimer's. The professor uses an advanced imaging technique called curvelet transform to enhance the accuracy of Alzheimer's detection from MRI scans. With Aamna Al Shehhi, assistant professor, the research team used convolutional neural networks, a form of AI that processes visual data, to extract detailed patterns from medical images. Unlike traditional methods that rely on raw MRI data, their approach preprocesses brain scans to highlight crucial anatomical features.

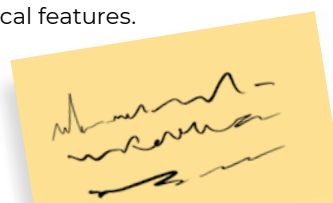
Artificial intelligence is already used in medical imaging to detect changes in brain structure, but current techniques struggle with capturing curved edges — critical in brain anatomy. Curvelet transform addresses this by analyzing images at multiple scales and orientations, allowing for better differentiation of brain-tissue changes associated with Alzheimer's.

Digital phenotyping and deep learning

AI has shown promise in medical imaging, but its applications to behavioral science remain underutilized, as far as Hadjileontiadis is concerned. The challenge, he says, lies in interpreting vast amounts of real-world patient data to detect meaningful patterns — something traditional diagnostic tools struggle to achieve.

"Explainable digital phenotyping is a novel framework that integrates AI with real-world behavioral data to create individualized digital profiles of patients," Hadjileontiadis explains. "This approach moves beyond static diagnostic categories, instead analyzing dynamic behavioral patterns at three levels: brain, body and social. By mapping these, the AI can create a real-time, individualized picture of neurodegenerative-disease progression."

Explainable digital phenotyping can personalize treatment. The AI can analyze speech patterns, fine motor skills and cognitive function using smartphone keystroke dynamics and speech recordings at the brain level, and movement and circadian rhythms at the body level using wearable sensors. >>>



Social-interaction patterns such as changes in phone call frequency or engagement in social activities may be subtle clues indicating cognitive decline or emotional disturbances that may be early indicators of neurodegenerative disease. By identifying patient-specific disease trajectories, doctors can identify disease earlier and tailor interventions to individual needs.

Blood biomarkers

For those without access to costly brain imaging, blood-based biomarkers could revolutionize early Alzheimer's detection. Al Shehhi's research highlights the potential of non-invasive blood-based biomarkers for early Alzheimer's diagnosis, well before severe cognitive decline sets in.

Using machine learning and blood samples from 623 participants in the Alzheimer's Disease Neuroimaging Initiative, the research team pinpointed several key blood-based genetic markers associated with neurodegeneration, including one implicated in learning and memory processes and one affecting glucose metabolism and energy regulation in the brain.

"Traditionally, Alzheimer's biomarkers such as amyloid-beta and tau proteins have required PET scans or lumbar punctures, limiting their widespread use," Al Shehhi says. "Blood-based biomarkers have huge potential for Alzheimer's detection, and by integrating

AI with genetic data, we've identified promising molecular targets that could improve early diagnosis and possibly lead to new therapeutic strategies."

Language matters

Mohamed Seghier, professor and director of KU's Healthcare Engineering Innovation Center, is looking at traditional diagnostic methods to improve access to early and accurate dementia diagnosis. He recognizes that not everyone can pop along for an MRI scan and wanted to investigate the language gap in using standardized neuropsychological tools:

"Here is a real challenge for a health-care professional: assess the cognitive abilities of someone speaking Hausa or Fulani. Assessment tools have been effectively validated in widely spoken and well-researched languages such as English. But not everyone speaks English, and it is unlikely that validated tests exist for speakers of less-studied languages. This isn't limited to rare languages but applies to many languages spoken by hundreds of millions of people. Take Arabic, for example."

The linguistic landscape of the MENA region is marked by diglossia. Most people use Modern

Standard Arabic for formal education and colloquial Arabic for everyday communication. This linguistic complexity raises questions about the impact of diglossia on dementia onset and assessment.

Seghier does recognize it might not be realistically feasible to develop tests for every group and in every spoken language, and that translated versions might be the only option for some populations. However, the researchers point out that recent sophisticated machine learning architectures could support translation efforts ensuring "no language is left behind." ●



"Assessment tools have been effectively validated in widely spoken and well-researched languages such as English. But not everyone speaks English."

Mohamed Seghier

EAVESDROPPING ON ATOMS

New tech translates atomic behavior into sound

By: Jade Sterling

Atoms are always in conversation — sharing energy, exchanging forces and reacting to their environment. Now, thanks to an innovative acoustic system, researchers can “listen in” on atomic communications, and they’re learning that the volume of the conversation matters.

Mathieu Padlewski, Romain Fleury and Herve Lissek at the École Polytechnique Fédérale de Lausanne (EPFL)’s Laboratory of Wave Engineering had a “physicist” problem: the limitations of quantum mechanics in trying to study densely packed atoms. Traditional approaches using light or particles just weren’t doing it, so the team created a synthetic material made of sound — a lattice of acoustic resonators that mimics how quantum atoms interact and respond to energy.

Here, each point on the lattice behaves like a talking atom. The louder the energy input, the more dramatic the interactions. At low levels, the atoms’ “voices” blend into a calm uniform hum, but turn up the volume, and the energy suddenly shifts direction and starts behaving as if the atoms are shouting only in one direction.

The system’s energy becomes non-reciprocal, meaning waves travel differently depending on their direction. It’s this phenomenon that allows the team to “hear” how atoms talk to each other and lets them explore fundamental quantum behaviors without needing ultra-sensitive quantum equipment.

Padlewski says this gives them direct control and means they’re not limited by the “fragility of quantum states.”

The quantum world is famously counterintuitive. Schrodinger’s cat, the paradoxical feline trapped in a box that can be considered both dead and alive until the box is opened, explains how quantum systems exist in multiple states at once. Observing the system collapses it into a single outcome. That’s a huge limitation when studying things like electronic states in materials: Just measuring them can destroy what you’re trying to observe.

With sound, it’s different. Sounds are made up of many frequencies at once — a superposition of harmonics, just like a quantum particle might exist in multiple energy states. Lissek says their metamaterial works in a similar way to the human cochlea, a chain of cells in the ear that respond to different sound frequencies.

The EPFL team’s acoustic material is more than just a model borne of frustration. It could be used to explore real-world applications, like guiding energy in telecommunications. ●

LISTEN UP

Non-human species have their own ways of communicating

By: Maggie Kinsella

As you wander out on a quiet, crisp morning for a hike through a forest trail, the only sounds are those of nature: the birds calling, crickets chirping, the slither of a nearby garter snake and the crackling of fallen twigs underfoot.

The language of nature is all around us. We may hear these animal sounds, but what are they saying and to what (or whom) are they saying it?

Let's have a listen

HUMPBACK WHALES

Because light can penetrate only a few hundred feet of water, whales rely on sound for survival. Sound is particularly useful for communication because it can dispatch a large volume of information in a speedy manner and travels faster and farther under water than above it. And recent research published in *Science* suggests their language is more human-like than previously thought.

Analyzing eight years of whale songs, researchers found that patterns are passed from whale to whale. "Human language and whale song are both culturally learned, so whales learn the songs from the other whales that they spend time with.

"So that's why all the whales in one population will be singing the same song," says Jenny Allen, co-author of the study and Griffith University whale-song-structure expert. This may offer insight into how communication systems, like language, may have evolved.

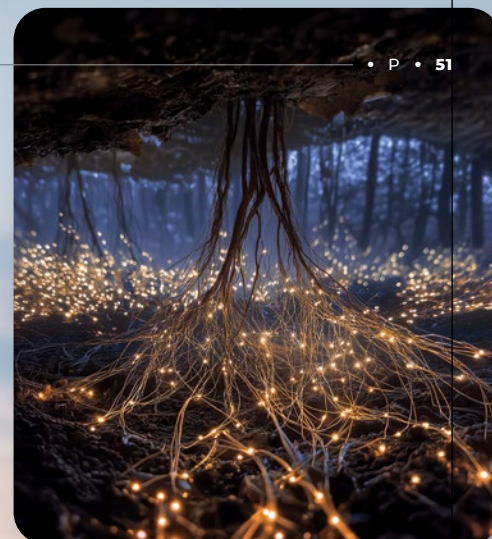


AFRICAN SAVANNA ELEPHANTS

If you're on safari in Botswana and feel something a little peculiar and pulsating in the air, it might just be sound.

However, this sound carries such a low frequency it evades the human ear. For the African savanna elephant, however, these sounds sometimes travel up to 10 kilometers.

