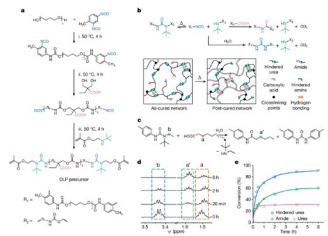# Weekly Discovery

We SHARE to inspire and ignite ideas!

15 Jul – 19 Jul 2024

3D PRINTING
3D Printable Elastomers with Exceptional Strength and Toughness

"Three-dimensional (3D) printing has emerged as an attractive manufacturing technique because of its exceptional freedom in accessing geometrically complex customizable products. Its potential for mass manufacturing, however, is hampered by its low manufacturing efficiency (print speed) and insufficient product quality (mechanical properties). Recent progresses in ultra-fast 3D printing of photo-polymers have alleviated the issue of manufacturing efficiency, but the mechanical performance of typical printed polymers still falls far behind what is achievable with conventional processing techniques. This is because of the printing requirements that restrict the molecular design towards achieving high mechanical performance. Here we report a 3D photo-printable resin chemistry that yields an elastomer with tensile strength of 94.6 MPa and toughness of 310.4 MJ m−3, both of which far exceed that of any 3D printed elastomer. Mechanistically, this is achieved by the dynamic covalent bonds in the printed polymer that allow network topological reconfiguration. This facilitates the formation of hierarchical hydrogen bonds (in particular, amide hydrogen bonds), micro-phase separation and interpenetration architecture, which contribute synergistically to superior mechanical performance. Our work suggests a brighter future for mass manufacturing using 3D printing."

Source: Nature (3 Jul 2024)

AI
When To Trust an AI Model

"CAMBRIDGE, MA – Because machine-learning models can give false predictions, researchers often equip them with the ability to tell a user how confident they are about a certain decision. This is especially important in high-stake settings, such as when models are used to help identify disease in medical images or filter job applications.

But a model's uncertainty quantifications are only useful if they are accurate. If a model says it is 49% confident that a medical image shows a pleural effusion, then 49% of the time, the model should be right.

MIT researchers have introduced a new approach that can improve uncertainty estimates in machine-learning models. Their method not only generates more accurate uncertainty estimates than other techniques, but does so more efficiently.

In addition, because the technique is scalable, it can be applied to huge deep-learning models that are increasingly being deployed in health care and other safety-critical situations.

This technique could give end users, many of whom lack machine-learning expertise, better information they can use to determine whether to trust a model's predictions or if the model should be deployed for a particular task."

Source: Eurekalert! (12 Jul 2024)

AI
Researchers Customize AI Tools For Digital Pathology

"Scientists from Weill Cornell Medicine and the Dana-Farber Cancer Institute in Boston have developed and tested new artificial intelligence (AI) tools tailored to digital pathology—a rapidly growing field that uses high-resolution digital images created from tissue samples to help diagnose disease and guide treatment.

Their paper, published July 9 in The Lancet Digital Health, demonstrates that ChatGPT, an AI language model developed to understand and generate text, can be tailored to provide accurate responses to questions about digital pathology and compile detailed results. The authors also found that ChatGPT can help pathologists without extensive coding experience use complex software that analyzes tissue samples, helping bridge the gap between pathology and digital pathology skills."

Source: Cornell (9 Jul 2024)

AI
### AI Chatbots Have Shown They Have An 'Empathy Gap' That Children Are Likely to Miss

"When not designed with children's needs in mind, Artificial intelligence (AI) chatbots have an "empathy gap" that puts young users at particular risk of distress or harm, according to a study.

The research, by a University of Cambridge academic, Dr Nomisha Kurian, urges developers and policy actors to make "child-safe AI" an urgent priority. It provides evidence that children are particularly susceptible to treating AI chatbots as lifelike, quasi-human confidantes, and that their interactions with the technology can often go awry when it fails to respond to their unique needs and vulnerabilities.

The study links that gap in understanding to recent cases in which interactions with AI led to potentially dangerous situations for young users. They include an incident in 2021, when Amazon's AI voice assistant, Alexa, instructed a 10-year-old to touch a live electrical plug with a coin. Last year, Snapchat's My AI gave adult researchers posing as a 13-year-old girl tips on how to lose her virginity to a 31-year-old."

Source: Cambridge (12 Jul 2024)

AI
Atlas Of Proteins Reveals Inner Workings of Cells
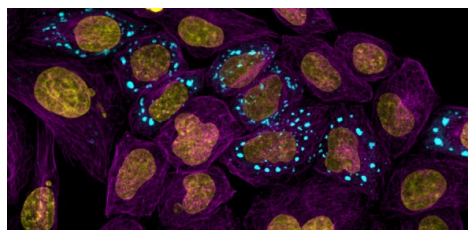
"Researchers at our department discover how proteins behave inside cells using AI, which has the potential to guide drug design.

