No Fishin'...Check This Out

Wildlife photographer Bill Doherty

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A Wright Whale of a Time (Groan)

This ought to make us think.

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Into the Woods; Color Woodcut, 1955.

笠松 紫浪

Kasamatsu Shiro, Japanese engraver and print maker (1898-1991).

The Japanese engraver was born in Tokyo in 1898 and apprenticed at the age of 13 to Kaburagi Kiyokata (1878–1973), a traditional master of Bijin-ga, pictures of beautiful women.

Kasamatsu however took an interest in landscape and was given the pseudonym Shiro by his teacher, which he used as a signature mark in his prints.

Kasamatsu made woodblock prints for the publisher Shōzaburō Watanabe from 1919. Almost all the woodblocks were destroyed in a fire in Watanabe's print shop following the Great Kanto Earthquake of 1923. Around 50 prints were published by Watanabe by the late 1940s.

Kasamatsu began to partner with Unsodo in Kyoto from the 1950s and produced nearly 102 prints by 1960. He also began to print and publish on his own in the Sōsaku-Hanga style. He produced nearly 80 Sōsaku-Hanga prints between 1955 and 1965

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Ok, I Surrender. Here are the Beatles

I got back from Vietnam in 1970 and everyone was talking about the beetles (or so I thought). All I could think of were the cockroaches that paraded around our hootch exciting the lizards, and in retrospect I wondered, "who cares about beetles?"

You all know just a heck of a lot more about these guys than I, so I'll spare us both.

Eleanor Rigby https://youtu.be/HuS5NuXRb5Y
Help https://youtu.be/2Q_ZzBGPdqE
Hey Jude https://youtu.be/A_MjCqQoLLA
Blackbird https://youtu.be/RDxfjUEBT9I
Penny Lane https://youtu.be/QjvzCTqkBDQ

<div align="center">That takes care of that.</div>

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Why do Auburn fans wear orange?
So they can dress that way for the game on Saturday, go hunting on Sunday, and pick up trash on Monday.

What does the average Alabama player get on his SATs?
Drool.

How many Michigan State freshmen football players does it take to change a light bulb?
None. That's a sophomore course.

How did the Auburn football player die from drinking milk?
The cow fell on him.

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German Aircraft on the Drawing Boards:
VE Day Came not a Moment too Soon

https://youtu.be/G6tIDxOMgX8

If these advanced don't give you pause to consider how risky going to war can be, you may be one of those adventurers who think that rattling swords in light of today's technology makes sense. Better to look for other options.

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The Horton Excursion (Dr. Joe Horton Comments on Odes)

Thoughts on the November 28, 2021 Ode

Stopped clocks...good observations about the stopped clocks. As it turns out, either the brain has a strong reason for constancy or consciousness itself does. But either way, magic happens. None of the most impressive of these is the need for our visual world to appear complete. The anatomy of our eye makes it physically impossible for it to send a complete image of the world to our brain. Why not? Because the optic nerve has to go through the retina to get there. Where it does this, there is a hole called the optic disc. There are no light receptors there, so no information can be acquired in that place. And it's very near the center of our vision. And still, we see a continuous world.

WW I and WW II provided many patients who had survived serious brain injuries. This was pure gold for neurologists, neuroanatomists, and psychologists because it allowed

them to Susa out what did what. The combination of survivors, autopsies (they didn't live forever), and a reasonable amount of sophistication got us from knowing that the brain was important to knowing how some of it actually worked. Among the patients were those who had had injuries to their occipital lobes, which live in the backmost part of the brain. The first piece of cortical brain (the part that starts to actually turn a bunch of raw data into meaning) lives there in what is known as area 17.

What happens when you have an injury to Allred part of area 17? The "all" case is easy: if you lost it all, you're blind. Surviving loss of all of it, though, would involve so egregious an injury that you'd be very unlikely to survive. And given that much brain injury, death would probably not be a worst-case scenario. But the interesting case is a less-than-total loss. What do those people see? They think they see a complete world, but that's provably impossible.

Brain function is "plastic" in that it can develop workarounds when parts of it are compromised. If a person has a stroke and stops being able to walk, aggressive rehab can often allow the patient to relearn how to walk, if less gracefully than originally. When it comes to vision, it very much doesn't work that way. Each set of receptors in the eye is connected to its own set of brain cells. Once either end of that chain dies, the rest does as well. That can be as limited as a few cells or as many as a large piece of the visual field. Dead is dead.

Consider the case of someone who has lost, say, the upper right quadrant of his visual field. How does the world appear to him? Does he see blackness there? He does not: he sees an entire visual world, or at least he thinks he does. His brain fills in what it thinks is there. But if something is happening in that location, he cannot respond to it. He can't see it. If he looks at a chessboard, he'll see an 8x8 board. If you put a chess piece on the part affected, he only sees the chessboard, not the chess piece. I'll leave figuring out the implications of letting someone like that drive to your imagination.

I don't recall when the article appeared in Scientific American, but they described fixed images on the retina and what happens to them. I'm pretty sure it appeared while I was in high school, so we're north of 55 years ago. Anyway, the way they got those images on the retina was to create a contact lens that contained a tiny projector that placed a pattern where they wanted it to be. They could turn it on and off at will. When they turned it on, the subject saw the entire pattern, which consisted of an interlocking square, circle, and triangle. Within a few seconds--few, as in 3 or 4 seconds--parts of the pattern started disappearing and reappearing. Weird, huh? What's going on here?

Fixed images on the retina do not keep sending a continual stream of nerve impulses to the brain. Hogwash, you say, you can stare at a pen on your desk, and you keep seeing the pen. Would that it were that simple. First of all, if the image moves a little bit, it's not fixed. But the pen doesn't have legs and feet, so it can't move. And indeed, it really is just sitting there. But your eyes are moving, and they're doing it just about all the time. Saccadic eye movements are tiny and happen between 50 and 150 times/second. They're more or less random chaotic movements comparable to dithering (in engineering terms), and their amplitudes make a point about 18" from your eye project

back and forth between adjacent receptors (rods and cones). It took some doing to make that contact lens projector.

Don't believe it all? If you look at a picture of the retina, you'll see arteries and veins on them. They're between incoming light and your rods and cones. When was the last time you saw them or their shadows? Most people never see them. But they're there. Wanna see them? Get a small flashlight and turn it on. Close your eyes and put the light on side of your eyelid. Now move the light back and forth a little bit. The branching pattern you're seeing is called the Purkinje tree, named after an anatomist, Professor Purkinje. When you stop moving the light, the tree quickly disappears; move it again and it reappears. That's the difference between fixed and moving images.

But wait! you say. What if I just look at a painted wall with uniform illumination? There are no edges anywhere close to the center of my vision, and yet I keep seeing a (say) green wall. Hah, you're wrong, Horton! As usual!! Yeah, uh, no. We already know the no, or at least only intermittent info can come from the fixed image part. The periphery still moves a bit, and the interpolation tells the brain that there's no significant gradient across the visual field, so it interprets the center as the same as the edges. Think of the chess board.

And this just scratches the surface....

Bitcoin...it's hard to trust storing my wealth in a form that consists solely of 1's and 0's. What happens if the system goes down or is successfully hacked by, say, the Russians or the Chinese? Adios wealth, hello poverty. I do, however, see a potential use for it. If banks stop being willing to transact business in spheres the gov disfavors, like guns and ammo, for example, putting enough money into digital currency and then paying for goods from that pocket would be a field-expedient workaround.

Cancer...cancer research...who could fault that? The problem with cancer research is that cancer researchers like to study cancer. What do you suppose would happen if they discovered a magic bullet? They'd have to retool and look for new jobs. So, they keep studying it, and studying it, and studying it. In principle, we know a lot about cancer and how to cure many of them. It takes a fair amount of sophistication, which is above and beyond most physicians and surgeons, but isn't impossible. Problem is that most P&S are like most of humanity: they don't like or trust change. And using logic terrifies them. Better to rely on what's in a book, no matter how dismal that might be.