These grand creatures that mostly roam southern and eastern African countries don't only use their trumpeting voices to communicate; they use their trunks, ears and tails and scented bodily secretions. >>>



The communicators no one can hear

The only sound humans might hear from a tree is the rustling of its leaves or a creak or two on a windy day. But don't be fooled by the silence. Trees speak volumes of volumes. It's all just happening below the soil.

In **"The Secret Life of Trees,"** German forester Peter Wohlleben explores the enormous network beneath the soil that resembles a mess of cables, through which trees transmit resources like nutrients, water and carbon to each other. Wohlleben refers to this network as the **"internet of the forest;"** other biologists refer to it as the "wood-wide web."

Fungi form this thready communication system to support nearby trees. The network is called **mycorrhizae** — which translates from the Greek to fungal root. The fungi form these communication systems for the host plants, and **the relationship is symbiotic** — that is, they both benefit: the trees via their network and the fungi by receiving the carbohydrates they cannot photosynthesize on their own.

SAKER FALCONS

The saker or desert falcon has long been an integral part of Arab culture. Falcons, revered for their hunting abilities, were historically a status symbol amid Bedouin tribes.

Unlike other raptors, saker falcons communicate less with voices and rely on body language and territorial displays.

Loud "kek, kek, kek" calls signal alarm or territorial defense. During courtship, soft chittering sounds say, "I'm interested."

Body language and flight maneuvers, like a male fluttering its wings or performing aerial displays, show aggression or courtship. Feeding juveniles involves postures indicating food placement, later teaching them to hunt through demonstrations.

Though saker falcons use voices sparingly, their bodies speak volumes. Frequent human contact and training has helped the falcons understand some human language or tone, associating specific actions with intended messaging.



HONEYBEES

It may look like a little bum wiggle, but it's packed with information

The dance performed by the honeybee, known as the waggle, was first presented by researchers nearly 80 years ago.

Today we know much more about what the little waggle is saying and how young bees learn the conversation.

The waggle dance is meant to communicate to the hive where to forage for food. The length of the waggle indicates distance to the food source, and waggle direction angle correlates to the angle from the sun the bees should head to after leaving the hive.

It was once thought that all honeybees were born knowing how to do it, but the latest research tells us that dance lessons are required, and, like most skills, practice makes perfect.



THE WOLF & THE RAVEN

The wolf and the raven have a system in place that works for both.

Ravens often use their birds' eye view to spot prey and sometimes call out to notify the wolf. The wolf takes down the typically large prey and the ravens feast on the leftovers.

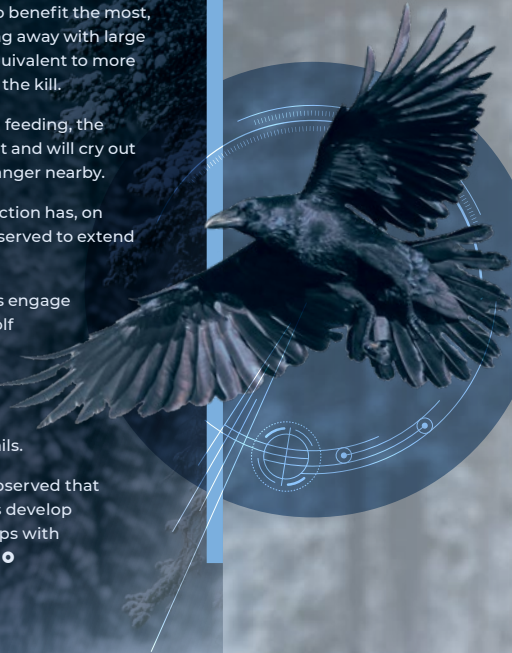
This symbiotic relationship ensures both species get their needs met but the ravens seem to benefit the most, consuming or flying away with large chunks of meat equivalent to more than 65 percent of the kill.

Conversely, during feeding, the ravens remain alert and will cry out should there be danger nearby.

This special connection has, on occasion, been observed to extend beyond the hunt.

Ravens sometimes engage in play with the wolf cubs, playing tug-of-war with sticks or initiating a game of chase by tugging their tails.

It has also been observed that ravens sometimes develop playful relationships with individual wolves. ●



On an even smaller scale: Cell communication

Cells are fundamental units that make up all living things. Like most living things, they need to communicate in order to survive and function. They do so by sending and receiving information between each other and the outside environment.

Cells are capable of receiving many signals at the same time, processing the information and creating an action plan based on the messaging. These messages take on many forms. **They could be hormonal**, like insulin telling a cell to take in glucose from the blood stream or temperature changes during a fever.

Cells consolidate these signals to choose their next move, which might be to grow, divide, shift, alter function or self-destruct. But cells don't just receive information, they also dish it out.

Cells communicate with other cells to coordinate bodily processes. When a signaling cell sends a molecule (ligand) to another cell, the target needs to have the right receptor to properly receive and process that message. Once it binds to the receptor, it triggers a change inside the receiving cell.

PHOTOS: Shutterstock, Envato, Unsplash.

BACKGROUNDS: Ai generated, KUST Review.

DESIGN & PROMPTS: Anas Albounni, KUST Review.

WALK A THIS WAY K

The way you move is unique – health and security researchers are paying attention

By: Jade Sterling

PHOTO: Shutterstock

DESIGN: Abjad Design

VERIFIED

"I recognize your
footsteps, old man."

- Dune

Amal and Noor Alshehhi are in their 30s. Two of five sisters, they share many of the same interests and friends and spend much of their time together.

They're Emirati and dress traditionally: in long, black abayas and headscarves. In the malls where they like to hang out, they are two of many women wearing the same attire. Yet, without fail, Amal can tell Noor from the back of her scarf-covered head. Sisterly intuition or is something else going on?

"I can tell through her height, her abaya, her shoes, her walk," Amal says. "I can tell who it is."

Adeel Mohammed is a paramedic in Dubai. During the COVID-19 pandemic, he had to wear a fit-tested N95 mask, eye protection, gloves, head cover and impermeable gown when attending to calls — as did all of his colleagues at the ambulance stations and hospitals.

"You would be shocked at how easily you can identify someone you spend a lot of time with just by the way they walk," he says. "It's amazing how personalized a person's gait is."

Anecdotes aside, there is plenty of scientific backing to the power of gait analysis. The way we walk is as unique as our fingerprint, suggests the research, as we each have our own subtle pattern of muscle activity in putting one foot in front of the other.

"It is believed that distinguishing individuals from afar was an important human survival mechanism in the past, as it allowed us to recognize if an individual was a friend or a foe before the person was close enough to be a potential threat," says Thorsten Strufe, Karlsruhe Institute of Technology. "Gait can be considered an individual trait that shows little variability over time and even lifespan. The way we walk is believed to emerge at the age of five, although we do see some age-related effects such as slower gait or shorter steps."

We may no longer need to rely on gait recognition for our own safety, but there are practical applications to gait analysis beyond simply recognizing each other in a crowded place.

Experts can identify suspects in CCTV footage by the way they walk; physicians can track physical deterioration in cases of disease or physical improvement in rehabilitation programs; and coaches can improve the form of professional athletes and casual runners alike.

Research at Khalifa University is also investigating gait biometrics, or gait recognition. One team developed a model that recognizes the biological and physical characteristics of individuals through their gait.

"Our approach involved collecting gait data through wearable

technology in the shoes while users walk on a treadmill," says Chan Yeob Yub, one of the study authors. "Previous studies have predominantly relied on 2D or 3D images captured by cameras, but this reliance on image-based data presents challenges, such as image resolution and variations in an individual's appearance due to clothing or environmental conditions."

Another KU team used accelerometers embedded in the floor to detect subtle vibrations caused by footsteps. This is an entirely unobtrusive approach

The way we walk is as unique as our fingerprint ... as we each have our own subtle pattern of muscle activity in putting one foot in front of the other.

— users don't need to wear any device or take specific actions to be identified. Leontios Hadjileontiadis, one of the researchers, envisioned this technology being used in a smart home with individuals able to unlock their front door simply by walking up to it, but recognizes the system has exciting applications in health care too:

"Gait analysis is a valuable tool for monitoring neurological conditions like Parkinson's disease, multiple sclerosis or early signs of cognitive decline," Hadjileontiadis said. "Since the system requires no wearables, it could be particularly beneficial for older adults who

may struggle with traditional health-monitoring devices."