Led by the Knowles group, scientists have developed an atlas of proteins describing how they behave inside human cells. This tool could be used to search for the origins of diseases which are related to proteins misbehaving such as dementia and many cancers.

The atlas, published in Nature Communications, has allowed the researchers to find new proteins inside cells that are responsible for a range of important bodily functions. The team focuses on a droplet-like part of the cell called a condensate which is a meeting hub for proteins to go and organise themselves. These hubs are also key sites where disease processes start.

The predictions are available with the paper so researchers around the globe can explore their protein targets of interest and any surrounding condensate systems.

"This model has allowed us to discover new components in membraneless compartments in biology as well as discover new principles underlying their function," said Professor Tuomas Knowles, who led this research."

Source: Cambridge (7 Jul 2024)

AI
Young People Believe That Artificial Intelligence Is a Valuable Tool for Healthcare

"The national study asked children and young people aged six to 23 years old, across all four UK nations for their views on how they would like AI to be used to enhance their healthcare.

The team was led by Professor Susan Shelmerdine (UCL Great Ormond Street Institute of Child Health and GOSH) and Dr Lauren Lee, a Young Facilitator in the GOSH Young Persons' Advisory Group (YPAG) - a group that works with GOSH to ensure young people's views are considered.

AI is becoming more available in modern healthcare, particularly in the field of radiology, where it can be used to analyse scans. But while the radiology community, including children's radiologists, are generally positive about AI use, little attention has been paid to how children and young adults feel about the use of AI on their own imaging data.

The results of the survey, which was co-developed with a steering committee of patients and carers from the GOSH YPAG and GOSH parents and Carer Advisory Group (PCAG) for research showed that children and young people are cautious, but generally positive about AI.

The survey results found that young people were keen for AI to be used in healthcare, particularly if it could improve their care and outcomes. However, they wanted the tools to be supervised by healthcare professionals as they feel there are elements of care such as empathy and ethical decision making, that AI cannot mimic and when faced between a human and computer they would be more willing to trust the human."

Source: UCL (10 Jul 2024)

ARCHITECTURE
How Researchers Are Using Digital City-Building Games to Shape the Future

"Lancaster University researchers have come up with exciting and sophisticated new mapping technology enabling future generations to get involved in creating their own future built landscape.

They say, in their new research published today (June 30) that planners are missing a real trick when it comes to encouraging and involving the public to help shape their own towns, cities and counties for the future.

They also say that games platforms can be used to plan future cities and also help the public immerse themselves in these future worlds.

The researchers have modified Colossal Order's game 'Cities: Skylines' where players control zones, public services and transportation.

Real-world buildings and models can be imported into the game to create realistic cities and inform planning.

Players can manage education, police and fire services, health and even set tax policies, amongst other realistic simulations. The game dashboard even measures how happy citizens are!

Players must add infrastructure, manage power, water and think carefully about what is needed for their community.

Given that, according to Royal Town Planning Institute statistics, only 20% of younger people are interested in planning, the use of digital games, say the researchers, enables the public to 'play' real-world planning policies based on a 'real world' place, which creates a dialogue with planners."

Source: Lancaster (1 Jul 2024)

ARCHITECTURE
Headed To The 2024 Olympics: 20 Innovative and Iconic Architectural Projects to Explore in Paris

"In 1900, Paris hosted its first Olympic games. It had been the second city to host them after the first Olympics in Athens. It was also the year of the Exposition Universelle, where the city would again showcase how it remade itself anew in less than 30 years. To this day, Paris remains a hub for all sorts of architectural innovation and development through bold designs that affect how people live and new materials and techniques. It fascinatingly juxtaposes grandeur and monumentalism with its predominately baroque, "second empire," and art nouveau works, while also pushing for designs that strive for social living reforms such as in Le Corbusier's experimental works or Lacaton & Vassal's considerate interventions.

It's this openness to the world that attracts not only millions of visitors a year but also innovators and architects who have set up shop in Paris and made it their second home. Once again, the city reworks itself as mass construction, renovation, and restoration sites culminate all over the city to host international athletes at the 2024 Olympics.