The only exception to this that I'm aware of is treatment of childhood cancers. The people who do that aren't screwing around. They're willing to push the envelope so kids don't die of cancer.

And thus endeth today's lesson....

By Dr. Joseph Horton, M.D.

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John Keats (1795-1821)

A member of England's second generation of Romantic poets that included Byron and Shelley, Keats did not achieve recognition during his lifetime—he died of tuberculosis at the age of 25. His influence, however, grew throughout the 19th Century, paced by his Odes. Ode to a Nightingale, Ode on a Grecian Urn, Sleep and Poetry, and the sonnet On First Looking into Chapman's Homer exemplify his works.

Ode on a Grecian Urn

Thou still unravish'd bride of quietness!
Thou foster-child of Silence and slow Time,
Sylvan historian, who canst thus express
A flowery tale more sweetly than our rhyme:
What leaf-fringed legend haunts about thy shape
Of deities or mortals, or of both,
In Tempe or the dales of Arcady?
What men or gods are these? what maidens loath?
What mad pursuit? What struggle to escape?
What pipes and timbrels? What wild ecstasy?

Heard melodies are sweet, but those unheard
Are sweeter; therefore, ye soft pipes, play on;
Not to the sensual ear, but, more endear'd,
Pipe to the spirit ditties of no tone:
Fair youth, beneath the trees, thou canst not leave
Thy song, nor ever can those trees be bare;
Bold Lover, never, never canst thou kiss,

Though winning near the goal—yet, do not grieve;
She cannot fade, though thou hast not thy bliss,
Forever wilt thou love, and she be fair!

Ah, happy, happy boughs! that cannot shed
Your leaves, nor ever bid the Spring adieu;
And, happy melodist, unwearied,
For ever piping songs for ever new;
More happy love! more happy, happy love!
For ever warm and still to be enjoy'd,
For ever panting, and for ever young;
All breathing human passion far above,
That leaves a heart high-sorrowful and cloy'd,
A burning forehead, and a parching tongue.

Who are these coming to the sacrifice?
To what green altar, O mysterious priest,
Lead'st thou that heifer lowing at the skies,
And all her silken flanks with garlands drest?
What little town by river or sea shore,
Or mountain-built with peaceful citadel,
Is emptied of this folk, this pious morn?
And, little town, thy streets for evermore
Will silent be; and not a soul to tell
Why thou art desolate, can e'er return.

O Attic shape! Fair attitude! with brede
Of marble men and maidens overwrought,
With forest branches and the trodden weed;
Thou, silent form, dost tease us out of thought
As doth eternity: Cold Pastoral!
When old age shall this generation waste,
Thou shalt remain, in midst of other woe
Than ours, a friend to man, to whom thou say'st,
"Beauty is truth, truth beauty,—that is all
Ye know on earth, and all ye need to know."

La Belle Dame Sans Merci

O what can ail thee, knight-at-arms,
Alone and palely loitering?
The sedge has withered from the lake,
And no birds sing.

O what can ail thee, knight-at-arms,
So haggard and so woe-begone?
The squirrel's granary is full,
And the harvest's done.

I see a lily on thy brow,
With anguish moist and fever-dew,
And on thy cheeks a fading rose
Fast withereth too.

I met a lady in the meads,
Full beautiful—a faery's child,
Her hair was long, her foot was light,
And her eyes were wild.

I made a garland for her head,
And bracelets too, and fragrant zone;
She looked at me as she did love,
And made sweet moan.

Bright Star, Would I Were Stedfast as Thou Art

Bright star, would I were stedfast as thou art—
Not in lone splendour hung aloft the night
And watching, with eternal lids apart,
Like nature's patient, sleepless Eremite,
The moving waters at their priestlike task
Of pure ablution round earth's human shores,
Or gazing on the new soft-fallen mask
Of snow upon the mountains and the moors—
No—yet still stedfast, still unchangeable,
Pillow'd upon my fair love's ripening breast,
To feel for ever its soft fall and swell,
Awake for ever in a sweet unrest,
Still, still to hear her tender-taken breath,
And so live ever—or else swoon to death.

To Autumn

Season of mists and mellow fruitfulness,
Close bosom-friend of the maturing sun;
Conspiring with him how to load and bless
With fruit the vines that round the thatch-eves run;
To bend with apples the moss'd cottage-trees,

And fill all fruit with ripeness to the core;
To swell the gourd, and plump the hazel shells
With a sweet kernel; to set budding more,
And still more, later flowers for the bees,
Until they think warm days will never cease,
For summer has o'er-brimm'd their clammy cells.

Who hath not seen thee oft amid thy store?
Sometimes whoever seeks abroad may find
Thee sitting careless on a granary floor,
Thy hair soft-lifted by the winnowing wind;
Or on a half-reap'd furrow sound asleep,
Drows'd with the fume of poppies, while thy hook
Spares the next swath and all its twined flowers:
And sometimes like a gleaner thou dost keep
Steady thy laden head across a brook;
Or by a cyder-press, with patient look,
Thou watchest the last oozings hours by hours.

Where are the songs of spring? Ay, Where are they?
Think not of them, thou hast thy music too,—
While barred clouds bloom the soft-dying day,
And touch the stubble-plains with rosy hue;
Then in a wailful choir the small gnats mourn
Among the river sallows, borne aloft
Or sinking as the light wind lives or dies;
And full-grown lambs loud bleat from hilly bourn;
Hedge-crickets sing; and now with treble soft
The red-breast whistles from a garden-croft;
And gathering swallows twitter in the skies.

Ode to a Nightingale

My heart aches, and a drowsy numbness pains
My sense, as though of hemlock I had drunk,
Or emptied some dull opiate to the drains
One minute past, and Lethe-wards had sunk:
'Tis not through envy of thy happy lot,
But being too happy in thine happiness,—
That thou, light-winged Dryad of the trees
In some melodious plot
Of beechen green, and shadows numberless,
Singest of summer in full-throated ease.

O, for a draught of vintage! that hath been
Cool'd a long age in the deep-delved earth,
Tasting of Flora and the country green,
Dance, and Provençal song, and sunburnt mirth!
O for a beaker full of the warm South,
Full of the true, the blushful Hippocrene,
With beaded bubbles winking at the brim,
And purple-stained mouth;
That I might drink, and leave the world unseen,
And with thee fade away into the forest dim:

Fade far away, dissolve, and quite forget
What thou among the leaves hast never known,
The weariness, the fever, and the fret
Here, where men sit and hear each other groan;
Where palsy shakes a few, sad, last gray hairs,
Where youth grows pale, and spectre-thin, and dies;
Where but to think is to be full of sorrow
And leaden-eyed despairs,
Where Beauty cannot keep her lustrous eyes,
Or new Love pine at them beyond to-morrow.

Away! away! for I will fly to thee,
Not charioted by Bacchus and his pards,
But on the viewless wings of Poesy,
Though the dull brain perplexes and retards:
Already with thee! tender is the night,
And haply the Queen-Moon is on her throne,
Cluster'd around by all her starry Fays;
But here there is no light,
Save what from heaven is with the breezes blown
Through verdurous glooms and winding mossy ways.

I cannot see what flowers are at my feet,
Nor what soft incense hangs upon the boughs,
But, in embalmed darkness, guess each sweet
Wherewith the seasonable month endows
The grass, the thicket, and the fruit-tree wild;
White hawthorn, and the pastoral eglantine;
Fast fading violets cover'd up in leaves;
And mid-May's eldest child,
The coming musk-rose, full of dewy wine,
The murmurous haunt of flies on summer eves.

Darkling I listen; and, for many a time
I have been half in love with easeful Death,
Call'd him soft names in many a mused rhyme,
To take into the air my quiet breath;
Now more than ever seems it rich to die,
To cease upon the midnight with no pain,
While thou art pouring forth thy soul abroad
In such an ecstasy!
Still wouldst thou sing, and I have ears in vain—
To thy high requiem become a sod.