Maria De Marsico doesn't need you to put accelerometers in the ground outside your home: Her method uses data from the accelerometer in a standard smartphone while it jostles around in your pocket as you walk. Her team at the Sapienza University of Rome uses this information to unlock a smart door, which is much more convenient than turning a key or scanning an eyeball. Heist movies, however, might veer from dramatic to comedic as protagonists attempt to mimic the gait that will unlock the bank door.

In all seriousness, how vulnerable gait-recognition technologies are to this kind of attack remains to be seen. In Indonesia, where officials are investigating using voice and gesture information combined to control personnel access to a new nuclear power plant, security-system failure presents a more dire consequence. Someone analyzing and copying a walk is known as "spoofing," in the same way someone trying to obtain personal data by pretending to be someone they aren't is a "spoofing" attack.

But we're not quite walking the talk yet. Gait analysis hasn't reached the ubiquity of face recognition, mostly due to the computing power needed to analyze what Strufe calls the static, dynamic, micro and macro categories for gender recognition alone. He says person recognition depends on familiarity, which would explain why a person is able to spot her sister by the way she walks but not someone she barely knows.

"I could make a good guess," Amal says. "But I don't know if I'm guessing from her handbag!"

Catching THE WAVE

**Disciplines unite
to unearth a lake's
hidden history**

By: **Denys Dutykh**

Denys Dutykh is an associate professor
of mathematics at Khalifa University.

ILLUSTRATION: Abjad Design

Buried deep in the untouched sediments of a lake in the Alps of northwestern France lay the clues to a geological mystery nearly 12,000 years old. But it took the combined efforts of mathematicians and geologists to not only piece together proof of an ancient natural disaster but also help modern humans protect themselves from future catastrophes.

The origins of our recent study can be traced to 2016, when two geologists from the University of Savoy Mont Blanc (USMB) embarked on an expedition to Lake Aiguebelette. This lake had, until then, remained uncharted territory for sedimentologists, and its sediments held the promise of untold stories.

This initial exploration sparked the curiosity of Mathilde Banjan, whose Ph.D. thesis became a quest to unravel the geological history hidden beneath the lake's tranquil surface. Over the course of her research, she meticulously analyzed sediment cores, performed radiocarbon dating and identified traces of several ancient earthquakes.

Among these findings, one event stood out — a [major underwater sediment landslide that occurred approximately 11,700 years ago](#). The triggering of this landslide by one of the detected earthquakes was established, yet one question lingered: Could this landslide have triggered a tsunami?

The enigma of this potential ancient tsunami remained unsolved at the conclusion of Banjan's Ph.D. This is a mystery that begged further investigation, and thus, the quest continued.

In collaboration with USMB's Pierre Sabatier, we embarked on a new journey,

launching a graduate project to reconstruct this ancient event through numerical modeling. This endeavor was spearheaded by Muhammad Naveed Zafar, our Ph.D. student, under joint supervision. Our approach was systematic: First, we reconstructed the landslide event, validated by geological data. Then, by coupling this reconstruction with a hydrodynamic model, we simulated the generated wave field.

The results were nothing short of astonishing. The simulations revealed that [the ancient tsunami produced waves up to 3.5 meters high](#).

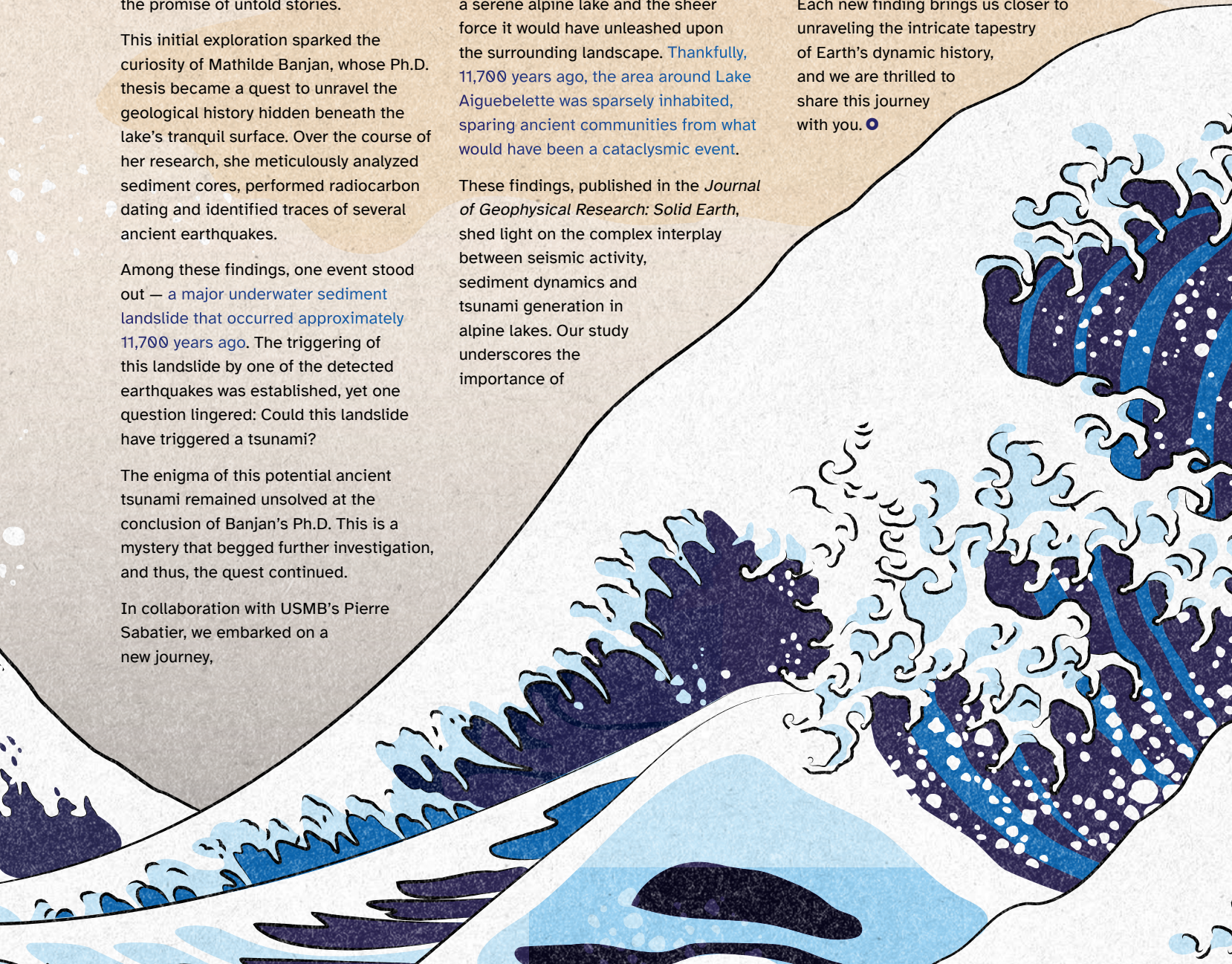
Imagine the scale of such a wave in a serene alpine lake and the sheer force it would have unleashed upon the surrounding landscape. [Thankfully, 11,700 years ago, the area around Lake Aiguebelette was sparsely inhabited, sparing ancient communities from what would have been a cataclysmic event.](#)

These findings, published in the *Journal of Geophysical Research: Solid Earth*, shed light on the complex interplay between seismic activity, sediment dynamics and tsunami generation in alpine lakes. Our study underscores the importance of

interdisciplinary collaboration, as it was the fusion of mathematics and geosciences that enabled us to solve this ancient riddle.

The implications of our work extend far beyond Lake Aiguebelette. The methodologies we developed are now being applied to larger alpine lakes, enhancing our understanding of past events and helping us better estimate future hazards in these regions. This research not only enriches our historical knowledge but also equips us with tools to mitigate potential risks.

As we continue to explore the geological mysteries of alpine lakes, we invite you to stay tuned for more exciting discoveries. Each new finding brings us closer to unraveling the intricate tapestry of Earth's dynamic history, and we are thrilled to share this journey with you. 





Capturing and reusing heat
might power the future

The reduce, reuse, recycle model no longer applies only to what might get tossed out in the bin. And in a world with fluctuating oil prices and the need to reach sustainability goals, waste-heat recovery looks to be a winner.

The U.S Department of Energy estimates that of the energy transferred within any human-originated activity, 20 to 50 percent is lost as heat. Whether that's from industrial plants, heat from the backside of our refrigerators or from the human body's metabolism, it's wasted energy. But if we capture and reuse it, what might this mean for big industries and subsequently, the environment and our pocketbooks?

