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After a 1982 massacre in Syria, a boy stands in front of a shop shutter riddled with bullet holes.

Zarqa, Jordan. "Science is about little steps, and this is a little giant step in understanding epigenetic inheritance," she adds.

Forty years of trauma

Syria has seen more than 40 years of almost continual trauma. In June 1979, then-president Hafez al-Assad unleashed a crackdown on an attempted rebellion. In 1982, his troops bombed Hama, killing up to 30,000 people.

One of the study participants, now a grandmother, was pregnant with her daughter during the crackdown. The study included nine other women whose mothers experienced this violence, and their children.

Another 22 mothers and 20 children in the study saw a second period of violence, after an uprising in 2011. Then-president Bashar al-Assad, who fled the country last December, deployed the army and militias against protesters. The mothers had 19 other children, born after these events, who were also studied.

To understand whether trauma resulting from these violent events had left epigenetic marks, and whether the marks are passed through the maternal germ line, Dajani and her colleagues focused on patterns of DNA methylation — an epigenetic mechanism in which DNA is tagged with methyl groups. It is one of "the most studied [processes] and we have the technology today to do it", Dajani says.

Over five years, the researchers searched for participants from Jordan's Syrian communities. The team defined a traumatic experience of violence as being severely beaten or persecuted by authorities or militias, seeing a wounded person or fatality, or witnessing someone else being beaten, shot or killed.

They analysed DNA samples from participants' cheek cells and found that children and women with first-hand traumatic experiences of violence in the 1980s and after 2011 had distinctive methylation tags on 21 DNA regions.

The analysis revealed tags on 14 DNA regions in the grandmother who witnessed the 1980s violence, as well as in her daughter and grandchild. These tags were also present in the daughters and grandchildren of nine women who witnessed that violence.

"Looking at at least two — if not three or maybe even four — generations is really crucial. That's not often done in humans," says epigeneticist Michael Kobor at the University of British Columbia in Vancouver, Canada.

Memory reset

Researchers disagree on whether methylation marks can pass between generations. During early stages of mammalian development, the genome undergoes the equivalent of a memory reset — called epigenetic reprogramming — that clears out DNA methylation tags.

"All of these marks, almost all of them, are erased when the eggs hit the sperm," says Kobor. "The biology just doesn't support DNA methylation as a vehicle of intergenerational transmission," he adds.

But studies[4] in animals suggest that the methylation of some DNA sites "could escape being reprogrammed", says Dajani.

Kobor says there might be explanations other than inheritance. There is "a possibility that the trauma of the mums is reflected in their parenting, and that then creates these marks in the next generation", he says.

Another possibility, Kobor says, is that DNA sequences in offspring that are inherited maternally might react to environmental stress in similar ways to what was seen in the mother, and end up with the same methylation tags.

But Dajani notes that the families in the 1980s group of participants were not related to each other by blood. This makes it less likely that shared genetics or parenting effects alone produced the consistent methylation marks in all ten families, she says.

"There is a need to be cautious because of the tissue choice and the small sample size and the uncertain clinical implication," says Yehuda. But the work is "ambitious", and "it's important when you get findings like this to try to replicate them", she adds.

Dajani is now planning to explore the epigenetic signatures of traumatic events in four generations of Palestinians.

1. Mulligan, C. J. *et al. Sci. Rep.* **15**, 5945 (2025).
2. Musanabaganwa, C. *et al. Epigenomics* **14**, 11–25 (2022).
3. Yehuda, R. *et al. Am. J. Psychiatry* **171**, 872–880 (2014).
4. Braz, C. U., Passamonti, M. M. & Khatib, H. *Environ. Epigenetics* **10**, dvad010 (2023).

BRAIN IMPLANT TRANSLATES THOUGHTS TO SPEECH IN AN INSTANT

Improvements in computer-interface technology approach natural conversational speed.

By Miryam Naddaf

A brain-reading implant that translates neural signals into audible speech has allowed a woman with paralysis to hear what she intends to say nearly instantly.

Researchers enhanced the device — known as a brain–computer interface (BCI) — with artificial intelligence (AI) algorithms that decoded sentences as the woman thought of them, and then spoke them out loud using a synthetic voice. Unlike previous efforts, which could produce sounds only after users finished an entire sentence, the current approach can simultaneously detect words and turn them into speech within 3 seconds.

The findings, published in *Nature Neuroscience*[1], represent a big step towards BCIs that are of practical use.

Older speech-generating BCIs are similar to "a WhatsApp conversation", says Christian Herff, a computational neuroscientist at Maastricht University in the Netherlands. "I write a sentence, you write a sentence and you need some time to write a sentence again," he says. "It just doesn't flow like a normal conversation."

BCIs that stream speech in real time are "the next level" in research because they allow users to convey the tone and emphasis that are characteristic of natural speech, he adds.

Brain-signal reader

The study participant, Ann, lost her ability to speak after a stroke in her brainstem in 2005. Some 18 years later, she underwent surgery to place a paper-thin rectangle containing 253 electrodes on the surface of her brain cortex. The implant can record the combined activity of thousands of neurons at the same time.

Researchers personalized the synthetic voice to sound like Ann's own voice from before her injury, by training AI algorithms on recordings from her wedding video.