Thou wast not born for death, immortal Bird!
No hungry generations tread thee down;
The voice I hear this passing night was heard
In ancient days by emperor and clown:
Perhaps the self-same song that found a path
Through the sad heart of Ruth, when, sick for home,
She stood in tears amid the alien corn;
The same that oft-times hath
Charm'd magic casements, opening on the foam
Of perilous seas, in faery lands forlorn.

Forlorn! the very word is like a bell
To toll me back from thee to my sole self!
Adieu! the fancy cannot cheat so well
As she is fam'd to do, deceiving elf.
Adieu! adieu! thy plaintive anthem fades
Past the near meadows, over the still stream,
Up the hill-side; and now 'tis buried deep
In the next valley-glades:
Was it a vision, or a waking dream?
Fled is that music:—Do I wake or sleep?

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Joaquin Rodrigo (1901-1999)

Rendered virtually blind by diphtheria at the age of four, Rodrigo was enrolled in a school for the blind where he received his early tutelage in music.

His most famous work, Concierto de Aranjuez, was composed in 1939 in Paris for the guitarist Regino Sainz de la Maza. In later life he and his wife declared that it was written as a response to the miscarriage of their first child.

It is a concerto for guitar and orchestra. The central adagio movement is one of the most recognizable in 20th-century classical music, featuring the interplay of guitar with cor anglaise, a double reed woodwind similar to the oboe. This movement was later adapted by the jazz arranger Gil Evans for Miles Davis' 1960 album "Sketches of Spain". The Concerto was adapted by the composer himself for the 1974 Harp and Orchestra Concerto at the request of Nicanor Zabaleta and dedicated to Zabaleta.

Concierto de Aranjuez   https://youtu.be/nb6Rf2FfCwY... Stjepan Hauser

Sketches of Spain; Miles Davis & Gil Evans: https://youtu.be/mSS5p9BdNGU

Concerto for Harp & Orchestra   https://youtu.be/_k4xxh5bMjc

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Blue-Footed Booby

The Blue-Footed Booby is a curious bird
Seen often on the shores of the Galapagos
His high-pitched whistle is easily heard
And his blue feet are splen'dapagos.

High-strutting his blues is his way to meet
A prospective and like-minded mate.
The Booby likes to dance and show off his feet
And seduce with a rhythmic gait.

Our best foot forward may not be in blue
But we each have a talent to share.
Expressing our thoughts or playing the kazoo,
Or being best-in-show at the fair.
Its all about promoting our most favorable features
And sometimes that's simply caring for our fellow
Creatures.

(Francie Troy)

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Blue Angels at 75...Still Turning and Burning

In the 75-year history of the Blue Angels, less than 300 pilots have sat at the controls of the world famous blue and gold jets. From the first team back in 1946 thru the 2021 Super Hornet transition team, the pilots of the U.S. Navy's flight demonstration squadron's primary mission has been to showcase the elite skill and teamwork of the Navy and Marine Corp while striving to fly the perfect air show.

In this video, you'll hear from the pilots themselves as they provide insight into the unique mindset required to serve on the Blue Angels as well as their desire to reach and engage with public.

Blue Angel pilots featured in this video in order of appearance:

> Roy "Butch" Voris - The first team leader of the Blue Angels
> Al Taddeo - Blue Angels pilot | 1946 - 1947
> LCDR Jame Cox - Blue Angels pilot | 2019 - 2021
> Dan Keating - Blue Angels pilot | 1977 - 1978
> Steve Foley - Blue Angels leader | 2005 - 2006
> Curt Watson - Blue Angels pilot | 1983 - 1986
> Keith "Casey" Jones - Blue Angels leader | 1976 - 1977
> Scott Anderson - Blue Angels pilot | 1982 - 1984
> Al Cisneros - Blue Angels pilot | 1975 - 1977
> Gil Rud - Blue Angels leader | 1986 - 1988
> Dave Carroll - Blue Angels Leader | 1982 - 1983
> John Miller - Blue Angels pilot | 1976 - 1978
> Bob Stephens - Blue Angels pilot | 1981 - 1982
> Wayne Molnar - Blue Angels pilot | 1986 - 1988
> Jim Ross - Blue Angels pilot | 1979 - 1980 | 1982 - 1983
> Ernie Christensen - Blue Angels pilot | 1969 - 1970
> John Fogg - Blue Angels pilot | 1973 - 1974
> Jerry Tucker - Blue Angels pilot | 1973 - 1974

https://youtu.be/9ywQyDOuI8E

This video was produced to commemorate the 75th anniversary of the Blue Angels in coordination with the Blue Angels Association.

This Week's Canepa Shop Walk...Oh My the Goodies

'47 Merc Woodie…Cawabunga baby

https://youtu.be/kotOP1wvIZo?t=4

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Six Charts Show How the World is Improving

We are constantly bombarded with bombasts (what else) from all corners about how terrible things are. Unfortunately, perfection is the province of the few anointed among us. For the rest, it remains an uphill battle. Still there are signs there is hope that tomorrow will be better than today…It was a major factor in the birth of our nation.

It only takes a few minutes of cable news to get the feeling that the world is heading into a tailspin.

Endless images of homicide investigations, natural disasters, car crashes, and drug busts fill the airwaves on a daily basis. It's upsetting – but also certainly captivating for the average viewer.

In fact, the news cycle thrives on fear and violence, so mainstream networks find a way to fill up 99% of programming with these singular events. It's addicting and sometimes anger-inducing, but is it representative of what's really going on in the world?

Good News Happens Slowly

Today's infographic comes to us from economist Max Roser of Our World in Data, and it highlights six megatrends that show that in many important ways, our world is improving drastically.

The one commonality of these six indicators? They all happen slowly and incrementally but are more evident with a long-term perspective.

Each family lifted out of poverty, each classroom that gets built, and each village gaining access to basic vaccinations may not seem significant on a scale of billions of people – but over decades, these gains add up to create a richer, more educated, and healthier world and a very powerful statistical story.

Six Global Trends

Here are the six big picture trends pointed out by Roser, using data collected over hundreds of years:

1. Extreme Poverty

The portion of people in extreme poverty – making less than $1.90 per day – has dropped like a rock over the years. Back in 1940, about 75% of the world was in extreme poverty – today, that number is just 10%.

The most potent recent example of this is China, where access to free markets have enabled 700 million people to be lifted out of poverty in just over 20 years.

Poverty in China

It's also worth mentioning that statistics for this category are done using inflation-adjusted international dollars, which take into account inflation over time as well as exchange rates. Non-monetary forms of income are also included in the calculations.

2. Basic Education

In 1820, only a privileged few were able to get basic schooling. Since then, millions of classrooms and schools have been added around the globe, and the numbers are staggering. In relative terms, we've gone from 17% of people having a basic education to 86% today.

Here's a more detailed breakdown of this, also from Our World in Data:

Level of education of world

3. Literacy

Following a similar trend line as basic education, literacy has risen from 12% to 85% over roughly two hundred years. In absolute terms, these numbers are even more impressive. In the 1820s, there were only about 100 million people that could read that were 15 years or older. Today, the number stands at 4.6 billion.

4. Democracy

While the world has been having some short-term setbacks when it comes to freedom and democracy, the overall trend line is still impressive over the long run.

In 1900, only 1 in 100 people worldwide lived in a democracy – and today, the majority (56 in 100) can say they live in a country with free and fair elections.

5. Vaccination

Vaccinations for diseases like whopping cough, tetanus, and diphtheria were unavailable for most of the 200-year chart. However, today around 86% of people globally are vaccinated against these basic and devastating illnesses.

6. Child Mortality

Even as far back as 1920, it used to be that over 30% of infants would die before they hit their 5th birthday.

Since then, developments in housing, sanitation, science, and medicine have made it so that death is a much rarer occurrence for the youngest people in our society. Today, on a global basis, child mortality has been reduced to 4%.