"Energy efficiency is a win-win. It's good payback and good for the bottom line and it's good for the planet. We have the technology, we just have to make it happen," says Julien Gennetier, president of Business Unit Gasketed Plate Heat Exchangers and vice president of the energy division at Swedish heavy industry company Alfa Laval.

Industry

The fossil-fuel combustion process generates energy for things from powering machinery to fueling delivery trucks, all producing heat as a byproduct.

But if we're capturing carbon, why not heat? It's much easier to repurpose and we don't have to create something new to use it for or store it underground — we can simply use it in its existing state for heat. It can also be repurposed for electricity generation or cooling.

This idea isn't a revelation. Waste heat has been used for decades, but its vast potential is majorly underutilized. Some industries, however, are taking advantage of improving technologies.

The petrochemical industry for one. Traditionally, waste-heat recovery is mostly focused on converting high heat to electricity, but most of the waste heat produced in refinery processes is low-temperature. And it is seen as costly and not overly valuable to convert.

"There is always a mismatch in terms of available waste-heat supply and heat demand in terms of heat and location. The majority of waste-heat is low-grade (low temperature), which is not suitable for industrial processes operating at high temperatures. Otherwise, this type of heat is ideal for buildings, which are far away from factories. In this case, careful planning of available waste-heat and requirements is needed in addition to waste-heat recovery devices >>>



Variation in pressure is harnessed to power a turbine that generates clean electricity."

— Climeon



and infrastructure,” says Ismail Issa Alkhatib, a post-doctoral researcher in chemical and petroleum engineering at Khalifa University.

Sweden-based clean-tech company Climeon, however, developed a technology that converts this low-temperature heat to decarbonized electricity. It works by using waste heat and cold water. The liquid is evaporated into gas and then condensed back into a liquid state, operating as a closed-loop system.

“This variation in pressure is then harnessed to power a turbine that generates clean electricity, which can be used for on-site power or fed back to the grid,” Climeon’s website says.

Meanwhile, the cement industry, which is responsible for about 7 percent of global industrial carbon dioxide emissions, has been harnessing high-temperature waste heat.

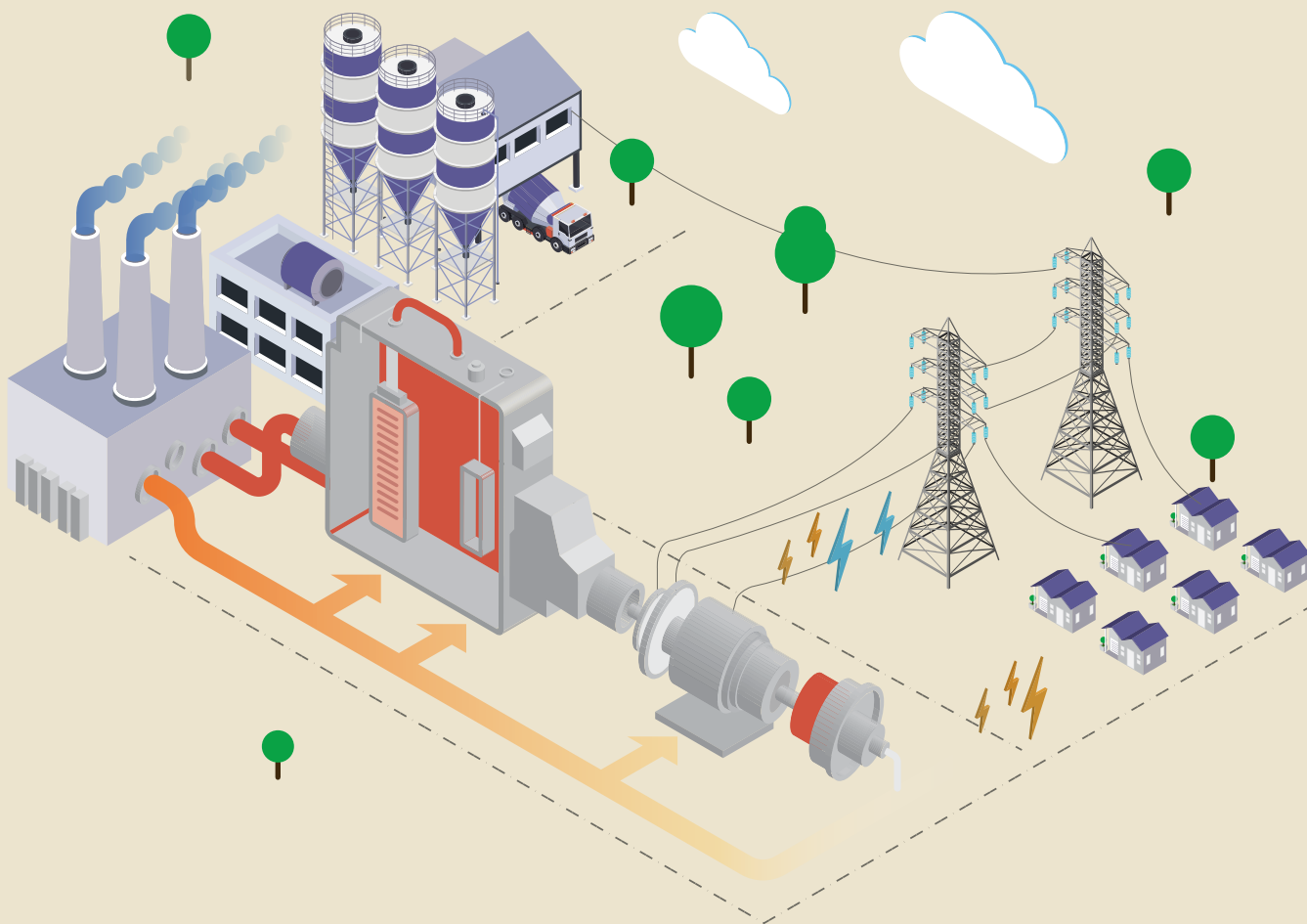
Some processes involved in manufacturing cement are extremely energy-intensive. Making clinker, a blend of limestone and minerals that binds cement products, can require kiln temperatures above 1,400 degrees Celsius.

A 2023 study by researchers at Universidad Pontificia Bolivariana finds that only 31 percent of the input heat in the process is used. The rest is waste.



Waste-heat recovery emerges as a promising solution for addressing energy shortages and environmental pollution.”

— Researchers at South China University of Technology



Waste-heat recovery

The unseen power

20-50%

of energy is lost as heat

3,100 Twh

heat wasted annually: 11.6% of global electricity consumption



Heat captured → converted

33%

Energy needs in the cement industry potentially met by waste heat

€140B

Can be saved annually (McKinsey)



But industrial news site Power Engineering International suggests that waste heat from the kiln and other processes can power up to 33 percent of the plant's energy needs, and industry consultant McKinsey Sustainability says global waste heat recovery, depending on whether the waste-heat is used for heat or electricity, can reach up to €140 billion in energy savings annually.

And according to Custom Market Insights, the global waste-heat-recovery market is estimated to reach U.S.\$133,748.4 million by 2033, up from the 2024 expected valuation of U.S.\$63,653 million.

That's just the monetary side of the savings.

The next level

The same McKinsey report estimates that 3,100 thermal

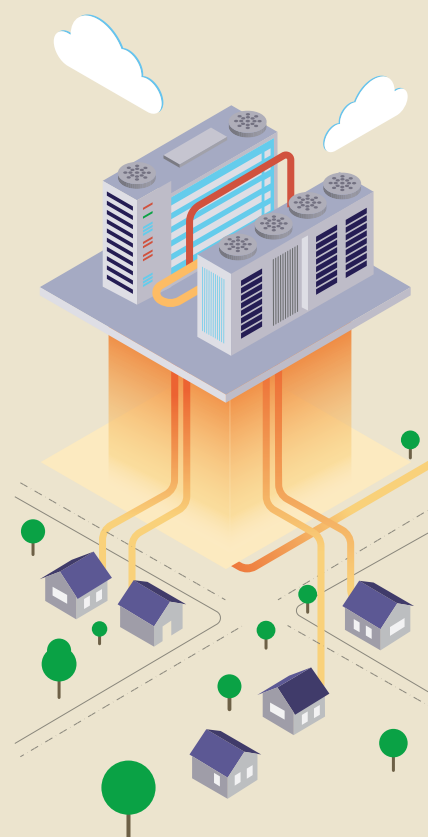
terawatt-hours of reusable heat are wasted annually — this equates to about 11.6 percent of total global electricity consumption.

In the tech sector, one of the most energy-intensive sources is data-processing centers.