While we've already considered some of Paris's renowned modernist and brutalist buildings, we've listed 20 iconic Cultural, Commercial, and large Office projects worth visiting this summer."
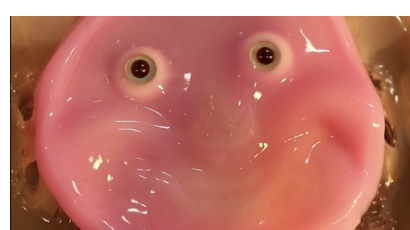
Source: Archdaily (5 Jul 2024)

ARCHITECTURE
Neuroscience And Architecture: Designing For the Human Experience

"Designing for the human experience has been at the forefront of architect's intentions and motivations behind their work. While

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DESIGN
Scientists Use Living Skin to Create Robot That Smiles

"Lifelike robots could be a step closer to reality with a new development from the University of Tokyo, where scientists have made a prototype

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ROBOTICS
Soft Robot Can Amputate and Reattach Its Own Legs: Inspired by Lizards and Ants, This Robot Can Change Its Shape at Will

"Among the many things that humans cannot do (without some fairly substantial modification) is shifting our body morphology

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ROBOTICS
Hydrogen Flight Looks Ready for Take-Off with New Advances
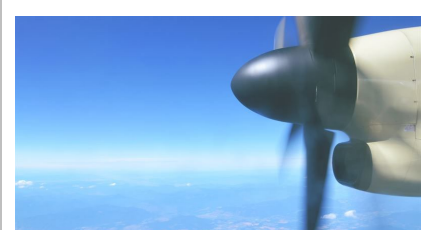
""If everything falls into place, the commercialisation of hydrogen flight can go really fast now. As early as 2028, the first

traditional processes prove beneficial, the industry is peering over boundaries to find opportunities for collaboration with other design and non-design fields. New approaches have emerged with collaborations between architects and service designers, or even psychologists, to create more human-centric spaces. A new intersection captures the attention of practitioners, especially with a recent installation at Salone de Mobile neuroarchitecture. ArchDaily breaks down the scope and potential for this new field with Federica Sanchez, architect and neuroscience researcher at Italian firm Lombardini22, responsible for revamping the Salone.

Neuroarchitecture brings a positive influence on traditional practice- often concerned with aesthetics, functionality, and code compliance- with a focus on well-being in design considerations. Essentially, the hybrid pursuit recognizes that human brains are intricately connected to the environments they inhabit. "Our body and brain continuously communicate interactions between external stimuli and sensory organs are converted into electrical signals, and the body sends sensory information to the brain," explains Sanchez. The emerging discipline bridges neuroscience and spatial design to challenge perceptions of a building's influence on human emotions, thoughts, and actions."

with living skin capable of a "natural smile".

The University of Tokyo team aimed to find a good way of binding living skin, which is skin grown in a lab from living cells, to a humanoid robot.

Living skin, also known as cultured skin, has been used in the robotics field before, but without a good mechanism to attach it to a base layer, it is deformed or damaged with movement.

The researchers' attachment method is inspired by the ligaments in human tissues and allows the skin to move in a realistic way, which they demonstrated by way of a smile."

around on demand. It sounds a little extreme to be talking about things like self-amputation, and it *is* a little extreme, but it's also not at all uncommon for other animals to do—lizards can disconnect their tails to escape a predator, for example. And it works in the other direction, too, with animals like ants adding to their morphology by connecting to each other to traverse gaps that a single ant couldn't cross alone.

In a new paper, roboticists from The Faboratory at Yale University have given a soft robot the ability to detach and reattach pieces of itself, editing its body morphology when necessary. It's a little freaky to watch, but it kind of makes me wish I could do the same thing.

These are fairly standard soft-bodied silicon robots that use asymmetrically stiff air chambers that inflate and deflate (using a tethered pump and valves) to generate a walking or crawling motion. What's new here are the joints, which rely on a new material called a bicontinuous thermoplastic foam (BTF) to form a supportive structure for a sticky polymer that's solid at room temperature but can be easily melted.

The BTF acts like a sponge to prevent the polymer from running out all over the place when it melts, and means that you can pull two BTF surfaces apart by melting the joint, and stick them together again by reversing the procedure. The process takes about 10 minutes and the resulting joint is quite strong. It's also good for a couple hundred detach/reattach cycles before degrading. It even stands up to dirt and water reasonably well."

commercial hydrogen flights in Sweden could be in the air," says Tomas Grönstedt, Professor at Chalmers University of Technology, and Director of the competence centre TechForH2* at Chalmers.

Some of these technological advances can be seen inside the Chalmers wind tunnels, where researchers test airflow conditions in cutting edge facilities. Here, more energy-efficient engines are being developed that pave the way for safe and efficient hydrogen flight for heavy-duty vehicles."

Source: Archdaily (14 Jul 2024)

Source: Dezeen (28 Jun 2024)

Source: IEEE Spectrum (13 Jul 2024)

Source: Chalmers (11 Jul 2024)