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100th Anniversary of San Diego Marine Base; MCRD

At the outbreak of the Korean War there were 300 recruits at the Depot. By April 1952 the recruit strength was more than 15,000 and the total strength of the post more than 23,000. (Courtesy U.S. Marine Corps)

The first purpose-built Marine Corps base was part of an early century military boom that forever changed San Diego

By Andrew Dyer for the San Diego Union-Tribune

When Marine Brig. Gen. Joseph Pendleton raised the first American flag 100 years ago at what would eventually become the Marine Corps Recruit Depot in San Diego, the city was still a small border town with a population of around 75,000. The Navy had previously established an airfield on North Island, but the city's destiny as a military and defense hub was still uncertain.

It was the advocacy of Pendleton, city leaders and Rep. William Kettner that put San Diego on the path to being the city it is today, said Ellen Guillemette, a historian at the depot's museum.

Kettner "recognized San Diego would not be able to develop itself," Guillemette said. "He felt the best way to get San Diego on the map and get federal money here was to get military bases. He realized that San Diego could serve as a hub for the military and that would provide a big influx of federal dollars."

Kettner also foresaw the many industries a military presence would bring to the region.

"He knew it would invite other growth industries along with it," Guillemette said. "He was really visionary in that."

Today, MCRD San Diego serves as the Corps' West Coast boot camp, training recruits from all areas west of the Mississippi. It's also the service's Western recruiting headquarters.

Recruits spend 13 weeks at boot camp — most of it in San Diego, though a few weeks are spent training at Camp Pendleton. Marines who trained at the depot went on to fight in some of the most storied battles in American history, including Guadalcanal and Iwo Jima, and in its most recent conflicts in Iraq and Afghanistan.

Among the challenges San Diego faced at the start, especially stacked up against its better-established competition to the north in San Francisco and Los Angeles, was geography. With a shallow harbor and surrounded by mountains, city leaders knew they'd have trouble attracting private investment, said Karl Zingheim, a historian at the USS Midway Museum.

Aerial photo of the Marine Corps Recruit Depot in San Diego in 1958.
(Marine Corps photo/Courtesy of the Marine Corps)

"We have a harbor to nowhere since we're cut off by concentric rings of mountains," Zingheim said. "If anybody's going to make the harbor deeper, it's going to have to be the federal government."

Marines had been housed in temporary camps at North Island previously as San Diego became a jumping-off point for the Corps, then based near San Francisco, after the Mexican revolution of 1910 and other interventions in Central America. A Marine regiment, led by Pendleton, was later assigned to the Panama-California Exposition in Balboa Park in 1915.

That year, San Diego voters overwhelmingly approved the transfer of tidelands then called "Dutch Flats" to the Marine Corps, according to a history of the base published by its museum in 1997.

Construction was delayed by World War I. In 1919, after the flats were dredged, officials broke ground on the new base and, on Dec. 1, 1921, Pendleton and his Marines moved in.

The administration building, barracks and arcade were designed in the Spanish Colonial Revival style by architect Bertram Goodhue, who also was responsible for El Prado in Balboa Park as well as the building that now houses the Museum of Us.

The base began as an advanced expeditionary base for the 1st Battalion, 7th Marine Regiment, which was formed by Pendleton as a sort of special regiment in San Diego, Guillemette said. But the new San Diego Marine base's role as an operational base was quickly supplanted by another need of the Corps: a boot camp.

In 1923, Marine recruit training was moved from a Vallejo, Calif., Navy base to San Diego. And although it was the first base purpose-built for the Corps, Guillemette said, a brief power struggle with local Navy officials delayed it from officially belonging to the Corps for another two years.

In 1924, the Marines officially took ownership of the base, and it was renamed Marine Corps Base San Diego.

The establishment of the base came at a time when other military facilities were being established in the region. Naval Base San Diego was established as a destroyer base in February 1922 — just a few months after the Marine base opened. In 1923, the Navy opened its own boot camp next door to the depot.

Things picked up in the mid-1920s, Zingheim said, when the Navy recognized its next big naval adversary was the Japanese and it started shifting focus to the Pacific. Three early aircraft carriers — the Langley, the Lexington and the Saratoga — were moved to San Diego.

But it was the attack on Pearl Harbor that led to the city becoming the metropolis it is today.

"It was really a boomtown in San Diego after Pearl Harbor," Zingheim said. "With all those people, we needed the infrastructure to keep up. President Franklin Delano Roosevelt accelerated plans to divert water from the Colorado River, and the power grid, to here."

World War II saw the establishment of Camp Pendleton, north of Oceanside, which gave the Marines room to maneuver after their old training terrain in Mission Valley and elsewhere was swallowed up by the growing city.

The recruit depot also surged during the war. The Marines installed several Quonset huts to house all its recruits, buildings that stood throughout the wars in Korea and Vietnam until the current barracks were built in the 1970s.

Zingheim said the depot is a "survivor," since many military facilities were closed as cities grew around them.

One such base, Camp Matthews, served as the rifle and gun range for recruits in San Diego. Camp Matthews, which occupied a large swath of land northeast of La Jolla, was eventually turned over to the University of California in the 1960s. The Marines moved their ranges to Camp Pendleton. What once was Camp Matthews is now UC San Diego, the Veterans Affairs Medical Center, parts of University City and Interstate 5.

The Navy consolidated its recruit training bases in the 1990s, closing its San Diego and Orlando boot camps in favor of just one in Great Lakes, Ill. Its former San Diego boot camp is now the site of Liberty Station.

"It's remarkable the Marines were able to retain the base," Zingheim said, adding that since the depot buttresses the airport, there's been pressure to find a way to expand the airport.

Recruits from Bravo Company quickly advance to the top of the last hill of the Reaper, during the 3-day Crucible event that caps basic training.
(Nelvin C. Cepeda / The San Diego Union-Tribune)

The base continues to make history. In 2021, the first female Marine recruits completed boot camp at the depot. Until then, women were exclusively trained at the Corps' East Coast depot at Parris Island, S.C.

The MCRD Command Museum is opening an exhibit to mark its centennial, Guillemette said, but the ongoing pandemic has limited how much it can do. A Marine Corps spokesman said the base does open to the public for its recruit graduations and that people can visit the museum on those days.

A Naval Base San Diego spokesperson said the base is planning a year-round celebration of its centennial beginning in the spring of next year.

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Is it Hanukkah or Chanukah? Why the Jewish Holiday has Multiple Spellings

Hannah Gaber, for USA Today

The evening of Dec. 10 marks the start of Judaism's eight-night Festival of Lights, Hanukkah.

The confusion over the spelling comes because the name of the holiday is a Hebrew word, and the English transliteration isn't totally clear. According to the Oxford English Dictionary, there are 24 spellings for Hanukkah, during which Jews light candles on a menorah to celebrate the miracle of a one-day oil supply lasting eight after the Maccabean Revolt in the second century B.C.

Even in pop culture, there are a number of ways to spell it. Woody Guthrie's festive songs use spellings "Hanukah Tree" and "Hanuka Gelt," while Adam Sandler calls his series of Jewish celebrity tunes "Chanukah Song." Rachel Bloom's "Santa Baby" parody is "Chanukah Honey", but she included other spellings of the holiday in her CW show "Crazy Ex-Girlfriend," in a scene where her character Rebecca mulls over which "Happy" holiday banner is best among Chanukah, Hanukah and Hanukkah.

What does Google prefer? If you type in the aforementioned three spellings, it shows you results for "Hanukkah," a spelling that has been the most popular on the search engine for at least the past 15 years, with second-place spelling "Chanukah" significantly waning in popularity in the past five years.

Rabbi Ilana Zietman, community rabbi of GatherDC in Washington, D.C., a group that helps connect young people to Jewish life, tells USA TODAY that she uses Hanukkah and Chanukah interchangeably. She grew up with both, though her organization officially uses Hanukkah.