These centers never take a break. They run continuously. And they use enormous amounts of energy keeping the technology cool, resulting in high carbon emissions.

A 2023 review of waste heat in data centers published in Science Direct says that IT equipment such as servers use 44 percent of total data center electricity. Cooling uses another 40 percent.

Some large companies around the world are now building their data facilities with heat repurposing in mind. >>>





Global tech giant Microsoft, for example, is building three data centers in Denmark, and the waste will heat up to 6,000 homes.

Microsoft isn't the only company helping Denmark meet its goal of shutting down its reliance on coal by putting otherwise wasted heat to work.

Global engineering, architecture and consultancy company Ramboll designed a heat pump and energy center in which heat-recovery systems operate to heat water and homes locally.

Any business, it appears, can harness its waste heat.

And perhaps soon — any body.

Human heat

We all burn fuel so we can function.

But is the heat we emit into the air enough to power anything?

As researchers develop and improve wearable and portable devices, it's worth exploring.

Scientists from the Laboratory for Organic Electronics in Japan are hoping a wearable material might one day allow you to throw on a sweater that could power your mobile phone.

The team developed yarn from carbon nanotubes that can be used in flexible, fabric-like devices to generate electricity from heat.

This dispersion method is new, inexpensive and environmentally friendly and makes the threads conduct electricity much more efficiently. The method also keeps the threads from getting too warm, which contributes to better functionality.

Why isn't everyone doing it?

But if it's so great, what's stopping the whole world from putting heat-exchange systems to work?

"Waste-heat recovery emerges as a promising solution for addressing energy shortages and environmental pollution. However, its viability is hampered by high operational expenses, formidable technical barriers, and substantial

capital requirements, rendering it economically daunting,” according to researchers at South China University of Technology.

These things take time. And money. For large corporations, the start-up infrastructure costs might be doable, but for others it might be a challenge.

Over time, waste-heat recovery saves costs, but installing equipment and systems are expensive. Up-front costs of such a program might be complicated for small- and medium-size enterprises. A typical return on investment could take about five years. For some businesses, that might seem too long.

“Additionally, the market is highly fragmented, in the sense, the heat-recovery solutions are on a case-by-case basis. One might fit this type of industry and layout, while another wouldn’t,” says KU’s Alkhatib.

Depending on the building that waste-heat-recovery systems are added to, it could also be a complicated installation. Many older buildings, additionally, would require insulation upgrades to make waste-heat-recovery systems efficient.

But all of these issues can be solved with money. The South China University of Technology report suggests government funding is the answer.

“If the government increases subsidies, members of the supply chain of waste-heat recovery are willing to expand the scale and third-party recycling companies may develop waste heat recovery business within a certain threshold. In this way, more end users can consume clean energy at a lower cost, which helps further reduce carbon emissions,” the report says. ●

HOW DOES IT WORK?

In order to fully comprehend the process by which heat is captured, converted and reused, you need a basic understanding of thermodynamics.

Thermodynamics is the study of the principles of energy, its transformations and how it interacts with matter. Two of its laws apply to capturing and reusing waste heat.

The first law of thermodynamics is that energy cannot be created or destroyed, it can only be transferred into another form; consequently, the total amount of energy in the universe never changes. For example, when you switch on a light, electrical energy is transferred to thermal or heat energy and radiant energy, which is light. So, flipping the light switch isn’t creating energy, it’s simply changing into different forms of energy — light, which can be used, and heat, which is not used and becomes waste.

The second law dictates that things in our world naturally go from being ordered or organized to being disordered or messy. This is called entropy. This law states

that the mess, or entropy, increases over time unless we tidy it up. This requires effort and energy. So, when waste heat is recaptured and repurposed, decreasing entropy, we’re finding a way to put it back to work. Conversion of heat to other forms of energy is subject to the second law of thermodynamics.

There are a wide variety of waste-heat-recovery systems in play today, and it’s really about choosing a system that’s right for the heat being captured and the energy purpose it might serve. From turbines using high-pressure steam or water from a boiler and recovering the low-pressure steam for process heating or combination of heat and power system (CHP), to a CHP that generates electricity via an engine or gas turbine and producing steam or hot water to heat or cool, there are options for most industries. And many of them today are decarbonized.

There are both open and closed systems. The open system, in which heat can be transferred to the air and lost, holds the potential we aim to repurpose, from industry to the human body.

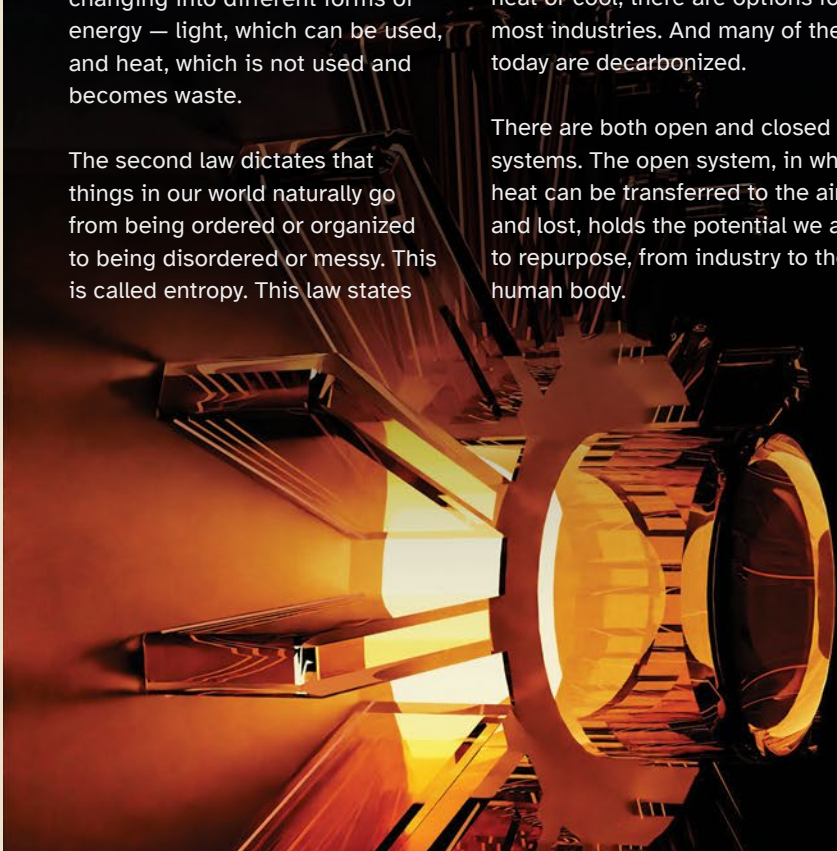


PHOTO : Unsplash



Urbanization presents significant challenges to wildlife, and while many species are suffering the impact of extensive urban sprawl, high vehicular and pedestrian traffic and increased pollution, some species have adapted to thrive in these new environments.

Urban areas can provide opportunities, especially to mammals, says Luca Santini. Santini leads the Sapienza University of Rome Ecology and Conservation Across Scales lab. His research focuses on unravelling how ecological patterns and processes have been altered by anthropogenic pressures.

“Urbanization exposes wildlife to new challenging conditions and environmental pressures. Some mammalian species have adapted to these novel environments, and we wanted to know which characteristics allow them to persist.”

Santini identified 190 mammals regularly recorded in urban settlements worldwide, including bats, rats, foxes, primates and rabbits, and analyzed their behavioral, ecological and life-history traits to understand their success.

He found **all urban mammals tend to have larger litters, which may help counterbalance the higher mortality rates found due to traffic accidents and human-wildlife conflicts; larger brain sizes, indicative of greater cognitive abilities and behavioral flexibility to help navigate the unpredictable conditions of urban life; and a varied diet that could help mammals exploit a wide range of**

There's something about urban life that encourages diverse strategies for survival

resources in urban environments where food sources are diverse and inconsistent.

“We found that a high diversity of mammals is regularly recorded in urban settlements worldwide, comprising around 3.4 percent of global mammal species,” Santini says.

“As urbanization continues, an increasing number of mammal species are expected to adapt to urbanized environments. Urban areas will, therefore, be progressively important as novel settings for mammal research, conservation and management.”

Menno Schilthuizen, author of “Darwin Comes to Town,” agrees. He argues urban environments are “powerhouses of evolution” and accelerate evolution. One of his examples is the urban crow in the Japanese city of Sendai.

“At some point in the 1980s, the crows discovered that it’s easier to take a walnut and put it in front of the wheel of a slowly moving vehicle than it is to drop it from a great height.