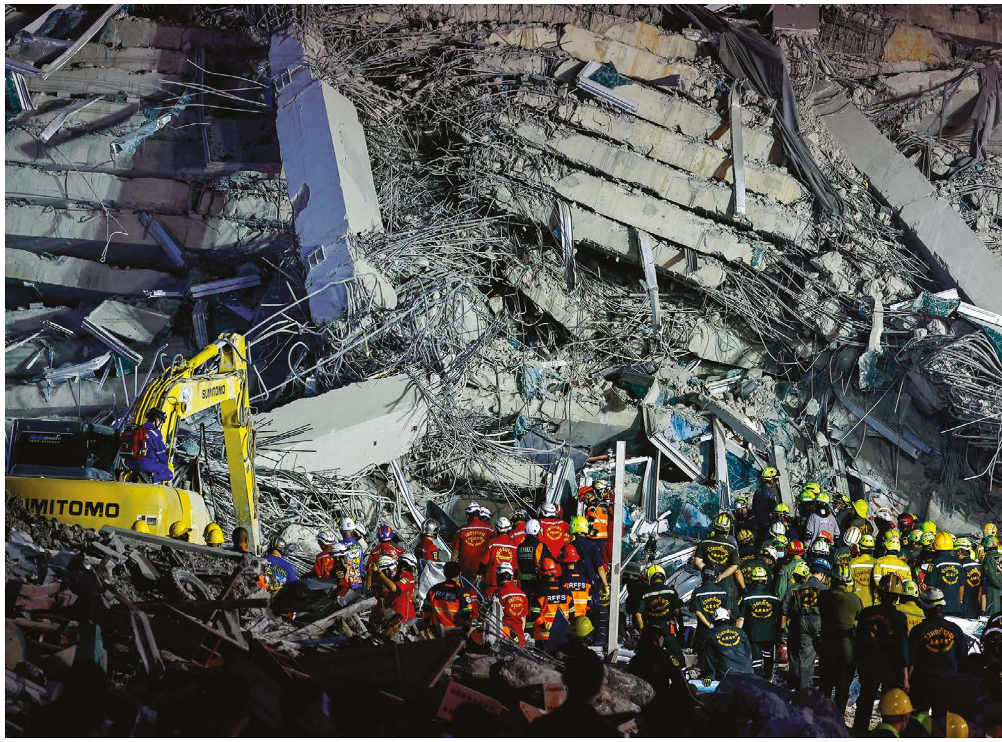
During the latest study, Ann silently mouthed 100 sentences from a set of 1,024 words and 50 phrases that appeared on a screen. The BCI device captured her neural signals every 80 milliseconds, starting 500 milliseconds before Ann started to silently say the sentences. It produced between 47 and 90 words per minute (natural conversation happens at around 160 words per minute).

The results represent a marked improvement compared with an older version of the technology that Ann tested in a previous study[2], and with the current assistant-communication device she uses, which takes more than 20 seconds to stream out a single sentence.

Herff says that, although the BCI works for short sentences, it still operates with "quite a big delay" compared with a natural conversation. Studies[3] show that, "when the delay is larger than 50 milliseconds, it starts to really confuse you", he adds.

"This is where we are right now," says study co-author Edward Chang, a neurosurgeon at the University of California, San Francisco. "But you can imagine, with more sensors, with more precision and with enhanced signal processing, those things are only going to change and get better."

1. Littlejohn, K. T. *et al. Nature Neurosci*. https://doi.org/10.1038/s41593-025-01905-6 (2025).
2. Metzger, S. L. *et al. Nature* **620**, 1037–1046 (2023).
3. Stuart, A., Kalinowski, J., Rastatter, M. P. & Lynch, K. J. *Acoust. Soc. Am*. **111**, 2237–2241 (2002).



A high-rise building under construction in Bangkok, Thailand, collapsed after the earthquake.

DANIEL CENG/ANADOLU VIA GETTY

DEADLY MYANMAR QUAKE WAS PROBABLY A RARE RUPTURE

'Supershear' earthquake moved fast and far, amplifying the damage and human toll.

By Alexandra Witze

The magnitude-7.7 earthquake that hit Myanmar on 28 March has killed at least 2,700 people, with the final death toll expected to be much higher. The quake appears to have been a rare type known as supershear — in which the energy of a rupture moves exceptionally fast through the ground, amplifying the destruction.

This kind of rupture is "the earthquake equivalent of a supersonic jet", wrote Frederik Tilmann, a seismologist at the GFZ Helmholtz Centre for Geosciences in Potsdam, Germany, in a preliminary analysis on LinkedIn (see go.nature.com/4ixz4si). Multiple research teams are converging on the supershear scenario.

If that explanation is correct, then the geological fault that broke during the quake — the massive Sagaing fault, which runs north–south through the heart of Myanmar — might have ruptured over 400 kilometres or more. Researchers might be able to confirm this by looking at satellite imagery of the region taken before and after the quake.

In supershear earthquakes, the ground rupture travels faster than the seismic waves. That can concentrate seismic energy ahead of the rupture, leading to greater damage at greater distances than would be expected from a non-supershear quake. Bangkok in neighbouring Thailand, for instance, saw at least one high-rise building that was under construction collapse during the quake, even though it is around 1,000 kilometres from the epicentre.

Widespread damage

Damage is widespread across Myanmar and, to a lesser extent, in Thailand. Search-and-rescue efforts in Myanmar are being hampered by the country's ongoing civil war, which began after the military seized power in 2021. The coup also reduced the ability of scientists in Myanmar to monitor the country's seismic activity — a capability that expanded in the 2010s, in part because of international collaborations[1].

Now, there are fewer seismometers than before to feed information into Myanmar's Department of Meteorology and Hydrology