"Personally, I don't think it's really that big of a deal which version people use in writing," Zietman says. "In pronunciation, like any way we approach saying a foreign word, it's nice to ask a native speaker how they pronounce it (or find it online) and try to do one's best to make the original sound."

Rabbi Sarah Krinsky of Adas Israel Congregation in Washington prefers the spelling that starts with an H, includes one N, adds two Ks and concludes with an H (Hanukkah).

Really want to nerd out on linguistics? Let's see why that version is a favorite.

חֲנֻכָּה

H-A-N-U-K-K-A-H

Why you probably want to start with an H

In Hebrew, the word "Hanukkah" begins with the Hebrew letter Chet. Although "there is no actual standardized transliteration" when it comes to that letter, Krinsky has seen it commonly written with an H and in prayer books with and an H and a dot underneath it.

She prefers writing Hanukkah with an H instead of a C-H, because the latter is a more typical way to transliterate a different Hebrew letter, a Chaf. Like the Chaf, though, the Chet has a throat-clearing sound that is commonly read as C-H in English, so if you weren't concerned with differentiating the Chet from the Chaf in transliteration, it makes sense you'd want to start the English-letter version of the word with a guttural C-H.

The C-H sound can be difficult for English-speakers to master. "This is why some say that 'Chanukah' is a traditional spelling of the word and that 'Hanukkah' came later, but is more popular today," Zietman says.

And although there are a few cases when the holiday is written with K-H, that spelling would feel "wrong" to Krinsky, because that transliteration seems further removed from the Chet letter and sound.

חֲנֻכָּה

H-A-**N**-U-K-K-A-H

The case for one N

In Hebrew, the N sound in Hanukkah comes from a single letter, Nun. It follows that the transliterated word should also have one N to represent that sound.

"I actually can't see any linguistic reason why there should be two Ns" Krinsky says. Still, she sees the word written as "Channukah" every year.

חֲנֻכָּה

H-A-N-U-K-K-A-H

One K or two?

The K sound in the middle of "Hanukkah" comes from the Hebrew letter Kaf. As it's written in Hebrew, Kaf has a dot called a dagesh in the center of the letter, which "in Hebrew is linguistically being doubled," Krinsky says.

Accordingly, Krinksy prefers to double the English K in Hanukkah. Still, one K is acceptable because the extra K doesn't technically change the way the word sounds.

חֲנֻכָּה

H-A-N-U-K-K-A-H

It makes sense to end with H

Again, let's look at the way the holiday is written in Hebrew: Its final letter is a Hei. The Hebrew Hei functions very similarly to the way the English H can in that "It doesn't change the pronunciation, like in my name Sarah," Krinsky says.

So, if a Hebrew ends with the silent Hei, "why not include (a silent H) in English?" she asks.

During Hanukkah, Jews light candles on a menorah over eight days in a celebration of the Festival of Lights.

Regardless of spelling, it has one meaning

Hanukkah means "dedication" in Hebrew. It's a holiday that commemorates the time when a small group of Jews called the Maccabees rose up against Greek-Syrian rulers to rededicate the Temple of Jerusalem and light its menorah for worship, which – as the story goes – had enough oil to last only a single night. The light miraculously burned for eight nights.

Hanukkah is observed by lighting candles on a nine-branched candelabra called a menorah over eight nights. Other Hanukkah traditions include eating potato pancakes called latkes and jelly donuts called sufganiyot (because they're foods fried in oil), spinning a top called a dreidel to win chocolate coins called gelt and exchanging gifts.

"I hope people can find meaning and inspiration in the rich story and customs of the holiday itself and use it as a means of greater interpersonal connection and sense of light in these dark times," Zietman says.

Celebrating a miracle and the ability to practice your religion, eating fried foods and winning chocolate, giving and receiving gifts: Hanukkah is a happy holiday however you spell it.

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North of the Border (Where the Foxes and Polar Bears Play?)

CANADA HAS FEWER PEOPLE THAN TOKYO'S METROPOLITAN AREA.

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CANADA HAS THE THIRD LARGEST OIL RESERVES OF ANY COUNTRY IN THE WORLD AFTER SAUDI ARABIA AND VENEZUELA.

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THE U.S. / CANADA BORDER IS THE LONGEST INTERNATIONAL BORDER IN THE WORLD AND IT LACKS MILITARY DEFENSE.

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THE FIRST CANADIAN CASUALTIES OF THE AFGHANISTAN WAR WERE FROM AN AMERICAN PILOT BOMBING A TRAINING EXERCISE.

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Caltech Researchers Team Up to Fight Parkinson's Disease

Parkinson's Disease at a cellular level: Recent research - Medivizor

By Lori Dajose for Cal Tech Weekly

Parkinson's disease (PD) is the second most common neurodegenerative disease after Alzheimer's, affecting more than 10 million people worldwide. PD is characterized by a decrease in a brain chemical called dopamine and the death of neurons in a part of the brain known as the substantia nigra. The loss of these neurons leads to the characteristic Parkinson's tremor as well as other debilitating movement symptoms and problems with cognition, mood, and sleep.

But PD does not only involve the brain. Indeed, researchers have recently started to investigate how the function of the gut can play a role in the disease, based on long-standing data that shows gastrointestinal dysfunction in PD. Now, several researchers from Caltech have teamed up to study the neural circuitry connecting the gut and the brain, to understand how this circuitry is impacted by PD and how it may provide new targets for treatments.

The team—which includes long-time collaborators on PD research Viviana Gradinaru (BS '05), professor of neuroscience and biological engineering and director of the Center for Molecular and Cellular Neuroscience, and Sarkis Mazmanian, Luis B. and Nelly Soux Professor of Microbiology; as well as David Van Valen (PhD '11), assistant professor of biology and biological engineering and Heritage Medical Research Institute Investigator, among others—has now received a major grant from the Aligning Science Across Parkinson's (ASAP) initiative that provides more than $11 million to carry out this research.

The team proposes that environmental and genetic factors impact the connections between neurons in the gastrointestinal nervous system, which can increase susceptibility to PD triggers. These triggers include a-synuclein, a protein that, when aggregated in clumps, is toxic to cells and can trigger both PD symptoms and gut inflammation. The researchers will investigate if the process that originates in the gut can then propagate to the brain and cause dysfunction in neural circuits that presents as the classic PD symptoms.

With the new funding, the team will map out the gut–brain connections within rodent and other animal models and examine how perturbations of this circuitry can affect disease outcomes. Understanding the role that the gut–brain neural circuitry plays in PD will open new possibilities for treatments that could slow, halt, or even reverse symptoms.

The work builds on the neuroscience and neurotechnology expertise in the Gradinaru laboratory as well as the long history of gastrointestinal and PD research in the Mazmanian laboratory and combines machine-learning and single-cell analysis techniques from the Van Valen laboratory. In addition to Gradinaru, Mazmanian, and Van Valen, the project team includes collaborators Andrew S. Fox of UC Davis, Sergiu P. Pasca of Stanford University, Ashley W. Seifert of the University of Kentucky, Roy Subhojit of UC San Diego, and Lin Tian of UC Davis.

ASAP is a coordinated research initiative to advance targeted basic research for Parkinson's disease. Its mission is to accelerate the pace of discovery and inform the path to a cure through collaboration, research-enabling resources, and data sharing. The Michael J. Fox Foundation for Parkinson's Research is ASAP's implementation partner and issued the grant.

Gradinaru, Mazmanian, and Van Valen are affiliated faculty members with Caltech's Tianqiao and Chrissy Chen Institute for Neuroscience.

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Caterpillar to Test Large Hydrogen Fuel Cells

Ballard teams up with Caterpillar & Microsoft to demonstrate megawatt-scale hydrogen fuel cell
BallardPower Systems

Caterpillar will test a power system incorporating large-format hydrogen fuel cells in a demonstration project with Microsoft and Ballard Power Systems to produce "reliable and sustainable backup power for Microsoft data centers," according to Caterpillar.