“It’s not evolution, in the sense that there is not a gene for putting walnuts in front of car wheels. But there are genes for personality traits, which have to do with problem solving, curiosity and being tolerant of people. Urban birds and mammals all over the world constantly find new ways of making use of the human inhabitants of the city.”

Schilthuizen says city **blackbirds** have shorter beaks than those in the countryside, start breeding earlier in the year and even sing at a different pitch. All these differences mean they can’t breed with forest

blackbirds anymore: They’re a new species now. The Puerto Rican crested anole lizard has evolved to have bigger toe pads to better grip smooth surfaces like glass windows and concrete, rather than the trees it would have climbed in a previous life.

“**We found that a high diversity of mammals is regularly recorded in urban settlements worldwide, comprising around 3.4 percent of global mammal species.**”

— Luca Santini

White-footed mice in New York can better digest pizza than their forebearers. **Snails** in Europe are now more likely to have yellow shells than brown ones, likely due to the fact that urban areas become heat islands and yellow shells keep the snails cooler.

City living is changing animals in all sorts of ways from their bodies to their brains to their behaviors. The city is the fastest-growing ecosystem on the planet, acting as a Petri dish for studying evolution on a rapid scale. As research continues to uncover animal adaptations to urban environments, one thing is clear: We’re all learning to share our space. ●

Protect the salamander

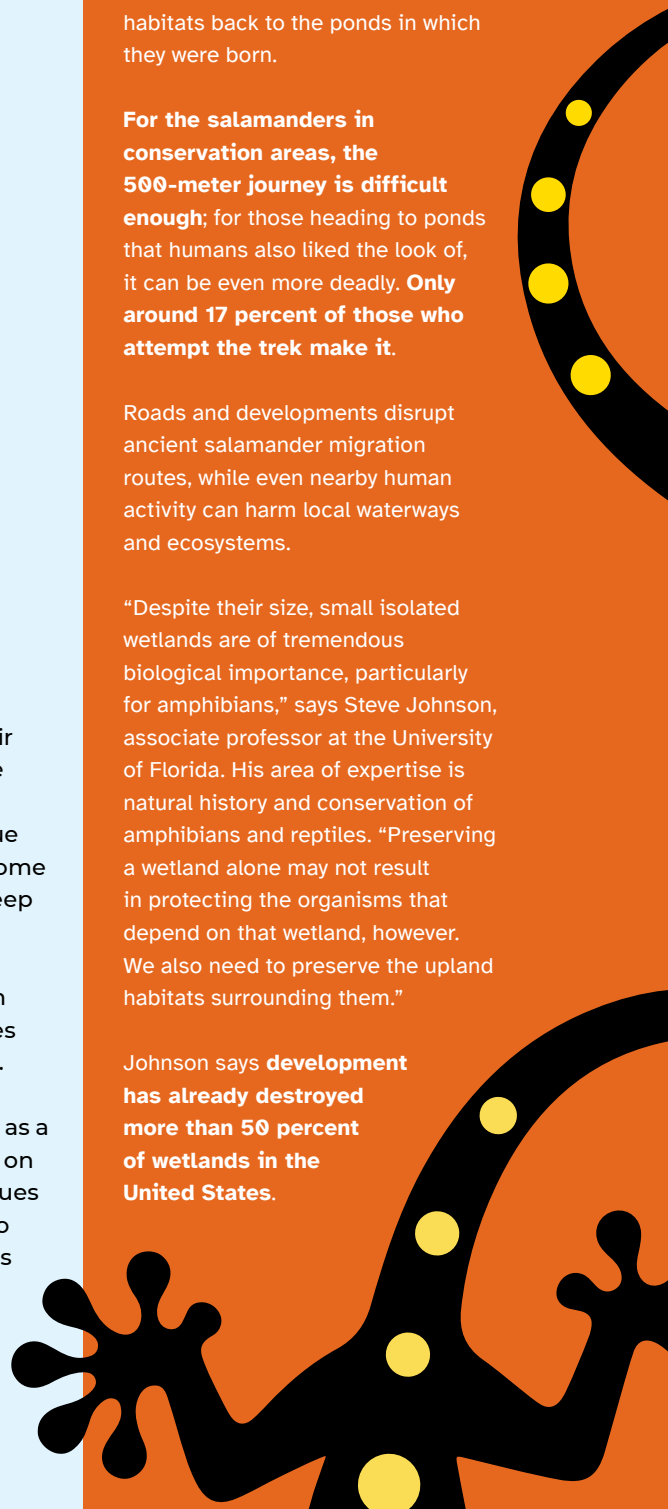
Scuttling through the long grasses and over fallen leaves, hundreds of spotted salamanders each spring make the arduous journey back to one or two ponds in the Daniel Boone Conservation Area in Missouri, USA. They are compelled by the need to breed, coaxed out of their usual habitats back to the ponds in which they were born.

For the salamanders in conservation areas, the 500-meter journey is difficult enough; for those heading to ponds that humans also liked the look of, it can be even more deadly. **Only around 17 percent of those who attempt the trek make it.**

Roads and developments disrupt ancient salamander migration routes, while even nearby human activity can harm local waterways and ecosystems.

“Despite their size, small isolated wetlands are of tremendous biological importance, particularly for amphibians,” says Steve Johnson, associate professor at the University of Florida. His area of expertise is natural history and conservation of amphibians and reptiles. “Preserving a wetland alone may not result in protecting the organisms that depend on that wetland, however. We also need to preserve the upland habitats surrounding them.”

Johnson says **development has already destroyed more than 50 percent of wetlands in the United States.**





WE ASKED THE EXPERTS:
**What small thing or simple idea will have
the biggest impact on your field in the
next 10 years?**

LOOKING TO THE OCEANS

By: **Naveed Nabi & Imtiaz Ahmed**

Climate change poses enormous risks to conventional agriculture production. Mitigating this crisis requires a sustainable shift toward one simple idea: the blue transformation.

Because agriculture production is highly sensitive toward spatial and inter-temporal variations in natural factors, aquaculture is reasonably resilient to such climatic alterations.

In present times, when food security is a serious concern, aquaculture has played a key role to mitigate this crisis, supplying about 178 million tons of food in which 20.2 kg per capita is destined for human consumption.

The rapid growth of aquaculture over the past three decades has both encouraged and alarmed scientists and policy professionals who are concerned about global food security.

The boost in blue economy has placed aquaculture product trade value at a record U.S.\$ 195 billion in 2022. Compared with the aquaculture sector, the majority of the terrestrial livestock business is less flexible when it comes to using agriculture and fisheries resources for human protein intake. Aquaculture not only adds resilience to global food system through improving resource-use efficiencies, but also by diversifying the farmed species.

Despite its remarkable worldwide expansion, the aquaculture industry is confronting many environmental challenges to achieve robustness of sustainability and a better public reputation.

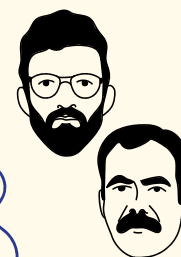
Escapes of fish from farmed systems can impose serious ecological consequences and

are considered one of the key environmental risks associated with aquaculture.

Farmed fish escapees can impact native species through predation, competition and the spread of disease and parasites.

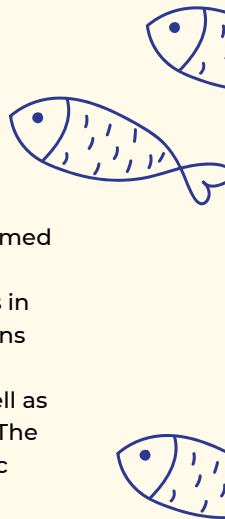
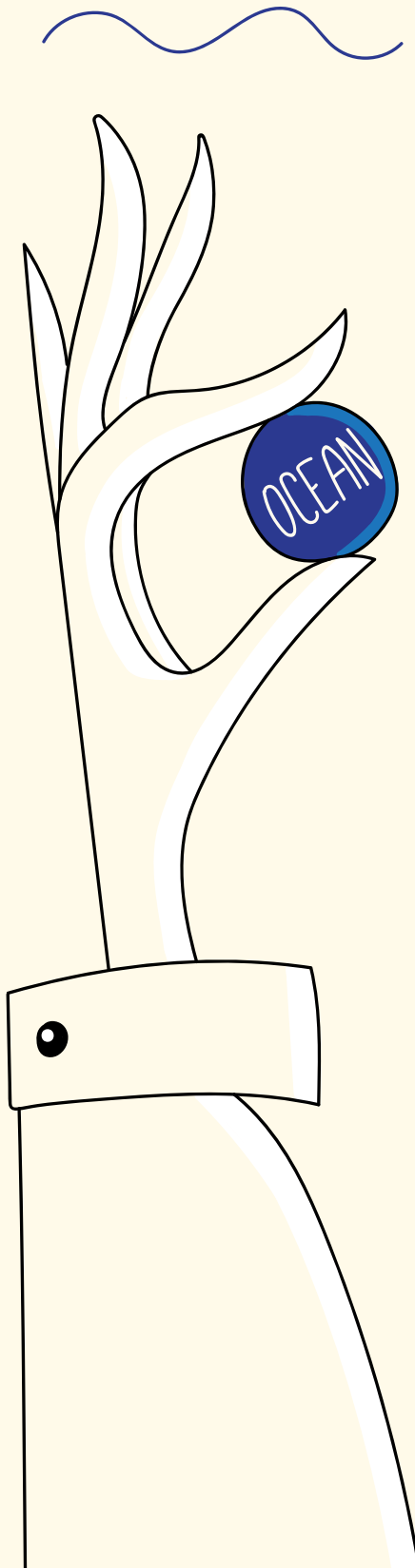
The other major effects of fish farming on natural ecosystem include eutrophication of downstream watershed posing crucial environmental risks such as establishment of harmful algal blooms. The common use of pesticides to control pathogen-specific infestations has deleterious effects on some non-target species that are thriving in the surrounding environment. Moreover, research suggests the massive use of antibiotics to prevent bacterial infections, particularly in salmon aquaculture.

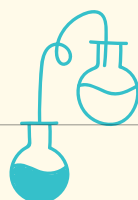
A significant portion of these antibiotics is released into the environment through unconsumed food, urine and feces. The persistence of these antibiotics in sediments can lead to alterations in species composition and biogeochemical function as well as resistance in benthic bacteria. The severe implications of antibiotic usage in aquaculture include the rising concerns about the proliferation in the proportion of antimicrobial-resistant bacteria to antibiotics that are used in human medicine. >>>



Naveed Nabi is an assistant professor at University Centre for Research and Development at Chandigarh University.

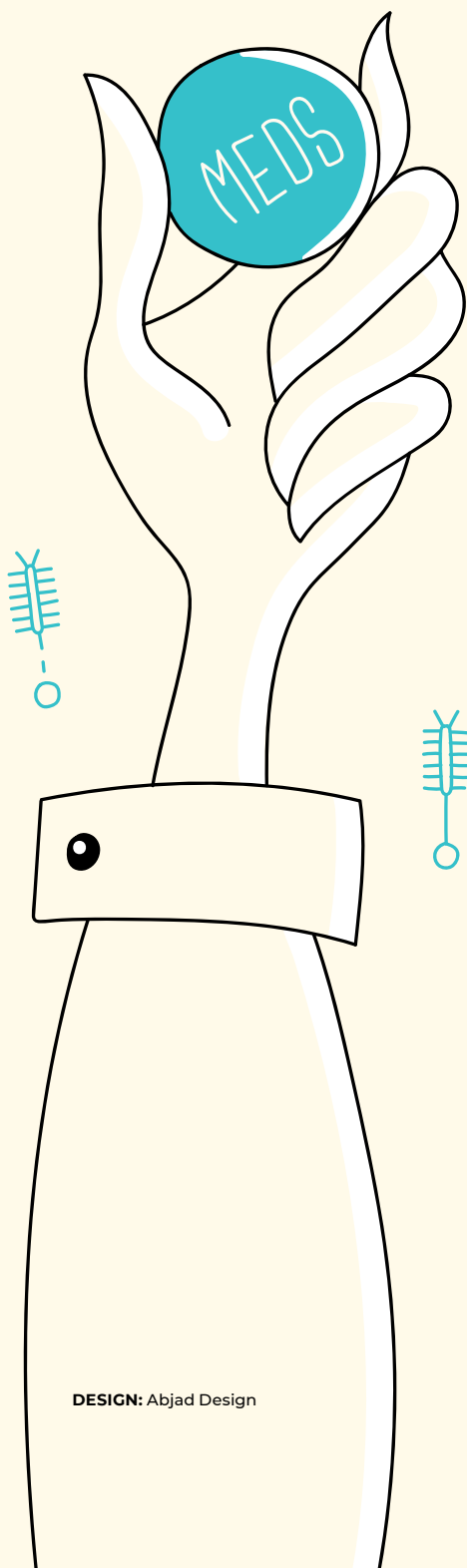
Imtiaz Ahmed is a professor of zoology at University of Kashmir.





DELIVERING NEW DRUGS FASTER THAN EVER

By: **Yasir S. Raouf**



DESIGN: Abjad Design

Drug discovery has long been considered one of the most difficult and expensive scientific endeavors.

Traditional approaches typically require more than 10 years of development, with costs exceeding U.S. \$1 billion.

Even after years of effort, failure rates remain relatively high due to lack of clinical efficacy, idiosyncratic toxicities and unforeseen resistance mechanisms.

This arduous process demands highly specialized personnel, extensive experimental validation and a rigorous regulatory pathway, making it one of the most resource-intensive fields in science.

However, a simple but transformative idea — the use of artificial intelligence (AI) — is now disrupting this paradigm.

Recent advances in AI, graphics processing units and quantum computing have already revolutionized fields like finance, materials science and climate modeling. Drug discovery is no exception.

Integrating AI-driven platforms into drug development dramatically reduces the time and resources required to bring new therapies to market.

AI-powered drug discovery has shown remarkable efficiency, making it possible to develop new drugs in a fraction of the cost/time.

A prime example can be seen with In Silico Medicine, an AI-driven drug-discovery company that recently expanded into the UAE's Masdar City. This reinforces the nation's commitment to innovations in biotechnology.

QPCTL is an essential gene for glioma proliferation (a type of brain cancer). In Silico's QPCTL-inhibitor program co-developed with Fosun Pharma reached developmental candidate nomination in just nine months. The typical timeline is two to four years.

Similarly, In Silico nominated a TNIK preclinical candidate for idiopathic pulmonary fibrosis in under 18 months.

TNIK is an enzyme involved in many cellular processes. This compound ISM005 recently showed positive Phase IIa results and represents a critical milestone in validating AI-powered drug discovery as a viable approach to accelerating clinical breakthroughs.

Cancer-drug resistance is one of the most important challenges in drug discovery.

It likely isn't an overstatement to consider this issue a "holy grail" of personalized medicine and targeted small molecules.

Many of the most successful cancer therapies fail within months or years due to powerful selective pressures, inducing broad mutant-resistance.

This is especially relevant in diseases like lung cancer, leukemia and melanoma, where tumors quickly develop resistance to targeted therapies.

While the pharmaceutical industry has long been cautious about disruptive technologies, the success of AI-driven pipelines suggests that the next decade will be defined by AI-accelerated drug discovery.

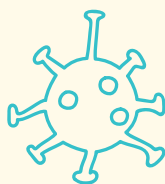
This shift does not replace the expertise of trained medicinal chemists but rather enhances



human decision-making by filtering out weak candidates early, expediting optimization and bridging computational insights with experimental validation.

As AI drug discovery continues to evolve, the dream of developing life-saving therapies in record time is rapidly becoming a reality.