The project is supported and partially funded by the U.S. Department of Energy (DOE) under the H2@Scale initiative and backed by the National Renewable Energy Lab (NREL).

"This hydrogen fuel cell demonstration project enables us to collaborate with industry leaders to take a large step toward commercially viable power solutions that also support our customers in making their operations more sustainable," said Jason Kaiser, VP for Caterpillar's electric power division, in a prepared statement.

Caterpillar is providing the overall system integration, power electronics, and controls that form the central structure of the power solution that will be fueled by low-carbon-intensity hydrogen. Microsoft is hosting the demonstration project at a company data center in Quincy, Washington, and Ballard is supplying an advanced hydrogen fuel cell module. The National Renewable Energy Laboratory (NREL) is performing analyses on safety, techno-economics, and greenhouse gas impacts.

"We continue to invest in research and advanced development in hydrogen fuel cells as one of the various pathways toward our commitment to be carbon negative by 2030,"

said Christian Belady, VP, advanced development, cloud operations and innovation at Microsoft, in a statement. "This latest project with Caterpillar will provide valuable insights into how to leverage hydrogen fuel cells for backup power in our datacenters at scale."

Caterpillar experts in advanced power technologies, controls and system integration are working alongside Microsoft experts in data center design and Ballard experts in fuel cell design to demonstrate a 1.5 MW backup power delivery and control system that would meet or exceed the expectations set by current diesel engine systems.

"We are excited to be collaborating with a complementary team of global industry leaders on this important demonstration project," said Randy MacEwen, president/CEO of Ballard, in a statement. "The results of this project will provide key insights into the capability of fuel cell systems to scale and serve multi-megawatt data centers. The project will also explore the scalability of fuel cell systems powered by low carbon-intensity hydrogen from cost and performance perspectives."

Source: Caterpillar

I'd like your thoughts on the addition of hydrogen fuel cells into our list of power solutions. Do you feel there's a place for them, and if so, where? Do you feel they're too dangerous, and if so, why?

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'Make or Break' Year for Supply Chains

Supply chain risks for next year include crime, climate and convergence.

istockphotos

From Material Handling & Logistics

The supply chain challenge is far from over and next year companies will have to face several issues. "Because of this unprecedented moment, the supply chain is about to have a make-or-break year and needs to be right at the top of the C-suite agenda," said Susan Taylor Martin, CEO, of BSI, in a statement.

In a recent report, Supply Chain Risk Insights, by BSI, a number of threats will emerge including:

Crime

The report notes that the past year saw a "significant number of criminal organizations trying to infiltrate the logistics supply chain, masquerading as legitimate companies working in warehousing, transportation and distribution." The group also noted the issue of fake carriers in an increasing number of countries.

As global prices increased due to congestion and delays surrounding ground transportation this forced some companies to shift to air. The report notes that cartels targeted vulnerabilities in these new chains., In the U.S., parallel to the shift toward air freight was an increase in smugglers introducing illegal drugs into air cargo shipments; up from 20% in February to 33.3% in June. The report says that "it seems Mexican drug cartels are using long-established networks to transport the goods from Mexico into the United States via the supply chain, utilizing truck, sea and air modalities along the US-Mexico border."

To address this situation BSI advises companies to undertake proper due diligence when onboarding their suppliers. Furthermore, an end-to-end risk assessment of a company's supply chain will mitigate the risks inherent to partnering with separate companies from around the world.

Climate

Companies are seeking to both protect their supply chains from the effects of climate change and ensure they play their role in a greener future. For example, BSI noted that this year, at least 18 companies-spanning several industries were identified as sourcing products from companies contributing to deforestation in the Amazon. "This type of association has the potential to bring significant reputational damage to an organization and could ultimately result in a drop in revenue," the report said.

Climate change is also increasing the frequency of natural disasters. For example, Hurricane Ida in August in the U.S. and Typhoon Chanthu in September in China have cumulatively caused various delays of shipment volume arriving infrequently at Californian facilities. This has put renewed stress on the ports of Los Angeles and Long Beach, which account for about one-third of all U.S. imports.

To mitigate these issues organizations need to reassess and look beyond traditional supply chain partners, methods and technologies.

Convergence

Another threat to supply chains is the inability of companies to understand how policies such as business continuity, sustainability, corporate social responsibility and security are interrelated. Business continuity threats can lead to security threats and vice versa.

The global shortage of semiconductors exemplifies this convergence. Taiwan holds roughly 90% of the world's manufacturing capacity to produce semiconductor chips, an overreliance that contributed to the global shortage of this component. In addition, factors such as droughts and COVID outbreaks in Taiwan between April and July impacted operational capacity, compounding the global shortage. This shortage also created security concerns; for example, a group of criminals attacked a truck driver's assistant as he was transporting a high-value cargo of semiconductor chips in Hong Kong in June, stealing $650,000 worth of goods.

Another high-profile convergence – between cyber security and physical security in this case – made international headlines in April this year. In the US, hackers gained entry into the Colonial Pipeline through a virtual private network account, which was intended for employees to remotely access the company's computer network. The hack took down one of the largest fuel pipelines in the country and led to gas shortages across the East Coast – all because of a single compromised password.

Convergence can be addressed by companies doubling down on collaboration, ensuring that all parts of an organization and their partners understand the integrated threats to a supply chain and that teams work together to address them.
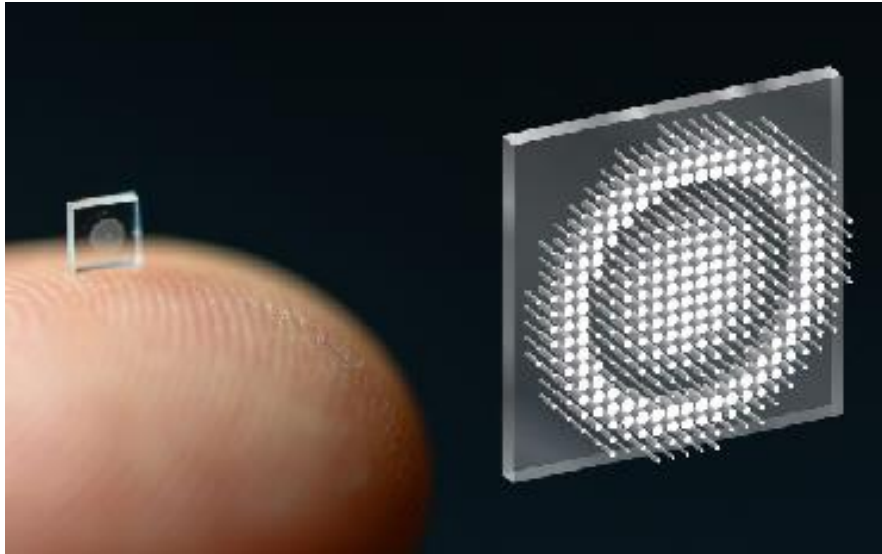
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It Appears We've been Given Another Chance

Unless, of course, it's now too late.

Camera the Size of a Salt Grain

Researchers at Princeton University and the University of Washington have developed an ultracompact camera the size of a coarse grain of salt. The system relies on a technology called a metasurface, which is studded with 1.6 million cylindrical posts and can be produced much like a computer chip.
Image courtesy of the researchers

Micro-sized cameras have great potential to spot problems in the human body and enable sensing for super-small robots, but past approaches captured fuzzy, distorted images with limited fields of view.

Now, researchers at Princeton University and the University of Washington have overcome these obstacles with an ultracompact camera the size of a coarse grain of salt. The new system can produce crisp, full-color images on par with a conventional compound camera lens 500,000 times larger in volume, the researchers reported in a paper published Nov. 29 in Nature Communications.

Enabled by a joint design of the camera's hardware and computational processing, the system could enable minimally invasive endoscopy with medical robots to diagnose and treat diseases and improve imaging for other robots with size and weight constraints. Arrays of thousands of such cameras could be used for full-scene sensing, turning surfaces into cameras.

While a traditional camera uses a series of curved glass or plastic lenses to bend light rays into focus, the new optical system relies on a technology called a metasurface, which can be produced much like a computer chip. Just half a millimeter wide, the metasurface is studded with 1.6 million cylindrical posts, each roughly the size of the human immunodeficiency virus (HIV).

Each post has a unique geometry, and functions like an optical antenna. Varying the design of each post is necessary to correctly shape the entire optical wavefront. With

the help of machine learning-based algorithms, the posts' interactions with light combine to produce the highest-quality images and widest field of view for a full-color metasurface camera developed to date.
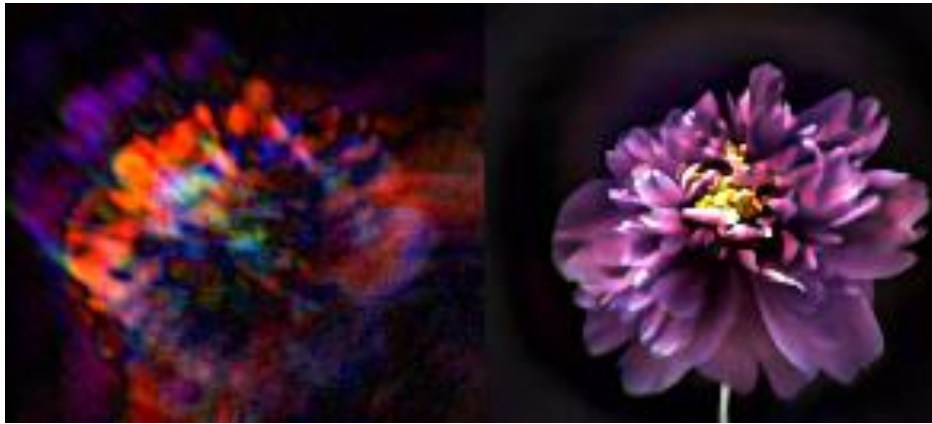
Previous micro-sized cameras (left) captured fuzzy, distorted images with limited fields of view. A new system called neural nano-optics (right) can produce crisp, full-color images on par with a conventional compound camera lens.
Image courtesy of the researchers

A key innovation in the camera's creation was the integrated design of the optical surface and the signal processing algorithms that produce the image. This boosted the camera's performance in natural light conditions, in contrast to previous metasurface cameras that required the pure laser light of a laboratory or other ideal conditions to produce high-quality images, said Felix Heide, the study's senior author and an assistant professor of computer science at Princeton.

The researchers compared images produced with their system to the results of previous metasurface cameras, as well as images captured by a conventional compound optic that uses a series of six refractive lenses. Aside from a bit of blurring at the edges of the frame, the nano-sized camera's images were comparable to those of the traditional lens setup, which is more than 500,000 times larger in volume.

Other ultracompact metasurface lenses have suffered from major image distortions, small fields of view, and limited ability to capture the full spectrum of visible light — referred to as RGB imaging because it combines red, green and blue to produce different hues.

"It's been a challenge to design and configure these little microstructures to do what you want," said Ethan Tseng, a computer science Ph.D. student at Princeton who co-led the study. "For this specific task of capturing large field of view RGB images, it was previously unclear how to co-design the millions of nano-structures together with post-processing algorithms."

Co-lead author Shane Colburn tackled this challenge by creating a computational simulator to automate testing of different nano-antenna configurations. Because of the number of antennas and the complexity of their interactions with light, this type of simulation can use "massive amounts of memory and time," said Colburn. He developed

a model to efficiently approximate the metasurfaces' image production capabilities with sufficient accuracy.

Colburn, who conducted the work as a Ph.D. student at the University of Washington Department of Electrical & Computer Engineering (UW ECE), where he is now an affiliate assistant professor. He also directs system design at Tunoptix, a Seattle-based company that is commercializing metasurface imaging technologies. Tunoptix was cofounded by Colburn's graduate adviser Arka Majumdar, an associate professor at the University of Washington in the ECE and physics departments and a coauthor of the study.

Coauthor James Whitehead, a Ph.D. student at UW ECE, fabricated the metasurfaces, which are based on silicon nitride, a glass-like material that is compatible with standard semiconductor manufacturing methods used for computer chips — meaning that a given metasurface design could be easily mass-produced at lower cost than the lenses in conventional cameras.

"Although the approach to optical design is not new, this is the first system that uses a surface optical technology in the front end and neural-based processing in the back," said Joseph Mait, a consultant at Mait-Optik and a former senior researcher and chief scientist at the U.S. Army Research Laboratory.

"The significance of the published work is completing the Herculean task to jointly design the size, shape and location of the metasurface's million features and the parameters of the post-detection processing to achieve the desired imaging performance," added Mait, who was not involved in the study.

Heide and his colleagues are now working to add more computational abilities to the camera itself. Beyond optimizing image quality, they would like to add capabilities for object detection and other sensing modalities relevant for medicine and robotics.

Heide also envisions using ultracompact imagers to create "surfaces as sensors." "We could turn individual surfaces into cameras that have ultra-high resolution, so you wouldn't need three cameras on the back of your phone anymore, but the whole back of your phone would become one giant camera. We can think of completely different ways to build devices in the future," he said.

Besides Tseng, Colburn, Whitehead, Majumdar and Heide, the study's authors include Luocheng Huang, a Ph.D. student at the University of Washington; and Seung-Hwan Baek, a postdoctoral research associate at Princeton.

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Looking for a Way to Waste Some Time?

Try the GiF Gallery where you'll find 99.9k+ of them. Happy hunting.

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Civic Involvement: Put your Penguins to Work

Are your flightless birds complaining about having nothing to do? Here an answer.

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Lady Wants to Promote Highway Safety for Deer

https://www.youtube-nocookie.com/embed/CI8UPHMzZm8?rel=0

Whom would you rather meet on the road, her or the deer?

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**If you could kick the person in the pants
responsible for most of your troubles
you wouldn't sit for a month.**
Theodore Roosevelt

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DeepMind's AI Helps Untangle the Mathematics of Knots

The machine-learning techniques could benefit other areas of maths that involve large data sets.

By Davide Castelvecchi for Nature

Knot theorists proved the validity of a mathematical formula about knots after using machine learning to guess what the formula should be.
Credit: DeepMind

For the first time, machine learning has spotted mathematical connections that humans had missed. Researchers at artificial-intelligence powerhouse DeepMind, based in London, teamed up with mathematicians to tackle two separate problems — one in the theory of knots and the other in the study of symmetries. In both cases, AI techniques helped the researchers discover new patterns that could then be investigated using conventional methods.

"I was very struck at just how useful the machine-learning tools could be as a guide for intuition," says Marc Lackenby at the University of Oxford, UK, one of the mathematicians who took part in the study. "I was not expecting to have some of my preconceptions turned on their head."

AI maths whiz creates tough new problems for humans to solve

Computer simulations and visualizations of knots and other objects have long helped mathematicians to look for patterns and develop their intuition, says Jeffrey Weeks, a mathematician based in Canton, New York, who has pioneered some of those techniques since the 1980s. But, he adds, "Getting the computer to seek out patterns takes the research process to a qualitatively different level."

The authors say the approach, described in a paper in the 2 December issue of Nature, could benefit other areas of maths that involve large data sets.

Maths versus machine

DeepMind, a sister company of Google, has made headlines with breakthroughs such as cracking the game Go, but its long-term focus has been scientific applications such as predicting how proteins fold.

The idea for a maths collaboration was sparked by a casual conversation in 2019 between mathematician Geordie Williamson at the University of Sydney in Australia and DeepMind's chief executive, neuroscientist Demis Hassabis. Lackenby and a colleague at Oxford, András Juhász, both knot theorists, soon joined the project.

Initially, the work focused on identifying mathematical problems that could be attacked using DeepMind's technology. Machine learning enables computers to feed on large data sets and make guesses, such as matching a surveillance-camera image to a known face from a database of photographs. But its answers are inherently probabilistic, and mathematical proofs require certainty.