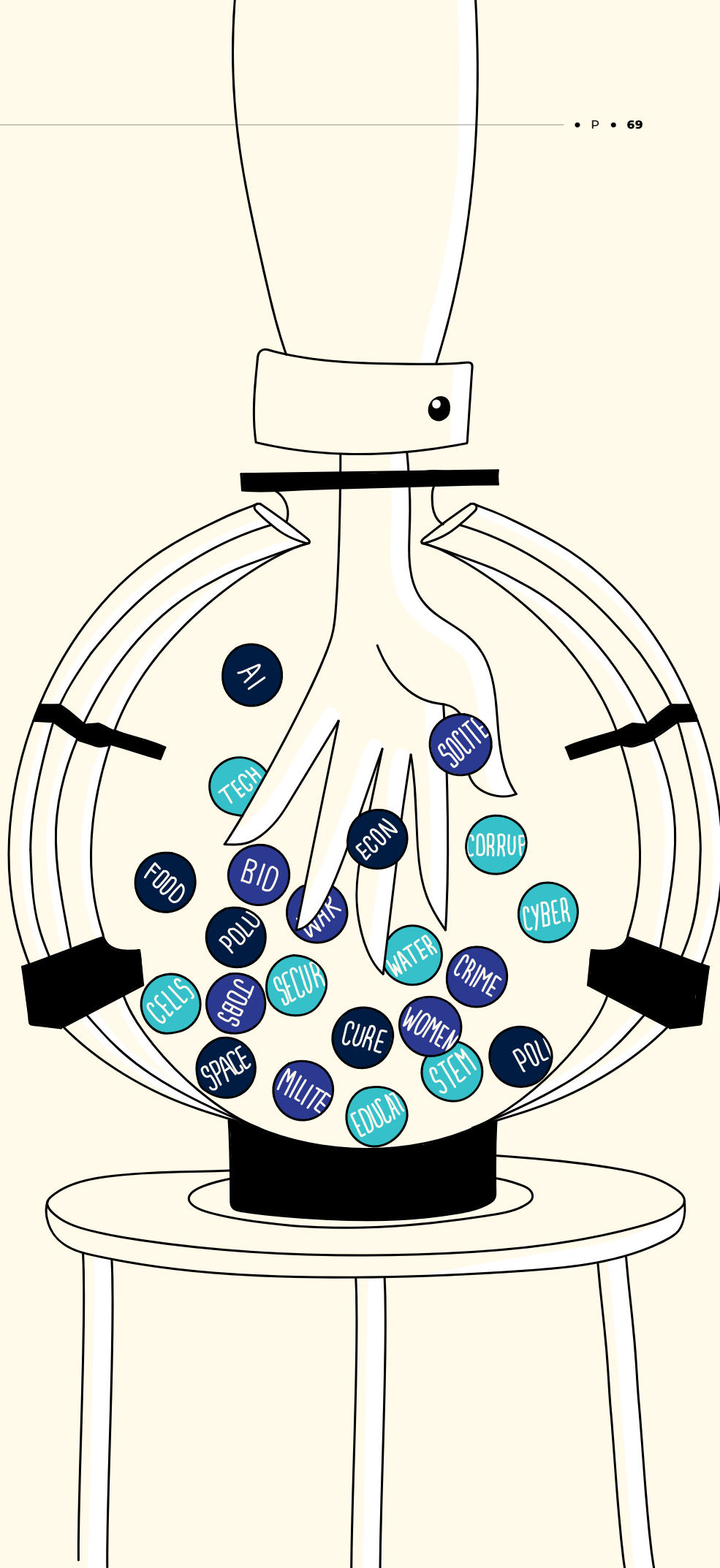
The simple but transformative idea of AI is already redefining the future of medicine — bringing hope to patients faster than ever before. Whether this paradigm can be extended to overcoming mutant resistance mechanisms in the next decade remains to be seen. >>>

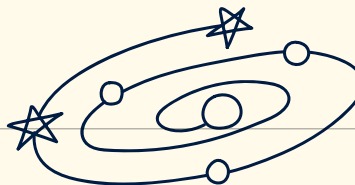


“Integrating AI-driven platforms into drug development dramatically reduces the time and resources required to bring new therapies to market.”



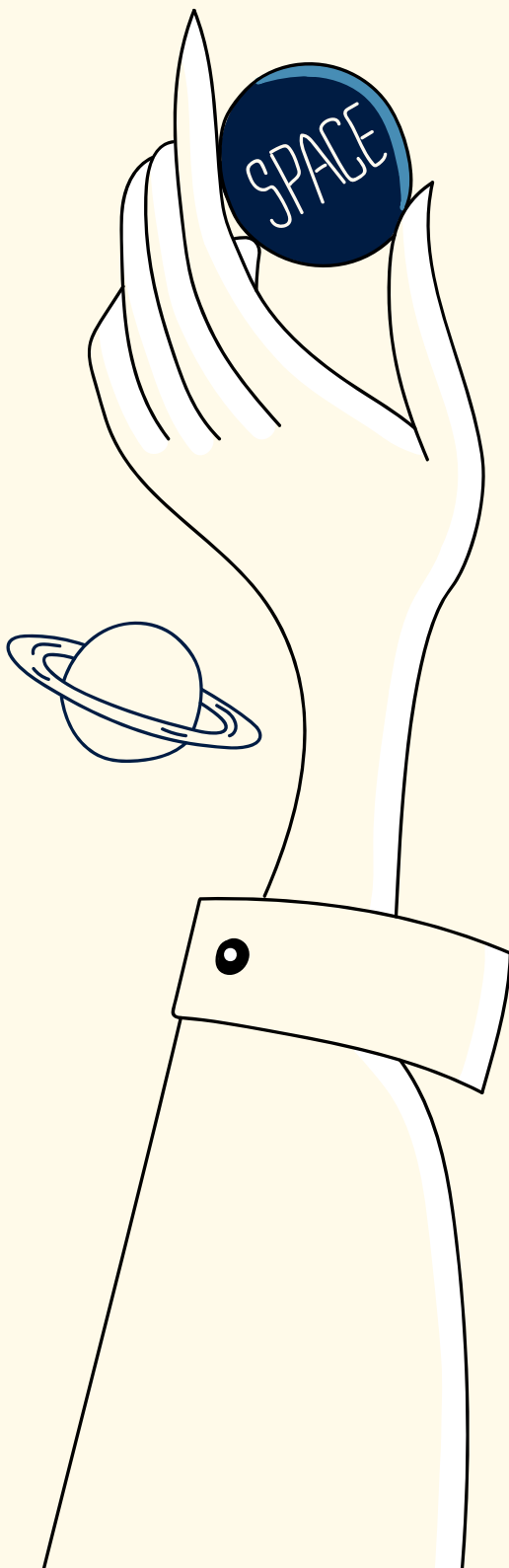
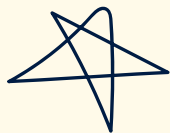
Yasir S. Raouf, Ph.D., is an assistant professor of medicinal chemistry at United Arab Emirates University.





A COMING SHIFT IN THE STARS

By: Moe Abbas



In the coming decade, our understanding of galaxy formation and evolution is poised for a profound shift, driven by the study of galactic cannibalism — the process by which the Milky Way has devoured smaller galaxies over billions of years. This is no abstract theory; it's a phenomenon written in the faint stellar streams that weave through our galaxy's outskirts, like whispers of a cosmic past waiting to be deciphered.

Galactic cannibalism happens when a larger galaxy, such as the Milky Way, captures and consumes smaller galaxies, tearing them apart through tidal forces. These devoured galaxies leave behind streams of stars and gas — delicate, ethereal traces of their once distinct identities. These streams, though faint and elusive, hold the key to unraveling the Milky Way's growth and transformation over time.

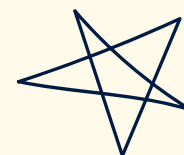
The next decade will usher in a revolution in our ability to uncover these streams, thanks to cutting-edge telescopes and the rise of AI-powered data analysis. With unprecedented precision, astronomers will map the remnants of ancient galactic interactions, revealing the Milky Way's intricate history of mergers and assimilations. These discoveries won't just illuminate how our galaxy came to be but will fundamentally reshape our understanding of how galaxies form, evolve and interact across the universe.

What's truly remarkable about this research is its ability to reconstruct the Milky Way's "cosmic autobiography." Stellar streams act as time capsules, offering snapshots of our galaxy at different stages of its existence. By piecing together these snapshots, we'll gain insights not only into the Milky Way's past

but also its future — especially as it continues its slow dance with nearby dwarf galaxies.

The implications of this work extend far beyond our galactic borders. Galactic cannibalism is a universal process, one that underpins the growth of galaxies across the cosmos. By studying these interactions in our own backyard, we establish a blueprint for understanding the life cycles of galaxies everywhere.

Though the idea of tracing faint, ancient stellar remnants might seem small, its potential to revolutionize our understanding of the universe is immense. These faint streams could redefine how we view galaxies, their histories and the cosmic forces that shape them, making galactic cannibalism one of the most transformative ideas in astrophysics today. ●



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THINK SMALL

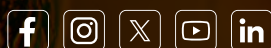
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Our Precious

In the highlands where ancient Ethiopia now lies, the coffee plant first awoke, hidden and wild, like a secret kept by the mountains. But it was in Yemen that this humble bean found its destiny, nurtured by careful hands and bound at last to the fate of peoples. From there, along winding trade roads and across perilous seas, it journeyed forth, bearing with it both its rich essence and its name, until all the world came to know the dark brew that once stirred only distant lands.

Wanderwort (German) or wander word: A word that has spread among many languages and cultures, especially those that are far away from one another. Coffee is one of those words.



One word to rule them all,
one word to find them.

One bean to bring them all,
and in the **dark roast** bind them.