DeepMind's AI predicts structures for a vast trove of proteins

But the team reasoned that machine learning could help to detect patterns, such as the relationship between two types of object. Mathematicians could then try to work out the precise relationship by formulating what they call a conjecture, and then attempting to write a rigorous proof that turns that statement into a certainty.

Because machine learning requires lots of data to train on, one requirement was to be able to calculate properties for large numbers of objects: in the case of knots, the team calculated several properties, called invariants, for millions of different knots.

The researchers then moved on to working out which AI technique would be most helpful for finding a pattern that linked two properties. One technique in particular, called saliency maps, turned out to be especially helpful. It is often used in computer vision to identify which parts of an image carry the most-relevant information. Saliency maps pointed to knot properties that were likely to be linked to each other and generated a formula that seemed to be correct in all cases that could be tested. Lackenby and Juhász then provided a rigorous proof that the formula applied to a very large class of knots.

"The fact that the authors have proven that these invariants are related, and in a remarkably direct way, shows us that there is something very fundamental that we in the field have yet to fully understand," says Mark Brittenham, a knot theorist at the University of Nebraska–Lincoln who frequently uses computational techniques. Brittenham adds that although machine learning has been used in knot theory before, the authors' technique is novel in its ability to discover surprising connections.

Solving symmetries

Williamson focused on a separate problem, regarding symmetries. Symmetries that switch around finite sets of objects have an important role in several branches of maths, and mathematicians have long studied them using various tools, including graphs — large abstract networks linking thousands of nodes — and algebraic expressions called polynomials. For decades, researchers have suspected that it would be possible to calculate the polynomials from the networks but guessing how to do it seemed like a hopeless task, Williamson says. "Very quickly, the graph becomes beyond human comprehension."

AI Copernicus 'discovers' that Earth orbits the Sun

With the computer's help, he and the rest of the team noticed that it should be possible to break down the graph into smaller, more-manageable parts, one of which has the structure of a higher-dimensional cube. This gave Williamson a solid conjecture to work on for the first time.

"I was just blown away by how powerful this stuff is," says Williamson. Once the algorithm zeroed in on a pattern, it was able to guess very precisely which graphs and polynomials came from the same symmetries. "How quickly the models were getting accuracy — that for me was just shocking," he says. "I think I spent basically a year in the darkness just feeling the computers knew something that I didn't."

Whether Williamson's conjecture will prove true is still an open question. Conjectures sometimes take a long time for the mathematical community to crack, but they can help to shape entire fields.

Wider applications

Throughout the project, the researchers had to tailor the AI techniques to the two different mathematical problems, says Alex Davies, a computer scientist at DeepMind. "We did not originally expect these to be the most useful techniques," he says.

"Any area of mathematics where sufficiently large data sets can be generated could benefit from this approach," says Juhász, adding that the techniques they demonstrated could also find applications in fields such as biology or economics.

Abel Prize celebrates union of mathematics and computer science

Adam Zsolt Wagner, a mathematician at Tel Aviv University, Israel, who has used machine learning, says that the authors' methods could prove valuable for certain kinds of problems. "Without this tool, the mathematician might waste weeks or months trying to prove a formula or theorem that would ultimately turn out to be false." But he adds that it is unclear how broad its impact will be.

At a press conference, Davies told reporters that the project has given him a "real appreciation" for the nature of mathematical research. Learning maths at school is akin to playing scales on a piano, he added, whereas real mathematicians' work is more like jazz improvisations.

Williamson agrees that the work highlights a more exciting aspect of maths than people normally see. "As mathematical researchers, we live in a world that is rich with intuition and imaginations," he says. "Computers so far have served the dry side. The reason I love this work so much is that they are helping with the other side."

"My personal guess is that computer-generated conjectures will become ever more useful in 'filling in the details', but will never replace human intuition and creativity," says Weeks.

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My Walking Thoughts
December 5, 2021
December 7th Memories

Ambling along Rice Road overlooking the Ventura River bottom (dry as a WCTU banner carrier) I got to thinking about the Japanese raid on Pearl Harbor, at the time one of several U.S Protectorates in the Pacific.

My first thoughts were questions: How many Americans know about the attack and its subsequent influence on today's global situation? For instance, is it even so much as a footnote in history courses? Are the factors leading up to it part of dinner table or classroom discussions? Will its monuments and lessons fall victim to this crazy desire to eliminate politically objectionable or inconvenient understandings from discussion?

These are strange times in which much could be learned from a step-by-step look at the situations that led (or forced) Japan to undertake what in retrospect appears to have been an irrational, even suicidal, adventure. This is particularly significant today since China lay close the heart of it…both from Japan's and our standpoints.

This causes me to wonder, were I to come back 100 years from now, how different would be the analyses then from now? A lot I suspect, hopefully rooted in a desire to understand and then avoid the kinds of pitfalls faced by leaders not only of Japan and the US prior to that fateful December day, but those of European and Asian colonialist nations as well.

That's enough speculation for now. Instead, I will tell of my experiences on that and the several fateful days that followed.

December 7th was a Sunday at our home in Los Angeles, from the viewpoint of a five-year-old boy, one of infinite possibilities once the established duties of the morning—first help Pop read the LA Times and second go to church with Mom—had been attended to.

Back from the 10 a.m. service, I thankfully shed my go-to-church finery that included (misery of all miseries) short pants and was about to stir up some mischief when the phone rang…a rather novel occurrence in our household since Pop hated the abominable contraption despite having written screen play for the movie, Alexander Graham Bell only two years before.

"What," he said in a voice generally reserved in response to some misdeed of mine, "say that again." Then to Mom, "turn on the radio."

Within five minutes, a half-dozen bigpeople showed up in high stages of excitement, all talking at once so I hadn't a clue what I had done to provoke this kind of activity.

Finally, the words 'Pearl Harbor' and 'Japs' hovered above the fray, and by dinnertime I had an inkling not only of what had caused the commotion, but what the near-term consequences might be.

Radio commentary was of the worst, fear-mongering kind, offering predictions of a Japanese invasion of the US—Los Angeles most likely—and what we should be doing to protect ourselves.

"Dye all your sheets black to cover your windows in case of air attack," was one pronouncement I remember coming from the mouth of our trustworthy Zenith radio (it was on the radio, so it has to be true), sending Mom into a dither. Pop intervened, explaining that it would take several days for the enemy fleet to move from Hawaii to the mainland, averting the first of many household calamities that were to come in the near future.

For me, all this excitement was terrific, partly because the supercharged atmosphere suited my temperament to a T, but mostly because no one had the time to watch and see what I was up to.

In days to come, Los Angeles was treated to a submarine bombardment of the Ellwood Beach cliffs several miles west of Santa Barbara that led to the thunderous anti-aircraft barrage that cleared LA of any threat of a bombing raid.

By mid-month the Basin was dotted with barrage balloons, one of which slipped its moorings at the intersection of Santa Monica and Westwood Boulevards, making its way sedately in the prevailing breeze to Wilshire and Beverly Glen where it was finally corralled and sent to barrage balloon heaven.

Apparently, Santa had good charts of these obstructions to air navigation because Christmas went off as scheduled, but Pasadena's Rose Parade was put on hold for a year and the Rose Bowl game itself was moved to Durham, NC, where the Oregon Ducks beat the Duke Blue Devils 20 to 16.

By early 1942, the nation's response to Pearl Harbor was moving into high gear. Men and women in uniform became plentiful, little signs with stars on windows testifying to the growing number throughout the neighborhood.

More than just their disappearance from daily consumption, the rationing of many items of food, energy, and luxury items, brought home to every household the realization that America had gone to war…and woe betide the enemy.

But for us kids, the war produced endless hours of unmonitored activity, something that made us different from the generations on either side. It wasn't until we were older, we found what the price for this had been.

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Once again, I apologize but I'm waiting for photos and remembrances of those around at that time before moving ahead with the story.

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